



FLEXWELL CRYO PIPE

Efficient solution for cryogenic media

Technology

BRUGG
Pipes

Pioneers in Infrastructure

FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

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FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

System description

The FLEXWELL® CRYO PIPE was developed for above-ground and underground transport of cryogenic liquefied gases.

A specially adapted super insulation made of highly reflective foil, together with the customised spacers in the vacuum chamber, enables the safe and efficient transport of liquefied gases with low heat input throughout the entire length of the pipeline.

Structure

The FLEXWELL® CRYO PIPE is a flexible, double-walled, vacuum-insulated pipe system for the transport of all cryogenic liquefied gases.

The flexible pipe consists of a spiral corrugated stainless steel carrier pipe, a spiral corrugated stainless steel exterior pipe and cryogenic insulation in between.

The insulation made of highly reflective polymer foils and spacers is located in a vacuum chamber that minimises the total heat input into the pipe system.

A stainless steel stripwound is also applied to the exterior pipe, which not only lends the FLEXWELL® CRYO PIPE greater pressure stability, but also ensures low longitudinal expansion.

This increases the tensile strength of the pipe and enables safe and easy installation. At the same time, it provides protection against mechanical influences during laying and acts as additional corrosion protection.

The final layer is a protective PE coating.

Applications

Transport of cryogenic liquefied gases such as

- Liquid nitrogen LN₂
- Liquid argon LAr
- Liquid oxygen LOX
- Liquid hydrogen LH₂
- Liquid helium LHe
- Liquefied natural gas LNG

Nominal diameters/Pressure levels

The FLEXWELL® CRYO PIPE is designed as a standard product in nominal diameters DN 15 to DN 80 for a maximum pressure of 30 bar (PN 30) in the temperature range from –200 °C (73 K) to a maximum of +50 °C (323 K).

The maximum pressure at temperatures below –200 °C is available on request.

The maximum nominal diameter is DN 200.

Other nominal diameters and pressure levels on request.

Laying

The FLEXWELL® CRYO PIPE can be laid directly above ground in ducts and in buildings.

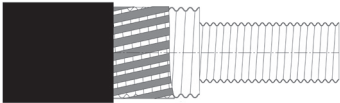
Suitable holder systems are available for this purpose.

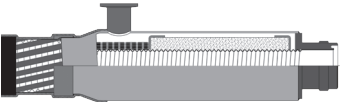
Laying in one piece in a trench (without connecting pieces or welding work) is also possible.

The unique corrugated pipe geometry of the carrier and exterior pipe ensures excellent flexibility and at the same time compensates for thermal expansion/shrinkage.


FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

Product overview

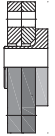





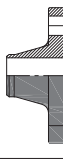

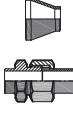



Design	Type	Nominal FCP		Pressure diameter bar	Connection connection type mm	Material no.	Worksheet
		DN	NPS				
	16/ 50	15	½"	30	33.7 x 2.60	Carrier 1.4404/AISI 316L	FCP 2.20.01
	22/ 50	20	¾"	30	42.4 x 2.60	Exterior 1.4404 or	
	30/ 61	25	1"	30	48.3 x 2.65	1.4301/AISI 316L	
	39/ 74	32	1¼"	30	60.3 x 2.90	Reinforcement 1.4301/AISI 316L	
	48/ 94	40	1½"	30	76.1 x 3.05		
	60 / 94	50	2"	30	88.9 x 3.20		
	98/155	80	3"	30	139.7 x 4.00		

	Long connector with vacuum pump connecting piece	16/ 50	15	½"	30	33.7 x 2.60	1.4404/AISI 316L or	FCP 2.30.01
	22/ 50	20	¾"	30	42.4 x 2.60	1.457/AISI 316Ti		
	30/ 61	25	1"	30	48.3 x 2.65			
	39/ 74	32	1¼"	30	60.3 x 2.90			
	48/ 94	40	1½"	30	76.1 x 3.05			
	60/ 94	50	2"	30	88.9 x 3.20			
	98/155	80	3"	30	139.7 x 4.00			

All long connectors are also available with leak detection (LD) and vacuum measurement. For more details, see page 6

