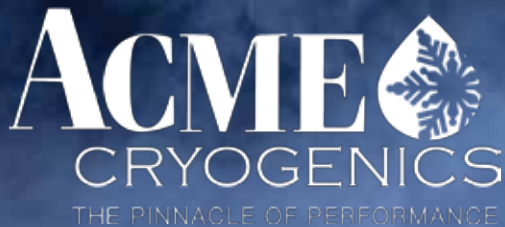


Acme Cryogenics

VACUUM INSULATED PIPE

Vacuum Jacketed Piping Solutions

Preferred piping solution for the safe, reliable, cost-effective transfer of cryogenic liquids - such as liquidified nitrogen, oxygen, argon, helium, hydrogen, and natural gas - from storage tanks to final point of use.



THE ACME ADVANTAGE FOR YOUR VACUUM JACKETED PIPE

LEGACY

The "Quality Cryogenics" brand of Vacuum Jacketed Pipe (VJP) was acquired by Acme Cryogenics in 2001. With the new name came added resources. Our current customers include major aerospace companies, all major gas distributors, and the US Government.

FACILITIES

The Vacuum Jacketed Pipe division of Acme Cryogenics has recently completed a move into a new 38,400 square foot facility, located in Ball Ground, Georgia. This new facility will result in shorter lead times for customers and give Acme the ability to produce larger sizes of VJP (up to 12" NPS inner line size).

EXPERTISE

Each VJP project is managed by a "sales engineer" who has been trained in ASME B31.3 pipe design, cryogenic safety and VJP project management.

RESPONSIVENESS

Our goal is to return your quote within 24 hours of submittal. Standard lead time for custom designed VJP can be as little as four weeks from approved design. Acme can offer an expedited build for critical delivery projects.

Acme Cryogenics was established in 1969. Today we are North America's leading manufacturer of cryogenic gas equipment and systems with a proud history of innovation, responsive customer service, and responsible environmental stewardship. We provide engineering, design, fabrication, installation, and repair services to the Food Packaging, Pharmaceutical, Semi-Conductor, Aerospace, Medical Gas Pipe, and Industrial Gases industries. We welcome the opportunity to deliver for you.

DESIGN CAPABILITIES

We offer surveying and on-site pipe design resulting in a safe and reliable system to fit your facility's needs. This guarantees the VJP system fits your building, or we fix it – for free.

EXTENSIVE PRODUCT LINE

Custom designed VJP systems, Quick-Fab VJ pipe and CryoFast piping covers virtually all uses of Vacuum Jacketed Pipe. In addition, Acme also offers a complete line of accessories including bayonet or field joint couplings, keep-colds, phase separators, tank switchers, and VJ SuperFlex hoses.

INSTALLATION SERVICE

Acme Cryogenics has a nationwide field service team available to install your new VJP system. The field service team is also trained in repairing existing systems and preventative maintenance on your current vacuum lines, regardless of manufacturer. Acme' standard manufacturer's warranty is doubled when the VJ pipe is installed by Acme's field service technicians.



To discuss the benefits of putting the Acme Advantage to work for you, call 1.800.966.6167.

Vacuum Jacketed Piping Solutions

Acme Cryogenics has designed and fabricated Vacuum Jacketed Piping (VJP) systems, equipment, and components since 1969, serving national laboratories, Fortune 500 companies, and cryogenic equipment users worldwide.

Our VJP systems are the most cost-effective and highest quality method of transferring liquefied nitrogen, oxygen, argon, natural gas, carbon dioxide, hydrogen, and helium. We provide complete system design and installation while meeting the most stringent safety and quality standards at every stage of manufacturing.

VJP is the state-of-the-art solution for super-insulated piping that protects process integrity and the quality of process and product results. Field proven over decades of use in the most demanding applications, Acme Cryogenics VJP delivers precise performance, long life, and exceptional reliability to also ensure your process or facility's operation and safety, and to minimize downtime.



VJP – THE INSIDE STORY

Vacuum Jacketed Pipe is essentially two pipes in one—an inner carrier pipe in which the cryogenic liquid is transferred, and an outer pipe that supports and seals the vacuum insulation, forming the “Vacuum Jacket” around the inner pipe. The inner line is suspended inside the outer jacket by a series of non-conductive supports. Depending on system design pressure, internal or external expansion joints are used to compensate for thermal contraction of the inner line.

The inner carrier pipe and the outer jacket are constructed from stainless steel pipe or tubing. The inner line is wrapped with a multi-layered super insulation which blocks radiative heat transfer. The entire annular space between the inner line and the outer jacket is evacuated to prevent convective heat transfer. The vacuum space is then factory sealed, forming a “static vacuum”. Chemical getters are used to maintain the vacuum space and provide maintenance free operation for up to 20 years.

