

FLEXWELL® CRYO PIPE

Pipe system for cryogenic gases

Technical Details

PIONEERS IN INFRASTRUCTURE



Notes

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FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

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FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

System description

FLEXWELL® CRYO PIPE has been developed for above-ground and underground transport of cryogenic liquefied gases. The special super-insulation made of highly reflective foil together with spacers in the vacuum layer enable an efficient and safe cryogenic fluid transport with low heat inleak along the whole length of the pipeline.

The specially adapted stainless steel armoring of the outer pipe guarantees high pressure stability and minimal elongation of FLEXWELL® CRYO PIPE. The stainless steel armoring also provide a stiffening component to ensure that the piping can be laid and pulled-in without risk. The pipe system is designed for a maximum pressure of 25 bar (PN 25) for the DN 15 to DN 32 pipes and for a maximum pressure of 30 bar for the DN 40 pipe in the temperature range between –200 °C (73 K) and +50 °C.

Construction

FLEXWELL® CRYO PIPE is a flexible, double-walled, vacuum-insulated pipe system for the transport of all cryogenic liquefied gases. The pipe consists of two concentrically helically-corrugated stainless steel pipes with a cryogenic insulation in between. The insulation of highly reflective polymer foil and spacers in a vacuum layer minimizes the total heat input into the pipe system. Stainless steel armoring is additionally applied to the outer pipe in order to provide a higher pressure stability of the pipe system and to increase the tensile strength of the pipe for the installation. The final layer is a PE protective coating.

Applications

Transporting cryogenic liquid 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 ratings

FLEXWELL® CRYO PIPE is currently available as a standard product in the nominal diameters DN 15 to DN 40 in the temperature range from –200 °C to +50 °C with the pressure level PN 25 for the sizes DN 15 to DN 32 and with a maximum pressure of 30 bar for the size DN 40. The maximum pressures at temperatures below –200 °C are available on request. Other nominal diameters and pressure levels on request. The maximum nominal diameter is DN 200.

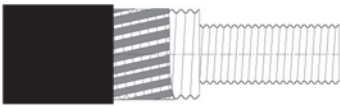
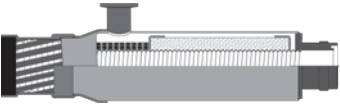
Laying

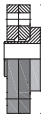
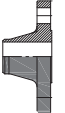
FLEXWELL® CRYO PIPE can be laid above ground, directly in buildings. Suitable pipe brackets, etc. are offered for this purpose.

It is also possible to install it in one piece directly in a pipe trench or on sand bed. The unique corrugated pipe geometry of the inner and outer pipe ensures excellent flexibility and simultaneously compensates for thermal expansion/shrinkage.

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

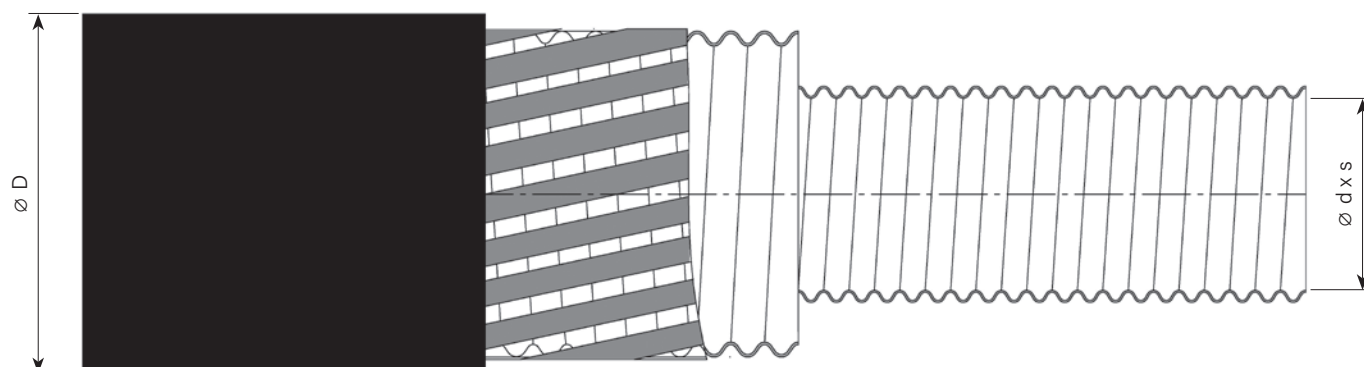
Product overview

Design	Type FCP	Nominal diameter	Max. pressure bar	Connection type	Material no.	Work sheet
	16/50	15	25	33.7 x 2.6 mm	Inner 1.4404 (316L)	FCP 2.20.01
	22/50	20		42.4 x 2.6 mm		
	30/61	25		48.3 x 2.6 mm	Outer 1.4404 (316L)	
	39/74	32		60.3 x 2.6 mm		
	48/94	40	30	76.0 x 3.0 mm		
	16/50	15	25	33.7 x 2.6 mm	1.4404 (316L)	FCP 2.30.01
	22/50	20		42.4 x 2.6 mm	or	
	30/61	25		48.3 x 2.6 mm	1.4571 (316TI)	
	39/74	32		60.3 x 2.6 mm		
	48/94	40	30	76.0 x 3.0 mm		
	16/50	15	25	33.7 x 2.6 mm	1.4404 (316L)	FCP 2.30.01
	22/50	20		42.4 x 2.6 mm	or	
	30/61	25		48.3 x 2.6 mm	1.4571 (316TI)	
	39/74	32		60.3 x 2.6 mm		
	48/94	40	30	76.0 x 3.0 mm		