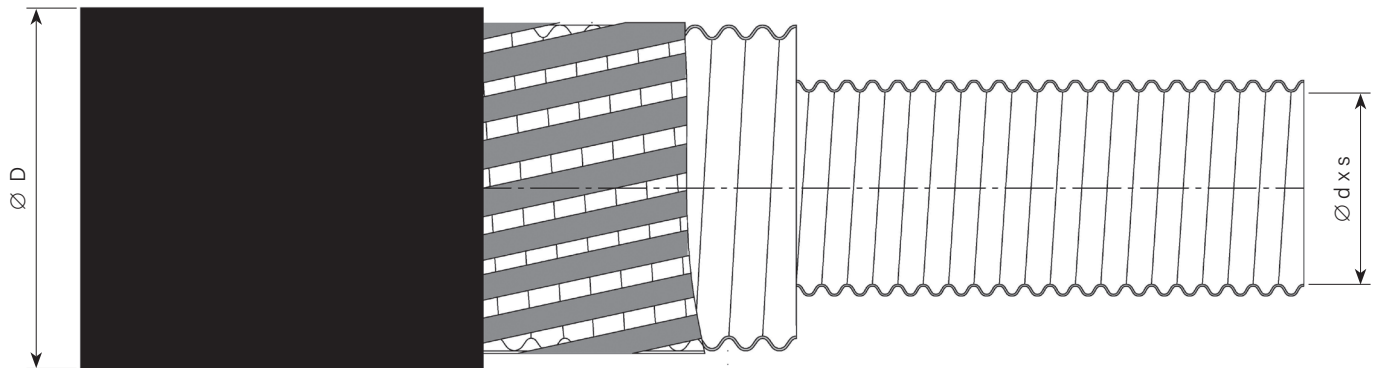
	Short connector	16/ 50	15	½"	30	33.7 x 2.60	1.4404/AISI 316L or	FCP 2.30.01
	22/ 50	20	¾"	30	42.4 x 2.60	1.457/AISI 316Ti		
	30/ 61	25	1"	30	48.3 x 2.65			
	39/ 74	32	1¼"	30	60.3 x 2.90			
	48/ 94	40	1½"	30	76.1 x 3.05			
	60/ 94	50	2"	30	88.9 x 3.20			
	98/155	80	3"	30	139.7 x 4.00			

Customer interface

 <p>Collar with split loose flange acc. to DIN EN 1092 type 4 and 34</p>	 <p>Collar and loose flange acc. to DIN EN 1092 type 4 and 34</p>	 <p>DIN welding neck flange acc. to DIN EN 1092 type 11</p>	 <p>Concentric reduction acc. to EN 10253 type B</p>	 <p>ANSI collar with split loose flange acc. to ANSI 16.9 type A</p>
 <p>ANSI collar with loose flange acc. to ANSI 16.9 type A</p>	 <p>ANSI welding neck flange acc. to ANSI B16.5</p>	 <p>Concentric reduction acc. to ANSI B16.9</p>	 <p>Cryogenic pipe fitting with counterpart</p>	
 <p>Johnston coupling piece</p>	 <p>T-piece</p>	 <p>Mechanical degassing</p>		

FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

Product structure, technical data



Material:

Carrier pipe	1.4404/AISI 316L
Exterior pipe	1.4404 or 1.4301/AISI 316L
Reinforcement	1.4301/AISI 316L
External corrosion protection	PE-LD protective casing

Temperature range:

At 30 bar (DN 15 – DN 80)	-200 °C to +50 °C
	Lower temperatures on request

Operating pressure:

DN 15 – DN 80	Max. 30 bar
At temperatures below -200 °C	Max. pressure on request



Technical data

Type	Nominal diameter		Inner diameter d mm	Outer diameter D mm	Volume l/m	Weight kg/m	Bending radius m	Heat input ¹⁾ W/m	Art. no.
	DN	NPS							
FCP 16/ 50	15	½"	16	50	0.20	1.85	0.3	0.4	1086305
FCP 22/ 50	20	¾"	22	50	0.38	1.90	0.3	0.6	1086306
FCP 30/ 61	25	1"	30	61	0.71	2.40	0.4	0.8	1085059
FCP 39/ 74	32	1¼"	39	74	1.19	3.45	0.6	1.0	1086307
FCP 48/ 94	40	1½"	48	94	1.81	4.75	0.8	1.2	1086308
FCP 60/ 94	50	2"	60	94	3.10	4.75	0.8	1.5	3000600
FCP 98/155	80	3"	98	155	8.26	10.03	0.8	3.0	3000691

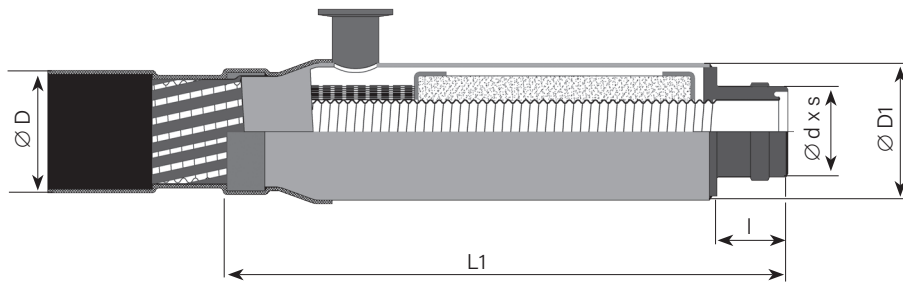
1) Heat input based on liquid nitrogen and an ambient temperature of 15 °C.

FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

Connectors

Long connector with vacuum pump connecting piece, short connector

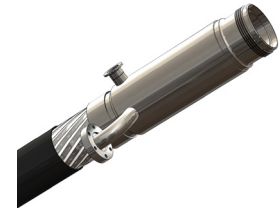
Long connector with vacuum pump connecting piece



Without leak monitoring



With leak monitoring

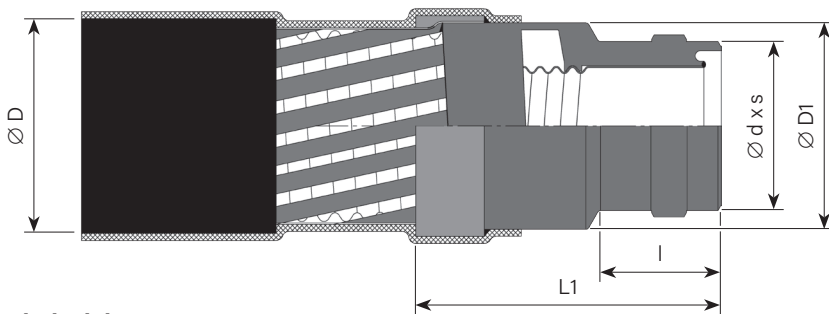


Technical data

Type	Nominal diameter		Max. pressure bar	D mm	D1 mm	d x s mm	L1 mm	l mm	Art. no. Conn. w/ LD	Art. no. Conn. w/ LD
	DN	NPS								
FCP 16/ 50	15	½"	30	50	64	33.7 x 2.60	300	20	1086788	3000263
FCP 22/ 50	20	¾"	30	50	64	42.4 x 2.60	300	31	1086789	3000264
FCP 30/ 61	25	1"	30	61	73	48.3 x 2.65	305	38	1086790	3000270
FCP 39/ 74	32	1¼"	30	74	84	60.3 x 2.90	320	40	1086791	3000271
FCP 48/ 94	40	1½"	30	94	102	76.1 x 3.05	341	41	1086792	3000272
FCP 60/ 94	50	2"	30	94	102	88.9 x 3.20	357	57	3000895	3000899
FCP 98/155	80	3"	30	155	169	139.7 x 4.00	457	50	3000812	3000815

On request with sensor for pressure measurement of the vacuum chamber (art. no. 3000865)

Short connector



Technical data

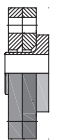
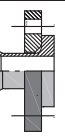
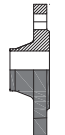


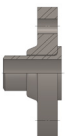


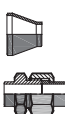



Type	Nominal diameter		Max. pressure bar	D mm	D1 mm	d x s mm	L1 mm	l mm	Art. no. Conn. w/ LD
	DN	NPS							
FCP 16/ 50	15	½"	30	53	49	33.7 x 2.60	72	29	1086793
FCP 22/ 50	20	¾"	30	53	49	42.4 x 2.60	74	31	1086794
FCP 30/ 61	25	1"	30	64	59	48.3 x 2.65	88	36	1086795
FCP 39/ 74	32	1¼"	30	75	70	60.3 x 2.90	97	43	1086796
FCP 48/ 94	40	1½"	30	96	91	76.1 x 3.05	110	38	1086797
FCP 60/ 94	50	2"	30	94	91	88.9 x 3.20	126	54	3000898
FCP 98/155	80	3"	30	155	149	139.7 x 4.00	169	50	3000813

For pipe lengths of up to 30 m, one long connector and one short connector are installed.
For pipe lengths over 30 m, two long connectors are installed.

FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

Customer interfaces

Flanged, welded, bolted

Customer interface	Type:	FCP 16/50	FCP 22/50	FCP 30/61	FCP 39/74	FCP 48/94	FCP 60/94	FCP 98/155
 Collar with split loose flange acc. to DIN EN 1092 type 4 and 34	Art. no.	DN 25/PN40 1086763	DN 32/PN40 1086764	DN 40/PN40 1086765	DN 50/PN40 1086766	DN 65/PN40 1086767	DN 80/PN40 3000884	DN 125/PN40 3000885
	Art. no.	DN15/PN40 ¹⁾ 3000886	DN20/PN40 ¹⁾ 3000887	DN25/PN40 ¹⁾ 1086763	DN32/PN40 ¹⁾ 1086764	DN40/PN40 ¹⁾ 1086765	DN50/PN40 ¹⁾ 1086766	DN80/PN40 ¹⁾ 3000884
 Collar and loose flange acc. to DIN EN 1092 type 4 and 34	Art. no.	DN 25/PN40 3000888	DN 32/PN40 1086801	DN 40/PN40 3000620	DN 50/PN40 3000889	DN 65/PN40 3000890	DN 80/PN40 3000891	DN 125/PN40 3000892
	Art. no.	DN15/PN40 ¹⁾ 1086798	DN20/PN40 ¹⁾ 1086799	DN25/PN40 ¹⁾ 3000888	DN32/PN40 ¹⁾ 1086801	DN40/PN40 ¹⁾ 3000620	DN50/PN40 ¹⁾ 3000889	DN80/PN40 ¹⁾ 3000891
 DIN welding neck flange acc. to DIN EN 1092 type 11	Art. no.	DN 25/PN40 1086740	DN 32/PN40 1086741	DN 40/PN40 1086742	DN 50/PN40 1086712	DN 65/PN40 1086713	DN 80/PN40 3000845	DN 125/PN40 3000855
	Art. no.	DN15/PN40 ¹⁾ 1086710	DN20/PN40 ¹⁾ 1086711	DN25/PN40 ¹⁾ 1086740	DN32/PN40 ¹⁾ 1086741	DN40/PN40 ¹⁾ 1086742	DN50/PN40 ¹⁾ 1086712	DN80/PN40 ¹⁾ 3000845
 Concentric reduction acc. to EN 10253 type B	Art. no.	DN 25-DN 15 1086750	DN 32-DN 20 1086751	DN 40-DN 25 1086752	DN 50-DN 32 1086753	DN 65-DN 40 1086755	DN 80-DN 50 3000847	DN 125-DN 80 3000846
 ANSI collar with split loose flange acc. to ANSI 16.9 type A	Art. no.	1"/300lbs 3000670	1¼"/300lbs on request	1 7/300lbs on request	2"/300lbs on request	2 1/2"/300lbs on request	3"/300lbs on request	5"/300lbs on request
	Art. no.	½"/300lbs ¹⁾ on request	¾"/300lbs ¹⁾ on request	1"/300lbs ¹⁾ 3000670	1 1/8"/300lbs ¹⁾ on request	1 1/4"/300lbs ¹⁾ on request	2"/300lbs ¹⁾ on request	3"/300lbs ¹⁾ on request
 ANSI collar with loose flange acc. to ANSI 16.9 type A	Art. no.	1"/300lbs 3000670	1¼"/300lbs on request	1"/300lbs on request	2"/300lbs on request	2 1/2"/300lbs on request	3"/300lbs on request	5"/300lbs on request
	Art. no.	½"/300lbs ¹⁾ on request	¾"/300lbs ¹⁾ on request	1"/300lbs ¹⁾ 3000670	1 1/8"/300lbs ¹⁾ on request	1 1/4"/300lbs ¹⁾ on request	2"/300lbs ¹⁾ on request	3"/300lbs ¹⁾ on request
 ANSI welding neck flange acc. to ANSI B16.5	Art. no.	1"/300lbs 1086743	1¼"/300lbs 1086716	1"/300lbs 1086718	2"/300lbs 1086719	2 1/2"/300lbs 1086720	3"/300lbs 3000852	5"/300lbs 3000853
	Art. no.	½"/300lbs ¹⁾ 1086714	¾"/300lbs ¹⁾ 1086715	1"/300lbs ¹⁾ 1086743	1 1/4"/300lbs ¹⁾ 1086716	1 1/2"/300lbs ¹⁾ 1086718	2"/300lbs ¹⁾ 1086719	3"/300lbs ¹⁾ 3000852
 Concentric reduction acc. to ANSI B16.9	Art. no.	1"-½"/300lbs 1086756	1¼"-¾"/300lbs 1086758	1½"-1"/300lbs 1086759	2"-1¼"/300lbs 1086761	2½"-1½"/300lbs 1086762	3"-2"/300lbs 3000956	3"-2"/300lbs 3000854
 Cryogenic pipe fitting with counter-part	Art. no.	DN 25 1086804	DN 25 1086805	DN 25 1086806	DN 50 3000893	DN 50 3000894		
 Johnston Coupling piece	The basic range is available for DN 25. We supply other nominal diameters on request.							
 T-piece								
 Mechanical Degassing								

¹⁾ In order to be able to use the smaller nominal flange diameter, a corresponding reduction must first be welded on.

