Technical Information
Metal Hoses

TECHNICAL INFORMATION METAL HOSES

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1. INSTRUCTION MANUAL FOR STORAGE, INSTALLATION, OPERATION & MAINTENANCE

Product description	
Pressure equipment type:	Stainless steel hose lines, PTFE hose lines in various versions (nominal sizes, lengths, materials, connection fittings etc.)
Designation:	In accordance with HANSA-FLEX nomenclature
Marking (minimum scope):	Manufacturer's marking (HF-I0)/ Manufacturing date (MM, YYYY)
Use:	Only as intended !

1.1 GENERAL

The hose lines are designed for the prevailing operating conditions. They are manufactured by expert personnel using proven and approved manufacturing methods. The hose lines undergo a final inspection, including a leak and/or pressure test. The hose lines are marked with the most important information. The hose lines comply with "sound engineering practice" according to Article 3 Section 3 of the Pressure Equipment Directive 97/23/EC or the standards specified in the order.

1.2 STORAGE

Adequate protection against damage, contamination, the weather etc. must be provided. The effects of chlorides, bromides, iodides, and extraneous and film rust must be avoided. Hose lines must be stored in a dry, strain-free and kink-free state. When stored wound up, the radius of the hose line must not be less than the minimum static bending radius.

Assuming the correct storage conditions, there are no restrictions on storage time for metal and PTFE hose lines with braiding and fittings made from chromium-nickel stainless steel. In the case of zinc-coated or painted steel fittings, storage time depends largely on the storage conditions and is usually limited.

1.3 INSTALLATION

- Hose lines may be assembled and installed only by appropriately qualified personnel.
- The guidelines for handling and fitting HANSA-FLEX hose lines must be observed. Some important points in the guidelines are highlighted below:
- No axial loads (tension or compressive buckling)
- No torsional loads (to avoid torsional loads, the longitudinal axis of the hose and the direction of motion must lie in the same plane).
- The minimum static and dynamic bending radius in accordance with the datasheet or with the information on the drawing must be observed.
- Check any separable connections for proper seating before commissioning.
- Damaged hose lines must not be installed or commissioned.
- Cover the hose lines to protect them against weld splatter and grinding dust when working on the equipment.

1.4 COMMISSIONING/ OPERATION

During commissioning and operation, the permissible limiting values (pressure, temperature, bending radii, medium concentration) must be observed. The hose lines may be used only in accordance with the designer's intention (intended pressure, temperature, medium, movement). Where flowing media are used, the lines must be bled of air during filling. Because of their compressibility, any gaseous fluids remaining in the lines represent a serious hazard and could potentially lead to a higher classification and stricter requirements becoming applicable to the product.

The resistance of the materials the medium flows through must be checked for the specific medium used. A definitive statement of the resistance of hose lines can normally be gained only by practical experience of opera-

tion. Incrustations in the medium flowing through the products can lead to corrosion damage. Incrustations also reduce the flexibility of the hose lines and lead to premature failure. A safety datasheet for the medium must be kept available.

In situations with high operating temperatures, the high thermal conductivity of metallic materials means there is a risk of burns if the hose line is touched. The appropriate measures must be put in place (protection against contact, warning notices, barriers). Safety measures against whipping hose lines must also be in place. Electrically conductive materials and adequate equipotential wiring or earthing must be used where there is risk of electrostatic discharge (PTFE hoses). The movement of the hoses must not be restricted, otherwise there is the risk of abrasive wear.

Hose lines must always be installed and operated in such a way that they present no danger to people or the environment. Protective measures must be put in place against any remaining unmitigated hazards. Technical and organisational measures for the safe use of hose lines are described in Information Sheet T 002 published by BG Chemie.

1.5 MAINTENANCE

The intervals for external and internal inspections must be determined taking into account the load and the degree of danger. A qualified person must check to see that the item is safe to use at work and must record the findings. Hose lines with damaged braiding must be replaced immediately. Repairs to rectify leaks on hose lines or at connections by welding, wrapping etc. are not permitted. Damage caused by mechanical cleaning, use of unsuitable cleaning materials etc. must be avoided.

