

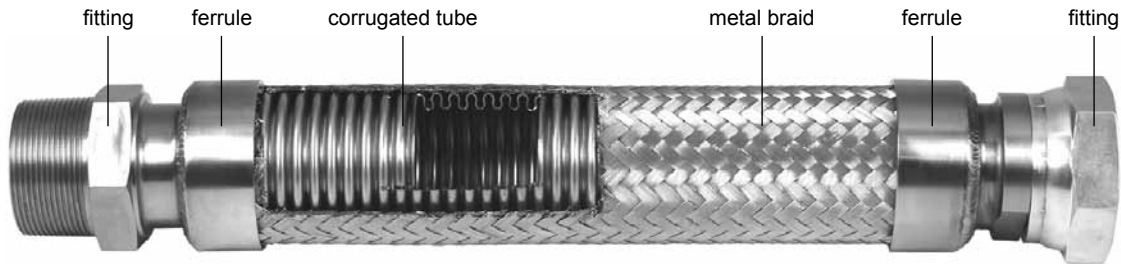
# INDUSTRIAL HOSES - metal

## Pressure hoses

### Characteristic and application

Flexible pressure hoses and metal hose assemblies meet all working conditions and requirements that are unattainable for rubber or plastic hoses.

Pressure metal hoses are manufactured by parallel or spiral corrugation of thin-walled metal tube. The lead and depth of corrugations create necessary flexibility, resistance to deformation and vacuum. Widely used as complete metal hose assemblies in no braid, single or double braid versions. Versions in metal wire braid resist internal pressure. Used in all branches of industry to transfer: hot water, steam, oils, chemicals, gaseous and liquid gases etc.



### Advantages of metal pressure hoses

- resistance to ageing, heat, oils and hydrocarbons, various chemicals, steam, hot water, etc.,
- wide range of temperature resistance (from  $-270^{\circ}\text{C}$  up to  $+800^{\circ}\text{C}$ ),
- non-flammability,
- resistance to high pressure and vacuum,
- impermeability to penetrating gases and liquids,
- large diameter and low temperature flexibility, kink resistance,
- high thermal and electrical conductivity,
- permanent assembly of fittings (welding), relatively safe run of possible breakdown.

### Proper selection, installation and use of a hose assembly

Due to unique construction of pressure metal hoses it is required to contact Sales or Technical Department of TUBES INTERNATIONAL® in order to select the hose properly. Installation and usage guidelines of pressure metal hose assemblies are outlined in a manual on the following page.

### Important notes on pressure metal hoses:

- follow installation and handling guides given in the manual,
- the hose must not be twisted during installation and usage,
- dynamic hose flexing has to be defined and taken into consideration,
- it is necessary to match the material of the hose and fittings taking into account corrosive action of both media to be transferred and external conditions,
- note must be taken of vibrations occurrence and its influence,
- high flow velocity in a corrugated hose can cause turbulence, big pressure drop and occurrence of dangerous vibrations,
- temperature correction factor has to be taken into consideration - values given in the tables apply to working pressure at  $+20^{\circ}\text{C}$ .

# INDUSTRIAL HOSES - metal

## Pressure steel assemblies complying with ISO 10380

ISO 10380 (PN-EN ISO 10380:2003) defines material specifications as well as construction and pressure requirements for flexible steel hoses. One of the conditions is to ensure the life of 10 000 cycles of standard flexing of the hose at minimum bend radius and maximum working pressure defined for dynamic conditions. However TUBES INTERNATIONAL® also provides hoses whose cycle life of 50000 is guaranteed.

### Hose material

The most popular hose material:

- AISI 304 stainless steel (braid),
- AISI 321 stainless steel (hose),
- AISI 316 L stainless steel (hose and braid),
- copper alloy: bronze (hose and braid, used up to +200°C),
- nickel alloys: monel, Inconel (hose and braid, used to achieve high corrosion resistance, against chlorine in particular).

