



LNG

VACUUM INSULATED PIPE SOLUTIONS



www.ChartLNG.com

Your Proven, One-Stop LNG VIP Solutions Provider

Chart delivers the broadest portfolio and deepest expertise for the full range of bulk transport applications.



Photo Courtesy Darwin LNG | 21,000 feet of vacuum insulated pipe | 4", 6", 12", 20" 24" and 30" inner diameter Design pressure of 18.7 bar (275 psi) | Placed into service in 2005 | Darwin, Australia Due to oil instability and rising energy demand, natural gas has become a preferred fossil fuel for a variety of commercial applications worldwide. Consequently, liquefied natural gas (LNG) will play a vital role in helping many organizations reach new markets with their products. However, one key challenge involves finding a way to distribute LNG in the safest, most reliable and most economical manner possible.

Vacuum insulated pipe (VIP) offers a long list of proven LNG distribution advantages over the commonly used mechanically insulated pipe (MIP). Although MIP has a lower purchase price, the savings end there. With its double-wall design, VIP heat leakage is 90% less than MIP. VIP is also easy to install, maintain and expand upon, while lasting for decades instead of only a few years. All of this results in a significantly lower total cost of ownership.

As a leading global manufacturer of products, systems and services for cryogenic and gas processing applications, Chart provides flexible, integrated VIP solutions for almost any LNG bulk transport configuration imaginable — whether over water, overhead, underground, at grade or in any combination. We offer the broadest portfolio of standard and custom-engineered products. Our VIP Design Services team also applies 50 years of experience toward ensuring the safest, most reliable and most cost-efficient installations for every customer, over the long term.

High Performance, Minimal Maintenance

With its double-wall and vacuum insulated design, Chart VIP features the lowest inherent leak of any pipe insulation available. Such thermal efficiency minimizes vaporization and ensures a consistent supply of high-quality liquid. Internal expansion bellows also eliminate the need for large expansion loops, reducing pressure drops and simplifying installation. Since the VIP exterior will not corrode and interior insulation will not disintegrate, periodic touchup painting is typically the only maintenance required.

Advanced Safety and Security

The Chart VIP Design Services Team applies a long list of best practices to ensure safe and secure installations. In addition to using only top-quality materials, that includes adding dual relief valves to protect against overpressurization, along with ongoing system health monitoring and sound containment management strategies. We also employ sophisticated measures to protect against terror threats, energy plant failures and natural disasters. In fact, VIP is proven to withstand hurricane and typhoon strength storms far better than conventional piping.

Lowest Cost of Ownership

With the greatly reduced product loss, low maintenance and 20 to 30-year service life of a doublewall containment vessel, Chart VIP solutions easily pay for themselves over time compared to MIP. The resulting long-term operational savings will greatly surpass the slightly higher one-time capital expenditure of VIP. In addition, every Chart customer has ongoing access to the consultative expertise of the VIP Design Services team, which is readily available to help ensure that each installation operates safely and efficiently at all times.



Photo Courtesy Freeport Texas | 14,000 feet of vacuum insulated pipe | 26" process line and 12" vapor lines Design pressure of 15.4 bar (224 psi) | Placed into service in 2008

Expanding What's Possible in LNG Distribution

Over the last 30 years, Chart has made the investments necessary to become a true one-stop LNG VIP solutions provider. From concept through creation, we handle everything from feasibility studies, process engineering and project management to procurement, shop fabrication, field installation and ongoing support. The end result is state-of-the-art VIP designs that have provided decades of exceptional performance and cost-efficiency in applications around the world.

Liquefaction Plants

The exceptional thermal efficiency of VIP makes it an ideal solution for systems that convert natural gas into a highly space-efficient liquefied cryogenic state. Within only a few years of use, MIP tends to become saturated with moisture in liquefaction plants, resulting in noticeable insulation value reductions. In contrast, VIP maintains its like-new performance and full insulative properties for decades and does not develop condensation or ice buildup. This keeps the LNG in a liquid state longer, helping plants to minimize their product losses.



In 1998, VIP was first used to transfer LNG at the Atlantic Train 1 facility in Trinidad, West Indies, on an LNG cool-down line measuring 760 meters (2,493 feet) in length. The installation has been extremely successful and remains in continuous operation today, with no performance degradation and minimal required maintenance.

