DANAÏS Cryogenic: Valves all along the LNG Chain
With its AMRI butterfly valves, KSB is present all along the LNG chain, from gas production to distribution to the final customer. KSB is a leading butterfly valve manufacturer for industry and supplies valves from DN 25 (1’’)) to 3000 (125’’), for cooling water, sea water, steam, inert gas applications, fire fighting systems,…

With the DANAÏS Cryogenic series, you benefit from more than 30 years of experience and constant improvements in the AMRI butterfly valve range. All over the world, several thousands of DANAÏS Cryogenic valves are operated by the most renowned companies in the gas industry – should it be in liquefaction plants, LNG tankers or LNG receiving terminals. They have proven their reliability and absolute safety in the most demanding environments. An outstanding achievement: almost 40% of existing LNG tankers are equipped with DANAÏS Cryogenic valves. The AMRI butterfly valves are manufactured by KSB, as well as the AMRI actuator and automation series. KSB is able to provide you with complete solutions, tailored to your specific needs.

References

Liquefaction plants
- Air Liquide
- Shell Française
- BOC Cryoplants
- Osaka Gas, Osaka (Japan)
- Korean Gas Corporation, Pyeong Taek, Inchon, Tong Young LNG Terminals (Korea)
- Enagas, Barcelona, Huelva and Cartagena (Spain)
- Enron, Dabhol (India)
- Chinese Petroleum Corporation, Yung An (Taiwan)
- Shanghai Haosheng Petroleum, Ring-Ring LNG peak shaving (China)
- Gaz de France, Montoir de Bretagne (France)
- Kempf, Bonn/Bremen

LNG Tankers
- Mitsui O.S.K Lines (Japan)
- N.Y.K. (Japan)
- Kawasaki (Japan)
- Indian (India)

Receiving Terminals
- Sonatrach, Arzew trains GL 2Z / GL 4Z (Algeria)
- Qatar Petroleum, Qatar gas trains I, II and III (Qatar)
- Petronas, M LNG Sato, Dua and Tiga (Malaysia)
- PT Badak, Bontang trains E, F, G and H (Indonesia)
- ADGAS, DAS island trains II (U.A.E.)
- FEAL, Clean LNG trains I and II (France)
- Skandi, Undeland train (Hellas and Slovópolis)
- North West Shelf Woodside train II (Australia)

Constructors
- Kellogg Brown & Root, J.G.C.
- Chantiers de l’Atlantique, Chantiers d’Entretien, Chantiers d’Entretien...
DANAIS Cryogenic valves are renowned for their easy maintenance. All parts can be easily replaced: the main parts are identical for a given diameter, whatever the valve body type. Our maintenance centres are operated by highly skilled technicians. They are located all along the main tanker routes or close to the main production or reception areas. Most of the replaceable parts are available on stock there. We will assist you at very short notice for installation, commissioning or regular maintenance operations.
References

Liquefaction plants
- Sonatrach, Arzew trains GL 2Z/4Z (Algeria)
- Qatar Petroleum, Qatar gas trains I, II and III (Qatar)
- Petronas, M LNG Sato, Dua and Tiga (Malaysia)
- PT Badak, Bontang trains E, F, G, and H (Indonesia)
- ADGAS, DAS island train II (Abu Dhabi)
- PDO, Oman LNG trains I and II (Oman)
- Atlantic LNG, Trinidad train I (Trinidad and Tobago)
- North West Shelf, Woodside train III (Australia)

constructed by Kellogg Brown & Root, J.G.C., Chiyoda, Foster Wheeler,…

LNG Tankers
- Mitsui O.S.K Lines (Japan)
- N.Y.K (Japan)
- Kawasaki (Japan)
- Shell (UK)
- Petronas (Malaysia)
- Hanjin Shipping (Korea)
- B.P. (UK)
- ADGAS (U.A.E)
- Sonatrach (Algeria)

built at Mitsui, Mitsubishi, Kawasaki, Chantiers de l’Atlantique, Hanjin, Samsung, Daewoo, Fincantieri shipyards,…

Receiving terminals
- Osaka gas, Osaka (Japan)
- Korean gas corporation, Pyong Taek, Inchon, Tong Young LNG Terminals (Korea)
- Enagas, Barcelona, Huelva and Cartagena (Spain)
- Enron, Dabhol (India)
- Chinese Petroleum Corporation, Yung An (Taiwan)
- Shanghai municipal natural gas, Ping Hu LNG peak shaving (China)
- Gaz De France, Montoir de Bretagne (France)
- Depa, Revithousa (Greece)

constructed by Sofregaz, Tractebel, N.W Kellogg, I.H.I., Technicas reunidas,…

Industry
- Air Liquide
- Shell Française
- BOG Cryoplants
Different valve types are used on a LNG tanker or in a terrestrial installation. The spare part stocks should be kept to a minimum. KSB took this into account when conceiving AMRI butterfly valves and especially the DANAÏS Cryogenic series. Most of the replaceable parts (seat, shaft, disc, gasket holder) are identical for a given diameter, whatever the body type (buttweld top or side entry, wafer, lugged or flanged).
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DANAÏS Cryogenic. A family profile:

DANAÏS Side Entry
Different valve types are used on a LNG tanker or in a terrestrial installation. The spare part stocks should be kept to a minimum. KSB took this into account when conceiving AMRI butterfly valves and especially the DANAÏS Cryogenic series. Most of the replaceable parts (seat, shaft, disc, gasket holder) are identical for a given diameter, whatever the body type (buttweld top or side entry, wafer, lugged or flanged).
Features

3 layers for unmatched tightness

External sheath: copper or nickel. Resilient even at low temperatures. It compensates for minor alterations to the disc surface.

