



Press fitting systems Technical Handbook

OVERSIZE Ø 139,7 - 168,3 mm





CERT

DVGW-Baumusterprüfzertifikat

DVGW type examination certificate

DW-8511AU2084

Registrierungsnummer
registration number

Anwendungsbereich <i>field of application</i>	Produkte der Wasserversorgung <i>products of water supply</i>
Zertifikatinhaber <i>owner of certificate</i>	Raccorderie Metalliche S.p.A. Strada Sabbionetana, 59, I-46010 Campitello di Marcaria (MN)
Vertreiber <i>distributor</i>	Raccorderie Metalliche S.p.A. Strada Sabbionetana, 59, I-46010 Campitello di Marcaria (MN)
Produktart <i>product category</i>	Installationssysteme und Systemverbinder: Rohrverbinder für Trinkwasserinstallationssysteme (8511)
Produktbezeichnung <i>product description</i>	Systemverbinder als Pressverbinder aus nichtrostendem Stahl, Typ M-MM, für Rohre aus nichtrostendem Stahl gemäß DVGW-Arbeitsblatt G/W 541 (bis 54 mm unverpresst undicht)
Modell <i>model</i>	INOXPRES
Prüfberichte <i>test reports</i>	Ergänzungsprüfung: 20181126 vom 26.11.2018 (TTR) Ergänzungsprüfung: 20170622 vom 22.06.2017 (TTR) Kontrollprüfung Labor: 1104916_001 vom 18.03.2016 (TTR) Baumusterprüfung: 120003084 vom 17.07.2008 (MPM)
Prüfgrundlagen <i>test basis</i>	DVGW W 534-(P) (01.07.2015) DVGW CERT ZP 8500 (09.03.2017) UBA METALLE (21.11.2018) UBA ELASTOM (16.03.2016) DVGW W 270 (01.11.2007)
Ablaufdatum / AZ <i>date of expiry / file no.</i>	16.03.2022 / 18-0059-WNR

FRÜHER DA-AZ

08.02.2019 Fk A-1/2

Datum, Bearbeiter, Blatt, Leiter der Zertifizierungsstelle
date, issued by, sheet, head of certification body

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DVGW certification (Ø 139,7-168,3 mm only with pipe 2,6 mm thickness)

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1.0 Introduction

1.1 Raccorderie Metalliche S.p.A

Raccorderie Metalliche S.p.A. (RM) was founded as a family company in the Mantova province of Italy in 1970 and is specialised in the production and distribution of:

- sockets;
- carbon steel fittings;
- stainless steel fittings;
- plugs and accessories for radiators.

In 1999 the company introduced **inoxPRES**, the press fitting system in stainless steel, and later **steelPRES**, the carbon steel press fitting system.

Extensive investment in buildings and very modern machinery in operation ensure the current annual capacity of approximately 10 million press fittings. The specialist sanitary and heating stockist trade within Europe, together with selected non-European markets, are supplied within the framework of the three-stage distribution set-up; market support subsidiary companies exist in both Germany, France and Spain.

The company has a distinctive quality management system which has been certified in accordance with UNI EN ISO 9001:2008.

The suitability of press fitting systems described in this handbook for the applications defined has been- as far as required- tested and certified by DVGW and a wide range of other international organisations.



Figure 1 – Campitello head office and factory



Figure 2 – EN ISO 9001:2008 RM Certification

1.2 Press fitting systems in water, heating and cooling installation

Press fittings made of steel and copper were developed in Sweden at the end of the fifties and have enjoyed an increasingly large share of the market since the beginning of the eighties, in Europe. The connection technique is still considered to be innovative, since the tried-and-trusted simple 'cold' mounting technique allows fast, solid and permanent connection of tubing, especially in domestic water, gas and heating installations. In the meantime, the connection technique in the form of press fittings has spread to include not only all types of metal, carbon steel, stainless steel, copper, red bronze, etc., also plastic and plastic composite tubing, and is in Europe the leading connection technique.

Raccorderie Metalliche S.p.A. (RM) has furtherly developed carbon steel, stainless steel and nowadays copper/copper-nickel press fitting range as well. Besides It has clearly simplified the system assembly through the modification of our o-ring shape and toroidal chamber. At the same time, the sealing surface has been enlarged and the risk of accidental non-pressing has been minimised by the creation of a security seal ring.



