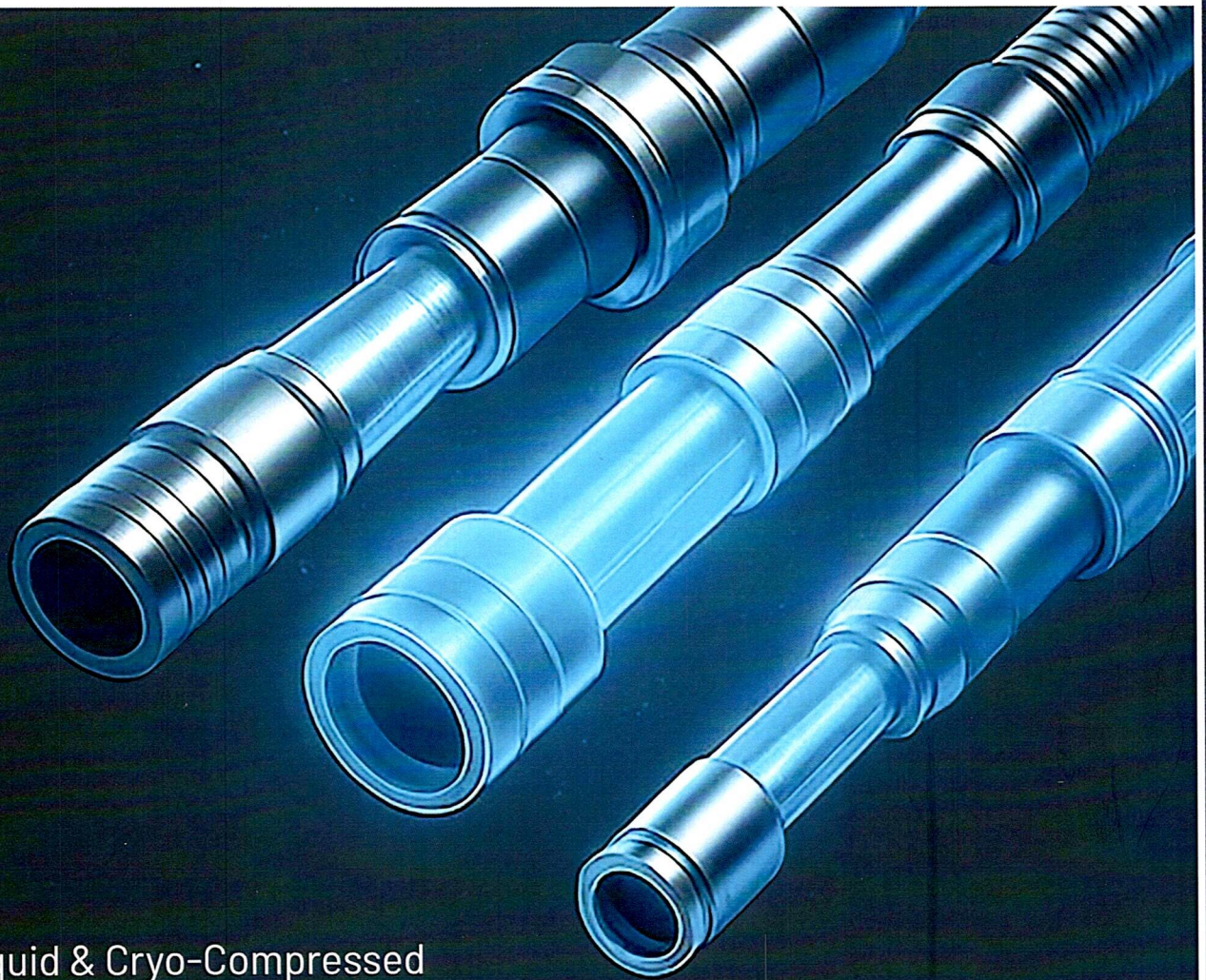




BENGAL INDUSTRIES PRIVATE LIMITED

FLEXIBLE SOLUTION FOR **CRYOGENIC VACUUM & AEROSPACE**



Liquid & Cryo-Compressed
Storage System
Oil & Gas



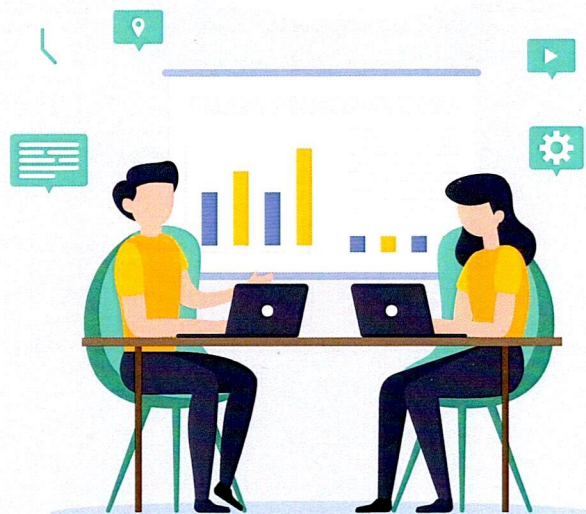
ABOUT US

Bengal Industries Private Limited stands at the forefront of manufacturing excellence, specializing in Machined, Welding Components and Assemblies.