Customer interface for type		FCP 16/50	FCP 22/50	FCP 30/61	FCP 39/74	FCP 48/94
	Collar and split loose flange acc. to DIN EN 1092 type 11	DN 25/PN 25	DN 32/PN 25	DN 40/PN 25	DN 50/PN 25	DN 65/PN 40
	Reducer with collar and loose flange acc. to DIN EN 1092 type 11	DN 15/PN 25	DN 20/PN 25	DN 25/PN 25	DN 32/PN 25	DN 40/PN 40
	DIN weld neck flange acc. to DIN EN 1092 type 11	DN 25/PN 40	DN 32/PN 40	DN 40/PN 40	DN 50/PN 40	DN 65/PN 40
		DN 15/PN 40	DN 20/PN 40	DN 25/PN 40	DN 32/PN 40	DN 40/PN 40
	ANSI weld neck flange acc. to ANSI B16.5	1"/300 lbs	1¼"/300 lbs	1½"/300 lbs	2"/300 lbs	2½"/300 lb
		½"/300 lbs	¾"/300 lbs	1"/300 lbs	1¼"/300 lbs	1½"/300 lbs
	Concentric reducer acc. to EN 10253 type B	DN 25 – DN 15	DN 32 – DN 20	DN 40 – DN 25	DN 50 – DN 32	DN 65 – DN 40
	Concentric reducer acc. to ANSI B16.9	1" – ½"	1¼" – ¾"	1½" – 1"	2" – 1¼"	2½" – 1½"
	Cryogenic pipe fitting with counterpart	DN 25	DN 25	DN 25		

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

Product design, technical data



Material:

Inner pipe	1.4404 (316L)
Outer pipe	1.4404 (316L)
Armoring	1.4301 (304)
Outer corrosion protection	PE-LD protective jacket

Temperature range:

at 25 bar (DN 15 – DN 32)	–200 °C to +50 °C
at 30 bar (DN 40)	–200 °C to +50 °C

Operating pressure:

DN 15 – DN 32	max. 25 bar
DN 40	max. 30 bar
in 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 leak ¹⁾ W/m	Article no.
FCP 16/50	DN 15	16	50	0.20	1.85	0.3	0.4	1086305
FCP 22/50	DN 20	22	50	0.38	1.90	0.3	0.6	1086306
FCP 30/61	DN 25	30	61	0.71	2.40	0.4	0.8	1085059
FCP 39/74	DN 32	39	74	1.19	3.45	0.6	1.0	1086307
FCP 48/94	DN 40	48	94	1.81	4.75	0.8	1.2	1086308

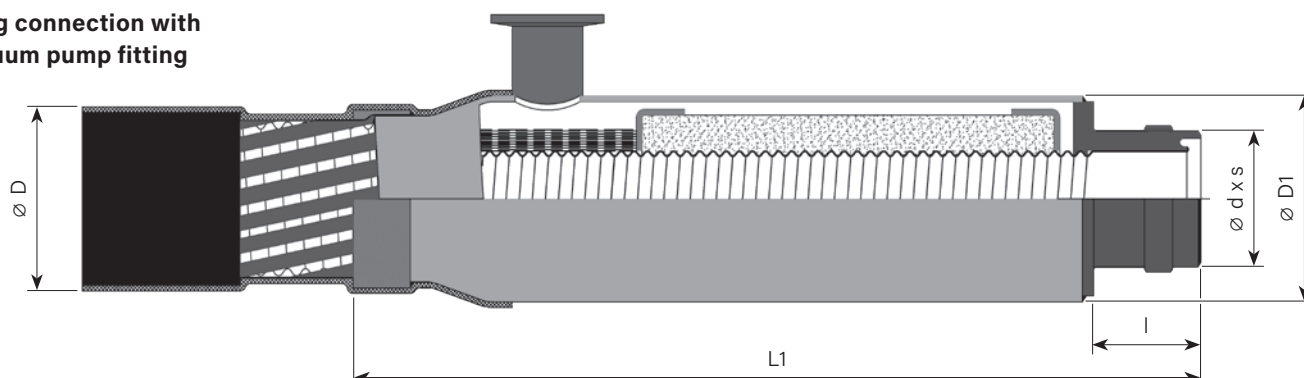
1) Heat leak based on liquid nitrogen and an ambient temperature of 15 °C.

