

CRANE

CRYOFLO^{H₂}

Keeping Cryogenics Cool

VACUUM JACKETED PIPING

www.cranecryoflo.com

brands you trust.

REDUCED HEAT FLUX. INCREASED FLOW RATE.

CRANE CRYOFLO[®] vacuum jacketed piping is the optimal solution for transporting cryogenic liquids with minimal waste, maximum flexibility, and speedy delivery.

CRANE ChemPharma & Energy



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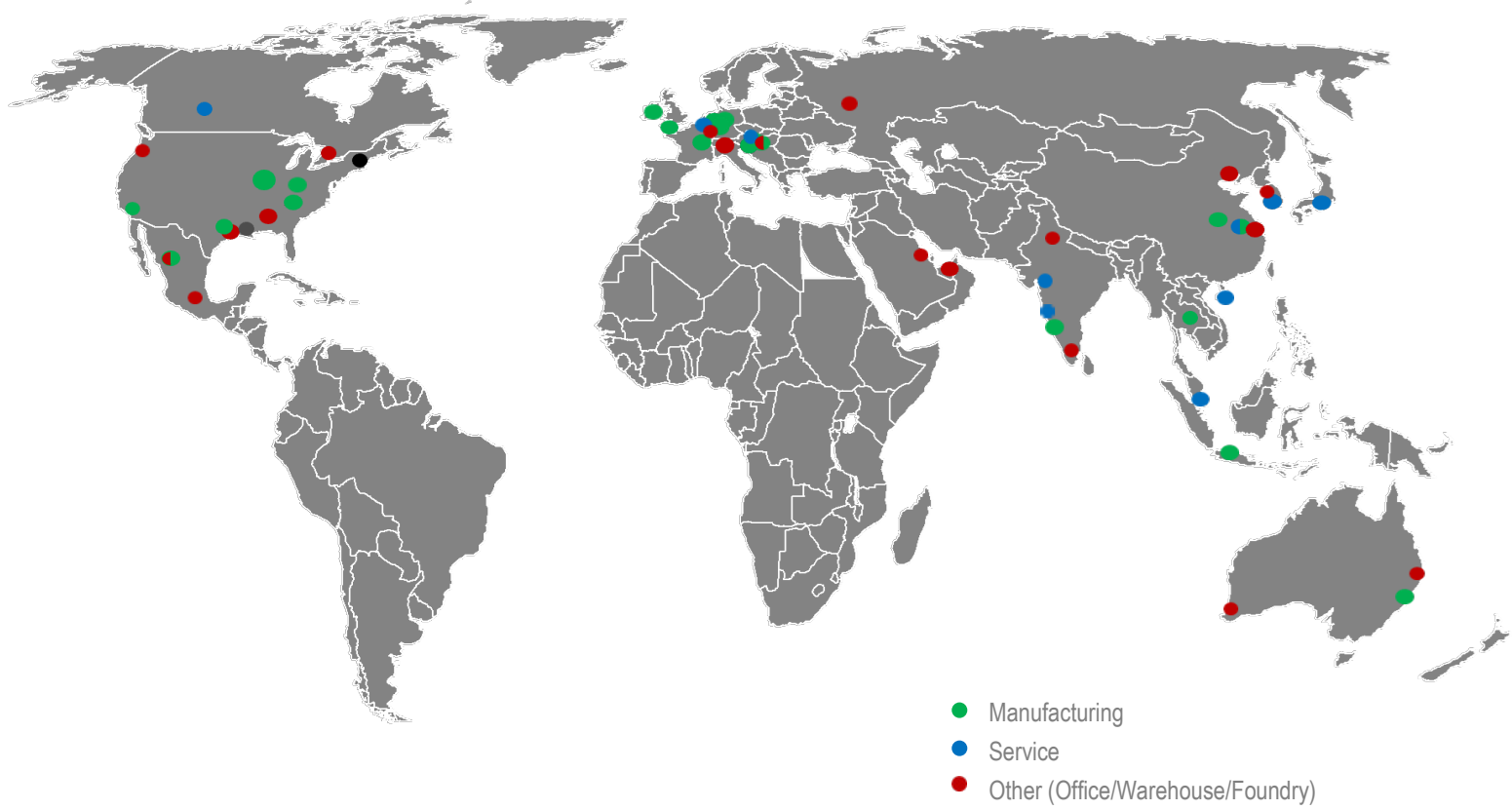


Crane ChemPharma & Energy **INTRODUCTION**

Crane Co. is a diversified manufacturer of highly engineered industrial products with a substantial presence in a number of focused niche markets. We are dedicated to integrity and honest dealings in all that we do.