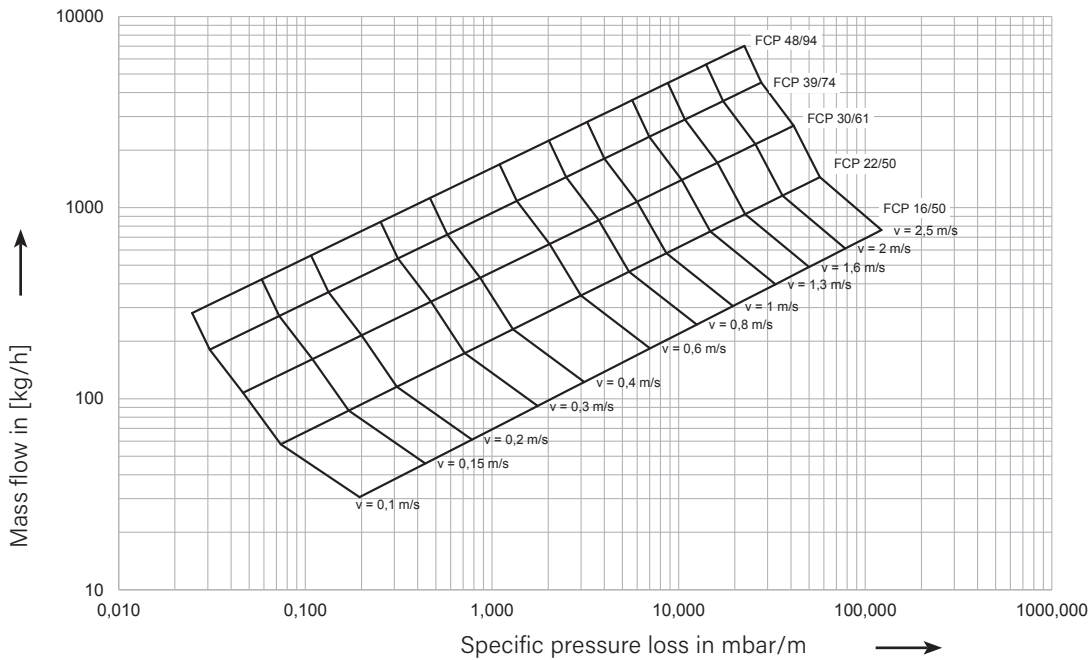
FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

Flow technology

Pressure loss diagram for LNG (liquid methane)

Temperature: -161 °C (112 K)
 Pressure: 3 bar g (4 bar a)
 Density: 422 kg/m³
 Dynamic viscosity: 116 μ Pa-s

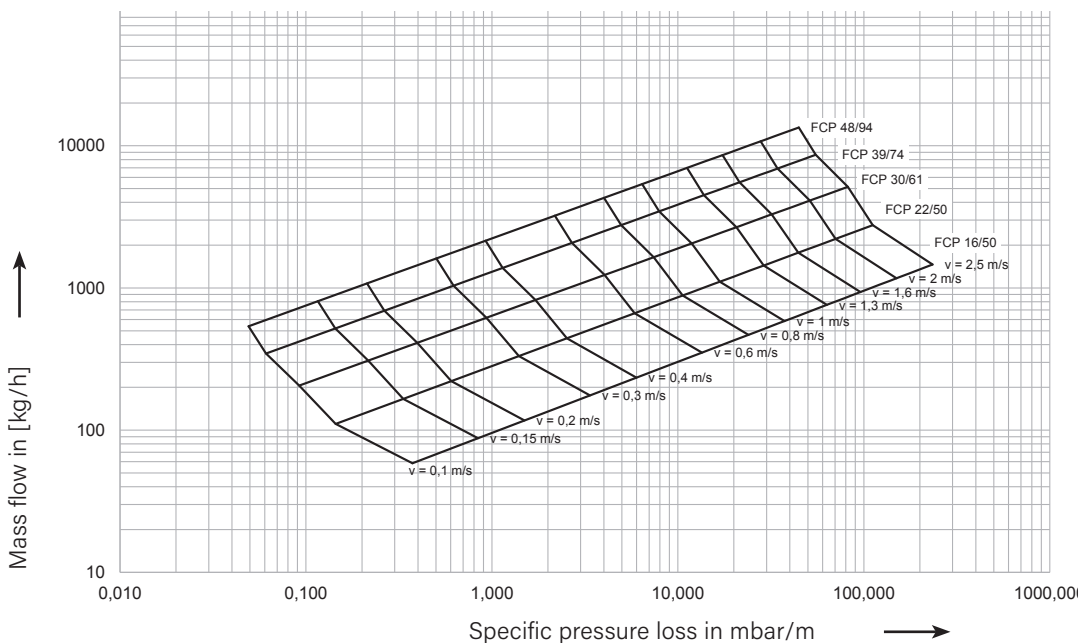
Example:
 Pipe DN 25 (FCP 30/61)
 Mass flow 1500 kg/h, at a speed of approx. 1.4 m/s
 the pressure loss is 12 mbar/m



Pressure loss diagram for LN₂ (liquid nitrogen)

