Winterization of LNG cargo valves

By Stanislas Longuet, Sales Director, SNRI/Malbranque Member of Valco Group

SNRI, France is one of the leading makers of valves for LNG applications with a huge global Reference list including practically all LNG projects of Greek owners. (**INTRA MARE is local distributor for Greece and Cyprus**).
Subject article is focusing on special demands of cryogenic valves operating in Arctic environment.
LNG cargo valves are expected to be considered as «essential service» by Class.
Extreme cold temperatures are not new for LNG cargo valves which are routinely operating at – 160°C. Low temperature is not the only issue that the valve on the deck has to deal with in the arctic seas. Icing is also very critical for the good operation of the valves. Ice can badly damage moving parts and damage the tightening parts of the valves.
Primarily, the following points shall be reviewed at Design Stage to avoid any risk of failure or mis-operating with the above mentioned conditions (temperature and ice):
- what about the cargo valves actuators?
- what about position sensors and indicators?
- what about stem packing and seals?
- what about manual emergency operations?
- what about actuator operating fluid ?
- What about icing of moving parts?

To assess the valve behavior under these extreme weather conditions, a specific thermal model has been performed on a standard cryogenic valve

•Valve body at –163°C
•5 cm of ice cover over the extension rod
•- 40 C ambient temperature

Thermal modelling results for globe valve shows that
everything depends on the ice thickness, with the following results;

•Calculated temperature at level of the actuator flange:- 50°C

• Calculated temperature at level of the stem packing : - 70°C
According to these results, specific materials (for packing) and arrangement have to be considered. In addition the length of the cryogenic extension shall be re-considered and extended (at least in compliance with the BS6364 or ISO ISO 28921-1,) with a minimum length m from the bottom of it to the bottom of the gland packing between 200 mm to 700 mm according to the size of the valve. One other technical aspect which should be simulated is also the vibration as the ship will meet severe shock and vibrations during arctic voyages with icebreaking. These vibrations are very critical for cryogenic , especially in the case of remote controlled valve with actuators. The weight located on the top of the cryogenic extension may generate heavy stress on it. The quantity of ice will make the situation worse. Extensive vibration tests should be done to check the potential risks of damage.
Taking into account, these two simulations, the design of valves shall be reviewed with the following improvement in order
• Specific packing
– For extremely low temperatures
– With Low effort, to compensate the additional friction due to the ice on the moving parts
• Specific arrangement to protect the stem against ice
– Protected by a housing (large valve) or sensitive area embedded (small valves)
• Actuator support for large valves with actuator to avoid any damage of the cryogenic extension in case of high vibration during ice breaking transit.
• Specific and dedicated operating mode
– Manual valves
• Specific handwheel nut bearings for low temperatures (316SS)
• Possibility to implement reduction gears + in-housing switches for remote reading (visual limit switches will not be readable when covered by ice)
– Remote controlled valves:
• Based on Explosion proof Electrical actuators (if acceptable) or hydraulic actuator with special device and special oil with viscosity compliant with low temperatures and also high temperature. SNRI has developed a specific design which has been tested from -40°C to 55°C with homogenous performances.
As a conclusion, a cryogenic valve shall be considered as a complete system to be qualified with these specific conditions. Design shall be confirmed not only based on the sum of evaluation of single components which may be damaged by the low temperature, such as gasket, packing grease, electrical components, but also as a global assembly which will contain LNG at -196°C, will be totally or partially covered by ice. Tests are mandatory to validate the calculations and to be sure that valves can perform its main functions and performance safely.