Crane CP&E designs and manufactures a variety of high performance products including: highly-engineered check valves, sleeved plug valves, lined valves, process ball valves, high performance butterfly valves, bellows sealed globe valves, aseptic and industrial diaphragm valves, multi/quarter-turn valves, actuation, sight glasses, lined pipe, fitting and hoses, and air-operated diaphragm and peristaltic pumps. Its trusted brands are in use worldwide in many industries, including Oil & Gas, Oil Refining, Petrochemical, Power Generation, Chemical Processing, Biotechnology, and Pharmaceutical.

Crane CP&E WORLDWIDE



CPE MANUFACTURING SITES (Examples):



AMERICAS

CHIHUAHUA, MEX • CINCINNATI, OH
 • CULLMAN, AL • EDMONTON, AB
 GONZALES, LA • HOUSTON, TX
 • MARION, NC MEXICO CITY, MEX
 • PORTLAND, OR • SADDLE
 BROOK, NJ • SPARTANBURG,
 SC • CONROE, TX , HQ: THE
 WOODLANDS (HOUSTON), TX



EUROPE

BELFAST, UK • CWMBRAN, UK,
 CRONING , SL • DÜSSELDORF, DE
 • KREUZTAL, DE • LINDAU, DE •
 SZÉKESVERHÉRVÁR, HU MUTA, SL
 • MAXDORF, DE • MONZA, IT • MUL-
 HOUSE, FR • BERGSCHENHOEK,
 NL WAALWIJK, NL • WAVRE, BE •
 WR. NEUDORF, AT



ASIA

BEIJING, PRC • CHENNAI (MA-
 DRAS), INDIA KANAGAWA, JAPAN •
 NINJIN, PRC • PUNE, INDIA SATARA,
 INDIA • SHANGHAI, PRC SINGA-
 PORE • SUZHOU, PRC • VIRALI-
 MALAI, INDIA



AUSTRALIA

BRISBANE • KEWDALE • MEL-
 BOURNE • ST. MARYS



MIDDLE EAST

AL KHOBAR, SAUDI ARABIA • DUBAI,
 UAE



Local **SERVICE**

CRANE is committed to delivering efficient service and local technical expertise.

Crane is built on quality principles and practices to achieve the best safety, quality, performance, delivery, service and total cost.

Our vision as a global provider is to be the Supplier of Choice for on/off process valve solutions in chemical, power and refining, known for best-in-class customer responsiveness.