The result is the most efficient transfer system available for cryogenic liquids.

INTEGRITY IS INTEGRAL

The integrity of our customers' processes is what drives our quality program. The companies and research institutions we serve select us because of the exceptional results they can achieve using the highest quality VJP. The design and manufacture of Acme VJP are in accordance with the highest industry and manufacturing standards.

Inner Carrier Line – The inner line is designed and built in accordance with ASME/ANSI B31.3. Typical Design Pressure = 150 psig.

Outer Jacket – The outer jacket is designed to ASME Code Section VIII for unfired pressure vessels with an internal vacuum and external atmospheric pressure with the assembly at ambient temperature.

Certified Welders – Qualified per ASME Section IX and ANSI B31.3 for MIG, TIG, and orbital welds.

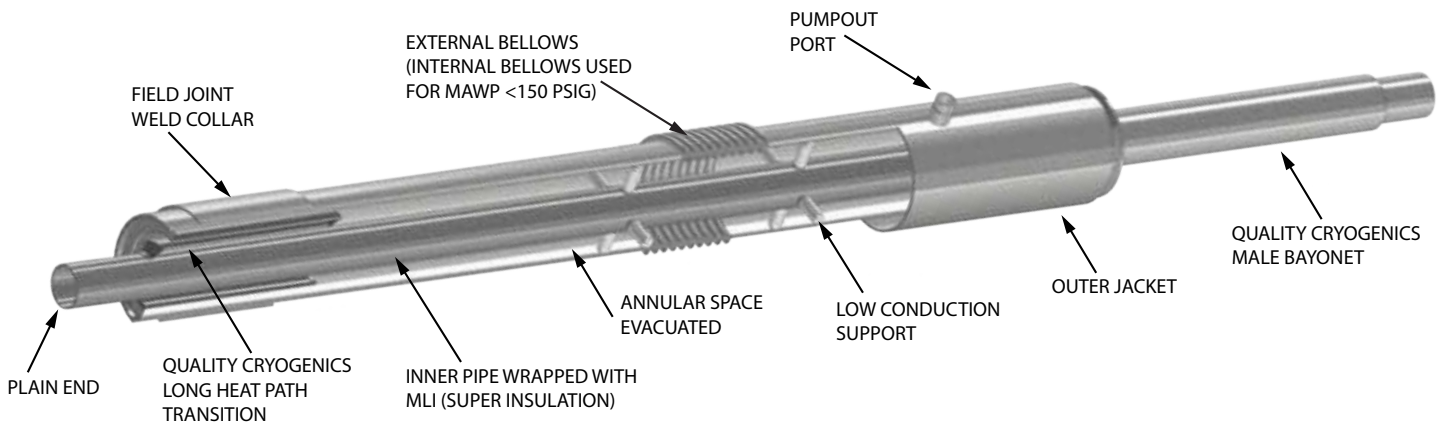
All inner process and outer jacket welds are helium mass spectrometer leak tested at 1×10^{-8} cc/sec. Vacuum pumpdown, bakeout and final retention testing is performed on every individual spool assembly.

MORE THAN THE SUM OF ITS PARTS

The numerous advanced features of Acme Cryogenic Vacuum Jacketed Piping solutions are designed to work together to produce exceptional efficiencies across the entire system. The result is substantial savings in terms of lost gas prevention, reduced maintenance costs, and exceptional value over the life of the system.

And because of our highly specialized expertise and cryogenic industry focus, we are able to offer the best lead times in the industry.

VJ PIPE FEATURES	BENEFITS
Double Walled Construction	Lowest Heat Inleak
Factory Sealed Vacuum Sections	Vacuum Integrity To 20 Years
Prefabricated	Easy Shipping and Installation
Vacuum Insulation	Maximum Liquid Preservation
Minimal Cryogenic Liquid Loss	Lower Ultimate Gas Costs
Series 304 Stainless Steel Fabrication	Maximum Service Life
Bayonet Design Options	Easy Installation
Standard Pipe Hangers	Low Install/Maintenance Cost
Helium Mass Spectrometer Leak-Testing	Vacuum Integrity
Modular Construction	Ease Of Expansion/Modification
Internal Liquid Traps	Prevents Boil-Off
Vacuum Jacketed Valves	Branch and Equipment Isolation
Flexible Piping Options	Thermal Contraction/Simple Installation



