FRABO

TECHNICAL CATALOGUE

FRABOPRESS C-STEEL

GALVANISED CARBON STEEL PRESS FITTINGS

FRABOPRESS C-STEEL SECURFRABO

FRABOPRESS C-STEEL BIG-SIZE

Galvanised Carbon Steel press fittings

CONTENTS

DESCRIPTION

FRABOPRESS C-STEEL SECURFRABO

Carbon-steel press fittings with special high corrosion resistance zinc-plating treatment and high-performance **EPDM** o-ring. These fittings comply with the requirements of **UNI 11179** standard and feature a red mark indicating they are not suitable for use with drinkable water. Suitable for pressing with "V" type jaws.

FRABOPRESS C-STEEL BIG-SIZE

Large diameter (> 76 mm) carbon-steel press fittings with special high corrosion resistance zinc-plating treatment and high-performance **EPDM** o-ring. These fittings comply with the requirements of **UNI 11179** standard and feature a red mark indicating they are not suitable for use with drinkable water. Suitable for pressing with "M" type jaws.

FRABOPRESS CARBON STEEL RODS

Carbon steel pipe, galvanized internally and externally, or only externally, electrically welded (without external fillet weld) at high frequency induction with external fillet weld. Non-destructive test on 100% of the pipes with induced-current methods according to UNI EN ISO 10893 standard to ensure tightness

FRABOPRESS CARBON STEEL RODS WITH COATING

Carbon steel pipe, galvanized externally and internally, electrically welded (without external fillet weld) at high frequency induction, with external fillet weld and protected by a polypropylene coating (PP). Nondestructive test on 100% of the pipes with induced-current methods according to UNI EN ISO 10893 standard to ensure tightness of coated pipes, which are not painted on the outside.

ADVANTAGES

- Easy and quick installation
- High hydraulic and mechanical seal
- High resistance to hydro-saline mists
- Material ideal for containing system construction costs
- Reduced thermal dilation of the system
- Wide application range
- Pipes not painted on the surface for optimum grip of the O-ring
- Total protective galvanizing (both externally and internally)

In the text of this manual are detailed references to Italian product standards and national installation. References to national rules of other countries (eg Germany) are presented for information purposes.

To get detailed information about consult the Technical Service FRABO

TECHNICAL FEATURES

COMPLIANCE FEATURES

FRABOPRESS C-STEEL fittings are suitable for the realisation of pressed joints on zinc-plated steel tubes, with or without coating, in most heating and plumbing systems. The threaded carbon-steel fittings are manufactured in compliance with EN 10226-1 standard.

CONSTRUCTION FEATURES

Available range: 12, 15, 18, 22, 28, 35, 42, 54 mm for the **FRABOPRESS C-STEEL SECURFRABO** series
76,1, 88,9 et 108 mm for the **FRABOPRESS C-STEEL BIG-SIZE** series

Fitting profile: the profile chosen by **FRABO** (for V-jaws) for the **FRABOPRESS C-STEEL** series allows for a 3-point pressing and therefore it ensures a high tightness and firmness of the tube-fitting joint. Furthermore, during installation, while the tube is inserted in the fitting, the protruding neck of the **FRABO** fitting ensures a safer axial coupling.

For the **FRABOPRESS C-STEEL Big-Size** series, the type of profile adopted by **FRABO** requires (for "M" type jaws) the use of high-power equipment that is already commercially available for a strong pressing commensurate with the increased robustness of the large diameter fitting.

O-Ring: the joint is already equipped with O-Ring (**EPDM**) pre-assembled to ensure the maximum speed and security for each application.

FITTING TECHNICAL FEATURES				
FIELDS OF APPLICATION	FRABOPRESS C-STEEL SECURFRABO		FRABOPRESS C-STEEL BIG SIZE	
	Pmax (bar)	Tmax °C	Pmax (bar)	Tmax °C
Heating	16	0° / +110°C	10	0° / +110°C
Cooling *	16	-10° / +110°C	10	-10° / +110°C
Compressed air (residual oil <5 mg/m^3)	16	30°C	10	30°C
Compressed air (residual oil >5 mg/m^3) (with O-ring FKM)	16	30°C	-	-
Sprinkler **	16	30°C	10	30°C

* Residual oil content below 5mg/m3 (Class from 1 to 4 according to ISO 8573-1:2001).
For oily residue according to Class 5 use the seal in FKM;
** Sprinkler fire-fighting systems. Please contact our technical department for further information regarding fire protection applications;

TUBES TECHNICAL FEATURES			
FEATURES	C-STEEL TUBES	C-STEEL COATED TUBES *	C-STEEL TUBES EXTERNALLY ZINCATED
Protective coating	Not present	PP	Not present
Material	1.0220 (E260)	1.0220 (E260)	1.0220 (E260)
Zinc-coating	Hot-galvanised steel sheet	Hot-galvanised steel sheet	Electrolytic external only
Protective zinc-coating	Internal and external	Internal and external	Only external
Welding treatment	Without external fillet weld	Without external fillet weld	Without external fillet weld

* The coating does not indicate heat insulation, but it provides corrosion protection for applications in the presence of rain and humidity or concealed installations;

CARBON STEEL

Among all metals used in heating and plumbing, **FRABOPRESS C-STEEL** carbon steel allows the realization of systems in a quick and extremely economical way. The **C-STEEL** tubes and fittings are made from hotrolled steel sheet. The rigorous 100% inspection and the accurate zinc-plating treatment produce safe and reliable joints.

Carbon steel can be used in a number of applications such as closed-circuit heating systems, compressed-air systems and fire systems (sprinkler systems). Since this steel is much more exposed to oxidation compared to conventional metals such as stainless steel and copper, carbon-steel tubes with protective coating should be used for buried trace systems.

The **FRABOPRESS C-STEEL** fittings series is characterised by a special high resistance zinc-plating system. This treatment considerably increases the oxidation time of standard corrosive agents. The carbon-steel tubes, with or without coating, are manufactured following the highest manufacturing quality standards: the red marking on the fittings reminds that this system is **NOT** suitable for use with potable water.

MATERIAL

FRABOPRESS C-STEEL SECURFRABO AND C-STEEL BIG SIZE JOINTS

The **FRABOPRESS C-STEEL** carbon steel galvanized high protection fittings are equipped with the high performance black **EPDM** gasket.

FRABOPRESS C-STEEL PIPES

They are made of carbon steel (non-alloy thin-walled steel conform to EN 10305-3) with a completely protective zinc-coating (both internally and externally) or external only, electrically welded at high frequency induction, with external fillet weld.

The pipes are available in lengths of 6 meters in a version coated with polypropylene (PP) and uncoated (the coating does not indicate heat insulation, but it provides corrosion protection for applications outside in the rain and humidity or concealed installations).

The optimum galvanization of tubes and fittings allows a complete system (tubes and fittings) with good corrosion resistance: in case of occasional and short-lived corrosion danger, due to the effects of moisture, galvanized steel ensures long term integrity and durability.

In any case where there is a greater risk of corrosion, galvanized steel must be further protected.

For fire systems:
Class A of the materials – DIN 4102, section 1, non-inflammable tubes and fittings:

- **FRABOPRESS C STEEL** with bare tube, galvanized internally and externally

For detailed information on the use of **FRABOPRESS C-STEEL** fittings for fire protection systems, contact the Engineering Department.

WATER PIPES CONTENTS	
Diameter x thickness [mm]	Water content (l/m)
12,0 x 1,2	0,072
15,0 x 1,2	0,125
18,0 x 1,2	0,191
22,0 x 1,5	0,283
28,0 x 1,5	0,491
35,0 x 1,5	0,804
42,0 x 1,5	1,194
54,0 x 1,5	2,042
BIG SIZE	BIG SIZE
76,1 x 2,0	4,081
88,9 x 2,0	5,658
108,0 x 2,0	8,491

FRABOPRESS C-STEEL FITTING GASKET SEALS - O-RING

The retaining ring of the **FRABOPRESS C-STEEL** series is made of black **EPDM**. The high performance and excellent behaviour of this material against ageing, ozone, sunlight, weather, alkaline substances, and a number of chemical compounds allow its safe and durable use in various civil and industrial applications.