Figure 3 - Product range

With the **inoxPRES** press fitting system of stainless steel for potable water and gas installations, **steelPRES** for closed hot water heating systems, **aesPRES** for potable water and gas installations, **marinePRES** for naval sector, RM offers a comprehensive shaped fitting series in the dimension range from 12 to 168,3 mm, together with piping, pressing tools and accessories. To simplify applications for the fitter, the pressing of the fittings has been so constructed that all the tools approved from the press fitting systems leading manufacturers, i.e. pressing tools and pressing jaws or collars, are also approved by RM.

The planning and installation of potable water and heating systems demands comprehensive expert knowledge, together with knowledge of a multitude of industrial standards and technical guidelines. Of particular importance are DIN 1988 part 100-600, the VDI guideline 6023, DIN EN 806, DIN EN 1717, DIN EN 12329 and the amendment to the potable water legislation (TrinkwV) which came into effect on the 1st January 2003 as well as DVGW work sheets W 534 and GW 541. This technical handbook is intended to provide especially planners and fitters with essential information to help both size up the field of application and to carry out professional installation.

This handbook mostly refers to industrial standards and regulations which are valid in Germany. Of particular importance are DIN 1988 part 100-600, the VDI guideline 6023, DIN EN 806, DIN EN 1717, DIN EN 12329 and the amendment to the potable water legislation (TrinkwV) which came into effect on the 1st January 2003 as well as DVGW work sheets W 534 and GW 541.

For supplementary information, please contact the appropriate technical department at Raccorderie Metalliche S.p.A. Names, addresses and further details can be found at raccorderiemetalliche.com.

2.0 Press fitting systems

2.1 Connection technique - M profil

The press connection is made by inserting the pipe into the press fitting as far as the marked insertion depth. The connection is created by pressing, using an approved pressing tool (see point 2.5 Pressing tools).

Press fittings in dimensions \varnothing 139,7 - 168,3 must be pressed with chains, through two cycles of deformation.

The longitudinal and compression closing character of the connection is clearly illustrated in figure 4. During the pressing process a deformation takes place on two planes. The first plane creates a permanent connection and provides mechanical strength through the mechanical deformation of the press fitting and the pipe. On the second plane the seal ring is deformed in its cross section and through its elastic properties creates the permanently tight joint.

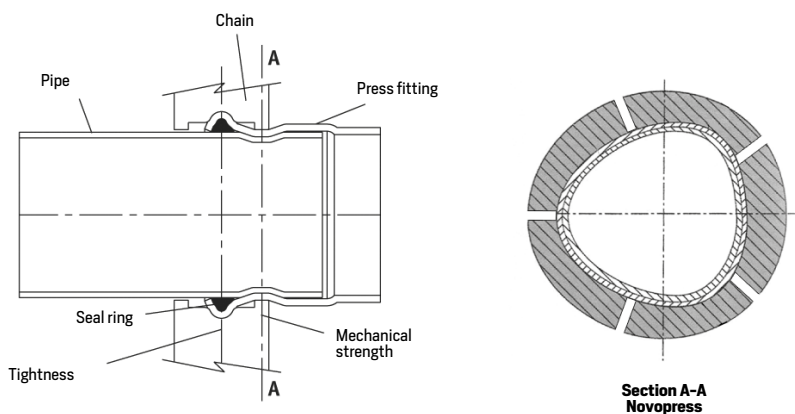


Figure 4 - Section through an **inoxPRES** connection with chain still in position. Dimensions of \varnothing 139,7 - 168,3 produce a defined contour, typical for Novopress chains manufacturer.

2.2 inoxPRES press fittings

inoxPRES press fittings are manufactured using high-alloyed austenitic stainless Cr-Ni-Mo steel with the material number 1.4404 (AISI 316L).

The press fittings are indelibly marked with laser reporting the manufacturer name, diameter and internal code.

The formed ends of the press fittings are fitted with a black EPDM seal ring as standard for potable water applications.



Figure 5 - **inoxPRES** press fitting

2.3 inoxPRES piping

inoxPRES pipes are longitudinally welded thin-walled tubes made of high alloyed austenitic stainless Cr-Ni- Mo steel with material number 1.4404 (AISI 316L), EN 10217-7 (DIN 17455) and EN 10312 and are therefore approved for:

➤ drinking water (14404 AISI 316L);

Inner and outer surfaces are bare metal and free of annealing colours and corrosion-promoting substances.

inoxPRES pipes are classified as non-combustible pipes according to material class A; they are supplied in lengths of 6 meters.