2. INSTALLATION REQUIREMENTS FOR METAL AND PTFE HOSE LINES

The following provisions must be observed in order to ensure correct handling and installation of HANSA-FLEX metal and PTFE hose lines:

2.1 CORRECT ROLLING UP AND ROLLING OUT

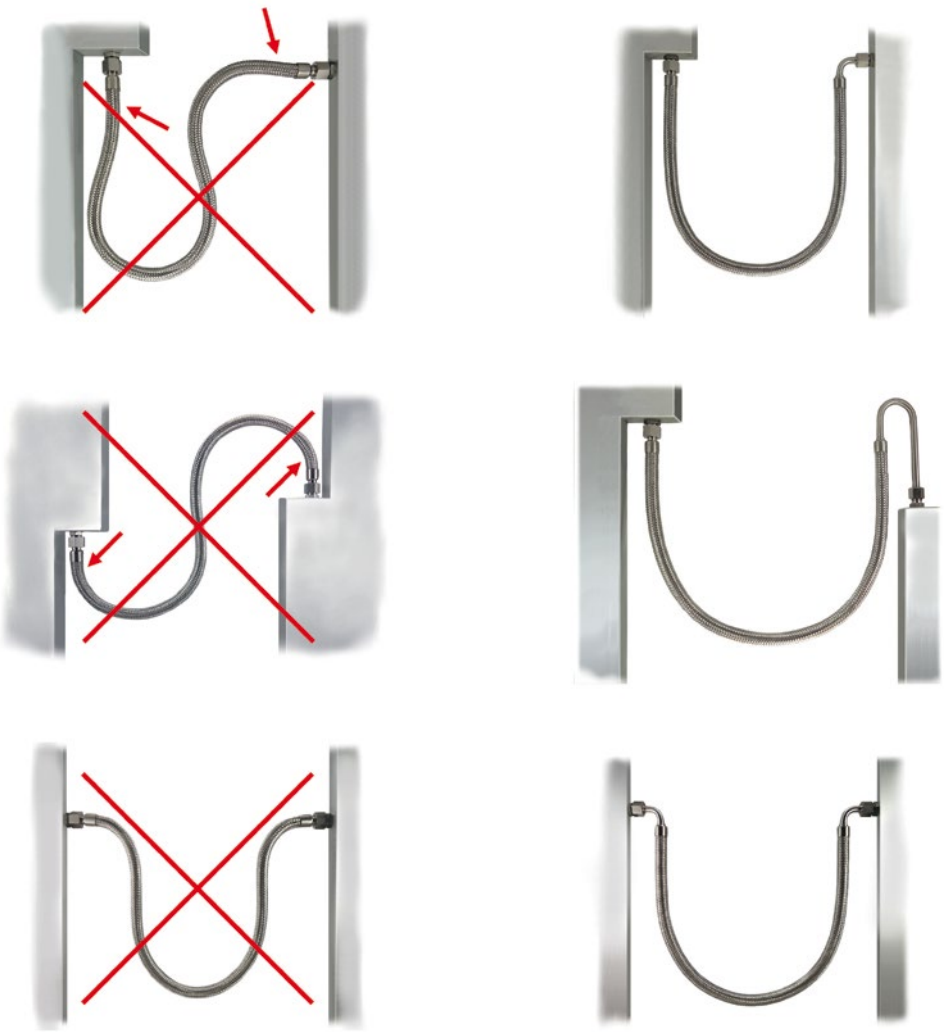
Pulling on the ends of rolled-out hose lines must be avoided in order not to subject them to damaging torsional loads. In addition, the radius of the hose line must not be smaller than its smallest permissible bending radius. These mistakes can be avoided by rolling up and rolling out the hose lines correctly.

2.2 CORRECT LENGTH

If the length of the hose is too short, hose lines become kinked at the connection points. A straight length of at least 1 x DN per connection point must be added to the length calculated from the bending radius.

2.3 APPROPRIATE BENDING

The incorrect installation of hose lines can lead to excessive bending of the hose lines at the connections. This mistake can be avoided by the use of pipe bends.