Temperature: -196 °C (77 K)
 Pressure: 3 bar g (4 bar a)
 Density: 808 kg/m³
 Dynamic viscosity: 163 μ Pa-s

Example:
 Pipe DN 25 (FCP 30/61)
 Mass flow 2000 kg/h, at a speed of approx. 1 m/s
 the pressure loss is 11 mbar/m



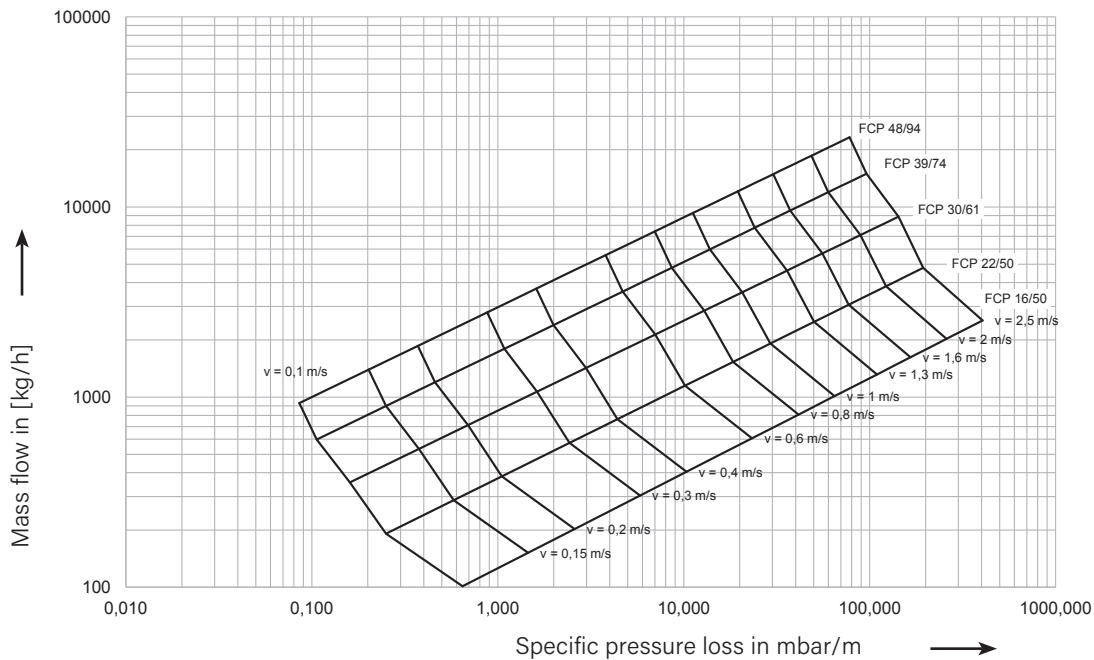
FLEXWELL® CRYO PIPE – pipe system for cryogenic gases

Flow technology

Pressure loss diagram for LAr (liquid argon)

Temperature: -186 °C (87 K)
 Pressure: 3 bar g (4 bar a)
 Density: 1398 kg/m³
 Dynamic viscosity: 264 μ Pa-s

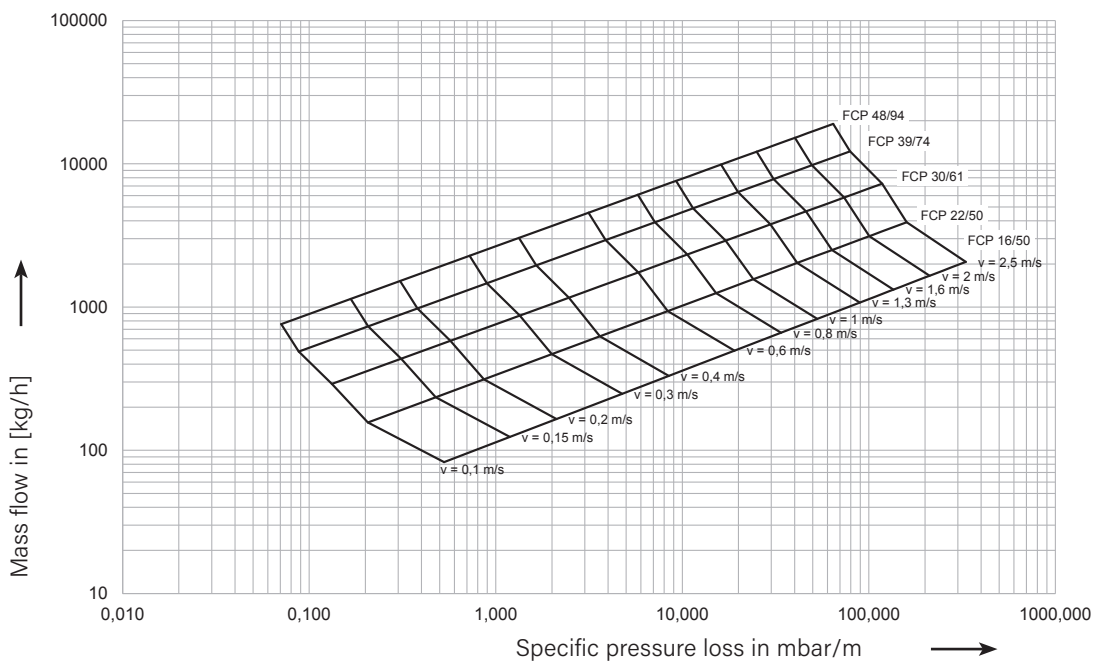
Example:
 Pipe DN 20 (FCP 22/50)
 Mass flow 1300 kg/h, at a speed of approx. 0.63 m/s the
 pressure loss is 11 mbar/m



