HANSA-FLEX

TECHNICAL INFORMATION
METAL HOSES

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Technical Information Metal Hoses

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1. General information about metal hose lines

DIN EN ISO 10380 is the basic standard for corrugated metal hoses and hose lines. According to the definition in this standard, the term “corrugated metal hose” is a “pressure-tight hose made from tube or from strip, with corrugations, helical or annular to the axis of the hose, made by deforming the metal, its flexibility being obtained by bending the corrugations”.

Metal hose lines (referred to in the standard as “metal hose assemblies”) are used in all fields of industry, such as the chemical and petrochemical, plant engineering, food, shipbuilding industries, gas and water supplies and in heating, ventilation, air-conditioning and solar energy technology etc.

Braided or unbraided metal hoses and their hose lines are designed to permit frequent movements or bending. They compensate for installation offsets, accommodate thermal expansion and contraction and absorb oscillations. These flexible hose line components are used when fluids under high pressure or at high or very cold temperatures must be conveyed. They are also extremely suitable for use under vacuum pressures.

2. Safety instructions

The load a hose line is capable of bearing depends on the components used and its construction. The “weakest” component in the hose line determines the nominal pressure (PN) of the hose line. The nominal pressure applies at 20 °C and under static loads. The maximum allowable operating temperature depends on the materials used and the method of joining them together.

The nominal pressure values of the components must be reduced to take account of the operating conditions specifically with respect to thermal and, if applicable, dynamic factors. The nominal parameters for the components, reduction factors etc. are found in the associated technical datasheets.

The nominal burst pressure for metal hose lines is 4 times the highest allowable nominal pressure PN at room temperature.

If no acceptance test (pressure test) is specified, HANSA-FLEX AG performs a standard leak test on metal hose lines using an air pressure of up to approximately 8 bar under water. Documented pressure tests are performed in accordance with the statutory regulations, guidelines, ordinances, standards, technical rules, customer requirements etc.

In general, the following applies: The service life of a hose line depends on the applied loads (operating medium, operating pressure, operating temperature, bend radius, type of movement, load cycles, environmental conditions etc.). The higher the applied loads, the shorter the service life. Hose lines are considered as wear parts.

The following information about dimensions, design, manufacture, testing, storage, assembly, bringing into first use, operation, maintenance and disposal is provided in the interests of safety.

3. Application-related dimensions / Design

3.1 General

To be able to ensure the safety of hose lines requires information about the operating conditions and the field of application. Having this information leads to the product being designed, manufactured, marked, tested and documented appropriately for its application.

The hose lines are designed for the given operating conditions. They comply with “sound engineering practice” in accordance with Article 4, Section 3 of the Pressure Equipment Directive (PED) 2014/68/EU or the guidelines, standards, technical rules, marine design and construction regulations or customer-specific requirements stipulated on the order.

Hose lines may be used only for the purpose for which they were designed (proper use) with regard to pressure, temperature, medium, movement etc.

3.2 Information about the total length (designation / nomenclature)

The designation of metal hose lines follows the in-house HANSA-FLEX nomenclature. The hose line length, offset angle of the fittings, leg length of the fittings are based on DIN 20066 or in accordance with our “Good to know” brochure.

Unless expressly agreed otherwise between the manufacturer and the purchaser, the total length of a hose line is the ordered length with a tolerance:

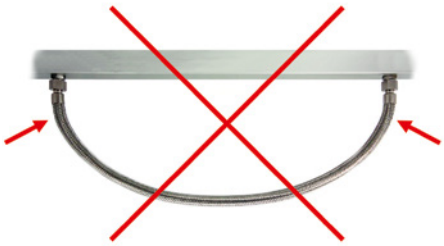
+15 mm and -10 mm for lines up to 0.5 m length

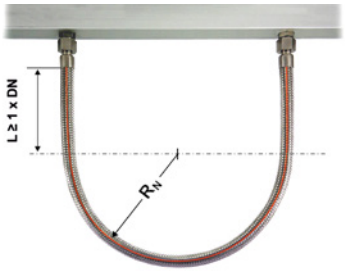
+3.0% and -1% for lines >1 m length

3.3 Required hose line lengths (refer in addition to “Installation regulations”)

If the lines have to accommodate movement, the required hose line lengths must be dimensioned for the relevant hose type and the type of movement (angular movement, lifting movement with U-bends, lateral movement etc.).