TABLE 1: INOXPRES PIPES - DIMENSIONS AND CHARACTERISTICS

Pipe outside diameter x wall thickness in mm	Nominal width DN	Pipe inside diameter in mm	Mass in kg/m	Water volume in l/m
139,7 x 2	125	135,7	6,896	14,460
168,3 x 2	150	164,3	8,328	21,200
139,7 x 2,6*	125	134,5	8,936	14,210
168,3 x 2,6*	150	163,1	10,801	20,890

*DVGW certification \emptyset 139,7-168,3 mm only with pipe 2,6 mm thickness

2.4 Sealing elements

2.4.1 Sealing ring profile

Traditional press fitting systems use round sealing rings, which can easily be damaged by careless fitting.

RM on the other hand uses a patented sealing ring with a lenticular profile which fits the press crimp groove.

This provides the following advantages:

- a 20% enlargement of the sealing surface area;
- major reduction of the risk of the sealing ring being pressed out or damaged;
- fit makes the pipes insertion easier.

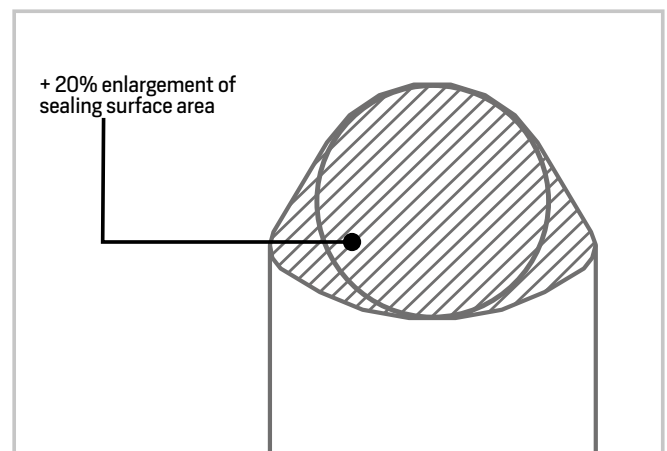


Figure 6 – Sealing ring profile

2.4.2 Materials, characteristics, applications

Press fitting systems were originally developed for use in potable water and heating installations and were fitted with a single standardised sealing ring for these applications.

Additional fields of application, such as gas and solar, have been added through the use of stainless steel material, at the same time motivating the development of sealing rings suitable for these applications. RM supplies four different sealing rings; their characteristics and fields of application are shown in table 2.

The black EPDM standard sealing ring only is factory-fitted in the siliconised version in **inoxPRES**.

TABLE 2: SEALING RINGS - FIELDS OF APPLICATION AND TECHNICAL DATA

Technical term	Colori	Operating temperature Min / Max degress centigrade	Operating pressure maximum in bar	Approvals and certification basis	Fields of application
EPDM	black ■	-20 / +120 °C	16	KTW W 270	Potable water Heating Cooling and refrigeration circuits Treated water Desalinated water Rainwater Compressed air (Class 1÷4)
FKM	green ■	-20 / +220 °C	16	-	Oils Compressed air (Class 5)

With the exception of potable water, heating, solar, compressed air and gas, the figures in the table above are only for guidance; examination and approval by RM of each individual situation is therefore required.

The FKM green o-rings are supplied loose and must be used by the installer, changing the black EPDM o-ring factory fitted.

2.5 Pressing tools

2.5.1 Basics

Pressing tools basically consist of the pressing machine (= drive machine) and pressing jaws or collars/chains.

Press fittings in dimensions \varnothing 139,7 - 168,3 mm must be pressed with chains.

Principally, all metallic press fitting systems have a pressing contour on the press fittings which matches the profile of the pressing jaws/collars. For this reason it is necessary to have the approval of the tooling by the manufacturer of the press fittings intended for use. In addition, it is important to follow exactly the maintenance and servicing instructions issued by the pressing tool manufacturer.

2.5.2 Approved pressing tools

RM approves the tools produced by Novopress listed in the below table 3.



Figure 7 - Novopress ACO401



Figure 8 - Novopress ACO403

TABLE 3: MANUFACTURER NOVOPRESS

Type	Piston strength	Dimension range	Weight
ACO401 ACO 403	100 KN - ACO 401 120 KN - ACO 403	139,7 ÷ 168,3 mm	~ 13 kg

2.5.3 Periodical equipment service

Jaw and chain pressing units are to be serviced for a correct joint production. The pressing tools must be checked by an officially authorized repairer according to the manufacturer specifications. What is more any moving part (drive rolls) and pressing jaw and chain surfaces (internal profiles) are to be daily serviced, cleaned and lubricated.

