## White paper:

# Cryogenic testing on the rise: Theory vs Practice

Following the trend to harness more energy from the non-toxic and eco-friendly LNG, valves and safety valves intended for cryogenic service are in great demand. Our customers involved in the production of these critical valves face the daunting task, while cryogenic testing seems to evolve from 'unique type approval' testing to standard production testing.

Liquefied natural gas (LNG) is natural gas (predominantly methane, $CH_4$) that has been converted to liquid form for ease of storage or transport. The liquefaction process involves removal of certain components, such as dust, acid gases, helium, water, and heavy hydrocarbons, which could cause difficulty downstream. The natural gas is then condensed into a liquid at close to atmospheric pressure by cooling it to approximately −162 °C (−260 °F).

It generally is accepted in the oil and gas industry that the cryogenic temperature range starts at -150 $^0$C (-238° F). In addition to this temperature range, certain gases are considered "cryogenic" because they take more than just an increase in pressure to compress their volume. Anything warmer than the cryogenic range up to 37° F (3° C) is called "refrigeration."

No long ago one single 'type approval' test was considered to be sufficient to accept the valve for this purpose. However, the tough process conditions, rising environmental (emission) standards and failure impact (liability) results in higher demands on cryogenic testing. Some conclude that the rising need for tests like this is caused by the declining level of knowledge and experience with engineering companies. The 'office desk' engineers ignorantly dictate the test requirements without knowing what this tests really takes..!

**Some 'cryogenic considerations'.., to keep up with demand;**

- What test standards really apply..? Already, there are too much to individually mention in this article. The procedure has a direct impact on the test facility and leak detection and measuring equipment. Using the latest test software and flow measuring technology makes live easy.

- Prepping needs to be normalized. Cooling down the valve, prior to the test can take hours or maybe even half a day. When getting to the point of finally increasing pressure, time is of the essence and you can't be experiencing leaks or other problems caused by; dirt or any foreign material inside the valve, improper packing sealing, misalignments or instrument failure. These valves need to be assembled in a clean room and treated as delicate instruments. Prior to cryogenic testing the valve must have proven its working, strength and integrity by successfully passing body and performance tests. The equipment must be fit for purpose and operating personnel must be well trained for the job.



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- Choose the right cooling method. The valve type, application, target temperature and test procedure determine the method of cooling. This can be direct and complete submerging of the valve in Liquid Nitrogen, slow filling or controlled Liquid Nitrogen spraying on the outside.

- Implementing automation reduces the human error incidence. Series testing becomes mind-numbing and routines often turn into habits. It is becoming very hard to find skilled and qualified personnel. A semi or full automatic test system is programmed to consequently test and measure according to the applicable standard. It is not influenced by Monday morning (hang-over) or Friday afternoon fatigue.

- Safety is paramount. Testing new produced valves remains a 'risk activity' and implementing the right safety measures is paramount. The valve is tested under critical conditions with high pressure gas (generally Helium, Nitrogen or a mixture of both). Then, the evaporating coolant Liquid Nitrogen increases about 700 times in volume at 20°C. It is odourless, colourless, tasteless, but acts as a direct asphyxiate replacing Oxygen. The test system must be carefully selected for this daunting task and a variety of additional safety measures need to be in place to protect the operating personnel against 'lurking' dangerous effects of testing in Cryogenic conditions.

Ventil supplies 'turn-key' cryogenic test facilities, including; LN storage and loading facility, test gas pre-cooling and boosting system, insulated cooling tanks, manual or full automatic (computer controlled test systems, full surrounding safety enclosure and Oxygen sensor controlled exhaust system. Range: ¼ - 100", test pressure / 0 – 700 bar / 10,150 psi.

*Is Cryogenic testing a challenge for you and you need help..?*

*Get in touch with Ventil*

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