If the length of the hose line is too short, it cannot accommodate the required movements. There is also the danger that the hose lines may kink close to the connection points. In calculating the required length from, for example, the minimum allowable bending radius, an additional straight length of at least 1 x DN per connection is normally added.

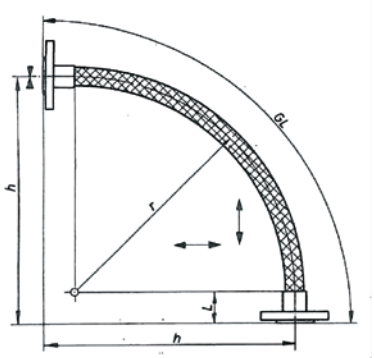




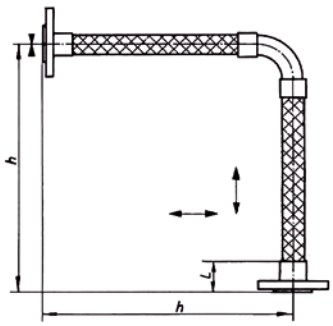
3.3.1 Accommodation of oscillations (refer in addition to “Installation regulations”)

Oscillations and vibrations lead to noise and material fatigue. HANSA-FLEX metal hose lines have a proven record as an oscillation- and sound-dampening component. An application-related design and correct installation are essential.

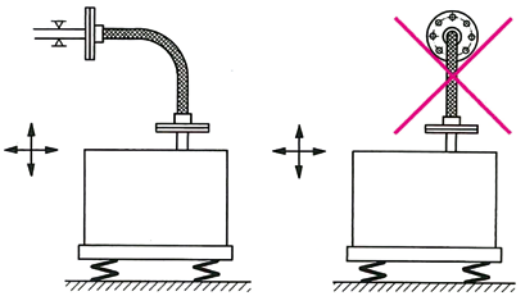
The geometric calculation for the installed hose line is in accordance with the following equations:



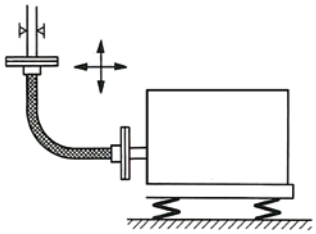
GL = 2.4r + 2L



h = 1.4r + L



Upright installation (support may be required)



Suspended installation

The connected hose lines must be free of torsional strain (not twisted). The main movement direction and the hose bend must be in the same plane. The pipeline must continue to a fixed point (non-moving attachment point).

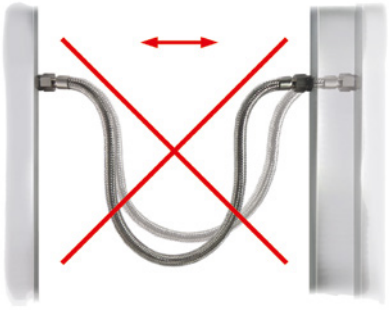
3.4 Accommodation of thermal expansion for metal hose lines

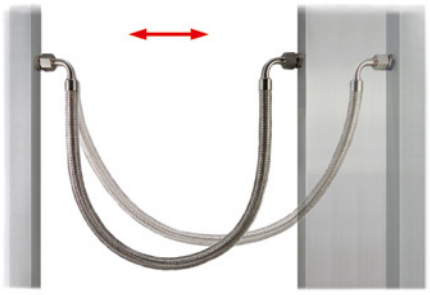
Components expand when heated and contract again when cooled.