Our diverse product portfolio includes stainless steel corrugated hoses, stainless steel wire braid, expansion joints, fabricated pipe spools, cryogenic transfer hoses, cryogenic valves, vacuum jacketed pipe, bayonet connections, vacuum jacketed hose, high pressure hose and precision machined products, all designed to meet the rigorous demands of various applications. From oil & gas and aerospace our solutions are integral to numerous components across various industries.

Nestled in Faridabad, within the National Capital Region of New Delhi, India, our state-of-the-art facility is a testament to our commitment to top-tier production standards.

Our accreditation is a hallmark of our unwavering dedication to quality and excellence. Under the guidance of a professionally managed and highly motivated team, we consistently strive to exceed the expectations of our esteemed customers, ensuring their utmost satisfaction with every product we deliver.



OUR VISION

Our vision is to lead globally through unwavering commitment to innovation and sustainability. We aspire to set industry standards in product quality and customer satisfaction by continuously expanding our product lines and embracing emerging technologies. By upgrading our facilities with the latest technologies and adopting eco-friendly practices, we work towards reducing our carbon footprint. Through relentless research and development, we seek to inspire excellence and create a positive impact on the environment and society.

QUALITY APPROVALS & CERTIFICATIONS

We are proud to hold prestigious certifications that underscore our commitment to excellence and customer satisfaction. Our quality management systems adhere to international standards, ensuring the highest level of product integrity and reliability. Certifications include:

ACCREDITATIONS/CERTIFICATION

ISO 9001:2015

IATF 16949:2016

PED 2014/68/EU

EN 15085-2 CL-1

AS 9100D-2016

ISO 10380-2012

MARINE -TYPE APPROVAL CERTIFICATE

CRN CERTIFICATION FOR CANADA

ENVIRONMENTAL & SAFETY CERTIFICATION

ISO 14001:2015

ISO 45001:2018



Certificate of Registration
QUALITY MANAGEMENT SYSTEM - ISO 9001:2015
This is to certify that the quality management system of
Bengal Industries Pvt. Ltd.
PED No. 2284, Sector 55, Faridabad - 121 304, Haryana, India
has been assessed and found to comply with the requirements of ISO 9001:2015 in accordance with the following scope:
The manufacture of stainless steel flange assemblies and components for automotive engine application.
Relevant standards: Product Design.



FULL QUALITY ASSURANCE CERTIFICATE
This is to certify that the quality management system of
Bengal Industries Pvt. Ltd.
PED No. 2284, Sector 55, Faridabad - 121 304, Haryana, India
has been assessed and found to comply with the requirements of ISO 9001:2015 in accordance with the following scope:
ANNEX III MODULE H OF DIRECTIVE 2014/68/EU ON PRESSURE EQUIPMENT
The certificate is valid for the following scope:
Type of Pressure Equipment: Pressure Accessories
Product Name: Stainless Steel Corrugated Flexible Hose Assemblies and Various Bellows & Expansion Joints with accessories



MANAGEMENT SYSTEM CERTIFICATE
This is to certify that the management system of
Bengal Industries Private Limited
PED No. 2284, Sector 55, Faridabad - 121 304, Haryana, India
has been assessed and found to comply with the requirements of ISO 9001:2015 in accordance with the following scope:
Design and manufacture of stainless steel flange assemblies and components for automotive engine application.
Relevant standards: Product Design.



THE ROAD MAP

We expand our product line to meet the challenges of emerging applications, like Green energy, Electric vehicles, Power, Aerospace, Oil & Gas, Defence and Railways sector.

Upgrading technology and infrastructure, we enhance production efficiency with advanced automation.

Our sustainability initiatives focus on eco-friendly practices, reducing our carbon footprint, and achieving certifications for our efforts.

We are constantly investing in research and development, modern equipment, while refining our processes to set new benchmarks in product quality and customer satisfaction.



VACUUM JACKETED PIPE (VJP)

BAYONET CONNECTION

Bayonet connections offer a quick installation as well as a reliable, leak-resistant, thermally efficient connection. Bayonet connections offer a slip-together joint used for easy field assembly of vacuum jacketed pipe sections. The male and female designs provide a long heat path from the outer jacket to the inner pipe. The o-ring seal at the flange make this a pressure-tight connection. Bengal industries offers unique bayonet connections that provides a superior mechanical joint for vacuum jacketed piping sections.

