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AUGUST 2023

ISO TUBI

STAINLESS STEEL PIPES AND FITTINGS

NUMEPRESS SYSTEM INSTALLATION MANUAL AND TECHNICAL INFORMATION

AISI 316 STAINLESS STEEL PRESSFITTED ACCESSORIES

NUMEPRESS

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GENERAL INDEX

INTRODUCTION

There are a number of possible ways to join tubes and accessories in plumbing installations, including threaded joints, welding and inseparable joints using pressfitting of accessories (such as elbows, tees, couplings, etc.).

The NUMEPRESS system consists of a range of accessories, tubes and a pressfitting tool. This system makes it easy to quickly and safely install a wide range of civil, industrial and naval systems, with diameters ranging from 15 mm to 168.3 mm.

This wide range means that the NUMEPRESS system can be used in any type of installation.

The main advantages of the system:

- Installation is quick and safe using this system
- The installation is reliable, even under severe use conditions
- Less labour is needed
- Resistant to corrosion
- Easy to handle
- No anti-fire measures are needed

The basis of the NUMEPRESS system is the pressfitting of the accessory using an O-ring and tube. The O-ring is placed at the end of the accessory to make the joint watertight. The tube is then inserted into the accessory up to its limit and the joint is created by mechanical deformation using an electric-hydraulic tool.

The strength of the joint results from the accessory and the tube being fitted to each other creating a durable, inseparable joint.

Technical specifications of the system

Joint type: O-ring resistant to hot water, ageing and the additives commonly used in drinking water. There are two types: EPDM and FKM.

Accessory material: Stainless steel nº 1.4404 (AISI 316L). Characteristics:

- Hygienic, as demonstrated in many food and pharmaceutical industry applications.
- Minimum load loss, resulting in faster fluid flows.
- Excellent decorative finish avoiding need for additional painting or external protection costs.
- Less heat conduction than other materials.
- The use of molybdenum results in good performance in chlorinated environments.
- Good resistance to oxidation up to temperatures of 900 °C. Good mechanical and deformation resistance at high temperatures.

Joint type: Inseparable pressfitting for joining stainless steel tubes.

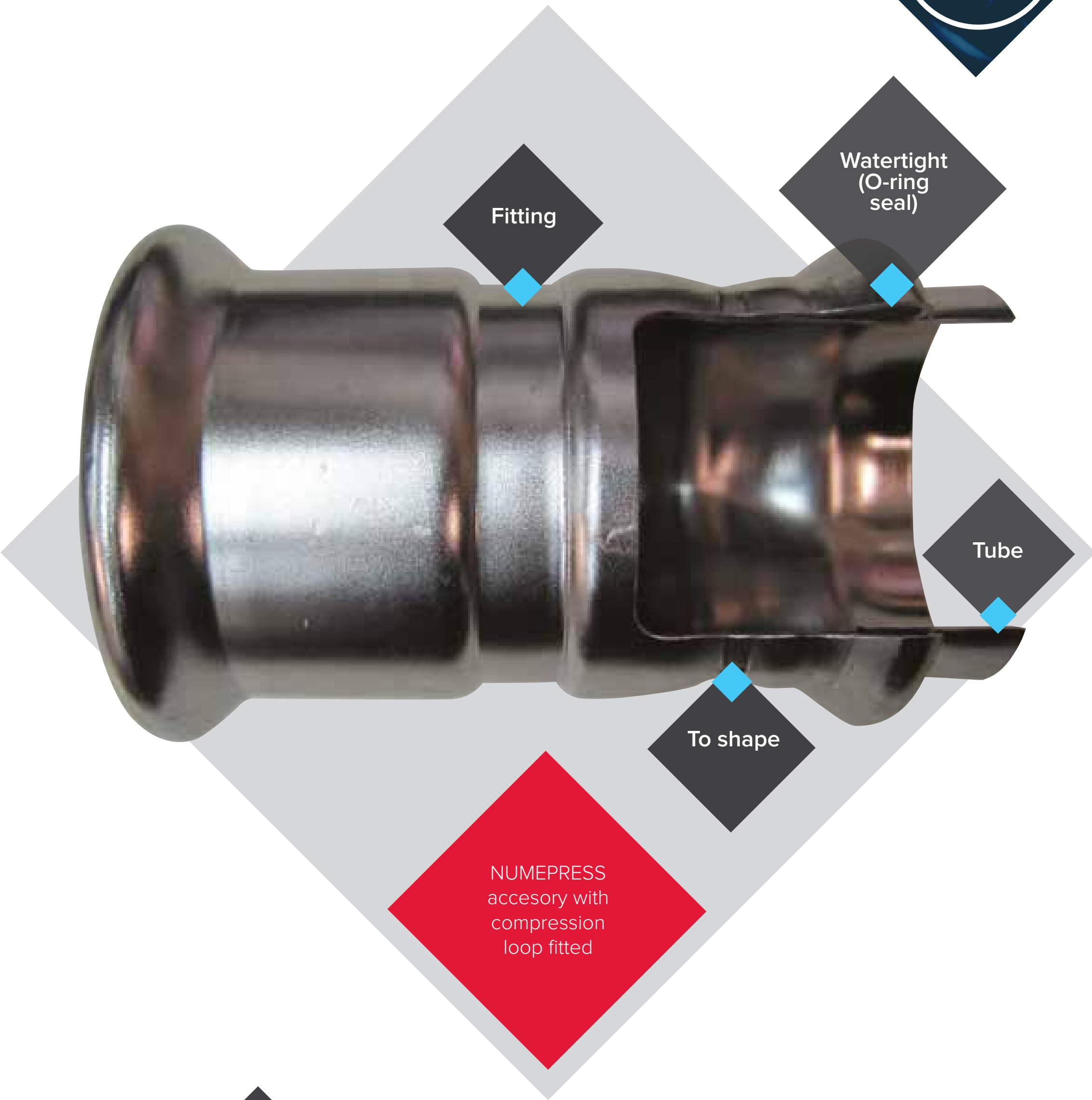
Working pressure: Max 16 bar

Working temperature:

- With EPDM O-ring (black) –20 a +110 °C
- With FKM O-ring (green) From –20 °C +200 °C dry app (hot air) or wet app (oils or primary solar energy circuits) or wet app (oils or primary solar energy circuits)
- With FKM O-ring (red) From –10 °C a + 160 °C (constant); short exposure (peak value) max. +170/180 °C; max. 7 bar
- With HNBR O-ring (yellow) From –20 °C a +70 °C

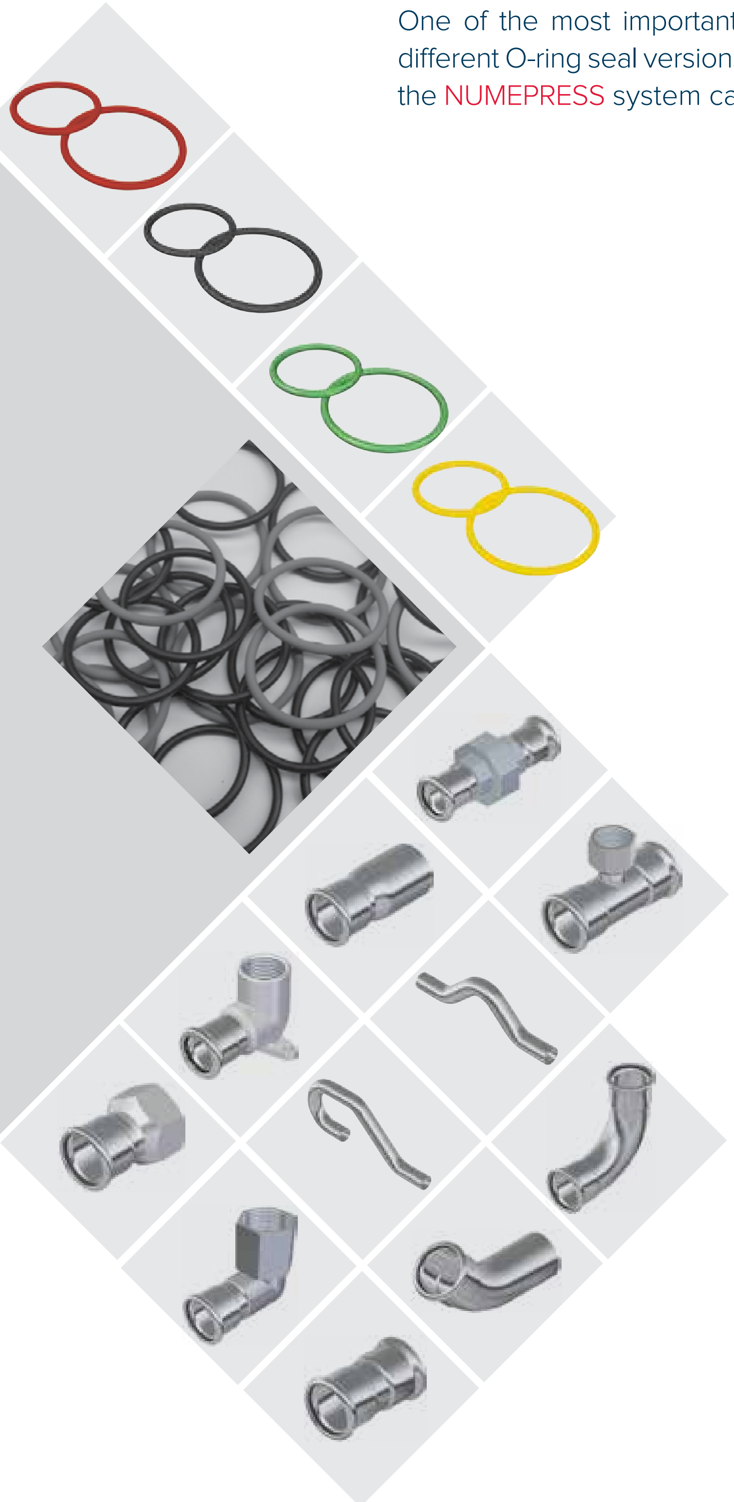
Thickness of the fitting:

- 1.5 mm for diameters 15, 18, 22, 28, 35, 42, 54
- 2 mm for diameters 76.1, 88.9, 108, 139.7, 168.3
- 2.6 mm for diameters 139.7, 168.3



CERTIFICATES

As the manufacturer of the NUMEPRESS system of stainless steel tubes and accessories, ISOTUBI S.L. has been awarded certificates from the most prestigious bodies in Europe.