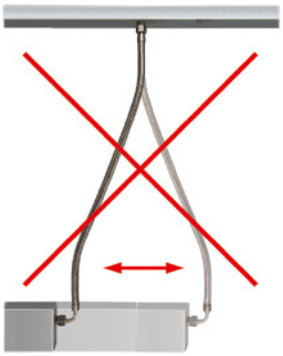
For pipeline installations in which high temperatures and high pressures may prevail, the flexible intermediate components (e.g. metal hoses) must fulfil higher requirements. The expansion movements caused by heat must be accommodated. It is essential to ensure that the metal hoses are not loaded axially in tension (stretched) or compressed (buckled). The hose must incorporate a 180° U-bend to ensure that large axial expansion movements can be accommodated.

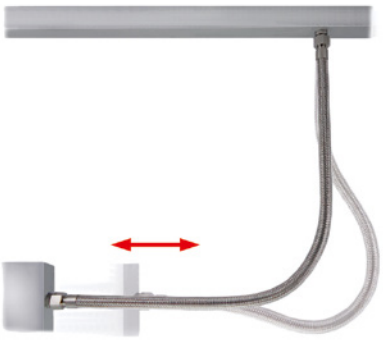
This double directional arrow ⟷ is intended to illustrate the movement of the hose line caused by thermal expansion of the components. What is not meant here is the movement caused by the operating equipment itself!

3.4.1 Preferred installation situation for accommodating larger axial expansion movements (refer in addition to “Installation regulations”)

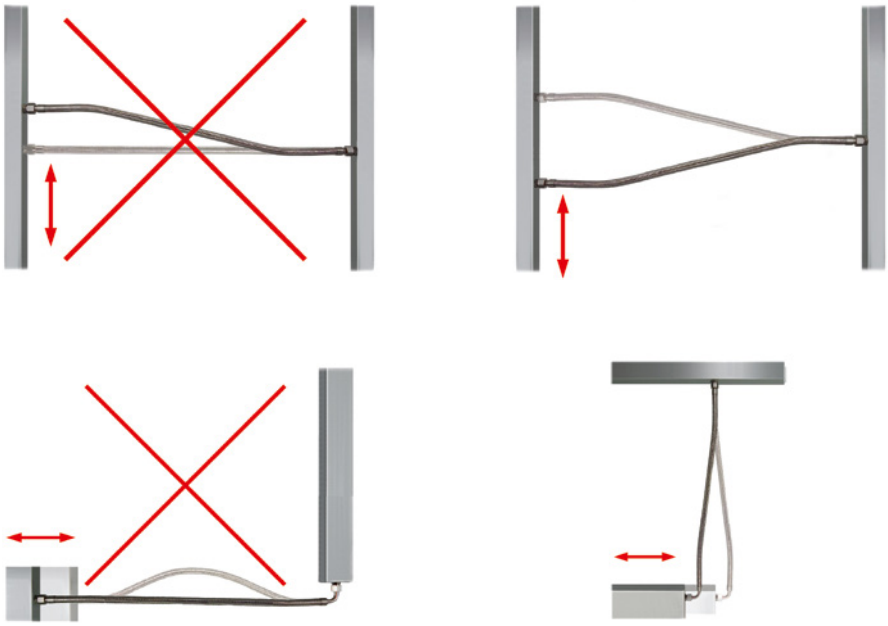








3.4.2 Possible installation situation for accommodating small lateral expansion movements (refer in addition to “Installation regulations”)

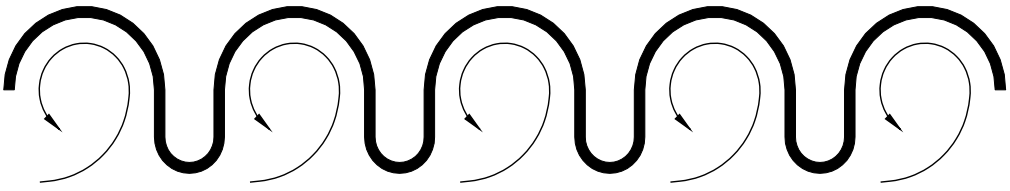


Install at right angles to the expansion direction, preconfigure for half of the occurring expansion, avoid specifying too short a length otherwise the hose will be subject to tension in the full expansion position.