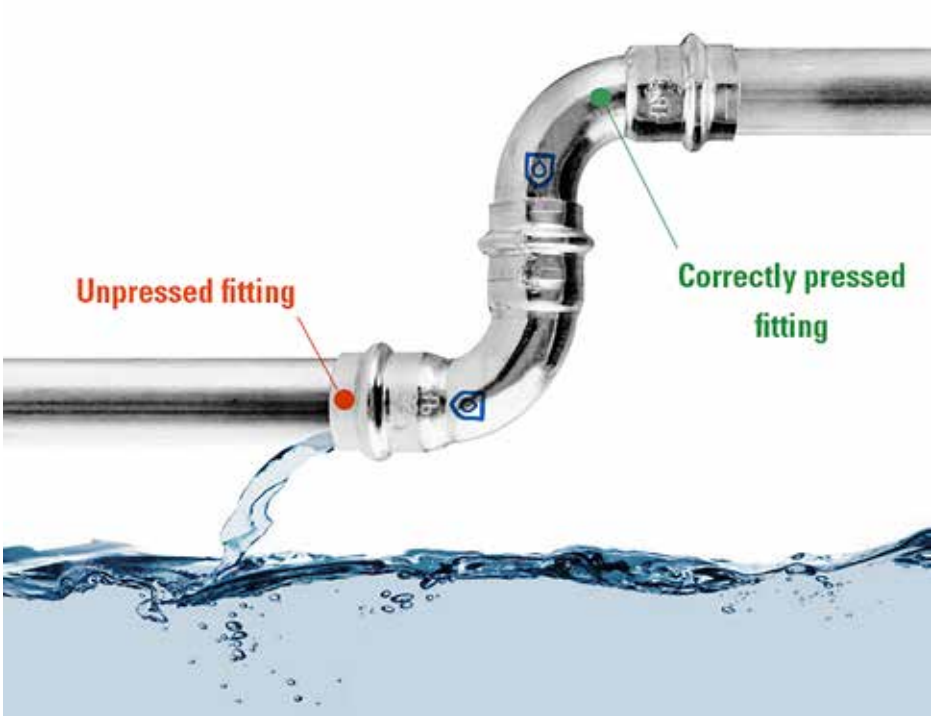
The maximum operating temperature that can be handled by the sealing gaskets is 110°C.

The **EPDM** o-ring complies with EN 681-1 standard. The **EPDM** polymer of the **FRABOPRESS C-STEEL** series is not resistant to fuel gases, oils, petrol, turpentine, and hydrocarbons in general.

Where necessary convey fluids containing mineral oils (fuel, diesel oil, etc...) or for installations subjected to high operating temperatures (up to 160°C for continuous use and 200°C for short term peaks) **FRABO** provides the appropriate **FKM** seals, suitable for these types of applications.

For fluids other than heating water please contact **FRABO**'s technical service.

SECURFRABO



FRABOPRESS C-STEEL SECURFRABO fittings are equipped with the new **SECURFRABO** safety system, which allows any un-pressed fittings to be detected. The **SECURFRABO** system is made using an elastomeric gasket whose patented shape allows liquid to leak out if the junction has not been pressed.

Thanks to **SECURFRABO**, when the system is tested, the fitting end not pressed can be quickly identified and action can be taken so as to reduce the possibility of mistakes or oversights that can reduce the system's effectiveness over time.

USABLE PIPELINES

The **FRABOPRESS C-STEEL** carbon steel fittings and tubes can be used in a number of applications such as heating systems, closed-circuit compressed-air systems and fire systems (sprinklers) and gas and they comply to the following requirements:

- Fittings made of carbon-steel with **EPDM**/**HNBR** elastomeric seals
- Tubes galvanized internally and externally, made of carbon steel welded with external bead weld in accordance with EN 10305, polypropylene coated version and uncoated or external electrolytically galvanized.

With the **FRABOPRESS** system, it is possible to connect all pipes provided in the EN 10305-3 standard, with the thickness reported in the table.

THICKNESSES FOR HEATING / COOLING SYSTEMS								
External Pipe Diameter [mm]	12	15	18	22	28	35	42	54
Minimum thickness [mm]	1,2	1,2	1,2	1,5	1,5	1,5	1,5	1,5

The indicated thicknesses must be considered as reference to obtain a problem-free junction.

MARKINGS

The marking of **FRABOPRESS C-STEEL** fittings allows for an easy identification and provides useful information about their application field.

In fact, they are provided with a red mark, featuring a banned tap, to indicate they are **NOT** suitable for drinkable water (NOT for drinkable water).

In addition to the nominal diameter of the fitting and the initials of the manufacturer, the marking indicates:

NOT FOR DRINKABLE WATER: this means that the tubes used with carbon-steel fittings are not suitable for household water applications.

The **RED COLOUR** allows an easier identification.

The fittings with SECURFRABO system are characterized by the presence of the symbol

STORAGE

Even if it is zinc-plate, the tube must be protected against humidity and contact with water, which causes stagnation inside the storage pack. It is recommended to store the rod bundle in a dry place and loosely, to prevent the possible formation of blooms of zinc.