One of the most important elements in the system is the O-ring seal. A number of different O-ring seal versions have been developed which are resistant to ageing so that the NUMEPRESS system can be used in as wide a range of installations as possible.

O-ring type

EPDM (Black) Ethylene rubber, resistant to ageing and hot water.

- Applications: Hot water, heating, fire protection and compressed air (oil-free)
- Temperature: From –20 °C to +110 °C

FKM (Green) Fluoroelastomer rubber

- Applications: Oils, hydrocarbons, compressed air
- Temperature: From –20 °C +200 °C dry app (hot air) or wet app (oils or primary solar energy circuits)

FKM (Red) Fluoroelastomer rubber

- Applications: Steam, solar installations
- Temperature: From –10 °C a + 160 °C (constant); short exposure (peak value) max. +170/180 °C; max. 7 bar

HNBR (Yellow) Nitrile rubber

- Applications: Gas
- Temperature: From –20 °C a +70 °C

We use the appropriate O-ring seal for the type of fluid. Our technical department can provide advice on this.

All NUMEPRESS pressfitting accessories are manufactured using AISI 316L Nº1.4404 UNE EN 10088 stainless steel tubing, meeting the requirements of the DVGW W534 standard. Threads in mixed format accessories are manufactured to the DIN 2999 standard.

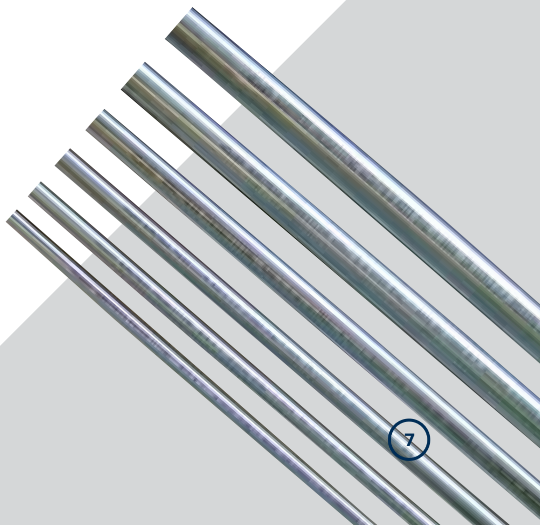
NUMEPRESS BRAND STAINLESS STEEL TUBES

Welded stainless steel tubes are manufactured in accordance with the EN 10312 standard. This meets the 1.4404/1.4301 AISI 316L/AISI 304 standard under UNE EN 10088 and EN 10.217-7. The tubes comply with DVGW W541 specifications.

Ext. diameter Wall thickness x (mm)		Weight (Kg/m)		Max tube pressure (bar)		Water capacity (l/m)
Serie 1	Serie 2	Serie 1	Serie 2	Serie 1	Serie 2	
15 x 1,0	15 x 0,6	0,333	-	147	160	0,133
18 x 1,0	18 x 0,7	0,410	-	123	133	0,201
22 x 1,2	22 x 0,7	0.624	-	120	131	0,302
28 x 1,2	28 x 0,8	0,790	-	95	103	0,514
35 x 1,5	35 x 1,0	1,240	-	94	103	0,804
42 x 1,5	42 x 1,2	1,503	-	79	86	1,194
54 x 1,5	54 x 1,2	1,972	-	61	67	2,042
76,1 x 1,5	76,1 x 2	3,655	-	58	63	4,082
88,9 x 2	88,9 x 2	4,286	-	49	54	5,.661
108 x 2	108 x 2	5,223	-	40	44	8,494
139,7 x 2	139,7 x 2	6,94	-	21	-	14,45
139,7 x 2,6	139,7 x 2,6	8,98	-	27	-	14,20
168,3 x 2	168,3 x 2	8,328	-	17	-	21,19
168,3 x 2,6	168,3 x 2,6	10,787	-	22	-	20,88

Format supplied: 6 metre lengths

- **Curvature radius**: r = 3,5 x d
- **Surface supplied**: The exterior and interior surfaces are smooth.
- **Heat insulation**: The content of disolved chlorine ions in insulating materials for stainless steel tubes should not exceed 0.05%. Heat insulation should be in accordance with current regulations.



The pressfitting tool can be manual, battery or electrically-powered. There is a corresponding easily exchangeable jaw for each diameter which is placed in the tool cylinder.

Most of the machines that exist in the market allow pressing NUMEPRESS fittings properly from diameter 15 mm to diameter 54 mm. Each diameter needs its own jaw or collar. There is one machine that presses from 15 mm to 54 mm and another one that presses from 76.1 mm to 168.3 mm (ask for bigger dimensions).

M profile jaws or collars should always be used. In case of doubt, please ask our technical department.

Main pressfittings tools

Technical data	UAP4L	MAP2L19	UAP100L	ECO 301	ACO 401
Power supply	18 V / 3 Ah	1.5 Ah / 3 Ah	18 V / 3 Ah	220–240 V / 50 Hz	18 V / 3 Ah
Power	-	-	-	560 W	400 W
Dimensions (L x W x H)	512 x 81 x 317 mm	370 x 75 x 116 mm	567 x 81 x 359 mm	420 x 85 x 110 mm	660 x 100 x 250 mm
Weight	4.3 Kg	3.1 Kg	12.7 Kg	5 Kg	13 Kg
Piston force	32 kN	19 kN	120 kN	45 kN	100 kN

APPLICATIONS

Drinking water

All design, calculation, installation and bringing into service of drinking water facilities is subject to the provisions of regulations applicable at the time.

NUMEPRESS's AISI 316L stainless steel tubes and accessories have no effect on the perfect quality of drinking water.

The O-ring seal complies with recommendations for drinking water installations (EPDM O-ring seals are used for sanitation water installations).

Stainless steel is not recommended for installations which contain or transport sea water.

Solar power facilities

Solar power installations obtain heat energy from the Sun. This energy is captured by a solar collector and, once absorbed, it is conducted by a solar fluid (a mixture of steam and anti-freeze) to the heat accumulator.

We recommend that FKM (green) O-ring seals are used in such installations as they can withstand temperatures of up to 200º.

The anti-freezes used are basically chemical preparations based on glycol which lower the freezing point. These anti-freezes always contain other additives, and it is advisable to consult the manufacturer when such additives are used.

The main reasons for using stainless steel in such installations are: **low maintenance**, **better performance** and **less labour needed**.

Sprinkler

Sprinkler systems consist of fixed tubing with fittings for connecting hoses and other outlet systems. These tubes can be divided into:

- **Wet tubes**: these are always full of water.
- **Dry tubes**: the tubes are filled by fire-fighters or by automatic devices which are activated in an emergency.

These installations are subject to the accreditation and approval conditions of insurance companies.

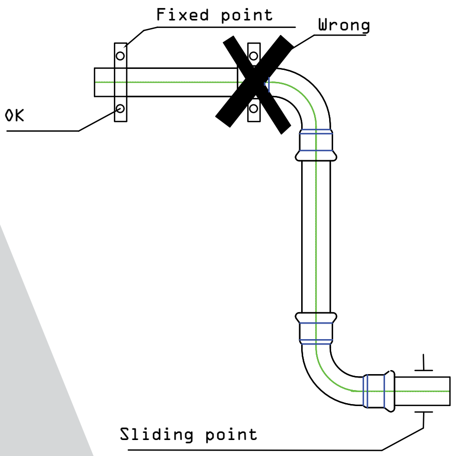
Compressed air

Compressed air is used in a wide range of applications.

Service pressures in compressed air installations goes up to a maximum of 10 bar. However, tools frequently only require a maximum connection pressure of 6 bar.

NUMEPRESS system can work with pressures up to 16 bar.

FKM (green) O-ring seals are used in such installations. These O-ring seals are used because there are often traces of oil in most compressed air installations. The standard O-ring (EPDM black) can be used when the volume of residual oil is below 1 mg/m^3.



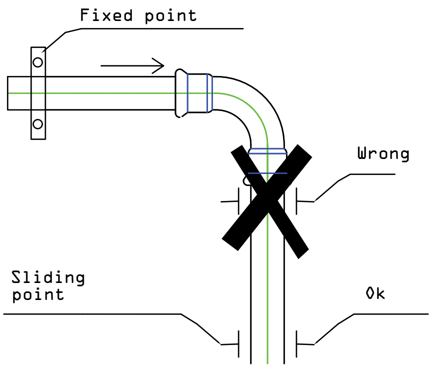
Fixing of fixed fastenings on the tube and not the fitting.

Correct fixing of fixed and sliding fasteners

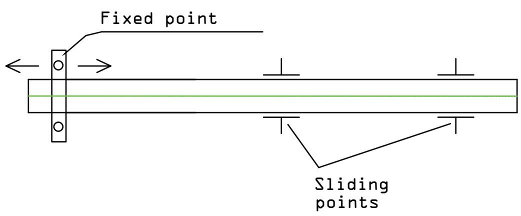
There are two purposes for fixing tubes. Firstly the fasteners support the tube system; and secondly, they direct changes in the length of tubes resulting from temperature changes in the desired direction.

In tube fixings we can distinguish between fixed (static) fasteners and sliding fasteners (enabling axial movement of the tube).

Fixed fastenings should not be used with accessories. Sliding fastenings should be fitted in such a way that they do not involuntarily become fixed fasteners in use. With tube elongation, we should take into account the minimum distance to the first sliding fastening. A stretch of tubing with no changes of direction and no elongation compensator should not have more than one fixed fastening.



Incorrect fixing: the horizontal tube cannot extend freely.