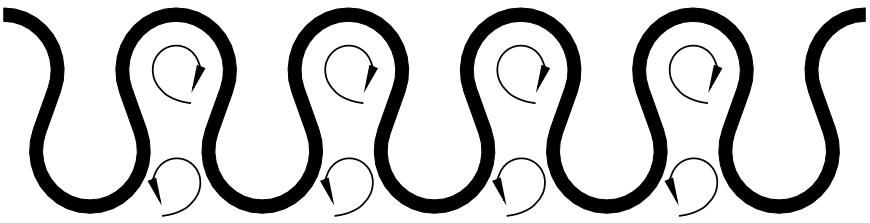
3.5 Metal hose lines for the food and chemical industries

Hose lines with wider corrugations are most suitable for the food and chemical industries. The single vortex each corrugation creates flushes any residues of the conveyed products or cleaning fluids out of the corrugated profile. The wide corrugation profile creates a self-cleaning effect in the flowing media.

3.5.1 Corrugation geometry



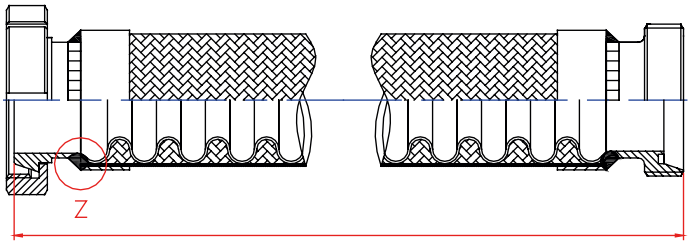
Wide corrugation with good cleaning properties



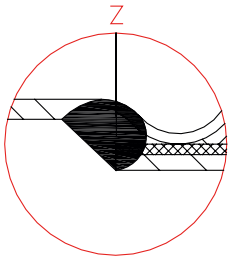
Narrow corrugation with increased flexibility

Direction of flow

3.5.2 Joining technique for hose lines free from internal burrs and gaps based on DIN 2827



Nominal length



Gapless and burr-free welded seam design

The welded connection between corrugated hose and connection components must be free of burrs and gaps based on the provisions of DIN 2827. Any welds at the connection components must be full penetration welds. All weld beads are back-purged and brushed as standard.

3.5.3 Declaration of suitability of the materials in contact with food

A certificate or test confirming the hygienic suitability of the hose line assembly as a complete component is not available. The declaration relates to the suitability for use in contact with food of the materials in the component.

3.6 Calculation of the allowable operating pressure / thermal reduction

The allowable operating pressure is as follows:

$P_{zul.} = PN \cdot k_t$

$P_{zul.}$ = Max. allowable operating pressure in bar

PN = Nominal pressure of the components in accordance with product datasheets in bar at 20 °C

k_t = Thermal reduction factor (material dependent)

If necessary, the calculation can be performed for each component separately and further reduction factors considered.

Table of thermal reduction factors kt for components of metal hose lines:
(Example values, the appropriate information from the component or works material standards is to be used)

Operating temp.	Machining steel	Carbon steel	Non-rusting steel Material No.			
°C	9SMnPb28K or similar	1.0460 or similar	1.4301	1.4404	1.4541	1.4571
20	In accordance with DIN 3859-1 up to max. 120 °C. Up to 200 °C depending on manufacturer. Reduction factor subject to separate request	1.00	1.00	1.00	1.00	1.00
50		1.00	0.88	0.88	0.92	0.90
100		0.95	0.73	0.74	0.83	0.81
150		0.86	0.66	0.67	0.78	0.76
200		0.76	0.60	0.62	0.74	0.73
250		0.68	0.56	0.58	0.71	0.69
300		0.60	0.52	0.54	0.67	0.65
350		0.52	0.50	0.52	0.64	0.63
400		0.44	0.48	0.50	0.62	0.61
450		0.36	0.47	0.48	0.61	0.59
500		–	0.46	0.47	0.60	0.59
550		–	0.42	0.47	0.59	0.58

3.7 Flow velocity / Pressure loss

Natural, self-induced oscillations with consequent noise generation and considerable pressure losses may occur depending on the hose type, nominal diameter, volumetric flow, hose line length, curvatures or bends in the installed lines and the density of the flow media.