Any possible oxidation, paint or dirt in generally affect the tool reliability leading to equipment sliding problems on joints during pressing.

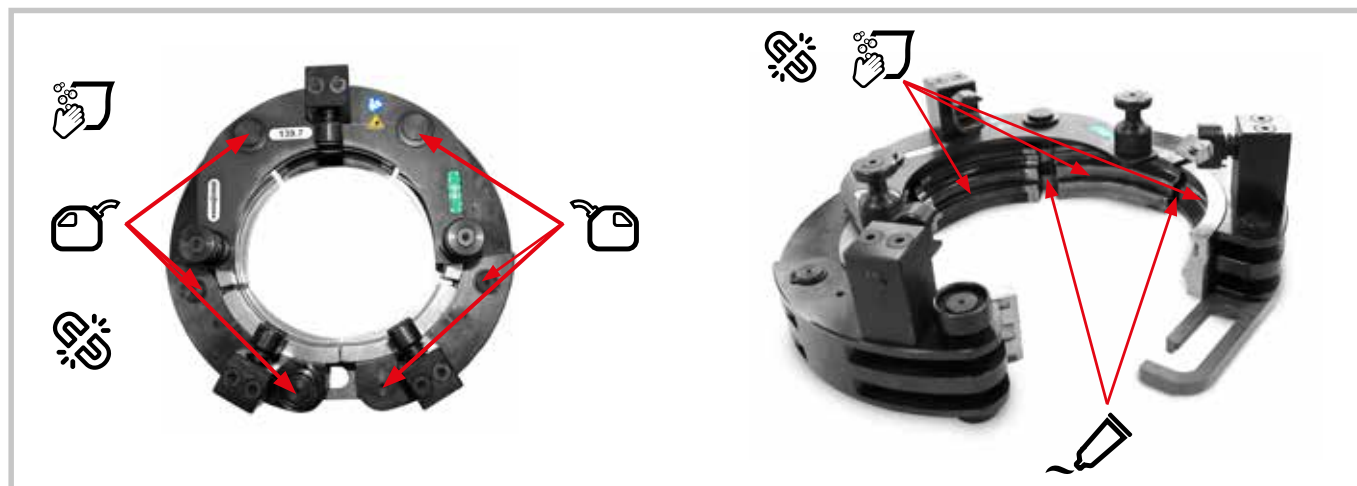


Figure 9 - Novopress Equipment



Keep the chain clean



Keep the pins lubricated with oil



Keep the pins lubricated with grease



Attention it can be broken

3.0 Areas of use

TABLE 4: FIELD OF APPLICATION FOR PRESS FITTING SYSTEMS INOXPRES

Application	System	O-ring	Notes	PN max. (bar)	T °C
Drinking water*	inoxPRES	EPDM black	-	16	0 / +120 °C
Heating	inoxPRES	EPDM black	-	16	0 / +120 °C
Extinguishing water	inoxPRES	EPDM black	-	16	Room temperature
Cooling	inoxPRES	EPDM black	-	16	-20 / +120 °C
Compressed air	inoxPRES	⁽¹⁾ EPDM black Class 1÷4 (residual oil <5 mg/m ³) FKM green Class 5 (residual oil >5 mg/m ³)	System not silicone-free (not suitable for varnishing systems)	12,5**	Room temperature
Vacuum	inoxPRES	EPDM black	-	- 0,8 bar (up to a max. of -0,95/-0,98 bar)	Room temperature

⁽¹⁾ According to ISO 8573-1/2010

The above mentioned information/compatibility does not exempt the planning manager of the responsibility to create a detailed implementation planning and a risk analysis in accordance with the provisions of Directive 2017/68/CE pressure systems.

*DVGW certification Ø 139,7-168,3 mm only with pipe 2,6 mm thickness

**Safety factor = 2,5

3.1 Applications

3.1.1 Potable water, treated water, water for extinguishing systems

The **inoxPRES** press fitting system is manufactured using high alloy austenitic Cr-Ni-Mo stainless steel with the material n° 1.4404 (AISI 316L). Thanks to its high resistance to corrosion and suitability in terms of hygiene, **inoxPRES** can be used for all drinking water applications. Since this material does not release any heavy metals into the water, the purity of the potable water remains unchanged by the **inoxPRES** press fitting system.

The black EPDM sealing ring fullfils the standards of the KTW recommendations and meets the standards in accordance with DVGW worksheet W 270.

inoxPRES with black EPDM sealing rings are suitable for use in the fields of:

- ❑ potable water in cold water, warm water and circulation piping;
- ❑ treated water, such as softened, decarbonated and desalinated water;
- ❑ extinguishing systems.