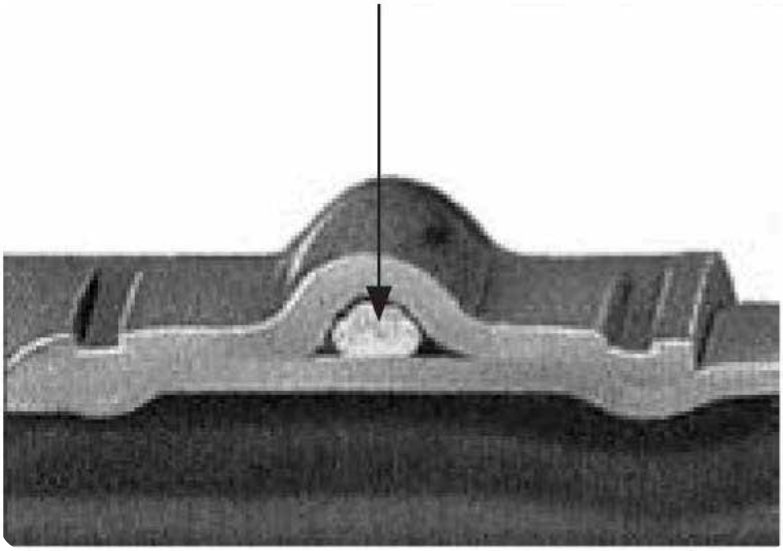
PRESSING / JAW EQUIPMENT

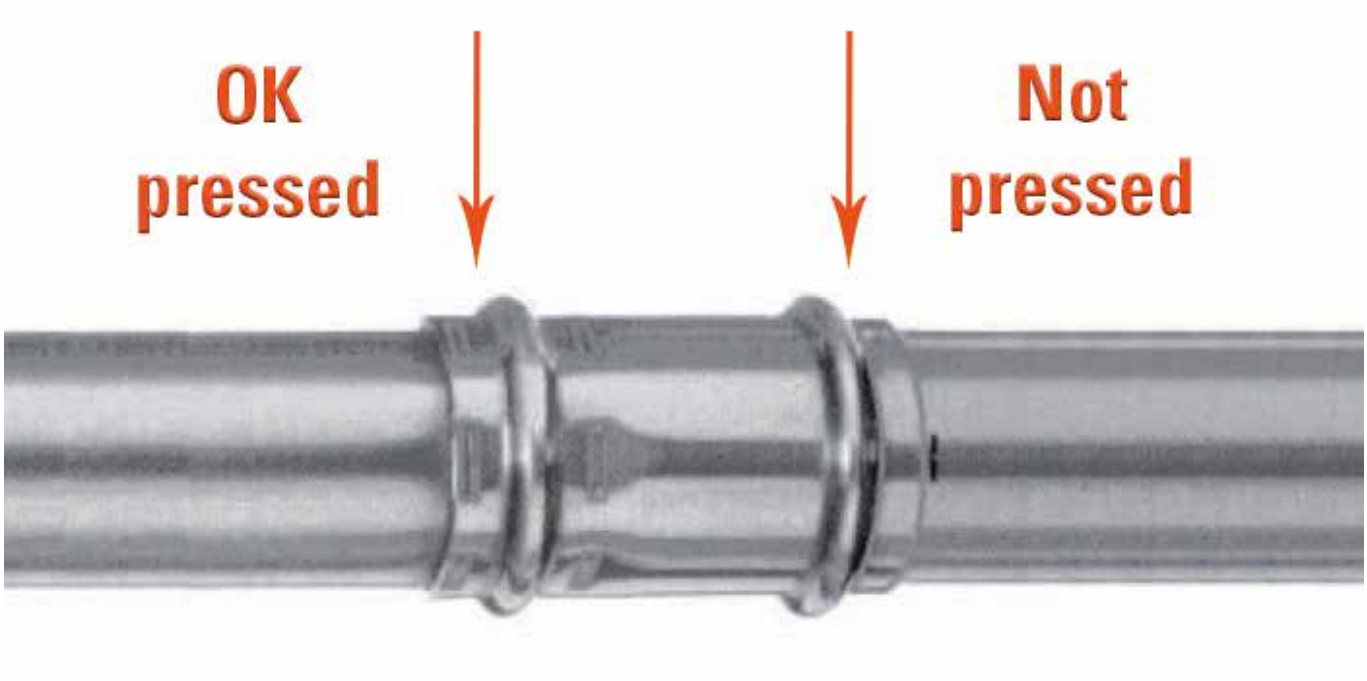
The installation tools for the **FRABOPRESS C-STEEL** products comprise a set of electronically controlled electromechanical equipment. Please refer to the printed price list or the website www.frabo.com to see the updated list of available equipment.

Thanks to the deformation imposed on the fitting and the conduit, the pressing tools create a permanent junction, which is constantly airtight and not removable.

For the definition of the operational methods for the use of the pressing tool, carefully consult the equipment manual.

A clear visual example of the nature of the deformation is provided in the next figures.





A notable characteristic of the electric pressing tools provided by **FRABO** is the ability to optimize the pressure force based on the nominal diameter to compress.

For larger diameters (42, 54, 76.1, 88.9 e 108) the **FRABOPRESS** system proposes, instead of traditional pressing jaws, chains with the same function. (fig.1)

Figure 1 - Chain and its adapter

COMPATIBLE INSTALLATION EQUIPMENT

For the installation of **FRABOPRESS C-STEEL** fittings, original **FRABO** jaws or jaws with the same profile ("V" up to 54 and "M" from 76.1 to 108) can be used.
A good number of pressing tools, produced by different manufacturers, is available on the market and can be used for **FRABOPRESS C-STEEL** fittings.

For the sake of simplicity, we list the minimal characteristics of the pressing tools here below:

- Minimum pressing force of the electric tool: 32kN with standard pressing machine, 19kN with compact pressing machines (up to diam. 28)
- Jaw profile suitable for **FRABOPRESS** fittings

TOOLS FOR FRABOPRESS C-STEEL BIG SIZE

For large diameters **FRABO** provides an electric tool with suitable features and special chains of the appropriate size to offer excellent pressing quality. The size of the forces and profile of the chains are especially designed to uniformly distribute the pressure onto the fitting.

The minimum pressing force of the electric tool is 45 kN.

ATTENTION

Except in cases where the manufacturer of the pressing equipment explicitly declares the compatibility of its electric tool with jaws produced by other manufacturers, the use of a brand of jaws different from that of the electric tool is not allowed.

The chain offers the advantage of a smaller footprint during positioning and pressing and allows the achievement of an installation with excellent concentricity between the pipe and the fitting.

Using suitable jaws, the electric tool supplied by **FRABO** can also be used for other pressing systems.

INSTRUCTIONS FOR FRABOPRESS C-STEEL INSTALLATION AND ASSEMBLY

Cut the pipe across its section by means of a pipe cutter

The pipe can also be cut across its section using a fine teeth steel saw

Deburr the pipe both inside and outside.

Check that the O-Ring is well fitted

Pull the pipe into the fitting up to the stop

Mark the pipe on the stop position

Insert the jaw suitable for the pressing tool and push the pin until it locks

Open the jaw and place it across the fitting

Start pressing. The jaw must close completely

The installation sequence of the product FRABOPRESS C-STEEL was performed using a NOVOPRESS ECO202 machine and a “V” profile Novopress PB2 jaw.

TECHNICAL SOLUTIONS FOR INSTALLATION AND ASSEMBLYFRABOPRESS C-STEEL

FRABOPRESS C-STEEL represents the ideal solution for a variety of systems. A good installation depends on the degree of accuracy used for the assembly of the various components and respect for some simple technical rules in addition to the Regulations.

CUTTING OF THE PIPE

The carbon-steel tubes used with the **FRABOPRESS** fittings have to be cut by means of a perfectly efficient tube cutter. By using this tool, the cut will not have burrs and will be perpendicular to the pipe's axis. Other cutting systems can of course be used, although they are discouraged. In any case, it is absolutely necessary to deburr and calibrate the pipe.

The PolyPropylene coated pipes must be peeled. The operation can be facilitated by the use of suitable commercially available tube cutters.

DEBURRING THE PIPE

Once the pipe has been cut to the desired size, it is always necessary to carefully deburr its internal and external extremities. This is indispensable if you use cutting methods, which produce burrs (i.e. manual or electric saws). The removal of any residual chips prevents the possible damage of the O-ring gasket once the pipe is introduced into the fitting.

DEPTH OF THE CONNECTION

To be absolutely sure of the correct depth of the connection of the pipe inside the fitting, it is sufficient to mark the depth of the connection beforehand, or make sure that the pipe is introduced up to the end stop in the coupling block of the fitting itself.
In the case of passing fittings, i.e. without an arresting block, or for a better quality of work, it is advisable to trace the depth of the connection on the pipe, in order to verify, visually as well, the proper insertion of the pipe.

CONTROL

Before proceeding, it is best to check correct O-ring position beforehand; then check its integrity and cleanliness.

PRESSING

To perform a proper pressing, the appropriate equipment must be used, which can be battery powered or plugged into an electricity supply. For each diameter of pipe utilized, the appropriate deformation jaws must be used to permit the realization of a perfectly airtight junction.
To perform perfect pressing, put the fitting inside the jaw and keep the tool positioned at right angles to the pipe.

Ensure that the toroidal chamber of the fitting (which contains the O-Ring) is properly positioned inside the corresponding groove of the jaw.

Then begin pressing the junction; the pliers will automatically perform the deformation until its completion.

INSTRUCTIONS FOR INSTALLATION AND ASSEMBLY FRABOPRESS C-STEEL BIG-SIZE

Cut the pipe across its section by means of a pipe cutter

The pipe can also be cut across its section using a fine teeth steel saw.

Check that the O-Ring is well fitted

Mark the pipe on the stop position

After having visually verified the correct positioning of the sealing gasket and the absence of foreign bodies, proceed to assembling the fitting on the pipe until it is firmly attached. Then open the chain jaw and position it perpendicularly on the fitting.

Connect the pressing tool with the adapter to the chain and start pressing. The jaw must close completely.

Connect the electric tool equipped with a chain adapter and begin pressing. It will run completely automatically.
NOTICE: the chain must close completely.
After pressing, the adapter can be opened and disconnected from the chain remaining on the piece

After pressing, open the adapter and remove it from the chain.

The installation sequence of the FRABOPRESS C-STEEL BIGSIZE product was performed using a NOVOPRESS ECO3 machine, a NOVOPRESS ZB321 adaptor and an “M” profile 76.1 diameter chain.

ADAPTOR FOR 108 DIAMETER
NOTICE: The installation of a 108 diameter FRABOPRESS C-STEEL BIGSIZE fitting with the same NOVOPRESS tools would have required repeated pressing with the same chain making use of the ZB321 adaptor first and then the ZB322 adaptor.