TECHNICAL DATA

OPERATING RANGES

- Temperatures- 20K to 313k
- MAWP- upto 250 bar

TESTS

Mass spectrometer leak test with helium, leak rate shall not be greater than 5×10^{-7}

SERVICE

Liquid argon, helium, hydrogen, Nitrogen and oxygen

MATERIALS

Metal components- Stainless steel (304L & 316L) Soft components-PTFE

APPLICATION:

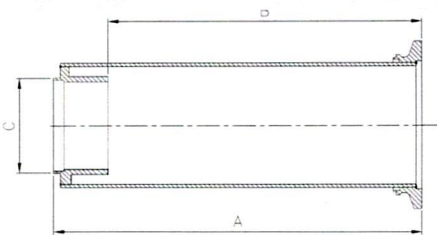
- New vacuum jacketed piping systems
- Storage vessels, tanks and dewars
- Transfer hose & fill systems
- Bayonets available for LNG service also
- Consult factory for special applications



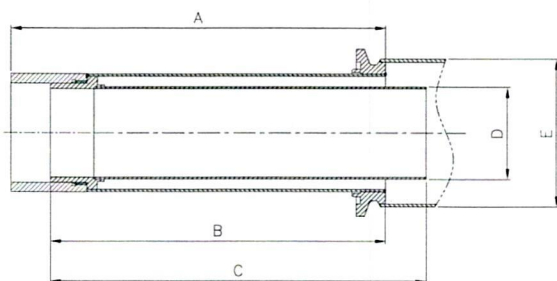
FEATURES:

- Reliable Close Tolerance Design for Vertical or Horizontal Applications.
- Designed For Fast and Convenient Installation For PipingFabricators.
- Constructed of material suitable for cryogenic service.
- Butt weld and socket weld ends for simple fabrication into your system.
- Thermally efficient for vacuum jacketed systems.

Bayonet connections for cryogenic fluids (LOX, LH2, LHe, etc.) vacuum jacketed male end to non-jacketed female end connection:

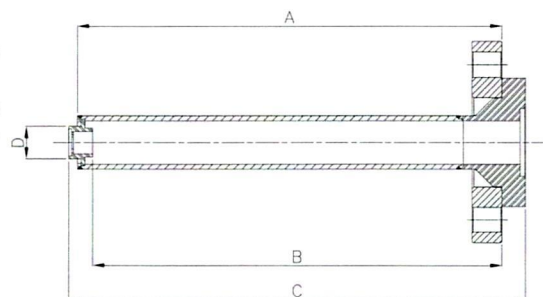
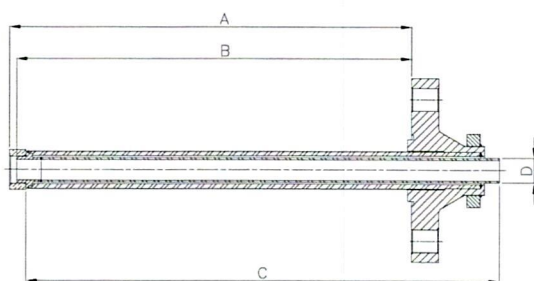


FEMALE BAYONET- CHAIN CLAMP TYPE				
SIZE	A	B	C	WORKING CONDITIONS
25 NB	493	468	32	20K to 313K, 20 Bar
50 NB	365	341.5	53.5	20K to 313K, 20 Bar
80 NB	418	356	109	20K to 313K, 20 Bar
100 NB	417	355	109	20K to 313K, 20 Bar



MALE BAYONET CHAIN CLAMP TYPE						
SIZE	A	B	C	D	E	WORKING CONDITIONS
25 NB	494	487	497	28	76.1	20K to 313k, 20 Bar
50 NB	371.5	365	380	54	88.9	20K to 313k, 20 Bar
80 NB	433.5	388.5	436.5	88.9	168.3	20K to 313k, 20 Bar
100 NB	433.5	388.5	434.5	104	168.3	20K to 313k, 20 Bar

FEMALE BAYONET FLANGE TYPE				
SIZE	A	B	C	WORKING CONDITIONS
25 NB	443	427	477	35K to 313k, 250 Bar



MALE BAYONET FLANGE TYPE					
SIZE	A	B	C	D	WORKING CONDITIONS
25 NB	458	450	539	28	35K to 313K, 250 Bar

ASSEMBLY KIT OPTIONS:

Chain Clamp Type Bayonets

- Kit includes PTFE/PCTFE O-Ring and PTFE nose seal.
- Dust caps and pressure caps can be provided separately as per requirements.
- Material of dust caps and pressure caps shall be as per customer

Super insulated type bayonet connections can also be developed as per customer's specifications.



VACUUM JACKETED PIPE (VJP)

CRYOGENIC TRANSFER LINE

Bengal Industries offers a number of different types of cryogenic transfer pipe & hoses . This particular piece of equipment is an indispensable accessory for the safe and efficient transfer of liquid cryogenics, including liquid helium, Liquid nitrogen, liquid argon, liquid oxygen and LNG. The product line ranges from the simplest non-jacketed flex line to the vacuum-encased system necessary for transferring liquid helium. The materials of construction make these transfer systems useable in any type of work environment, whether it be a laboratory, industrial site, or as an instrumentation accessory. Products design, and manufacture a liquid transfer system for your cryogenic application. We are specialists in cryogenic fluid transfer, control, and storage systems.

OUR SYSTEM COMPONENT PRODUCTS INCLUDE:

Stainless Steel Rigid and Bendable Vacuum Jacketed Pipe is a low heat leak, high-performance vacuum insulated pipe designed to transfer cryogenic liquids such as liquid nitrogen. It is manufactured in easy-to-assemble sections using bayonet connections. Vacuum jacketed pipe is safe to touch and reduces frost formation and condensation improving on-site safety.