Fixing in a continuous length with a fixed fastening.

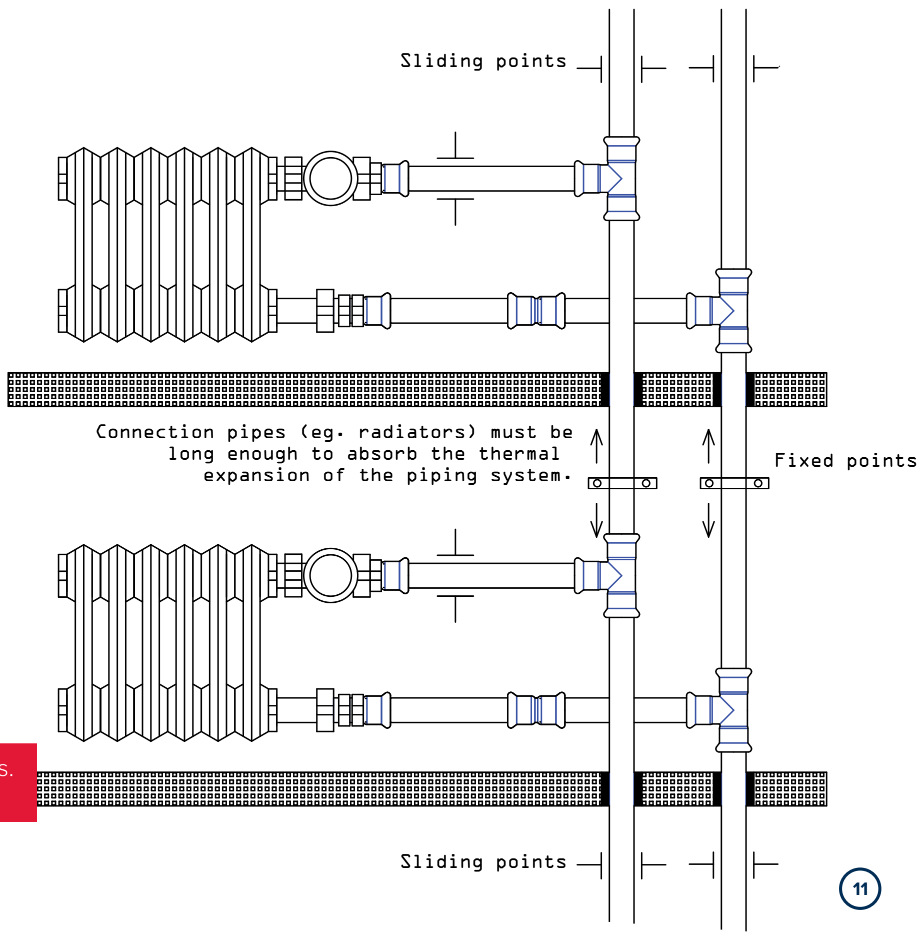
With long stretches, we recommend that the fixed fastening should be in the centre of the stretch in order to distribute the elongation in both directions. This occurs for example in vertical tubes between floors in a building when there is no elongation compensator.

As the ascending tube is fixed in the centre (and not unilaterally to the building) the heat elongation is distributed in two directions, and this reduces the force of the deviation. Commercial fastenings are used. Insulating brackets should be used for noise insulation.

Tubing does not usually produce noise, but it does transmit noise (from other equipment, etc.) and it should therefore be fitted in a way which provides insulation from noise pollution.

Table of bracket distances for stainless steel tubes

Diameter x thickness	Support distances (m)
15 x 1.0	1.25
18 x 1.0	1.5
22 x 1.2	2.0
28 x 1.2	2.25
35 x 1.5	2.75
42 x 1.5	3.0
54 x 1.5	3.5
76.1 x 2	4.25
88.9 x 2	4.75
108 x 2	5.0
139.7 x 2	5.0
139.7 x 2.6	5.0
168.3 x 2	5.0
168.3 x 2.6	5.0



Fixing extremely long tubes.

Storage

Damage and lack of cleanliness should be avoided during transport and storage. Accessories are packed effectively in plastic bags to ensure that they are received by the warehouse or installer in perfect condition.

Bending

Stainless steel tubes cannot be bent using heating. Bending using heating damages the properties of stainless steel.

Tubes with DN ≤ 35 mm can be bent when cold using common tube bending tools. The minimum radius is 3.5 x φ exterior.

Threaded joints

The stainless steel pressfitting system for domestic drinking water installations can be connected to standard threaded accessories (thread in accordance with DIN 2999) or non-ferrous metal accessories using connection parts.

Limits for application

Maximum pressure

16 bar

Maximum depression in relative terms

–0.8 bar

Mechanical properties

Minimum elasticity limit	240 N/mm²
Minimum elongation	40%
Minimum breakage load	530 N/mm²

Cutting

Once the tubes have been measured, they can be cut to the correct length using:

- A fine tooth saw
- A tube-cutting knife (stainless steel)
- A fine-tooth electric saw

The tools must be suitable for stainless steel.

Cutting using abrasive discs makes the stainless steel more fragile as a result of the high temperature caused by the friction.

After cutting the tube, the inside and outside of the ends should be thoroughly deburred to avoid damaging the O-ring seal when the cut tube is inserted into the accessory.

When tubes are cut using electro-mechanical saws which are cooled with oil or other refrigerants, all traces of oil should be removed so as not to affect the O-ring seals on the accessories.

Preparation of the joint for pressfitting

After cutting, the ends of the tube should be deburred inside and outside prior to fitting of accessories. The availability of an O-ring seal for the accessory should be checked prior to assembly.

The zone of contact of the O-ring of the pressfitting with the pipe has to be clean, smooth, free of dirt, free of rills and grooves.

In order to create a sound joint using pressfitting, the length to be inserted into the accessory should be marked on the tube.

In the event of any difficulties in inserting the tube into the accessory as a result of the tolerance of the tube, water or soap can be used as effective lubricants.

Prior to pressfitting, the tube and the accessory are fitted together by gently rotating and pressing in the direction of the limit or mark. In accessories which do not have a limit, insert the tube based on its nominal diameter.

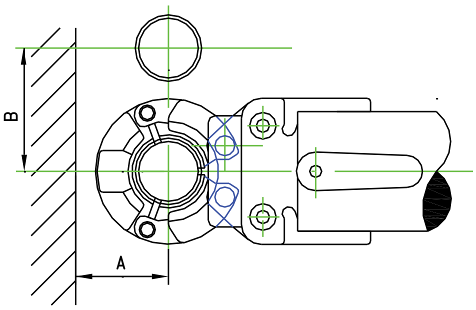
The accessories are pressfitted using the pressfitting tool. The right interchangeable jaw should be used for each tube diameter. Pressfitting can only be carried out using the correct pressfitting jaw.

In the event of a changes to tubes which have already been pressfitted, this should not be done to stretches already pressfitted. Movement in the tubes, which often occurs when they are raised to be installed or removed, is acceptable.

Taping of tubes should be carried out prior to pressfitting, and should use commercial substances which do not contain chlorides.

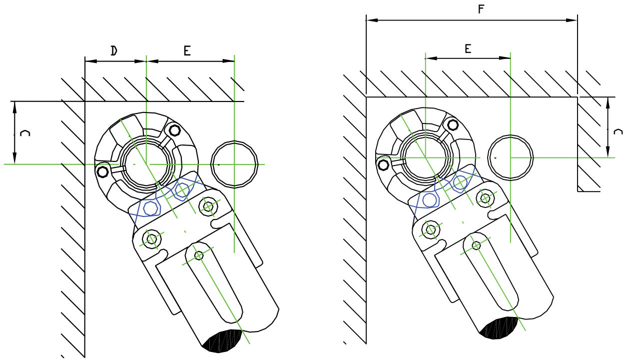
Space required and minimum distances

Due to the design of the jaws and the compression collars, minimum distances need to be respected during assembly of the pressfitting joint system. The tables show this information based on the external diameter of the tube and the jaws and collars required.

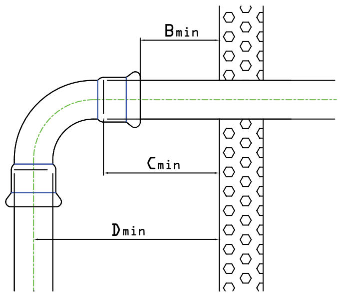


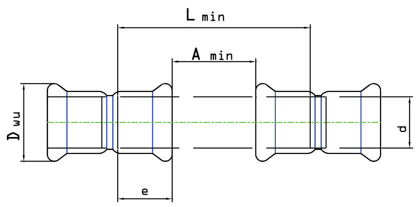
External diameter of the tube (mm)	A (mm)	B (mm)
Jaws		
15	20	56
18	20	60
22	25	65
28	25	75
35	30	75
42-54	60	140
Collars		
42	75	115
54	85	120
76.1	110	140
88.9	120	150
108	140	170
139.7	230	290
168.3	260	330

Space required and minimum distances



External diameter of the tube (mm)	C (mm)	D (mm)	E (mm)	F (mm)
Jaws				
15	20	28	75	130
18	25	28	75	131
22-28	31	35	80	150
35	31	44	80	170
42-54	60	110	140	360
Collars				
42	75	75	115	265
54	85	85	120	290
76.1	110	110	140	350
88.9	120	120	150	390
108	140	140	170	450
139.7	230	230	290	750
168.3	260	260	330	850





Minimum distance and length of fit

External tube diameter	Accessory distance		Tube dist.	Tube depth	Min. tube length	Accessory edge	Depth of insertion
d (mm)	A_{min} (mm)	B_{min} (mm)	D_{min} (mm)	C_{min} (mm)	L_{min} (mm)	D_{wu} (mm)	e (mm)
15 x 1.0	10	35	85	55	50	23	20
18 x 1.0	10	35	89	55	50	26	20
22 x 1.2	10	35	95	56	52	32	21
28 x 1.2	10	35	107	58	56	38	23
35 x 1.5	10	35	121	61	62	45	26
42 x 1.5	20	35	147	65	80	54	30
54 x 1.5	20	35	174	70	90	66	35
76.1 x 2	20	75	223	128	126	95	53
88.9 x 2	20	75	249	135	140	110	60
108 x 2	20	75	292	150	170	133	71
139.7 x 2.6	60	140	459	240	232	166	100
168.3 x 2.6	60	140	523	261	279	195	121

Pressfitting

There is one pressfitting tool for diameters from 15 mm to 54 mm, and another for diameters from 76.1 mm to 168.3 mm.