### Temperature correction factors of metal hoses

Temperature correction factor (compliant with EN ISO 10380:2003)  
applies to all metal hoses, except B-FLEX and C-FLEX

steel	temperature [°C]																		
	-200	-100	0	+20	+50	+100	+150	+200	+250	+300	+350	+400	+450	+500	+550	+600	+650	+700	+750
321	1.00	1.00	1.00	1.00	0.93	0.83	0.78	0.74	0.70	0.66	0.64	0.62	0.60	0.59	0.58	*	*	*	*
316L	1.00	1.00	1.00	1.00	0.90	0.73	0.67	0.61	0.58	0.53	0.51	0.50	0.49	0.47	0.47	*	*	*	*

\* - application after confirmation with Technical Department of TUBES INTERNATIONAL®

### Temperature correction factor for B-FLEX and C-FLEX

temperature [°C]															
-200	+20	+50	+100	+150	+200	+250	+300	+350	+400	+450	+500	+550	+600	+650	+700
1	1	0.89	0.72	0.64	0.58	0.54	0.5	0.48	0.46	0.44	0.43	0.43	0.34	0.19	0.1

### Correction factors for dynamic operation

flow	motion		
	no vibration, slow, small motion	vibration, frequent, constant motion	high vibration, high motion - heavy duty service
constant and slow	1	0.8	0.4
pulsation, variable	0.8	0.63	0.32
pulsation, steady	0.32	0.2	not recommended

### Assembly of metal hose fittings

The fittings of flexible pressure steel assemblies can be installed in the following ways:

- twisting (special kind of a reusable fittings, allowing direct assembly on an installation, with limited pressure parameters),
- soft soldering or brazing - with limited temperature resistance,
- TIG method (tungsten inert gas welding) - the most popular method.

Steel hose fittings can be made of carbon steel, AISI 304 and AISI 316 stainless steel as well as copper alloys (brass, bronze).

### NOTE !!!

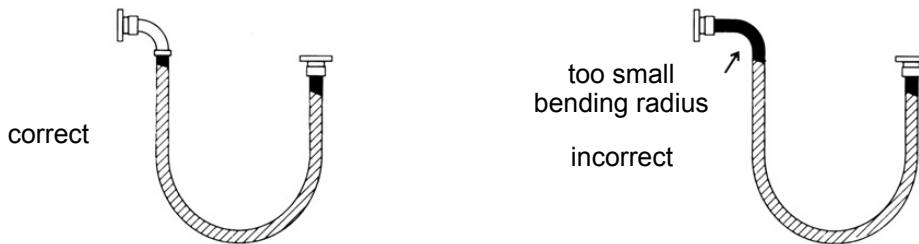
Carbon steel fittings should not be used at temperatures below -20°C and above +400°C.

# INDUSTRIAL HOSES - metal

## Pressure metal hoses installation and usage manual

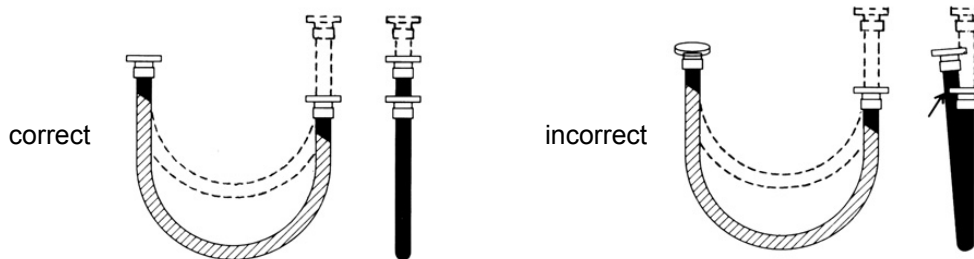
A steel hose has to be properly installed to prolong its life and to ensure faultless service. The main reason of failure is material fatigue on the hose corrugation. It is vital to remember that all elastic assemblies have limited service life. If they are used to deliver dangerous media (e.g. hot or flammable substances, dangerous chemicals), test and inspections should be carried out regularly.