The use of anticorrosion or ant-freeze additives requires the approval of RM.

inoxPRES are not suitable for applications which require a higher degree of water purity than for the quality of potable water, such as for example for pharmaceutical water or purest types of water.

3.1.2 Heating

The **inoxPRES** press fitting systems with black EPDM sealing rings is used for hot water heating systems in accordance with DIN 4751 which have a flow temperature up to max. 120 °Centigrade and maximum pressure PN16: closed and open versions. They are suitable for both on-wall and in-wall installation (with appropriate protections).

In case of floor radiator connections, it is necessary to provide for a consistent corrosion protection, with a joint sealing, made according to the highest standards. Otherwise it is possible to run the risk of washing water penetration hydrating the insulation and thus increasing the risk of corrosion.

The use of anticorrosion or ant-freeze additives requires the approval of RM.



Figure 10 - **inoxPRES** - Drinkable water



Figure 11 - **inoxPRES** - Industry

3.1.3 Cooling and refrigeration circuits, compressed air

inoxPRES with black EPDM sealing rings are suitable for use cooling and refrigeration circuits in closed and open versions with operating temperatures between $-20 / +120$ °Centigrade.

The use of anti-corrosion or antifreeze additives requires the approval of RM.

The **inoxPRES** press fitting system are suitable for pneumatic lines and inert gases. For systems with a residual oil content of class 1 to 4 (according to ISO 8573-1/2010) the black EPDM sealing ring can be used. For systems with a residual oil content of class 5 (according to ISO 8573-1/2010) the green FKM sealing ring can be used. It is loosely supplied and the factory-loaded black EPDM sealing ring is to be replaced by the processor. To ensure optimal sealing of compressed air or vacuum lines, it is recommended to humidify the sealing ring with water prior to assembly. In case of necessity of clean air, in absence of dust, the use of **inoxPRES** system is recommended.

3.1.4 Vacuum

inoxPRES with black EPDM sealing rings can be used in the following field of application:

➤ vacuum piping up to 200 mbar absolute ($-0,8$ bar relative, up to a maximum of $-0,95 / -0,98$ bar).

It is recommended that the sealing ring be moistened using water before assembly.

3.1.5 Glycols for installation

The following table lists some glycols normally used for heating systems, cooling and solar systems. Should glycols be used, which are not listed in the table, please contact the technical office of Raccorderie Metalliche.

TABLE 5: CHEMICAL COMPATIBILITY OF GLYCOLS

GLICOLE	MANUFACTURER	AREAS OF USE
GLYKOSOL N	Pro Kühlsole GmbH	Heating Cooling
PEKASOL L	Pro Kühlsole GmbH	Heating Cooling
PEKASOLar 50	Pro Kühlsole GmbH	Solar
PEKASOLar 100	Pro Kühlsole GmbH	Solar
PEKASOLar F	BMS Energy	Solar
TYFOCOR	Tyforop Chemie GmbH	Heating Cooling
TYFOCOR L	Tyforop Chemie GmbH	Heating Cooling Solar
TYFOCOR LS	Tyforop Chemie GmbH	Solar
CosmoSOL	Tyforop Chemie GmbH	Heating Cooling Solar
Antifrogen N	Clariant	Heating Cooling
Antifrogen L	Clariant	Heating Cooling
Antifrogen SOL-HT	Clariant	Solar
DOWNCAL 100	DOW	Heating Cooling
DOWNCAL 200	DOW	Heating Cooling

NOTE: please follow the manufacturer's utilization notes.

4.0 Processing

4.1 Storage and transport

inoxPRES system components have to be protected against dirt and damage during transport and storage. The ends of the pipes are factory-fitted with plugs/caps to prevent dirt. The pipes must be stored in a device with a protective coating or plastic alloy, so that they do not come in contact with other materials. Moreover, pipes as well as press fitting must be stored in a covered area protected against effects of humidity in order to prevent corrosion and/or oxidation of the surface to avoid.

4.2 Pipes - cutting to length, deburring, bending

The pipes should be cut to length using professional pipe cutters which are suitable for the material in use. Alternatively, fine-tooth hacksaws or suitable electric saws may be used. The cutting and deburring tools must be clean, free from adherence or chips. After cutting / deburring, the cutting edges or pipe ends must be cleaned or freed from chips or impurities.