You should take into account the minimum space you need to be able to use the pliers around the tube and the accessory.

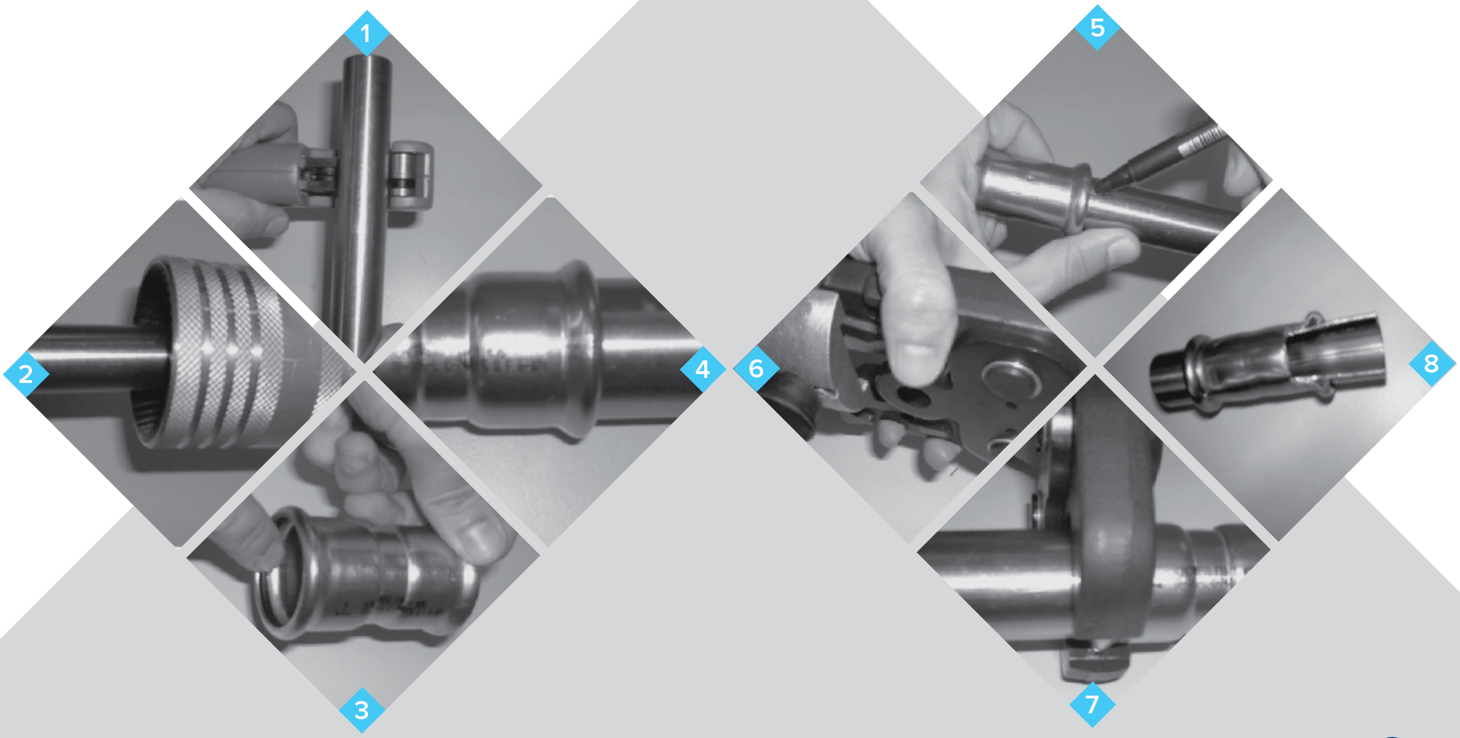
There are a range of jaws and collars with adaptors which can be changed quickly and easily depending on the external diameter of the tubes.

Only the appropriate jaws, collars and adaptors should be used with the pressfitting tool.

The internal slot in the jaws or collars should enclose the edge of the accessory in order to produce an adequate join. Our system uses an M jaw profile.

Assembly sequence

1. *Cut tube at right angle.*
2. *Debur the tube internally and externally to avoid damaging the seal.*
3. *Check the seal is properly placed. Do not use oil or grease.*
4. *Rotate the tube slowly as you insert it in the joint until the limit.*
5. *Mark the tube as a reference point.*
6. *Place the pressfitting jaw in the machine and insert the fastening bolt until it fits.*
7. *Open the jaw, place at a right angle and carry out the pressfitting.*
8. *After the pressfitting: a longitudinal section of a pressfitted joint.*



Testing for watertightness

The finished tubes are tested for watertightness before being covered or painted. Water is used in such testing for drinking water and heating installations. The results of the watertightness testing should be documented appropriately. If it is foreseen that the tube installation would not be operational for a long period of time after accomplishing of the water-tightness test, and for the sake of protecting the installation against possible corrosive process (there is a high probability of appearance of a puncture corrosion), we recommend that the water-tightness test should be carried out using air instead of water (please double check if you may need to have corresponding authorization for running the air test).

Drinking water installation

The watertightness test for the tubes installed is carried out in accordance with current regulations. The tubes should be filled with filtered water so that they contain no air. The watertightness test is used for both the preliminary and also the main test; the preliminary test may be sufficient for small parts of the installation such as, for example, connection and distribution tubing in wet areas.

- **Preliminary test**: The preliminary test involves applying a test pressure corresponding to the acceptable overpressure plus 5 bar. This test pressure should be applied twice for ten minutes, within a total interval of 30 minutes. After a further 30 minutes, the test pressure should not have fallen by more than 0.6 bar (0.1 bar per 5 minutes).

- **Main test**: Immediately after the preliminary test. The test lasts 120 minutes. After this 120 minute period, the pressure reading from the end of the preliminary test should not have fallen by more than 0.2 bar. There should be no visible signs of leakage in any part of the installation checked.

- **Air tightness test**: If appropriate, carried out with the corresponding authorisation.

Heating installation

The watertightness test for the tubes is carried out using water. Water-based heating is tested at a pressure 1.3 times higher than the overall pressure at each point in the installation, increasing the pressure by a minum of 1 bar. If possible, immediately following the watertightness test using cold water, the installation should be checked to verify its watertightness up to its maximum temperature.

This is carried out by heating the water to the maximum temperature on which the calculation is based. The tubes are washed out with drinking water before being put into operation.

Insulation

Insulation of tubing serves to reduce:

- heat loss
- fluids transported being heated by ambient temperatures
- noise
- condensation

Closed cells insulation material also provides protection against corrosion.

Requirements for tube insulation are specified in local regulations.

When choosing insulating materials, we should ensure that they do not contain in excess of 0.05% of chloride ions. AS quality insulation is adequate for stainless steel.

Drinking water installation

Drinking water tubes should be protected against the formation of condensation and heating. Cold drinking water tubes should be installed at a sufficient distance from heat sources, and should be insulated so that the water quality is not affected by heating. In order to save energy, and for reasons of hygiene, hot drinking water tubes and water circulation tubes should be insulated to avoid excessive heat loss.

Heating installations

The insulation of water-based heating installations is a way of saving energy. This measure reduces CO_2 emissions. Heating is the largest single domestic source of energy consumption, accounting for 53% of energy use.

Water-based refrigeration systems

The main reasons for insulation against cold are to prevent the formation of condensation and to reduce energy losses when the water-based refrigeration tubes are in use. Increasing energy costs can only be avoided safely and lastingly by establishing the correct system.

Insulating materials and hoses can result in corrosion of tubes. For this reason, materials should be assessed for suitability when they are being chosen.

Elongation compensation

Whilst in use, tubes are subject to thermal loads which elongate them to differing degrees depending on temperature differences. Tube installations should take into account such thermal elongation by:

- Allowing space for longitudinal elongation
- Elongation compensators
- Correct fixing of the fixed and sliding fastenings

The flexion and torsion effects on a tube during use can easily be absorbed if these factors are taken into account during assembly (to offset the elongation).

Small longitudinal changes in tubes can be offset by expansion space or absorbed by the elasticity of the tube network.

Elongation compensators (such as flexible arms, expansion bends) should be used in large tube networks. The choice of the compensator to be used depends on the material and characteristics of the construction and its service temperature.