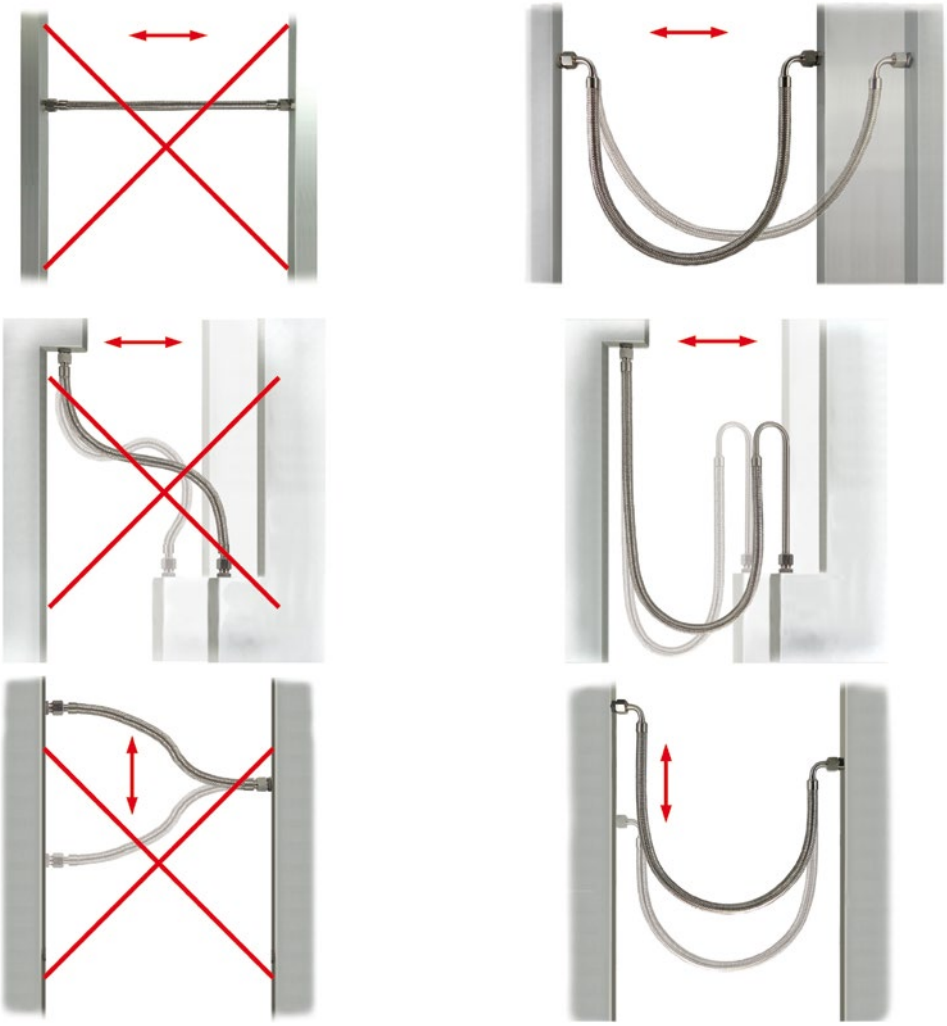


2.4 PREVENTION OF KINKS

Laying the hose line over a saddle or a roller of the appropriate diameter prevents the hose line from kinking.