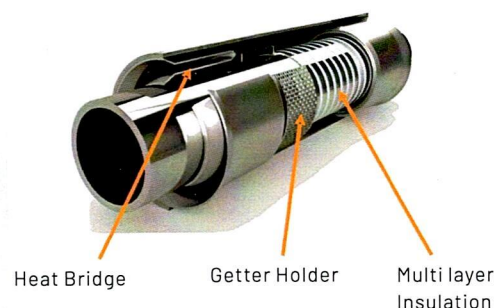
FEATURES

- Durable Covering; Braided, light weight and flexible Outer.
- Vacuum Port: Factory evacuated and sealed shall be re-evacuated at site.
- Bengal offers a proprietary vacuum port which can seal off the vacuum as well as acting as a pressure relief valve.
- Thermally Efficient: Low heat leak rate and highly efficient.

Inner Pipe Size (DN)	Outer Pipe Size (DN)	Pipe Material	Heat Leak Rate (W/m)
1/2"	1 1/2"	AISI 304 or 316L	0.31
1"	2"	AISI 304 or 316L	0.43
1 1/2"	3"	AISI 304 or 316L	0.54
2"	3 1/2"	AISI 304 or 316L	0.72
3"	5"	AISI 304 or 316L	0.94

HEAT BRIDGE

Vacuum jacketed pipe are constructed with heat bridge at the ends to facilitate vacuum tight joint between inner and outer pipe. A long heat transfer path of heat bridge control heat transfer. Also it compensates relative displacement of inner pipe to outer pipe due to thermal expansion and contraction. Segments of VJ pipes constructed with heat bridge facilitate easy field welding of long pipelines.



VACUUM JACKETED HOSE

Bengal Industries vacuum jacketed transfer Hoses are lightweight, extremely flexible, and thermally efficient.

FEATURES:

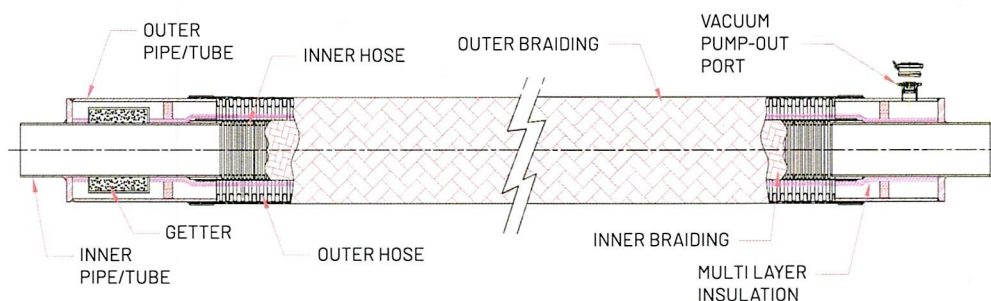
- **Durable Covering** - Braided, lightweight, and flexible outer.
- **Vacuum Port** - Factory evacuated and sealed, and can be re-vacuumed at the site, We also provide a proprietary vacuum port which can seal off the vacuum as well as act as a pressure relief valve,
- **Thermal Efficiency** - Low heat leak rate and highly efficient.
- **Quick Delivery** - Popular styles maintained in stock to reduce lead time.
- **Customization** - Choose from a wide variety of inner sizes, end connections, lengths, pressure ratings, and protective covers. Cleaning - Oxygen class cleaning can be provided for flex assemblies as per ASTM G93,

BENEFITS:

- Safely handles the cryogenic fluids with a vacuum insulated transfer hose that remains flexible during fluid transfer
- Transfer hose material is designed for strenuous conditions.
- Can be used with all quid cryogenes from LNG to liquid helium (LHe).
- Manoeuver around abstractions with our extremely flexible corrugated hose design.
- Get better liquid performance: each hose vacuum space includes Super-Insulation (Multilayer Insulation, MLI) that keeps thermal heat loss to a minimum.
- Long Term Vacuum Levels: Chemical gettering is installed within the vacuum portion and helium leak tested by MSLD Hose assemblies can be fabricated with full-lenght armor casing or cuffs.

APPLICATIONS:

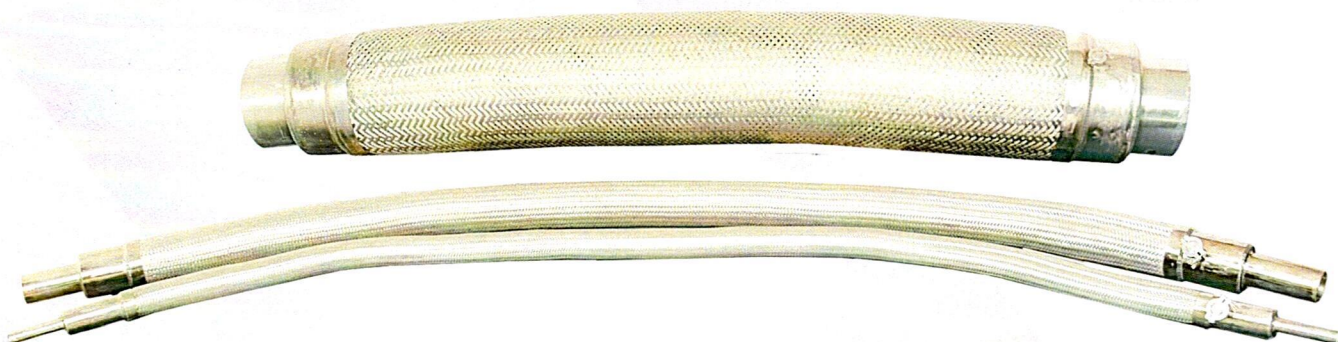
- Liquid and Cryo-compressed storage ystems
- Semiconductor Gas Delivery
- Aerospace
- Military & Defense



