

Large-scale Electrical Feedthroughs for Cryogenic Pumps used in Liquefied Natural Gas (LNG) Vessels

Glass-to-metal sealing technology offers highest safety & reliability

Ships are increasingly used to transport liquefied natural gas (LNG) inside four or five huge tanks, after it has been liquefied by reducing its temperature. The special pumps that charge and discharge carrier vessels with LNG typically feature an integral shaft with the entire motor, bearings and all other components completely submerged and flooded with LNG. For this reason, they must be sealed perfectly, particularly where the electrical connections from the deck of the ship lead into the pump.

Functions of Large-scale Electrical Feedthroughs

- SCHOTT's penetration modules perform two key functions:
 - 1) Safely provide electricity to applications which are highly sensitive due to its potential exposure to explosive atmospheres, e.g. expanders, compressors and (submerged) pumps (spray-, cargo-, emergency cargo-).
 - 2) Maintain the pressure boundary integrity of the containment structure.
- Large-scale electrical feedthroughs are hence **critical safety components** – Reliability of the technology is of utmost importance.

Product Information

Glass-to-metal sealed (GTMS) penetrations allow the safe conduction of electricity and data through the pressure-resistant and tightly-sealed containment walls of LNG vessels. In the case of an accident, these GTMS penetrations will withstand high pressure and temperature as stipulated by ATEX requirements.

SCHOTT's penetrations, with glass compression technology, can survive significant accelerations and is insensitive to temperature and aging for periods much longer than the service lifetime of the LNG vessel, thereby providing an ample margin of safety.

Advantages

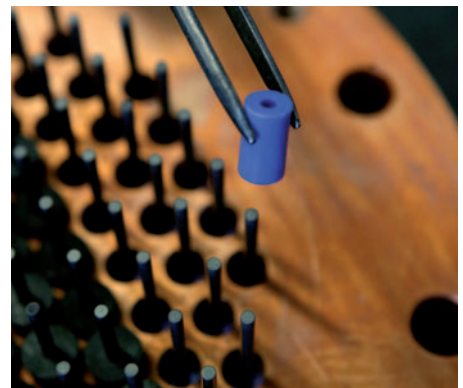
- **Unlimited lifetime** of pressure barrier due to inorganic, glass-to-metal sealing technology
- **Resistant to thermo-cycling and thermo-shock**
- **Resilient to cold temperature** (ranges from -196 °C to $+65\text{ °C}$ or -320.8 °F to $+122\text{ °F}$)
- **High pressure resistance**
- **Mechanically rugged**
- **Low life cycle cost** due to low cost installation and age-insensitive technology
- **Maintenance-free**
- **Minimum 60 years** of qualified lifetime for assembly
- **Easy installation** utilizing a connector
- **Minimum space impact**
- **Ideal for up to 6,600 volts and 400 amperes** as well as for instrumentation purposes



Testing of large-scale electrical feedthrough used for LNG vessels



Visual inspection of feedthrough used for LNG vessels



Assembly of glass preform for large-scale feedthrough (LFT) for LNG vessels

Maintenance-Free Performance – For over 25 years in land-based and marine LNG applications around the world

Our Experience

- **Manufactured and certified according to CENELEC (Comité Européen de Normalisation Electrotechnique) or IEC (International Electrotechnical Commission)**
- **Proven and standard technology in other harsh environments:**
 - Automotive safety systems (air bags)
 - Oil and Gas
 - Nuclear power plants / submarines

Our Quality Assurance Ensures 100% Final Inspection of All Products

- **Our In-house Testing Capabilities:**
 - Current / Voltage (up to medium voltage)
 - Hermeticity (mass spectrometer)
 - Insulation resistance
 - Corrosion material analysis (REM)
 - Non-destructive tests / investigations (MPI, DPI)
 - Pressure Tests up to 160 MPa
 - Cryogenic tests
 - LOCA Simulations (Loss of Coolant Accident)

Our In-house Competences

- **Engineering Capabilities:**
 - Design of electrical penetrators, connectors and complete system solutions
- **System Expertise:**
 - Specific knowledge on thermal and radiation aging of organic materials
 - LOCA load, type tests, reliability investigations
 - Mathematical simulation and calculation, own type test capabilities
- **Materials Science Expertise:**
 - Europe's largest R&D and Testing Center for Glass
 - Specialty glass melting, milling, spray drying and preform production
 - In-house processing of ceramics
- **Surface Treatment Expertise:**
 - Major plating facility including Ni (E-less, Watts), Cu, Ag, Au, Sn



Various sizes and designs of sintered glass performs



Plating of large-scale electrical feedthrough for LNG vessels

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