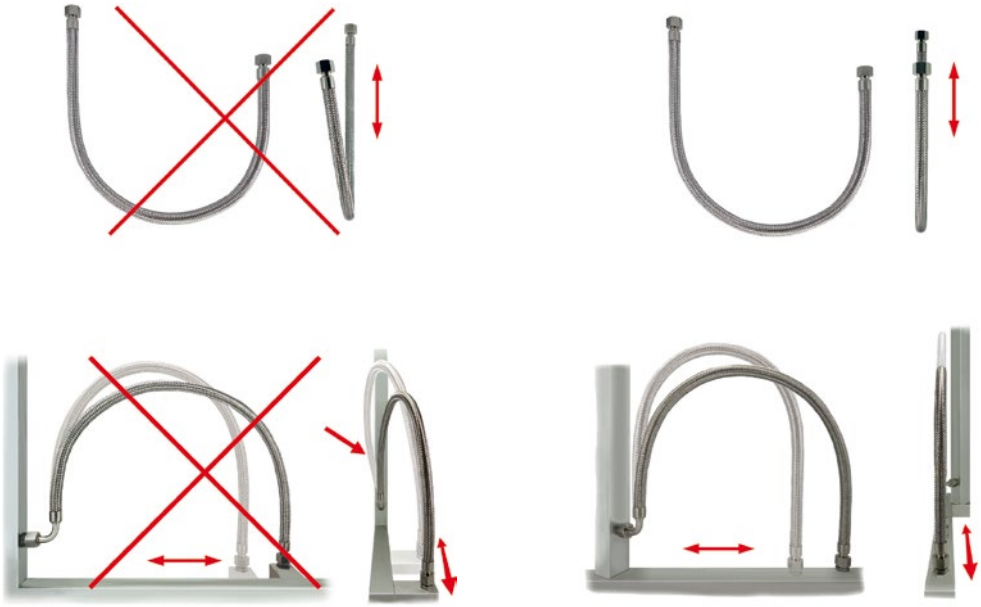
2.5 PREVENTION OF BUCKLING

Incorrect installation can lead to compression of the hose on its longitudinal axis. This mistake can occur as a result of poor installation or the movement of the hose line and leads to the braiding separating from the hose. Once this happens, the pressure resistance of the hose cannot be guaranteed. Hose lines with braiding are therefore not suitable as a means of compensating for axial expansion. Axial expansion can be accommodated by hose lines installed in a U-shape.

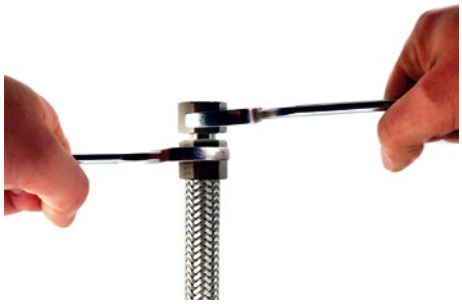


2.6 TORSIONAL MOVEMENT

The greatest mistake during installation is to end up with the hose line twisting during operation. Torsional movement leads to early failure of the hose line. Ensure that the pipe and hose axes and the direction of movement lie in the same plane.



During installation, the hose line must be held with a second spanner. This ensures that the hose line cannot be subjected to torsion during installation.



3. REDUCTION FACTORS FOR METAL HOSES

3.1 DYNAMIC REDUCTION

Table of **dynamic reduction factors k_d**:

Movement / flow	No vibration, slight, slow movement	Slight vibration, frequent, uniform movement	Significant vibration with continuous movement
Static or uniform flow	1.00	0.82	0.40
Pulsating and dynamic flow	0.80	0.65	0.33
Rhythmic and intermittent flow	0.40	0.35	0.15
Highly intermittent flow	0.30	0.20	0.10

3.2 THERMAL REDUCTION

Table of **thermal reduction factors k_t**:

Operating temp. °C	Machining steel	Steel	Stainless steels			
	9SMnPb28K	Mat. 1.0460	Mat. 1.4301	Mat. 1.4404	Mat. 1.4541	Mat. 1.4571
20	In acc. with DIN 3859-1 up to max. 120 °C, manufacturer-dependent up to 200 °C, reduction subject to separate request	1.00	1.00	1.00	1.00	1.00
50		1.00	0.90	0.90	0.93	0.92
100		0.95	0.73	0.73	0.83	0.80
150		0.86	0.66	0.67	0.78	0.76
200		0.76	0.60	0.61	0.74	0.72
250		0.68	0.55	0.58	0.70	0.68
300		0.60	0.51	0.53	0.66	0.64
350		0.52	0.49	0.51	0.64	0.62
400		0.44	0.48	0.50	0.62	0.60
450		0.36	0.46	0.49	0.60	0.59
500		---	0.46	0.47	0.59	0.58
550		---	0.46	0.47	0.58	0.58

4. DESIGN OF METAL AND PTFE HOSE LINES

4.1 GENERAL

Ensuring the safety of hose lines requires knowledge of the operating conditions and field of application. This information leads to the design, manufacture, marking, testing and documentation being appropriate for the application.