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

Fittings

Long connection with vacuum pump fitting, short connection

Long connection with vacuum pump fitting

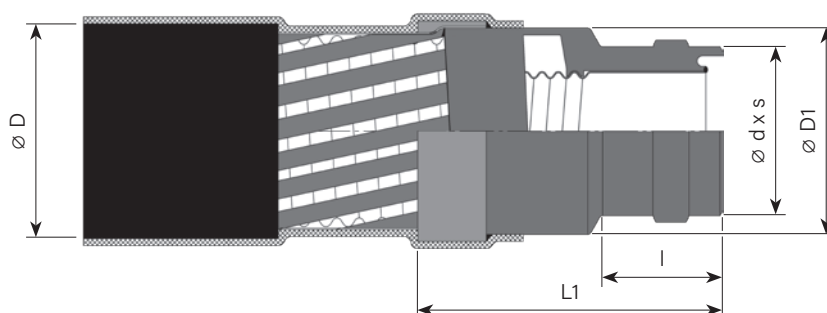


Technical data

Type	Nominal diameter	Max. pressure bar	D mm	D1 mm	d x s mm	L1 mm	l mm	Article no.
FCP 16/50	15	25	50	64	33.7 x 2.6	300	20	1086788
FCP 22/50	20	25	50	64	42.4 x 2.6	300	30	1086789
FCP 30/61	25	25	61	73	48.3 x 2.6	300	38	1086790
FCP 39/74	32	25	74	84	60.3 x 2.6	300	38	1086791
FCP 48/94	40	30	94	102	70.0 x 3.0	340	41	1086792



Short connection



Technical data

Type	Nominal diameter	Max. pressure bar	D mm	D1 mm	d x s mm	L1 mm	l mm	Article no.
FCP 16/50	15	25	50	53	33.7 x 2.6	80	30	1086793
FCP 22/50	20	25	50	53	42.4 x 2.6	80	30	1086794
FCP 30/61	25	25	61	63	48.3 x 2.6	90	35	1086795
FCP 39/74	32	25	74	75	60.3 x 2.6	90	35	1086796
FCP 48/94	40	30	94	100	70.0 x 3.0	105	38	1086797



Dimensions

Type	Nominal diameter DN	Outer diameter D1 "short" mm	Outer diameter D1 "long" mm	Length L1 "short" mm	Length L1 "long" mm	Welded connection mm
FCP 16/50	15	53	63.5	80	300	33.7 x 2.6
FCP 22/50	20	53	63.5	80	300	42.4 x 2.6
FCP 30/61	25	63	73.0	90	300	48.3 x 2.6
FCP 39/74	32	75	84.0	90	300	60.3 x 2.6
FCP 48/94	40	100	102.0	105	340	70.0 x 3.0

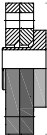
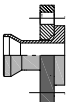
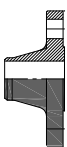
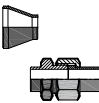
For pipe lengths up to 30 m, one long connection and one short connection is fitted on the pipe.

For pipe lengths over 30 m, two long connections are fitted on the pipe.

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

Customer interfaces

flanged, welded, screwed

Customer interface	Type:	FCP 16/50	FCP 22/50	FCP 30/61	FCP 39/74	FCP 48/94
	Collar and split loose flange acc. to DIN EN 1092 Type 11	Article no.: 1086763	DN 25/PN 25 1086764	DN 40/PN 25 1086765	DN 50/PN 25 1086766	DN 65/PN 40 1086767
	Reducer with collar and loose flange acc. to DIN EN 1092 Type 11	Article no.: 1086798	DN 15/PN 25 1086799	DN 25/PN 25 1086800	DN 32/PN 25 1086801	DN 40/PN 40 1086802
	DIN weld neck flange acc. to DIN EN 1092 Type 11	Article no.: 1086740 1086710	DN 25/PN 40 1086741 DN 15/PN 40 ¹⁾ 1086711	DN 40/PN 40 1086742 DN 25/PN 40 ¹⁾ 1086740	DN 50/PN 40 1086712 DN 32/PN 40 ¹⁾ 1086741	DN 65/PN 40 1086713 DN 40/PN 40 ¹⁾ 1086742
	Concentric reducer acc. to EN 10253 Type B	Article no.: 1086750	DN 25 – DN 15 1086751	DN 40 – DN 25 1086752	DN 50 – DN 32 1086753	DN 65 – DN 40 1086755
	ANSI weld neck flange acc. to ANSI B16.5	Article no.: 1086743 1086714	1"/300 lbs 1086743 ½"/300 lbs ¹⁾ 1086714	1½"/300 lbs 1086718 1"/300 lbs ¹⁾ 1086743	2"/300 lbs 1086719 1¼"/300 lbs ¹⁾ 1086716	2½"/300 lbs 1086720 1½"/300 lbs ¹⁾ 1086718
	Concentric reducer acc. to ANSI B16.9	Article no.: 1086756	1" – ½" 1086758	1½" – 1" 1086759	2" – 1¼" 1086761	2½" – 1½" 1086762
	Cryogenic pipe fitting with counterpart	Article no.: 1086804	DN 25 1086805	DN 25 1086806		