LNG Filling Stations

LNG filling station construction involves a series of design considerations, each of which ultimately contributes to the long-term safety, reliability and profitability of the installation. However, one decision that often gets oversimplified is the piping used to distribute LNG from the onsite storage vessels to the LNG dispensers. Chart offers complete, integrated VIP solutions for safe, dependable and economical dispensing. Our expertise covers the full range of LNG filling station types, including those supporting anywhere from one to hundreds of vehicles.

Import/Export Shipping Facilities

When used as transfer piping for loading and unloading ships, Chart VIP offers flexibility to be routed either underwater or along the trestle between the ship offload area to the onshore storage or processing facilities. VIP also exhibits minimal heat losses even when traveling several kilometers, and since internal bellows eliminate the need for major expansion loops, it's far safer and more secure than MIP. Facility owners will benefit from reliable performance and minimal maintenance over a long service life, helping to keep operating costs low.



A major energy company contracted Chart to design, manufacture and commission 20 LNG fueling stations, the first of which opened in May 2014 in California. Each station can fill 150 trucks per day.



The Chart VIP Design Services team helped configure, design, manufacture, supervise installation and commission the LNG Export Facility in Darwin, Australia, which has been in continuous use since 2005. All piping connecting the liquefier to the tank and ships is VIP, with more than 400 spools extending a total of 6.1 kilometers (3.8 miles).

The Complete Product Offering

Only Chart delivers the components, service and application-specific expertise you need to reliably and economically manage LNG distribution, today and well into the future.

Outer Stainless Steel Piping

The outer carrier of Chart LNG VIP offers superior structural integrity for the annular vacuum. The standard factory finish is a bright anneal. Fiberglass supports keep the inner and outer piping concentric, and a wide variety of jacket sizes are available.

2 Inner Stainless Steel Piping

The Chart inner line handles cryogenic liquids at temperatures as low as -450°F (-268°C), with working pressures up to 400 psi. Stainless steel internal bellows help to compensate for thermal expansion. The inner wall itself is kept as thin as possible while still remaining ASME B31.3 and ASTM A312 compliant. Piping turns are also kept to a minimum to uphold high flow, and pressure drop is minimized by avoiding cross-sectional area reductions.

3 Insulation Wrap and Vacuum System

A super insulation vacuum system is hermetically welded for leak-free construction within the double walls. Annual space vacuum levels are held to fewer than 10 microns to minimize heat transfer from convection. To minimize radiation, layers of cryogenicgrade foil and glass paper are wrapped on the inner pipe.

4 Vacuum Technology

Many Chart vacuum systems still hold a vacuum after 30 years of heavy use, some even after 50 years. We back these claims with an industry-leading 10-year limited VIP warranty, plus 20 years on design life. The Chart DV-6 vacuum monitor also leverages Hastings thermocouple technology for highaccuracy measurements of LNG VIP annular space vacuum level.



Leveraging proprietary chemical systems, Chart Vacuum Technology™ (CVT) is proven to deliver decades of superior LNG VIP performance in applications worldwide.

Your Premier LNG VIP Solutions Partner

Through unmatched product depth, application expertise and service, Chart provides everything required to deliver LNG VIP solutions that offer the utmost in reliability and longevity, with minimal maintenance and a low cost of ownership.

Partnering with us means you have a highly experienced team of VIP design specialists to support you long after installation is complete. Regardless of the scope, scale or required configuration, we'll apply more than 50 years of experience toward keeping your LNG VIP solution safe, productive and cost-efficient for decades.



Idku, Egypt – ELNG Two piping sections are connected during field installation. In service since 2005, the Idku site incorporates 11,000 feet of LNG VIP for cool-down and processing. The internal diameter is 8" and includes internal bellows, with a design pressure of 18.7 bar (275 psi).



Darwin, Australia – LNG Export Facility

A support fixture helps maintain inner stainless steel roundness during welding. The Darwin site was placed into service in 2005, with 21,000 feet of LNG VIP for cool-down transfer and return. Internal diameters range from 4" to 30" with internal bellows and a design pressure of 18.7 bar (275 psi).



Photo Courtesy Darwin LNG | 21,000 feet of vacuum insulated pipe | 4", 6", 12", 20" 24" and 30" inner diameter Design pressure of 18.7 bar (275 psi) | Placed into service in 2005 | Darwin, Australia

Learn More Today Contact us to further explore how a partnership with Chart VIP Design Services can optimize the long-term safety, reliability and cost performance of your LNG distribution system.

Call 1-888-877-3093 or Email chart.sales@chartindustries.com



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