



CRYOGENIC SOLUTIONS

**PREMIER ENGINEERED LNG/LPG
PRE-INSULATED PIPE SYSTEMS**

PARTNERS IN EXCELLENCE



PREVENTION MATTERS

LNG is used as a way for transporting natural gas economically to the global energy markets where it is regasified and distributed as natural gas. To be able to safely, economically, and efficiently ship LNG around the world in large LNG tanker ships, natural gas is liquefied by cooling the gas down to $-163\text{ }^{\circ}\text{C}$ ($-261\text{ }^{\circ}\text{F}$). Liquefying natural gas also allows for efficient storage and transportation.

Because LNG is stored as a cryogenic liquid, it requires using appropriate, reliable, high-quality materials, and safety precautions to contain and handle the fluid in the piping systems and storage tanks. The LNG lines are properly insulated to maintain the constant low temperature of the fluid to minimize any heat gain and boil-off, as well as protecting the personnel handling the system.

To address these LNG requirements, it is important to have proper system design, material specification, installation, and maintenance to protect the overall piping system from these risks and provide long-term pipe efficiency.

SYSTEM DESIGN & MATERIAL EXCELLENCE

Prevention starts with the proper design of the piping system and the right selection of materials. PERMA-PIPE is available to support your project from start to finish with the following LNG offerings:

- XTRU-THERM® pre-insulated pipe system with HDPE outer jacket or POLY-THERM® with FRP/GRP outer jacket to meet LNG/LPG design requirements.
- Available in either thermally efficient polyurethane (PUR) or polyisocyanurate (PIR) foam insulation. The PERMA-PIPE systems are factory-applied, sprayed, and void-free.
- The insulation is fully bonded to the pipe and interface layer. Therefore, it will contract and expand at the same rate as the carrier pipe.
- The foam can be applied in a single layer with no thickness limitations. Shiplap formation and vapor barrier between layers are not required.

- Contraction joints are not required in the PERMA-PIPE systems.
- The HDPE/FRP/GRP outer jacket serves as a single moisture barrier, and stainless steel or aluminum jacket is not required.
- Systems are designed to meet structural strength requirements for handling and slinging during construction and for potential movement during operation (typically 350 KPa–400 KPa or greater).
- A metallic diffusion barrier is used to ensure continuous thermal conductivity during the pipe's service life.
- The PERMA-PIPE systems meet ABS, IMO, and U.S. Coast Guard regulations for maritime application and ensure the highest quality, consistency, safety, and efficiency.

EASY & COST-EFFICIENT INSTALLATION

Commonly used field-applied metallic jacket-type insulation systems are vulnerable to poor or incorrect installation and require a high level of craftsmanship. PERMA-PIPE's pre-insulated pipe systems are:

- ISO-certified quality assurance system includes testing and traceability conducted on all piping systems to increase supply chain visibility, improve quality control, and reduce future risk.
- XTRU-THERM and POLY-THERM foam insulation systems use simple cradle supports directly clamped over the jacket. This design provides numerous advantages, such as an uninterrupted insulation system, consistent thermal performance along the pipe, and a robust and straightforward design that is easy to install and commercially attractive.
- 100% waterproof bonded systems, with no carrier pipe movement within the insulation system and total elimination of water ingress and mechanical wear.
- Custom designed in modular sections of pipe that ship from our plant to the project site where it is easily assembled.

MAINTENANCE-FREE

If system design, material specification, or installation do not lead to corrosion under insulation or other failures, maintenance can. PERMA-PIPE's premier engineered pre-insulated pipe systems are virtually maintenance-free.

- XTRU-THERM and POLY-THERM pipe systems reduce piping costs, maintenance requirements, and increase pipeline reliability.
- Utilization of optional Aerogel nanotechnology insulation reduces insulation thickness resulting in a more compact pipe, increased overall savings, and a leak-free system.
- Optional PermAlert® leak detection systems detect small amounts of moisture on the pipe or in the insulation, providing an early warning of potential problems.

PERMA-PIPE'S SOLUTIONS

PERMA-PIPE pre-insulated pipe systems avoid premature failure of the pipe caused by corrosion and resulting in production downtime, costly maintenance & repair, and health & safety risks. Furthermore, our systems not only increase overall value by reducing installation and field labor costs but also to extend the life of the piping system.

PERMA-PIPE has a dedicated team of engineers ready to assist throughout your project from front-end engineering design (FEED) to construction and installation to meet your application requirements. We have an extensive track record of successful global projects to showcase our experience.



PARTNER WITH PERMA-PIPE

PERMA-PIPE International Holdings, Inc. (NASDAQ:PPIH) is a global engineered pipe services company offering core competencies in anti-corrosion coatings, insulation solutions, containment systems, leak detection systems, engineering support, field service, and custom fabrication.

When you do business with PERMA-PIPE, you are partnering with a company that has served the industry for over 100 years and has vast experience in all the markets we serve. You are not just buying a long-lasting, reliable piping system; you are also investing in a partnership with a company that stands behind its products and services while providing lasting peace of mind.

PREMIER ENGINEERED SERIES

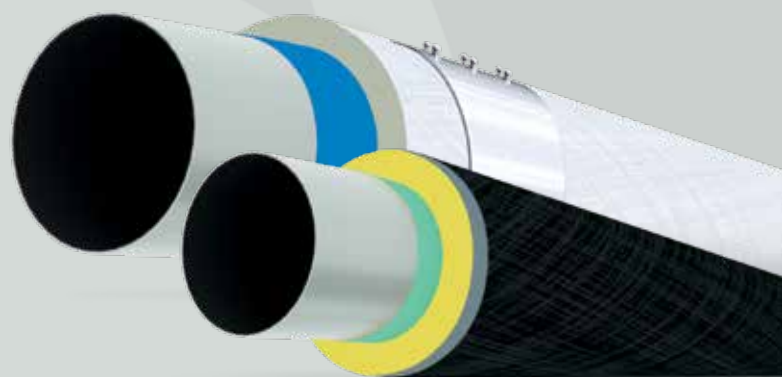
XTRU-THERM®

Pre-Insulated Pipe System




POLY-THERM®

Pre-Insulated Pipe System



The outer jacket's standard color is black. Also, available in any color, please ask PERMA-PIPE for more information.



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