Quick access to high-demand stock



Engineering support



System design and drawings



MRO services



Training and testing

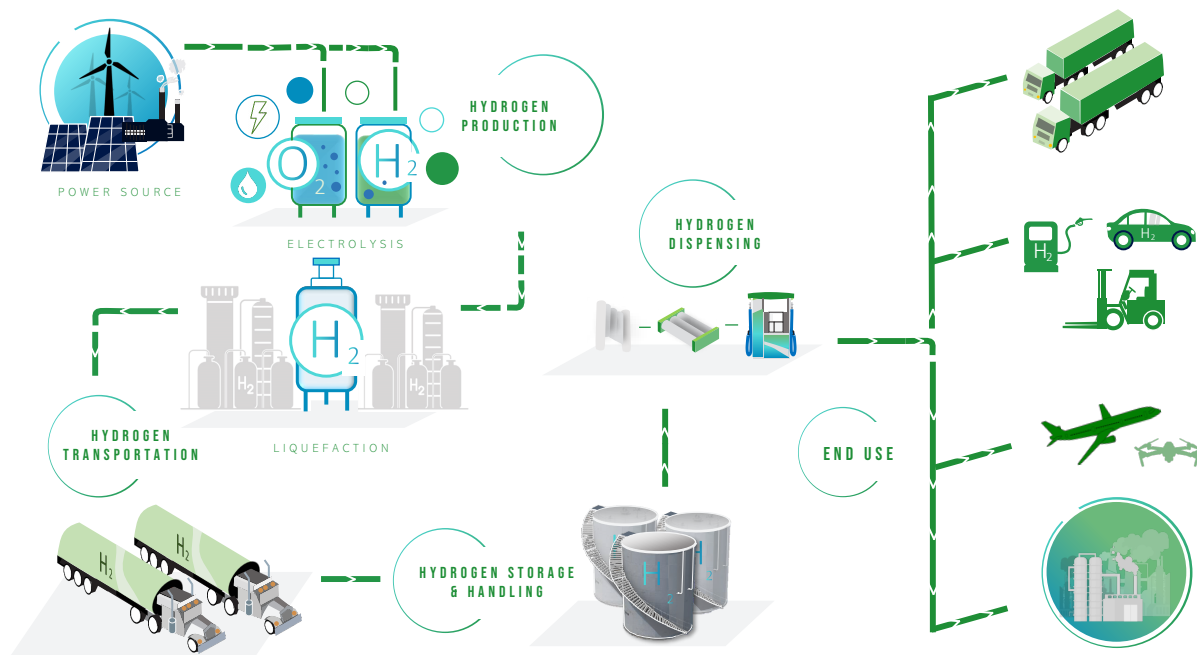


ABOUT CRANE CRYOFLO®

For hydrogen energy to be an effective and efficient alternative to fossil fuels, liquefaction plants, storage facilities, transportation methods and pipelines must be outfitted with state-of-the-art PVF (Pipe Valves and Fittings) components. Crane® CRYOFLO® will be focused on solving Customer's toughest challenges within the Hydrogen Industry backed by decades of field experience in severe service applications.

Crane® CRYOFLO® Solutions for Cryogenic Applications:

- Production
- Liquefaction
- Transportation
- Transfer
- Storage





Our New Conroe Facility

Profile

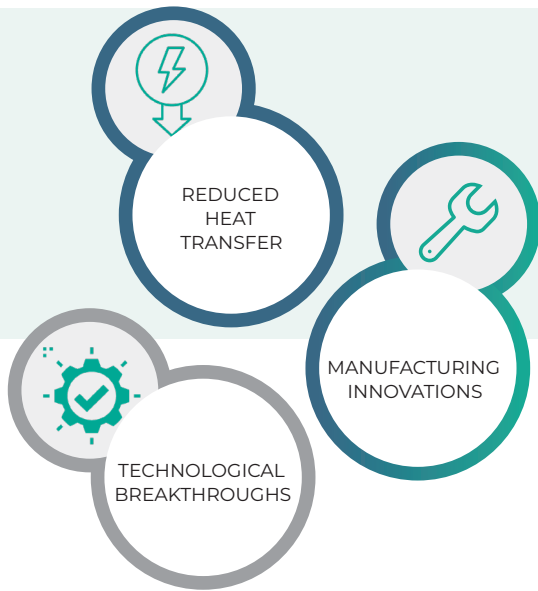
- 80,000 Sq-ft
- Planned 90 Associates
- 1 Hour to downtown Houston

Core Technology

- Cryogenic Applications
- Vacuum Acquisition
- Welding/Fabrication
- Valve Automation
- Oxygen Cleaning



ABOUT OUR VJP PRODUCT LINE



Crane CRYOFLO® is pleased to announce the launch of its new vacuum jacketed piping (VJP) product line. VJP is a double-walled piping system with a vacuum space between the inner and outer pipes. This vacuum space acts as a thermal barrier that reduces heat transfer and prevents product boil-off, minimizing product loss and ensuring safety and quality. Additional insulation is also present to further enhance thermal performance.

Vacuum Jacketed Piping OVERVIEW

VJP is ideal for transporting liquid cryogenic media, which are substances that exist in a liquid state at very low temperatures, such as liquid nitrogen, oxygen, argon, hydrogen, helium, or carbon dioxide. Cryogenic fluids are used in a wide range of applications, including aerospace, medical, industrial, and energy.

Benefits of Crane CRYOFLO® Vacuum Jacketed Piping

Crane CRYOFLO® VJP offers a number of significant advantages over conventional piping systems for liquid cryogenic media, including:

Reduced heat transfer and product boil-off: VJP significantly reduces heat transfer and product boil-off, leading to cost savings and improved efficiency.

Enhanced safety and reliability: VJP is designed to meet the highest safety standards, with the vacuum space and insulation helping to prevent leaks and spills. The system is also resistant to corrosion and other environmental factors.

Easy installation, operation, and maintenance: VJP is easy to install, operate, and maintain, with a modular design that can be customized to fit any application.

1-year warranty: Crane CRYOFLO® VJP comes with a 1-year warranty, demonstrating our confidence in the quality and reliability of our product.