4. Manufacture / Inspection / Documentation / Delivery condition / Storage

4.1 Manufacturing competences

Manufacturing is performed by expert personnel using proven and approved manufacturing methods.

4.2 Manufacturing regulations

Metal hose line assembly is performed in accordance with in-house nomenclature, associated part lists and route sheets. Assembly drawings are unnecessary and are created only in special cases.

4.3 Hose line marking

Hose lines are marked with at least one manufacturer's marking (HF I0) and a date of manufacture (MM, YYYY). Other markings may be required, e.g. for guidelines, standards, technical rules, design and construction regulations, or customer-specific requirements stipulated on the order.

4.4 Final inspection / Documentation

Hose lines are all (100%) tested for leaks with air under water (bubble test) as standard. Random testing is also possible in exceptional cases. Depending on the field of application and the associated regulations, a documented pressure test based on the operating conditions and other certificates or declarations may be necessary.

4.5 Delivery condition of hose lines / Cleanliness

Cleaning to meet user-appropriate cleanliness standards must be performed by the customer before installation! Compliance with special requirements for cleanliness in the delivered condition (particle size, residue weight etc.) is applicable only if these requirements were made known in advance and their capability of fulfilment was checked and confirmed. The products are normally supplied in cardboard packaging or with pallet collars on pallets. Any special requirements relating to packaging must be agreed.

4.6 Storage

Adequate protection against damage, contamination, the effects of weather etc. must be provided. In particular, the effects of chlorides, bromides, iodides, extraneous or film rust must be avoided. Store hose lines in a strain-free, kink-free and dry condition. The minimum bending radii specified in the technical datasheets must be observed.

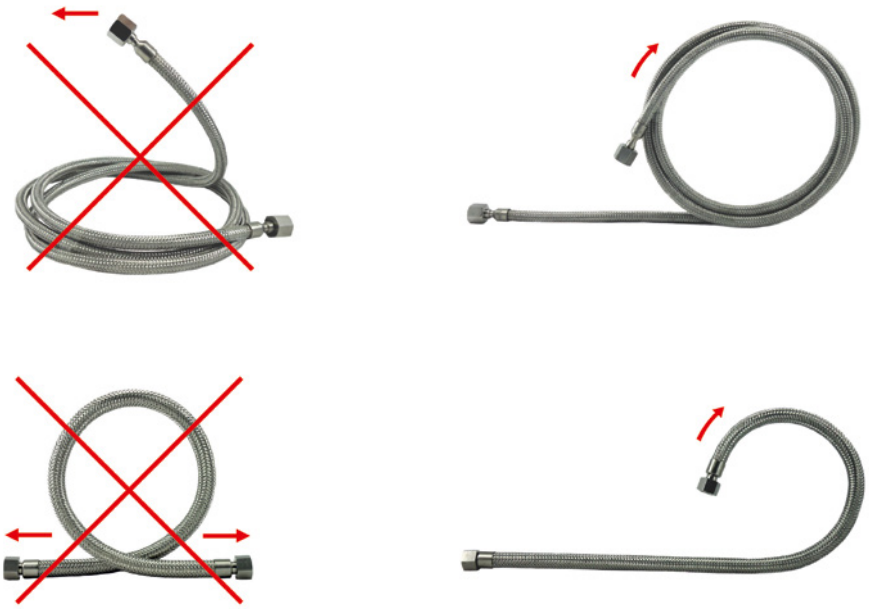
Metal hose lines with braiding and fittings made from non-rusting alloys have no limit on storage time provided they are stored correctly. In the case of untreated, painted, galvanised or otherwise coated steel fittings, their storability depends greatly on the storage conditions and is generally time-limited.