Longitudinal change Δl (mm) of stainless steel

Tube length (m)	Δl (mm) Δυ: Temperature difference (K)									
	10	20	30	40	50	60	70	80	90	100
1	0.16	0.33	0.50	0.66	0.82	1.00	1.16	1.30	1.45	1.60
2	0.33	0.66	1.00	1.30	1.60	2.00	2.30	2.60	2.90	3.20
3	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00	4.50	5.00
4	0.66	1.30	2.00	2.60	3.30	4.00	4.60	5.20	5.90	6.60
5	0.82	1.60	2.50	3.30	4.10	5.00	5.80	6.60	7.40	8.20
6	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.40	10.80
7	1.16	2.30	3.50	4.60	6.70	7.00	8.20	9.00	10.20	11.40
8	1.32	2.60	4.00	5.30	6.50	8.00	9.30	10.40	11.70	13.00
9	1.48	3.00	4.50	6.00	7.40	9.00	10.50	11.70	13.30	14.80
10	1.65	3.30	5.00	6.60	8.30	10.00	11.60	13.20	14.90	16.60

In stainless steel tubes, the longitudinal change resulting from thermal elongation (from 20 °C to 100 °C) is given by:

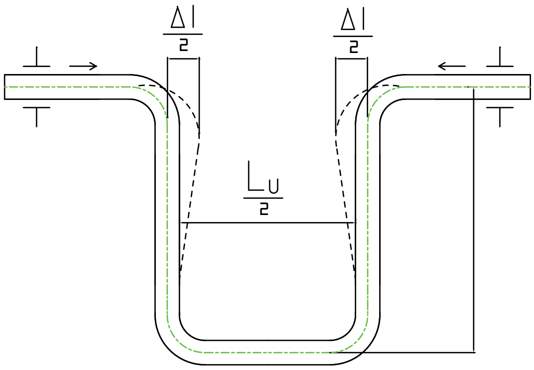
$\Delta l = l_0 \times \alpha \times \Delta \upsilon$

With a thermal elongation coefficient of:

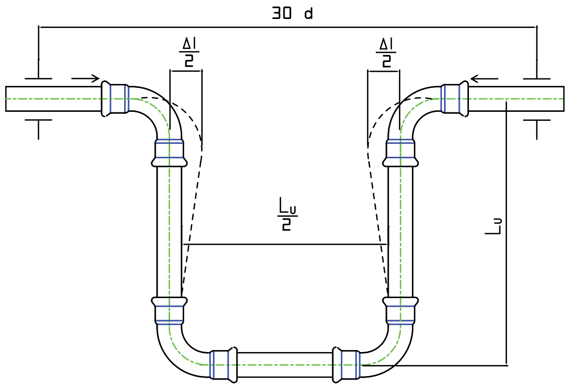
$\alpha\ [10^{-6}\ K^{-1}] = 16.5$

For tube length 10 m:

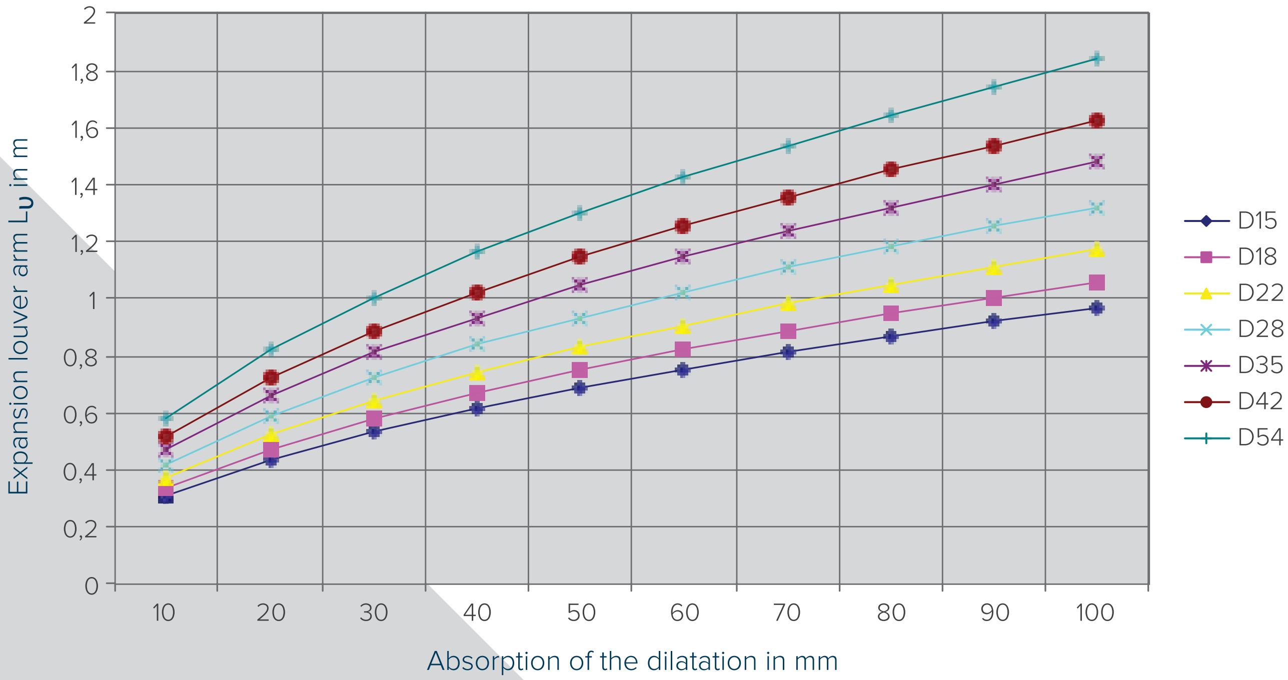
$\Delta \upsilon = 50$ K. Δl (mm) = 8.3



Offsetting elongation using bend based on a curved tube.

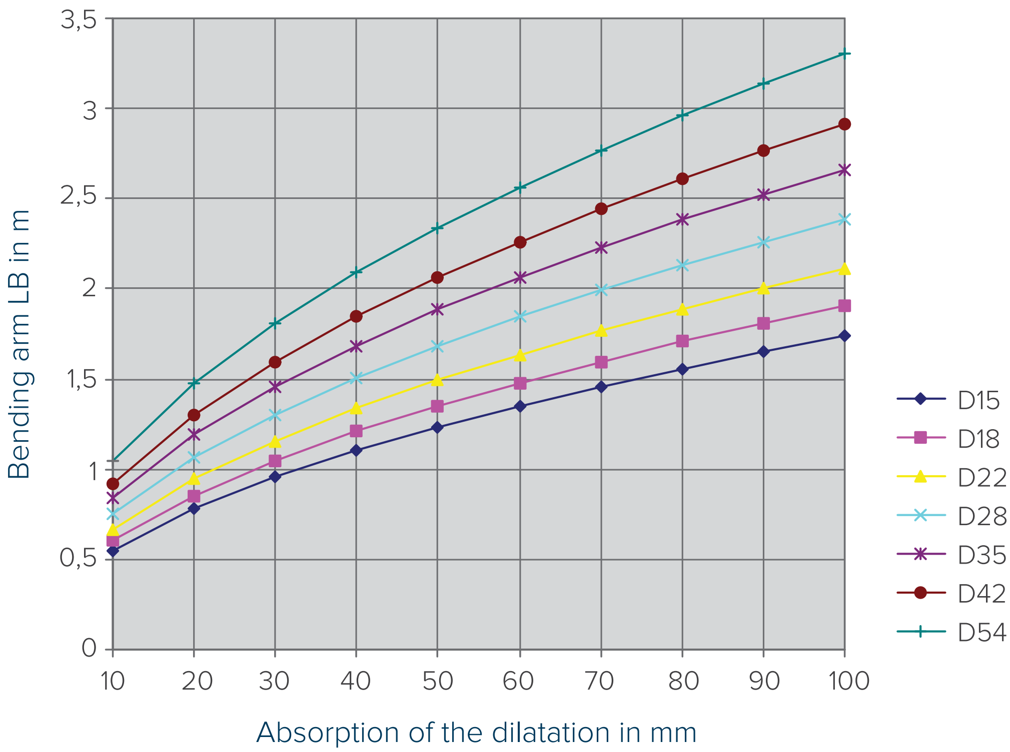


Offsetting elongation using bend made with accessories.

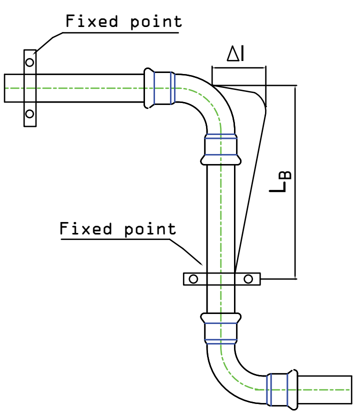


Determining the length of the flexible arm L_υ. Formula: $L_\upsilon = 0.025\sqrt{(d \times \Delta l)}$ mm (d and Δl in mm).

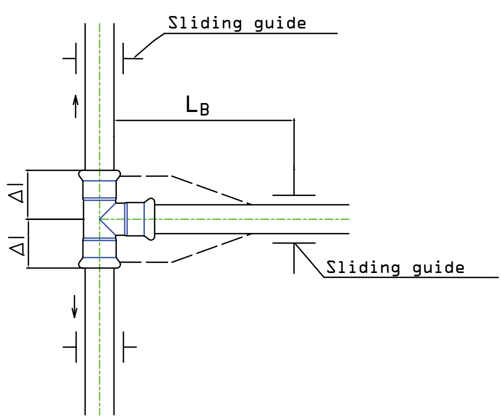
Elongation compensation



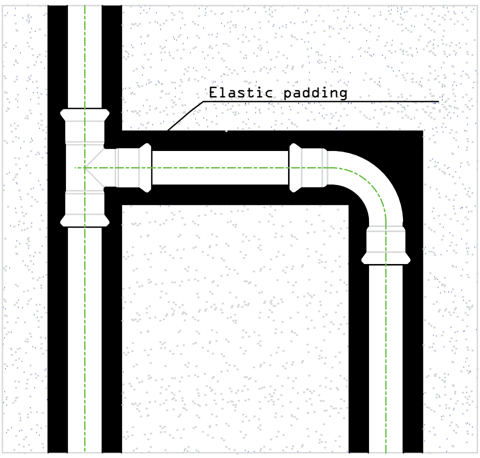
Determining the length of the flexible arm L_B. Formula: $L_B = 0.045\sqrt{(d \times \Delta l)}$ m (d and Δl in mm).



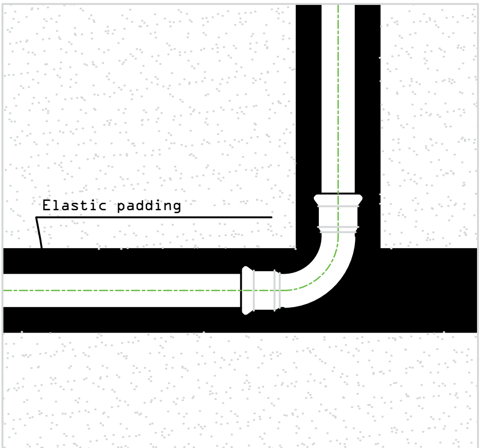
Offsetting elongation using flexible arm.