Not permitted are:

- ❌ tools which cause tarnishing during the cutting operation;
- ❌ oil-cooled saws;
- ❌ flame cutting or angle grinders.

To avoid damaging the sealing ring when inserting the pipe



Figure 12 - Cutting the pipe to length



Figure 13 - Deburring the pipe

into the press fitting, the pipe must be carefully deburred, both inside and outside, following cutting to length. This can be carried out using manual deburring tools which are suitable for the material in use, whilst for larger dimensions suitable electrical pipe deburring tools or files can be used. No tube hot bending allowed.

4.3 Marking the insertion depth

Sufficient mechanical strength of the press fitting connection will only be achieved if the insertion depths shown in table 6 are adhered to. These insertion depths are valid for pipes or fittings with insertion ends (i.e. fittings without pressfit end) and must be marked using a suitable marking tool. The marking of the insertion depth on the

pipe must be visible directly next to the press fitting formed end following pressing. The distance of the marking on the pipe/fitting from the press fitting formed end may not exceed 10% of the required insertion depth, since otherwise the mechanical stability of the connection cannot be guaranteed.

**TABLE 6:
INSERTION DEPTH AND MINIMUM DISTANCES**

Pipe outside diameter mm	A (*) mm	D mm	L mm
139,7	95	100	290
168,3	113	100	326

(*) Tolerance: ± 3 mm

4.4 Controllo dell'O-ring del raccordo a pressione

Before assembly the sealing ring must be checked to ensure that it is lying in the pressing groove correctly and that it is clean and undamaged.

If necessary, the sealing ring should be replaced.

Additionally, the fitter should check whether the ring in position is suitable for the special application, or whether another sealing ring needs fitting.

4.5 Making the press connection

Using light pressure and making a turning movement at the same time, press the pipe into the press fitting up to the marked insertion depth.

Oil and grease are not permitted for use as lubricants.

Pressing is carried out using suitable electromechanical/ electrohydraulic pressing tools and dimension-matching pressing jaws or collars/chains. Tested and approved pressing tools or pressing jaws/collars/chains are listed under table 3, approved pressing tools.

On the other hand, from diameters up to 108 mm, the pressing phases of the Oversize dimensions 139,7 and 168,3 mm must be realized through two different pressing phases. Through the dedicated chain you can proceed according to the following work's phases:

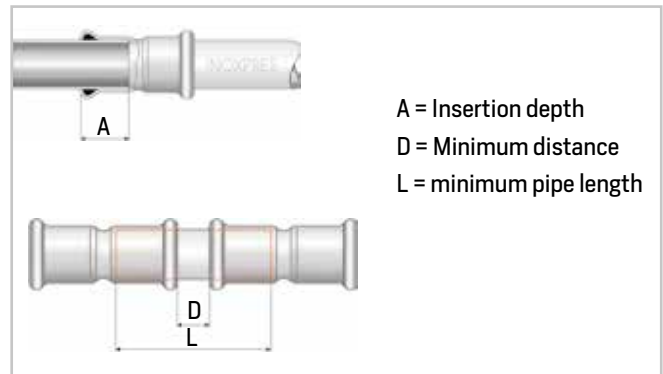


Figure 14 - Insertion depth and minimum dimensions



Figure 15 - Marking the insertion depth



Figure 16 -Checking the sealing ring



Figure 17 - Inserting pipe into the press fitting

1st PRESSING PHASE

- a) Open the collar and place it on the fitting: the chain groove must be positioned exactly above the toroidal chamber of the fitting
- b) Close the collar and press the lock button.

**Figure 18** - Making the press connection n° 1**2nd PRESSING PHASE**

- a) Place the chain on the pipe insertion depth area, aligning it with the appropriate guides above the o-ring containment seat
- b) Close the collar and press the lock button.

**Figure 19** - Making the press connection n° 2**Figure 20** - Checking the press connection

- c) Swivel the catch inwards and secure the lock.
- d) Perform pressing operation n° 1.
- e) Unhook and turn the catch, open the chain and remove it from the fitting.

Chain groove above the
O-ring containment site



- c) Swivel the catch inwards and secure the lock.
- d) Perform pressing operation n° 2.
- e) Unhook and turn the catch, open the chain and remove it from the fitting.

Guides above the O-ring
containment seat



Following pressing, the complete connection should then be checked to ensure that the work has been carried out correctly and that the insertion depth is correct.

The fitter should also ensure that all connections have actually been pressed.