TECHNICAL SOLUTIONS FOR C-STEEL BIG-SIZE INSTALLATION AND ASSEMBLY

The **FRABOPRESS C-STEEL Big-Size** system is an excellent solution for the realization of many types of large capacity plants. A good installation depends on the degree of accuracy used for the assembly of the various components and respect for some simple technical rules in addition to the Regulations.

CUTTING OF THE PIPE

The pipes used in coupling with the fittings **FRABOPRESS C-STEEL Big-Size**, must be cut perpendicular to the tube axis. Given the size, the integrity of the pipe must be carefully verified, so that it does not become crushed. It is not recommended to use grinders since excessive burrs can be caused. In any case, it is absolutely necessary to deburr and calibrate the pipe.

DEBURRING THE PIPE

Once the pipe has been cut to the desired size, it is always necessary to carefully deburr its internal and external extremities. This operation is absolutely indispensable whenever the adopted cutting system can create burrs; for example hand saws and electric saws. The use of professional equipment is therefore recommended to carry out this operation (eg. specific electrical deburring systems).

The removal of any residual chips prevents the possible damage of the O-ring gasket once the pipe is introduced into the fitting.

DEPTH OF THE CONNECTION

To be absolutely sure of the correct depth of the connection of the pipe inside the fitting, it is sufficient to mark the depth of the connection beforehand, or make sure that the pipe is introduced up to the end stop in the coupling block of the fitting itself.

In the case of through fittings, i.e. without an end stop, or for a better quality of work, it is advisable to mark the depth of the connection on the pipe, in order to verify, also visually, the proper insertion of the pipe.
The use of lubricants is recommended to facilitate the insertion of the tube inside the fitting.

CONTROL

Before proceeding it is best to first verify the presence of the O-ring gasket, followed by its integrity and cleanliness, and then the correct positioning of the O-ring. Do not ignore scratches or incisions on the pipe either, which could interfere with the sealing ring once it has been inserted: in these cases, it may not be possible to have a proper seal even after pressing.

PRESSING

To perform correct pressing, the appropriate equipment must be used, which can be battery powered or plugged into an electricity supply. For each diameter of pipe used, the appropriate deformation jaws must be used to permit the creation of a perfectly airtight junction.

To perform perfect pressing, put the fitting inside the jaw and keep the tool positioned at right angles to the pipe. Ensure that the toroidal chamber of the fitting (which contains the O-Ring) is properly positioned inside the corresponding groove of the chain.

Then begin pressing the junction; the pliers will automatically perform the deformation until its completion. Ensure that the pressing machine is positioned in line with the chain and perpendicular with the pipe so as not to cause excessive stress that could damage the equipment (breakage of the jaw or press).

FRABO provides high-quality pressing machines in its catalogue, as well as a model equipped with electronic sensors for effective and safe pressing. Please refer to the manuals of the specific machines for further information on use and maintenance.

PIPE BENDING

The **FRABOPRESS C-STEEL** range includes 45° and 90° elbows allowing changes of direction without the need of bending the tube.

We strongly advise not to bend these tubes. The use of inappropriate methods or tools might crash the tube and affect its safety.

However, sometimes, the cold shaping of the pipes is necessary. To carry out this type of operation, the use of a special pipe-bending tool is absolutely recommended.

The minimum bending radius (R) can be deduced from the following relationships:

R = 6 x D

where D is the diameter of the pipe

Avoid making bends that have a minimum radius that is lower than that indicated.

NB: Before bending, check the position of the electrowelding line.

Hot pipe bending using an acetylene torch or other tool is absolutely unacceptable.

A minimum distance is to be left from the bend made on the tube to install the fittings (fig. 2)

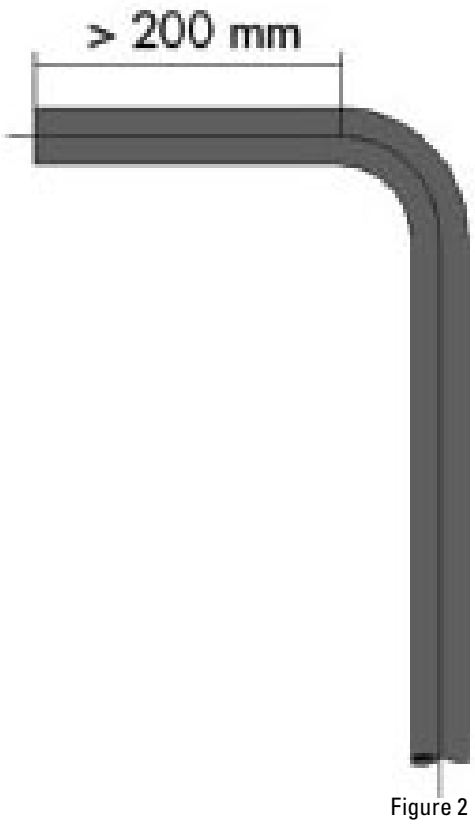


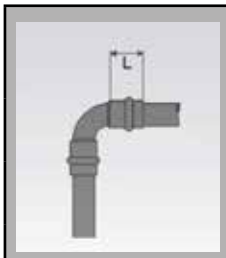
Figure 2

IT IS ABSOLUTELY FORBIDDEN TO BEND PIPES OF DIAMETERS THAT CAN BE COUPLED WITH FRABOPRESS BIG-SIZE FITTINGS.

FITTING DEPTHS

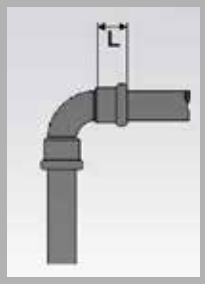
The installation depths and the coupling tolerances are designed and implemented with the utmost attention to ensure the highest degree of safety of the junction.

The connection depths based on the diameter are reported in the following table.



Nominal Diam. [mm]	L [mm]
12	19
15	21
18	22
22	23
28	24
35	25
42	35
54	39

Big size

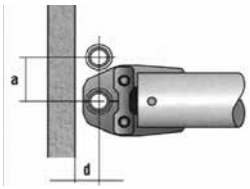


Nominal Diam. [mm]	L [mm]
76,1	50
88,9	55
108	70

INSTALLATION DEPTHS

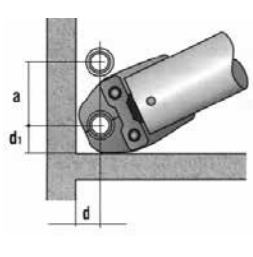
The use of the cold pressing technique gives a great advantage in terms of execution time of the connections. To facilitate correct installation, the cases that we report below may prove useful, as they very clearly exemplify the minimum installation depths that allow an installation that is easy and free of annoying complications.

The distances from walls, corners, and cracks in the wall necessary for the installation of pipelines can be deduced from the diagrams and the following tables:



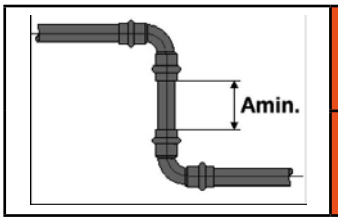
Nom. diam. mm	12	15	18	22	28	35	42 chain	54 chain	76,1 chain	88,9 chain	108 chain
d mm	20	20	22	25	25	30	75	85	110	120	140
a mm	56	56	60	65	75	83	115	120	140	150	170

Minimum depths of the pipelines installed in-wall



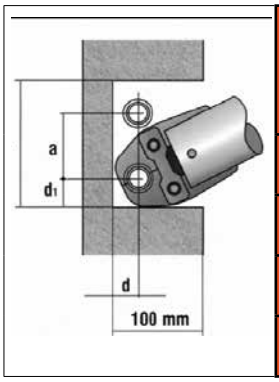
Nom. diam. mm	12	15	18	22	28	35	42 chain	54 chain	76,1 chain	88,9 chain	108 chain
d mm	31	31	31	31	31	31	75	85	110	120	140
a mm	80	80	80	80	80	84	75	85	110	120	140
d1 mm	28	28	28	35	35	44	115	120	140	150	170