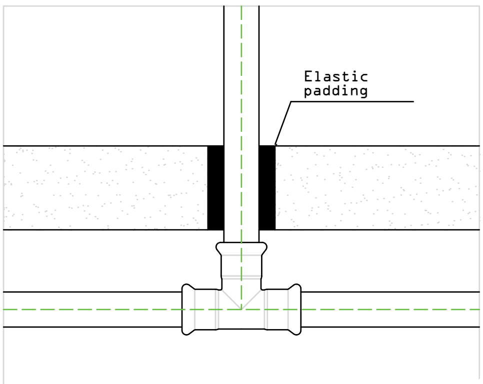
Offsetting elongation by derivation.



Under plaster



Under floating floor



Under gallery

Elongation space

In installations we have to distinguish the following types of tubes:

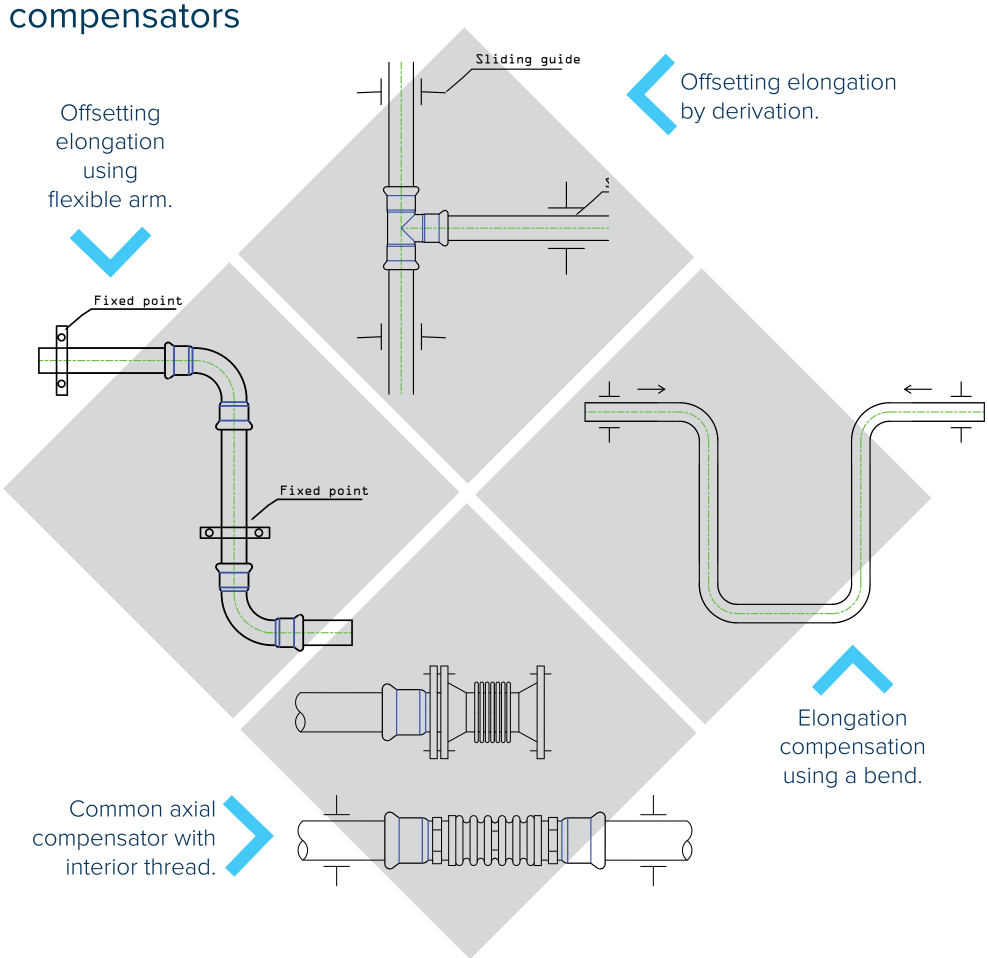
- those which are visible or installed under galleries
- those which are to be under plaster (built in)
- those which are under floating floors

In the case of visible installations or those under galleries, there is sufficient space. In the case of tubes which are built in, we should ensure the installation of an elastic protective filling of insulating fibre such as for example glass fibre, rock wool or sponge materials with closed pores.

Elongation compensators

The longitudinal variation of tubes may be offset by an expansion space and/or absorbed by elasticity in the tube network. If this is not possible, elongation compensators should be installed.

Elongation compensators



Heat emission and heat insulation for tubes

In this point, we need to differentiate between the heat emitted by hot water tubes –heating and hot water– and drinking water tubes. The former case deals with tubes installed in areas involving heating, whilst the other does not require specific heating, and might even need to be kept cold.

In the first case, the emission of heat by tubes has a favourable effect on the parts of buildings to be heated and, as a result, taking into account this heat emission in thermal calculations, does not result in economic losses.

Tubes which should be protected against heat emissions require additional insulation. Tubes can be insulated using fibres (such as glass fibre) or by prefabricated elements in the form of single-shell casings. We do not recommend the use of tubular casings or felt wrappings, as felt retains absorbed moisture for too long which can result in corrosion.

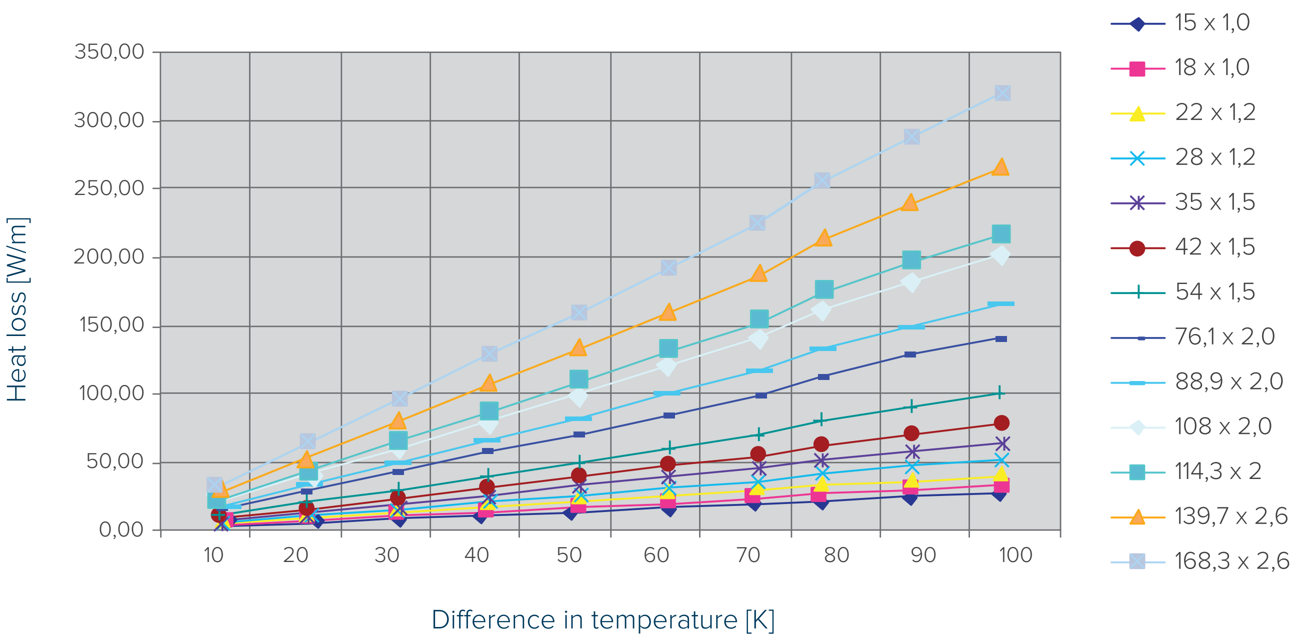
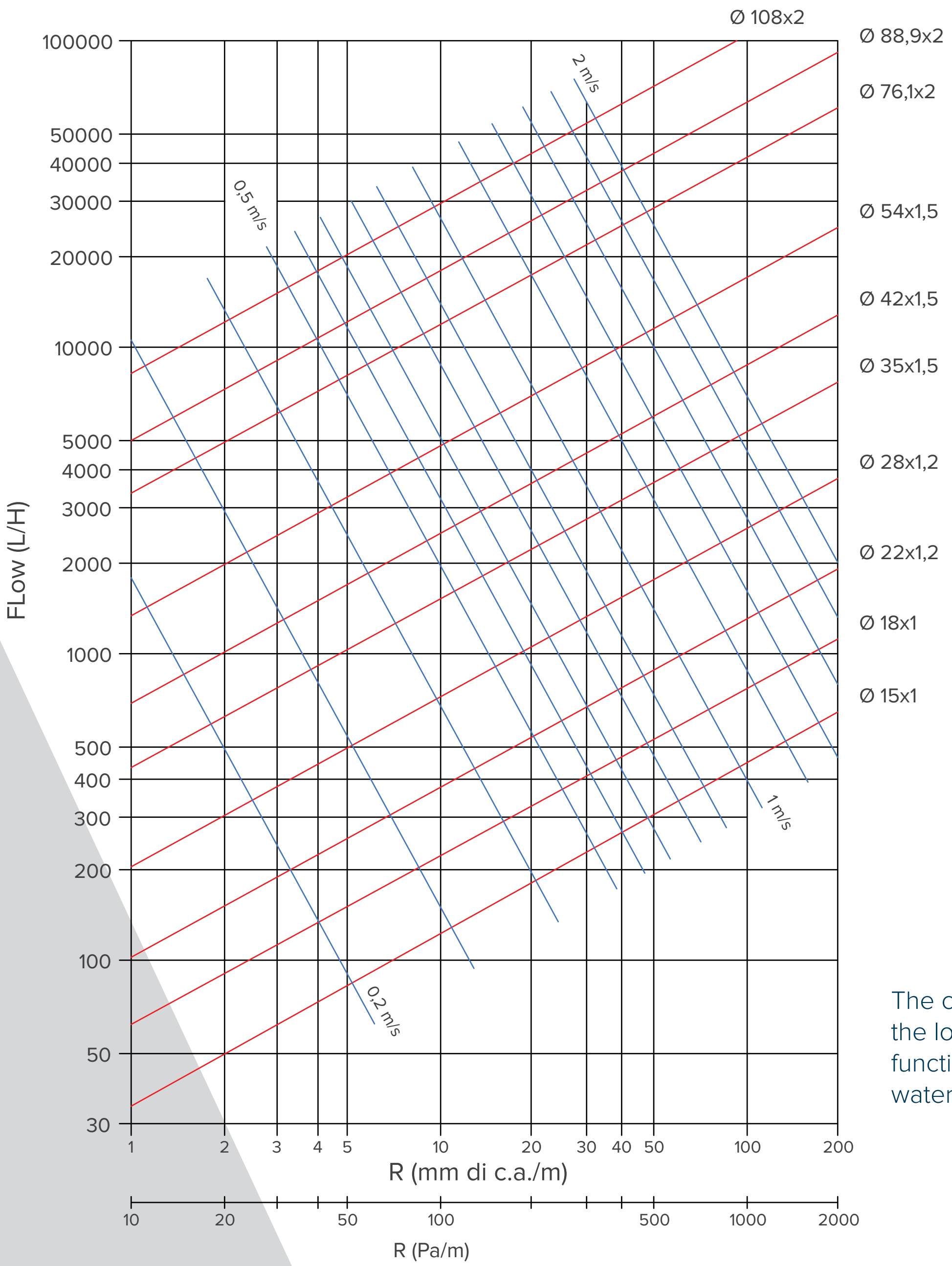