VALUE Vs. COST OF HEAT LEAK

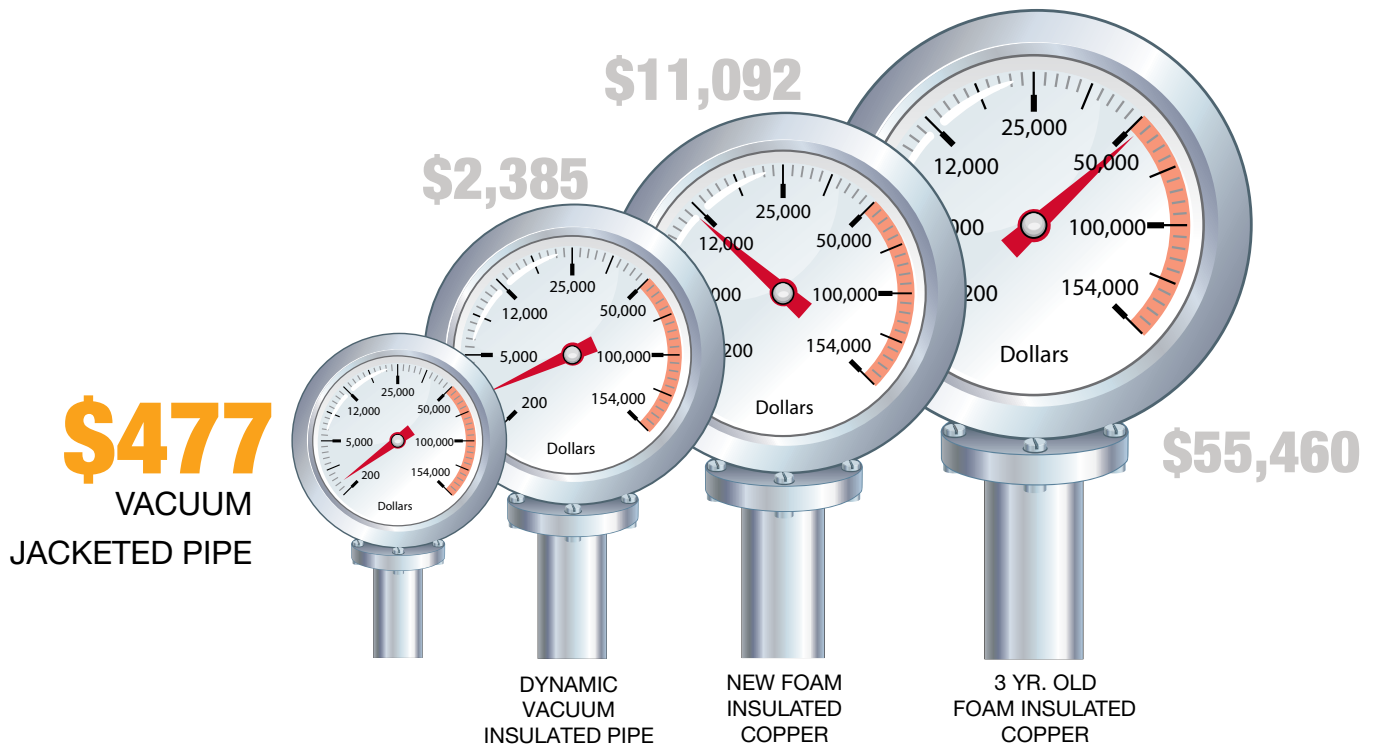
The biggest challenge during cryogenic liquid transfer is the loss of product due to heat transfer. Acme VJP is specifically designed to transfer cryogenics with minimum heat leak. The combination of our factory sealed vacuum jacket, internal support system, and multi-layered insulation prevents heat loss due to convection, conduction, and radiation.

VJP may have a higher initial cost than less efficient piping alternatives—however, VJP's vastly superior performance characteristics more than make up the difference in just a fraction of the system's lifespan. Substantial gas savings alone, over the lifetime of the installation, make it a significantly less expensive design choice than mechanically insulated pipe.

The following represents a typical gas product loss comparison based on 200' of 1" diameter process line transporting liquid nitrogen 16 hours per day/ 5 days per week/50 weeks per year with a base LN2 price of \$0.40 per gallon.



ANNUAL COST OF LOST GAS PRODUCT PER YEAR



HEAT LEAK / PERFORMANCE COMPARISON

Line Size	VJP BTU/HR/FT	Insulated Copper BTU/HR/FT		Bare Copper BTU/HR/FT
		New	After 3 Yrs Old	
¾" ODT	0.47	7.9	32.3	165
1" IPS	0.50	8.8	44.2	280
1½" IPS	0.58	10.5	52.7	397
2" IPS	0.64	12.2	60.8	530
3" IPS	0.79	15.2	76.1	769
4" IPS	0.92	18.2	90.8	1,000