Pressure loss diagram for LOX (liquid oxygen)

Temperature: -183 °C (90 K)
 Pressure: 3 bar g (4 bar a)
 Density: 1143 kg/m³
 Dynamic viscosity: 196 μ Pa-s

Example:
 Pipe DN 32 (FCP 39/74)
 Mass flow 4500 kg/h, at a speed of approx. 0.92 m/s the
 pressure loss is 10 mbar/m



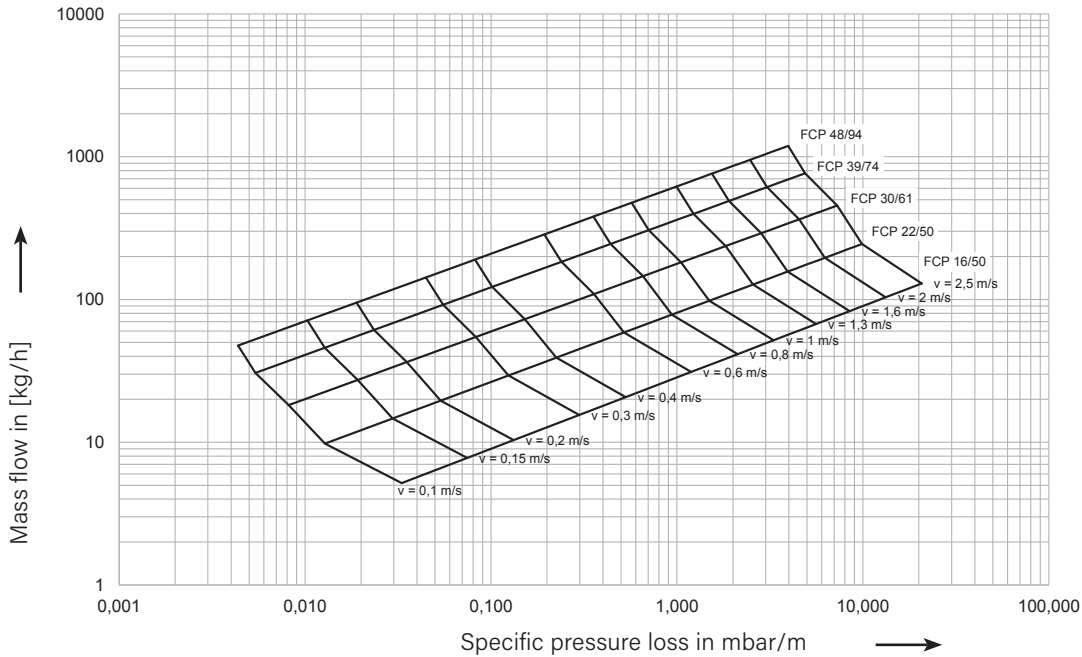
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Flow technology

Pressure loss diagram for LH₂ (liquid hydrogen)