Reduced Heat Transfer

Minimize product loss



Manufacturing Innovations

Unmatched quality and manufacturing agility



Technological Breakthroughs

Delivering best-in-class quote time





KEY FEATURES

Size Range

- Inner Pipe Size: 1/2", 1", 1-1/2", 2", 3", and 4" NPS

Pressure Ratings

- Up to 150 PSIG

Materials of Construction

- 300 Series Stainless Steel

Design Standards and Compliance

- ASME B31.12: Hydrogen Piping & Pipeline
- ASME B31.3: Process Piping
- CGA G-4.15: Vacuum-Jacketed Piping in Liquid Oxygen Service
- CGA G-5.6 – Hydrogen Pipeline Systems
- AWS 2.4 Standard symbols for welding, brazing and non-destructive examination
- AWS B2.1, ISO 15607, EN 1011-1: Specification for welding procedure and performance qualification
- AWS D10.18 Pipe welding (stainless steel)
- ASME B16.5: Pipe Flanges and Flanged Fittings
- ASME B16.9 – Factory made Wrought & fabricated butt welding fittings
- ASME B36.19M : Stainless Steel Pipe
- ASME BPVC Section IX: Welding and Brazing Qualifications

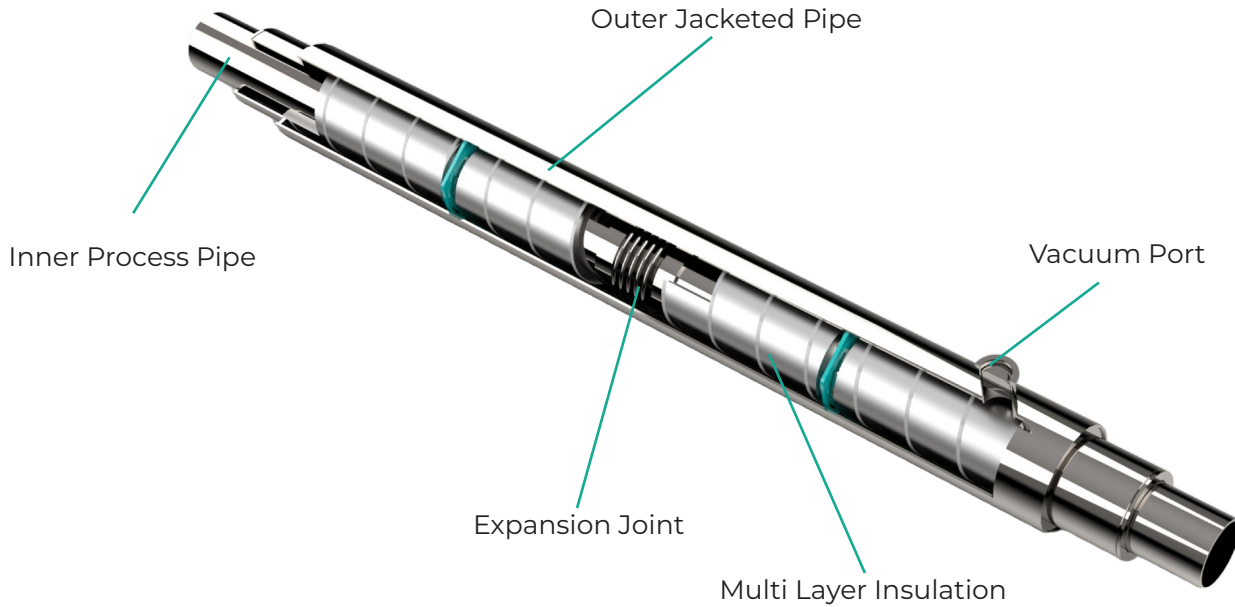
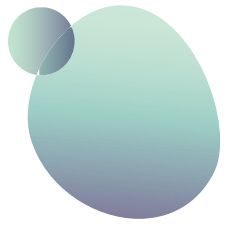
End Connections

- Bayonet
- Field Joint
- Mechanical Fitting

Testing Standard

- ASME B31.12: Hydrogen Piping & Pipeline
- ASME B31.3: Process Piping
- AWS B1.10 & ISO 17035: Guide for nondestructive examination of welds
- ASME BPVC Section V – Nondestructive Examination

KEY COMPONENTS



Inner process pipe: This is the innermost pipe that transports the cryogenic liquid from the source to the destination. It is usually made of stainless steel or copper and has a small diameter to reduce the surface area exposed to heat.