5. Assembly / Installation regulations

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

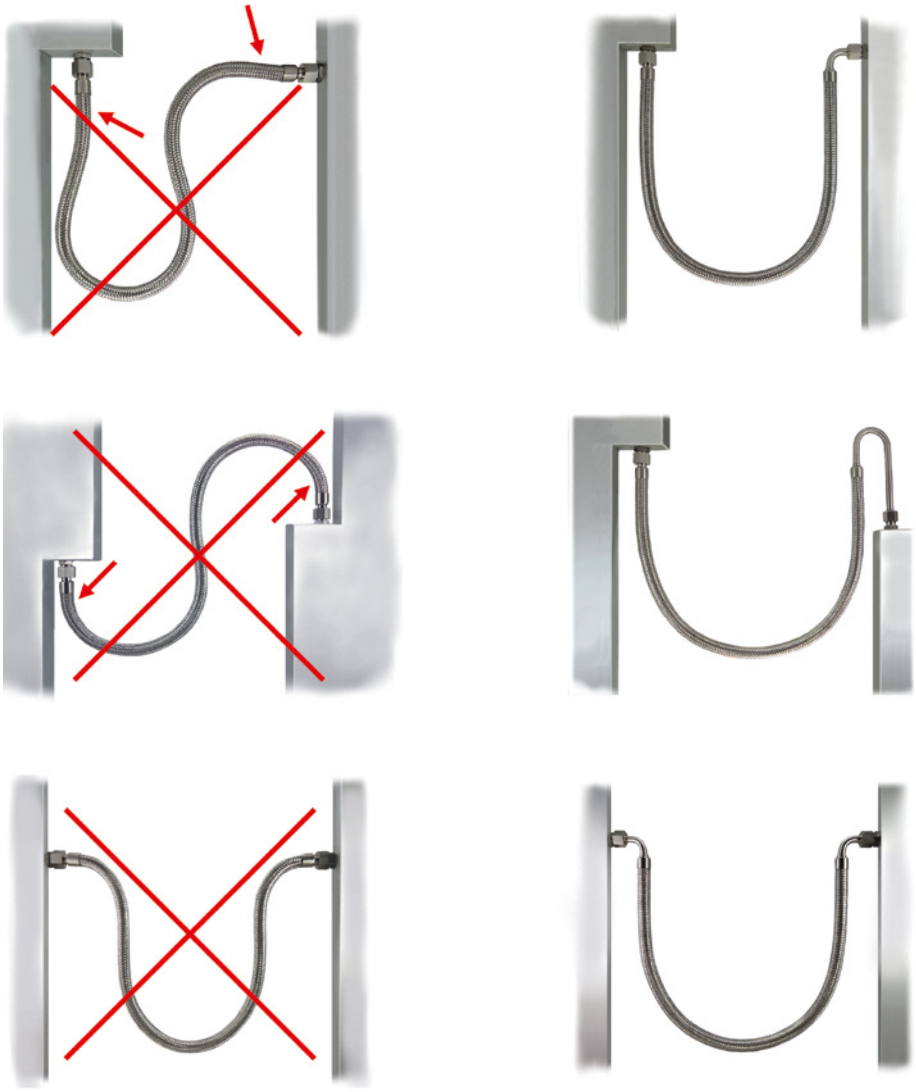
- Hose lines may be assembled and installed only by appropriately qualified personnel.
- The guidelines for handling, assembly and installation of HANSA-FLEX hose lines must be observed. Some important points from the installation guidelines are listed below:
- No axial loads (tension/stretching or compression/buckling)
- No torsional loads (twisting). 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 drawing information must be observed.
- Check all the connections before bringing into use.
- Damaged hose lines must not be installed or brought into use.
- Protect hose lines against possible sources of damage when working on the equipment.

5.1 Correct coiling and uncoiling



Pulling on the ends of an uncoiled hose line may twist it and cause damaging torsional loads. Observe the smallest allowable bending radius. This mistake is avoided by coiling and uncoiling correctly.