Table for heat loss [W/m] from nº 1.4401 (316) stainless steel tube (visible installation)

Diameter x thickness	Δv: Temperature difference [K]									
mm	10	20	30	40	50	60	70	80	90	100
15 x 1.0	2.72	5.44	8.16	10.88	13.60	16.32	19.04	21.76	24.48	27.20
18 x 1.0	3.29	6.57	9.86	13.15	16.44	19.72	23.01	26.30	29.59	32.87
22 x 1.2	4.02	8.04	12.06	16.08	20.10	24.12	28.14	32.16	36.18	40.20
28 x 1.2	5.15	10.31	15.46	20.61	25.77	30.92	36.08	41.23	46.38	51.54
35 x 1.5	6.44	12.88	19.32	25.76	32.21	38.65	45.09	51.53	57.97	64.41
42 x 1.5	7.76	15.53	23.29	31.05	38.81	46.58	54.34	62.10	69.86	77.63
54 x 1.5	10.03	20.05	30.08	40.11	50.13	60.16	70.19	80.21	90.24	100.26
76.1 x 2.0	14.14	28.28	42.42	56.56	70.70	84.83	98.97	113.11	128.43	141.39
88.9 x 2.0	16.55	33.11	49.66	66.21	82.76	99.32	115.87	132.42	148.97	165.53
108 x 2.0	20.15	40.31	60.46	80.61	100.77	120.92	141.70	161.23	181.38	201.53
139.7 x 2.6	26.54	53.09	79.63	106.17	132.72	159.26	185.80	212.34	238.89	265.43
168.3 x 2.6	31.98	63.95	95.93	127.91	159.89	191.86	223.84	255.82	287.79	319.77

The tube network places a continuous restriction on the flow of fluid resulting from friction which is known as **load loss**. This reduces pressure in the system as it flows through the tubes and accessories. This chart will help to calculate this factor.



The chart shows the value of the load loss R and the flow as a function of fluid velocity m/s for water at 10°C.

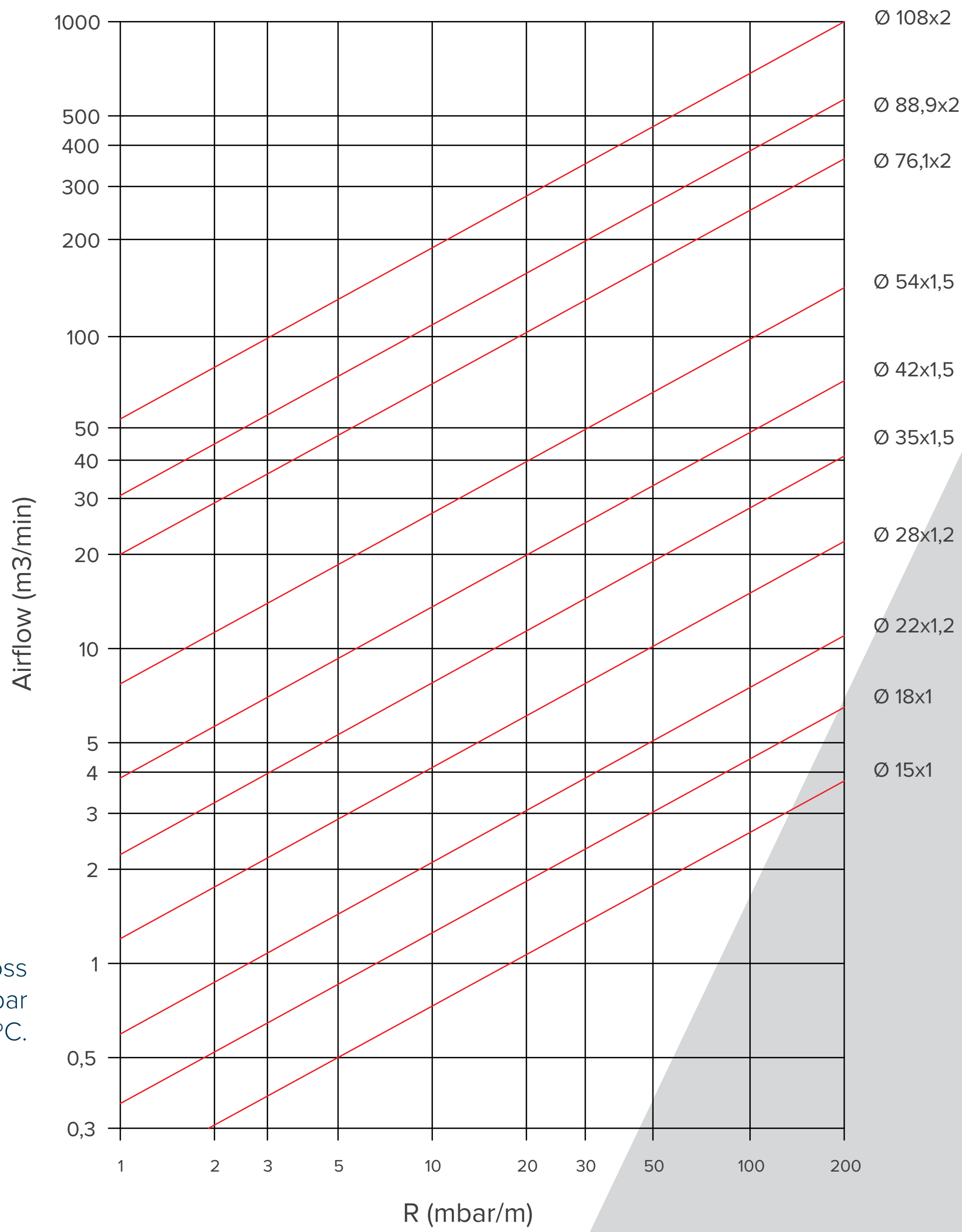
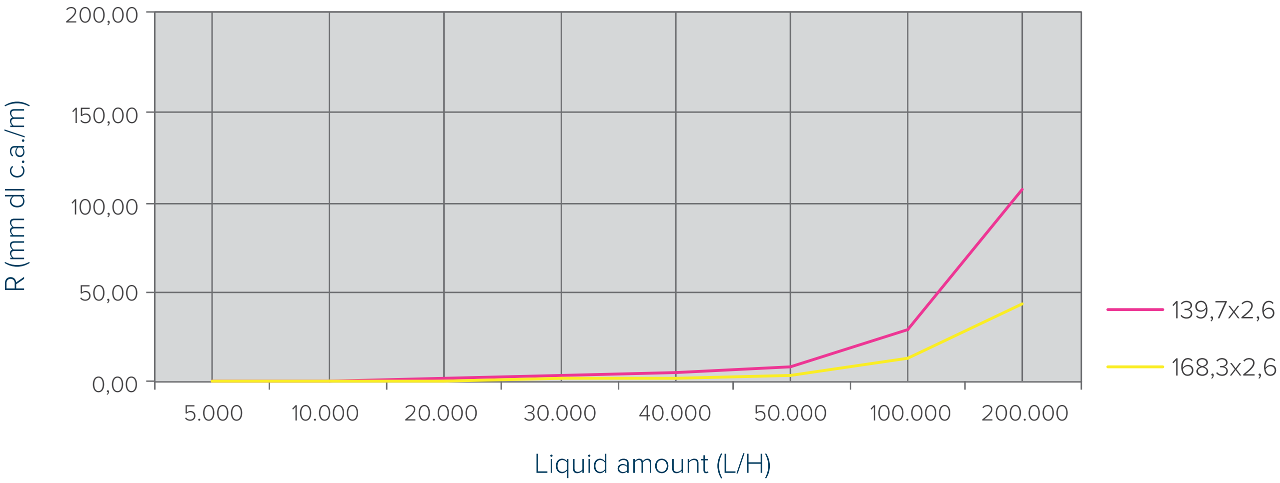
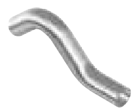


