Fire safe testing: the what and how

Fire safe testing has emerged as a key topic among valve manufacturers and end users. This is mostly due to the ever increasing focus on safety and environment. Almost on a daily basis, we receive requests for fire safe testing. Via our contacts in the industry it has become apparent that there is little knowledge regarding this procedure.

By Colin Zegers

More stringent regulation in terms of safety and the environment are having repercussions on the demands of equipment. For example leak rates and unwanted emissions that were acceptable in the past are now almost considered a crime. Equipment that is refitted or newly purchased today is required to come with an increasing number of conformity certificates. Whilst this is, of course, positive for us at ITIS, since our company is one of very few organisations who are specialised in testing valves and appendages, this can create quite some confusion. What we've seen in recent years is the fact that manufacturers and end-users who are suddenly required to provide Fire Safe certification, have little or no idea of what this entails.

Fire simulation

Very simply put, when putting a valve (or any other item) through a Fire Safe testing procedure, you set it on fire and see what happens. Through the years, accidents, like the Piper Alpha disaster in 1988 have happened in the petrochemical industry involving fire, with disastrous consequences. To try and prevent as much damage as possible, Fire Safe testing was conceived to ensure that equipment was able to withstand a fire and retain its functionality (to a certain extent).

For example, the API 607 procedure dictates that a valve is enveloped in flames for 30 minutes while pressurized, after which it is force-cooled with water. The procedure is very clear on the minimum exterior temperatures, flame temperatures, the location of thermocouples, in how many minutes the valve should be cooled to ambient and so on.

This simulates a fire on a plant after which the fire is extinguished by emergency services. After and during the simulated fire, the seat leakage and body seals are to be measured and a final open/close functionality test is performed. If the results are within prescribed parameters, the valve will be considered Fire Safe and receive a conformity report. This procedure can be applied to all kinds of valve, sealants, gaskets and appendages.

Confusion

The most common issue ITIS has encountered is simply confusion. The term Fire Safe is applicable for a wide range of valves, sealants and appendages. But for these different items, different procedures are relevant.

For example, the specific procedure for testing valves for Fire Safe conformity is the API-6FA.

About the author

Colin Zegers, founder and owner of ITIS has been involved in the field of leak testing with specialty valve testing for almost 20 years now. The Dutch independent test facility and service provider is able to test versatile products such as valves, appendages, vessels, heat exchangers and gaskets for functionality, emission, endurance, leakage and (fire) safety. The test facility is a one-stop shop for testing newly manufactured products, prototypes and revised valves also onsite leak testing, project supervision and consultancy can also be provided.

Its description reads: 'It is the purpose of this document to establish the requirements for testing and evaluating the pressure-containing performance of API Specs 6A and 6D valves when exposed to fire.'
In relation to this, API-6FB. Description: 'This specification was formulated to establish procedures for testing and evaluating the pressure-containing performance of API end connections when exposed to fire. Valves, wellhead seals, or other related equipment are not included in the scope of this document.'
Another example, API-589. This procedure relates to testing only a part of a valve, namely the stem seal. The description of this spec reads: 'Covers the requirements for testing valve stem packing and evaluating its performance when exposed to specifically defined fire conditions.'

A chain is only as strong as its weakest link

To make our point, here is one more example. Procedure ISO-19921. Now this procedure covers not only valves, but also pipe couplings. Description: 'This procedure specifies test procedures for determining the fire resistance of metallic valves, pipe couplings, and similar pipe components which contain a resilient or elastomeric seal and which are used in ship engineering systems.'

Long list

The list goes on. There are several organisations who provide procedures relevant to the testing of petrochemical equipment for its functionality when exposed to fire. API: American Petroleum Institute, ISO: International Organisation for Standardization, BS: British Standard, ASME: American Society of Mechanical Engineers, ANSI: American National Standards Institute.
API-6FA and BS6755-pt.2 are very similar, they both require the valve to be enveloped in flames for 30 min. Only the required test pressures differ slightly. It is therefore very important to determine what exactly needs to be tested, as well as the operational circumstances to which the item in question will be subjected. In relation to this the correct procedure can be chosen. As ITIS is familiar with most of the issues, and we can understand that you can no longer see the wood for the trees, we are happy to assist in clearing things up for you. And of course executing the Fire Safe testing in our state-of-the-art Fire Safe test bunker.

Disaster in the making

ITIS is convinced that one not only has to look at the Fire Safe capabilities of certain parts, but the 'bigger picture' has to be taken into account. In the field we have seen high quality valves integrated in a system made of very thin-walled piping with measuring equipment installed with Teflon tape close by. It's not hard to imagine where things will go wrong in this situation. In our experience these relatively small components are often overlooked.
Equally important are flange gaskets. As above, assume we have a valve installed which is fully Fire Safe and installed in a HP (high-pressure) piping installation by means of flange couplings. The gasket installed between the flange coupling is a simple EPDM gasket. Again, a disaster in the making.
Laws of physics also come into play. The coefficient of expansion in relation to temperature of different alloys/materials is something to be considered. A typical problem with, e.g., flange bolting when subjected to a heat cycle is that the initial torque may have degraded which will cause a less compressed gasket (and therefore possible leakage) as a result.

Conclusion

With all this in mind, ITIS invites you to challenge us with your projects as we have extensive experience with tackling the many Fire Safe applications, procedures as well as 'specials'. As we are in a unique position between supplier and end-user, we can offer advice and services to satisfy the requests of both parties.
We have at our disposal one of the most sophisticated Fire Safe test bunkers in the industry which has been engineered in-house. We even dare to say it is one-of-a-kind. Operation of the specially designed burners and extinguishing installation is automated which practically eliminates 'human error'. Test parameters (temperature, pressure etc.) and video images are remotely recorded and can be witnessed via live-stream services.
Feel free to contact us at info@itis-nl.com or visit our website: www.itis-nl.com. We offer a wide range of services besides Fire Safe testing.