Following completed pressing, the pressing points may not be subjected to further mechanical loading. The positioning and straightening of the pipes and the sealing of threaded connections must therefore take place before the pressing is carried out. Slight movement and lifting of pipes, for example for painting work, is permitted.

4.6 Minimum distances and space requirement for pressing

To carry out pressing correctly, there must be a minimum distance between the pipe and the building, and from pipe to pipe, as shown in table 7.

TABLE 7: MINIMUM DISTANCES AND SPACE REQUIREMENT (mm)

Pipe Ø	A	B	C
139,7	250	350	250
168,3	260	350	260

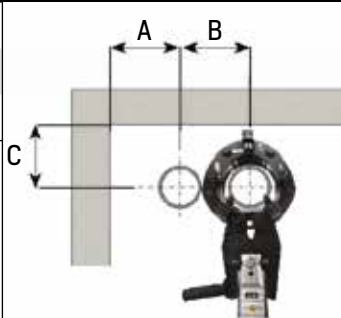


Figure 21 - Minimum distances for chains / collars

4.7 Thread or flange connections

Press fittings can be connected using normal trade threaded fittings in accordance with ISO 7-1 (thread standard DIN 2999) or ISO 228 (thread standard DIN 259) or with fittings made of stainless steel or non-ferrous metals. When sealing threaded connections, no sealant containing chloride (for example teflon tapes) may be used. The flanges available from the **inoxPRES** range can be connected to normal flanges at pressure stage PN10. During installation, first the thread/flange connection must be completed, then the press connection.

5.0 Planning

5.1 Pipe fixing, distances between clamps

Pipe supports serve to fix the pipe to the ceiling or wall and should take up changes in length which result from temperature variations. Through the setting of fixed and sliding points the length variations in the pipe are steered in the required direction.

Pipe supports may not be mounted on fittings. Sliding supports must be so positioned that they do not prevent the piping from moving.

The maximum permitted support distances for **inoxPRES** pipes are shown in table 8.

TABLE 8: MAXIMUM PERMITTED DISTANCES BETWEEN SUPPORTS

DN	Pipe outside diameter (mm)	Guideline (m)
125	139,7	5,00
150	168,3	5,00

5.2 Expansion compensation

The longitudinal change under various temperature differences in the pipe is shown for **inoxPRES** in table 9. The longitudinal change can be compensated for through the correct setting of fixed and sliding points, the installation of compensators, s-bends, u-bends or expansion compensators and by the creation of sufficient expansion spaces.

Typical installations are shown in figures 22-23-24.

TABLE 9: LENGTH VARIATIONS INOXPRES

L [m]	Δt [°K]										
	10	20	30	40	50	60	70	80	90	100	
inoxPRES	3	0,5	1,0	1,5	2,0	2,5	3,0	3,5	4,0	4,5	5,0
	4	0,7	1,3	2,0	2,6	3,3	4,0	4,6	5,3	5,9	6,6
	5	0,8	1,7	2,5	3,3	4,1	5,0	5,8	6,6	7,4	8,3
	6	1,0	2,0	3,0	4,0	5,0	5,9	6,9	7,9	8,9	9,9
	7	1,2	2,3	3,5	4,6	5,8	6,9	8,1	9,2	10,4	11,6
	8	1,3	2,6	4,0	5,3	6,6	7,9	9,2	10,6	11,9	13,2
	9	1,5	3,0	4,5	5,9	7,4	8,9	10,4	11,9	13,4	14,9
	10	1,7	3,3	5,0	6,6	8,3	9,9	11,6	13,2	14,9	16,5
	12	2,0	4,0	5,9	7,9	9,9	11,9	13,9	15,8	17,8	19,8
	14	2,3	4,6	6,9	9,2	11,6	13,9	16,2	18,5	20,8	23,1
	16	2,6	5,3	7,9	10,6	13,2	15,8	18,5	21,1	23,8	26,4
	18	3,0	5,9	8,9	11,9	14,9	17,8	20,8	23,8	26,7	29,7
20	3,3	6,6	9,9	13,2	16,5	19,8	23,1	26,4	29,7	33,0	

Linear expansion in general

$$\Delta L = L \times \alpha \times \Delta t$$

ΔL = linear expansion in mm

L = pipe length in m

α = linear expansion coefficient

inoxPRES α = 0,0165 mm / (m x °K)