5.2 Bending loads

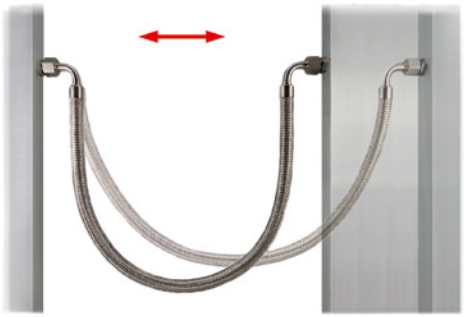
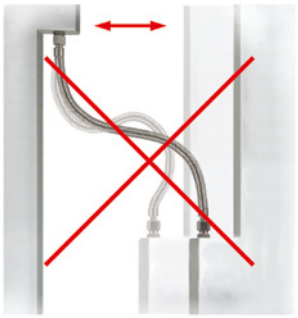


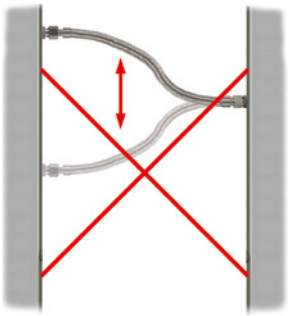
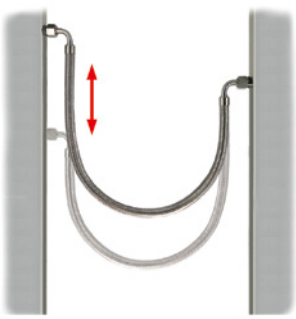
Incorrect installation of a hose line can place high bending loads on the hose close to the connections. This mistake is avoided by installing pipe bends.

5.3 Prevention of kinking

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

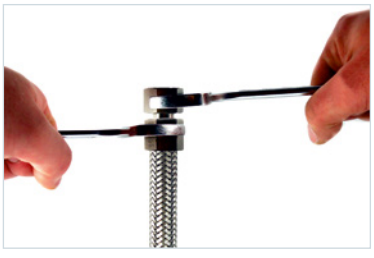
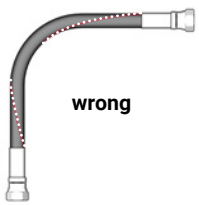
5.4 Prevention of stretching / buckling

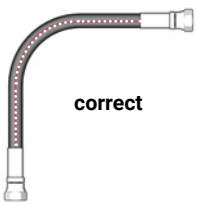




Incorrect installation can lead to longitudinal compression/buckling of the hose line. This mistake can happen during installation or as a result of movements. Stretching or buckling can cause the braiding to separate from the hose and as a result it can no longer be relied upon to provide the required pressure resistance. Hose lines with braiding are therefore not suitable for accommodating axial expansion and contraction. Axial expansion can be accommodated by expansion joints or by installing hose lines in a U-shape. This form of unwanted stretching can occur, for example, by installing a hose line that is too short or by using hose lines as a means of slinging the equipment.

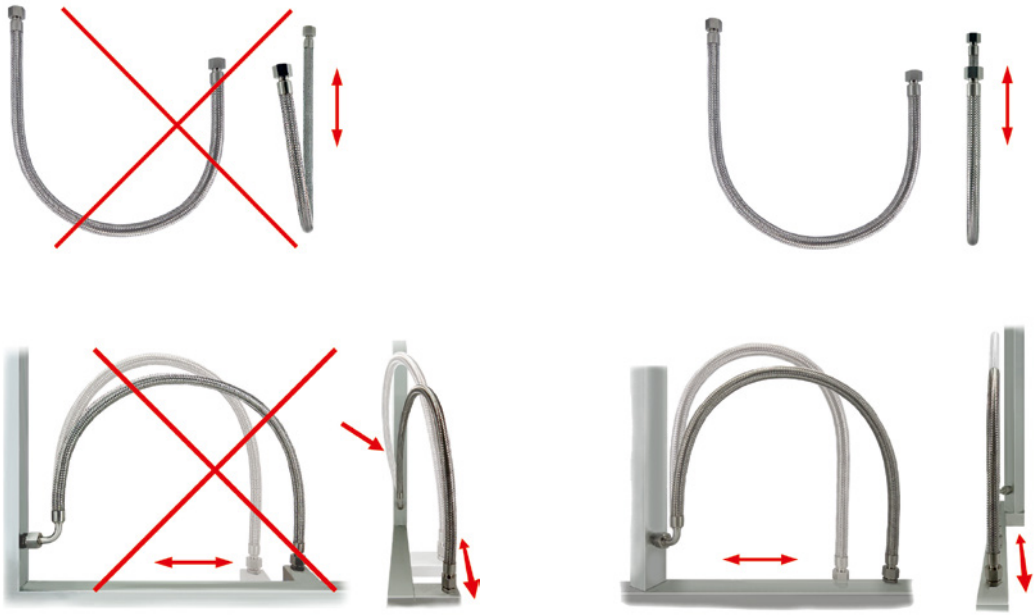
5.5 Torsional loading (twisting)