The load capacity of hose lines depends on the components and methods used. The "weakest" component of the hose line determines the nominal pressure PN of the hose line. The nominal pressure is valid at 20 °C and under static loading. The maximum permissible operating temperature depends on the materials used.

The nominal pressures of the components are reduced, depending on the operating conditions, by thermal or dynamic factors. The nominal values of the components, reduction factors etc. can be found in the associated technical datasheets.

The bursting pressure for metallic hose lines equals 4 times the highest permissible pressure PN at room temperature. The bursting pressure for PTFE hose lines equals 3 or 4 times the highest permissible pressure PN at room temperature.

If no acceptance test (pressure test) is specified, HANSA-FLEX AG performs a standard leak test on metal and PTFE hose lines at approximately 8 bar compressed air under water. Documented pressure tests are performed in accordance with official regulations, guidelines, prescriptions, standards, technical rules, customer requirements etc. The test pressure lies normally in a range of 1.1 to 2.2 times the operating pressure. In the tests, the limits of use of all the components must also be observed!

The nominal bending radii are adjusted in a similar way to the reduction of the nominal operating pressure. The permissible maximum pressures and minimum bending radii for a specific operating scenario are calculated as follows:

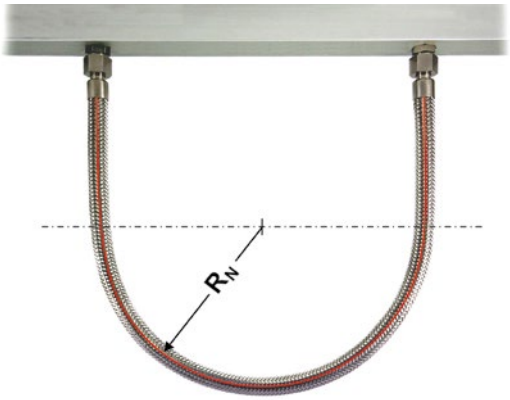
4.2 CALCULATION OF OPERATING PRESSURE AND BENDING RADIUS

The permissible operating pressure is:

$$P_U = P_N \cdot k_t \cdot k_d$$

The permissible bending radius is:

$$R_d = \frac{R_N}{2.8}\left(1.1 + \frac{P_U}{P_N} + \frac{1}{k_d} + \frac{1}{k_t}\right)$$



P_U = permissible operating pressure in bar
P_N = nominal pressure in accordance with table in bar
k_d = dynamic reduction factor
k_t = thermal reduction factor
R_d = bending radius for frequent bending
R_d = nominal bending radius for frequent bending