Minimum depths of pipelines installed near corners



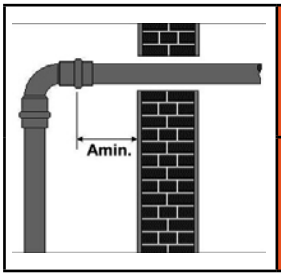
Nom. diam. mm	12	15	18	22	28	35	42	54
A mm	10	10	15	20	20	25	30	35

Minimum distance from the fitting to the wall for passing through walls



Nom. diam. mm	12	15	18	22	28	35	42 chain	54 chain	76,1 chain	88,9 chain	108 chain
d mm	31	31	31	31	31	31	75	85	110	120	140
a mm	80	80	80	80	80	84	75	85	140	150	170
c mm	155	155	161	173	181	206	265	290	350	390	450
d1 mm	28	28	28	35	35	44	115	120	140	150	170

Minimum depths of pipelines installed inside cracks and crevices



d mm	12-54
A mm	50

Minimum distance between two pressed fittings

NOTE - COMPACT PRESSES

Smaller pressing tools, with less obstructive jaws, are also present on the market.It is therefore possible to perform, in an even easier way, the maneuvers needed during pressing.

APPLICATIONS AND PLANT DESIGN PROBLEMS
TYPE OF APPLICATIONS

FRABOPRESS C-STEEL fittings can be used for a whole range of applications:

- NON-POTABLE WATER
- HEATING / COOLING
- COMPRESSED AIR AND INERT GASES
- TREATED WATERS
- FIRE PROTECTION (Sprinkler)

SPECIAL APPLICATIONS

For special applications the special red **FKM** O-ring available optionally must be used.

- COMBUSTIBLE OILS

NON-POTABLE WATER AND TREATED WATER

FRABOPRESS C-STEEL fittings are an ideal and reliable solution for many applications for closed-circuit nondrinkable water systems.
FRABOPRESS C-STEEL can also be used when building rainwater systems.

HEATING/COOLING

FRABOPRESS C-STEEL fittings offer great advantages for heating/cooling systems: The speed of system implementation, the ease of installation, and the guarantee of a perfect seal are the result of careful planning.

FRABOPRESS C-STEEL are also suitable in heating systems which use glycol as anti-freeze agent in standard ratios.

Given the broad category of products and additives on the market, it is advised to verify the compatibility between the antifreeze fluids and the material forming the tubes, gaskets and fittings. In the course of need, contact the technical department.

COMPRESSED AIR

Compressed air is widely used in all industries and its applications are endless. **FRABOPRESS C-STEEL** fittings are ideal for compressed-air systems thanks to their extremely quick installation.

The creation of the system starts from the connection of the compressor (downstream from the oil and condensate filtering unit) up to the end supply point; a max. operating pressure of 16 bars is recommended.

FIRE PROTECTION

The fittings **FRABOPRESS C-STEEL** conform to Class 1 of the UNI 11179 regulation (which includes the use of fire-protection systems).

The system **FRABOPRESS C-STEEL** is particularly suitable for the realization of sprinkler systems (wet) as required by UNI 12845. The ease of joining and the wide range of articles (i.e. threaded crosses and the tees for fixing the sprinkler) make the **FRABOPRESS C-STEEL** system very fast and convenient for the realization of this fire-fighting equipment. Also suitable for rain extinguishing systems (sprinkler/wet) thanks to the pressure warranty seal up to PN 16 bar (up to 54mm dia.)

Class A of the materials – DIN 4102, section 1, non-inflammable tubes and fittings:

- **FRABOPRESS C STEEL** with bare tube

Class B materials - DIN 4102, section 1, non-flammable pipes and fittings:

- **FRABOPRESS C STEEL** coated tube - with plastic coating of 1 mm thickness

For detailed information on the use of **FRABOPRESS C-STEEL** fittings for fire protection systems, contact the Engineering Department.

SPECIAL APPLICATIONS

COMBUSTIBLE OILS

In industrial applications, where the transport of combustible oils is necessary, the use of **FRABOPRESS** fittings with a red **FKM** O-Ring is recommended. The special mixture used makes this O-Ring resistant to the common combustible oils. For special applications it is recommended to consult the **FRABO** technical support office

PLANT DESIGN PROBLEMS

This catalogue provides a quick overview of the most common plant design problems.
The topics covered are principally intended to increase the attention of the designer to the most common plant design problems that they can meet to guarantee the realization of plants that are safe and reliable over time. Therefore, please refer to more comprehensive discussions and the full texts of the regulations to learn more about the issues presented in this catalogue in an in-depth way.

CONDENSATION

The changing of state from a vapour to a liquid is called condensation: when there is a sudden temperatureD-difference between the substance in the form of a vapour (e.g. water in the air) and a colder wall, it is likely that condensation will form.

Condensation in metal pipes may lead to oxidation and corrosion, which can affect the tightness and reliability of the system.

If a water supply system passes near a source of heat, it is recommended to use insulated tubes in the section affected, in order to avoid the condensation itself.

Insulated tubes are preferable for refrigerated water systems to reduce condensate.

FREEZING AND ANTI-FREEZE

It is known that freezing water increases in volume. This can cause breakage of tanks and deformations in the sections of the system where the increase in the volume of the water is hindered.

Should the pressing fittings be used in systems where the temperature is close to zero with possible formation of ice, it is recommended to empty the system (compressed air or inert gas can be used during inspection).

The strong stresses that any frost could give to the pipeline could also negatively affect the seal of the fitting, reducing performance and causing undesired leaks. In these cases, the use of antifreeze systems that are designed to ensure circulation within the system even at low temperatures is recommended.

ADDITIVES

In case of the use of anti-corrosion or antifreeze additives, it is recommended to contact the FRABO technical support office to verify their suitability. The additive's chemical composition may reduce the efficiency of the sealing device, compromising its durability and reliability.

COMPRESSED AIR FILTRATION

Compressed air systems require adequate filtering as since compressed air contains a high quantity of contaminants. Contamination essentially derives from three main sources: the environment (from which it is taken), the compressor (materials, lubrication, etc.), the storage tanks.

It is recommended to use **FRABOPRESS C-STEEL** fittings downstream from the compressor (after the filtering and condensate-collection units) so that the compressed air is conveyed in a safe and protected system, and with oil residues that do not damage the coupling elements. It is always recommended to provide filtering stations to minimize the circulation of contaminants.

Furthermore, the water vapour that is contained in the compressed air is the greatest contaminant of the air and acts as a catalyst: in the form of condensation it is combined with substances in suspension and forms abrasive and corrosive sludges. Whenever oily substances are present at high concentrations (oil residue **SUPERIOR** to 5mg/m³ (Class 5 according to ISO 8573-1:2001) the use of the red **FKM** O-ring available in the FRABO catalogue is recommended.

MECHANICAL VIBRATIONS

The mechanical stresses and vibrations that affect a system may make it less reliable in the long run. In this case, use mechanical circuit-breakers to separate the source of vibrations from the rest of the system and carefully assemble the tubes fixing brackets with the utmost care in order to reduce the effects of vibrations.

The piping systems are not in themselves sources of vibration or noise transmission. However, they can transmit vibrations and noises generated by other causes (equipment, engines) and therefore it is advisable to separate them mechanically and soundproof.

HEAT

If the operating temperature of the fluid is high or the system is located near heat sources (boilers / solar panels / industrial panels with high temperatures, etc.), it is important to ensure protection against heat.

For this, whenever the temperature of transported fluids exceeds 110°C, the use of specific high-performance O-rings is recommended. **FRABO** offers a red **FKM** O-Ring that can withstand temperatures (up to 160°C for continuous use and 200°C for short-term peaks). Moreover, if the system is located near heat sources, it is important to prepare insulating sheaths to reduce the formation of any condensation

PROTECTION FROM CORROSION
INTERNAL CORROSION

In closed-circuit systems there is not usually any exchange of oxygen, therefore there is no risk of corrosion. Small amounts of oxygen can penetrate into the system during filling or topping up, however this has almost no effect on the system since the amount of oxygen is practically negligible with respect to the whole internal metal surface area of the pipe.