Torsional loads are always to be avoided because they lead to early failure of the hose line. They can occur due to incorrect installation.

During assembly, the hose line must be held with a suitable tool to counteract any twisting of the hose line during tightening, which would otherwise cause a torsional load.



Where movement occurs, the longitudinal axis of the pipeline or hose must be in the same plane as the direction of movement.

We make no claim of completeness for the information given in sections 3 and 5 concerning dimensioning and installation. Other ways of dimensioning and installation are possible.

6. Bringing into first use / Operation

When commissioning/bringing into first use and during operation, the allowable limiting values for parameters such as pressure, temperature, bending radii, medium concentration etc. must be observed. Hose lines may be used only for the purpose for which they were designed (proper use) with regard to pressure, temperature, medium, movement etc. If used with liquid media, the hose lines must be bled of air after filling. The compressibility of any gaseous fluid remaining in the hose lines presents a higher potential danger and could lead, among other things, to a higher classification (e.g. DGRL – PED) and higher requirements on the product.

The resistance of the materials of the hose line must be checked for the specified medium flowing through it. However, a clear statement about the resistance of hose lines can be made with absolute certainty only based on experience gained in the operating state. Incrustation of the medium carried by hose lines can lead to corrosion damage. In addition, incrustation reduces the flexibility of hose lines and leads to premature failure. The safety datasheet for the operating medium must be kept at hand.

High operating temperatures give rise to the risk of skin burns on contact with the hose line because of the good thermal conductivity of metallic materials. Appropriate precautions (such as contact protection, warning notices or barriers) must be taken. Hose lines must not be pulled over sharp edges or across the floor. A suitable abrasion protection sleeve must be used if pulling hose lines across the floor is unavoidable.

Insulation materials, abrasion protection sleeves etc. must not corrode or limit the movement of the hose line. Furthermore, the movement of the hose line must not be restricted by other parts of the equipment. This gives rise to the danger of abrasion damage. In some circumstances, safety precautions against whipping hose lines will be required.

Hose lines must always be installed and operated in a manner that eliminates the risk of harm to people and the environment. Any residual risks must be controlled by suitable protective measures. Technical and organisational measures for the safe use of hose lines are described in the relevant rules and regulations.

7. Maintenance

The schedule for external and in-house inspections must be drawn up with intervals based on the loading and the degree of danger. A competent person must check and record the safe operational condition of the equipment. Damaged hose lines must be replaced immediately. Repairs are not permitted.

7.1 Services provided by HANSA-FLEX AG

HANSA-FLEX AG Metal Hose Production Division provides a range of services including approval in accordance with the relevant standards, advice on all project phases and product-related training.

7.2 Relevant HANSA-FLEX AG Internet pages (links)

Information about services in general:	**https://www.hansa-flex.com/services.html**
Technical information:	**https://shop.hansa-flex.de/de_DE/media/212599**

8. Disposal

Metal components are generally easy to recycle and return to the circular economy. Recycling turns waste into an important resource.

The components must be emptied of all residues so as not to endanger waste processing personnel. The components must not contain any residual substances that could endanger people, animals or the environment. This applies in particular to components containing substances that are under pressure, flammable, capable of exploding or radioactive.

Residual substances that could endanger people, animals or the environment must be taken to suitable facilities for disposal. All statutory provisions for documentation of the disposal of hazardous wastes must be observed.