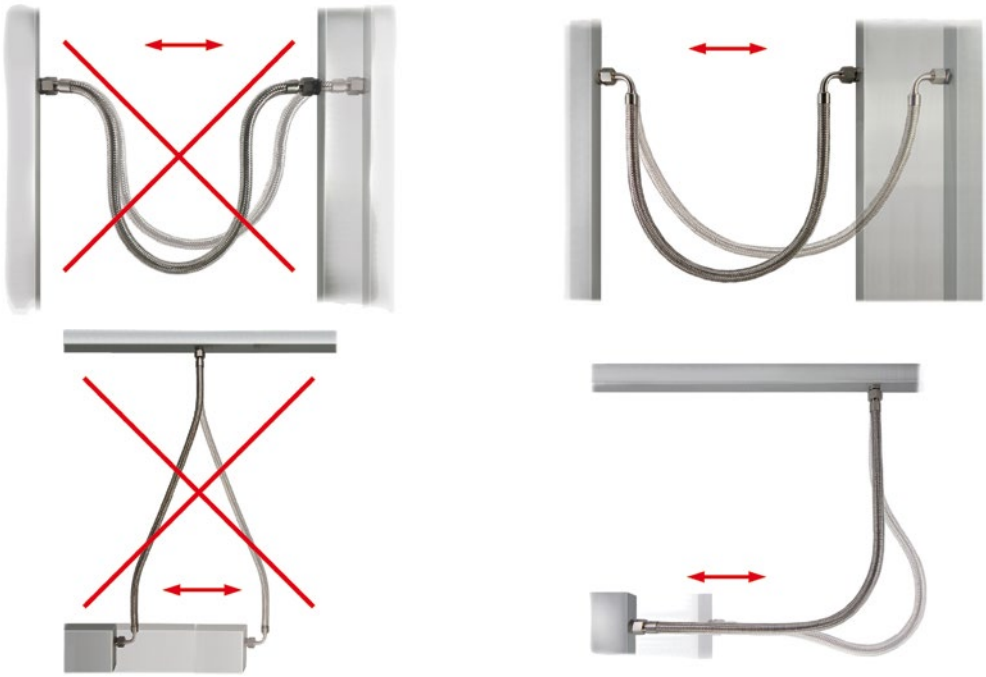
5. ACCOMMODATION OF THERMAL EXPANSION FOR METAL HOSE LINES

Components expand when heated and contract again when cooled.

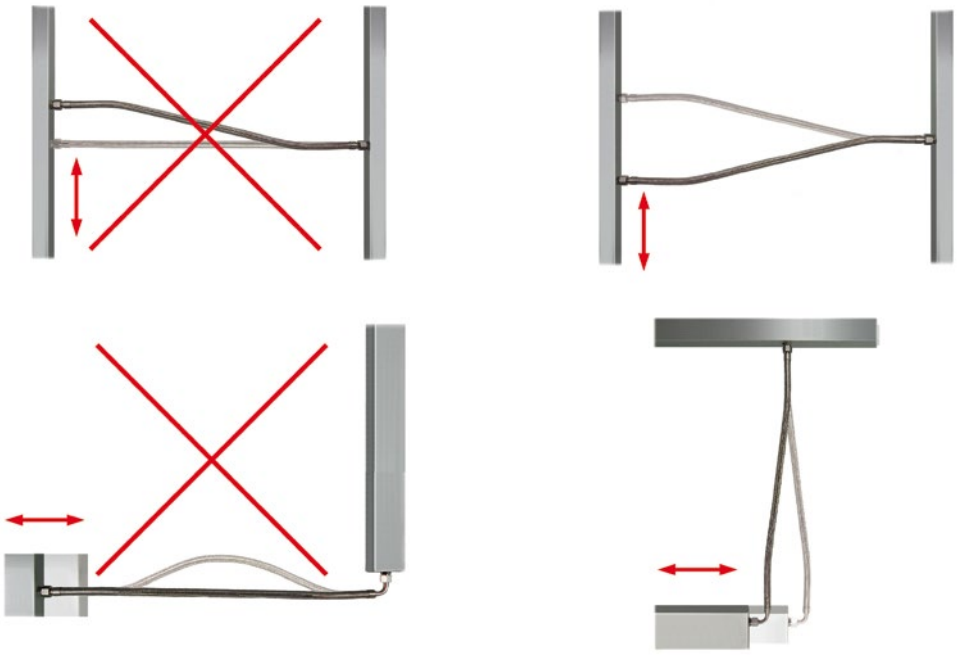
Pipelines where high temperatures can prevail in addition to high pressures place increased requirements on flexible intermediate members (e.g. metal hoses). The expansion caused by heat has to be accommodated. It is essential to ensure that metal hoses are not axially loaded or buckled. The hose must be installed if possible as a 180° U-bend in order to accommodate a large axial expansion.

⟷: shows the movement of the hose line caused by thermal expansion of the components. What is not meant here is movement caused by the operating system itself!