EXTERNAL CORROSION

FRABOPRESS C-STEEL pipes/fittings are protected against external corrosion by zinc plating. However, if the humidity acts over a prolonged period on the system components, external corrosion may arise.

The PP coating offers effective additional protection against external corrosion for FRABOPRESS C-STEEL pipes, whereas the fittings can be protected with some simple steps, such as:

- Coatings with closed-cell expanded elastomer insulating materials
- Corrosion resistant bandages
- Painting

NOTICE: Felt coatings are not allowed as it would absorb and withhold the humidity, hence causing more corrosion.

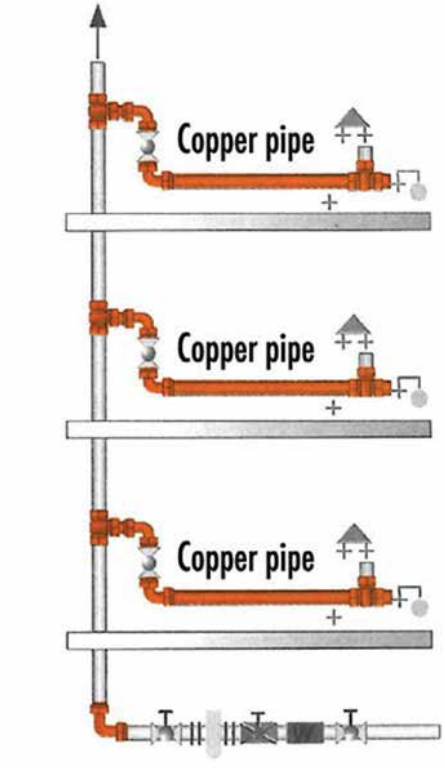
NOTICE: Do not lay in corrosive environments (e.g. floors in direct contact with the soil).).

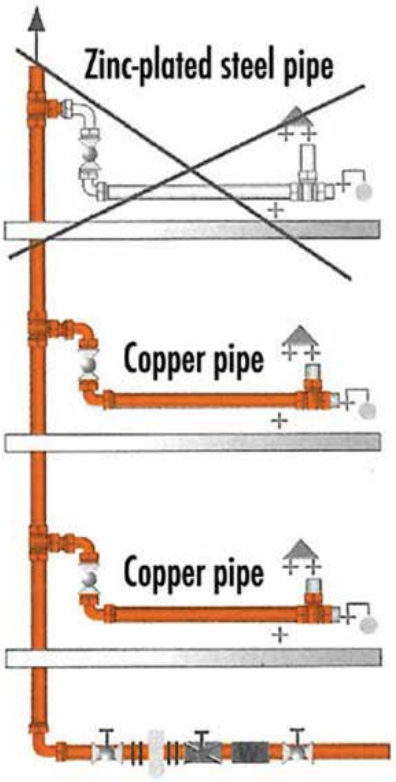
MIXED INSTALLATIONS

Whenever it is necessary to achieve a mixed system, it is recommended to observe the basic rules to prevent corrosion.
The bimetallic corrosion occurs when two materials with a significantly different electrochemical potential are located in (electrical) contact between them in the presence of an aggressive electrolyte (normally water). The less noble metal, i.e. the one having the most negative potential, undergoes the corrosive attack with an intensification factor proportional to the ratio between the areas of the two metals.
The carbon steel used for **FRABOPRESS C-STEEL** fittings must be adequately installed to avoid the above described corrosion.

The **FRABOPRESS C-STEEL** system, for closed systems (i.e. in the absence of oxygen) can be used in combination with other materials such as copper and copper alloys.

However, it is recommended not to install galvanized steel components downstream (in the direction of fluid flow) of copper lines or copper alloys (see figure 5.1 and 5.2.). More information about the behaviour in the case of mixed installations can be found in the UNI EN 12502-3:2005.





The designer and/or installer are responsible for choosing and applying the corrosion resistant protection and for evaluating the most effective protection methods in relation to the environment where the piping will be located.

STRAY CURRENTS AND GROUNDING

In reality, corrosion due to stray current phenomena is very rare and immediately recognizable. In these cases the corrosion begins outside the pipeline and creates a conical crater with the top (hole) toward the inside.

In order for corrosion from stray currents to occur, a continuous current that acts on the metal, imposing an anodic and therefore sacrificial behaviour, must be present.

The so-called stray currents are currents which, due to a leakage fault, disperse in the ground and penetrate the metal structures they find on their way (i.e. a household water system), using a section of this system as a conductor, they finally come out in the ground again. In order to penetrate inside a distribution network, the dispersed currents must find a point where the normal protective coating of the pipes and tubing is damaged or missing. First, metallic systems must be grounded (see CEI regulations) and, consequently, any current must be discharged through the appropriate dispersers and, since corrosion by stray currents occurs through the exit point of the system current, it is here that the disperser itself will eventually suffer. In general, also, equipment is not used under continuous current in homes and, on the other hand, alternating current does not produce an appreciable effect.

The electrical resistance offered by cement mortar structures, where the pipes are normally housed, is high. For in-wall systems, the use of insulated pipes is recommended for improved protection, also given the electrical resistance offered by insulation sheaths..

THERMAL EXPANSIONS

As for all the types of pipes constituting a distribution network, even with the **FRABOPRESS C-STEEL** system the elongations or contractions, due to thermal expansions as a result of the increase or decrease of temperature of the conveyed fluid, must be evaluated.
To compensate for these effects, the necessary space for the expansions, the proper placement of fixed sliding support points, and the realization of any line compensators must therefore be provided for.

First, the elongation of a determined stretch of pipeline [ΔL] as a result of a certain temperature change [ΔT] needs to be determined.

The equation used to calculate this variable is: $\Delta L = L \bullet \alpha \bullet \Delta T$

with ΔL: global elongation [m]
L: length of the stretch considered [m]
α: linear expansion coefficient of carbon steel (0.000012 K-1 between 25 and 100°C)
ΔT: thermal change [°C] or the difference between the maximum and minimum operating temperatures

For example: in a rectilinear carbon steel tubing, which is with a 40-metre long and is installed at a room temperature of 5°C and which can reach an operating temperature of 85°C, the elongation is:

ΔL = 40E 0,000012 • (85-5) = 0,0384 m, which correspond to 38 mm

If the conduit is found between two fixed pieces of equipment (e.g. a pump and a heat exchange group) andhas a limited diameter (e.g. 18 x 1.0), only bending of the pipe would most likely be found as a result of expansion, with harmful consequences for any intermediate bodies (valves or others).

If the pipe has a larger diameter (e.g. 54 x 1.5) and therefore less elasticity, elevated axial effects could occur. The result of the expansion, in fact, is a strain that is expressed by the following formula: $\delta = \varepsilon \bullet E$

with $\varepsilon = \Delta L / L = \alpha \bullet \Delta T$
$E = 190.000\ N/mm^2$ for carbon steel

Therefore:

$\delta = 0.000012 \bullet (85-5) \bullet 190.000 = 182.4\ N/mm^2$

Finally it is possible to determine the stress exerted by the pipe on the equipment placed at the ends using the following formula:: $F = \delta \bullet S$

where S is the section of the pipe calculated with the relationship::

$S = \pi \bullet (D^2-d^2) / 4 = \pi \bullet (54^2-51^2) / 4 = 247.40\ mm^2$

Consequently we have:

$F = 182.40 \bullet 247.40 = 45.125$ N an important value.

The above shows that thermal expansions cause deformations and stresses to the pipelines and strains at the ends.

Thus, in the case in which the section considered is not straight, the deformations of the conduit, depending on the geometry of the course, can dangerously stress typical points such as bends, derivations, extremities, etc.

It should be noted that the same stresses calculated for positive ΔT, can also be calculated for negative ΔT (e.g. cold water conduits placed between 10 - 15°C but subject to weather conditions such as cold and frost). In this case the calculated formulas change sign and compressive stresses turn into tensile stresses with a possible danger of disengagement of the pipe from the pressed connection.

