



Safety Bulletin: # 1013

Gas Train Solenoid Valves: They Don't Last Forever!

Periodically Combustion Safety Inc. comes across little known safety items or procedures that can greatly enhance a plant's ability to safely maintain combustion equipment. We developed email-based Combustion Safety Program Updates to more completely get the word out. Let us know if this update helped.

New test evidence suggests proactively changing out solenoid valves over 15 years old may reduce failure risks and save fuel dollars. Combustion Safety, Inc. has recently completed a study of interlock and valve tightness testing results from more than 260 boilers tested for a corporate client in 2003. Interlock and valve tightness testing is required at least annually by many states and jurisdictions and by all combustion equipment codes and standards. Our firm's technicians discovered important information regarding solenoid valves and their role in maintaining the safety and integrity of natural gas fired equipment.

valve life. However, most will talk in terms of 10 years depending on the installation, cycles, and operating environment.

This document also discusses installation issues that might increase valve useful life.

This document seeks to increase combustion equipment user's awareness regarding solenoid valve failure rates and the wisdom in considering proactively replacing such valves prior to them indicating leakage.

Automatic Gas Train Valves

There are four valves that are most commonly automatic on gas trains for combustion equipment over 400,000 btuh input. These are the safety shut-off valve, the blocking valve, the vent valve, and the pilot valve. The vent valve and the pilot valve are usually the ones that are of the solenoid type. Solenoid valves are usually the lowest cost automatic valves available for this application. While in general they do a great job it's important to recognize that they are not designed to last forever. Codes like NFPA 86 and NFPA 85 have recognized this. These codes both call for the use of more than one automatic valve in pilot applications.

What Are The Consequences?

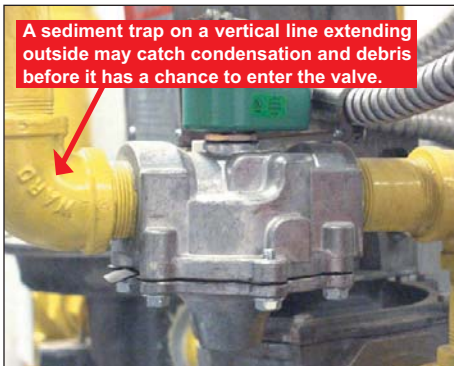
Leaking valves have serious consequences. In the case of leaking vent valves consider that the burner pressure will be disrupted. Gas that leaks through the vent valve after the main regulator will make for a lower pressure and a leaner flame. Lean flames are often unstable flames and are subject to going out. This makes for a situation where the low gas pressure switch and or the flame detection system will have to be called upon

and will have to work correctly. Every time this happens the site operates at a greater risk of catastrophe.

It can also be bad if the pilot valve leaks natural gas through to the firebox. Consider the case of a valve leaking at one cubic foot per hour, (not an impossible feat). If the service is to a relatively small firebox, say a 200 HP fire-tube boiler, the mixture in the entire firebox could be at a flammable range in about 2 hours. This leaves room for a number of things to go wrong like a less than perfect purge, a spark, and or even the mixture finding its way out of an exhaust opening or flue stack to an ignition source.

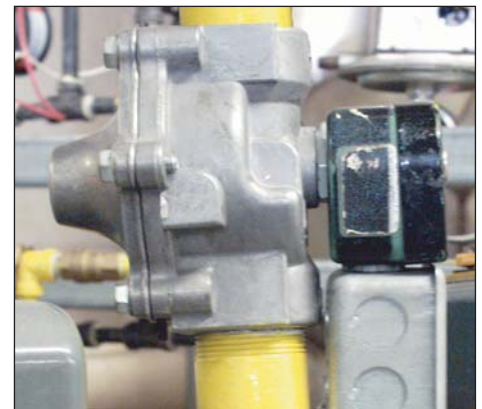
Leaking Valves Also Cost Money

One cubic foot per hour of gas leaking though a solenoid valve costs the typical owner about \$50 per year. Even this small of a leak makes for economics based on gas losses alone to change out a failed valve. Some large capacity equipment with higher pressure gas trains can lose hundreds or thousands of dollars a year worth of gas from a \$200 valve.



Manufacturers suggest horizontal installation of solenoid valves for prolonged life.

Our investigation found a significant failure rate for solenoid valves that were more than 15 years old. These valves were in both pilot and bleed vent line service. Our firm observed 16 valves out of about 300 tested that leaked through in the closed position at an unacceptable rate. We do not believe that these valves failed prematurely. It is very difficult to find valve manufacturers identifying expected useful



Vertical solenoid valve installation is not recommended.

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Why do they fail and how do you know?

Many of the solenoid valve failures we have seen have been due to dirt or debris lodging between the seat and the valve stem seal. Solenoid valves usually are designed with a flat surface to flat surface seal. The slightest amount of dirt or debris makes for a compromise of this seal. Dirt can especially be an issue when it comes to bleed vent valves. Consider the fact that many vent lines leave the warmth and comfort of a heated plant facility and extend outside somewhere. The change in temperature makes for a means to condense water from the air and have it run down the insides of the vent line. The condensing water provides a means for rust particles and dirt to enter solenoid vent valves.

If you ever walk up to a vent valve and hear it buzzing chances are it has dirt or debris stuck in it. However, it's not always that straight forward. Vent valves that don't make noise could also still be failed and leaking. Vent valves, like any other valves, need to be bubble tested for tightness. Bubble testing is the process of determining how much volume is leaking past the stem/seat interface when a valve is in the closed position. Bubble testing techniques are described in the appendices to NFPA 86, (National Fire Protection Association Standard for Ovens and Furnaces available at www.nfpa.org).

So What Can Be Done

Pay attention to the age and condition of all automatic valves, but especially solenoid valves that are 15 years old or more. If they aren't already leaking through you are most likely on borrowed time. The relatively low cost of solenoid valves versus the potential to do damage if they fail makes them an especially good candidate for proactive replacement even before a failure is found. Consider it cheap insurance to versus getting another 3 to 5 years of service and then maybe finding out the hard way that the valve was bad.

When installing new solenoid valves or doing retrofits, consider installation recommendations that are in many of the manufacturer's installation guides, but are rarely ever followed. For example, did you know that most solenoid valve manufacturers recommend installation in a horizontal vertical plane for maximum life? Also, consider adding drip legs after solenoid valves where long risers make for the possibility of condensation and falling debris. You might also consider ambient operating temperatures. Remember, most solenoid valve manufacturers have maximum ambient temperature ratings of only about 140F.

Being proactive about solenoid valves is an easy way to stay ahead of the risk curve. It's one of the few proactive replacements you can do that actually also can save you fuel dollars. In fact, some clients report saving tens of thousands of dollars in finding and repairing solenoid valves that leaked fuel.



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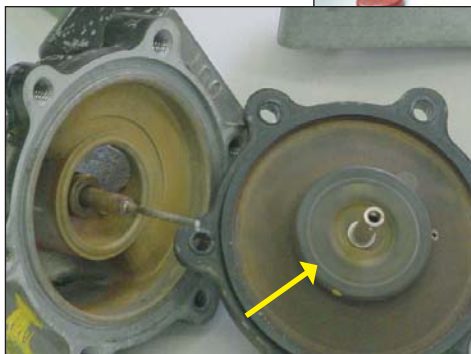
The industry's leading equipment combustion safety experts can provide a training program to specifically meet the needs of your facility. This hands-on operations safety training is available for all types of combustion equipment. Our workshops will give you what you need to recognize unsafe conditions, perform required maintenance, and operate equipment more efficient.

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Internal rubber, flat seals are susceptible to fouling and deterioration over time