Internal sheath: stainless steel. Enables the seat to resist pressure constraints.

Spring: Inconel. Compensates for relative displacements between seat and disc due to thermal dilation or pressure.

Solid seat to resist stress

The seat is machined out of a solid plate of stainless steel or inconel. It offers a similar capacity to compensate for relative displacements between seat and disc and a better resistance to high pressures. The reaction ring is no longer a separate part. Thus, the surface in contact with the disc is wider.

Full bi-directional tightness:

Full bi-directional tightness: the flexible seat offers the same high tightness level in both pressure directions.

Seat

For its AMRI butterfly valves, KSB has designed self-centring metallic seats. They feature a unique balance of strength to resist pressure and give flexibility to compensate for relative dilation by temperature changes.

The result

A very high level of upstream/downstream tightness in the most severe conditions. When the disc undergoes minute deflexion under high pressure, the flexible reaction ring will evenly push the seat against the disc, with the required contact pressure to ensure tightness. All internal parts are metallic, making the DANAIS Cryogenic valves intrinsically fire safe.

Kinematics

The double-eccentric kinematics eliminate friction during operation. The disc is hardened with stellite (i.e. hard chromium), reducing wear and resulting in a long service life.

Design and quality control

KSB is certified ISO 9001. We use the latest simulation methods – such as finite element analysis and casting flow simulation – to ensure that our valves meet the highest requirements of our customers. The standard procedure for buttweld valves includes radiographic examination of buttweld ends and die penetrant body test.
**DANAÏS Cryogenic.**

**Low maintenance. Very high cost savings. Long service life.**

<table>
<thead>
<tr>
<th>Models</th>
<th>DANAÏS Flanged*</th>
<th>DANAÏS Buttweld Side Entry</th>
<th>DANAÏS Buttweld Top Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sizes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to Class 150 - 20 bar</td>
<td>50 to 2000 mm</td>
<td>150 to 1200 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2” to 80”</td>
<td>6” to 48”</td>
<td></td>
</tr>
<tr>
<td>Class 300 - 50 bar</td>
<td>50 to 1500 mm</td>
<td>150 to 1200 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2” to 60”</td>
<td>6” to 48”</td>
<td></td>
</tr>
<tr>
<td>Class 600 - 100 bar</td>
<td>100 to 1050 mm</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>4” to 42”</td>
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<td></td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A 351 gr CF8M</td>
<td>A 351 gr CF3M</td>
<td></td>
</tr>
<tr>
<td>Extension bonnet</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A 351 gr CF8M</td>
<td>A 351 gr CF8M with stellite overlay</td>
<td></td>
</tr>
<tr>
<td>Disc**</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A 638 gr 660</td>
<td>A 638 gr 660</td>
<td></td>
</tr>
<tr>
<td>Shaft**</td>
<td>Stainless steel</td>
<td>Stainless steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A 638 gr 660</td>
<td>A 479 gr 316L</td>
<td></td>
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<tr>
<td>Seat</td>
<td>Class 150</td>
<td>Copper (Nickel on request)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 300</td>
<td>Stainless steel A 638 gr 660</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Class 600</td>
<td>Inconel</td>
<td></td>
</tr>
<tr>
<td>* also exists with wafer or lug body*&lt;br&gt;* other materials available**</td>
<td></td>
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</tr>
</tbody>
</table>

**Performances**

- **Temperature range:** -250 °C to +260 °C (-420 °F to +500 °F)
- **Tightness at ambient temperature:** BS 6755 rate A, API 598, ISO 5211 rate A
- **Tightness at cryogenic temperature:** BS 6364, Shell specifications. Also in accordance with specifications of major gas producers or LNG tankers ship owners.
- **Fire resistance:** DANAÏS Cryogenic valves have been successfully tested in accordance with BS 6755 part II and API 6 FA standards.
KSB offers a complete range of AMRI gear boxes and electric, pneumatic and hydraulic actuators, with torques up to 16,000 Nm. When mounted onto an AMRI valve, you benefit from an optimised and complete solution. With its complete AMRI accessory range, KSB offers standard solutions to almost any requirement as far as remote control, valve command or regulation are concerned. We are in a position to design and implement solutions tailored to your needs.
KSB maintenance centres worldwide along the LNG tanker routes

Call the Head Office or your local KSB Representative.

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Your local KSB Representative