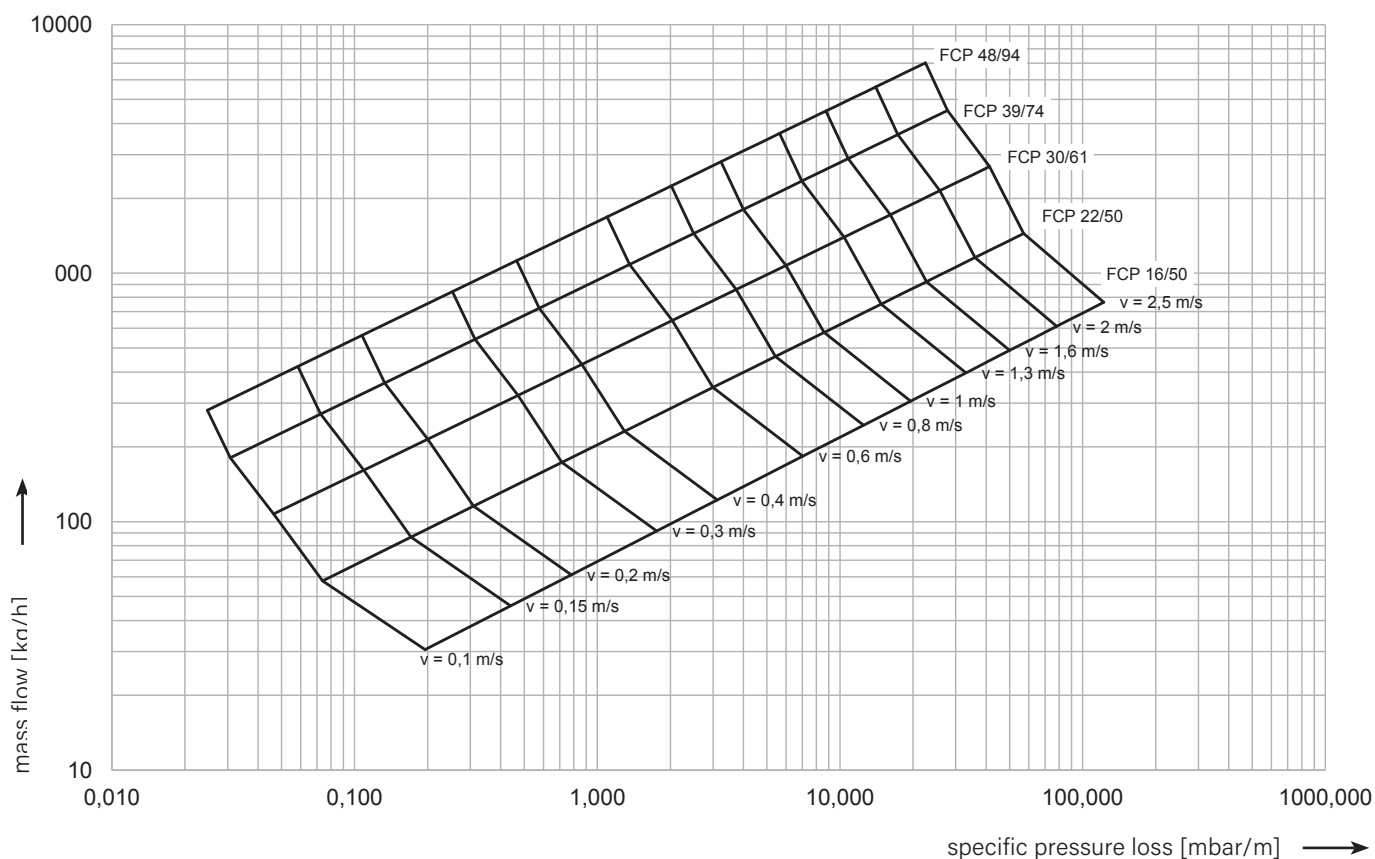
1) To use the smaller flange nominal diameter, a corresponding reducer must be welded on first.

