

Operating manual for hose assemblies (including hose assemblies for pressure equipment according to the Pressure Equipment Directive 2014/68/EU)

General

The hose assemblies have been designed acc. to the available order indications for medium, pressure, and diameter (min. necessary) and produced acc. to this layout.

The metal and PTFE hose assemblies are to be installed and operated in an adequate manner. The installation instructions acc. to the catalogue „corrugated metal hoses“ are to be observed.

Depending on the installation and operating conditions (relevant parameters: medium, min. / max. operating pressure, min. / max. operating temperature, prevailing flowing conditions of the medium inside the hose during all operating states, outside influences, e.g. mechanical, corrosive, oscillation-related, or thermal), serviceability of the hoses is to be examined by an outside and inside visual inspection, depending on the level of hazard, within adequate time intervals. Especially in case of aggressive, poisonous and highly inflammable media, these inspections are to be carried out within short distances of time.

Manufacturer acc. to the pressure equipment directive is the natural person or corporation responsible for the design and production of the hose assembly, and on whose behalf it is to be distributed. He is also responsible to carry out the conformity assessment according to the procedure prescribed in the directive(s).

Assembly

To ensure the serviceability of hose assemblies and in order to avoid a shortening of their service time by additional strains, the following is to be observed:

- The hose assemblies are to be installed in a way that their natural position and movement are not impeded
- hose assemblies must not be strained during operation by outsider influences like tension, torsion, and upsetting, unless they are specially designed and constructed to serve such an application
- the min. bending radius must not fall below the figure indicated by the manufacturer (figures can be taken from the catalogue)
- hose assemblies must be protected from damages by outsider mechanical, thermal, or chemical influences
- removable joints must be checked to fit tightly before putting in operation
- do not put the hose assembly in operation in case outside damages are visible
- if necessary, the hoses are to be cleaned appropriately before starting
- in case of hose assemblies requiring an equipotential bonding, bonding has to be checked and if necessary, provided afterwards

Correct application

Hose assemblies are only to be used for applications they are designed and determined for. Please take all relevant parameters like permissible pressure, tolerable bending radius, temperature range, and all media to get in contact with the hose, from the enclosed documentation, i.e. the manufacturers declaration, declaration of conformity, or the marking applied on the hose.

Relevant parameters are:

- **Pressure** (max. permissible excess pressure in service must not be exceeded)

- **Temperature** (max. admissible temperature depending on the medium must not be exceeded. If necessary, this has to be verified along resistance lists of the hose assembly components)
- **Bending radius** (min. tolerable bending radius must be observed)
- **Movement** (in case of a likely abrasion, a possible wearing-off effect must be taken into account and be monitored) and
- **Resistance** (materials of the hose assembly have to be resistant against the following substances. If necessary, this has to be verified by resistance lists)

In order to operate the hose assembly safely, technical, organisational and personal protection measures are to be carried out. Priority has always to be given to technical and organisational measures. In case not all dangers can be excluded by this, effective personal protection gear is to be provided and used.

Storage

For the storage of hoses and hose assemblies the following is to be observed, especially:

- Hoses and hose assemblies have to be stored lying, tension-free, and buckling-free. If stored in rings, the min. bending radius must not fall below the figure indicated by the manufacturer.
- Close the hose ends with protection caps to protect the inside from soiling and against corrosion (after residual evacuation resp. cleaning).
- Store in a cool, dry, and in a low-dust place; protect from near heat sources; hoses and hose assemblies must not get in contact with substances which can cause damages.

Maintenance & inspection

Cleaning

The hose assembly is to be cleaned and rinsed after each operation, and prior to each inspection. If cleaned with steam or with chemic additives, the resistance of the hose assembly components are to be observed (Warning: the use of steam lances is prohibited).

Inspection periods

The safe operating condition of hose assemblies subject to compulsory inspection is to be verified and documented by a "qualified person":

- prior to initial starting (hose assemblies purchased ready for service: random quality checks)
- in regular intervals after initial starting (each single hose assembly). (Inspection period e.g. for thermoplastic and elastomer hose assemblies min. 1 x per year, steam hoses twice a year. A higher strain requires shorter inspection periods, e.g. in case of higher mechanical, dynamic, or chemical strains)
- examine each hose assembly after a repair

Scope of inspection

Kind and scope of inspection (e.g. pressure test, visual examination, electrical conductivity test etc.) for example are controlled by the "qualified persons" acc. to an internally operating safety regulation.

Repairs

Repairs of hose assemblies are to be carried out by a 'qualified person' only, according to the valid operating safety regulation with following inspection, marking, and documentation.

Exceptional features for example are valid for the following hose assembly types:

Steam hoses

- do not use steam hoses for other substances, consider the fast ageing of an elastomer hose
- make sure, that condensates are evacuated completely in order to avoid structure damages („popcorning“), which occur by leaking of water into the inner layer and vaporisation upon a new charging with steam
- avoid negative pressure caused by cooling down if the hose line is locked on both sides
- protective measures against surface temperatures (danger of scorching)

Metal hose assemblies

In case of metal hoses, which are not equipped with an outside heat insulation, a higher danger of scorching occurs in case of an application with steam, due to their high heat conductivity.