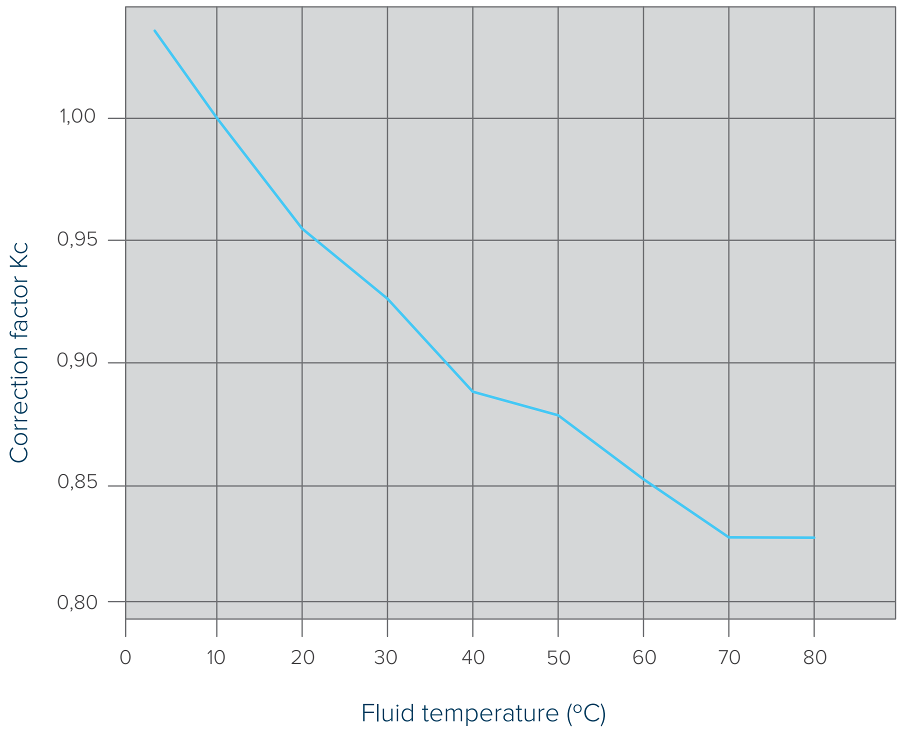
Chart of load loss for compressed air at 7 bar and 15ºC.



This graphic shows the values for the accessories 139.7 and 168.3.

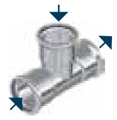
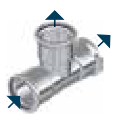
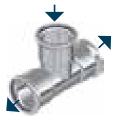
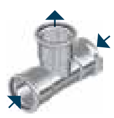
Table of load loss in the main pressfitting accessories (in equivalent metres of tube)

NUMEPRESS	Resistance coefficient in equivalent metres, calculated for a water velocity of 0.7m/s				
					
	1.5	0.7	0.5	0.5	0.4
15 x 1.0	0.90	0.40	0.30	0.30	0.25
18 x 1.0	1.10	0.50	0.40	0.40	0.30
22 x 1.2	1.40	0.60	0.50	0.50	0.40
28 x 1.2	1.90	0.90	0.60	0.60	0.50
35 x 1.5	2.50	1.20	0.80		0.70
42 x 1.5	3.10	1.40	1.00		0.90
54 x 1.5	4.00	1.80	1.30		1.10
76.1 x 2		2.50	1.90		1.60
88.9 x 2		3.00	2.20		1.90
108 x 2		3.50	2.60		2.20
139.7 x 2.6		4.75	3.49		2.93
168.3 x 2.6		5.72	4.21		3.53



We also have the correction Kc based on the water temperature.

Resistance coefficient in equivalent metres, calculated for a water velocity of 0.7m/s

				
0.9	1.3	1.5	3	1.5
0.50	0.70	0.90	1.80	0.90
0.65	0.90	1.10	2.30	1.10
0.80	1.20	1.40	2.80	1.40
1.10	1.50	1.90	3.80	
1.50	2.10	2.50	5.00	
1.80	2.60	3.10	6.20	
2.30	3.30	4.00	8.00	
3.10	5.00	5.60	11.50	
3.70	5.80	6.50	13.00	
4.40	7.00	7.80	16.00	
4.80	7.43	8.46	17.15	
5.87	9.08	10.34	20.96	
7.07	10.94	12.45	25.25	

REACTION TO CORROSION OF STAINLESS STEEL TUBES IN DRINKING WATER SYSTEMS

General

Perforation corrosion only occurs in stainless steel under certain conditions. Corrosion in fissures occurs in cracks or areas of sedimentation.

Resistance to interior corrosion

Austentic stainless steel is passive in drinking water systems. In this state it is completely resistant to uniform corrosion of its surface, avoiding any hygiene problems, such as, for example, contamination by heavy metals (non-ferrous metals).

Stainless steel is resistant to corrosion from the chemical products used in the treatment of drinking water. This is also true for decalcinated, decarbonated and distilled water.

The various forms of corrosion are defined below by their causes:

- **Perforation corrosion**: Perforation corrosion can only take place in wate with high levels of chlorides. In the use of AISI 316 stainless steel material, the concentration of chloride ions in the water cannot exceed 500 mg · l^{-1} = 30 mol · m^{-3}. Most other substances in water inhibit perforation corrosion. The probability of perforation corrosion in AISI 316 stainless steel material does not increase as a result of common chloride indices of 1 to 2 mg/l of water.

- **Fissure corrosion**: The contents of the “Perforation corrosion” section also apply here. Experience has shown that, under current application conditions, AISI 316 stainless steels fittings which contain molybdenum have sufficient resistance to fissure corrosion from water with authorised chloride levels in domestic sanitary water installations.

- **Intercrystalline corrosion**: In tests, tubes and fittings are shown to be resistant to intercrystalline corrosion. If water installations contains desinfectants, please always ask our technical department before use.

- **Transcrystalline corrosion resulting from tension-fissuring**: Transcrystalline corrosion does not take place in drinking water at temperatures below 45°C. This type of corrosion only occurs at higher temperatures combined with perforation and fissure corrosion. As a result, there will be no tension-fissuring corrosion if the stipulations of the “Perforation corrosion section” are followed.

Resistance to external corrosion

There is a risk of external corrosion when:

- Hot water tube system with accessories that come into contact with construction material containing chlorides (antifreeze, accelerators with chloride content) and insulating materials which contain chlorides; and when they are subject to humidity over prolonged periods which exceed those which normally occur during construction.

- It is not possible to avoid the appearance of humidity in hot water tubes and accessories which could result in higher chloride concentrations.

In such situations it is generally necessary to apply an anti-corrosive in layers. This layer needs to be thick, non-porous and defects, and to be resistant to heat and ageing. Plastic tape can be used as adequate protection against corrosion. Heat insulation measures are not sufficient to meet the requirements to ensure protection against exterior corrosion. The manufacturer's instructions should be followed.

If the stainless steel installation is in contact with construction materials which may be wet with water containing chlorides during a prolonged period, they should be dried before being installed.

In the case of installation on top of plaster or in installations under galleries, no anti-corrosive is required.

Mixed installations

Mixed installations of stainless steel tubes and galvanised steel tubes may result in contact corrosion in the latter.

This danger of contact corrossion is reduced with the installation of a non-ferrous metal accessory between the galvanised steel and stainless steel tubes. It is not necessary to observe the flow of the current.

There is no danger of contact corrosion in mixed installations of stainless steel with threaded or copper accessories.

Compensation of potential voltage

In accordance with current regulations, there should be compensation of potential voltage for all tubes which conduct electricity.

Stainless steel systems are conductors of electricity and therefore must comply with current regulations in this regard.

Physical properties	
Density	8.000 kg/m³
Specific heat (20°C)	500 J/kg · K
Thermal conductivity (20°C)	15 W/m · K
Linear elongation coefficient (20-200°C)	16.5 10^{-6}/K
Elasticity module (20°C)	200 KN/mm²
Electrical resistance (20°C)	0.75 Ω mm²/m

Mechanical properties	
Minimum elasticity limit	240 N/mm³
Minimum elongation	40%
Minimum breakage load	530 N/mm²

Chemical composition		
%	AISI 316L	AISI 304
Cr	16.5-18.5	17-19.5
Ni	10-13	8-10.5
Mo	2-2.5	
Mn max.	2	2
Si max.	1	1
P max.	0.045	0.045
S max.	0.015	0.015
C max.	0.03	0.07

Stainless steel is resistant to corrossion through its ability to remain passive in a large number of atmospheres. In its passive state, stainless steel has a very fine, invisible, stable protective layer.

Resistance to corrossion is not the same in all stainless steel, as some forms are more resistant than others. European regulation EN-10088 details the various types of stainless steel.

AISI 304 (1.4301) stainless steel is the most common form used in drinking water installations.

AISI 316L (1.4404) stainless steel is recommended when the level of dissolved chlorides in water exceeds 200 ppm (200 mg/litre), particularly for hot water installations, as the corrosive effect increases with temperature.

The difference between AISI 304 and AISI 316L is the presence of molybdenum (Mo) which is added to the alloy in a proportion of 2-2.5% to protect the stainless steel from the action of chloride.

Stainless steel is a poor conductor of heat, which means it can be used for transporting fluid with lower heat losses. The linear elongation tells us that elongation should be taken into consideration in installations which are subject to hot-cold cycles.

Comparison of main characteristics with other materials

	Physical properties		Mechanical properties		
	Specific weight (kg/dm³)	Linear elongation (k 10/°C)	Resistance to traction (N/mm²)	Elastic limit (N/mm²)	Lengthening
Stainless steel	8.0	16	600	220	45
Galvanised steel	8.0	12	350	220	25
Copper	8.9	16.5	250	130	50
Aluminium	2.7	24	90	70	15
Heat-resistant PVC		70	55		30

GUARANTEE

The guarantee covers defects in manufacture which are attributable to our areas of responsibility. This consists of the replacement of defective parts, and related dismantling and assembly costs. The guarantee is only valid when the joint has been created using NUMEPRESS tubes and accessories, and the joint has been pressfitted under pressure of not less than 32 Kn using a NUMEPRESS profile jaw. For diameters from 54 mm ask our technical department.

This guarantee is not valid if the installation was carried out by non-professionals or if the assembly instructions in our manual were not followed. Civil responsibility is limited to a period of ten years after the installation.

In the event of damage, this must be communicated to ISOTUBI, S.L. in writing within a period of five days from the accident. Defective NUMEPRESS tubes and accessories must be kept and made available to our technicians for the checks required in each case.

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2023 v.8