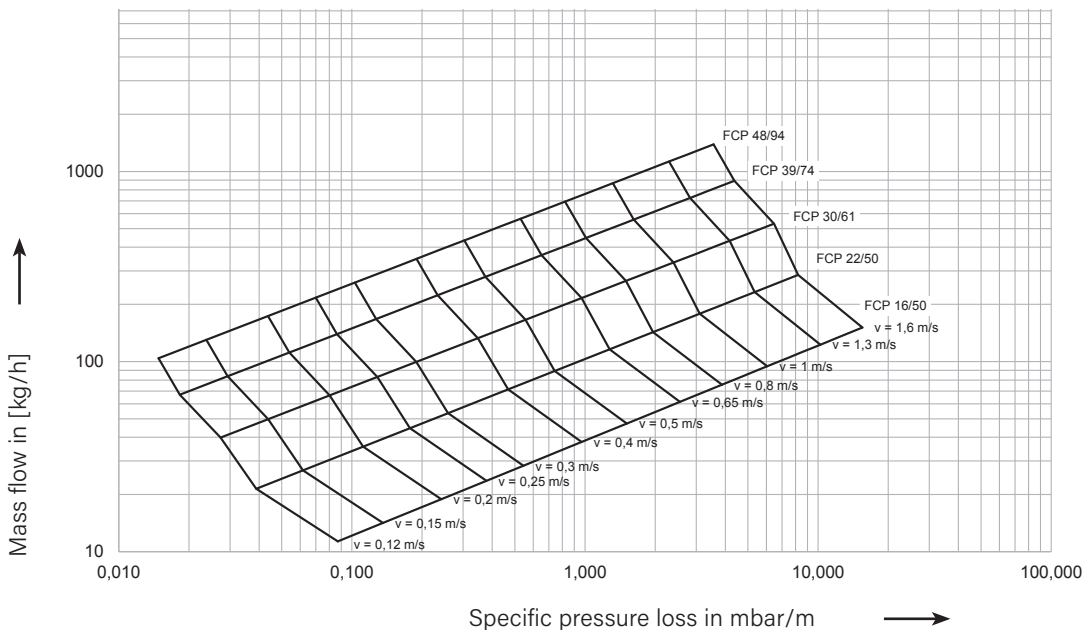
Temperature: -253 °C (20 K)
 Pressure: 3 bar g (4 bar a)
 Density: 71.5 kg/m³
 Dynamic viscosity: 14 μ Pa-s

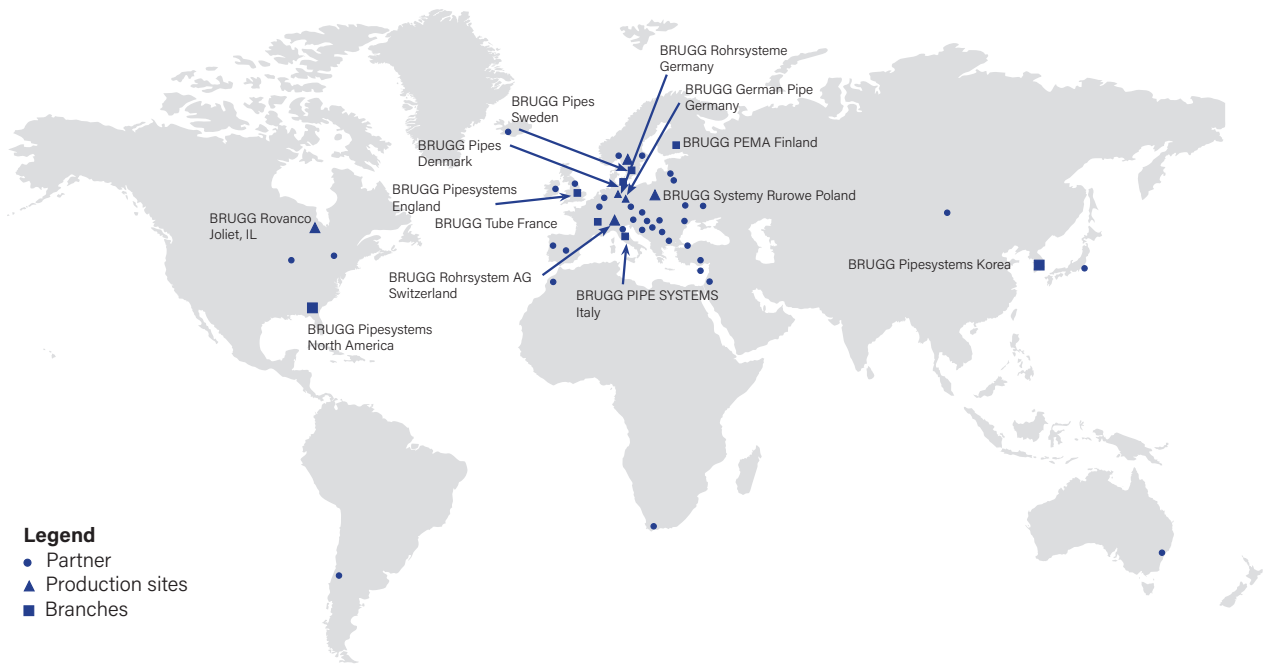
Example:
 Pipe DN 15 (FCP 16/50)
 Mass flow 50 kg/h, at a speed of approx. 0.96 m/s
 the pressure loss is 3 mbar/m



Pressure loss diagram for LHe (liquid helium)

Temperature: -269 °C (4.2 K)
 Pressure: 1 bar g (2 bar a)
 Density: 130 kg/m³
 Dynamic viscosity: 3.4 μ Pa-s





- Legend**
- Partner
 - ▲ Production sites
 - Branches



BRUGG
Pipes

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