5.1 ACCOMMODATING AXIAL EXPANSION

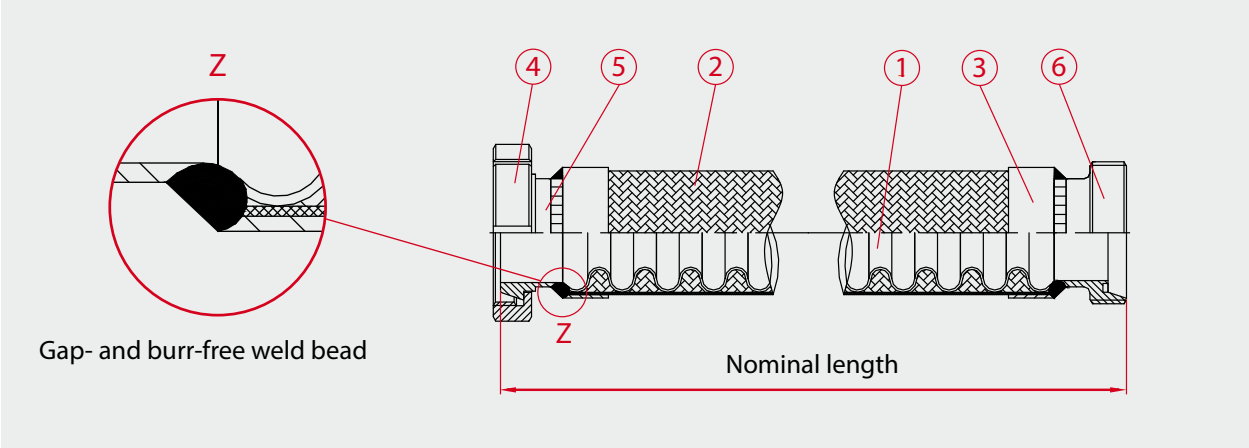


5.2 ACCOMMODATING LATERAL EXPANSION



6. FB... METAL HOSE LINES FOR THE FOOD AND CHEMICAL INDUSTRIES

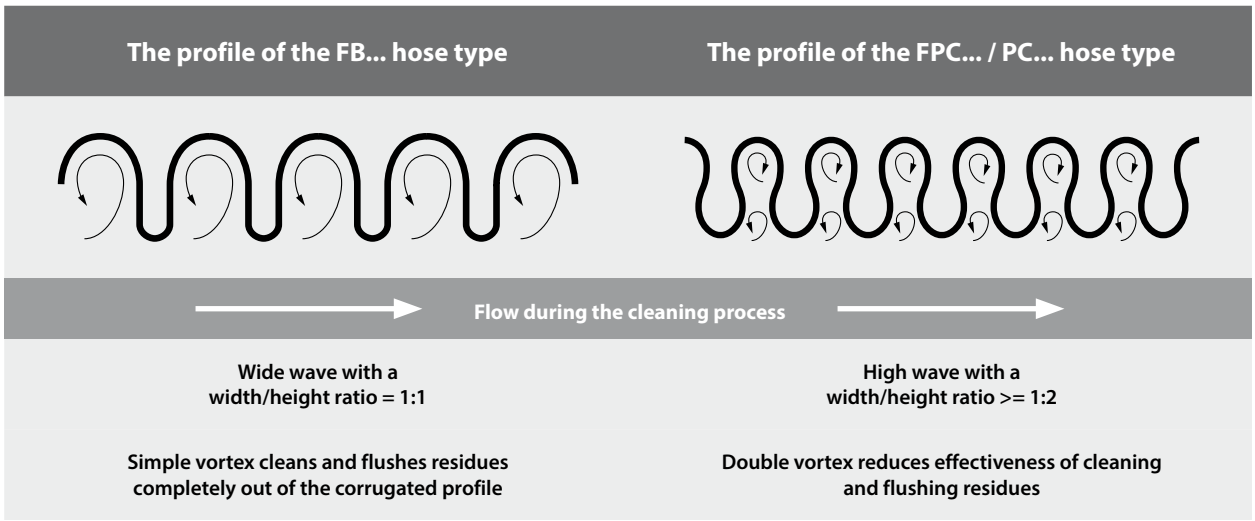
6.1 TECHNICAL DATA



Based on DIN 2827

① HANSA-FLEX annular corrugated hose FBA ..... Material 1.4404
② Braiding ..... Material 1.4301
③ End sleeves ..... Material 1.4301
④ DIN 11851 screw connection (other connections available) ..... Material 1.4404
⑤ Threaded element DIN 11851 screw connection (other connections available) .. Material 1.4404