S.N.	INNER HOSE SIZE (DN)	OUTER HOSE SIZE (DN)	WORKING PRESSURE (bar)	BEND RADIUS (mm)	HEAT LEAK RATE (W/m)
01	80	150	16	1250	3.5
02	100	150	16	1250	3.5
03	65	125	16	1000	3.5
04	15	40	250	340	1.8
05	25	65	16	460	1.8

MATERIALS:

Our vacuum jacketed flexible tubing is typically built with stainless steel, different materials can also be used according to custom requirement. We ensure that material selection suits the unique needs of your applications, including medical-grade, food-grade, and clean room requirements. Please do mention material specifications while submitting your project inquiry.



END FITTINGS:

We supply vacuum-insulated tubing across a variety of industries, so we understand the importance of the right end fittings. We are pleased to supply flexible lines with various types of end fittings (bayonets, pipe threads, compression, and custom end fittings) available configurations that your application requires. Please inform us of your unique end fitting specifications in your project inquiry.

STANDARD HOSE DETAILS:

TEMPERATURE RATING

Standard: -320° F (-196° C/77K)

Optional: -452° F (-269° C/4K)

PRESSURE RATING

Low Pressure (LP): Upto 16 bar

Medium Pressure (MP): 16 bar to 35 bar

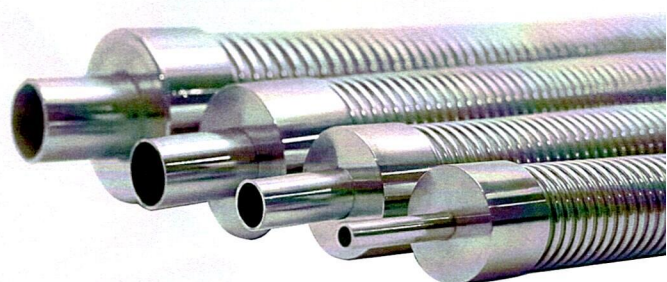
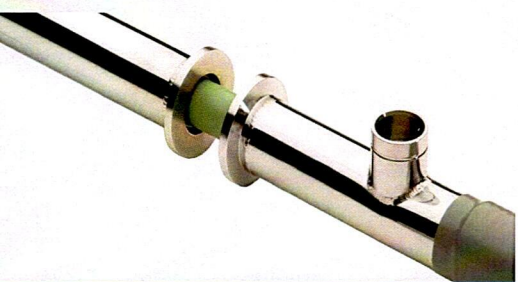
High Pressure (HP): 35 bar to 250 bar

STANDARD MATERIALS

321 or 316L Stainless Steel: Inner and Outer Hose

304/304L (Dual Certified) Stainless Steel: Braid, Tube, Pipe, and End Fittings

*Other high-performance materials are also available as per project requirements.



BELLOWS

WHAT IS THE PURPOSE OF BELLOWS?

Expansion joints bellow serve several important preposes in piping system as-

- 1- Absorbing thermal expansion and container
- 2- Reduces vibration and shocks
- 3- Allow flexibility
- 4- Prevent damage of piping

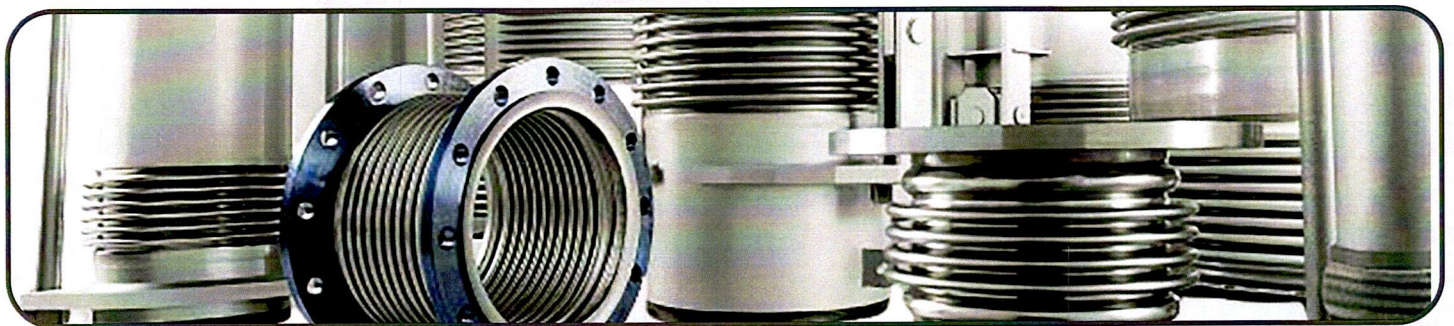
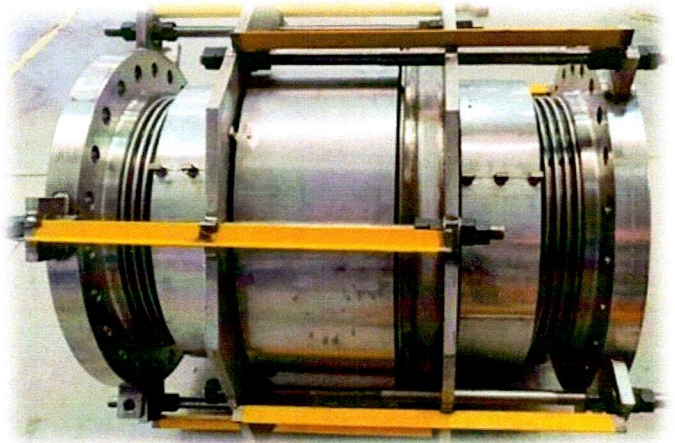
WHAT ARE THE DIFFERENT TYPES OF BELLOWS?