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Fluid mechanics

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



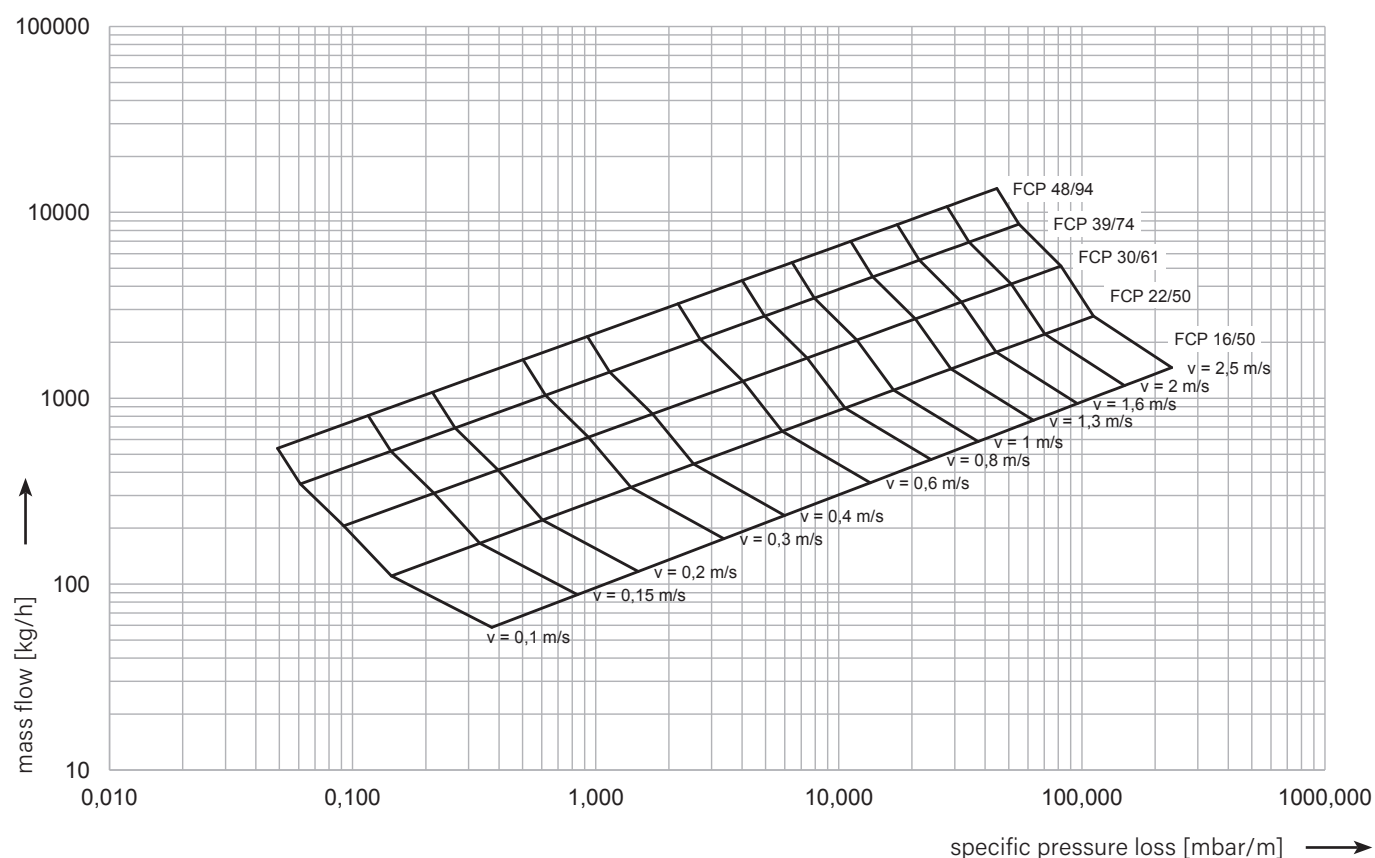
Example:

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

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

Fluid mechanicsPressure loss diagram for LN₂ (liquid nitrogen)