### Hose breakage prevention



Bending radius of a steel hose should not be smaller than the one given in the manual to avoid material fatigue or premature damage. It is necessary to prevent sharp bends in the hose near its fittings.

### Hose kinking prevention



It is kinking of a hose that causes failure or premature wear. So as to prevent hose kinking a swivel flange should be installed on one of the hose ends. The hose should always be installed in such a way that its movement is the same as its symmetry axis.

### Hose elongation and squeezing prevention



If a hose is squeezed or stretched, its life is significantly shortened.

### Hose abrasion prevention

If a hose is installed in a position causing rubbing against other objects, its service life is shorter.

### NEVER EXCEED HOSE MAXIMUM WORKING PRESSURE !!!

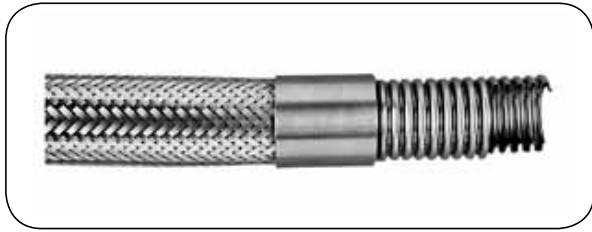
A hose must not be used under the pressure higher than its working pressure. Working temperature should always be taken into account and the maximum working pressure should be adjusted by proper factor. Contact Technical Department of TUBES INTERNATIONAL® in case of any problems.

### Hose damage

Hoses with any signs of failure or leakage must be exchanged immediately.

# INDUSTRIAL HOSES - metal

## Pressure hoses - steel



### METALFLEX / M

**Internal layer:** AISI 316L steel corrugated hose  
**Reinforcement:** Single AISI 304 steel braid  
**Working temp.:** From -270°C up to +700°C (working pressure depends on temperature)

Steel hose designed to transfer chemicals, gases and steam under pressure or in high vacuum conditions. Available with fittings described further in the catalogue on request. Safety factor 4:1.

code	I.D. [mm]	O.D. [mm]	working pressure [bar]	static bending radius [mm]	dynamic bending radius [mm]	weight [kg/m]
TB-METALFLEX-M-010	10.1	15.8	110	50	130	0.23
TB-METALFLEX-M-012	12.2	18.5	80	65	140	0.26
TB-METALFLEX-M-016	16.2	23.8	64	65	160	0.33
TB-METALFLEX-M-020	20.3	28.3	64	70	170	0.53
TB-METALFLEX-M-025	25.4	34	50	100	190	0.70
TB-METALFLEX-M-032	32.5	44.8	40	115	265	1.14
TB-METALFLEX-M-040	41.7	53.6	30	150	290	1.37
TB-METALFLEX-M-050	52	64	28	160	320	1.61
TB-METALFLEX-M-065	66	79.5	24	175	430	2.15
TB-METALFLEX-M-075	76	93.5	18	210	520	2.29
TB-METALFLEX-M-100	103	120.5	16	225	640	3.25
TB-METALFLEX-M-125	125	152	12	318	900	5.78
TB-METALFLEX-M-150	151	182	10	353	1050	6.20
TB-METALFLEX-M-200	197.5	231.8	8	456	1180	9.90



### METALICA / F

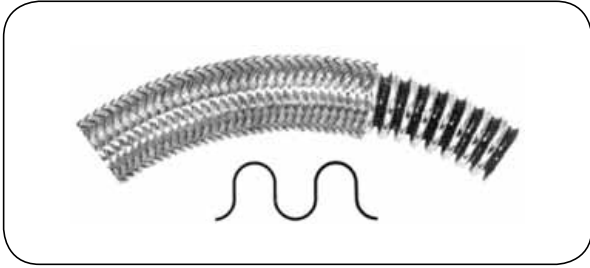
**Internal layer:** AISI 316L steel corrugated hose  
**Reinforcement:** Single AISI 304 steel braid  
**Working temp.:** From -270°C up to +600°C (working pressure depends on temperature)