Depending on application and working conditions:-

- 1- Single bellow
- 2- Universal bellows
- 3- Hinged bellows
- 4- Gimbal bellows
- 5- Pressure balanced Bellows

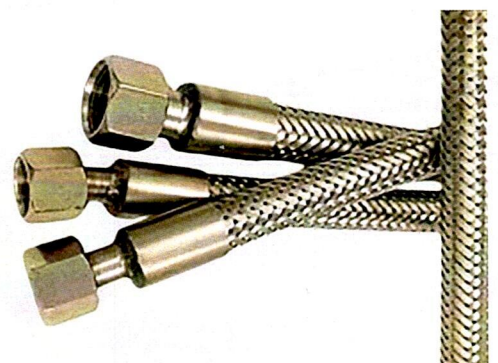
These bellows may be re-inforced or non-informed depending on pressure ratings. Expansion joints (bellows) are installed in piping system to absorb Installation misalignment and thermal displacement.

Overall system flexibility can be addressed by adding expansion loops. Specifically when external bellows are used. for vacuum jackets external pipe supports shall allow the piping system to move in order to compensate thermal expansion.



SPECIAL HIGH PRESSURE HOSES

- Bengal Industries has developed Highly engineered specialized high-pressure metallic and PTFE hoses, specifically designed to handle gases in pressure ranges up to 400 bar (5800 psig). These hoses are meticulously crafted to maintain their flexibility while operating at high pressures, ensuring both performance and durability.
- Available in size ranges of 1/4" (DN6) to 3/8" (DN10),



CRYOGENIC VALVES

- Bengal Cryogenic Globe Control Valves are designed & manufactured to exceed the highest industry standards. These Cryogenic Valves are designed to provide control of liquid and gases where cryogenic temperature may reach up to -250°C . When required, these valves can reliably provide tight shut-off for special applications. The optimized geometry of the these valve bodies presents smooth curves and a flow passageway nearly constant, which reduce the flowing fluid turbulence and increase the valve flow rate capacity. These valves are available in a range of configurations meeting various specifications and can deliver excellent performance.

CRYOGENIC VACUUM JACKETED GLOBE VALVES

- Live loaded gland packing
- Cleaned and degreased for cryogenic service

VALVE SPECIFICATION

Valve having the body of Stainless steel with pneumatic actuator & Copper Alloy.

"Cleaned and degreased for liquid service and other cryogenic plication"

Also available in options-as per customer request only:

- Female thread connection
- Butt weld, socket weld, Flanged
- Extension of H up to 850mm

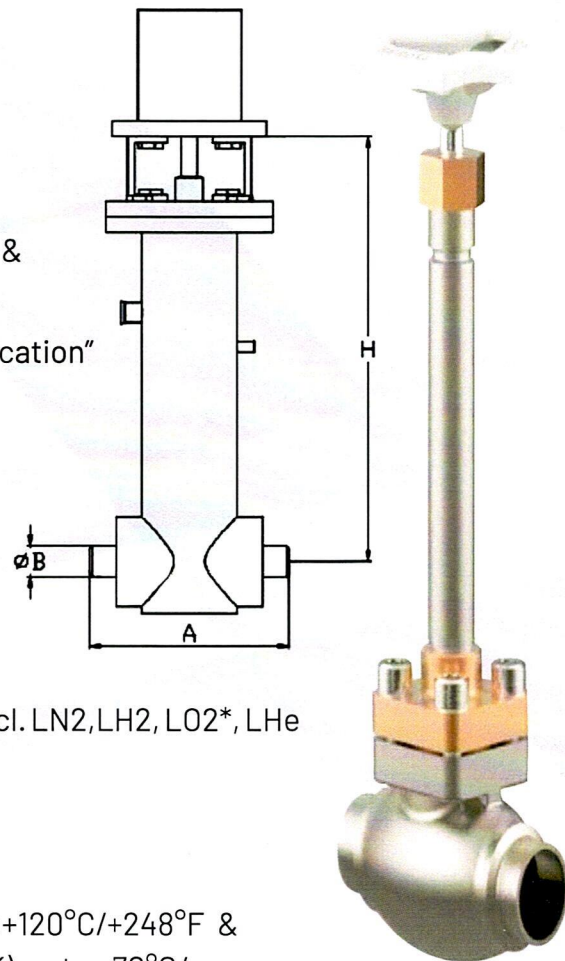
APPLICATIONS:

Applied for cryogenic conditions and cryogenic Liquefied gases incl. LN₂, LH₂, LO₂*, LHe

*For limited pressure and velocity

TECHNICAL DATA

Cryogenic Valves Working Temperature is $-250^{\circ}\text{C}/-423.4^{\circ}\text{F}$ upto $+120^{\circ}\text{C}/+248^{\circ}\text{F}$ & Cryogenic Vacuum Jacketed Globe Valves $-200^{\circ}\text{C}/-392^{\circ}\text{F}$ (65K) up to $+70^{\circ}\text{C}/+158^{\circ}\text{F}$ (393K)



Materials	DINEN	ASTM
1 Body	1.4409	A351CF3M
2 Bonnet Valve	Tin Bronze B505	C93200
3 Bonnet extension	SS 316L	A276
4 Gland nut Bonnet	SS B8	A193
5 Stem assembly	SS316	A276
6 Hand-wheel	Al alloy	A356
7 Nut-Hand wheel	SS B8	A193
8 Bolt-body & bonnet	SS B8	A193
9 Packing-1	PTFED792	
10 Packing-2	GRAPHITEJB/T7758.2-2005	
11 Gland packing	BRASS B124	C37700
12 Gasket	PCTFE	
13 Gland packing ring	BRASS B124	C37700

Globe Valves – Standard Design							
Nominal Size (DN)	10	15	20	25	32	40	50
Face to Face dimension (FF) mm	60	108	117	127	140	165	178
Height (H) mm	150	300	320	350	400	450	500
Outside Pipe diameter (mm)	Dependent on order						
Hand wheel Diameter (mm)	100	100	100	100	125	125	125
Weight (kg)	1.0	1.3	1.6	2.0	2.8	4.2	6.7
Cv – Values (gal/min)	1.9	5.0	7.8	13.4	14.1	26.3	43.2

Available options – on request only:

Extension H and A according to customer specification

CRYOGENIC FILTERS

- Cryogenic filters are used to remove unwanted particles, contaminants, and microbial presence from the cryogenic liquids. Bengal's Vacuum jacketed cryogenic filters are designed to deliver liquids at required flow rates. Materials of construction is stainless steel. Filters are supplied with mesh size ranging from 10 to 50 microns as per customer requirement. Vacuum jacketing of filter has been designed such a way that the filter replacement can be made easy without disturbing the vacuum in jacket portion.

FILTER SIZE	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)
DN 25	378	53	32	104	156
DN 40	529	90	48.3	156	245
DN 100	890	167.3	114.7	308	450

TECHNICAL SPECIFICATION	
Fluid Medium	LOX / LN2
Working Temperature	65 K - 343 K
Filter Size	TABLE 1
Pressure Drop	TABLE 1
Flow Rate	TABLE 1
End Connection	BUTT WELD
Mesh Size	TABLE 1
Features	VACCUME JACKETED, REMOVABLE MESH FILTER FOR CLEANING AND REPLACEMENT
MATERIAL	
Mesh	SS 316L
Inner Filter Container	SS 316L
Outer Jacket	SS 316L

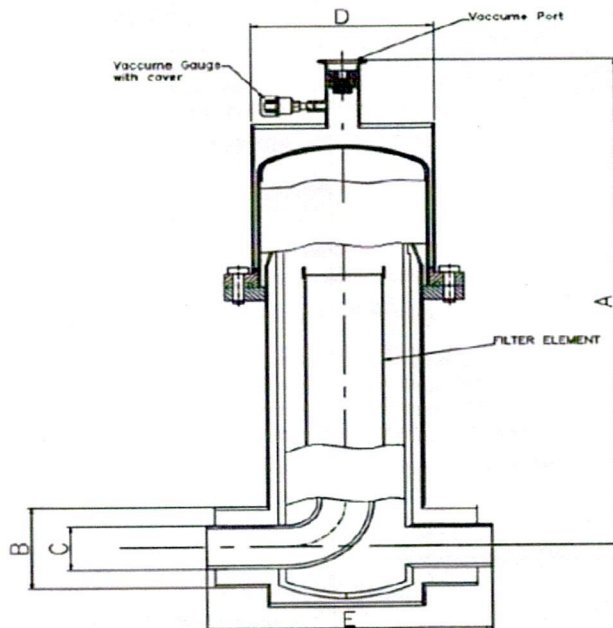
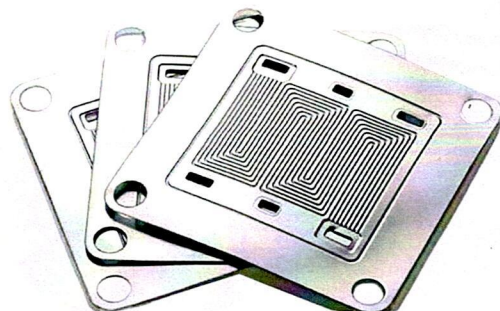