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

**Example:**

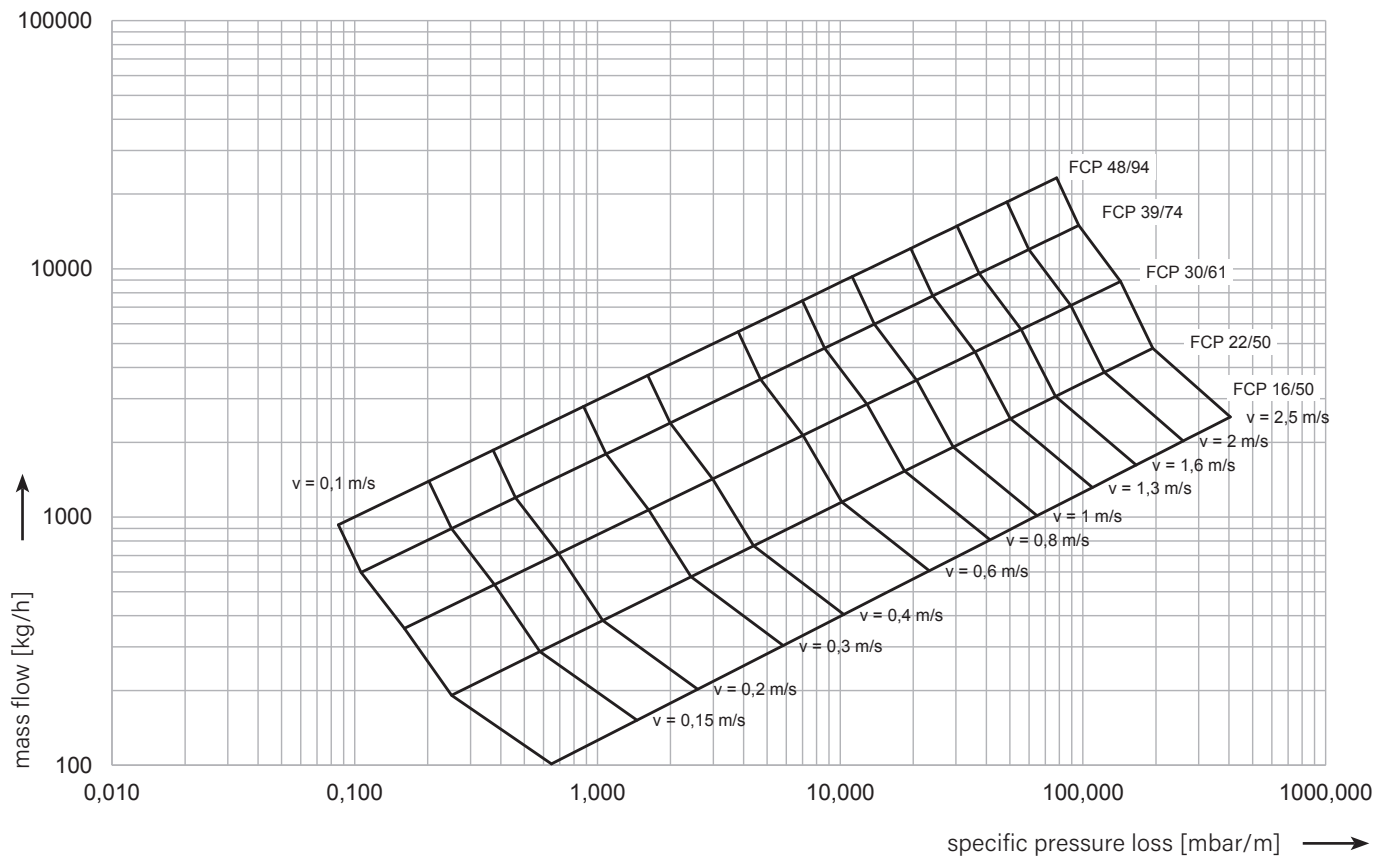
Pipe DN 25 (FCP 30/61)
 mass flow 2000 kg/h
 at a speed of approx. 1 m/s
 pressure loss is 11 mbar/m

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Fluid mechanics

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:**

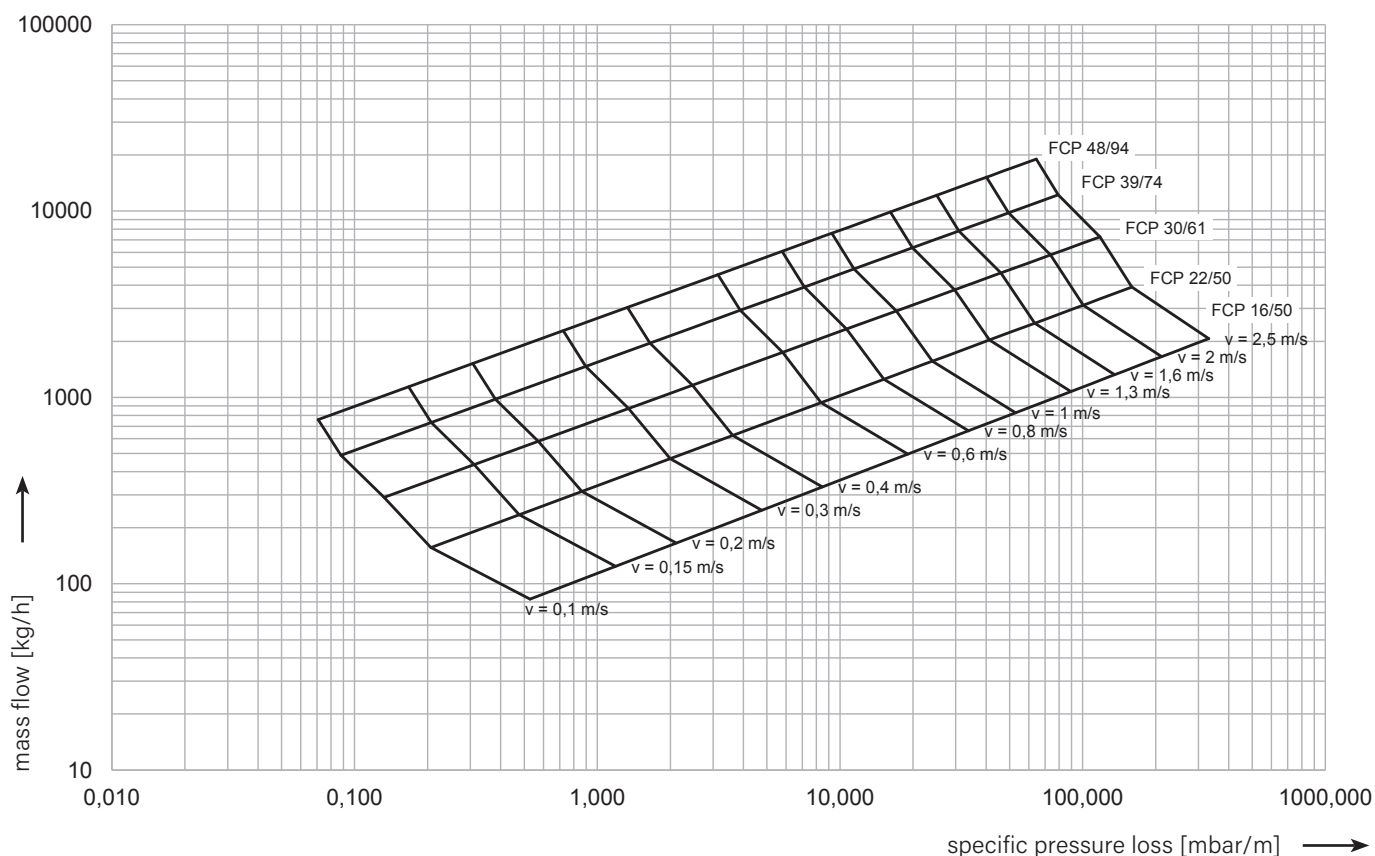
Pipe DN 20 (FCP 22/50)
 mass flow 1300 kg/h
 at a speed of approx. 0.63 m/s
 pressure loss is 11 mbar/m