Steel hose designed to transfer chemicals, gases and steam under pressure or in high vacuum conditions. Supplied as a complete hose assembly with fittings described further in the catalogue. Safety factor 4:1.

code	I.D. [mm]	O.D. [mm]	working pressure [bar]	static bending radius [mm]	dynamic bending radius [mm]
TB-METALICA-F-006	6.3	10.6	150	25	80
TB-METALICA-F-008	8.4	13.2	112	32	124
TB-METALICA-F-010	10.1	15.4	97	38	130
TB-METALICA-F-012	12.4	17.7	75	45	140
TB-METALICA-F-016	16.4	23.3	60	58	160
TB-METALICA-F-020	20.3	28.2	62	70	170
TB-METALICA-F-025	25.4	33.7	43	85	190
TB-METALICA-F-032	33.8	43.0	46	105	260
TB-METALICA-F-040	39.8	51.4	42	130	300
TB-METALICA-F-050	50.2	62.0	32	160	320
TB-METALICA-F-065	63.0	80.0	35	200	460
TB-METALICA-F-080	80.0	98.0	35	240	660
TB-METALICA-F-100	99.0	118.0	25	290	750

# INDUSTRIAL HOSES - metal

## Pressure hoses - steel



### PARNOR®

**Internal layer:** AISI 321 steel corrugated hose  
(316L for diameters: 6, 8, 10 and 125 mm)  
**Reinforcement:** Single AISI 304 steel braid as a standard  
**Working temp.:** From -273°C up to +600°C (working pressure depends on temperature)

The highest quality steel hose designed to transfer chemicals, gases and steam under pressure or in high vacuum conditions. Meets the requirements of ISO 10380 standard. Parallel corrugations of the hose obtained by hydroforming ensure extreme resistance to fatigue and stress corrosion. Suitable for dynamic application (when it bends at regular rate), where its service life in EN ISO 10380 conditions is as long as 50.000 cycles at the maximum working pressure for dynamic conditions. The highest quality of this hose is assured by pressure and tightness tests carried out on each production level. Available as no braid or double braid version as well. Supplied as a complete hose assembly with fittings for steel hoses. If the hose is used at elevated temperature, its working pressure should be reduced by temperature correction factor according to EN ISO 10380 (given in the technical description at the beginning of this chapter). Safety factor 4:1 (under dynamic conditions).

code	DN [mm]	O.D. [mm]	working pressure [bar]	min. bending radius [mm]	
				static conditions	dynamic conditions
TB-PARNOR-006*	6	11.4	140	23	110
TB-PARNOR-008	8	15.2	115	28	130
TB-PARNOR-010	10	17.8	100	32	450
TB-PARNOR-012	12	20.2	80	39	165
TB-PARNOR-015	15	24.1	63	50	195
TB-PARNOR-020	20	29.9	50	60	225
TB-PARNOR-025	25	36.4	40	73	260
TB-PARNOR-032	32	45.4	40	90	300
TB-PARNOR-040	40	54.4	32	115	340
TB-PARNOR-050	50	67.3	32	140	390
TB-PARNOR-065*	65	83.4	25	175	460
TB-PARNOR-080	80	102.6	23	240	660
TB-PARNOR-100	100	129.5	15	290	750
TB-PARNOR-125*	125	155	13	340	1000
TB-PARNOR-150*	150	177	11	390	1250

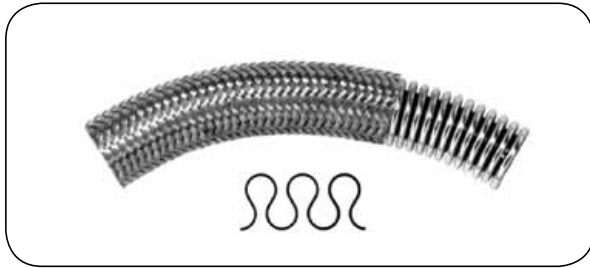
\* - does not meet the service life requirement of 50.000 cycles