TABLE 1

SL NO.	FILTER SIZE	MESH SIZE (micron)	PRESSURE RATING	PRESSURE DROP (Kpa)	PRESSURE DROP AT 50% CLOGGING (Kpa)	FLOW RATE (KG/S)	PIPE SIZE (IN)
1	DN 25	40	3700	1.625	9.5	5	1"
2	DN 40	40	3700	0.463	3.33	5	1-1/2"
3	DN 100	40	2500	3.42	18.43	70	4"
4	DN 25	10	3700	3.31	18.25	5	1"
5	DN 40	10	3700	1.96	6.37	5	1-1/2"
6	DN 100	10	2500	7.53	46.5	100	4"

Bi-POLAR PLATES

Bi-Polar plates are essential components in fuel cells and electrolyser. We can design and manufacturer Bi-Polar. Bi-Polar metallic plates with thickness starting from 50 microns. Also, these Bi-Polar plates are coated with titanium Nitrate.



SOCIAL RESPONSIBILITY INITIATIVES

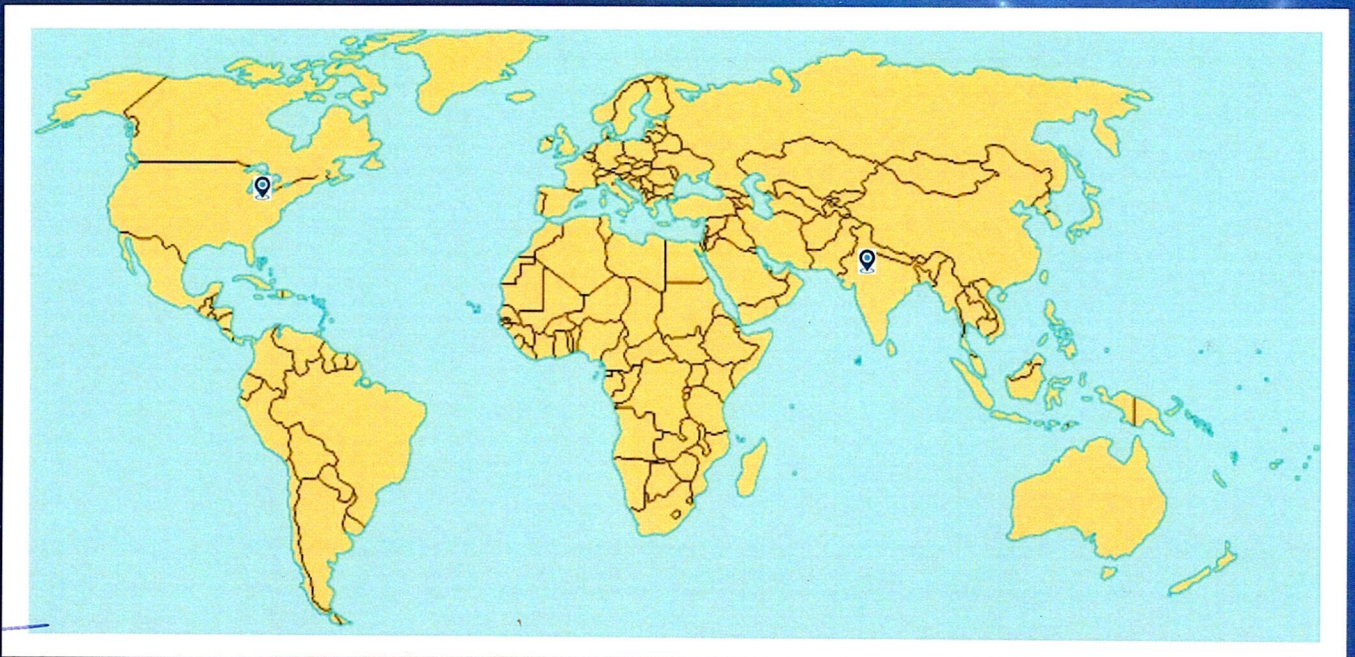
Empower Future Leaders: By sponsoring Indian Civil Services aspirants annually, we aim to nurture the next generation of leaders who will drive positive change in society and governance.

Promote Environmental Sustainability: Through our tree planting initiatives, we are committed to enhancing environmental health and contributing to a greener planet for future generations.

Enhance Community Health: Our organization takes pride in organizing medical camps and blood donation drives, ensuring access to essential healthcare services and promoting well-being in the communities we serve.

OUR PRESENCE

- Four Manufacturing Units in FARIDABAD (Delhi), India
- One warehouse in OHIO, US



BENGAL INDUSTRIES PRIVATE LIMITED

UNIT - 01

Plot No. 106, Sector - 59,
HSI IDC Industrial Estate,
Faridabad - 121004
(Haryana) India

UNIT - 02

Plot No. 228A, Sector - 59,
HSI IDC Industrial Estate,
Faridabad - 121004
(Haryana) India

UNIT - 03

11,12,13, Sector - 59,
HUDA Industrial Estate,
Faridabad - 121004
(Haryana) India

UNIT - 04

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