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Fluid mechanics

Pressure loss diagram for LOX (liquid oxygen)

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

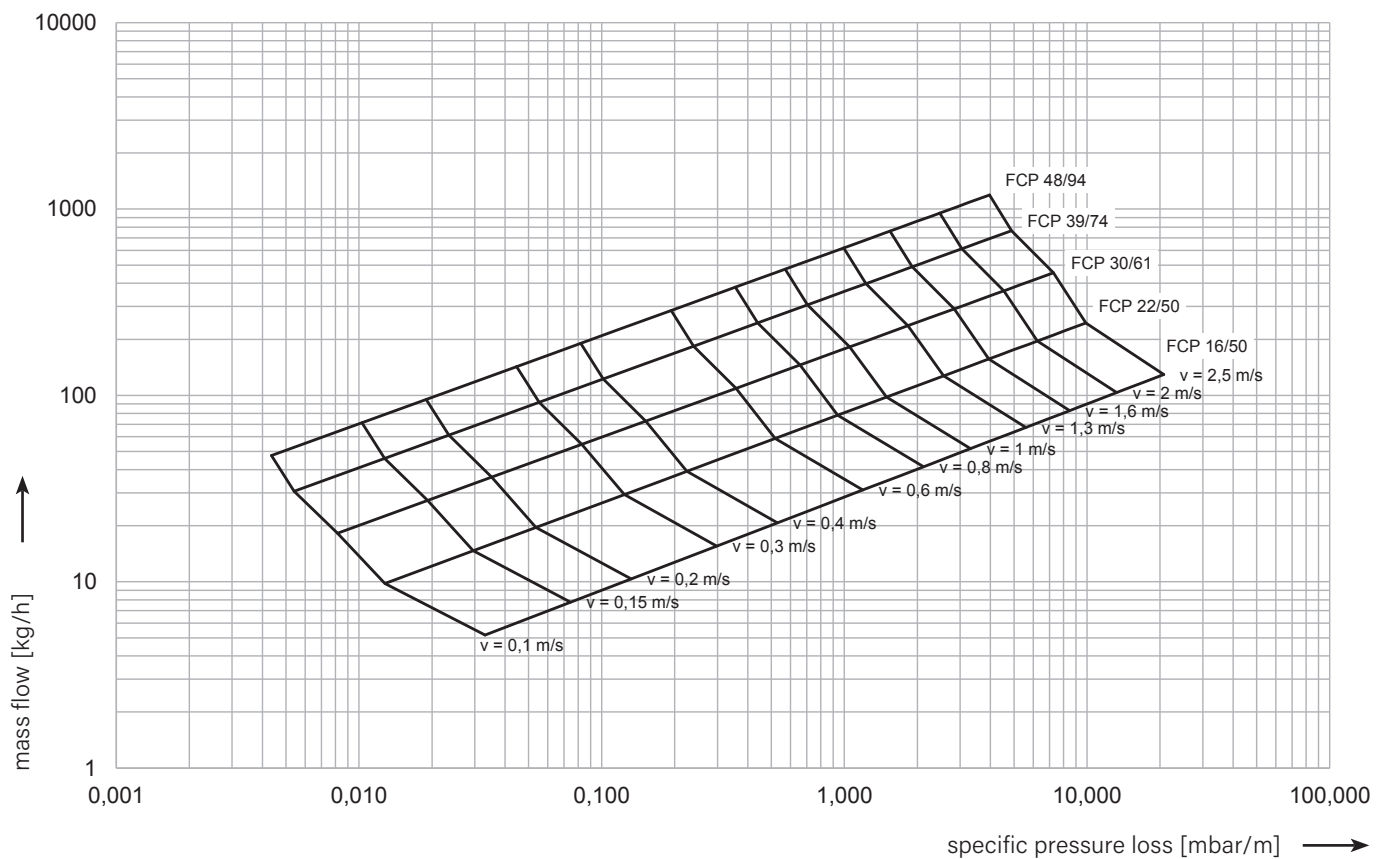
**Example:**

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

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

Fluid mechanicsPressure loss diagram for LH₂ (liquid hydrogen – pure para-hydrogen)