6.2 THE CRITICAL DIFFERENCE IN THE HANSA-FLEX FB... ANNULAR CORRUGATED HOSE



Questionnaire Choice of Expansion Joints

☐ OFFER ☐ CUST Offer No.: _____ Date: _____

☐ ORDER ☐ CUST Order No.: _____

CUSTOMER NO.: _____ Tel.: _____

Company: _____ City: _____ Fax: _____

Contact person: _____ e-mail: _____

TO BE FILLED OUT BY HANSA-FLEX

Accepted on: _____ By Ms/Mr: _____ Tel.: _____

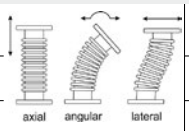
To be processed by (date): _____ e-mail: _____

Intended purpose: _____ Quantity: _____

TECHNICAL INFORMATION – EXPANSION JOINT

Nominal width (mm)	
Total length measured over all (mm)	
Type of connections	
Pumping medium	
Internal pressure value (bar pressure)	
External pressure value (bar pressure)	
Bending radius (mm)	
Pumping medium temperature (°C)	
Ambient temperature (°C)	

Movement load



Axial +/-	
Angular +/-	
Lateral +/-	
Frequency of movement	
Ind. service life (number of load cycles)	
Flow velocity (m/s)	
Flow rate (m^3/h)	

EXTERNAL INFLUENCES:

_____

INSTALLATION / USE:

_____

SPECIAL REQUIREMENTS:

_____

Material of the

Bellows	
Inner guide pipe	
Connections	

General comments

_____

_____

_____

Dispatch by ☐ Courier ☐ Night delivery ☐ Mail / post ☐ Freight company ☐ Truck load

Dispatch to _____

_____

_____

_____

_____

Date: _____ Signature: _____

Name in BLOCK CAPITALS: _____

Questionnaire Choice of Hose Lines (Page 1 of 2)

☐ OFFER ☐ CUST Offer No.: _____ Date: _____

☐ ORDER ☐ CUST Order No.: _____

CUSTOMER NO.: _____ Tel.: _____

Company: _____ City: _____ Fax: _____

Contact person: _____ e-mail: _____

TO BE FILLED OUT BY HANSA-FLEX

Accepted on: _____ By Ms/Mr: _____ Tel.: _____

To be processed by (date): _____ e-mail: _____

Intended purpose: _____ Quantity: _____

TECHNICAL INFORMATION – HOSE LINE

Please enter the technical information

Nominal width (mm)	
Total length measured over all (mm)	
Connection 1	
Connection 2	

MATERIAL

Please enter the applicable material of the

Hose	
Braiding	
Connections	
Hose protector	

OPERATING CONDITIONS

Please enter the operating conditions

Operating pressure, constant (bar)	
Operating pressure, intermittent (bar)	
Test pressure (bar)	
Temperature, constant (°C)	
Temperature, fluctuating (°C), from-to	
Flow medium*	
*for acidic concentrations	

MECHANICAL INFLUENCES: _____

CORROSIVE INFLUENCES: _____

→

Questionnaire Choice of Hose Lines (Page 2 of 2)

WHAT MOVEMENTS MUST BE ACCOMMODATED BY THE HOSE?

BENDING RADIUS (mm): _____

LOAD CYCLE (mm): _____

Please provide a sketch of the installation situation

MOVEMENT TYPE

Please select the corresponding movement type

- ☐ No vibration, slight, slow movement
- ☐ Slight vibration, uniform movement
- ☐ Significant vibration with rhythmic continuous movement

ADDITIONAL SERVICES

- ☐ Pressure test
- ☐ Helium leak test
- ☐ Flushing and cleaning
- ☐ Special embossing

APPROVALS

CE, DNV GL, GSI SLV, DVGW, DB etc.

General comments

Dispatch by ☐ Courier ☐ Night delivery ☐ Mail / post ☐ Freight company ☐ Truck load

Dispatch to _____

Date: _____ Signature: _____

Name in BLOCK CAPITALS: _____