Outer jacketed piping: This is the outermost pipe that surrounds the inner pipe and forms the vacuum jacket. It is also made of stainless steel and has a larger diameter than the inner pipe. It is welded at both ends to seal the vacuum and prevent air from entering the system.

Vacuum port: This is a valve that is attached to the outer pipe and allows the air to be evacuated from the space between the inner and outer pipes. It creates a low-pressure environment that reduces the heat transfer by conduction and convection.

Expansion joint: This is a flexible section of the outer pipe that absorbs the thermal stress caused by the temperature difference between the inner and outer pipes. It prevents the outer pipe from cracking or buckling due to thermal expansion and contraction.

Multi-layer insulation: This is a layer of thin reflective material, such as aluminum foil, that is wrapped around the inner pipe. It reduces the heat transfer by radiation by reflecting the infrared rays to the inner pipe. It also acts as a spacer between the inner and outer pipes and improves the vacuum performance.

PRODUCT APPLICATIONS

Crane CRYOFLO® vacuum jacketed flexible piping is a versatile and reliable solution for a variety of applications, including:



Food Processing

Cryogenic liquids are used to quickly cool and freeze food products with VJP, which helps to maintain their freshness and quality. VJP connects cryogenic liquids to freezers, chillers, and cryogenic grinders that process food items.



Pharmaceutical Manufacturing

Cryogenic liquids are used to support various pharmaceutical manufacturing processes with VJP, such as the production of vaccines and antibiotics. VJP connects cryogenic liquids to bioreactors and freeze dryers that manufacture pharmaceutical products.



Electronics Manufacturing

Cryogenic liquids are used to regulate the temperature of electronic devices during manufacturing with VJP, which helps to ensure their quality and performance. VJP connects cryogenic liquids to semiconductor etching and doping machines that produce electronic devices.



Research and Development

Cryogenic liquids are used to create ultracold environments and to cool superconducting magnets with VJP, which enable the study of quantum phenomena and other experiments. VJP connects cryogenic liquids to research and development facilities that conduct scientific investigations.

UNIT CONVERSION DATA FOR CRYOGENIC LIQUIDS

	WEIGHT		GAS		LIQUID	
	pounds (lbs)	kilograms (kg)	cubic feet (scf)	cu meters (Nm ³)	gallons (gal)	liters (l)
1 pound	1.0	.4536	192	5.047	1.6928	6.408
1 kilogram	2.205	1.0	423.3	11.126	3.377	14.128
1 scf gas	.00521	.00236	1.0	.02628	.00882	0.03339
1 Nm ³ gas	.19815	.08988	38.04	1.0	.3355	1.2699
1 gallon liquid	.5906	.2697	113.4	2.981	1.0	3.785
1 liter liquid	.15604	.07078	29.99	.7881	.2642	1.0

CRYOGEN	BOILING POINT (°F)	CRITICAL PRESSURE (PSIG ^a)	LIQUID DENSITY (g/L)	GAS DENSITY (27°C,g/L)	LIQUID-TO-GAS EXPANSION RATIO	TYPE OF GAS
Argon	-186(-303)	710	1402	1.63	860	Inert
Helium	-269(-452)	34	125	0.16	780	Inert
Hydrogen	-253(-423)	188	71	0.082	865	Flammable
Nitrogen	-196(-321)	492	808	2.25	710	Inert
Oxygen	-183(-297)	736	1410	1.4	875	Flammable
Methane	-161(-256)	673	425	0.72	650	Flammable
CO ₂	-79(-108)	1071	100	20	535	Inert

NOTES

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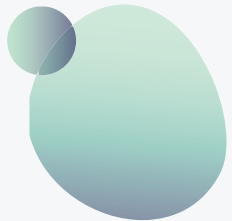


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CRYOFl_o

Keeping Cryogenics Cool

INNOVATION DRIVEN BY YOUR NEEDS



Our businesses are known for proprietary and differentiated technology, quality and reliability, deep vertical expertise, and responsiveness to unique customer needs.

brands you trust.



COMPAC-NOZ[®]



DEPA[®]

ELRO[®] DUO-CHEK[®]



KROMBACH
ARMATUREN

NOZ-CHEK[®]



RESISTOFLEX[®]



Saunders[®]
the science inside

STOCKHAM

UNI-CHEK[®]

WESTLOCK
CONTROLS

wta:

XOMOX[®]



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