**TUBES INTERNATIONAL® was granted GERMANISCHER LLOYD and DNV Certificates for producing PARNOR stainless steel hose assemblies (from DN 6 ÷ DN 100) for shipbuilding and marine industry applications. Please contact Technical Department for more information.**

# INDUSTRIAL HOSES - metal

## Pressure hoses - steel



### PARRAP®

**Internal layer:** AISI 321 steel corrugated hose  
(316L for diameters: 6, 8, 10 and 125 mm)  
**Reinforcement:** Single AISI 304 steel braid as a standard  
**Working temp.:** From -273°C up to +600°C (working pressure depends on temperature)

Extremely flexible, top quality steel hose designed to transfer chemicals, gases, steam under pressure or in high vacuum conditions. Thanks to exceptional omega-shaped corrugations it is strongly recommended for application demanding highly flexible connection. Meets the requirements of ISO 10380 standard. Parallel corrugations of the hose obtained by hydroforming ensure extreme resistance to fatigue and stress corrosion. Suitable for dynamic application (when it bends at regular rate), where its service life in EN ISO 10380 conditions is as long as 50.000 cycles at the maximum working pressure for dynamic conditions. The highest quality of this hose is assured by pressure and tightness tests carried out on each production level. Available as no braid or double braid version as well. Supplied as a complete hose assembly with fittings for steel hoses. If the hose is used at elevated temperature, its working pressure should be reduced by temperature correction factor according to EN ISO 10380 (given in the technical description at the beginning of this chapter). Safety factor 4:1 (under dynamic conditions).

code	DN [mm]	O.D. [mm]	working pressure [bar]	min. bending radius [mm]	
				static conditions	dynamic conditions
TB-PARRAP-006*	6	11.4	150	20	110
TB-PARRAP-008	8	15.2	115	20	130
TB-PARRAP-010	10	17.8	115	20	150
TB-PARRAP-012	12	20.2	80	25	124
TB-PARRAP-015	15	24.1	63	32	146
TB-PARRAP-020	20	29.9	55	38	169
TB-PARRAP-025	25	36.4	40	45	195
TB-PARRAP-032	32	45.4	40	58	225
TB-PARRAP-040	40	54.4	32	70	255
TB-PARRAP-050	50	67.3	32	85	293
TB-PARRAP-065*	65	83.4	25	105	345
TB-PARRAP-080	80	102.6	23	180	495
TB-PARRAP-100	100	129.5	15	218	563
TB-PARRAP-125*	125	155.0	13	255	1000
TB-PARRAP-150*	150	177.0	11	290	1250

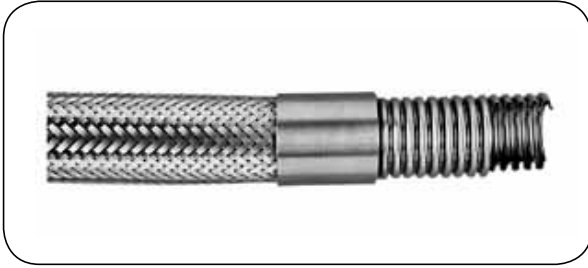
\* - does not meet the service life requirement of 50.000 cycles



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# INDUSTRIAL HOSES - metal

## Pressure hoses - steel



### HP, THP

**Internal layer:** AISI 316L steel corrugated hose (DN 32, DN 100 - AISI 321 steel)

**Reinforcement:** Single (HP) or double (THP) AISI 304 steel braid

**Working temp.:** From -270°C up to +800°C (working pressure depends on temperature)

Exclusive high pressure steel hose with heavy wall and close pitch, annular corrugation obtained by hydroforming. Designed to transfer chemicals, gases, steam under pressure and in high vacuum conditions. Designed according to the requirements of EN ISO 10380 class 1. Supplied as a complete hose assembly with fittings for steel hoses on request. If the hose is used at elevated temperature, its working pressure should be reduced by temperature correction factor according to EN ISO 10380 (given in the technical description at the beginning of this chapter). Safety factor 4:1 (under dynamic conditions).