RIGID VACUUM JACKETED PIPE HEAT LEAK RATES

Inner Pipe Size/Material	Jacket Pipe Size/Material	Total Weight LB/FT (KG/M)	Cooldown LBS OF LN2/FT (KG OF LN2/M)	Heat Leak BTU/HR/FT	Bayonet Heat BTU/HR (WATT)	Field Joint BTU/HR (WATT)
CRYO-FAST VJ PIPE (TUBE SIZES)						
½" ODT x .035W 12.7 mm OD 304SS	2" ODT x .065W 50.8 mm OD 304SS	1.6 (2.4)	0.10 (0.15)	0.28 (0.27)	7.2 (2.1)	N/A
¾" ODT x .035W 19.1 mm OD 304SS	2" SCH 5 60.3 mm OD 304SS	2.1 (3.1)	0.14 (0.21)	0.30 (0.29)	6.6 (2.1)	N/A
ACME CRYOGENICS VJ PIPE (PIPE SIZES)						
½" SCH 5 21.3 mm OD 304SS	2" SCH 5 60.3 mm OD 304SS	2.4 (3.6)	0.27 (0.40)	0.32 (0.31)	6.6 (1.9)	5.9 (1.7)
1" SCH 5 33.4 mm OD 304SS	3" SCH 5 88.9 mm OD 304SS	4.2 (6.2)	0.43 (0.64)	0.45 (0.43)	9.1 (2.7)	5.9 (1.7)
1½" SCH 5 48.3 mm OD 304SS	3½" SCH 5 101.6 mm OD 304SS	5.0 (7.4)	0.64 (0.95)	0.56 (0.54)	13.3 (3.9)	8.5 (2.5)
2" SCH 5 60.3 mm OD 304SS	4" SCH 5 114 mm OD 304SS	5.8 (8.6)	0.80 (1.19)	0.75 (0.72)	20.9 (6.10)	11.5 (3.4)
3" SCH 5 88.9 mm OD 304SS	5" SCH 5 141 mm OD 304SS	9.8 (14.6)	1.51 (2.25)	0.98 (0.94)	N/A	29.4 (8.6)
4" SCH 5 114 mm OD 304SS	6" SCH 5 168 mm OD 304SS	12.0 (17.9)	1.96 (2.92)	1.28 (1.23)	N/A	35.3 (10.3)
6" SCH 5 168 mm OD 304SS	8" SCH 5 219 mm OD 304SS	18.0 (26.8)	3.80 (5.65)	1.65 (1.59)	N/A	96.4 (28.2)



MAKING THE RIGHT CONNECTIONS

Acme offers two standard types of vacuum insulated connections depending on the design conditions and installation requirements.

Bayonet Connections are designed for lower pressure applications up to 150 psig. Bayonet connections do not require any welding or vacuum work in the field. With proper planning and careful measurement, bayonets offer an easy to install, low profile, vacuum insulated connection.

Field Joint Connections offer improved thermal efficiency over bayonets but require a skilled field service team and specialized vacuum equipment for installation. Field joints are designed to handle large diameter pipes and higher pressure applications and offer increase structural durability due to the all-stainless steel welded construction. In addition, field joints allow for some adjustments during the installation.

COMPLETE COMPONENT CHOICE

In addition to VJP, Acme provides a complete component offering to complete our system design, manufacture, and installation capability.

Mechanical Keep-Cold Device – A float activated device used to maintain liquid in the VJ Pipe line and vent the excess gas created by normal heat leak.

Phase Separators – Typically used in applications where a single bulk tank is being used to provide both high pressure (90-150 psig) Nitrogen gas and low pressure (5-30 psig) liquid Nitrogen.

Scale-Based Tank Switcher – Used in applications that require multiple liquid cylinders to be used in succession without interruption by automatically switching to a new cylinder as each cylinder is emptied.

Vacuum Gauge Tube – Used to monitor vacuum levels in individual factory sealed spool sections using a Hasting (DV-6R) Meter.

Pressure Relief Valve Assembly – Set to the design pressure as required in the system.

Vacuum Jacketed (VJ) Valves – Designed to have low heat leak and will not frost up during operation for in-line isolation or where superior thermal performance is required.

Internal Gas Traps – Used at the vertical drops/ use points and designed to keep liquid Nitrogen from "sitting" on un-insulated valves or components.

Vacuum Jacketed SuperFlex Hose – Remains warm and flexible during the transfer of cryogenic liquids. The vacuum insulation minimizes product loss and eliminates ice build-up.

Note: MAWP =150 psig, not compatible for LOX Service.

CryoFast – Laboratory grade, high efficiency VJP designed to quickly deliver LN2 for low flow applications with a limited LN2 source. Combine Acme's VJ SuperFlex Hoses to provide frost free LN2 delivery from Dewar to your storage freezers.

Quik-Fab Modular VJP – When time is critical, Acme offers pre-engineered VJP with mechanical foam joints in a one to two week lead time. Modular sections are offered in various length straights, with VJ elbow and tee sections, that can be assembled for a fast, low cost, low heat leak VJP solution.

ACME 
CRYOGENICS
THE PINNACLE OF PERFORMANCE

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