Temperature:	-253 °C (20 K)
Pressure:	3 bar g (4 bar a)
Density:	71,5 kg/m ³
Dynamic viscosity:	14 µ Pa·s

**Beispiel:**

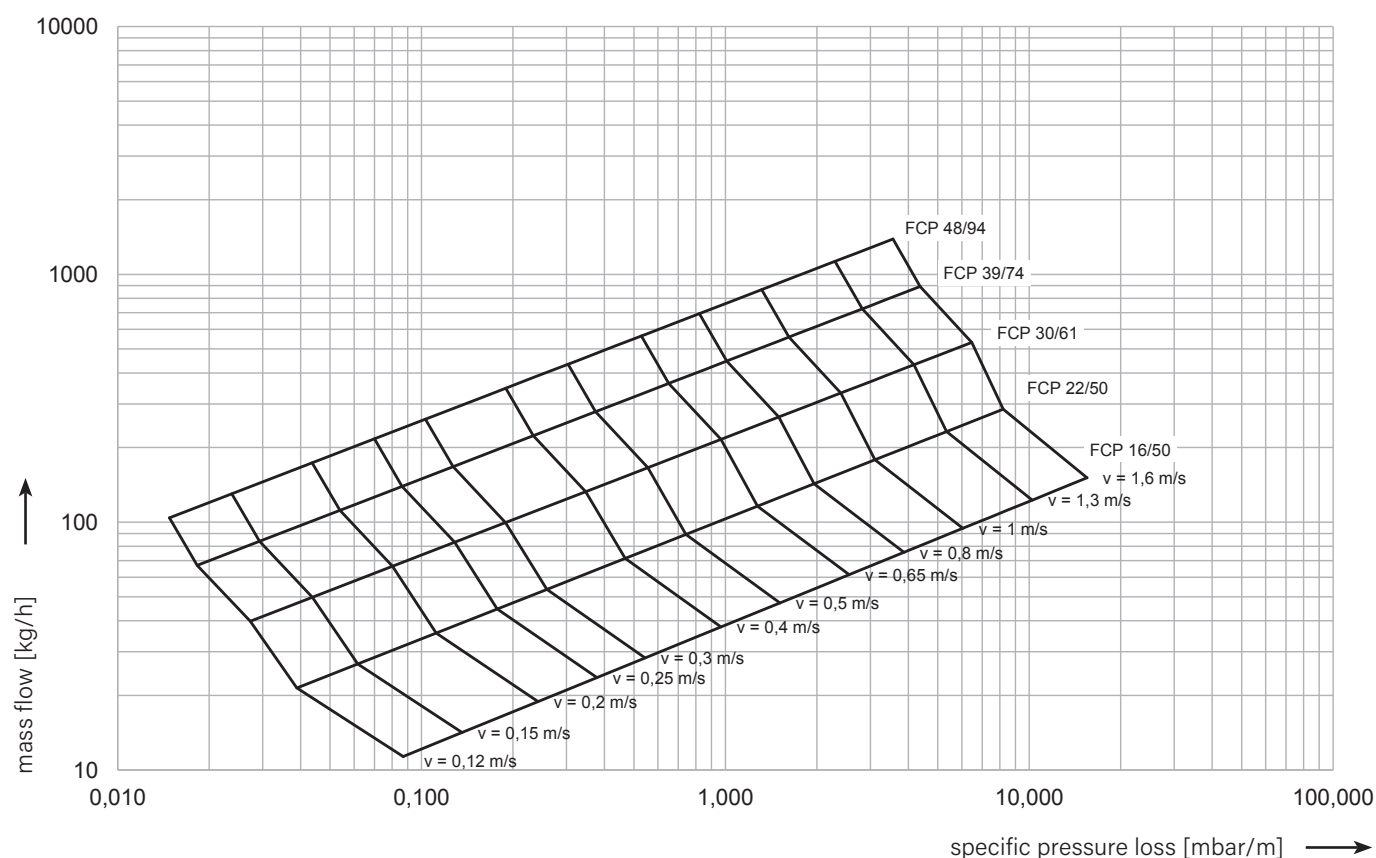
Pipe DN 15 (FCP 16/50)
 mass flow 50 kg/h
 at a speed of approx. 0.96 m/s
 pressure loss is 3 mbar/m

FLEXWELL® CRYO PIPE – Pipe system for cryogenic gases

Fluid mechanics

Pressure loss diagram for LHe (liquid helium)

Temperature:	-269 °C (4.2 K)
Pressure:	1 bar g (2 bar a)
Density:	130 kg/m ³
Dynamic viscosity:	3,4 µ Pa·s



Notes

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