### HP (single braid)

code	DN [mm]	O.D. [mm]	dynamic conditions		static conditions	
			working pressure [bar]	min. bending radius [mm]	working pressure [bar]	min. bending radius [mm]
TB-HP-006	6	11.4	180	110	225	25
TB-HP-010	10	17.8	145	150	166	38
TB-HP-012	12	20.2	140	165	175	45
TB-HP-020	20	29.1	85	225	99	70
TB-HP-025	25	38	78	215	91	85
TB-HP-032	32	46.5	65	300	78	105
TB-HP-040	40	54.9	61	280	68	130
TB-HP-050	50	67.3	55	390	62	160
TB-HP-080	80	99	25	660	33	240
TB-HP-100	100	129.5	24	750	27	290

### THP (double braid)

code	DN [mm]	O.D. [mm]	dynamic conditions		static conditions	
			working pressure [bar]	min. bending radius [mm]	working pressure [bar]	min. bending radius [mm]
TB-THP-006	6	13	255	110	293	25
TB-THP-010	10	19.4	195	150	223	38
TB-THP-012	12	21.8	185	165	213	45
TB-THP-020	20	30.7	125	225	147	70
TB-THP-025	25	40	124	260	142	85
TB-THP-032	32	49	115	300	134	105
TB-THP-040	40	57.4	90	340	104	130
TB-THP-050	50	69.8	78	390	92	160
TB-THP-080	80	102	50	660	66	240
TB-THP-100	100	132.5	45	750	51	290

# INDUSTRIAL HOSES - metal

## Pressure hoses - steel



### B-FLEX

- Internal layer:** AISI 321 S31 steel corrugated hose (AISI 316L steel to special order)
- Reinforcement:** Single or double AISI 304 steel braid (AISI 316L steel to special order)
- Working temp.:** From -270°C up to +800°C (working pressure depends on temperature)

Steel hose designed to transfer chemicals, gases, steam under pressure or in high vacuum conditions. Available on request with fittings described further in the catalogue. No braid version available as well.

### B-FLEX (single braid)

code	DN [mm]	O.D. [mm]	working pressure [bar]	bursting pressure [bar]	dynamic * bending radius [mm]	weight [kg/m]
TB-BFLEX1-006	6	15	140	560	100	0.28
TB-BFLEX1-010	10	18	100	400	125	0.39
TB-BFLEX1-012	12	23	90	360	125	0.50
TB-BFLEX1-016	16	28	65	260	150	0.55
TB-BFLEX1-020	20	31.5	55	220	150	0.62
TB-BFLEX1-025	25	37.5	48	192	175	0.80
TB-BFLEX1-032	32	47	38	152	200	1.15
TB-BFLEX1-040	40	55.5	34	136	250	1.50
TB-BFLEX1-050	50	71	31	124	350	2.10
TB-BFLEX1-065	65	88.5	27	108	500	2.65
TB-BFLEX1-080	80	100	24	96	525	3.13
TB-BFLEX1-100	100	130	15	60	625	4.15
TB-BFLEX1-125	125	169	14	56	750	6.40
TB-BFLEX1-150	150	183	9	36	900	7.85
TB-BFLEX1-200	200	241	8	32	1020	11.20
TB-BFLEX1-250	250	290	6	24	1220	15.30