- metal hoses are conductive enough without further measures
- pay special attention to damages of the wire braid (if applied) and on deformation of the hose, e.g. kinking
- no influences by chlorides, bromides or iodides, extraneous rust or rust film during storage must occur

Hose assemblies with thermoplastic inner liners

- protect the inner liner from damages caused by outside kinking and deformation of the hose

Metal hose design

Influence of the service conditions on the metal hose design

In view of the variety of the different applications the working pressure and bending radius stated in the technical tables can only be used as a guideline. They are valid for predominantly static stress and room temperature (20°C). The pressure values provide a minimum of three times the safety factor to the burst pressure. The usual test pressure is at 1.3 times the working pressure, unless the user

specifies a higher pressure for testing. The existing service conditions (i.e. pulsating and discontinuous demand, type and frequency of motion, higher working temperature etc.) exert additional demands on the hose material. These influences can be taken into account in favour of the working safety and working life by the following tables and diagrams.

Single motion: Minimum bending radius for single motion tested according to ČSN EN ISO 10380.

Several motion: For repeated motion without major dynamic demand.

Dynamic motion: For dynamic motion the radius R_b is to be recalculated according to the table with the help of the corrective factors f_1 and f_{dyn} .

The allowed working pressure is calculated as follows:

$$P_{zul} = P_{max} \cdot f_t \cdot f_{dyn}$$

P_{zul} = allowed working pressure (bar)
 f_t = safety factor for increased temperature
 P_{max} = working pressure acc. to table (bar)
 f_{dyn} = safety factor for dynamic demand

The allowed bending radius is calculated as follows:

$$R_{dyn} = \frac{R_B}{1,09 + f_t \cdot f_{dyn} + \frac{1}{f_t} + \frac{1}{f_{dyn}}}$$

R_{dyn} = bending radius for dynamic demand
 f_t = safety factor for increased temperature
 R_B = bending radius for repeated motion acc. to table (mm)
 f_{dyn} = safety factor for dynamic demand

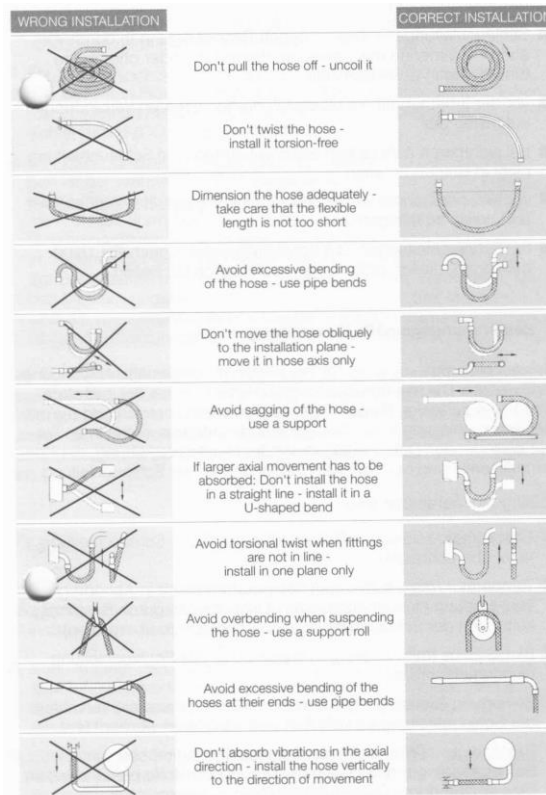
Safety factors for hose systems

material / temperature °C	20	50	100	150	200	250	300	350	400	450	500	600
X 5 CrNi 18 10	1.4301	1,00	0,92	0,83	0,75	0,68	0,63	0,59	0,56	0,54	0,53	0,52
X 6 CrNiTi 18 10	1.4541	1,00	0,94	0,89	0,83	0,79	0,74	0,71	0,69	0,66	0,65	0,63
X 2 CrNiMo 17 13 2	1.4404	1,00	0,96	0,88	0,80	0,74	0,70	0,64	0,62	0,60	0,58	0,57
X 6 CrNiMoTi 17 12 2	1.4571	1,00	0,96	0,89	0,84	0,80	0,76	0,71	0,69	0,67	0,65	0,64
X 2 CrNiMo 18 14 3	1.4435	1,00	0,96	0,88	0,80	0,74	0,70	0,64	0,62	0,60	0,58	0,57
NiCr 22 Mo Nb	2.4856	1,00	0,93	0,85	0,82	0,78	0,76	0,73	0,71	0,68	0,67	0,66
NiCr 21 Mo	2.4858	1,00	0,97	0,94	0,88	0,82	0,80	0,78	0,76	0,74	0,72	

Corrective factors for dynamic demand

flow / motion	Without vibration, low and slow motion	Low vibration, frequent uniform motion	Strong vibration, rhythmical ongoing motion
Stationary or slow uniform flow	1,00	0,80	0,40
Pulsating and swelling flow	0,80	0,64	0,32
Rhythmical and discontinuous flow	0,40	0,32	0,16

Installation instructions for metal hoses



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