Valve World

LNG

24 Cover Story:
Walworth: Celebrating 175 years of quality & innovation

33 How do valve end users develop strategic options for purchasing?
41 Valve bonnet structures and cryogenic valve packing performance
50 Market drivers for LNG high-performance cryogenic valves
81 Considerations on switching valves for molecular sieve service

The global magazine for valve and actuator users, suppliers, and specifiers | Vol. 22, Issue 4, May 2017

www.valve-world.net

TOP OF MIND

Why triple-offsets leak at minus 196°C 36

EURAD's Arjen Mollee says a quadruple-offset butterfly valve will be a better option.

FROM THE SHOPFLOOR

"It's important to go a step further" 49

A mini-series honouring some of the many professionals who contribute to the smooth running of the flow control industry. This month, Shanmuga Sundaram, assistant manager at KOSO India Private Limited.

TESTING

Cryogenic valves
Why are they tested with a gas? 65

Cryogenic test standards are based on testing the valve with helium whilst it is submersed in liquid nitrogen. This article endeavours to show why the tests are carried out the way they are, which to some would appear to be back to front!

MEETING POINT

Five minutes with… 69

During a visit to Germany Valve World met with Mr. Rolf Stadelmann, who is the CEO of Kihsco Valves Europe GmbH. He found a few moments in his busy day to discuss the needs of customers looking for non-commodity valves.

VALVE DESIGN

Selection considerations for plunger-type sampling valves 71

Sampling valves are widely used in industry as a way to safely extract a small amount of a fluid from a process system or vessel for testing. This may be required for identification purposes, quality control, etc. This article puts forward many of the issues which should be considered when selecting a plunger-type sampling valve.

VALVE HISTORY

The Industrial Revolution under pressure 90

Part 3 of a series of 4. Very little progress took place in valve design between the end of the Roman Empire and the advent of the Industrial Revolution. Until the 17th century the use of valves was limited to simple, low pressure applications such as storing water, wine and beer. Valves were often carved directly into wooden containers.

REGULAR FEATURES

Editorial	3
Calendar	8
Advertisers' index	8
Industry Update	10
Project Report	29
Ready for Export	79
Innovations & Solutions	96
Buyers Guide	110
Phone Directory	119
Application Guide	121

Why triple-offsets leak at minus 196°C

EURAD's Arjen Mollee says a quadruple-offset butterfly valve will be a better option

Triple-offset metal to metal sealing butterfly valves have been around for quite a time and have become well accepted in many of the process industries. Their benefits have been well-touted: compact size, optimum performance, good resistance in demanding applications, tight shut off, etc. However, their specification for use at cryogenic temperatures should be given more thought, according to EURAD's Managing Director Arjen Mollee.

"A properly engineered and manufactured triple-offset butterfly valve with for example a graphite laminated metal sealing - which is most common - will deliver decent performance in many applications. If you test a quality triple-offset valve at ambient temperature, or even at higher temperature for that matter, you may well see that when closed it has a bubble tight seat seal. However, if you run the test at cryogenic temperatures like minus 196 °C where graphite is no longer applicable for sealing even a quality triple-offset valve will, due to its design, show more internal leakage and even more so when seen in the negative flow direction. This is why users might need to think twice about using metal to metal triple-offsets in applications such as LNG, liquid nitrogen and other cryogenic media," states Mr. Mollee.

The reasons that metal to metal triple-offsets may leak in this fashion can be explained by examining the geometry of the metal components in the valve and taking into account how metals behave when the temperature drops, continues Mr. Mollee.

"Where one component becomes thinner, the other actually thickens"

"Everyone knows that metals will expand and contract as the temperature increases and decreases. The theory states that the change in dimensions occurs linearly, and that is indeed the case if the whole part is heated or cooled to a homogenous temperature. So for example the bore of a pipe with an equal wall thickness all around remains perfectly round at higher or lower temperatures, even when the temperature drops below minus 196 °C."

"However, problems can arise if various combined metallic materials are fitted together which do not have a reasonably equal circular thickness - which is exactly the case with triple-offset butterfly valves. In this situation you have a circular outside shape of a valve body but with the typical elliptical triple-offset seat. In addition, the elliptical shape of the triple-offset sealing ring has a circular inner centre for mounting it to the valve disc. This means you have metal components of varying thicknesses and moreover where one component becomes thinner, the other actually thickens."

Mr. Mollee adds that this factor becomes highly significant for metal to metal triple-offset valves in cryogenic applications. "The way the triple-offset is designed means that the wall sections in both the valve and the sealing ring are not of a constant thickness. The elliptical seat has its shorter axis in the trunnion area of the valve body, for example, meaning that the wall section in that region will be larger. To cut a long and somewhat complicated story short, this means that the valve body seat shrinks the most where the sealing ring shrinks the least and vice versa. Without graphite

A docked LNG tank ship is about to unload LNG to an onshore LNG tank storage terminal.

to overcome these differences - as it is not applicable for sealing at minus 196 °C - the full metal sealing will result in leakage over the seat. And this is why triple-offset valves may be unable to fulfil the criteria for leakage set by applicable standards."

"The valve body seat shrinks the most where the sealing ring shrinks the least and vice versa"

Engineers concerned about valve leakage at low temperature should therefore consider the so-called quadruple-offset valves, continues Mr. Mollee. "The quadruple-offset design is available with a genuine metal to metal seal and has fairly consistent dimensions all around the body as it has a circular shaped seat. The same applies for the sealing ring which is circular shaped with a circular inner centre for mounting it to the valve disc. This guarantees a more linear expansion and shrinkage no matter what the valve size or the applicable temperature."

According to Mr. Mollee, tests run on quadruple-offset butterfly valves have demonstrated the ability of the quadruple-offset design to deliver a tight metal to metal seal at even cryogenic temperatures. "In fact, within the Netherlands a specially designed quadruple-offset tight shut metal to metal butterfly valve is currently being live tested within the LNG truck loading facility of a leading LNG storage organisation. This quadruple-offset butterfly valve functions as a tight shut off control valve with frequent open/close cycles. The valve has an integrated bypass for recirculation LNG flow when required whilst the valve disc has a special anti-cavitation design. The experiences gained from this plus the wider advantages of quadruple-offset butterfly valves in general, should be very interesting for anyone interested in tight shut off metal to metal butterfly valves for cryogenic applications and many other applications for that matter," he concludes.

Arjen Mollee in Profile: Age: 46
- **Education:** Delft University of Technology (engineering) and Radboud University Nijmegen (marketing)
- **Career:** an entrepeneur almost all his life, Mr. Mollee spent several years working for an American global outsourcing provider before taking over the valve business from his father, Mr. Arend Mollee.
- **Current role:** Managing Director and owner of EURAD - www.eurad.com
- **Hobbies:** Mr. Mollee thoroughly enjoys technology in all its guises as well as travelling and meeting people.