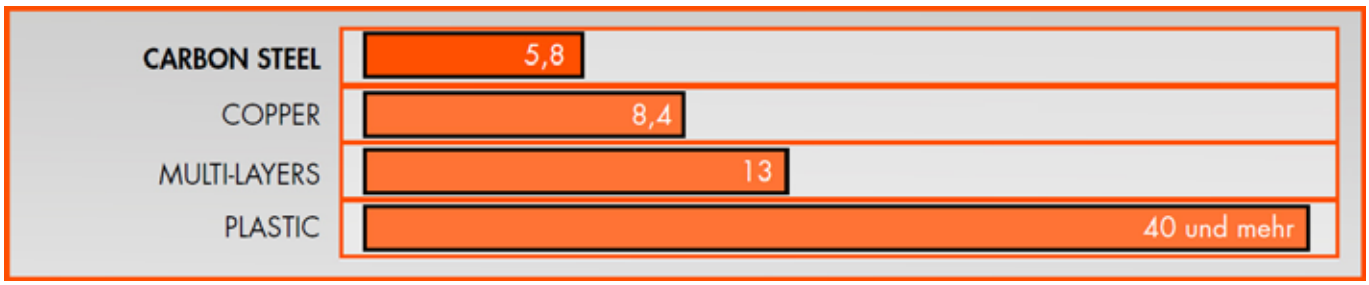


Table 6.1 – Expansion in mm for a 10 metre pipe upon material variation with ΔT50°

As shown in the diagram, the quality of **FRABOPRESS C-STEEL** fittings, together with the very small thermal expansion of the carbon steel tubes, guarantees system safety and stability even with temperature variations.

L [mm]	Δt [°K]									
	10	20	30	40	50	60	70	80	90	100
1	0,12	0,24	0,36	0,48	0,60	0,72	0,84	0,96	1,08	1,20
2	0,24	0,48	0,72	0,96	1,20	1,44	1,68	1,92	2,16	2,40
3	0,36	0,72	1,08	1,44	1,80	2,16	2,52	2,88	3,24	3,60
4	0,48	0,96	1,44	1,92	2,40	2,88	3,36	3,84	4,32	4,80
5	0,60	1,20	1,80	2,40	3,00	3,60	4,20	4,80	5,40	6,00
6	0,72	1,44	2,16	2,88	3,60	4,32	5,04	5,76	6,48	7,20
7	0,84	1,68	2,52	3,36	4,20	5,04	5,88	6,72	7,56	8,40
8	0,96	1,92	2,88	3,84	4,80	5,76	6,72	7,68	8,64	9,60
9	1,08	2,16	3,24	4,32	5,40	6,48	7,56	8,64	9,72	10,80
10	1,20	2,40	3,60	4,80	6,00	7,20	8,40	9,60	10,80	12,00
11	1,32	2,64	3,96	5,28	6,60	7,92	9,24	10,56	11,88	13,20
12	1,44	2,88	4,32	5,76	7,20	8,64	10,08	11,52	12,96	14,40
13	1,56	3,12	4,68	6,24	7,80	9,36	10,92	12,48	14,04	15,60
14	1,68	3,36	5,04	6,72	8,40	10,08	11,76	13,44	15,12	16,80
15	1,80	3,60	5,40	7,20	9,00	10,80	12,60	14,40	16,20	18,00
16	1,92	3,84	5,76	7,68	9,60	11,52	13,44	15,36	17,28	19,20
17	2,04	4,08	6,12	8,16	10,20	12,24	14,28	16,32	18,36	20,40
18	2,16	4,32	6,48	8,64	10,80	12,96	15,12	17,28	19,44	21,60
19	2,28	4,56	6,84	9,12	11,40	13,68	15,96	18,24	20,52	22,80
20	2,40	4,80	7,20	9,60	12,00	14,40	16,80	19,20	21,60	24,00
21	2,52	5,04	7,56	10,08	12,60	15,12	17,64	20,16	22,68	25,20
22	2,64	5,28	7,92	10,56	13,20	15,84	18,48	21,12	23,76	26,40
23	2,76	5,52	8,28	11,04	13,80	16,56	19,32	22,08	24,84	27,60
24	2,88	5,76	8,64	11,52	14,40	17,28	20,16	23,04	25,92	28,80
25	3,00	6,00	9,00	12,00	15,00	18,00	21,00	24,00	27,00	30,00
26	3,12	6,24	9,36	12,48	15,60	18,72	21,84	24,96	28,08	31,20
27	3,24	6,48	9,72	12,96	16,20	19,44	22,68	25,92	29,16	32,40
28	3,36	6,72	10,08	13,44	16,80	20,16	23,52	26,88	30,24	33,60
29	3,48	6,96	10,44	13,92	17,40	20,88	24,36	27,84	31,32	34,80
30	3,60	7,20	10,80	14,40	18,00	21,60	25,20	28,80	32,40	36,00

Table 6.2 – Overall elongations ΔL – [mm] for CARBON STEEL (linear dilatation coeff. equal to 12 10^{-6})

CALCULATION OF AN EXPANSION ARM

Elongation as an effect of thermal expansion cannot always be compensated for by counting on the normal conFiguretion of the distribution network, where the various path changes can actually act as compensators.

It is sometimes necessary to prepare and calculate expansion arms in a precise way or, in more challenging cases, [Ω] expanders constructed using appropriately shaped pipe or normal fittings.

The expression that permits the determination of the expansion arm of Fig. 6.1 in mm is as follows:

$$Bd = k * \sqrt{(de - \Delta L)}$$

where: k: material constant
de: external diameter of the pipe used
ΔL: expansion to be compensated

The extrapolation of the result offered by the aforementioned formula can also be made through the use of charts that relate the pipe diameter, elongation to compensate for, and the value of the expansion arm length [Bd].

For wide systems, it is often recommended to use compensating sections as shown in the figures below.

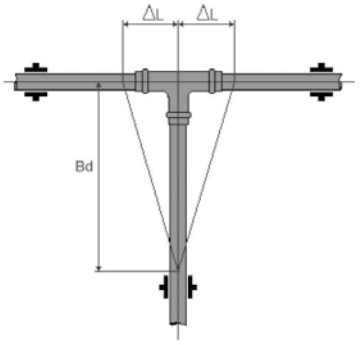


Figure 6.1

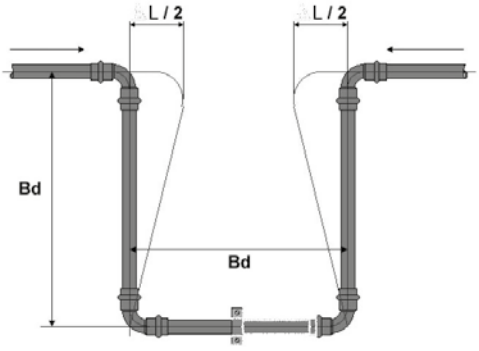


Figure 6.2

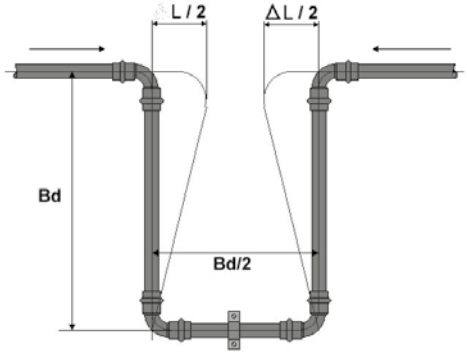


Figure 6.3

The expansion compensators mentioned are generally realizable on-site on the basis of the expansion to compensate for, but they are often bulky and sometimes undesirable for aesthetic reasons.

Alternatively, there are axial bellows compensators.

To size the bellows compensator, reference should be made to the following data:

- diameter of the pipe
- maximum operating pressure
- system test pressure
- operating pressures (minimum and maximum)
- expansion to absorb
- life desired for the compensator (number of cycles)

For these details, great emphasis should be placed on the installation of the pipe guides and clamps near the expansion joint so that the piece can be freely compensated.
The normal bellows expansion joint in commercial use can be connected to **FRABOPRESS** fittings through the use of standard threaded connections.