### B-FLEX (double braid)

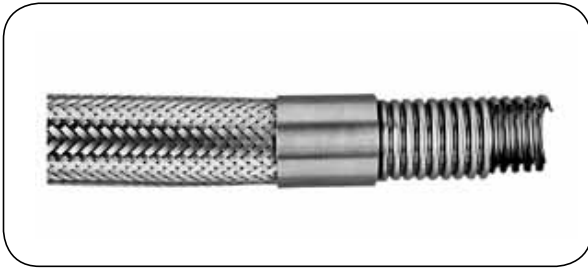
code	DN [mm]	O.D. [mm]	working pressure [bar]	bursting pressure [bar]	dynamic * bending radius [mm]	weight [kg/m]
TB-BFLEX2-006	6	17.6	250	1000	100	0.40
TB-BFLEX2-010	10	20.6	155	620	125	0.56
TB-BFLEX2-012	12	25.5	131	524	125	0.71
TB-BFLEX2-016	16	30	105	420	150	0.75
TB-BFLEX2-020	20	34.6	93	372	150	0.90
TB-BFLEX2-025	25	40.5	77	308	175	1.13
TB-BFLEX2-032	32	51	62	248	200	1.70
TB-BFLEX2-040	40	60	46	184	250	2.20
TB-BFLEX2-050	50	75	43	172	350	3.05
TB-BFLEX2-065	65	91	37	148	500	3.90
TB-BFLEX2-080	80	105	34	136	525	4.55
TB-BFLEX2-100	100	136	18	72	625	6.05
TB-BFLEX2-125	125	165	17	68	750	9.10
TB-BFLEX2-150	150	188	14	56	900	11.50
TB-BFLEX2-200	200	246	14	56	1020	16.20
TB-BFLEX2-250	250	295	10	40	1220	20.80

\* static bending radius is 60% of dynamic bending radius



# INDUSTRIAL HOSES - metal

## Pressure hoses - steel



### C-FLEX

- Internal layer:** AISI 321 S31 steel corrugated hose (AISI 316L steel to special order)
- Reinforcement:** Single or double AISI 304 steel braid (AISI 316L steel to special order)
- Working temp.:** From -270°C up to +800°C (working pressure depends on temperature)

Steel hose designed to transfer chemicals, gases, steam under pressure or in high vacuum conditions. Recommended for applications demanding increased resistance to vibrations. Available on request with fittings described further in the catalogue. No braid version available as well.

#### C-FLEX (single braid)

code	DN [mm]	O.D. [mm]	working pressure [bar]	bursting pressure [bar]	dynamic * bending radius [mm]	weight [kg/m]
TB-CFLEX1-006	6	15	160	640	75	0.33
TB-CFLEX1-010	10	18	138	552	90	0.48
TB-CFLEX1-012	12	23	103	412	100	0.60
TB-CFLEX1-020	20	31.5	62	248	115	0.75
TB-CFLEX1-025	25	37.5	52	208	125	0.95
TB-CFLEX1-032	32	47	42	168	150	1.40
TB-CFLEX1-040	40	56.5	38	152	200	1.75
TB-CFLEX1-050	50	71	34	136	275	2.45
TB-CFLEX1-065	65	86.5	31	124	350	3.00
TB-CFLEX1-080	80	100	27	108	400	3.55
TB-CFLEX1-100	100	130	17	68	500	4.80
TB-CFLEX1-125	125	159	16	64	660	7.50
TB-CFLEX1-150	150	183	10	40	760	9.10

#### C-FLEX (double braid)

code	DN [mm]	O.D. [mm]	working pressure [bar]	bursting pressure [bar]	dynamic * bending radius [mm]	weight [kg/m]
TB-CFLEX2-006	6	17.5	275	1100	75	0.45
TB-CFLEX2-010	10	20.5	172	690	90	0.65
TB-CFLEX2-012	12	25.5	155	620	100	0.80
TB-CFLEX2-020	20	34.5	110	440	115	1.00
TB-CFLEX2-025	25	40.5	90	360	125	1.25
TB-CFLEX2-032	32	51.5	69	276	150	1.95
TB-CFLEX2-040	40	60.5	52	208	200	2.45
TB-CFLEX2-050	50	75.5	48	192	275	3.40
TB-CFLEX2-065	65	91.5	41	164	350	4.20
TB-CFLEX2-080	80	106	38	152	400	5.00
TB-CFLEX2-100	100	136	20	80	500	6.70
TB-CFLEX2-125	125	165	19	76	660	10.20
TB-CFLEX2-150	150	188	15	60	760	12.70

\* static bending radius is 60% of dynamic bending radius