The case-by-case consultation of the publications and manufacturer's technical specifications for these devices is therefore advisable.

ARRANGEMENT OF COLLARS

To better manage system expansions, it is important to take special care of the arrangement of the fastening collars. In this way the system has the capacity to properly expand without giving rise to deformations that could reduce the seal of the junctions.

1. Never place collars that constitute a fixed point near a fitting. (fig. 7.4)
2. It is also important to note that the sliding supports are not positioned to ensure that they behave as if they were fixed points. (fig. 7.5)
3. When there are sections of straight pipe without expansion compensators, only one fixed point can be installed in order to prevent possible deformations. All of the remaining points must be sliding points. It is a good idea to place this point, as much as possible, in an intermediate position with respect to the length of the straight section (Fig. 7.6); this allocates the elongation due to expansion in the two directions and halves thereby the arm length necessary.

Figure 7.4

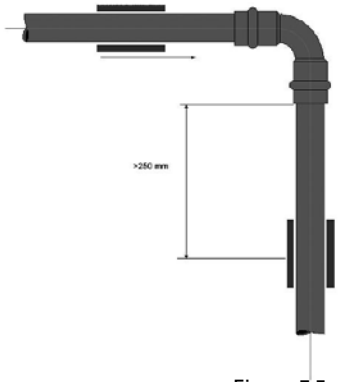


Figure 7.5

Figure 7.4

As a general rule, use steel collars with rubber seals; this type of support allows the isolation and dampening of any rustling and vibrations and a better behaviour of the combination of solicitations

PRESSURE DROPS

All of the fluids distributed through a network of pipes are hampered in their flow by continuous and localized resistances that are normally defined as pressure drops. First of all we distinguish between continuous and localized drops.

CONTINUOUS PRESSURE DROPS

The calculation of the total resistance of a straight pipe can be simply obtained by knowing the unit resistance value of the pipe and then multiplying it by the total length of the pipeline.

The calculation is normally performed using the appropriate diagrams. With these instruments, the unit pressure drop values [R] and the speed value in [m/s] for a given water flow rate can be determined.
Once the value of R and the length of the network in effective metres or equivalent metres have been determined, the value of the total pressure drop of the section can be obtained.
The unitary resistance values [R] change with variations in the temperature and velocity of the fluid conveyed; it is therefore necessary to use the appropriate diagram.
Similarly, any additives added to the water, such as common antifreeze, influence the unit resistance value and therefore require appropriate corrections.

LOCAL PRESSURE DROPS

The mathematical formula that allows the calculation of the local pressure drop is as follows:

$\Delta P_{.} = \Sigma\xi \bullet v^2 \bullet \gamma/2g$

where: v: fluid flow velocity [m/s]
g: acceleration due to gravity [m/s^2]
γ: specific weight of the fluid [kg/m^3]
ξ: localized resistance coefficient

For convenience, the method of equivalent metres can be used, i.e. considering the value of the fictitious length of a straight pipeline of the same diameter that produces the same pressure drop value.
All of the equivalent length values determined for each type of fitting from Table 8.1 should be added to the real length of the network.

EQUIVALENT LENGHT IN METERS							
External Pipe Diameter	Water Temperature [°C]	T joint			Curve	Reduction	
						D1/D2=2	D1/D2=3
							
15	10	0,04	0,57	0,51	0,22	0,10	0,11
	40	0,05	0,65	0,59	0,24	0,12	0,13
	70	0,05	0,74	0,65	0,27	0,13	0,14
18	10	0,05	0,73	0,63	0,25	0,16	0,15
	40	0,06	0,88	0,75	0,31	0,19	0,18
	70	0,07	0,93	0,82	0,34	0,19	0,18
22	10	0,07	0,97	0,82	0,34	0,20	0,19
	40	0,08	1,10	0,96	0,40	0,24	0,22
	70	0,09	1,20	1,10	0,45	0,25	0,23
28	10	0,10	1,30	1,00	0,47	0,28	0,27
	40	0,12	1,60	1,30	0,56	0,33	0,30
	70	0,12	1,70	1,50	0,61	0,34	0,31
35	10	0,13	1,80	1,50	0,60	0,38	0,35
	40	0,15	2,00	1,70	0,71	0,45	0,42
	70	0,16	2,30	2,00	0,80	0,48	0,44
42	10	0,16	2,20	1,90	0,74	0,48	0,45
	40	0,18	2,50	2,20	0,87	0,54	0,51
	70	0,20	2,90	2,50	0,97	0,57	0,54
54	10	0,22	3,10	2,70	1,00	0,75	0,63
	40	0,24	3,60	3,20	1,20	0,87	0,72
	70	0,26	4,00	3,40	1,30	0,87	0,71

Inside diameter of carbon steel pipes		8-16 mm	18-28 mm	35-54 mm
Type of localized resistance	Symbol			
Straight shut-off valve		10	8	7
Inclined shut-off valve		5	4	3
Reduced passage closure		1,2	1	0,8
Total passage closure		0,2	0,2	0,1
Reduced passage ball valve		1,6	1	0,8
Total passage ball valve		0,2	0,2	0,1
Butterfly valve		3,5	2	1,5
Check valve		3	2	1
Straight valve for heating body		8,5	7	6
Square valve for heating body		4	4	3
Straight retainer		1,5	1,5	1
Square retainer		10		1
Four-way valve		10		4
Three-way valve		10		
Passage through a radiator		10		
Passage through a hot-water heater		10		
Collector		10		
Section enlargement		10		

Table 8.2 localized drop coefficient values ξ (system components)

The total fictitious length determined in this way will be multiplied by the value of the unit pressure drop, thus obtaining the circuit's total resistance.

This operation allows the calculations to be dramatically sped up at the expense of the accuracy of the pressure drop value, which is forced to be approximate.

TESTING

Civil construction technologies are increasingly oriented toward the adoption of in-wall pipes and fittings so that the system and its components are not visible in any way.

The fittings **FRABOPRESS C-STEEL** can be placed under the duct, as long as they are adequately protected against corrosion.

A preventive test of the system must be carried out before it is integrated into the construction structure.

The test, almost established by the totality of the good practice rules, has two specific objectives:

- To verify that there are no leaks in correspondence with the junctions;
- To ensure that the heat expansions do not cause difficulties.

In relation to this, it is important to define the procedures for verifying the different installation types

TESTING AND START UP OF HEATING SYSTEMS

The heating systems are typically realized through the installation of in-wall pipes.
Before the completion of masonry work, some preliminary tests must be done to verify each junction's seal

These are described below in detail:

1. Leakage test immediately after lay and subjection to pressure of 10 N/cm2 greater than the normal operating pressure; the seal will be verified after the solicitation of the junctions, and a period of time not less than 15 minutes.
2. Flushing
3. Circulation test
4. Expansion test with circulation of water at 95°C
5. Second leakage test like the previous one

GUARANTEES

The **FRABO** production line is known for the high level of quality reached through years of experience in thermohydraulic systems.

The **ISO 9001** certification and the numerous quality marks associated with its products are a direct testimony.

With relation to its products **FRABO S.p.A.** declares that, in terms of third party liability insurance, it has taken out an insurance policy to cover any hidden product faults for a duration of 10 years.

The proper and professional use of the product according to **FRABO**'s specifications as well as respect for applicable technical regulations are essential conditions for the validity of the guarantee.

The guarantee is not valid for those installations that are performed in an incorrect or non-professional way.

FRABO declares that it has a corporate liability insurance policy through a major insurance company, including responsibility for the extended product.

For the latest list of certifications, technical documentation and statements, please refer to the website www.frabo.com

FRA.BO S.p.A.

HEADQUARTER Via Cadorna, 30 - 25027 Quinzano d'Oglio (BS) - Italy
MANUFACTURING UNIT Via Circonvallazione, 7- 26020 Bordolano (CR) - Italy

T +39 030 99 25 711 F +39 030 99 24 127 @ info@frabo.com W www.frabo.com