Δt = temperature difference in °K

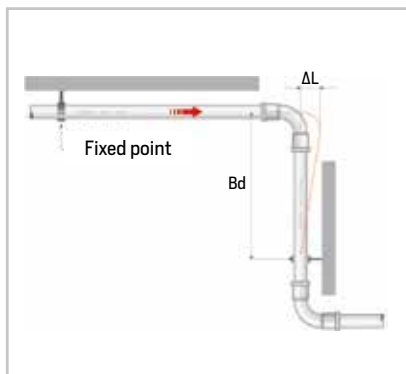


Figure 22 - Z-shaped expansion reach (Bd)

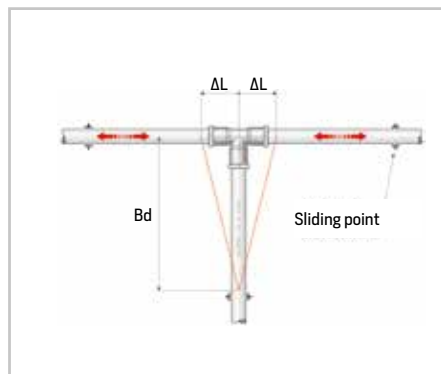


Figure 23 - Expansion compensation branch (Bd)

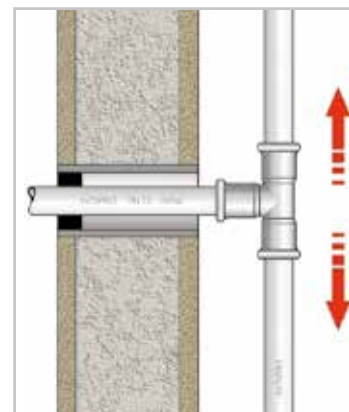


Figure 24 - Creation of expansion spaces

**Calculation formula Z - bend and T - junction
(figure 22 and 23)**

$$Bd = k \times \sqrt{(da \times \Delta L)} \quad [\text{mm}]$$

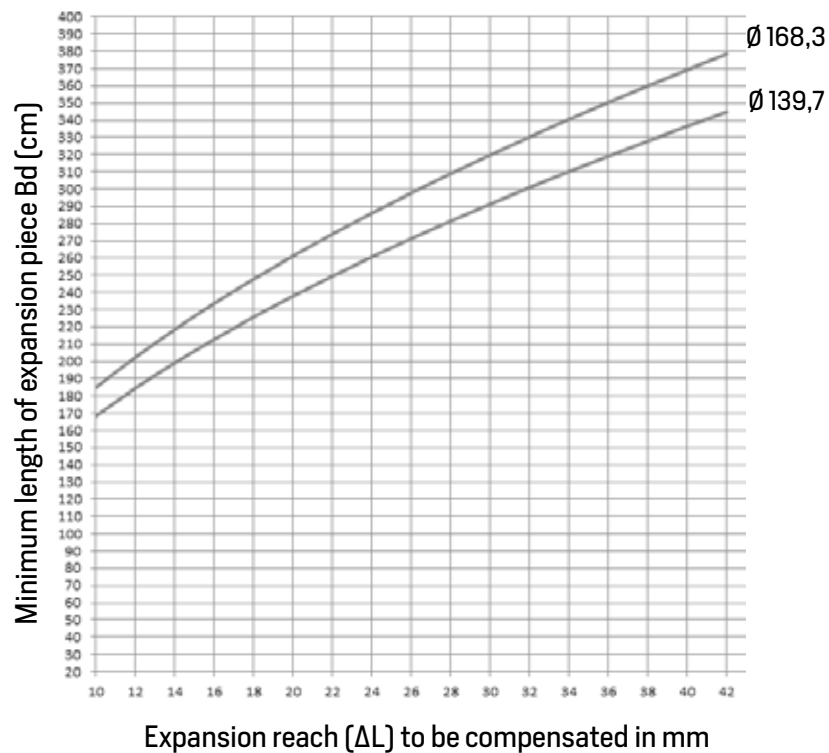
k = constant

inoxPRES = 45

da = outer diameter pipe in mm

ΔL = linear expansion in mm

**TABLE 10: CALCULATION OF THE EXPANSION REACH
(Bd) INOXPRES**



5.3 Thermal emission

Depending on temperature difference, warm piping releases heat into the environment. The thermal emission from **inoxPRES** pipes can be seen in table 11.

**TABLE 11: THERMAL EMISSION FROM INOXPRES
[W/m] UNCOVERED**

d x s (mm)	Δt TEMPERATURE DIFFERENCE (°K)									
	10	20	30	40	50	60	70	80	90	100
139,7 x 2	43,4	86,8	130,3	173,7	217,1	260,5	304,0	347,4	390,8	434,2
168,3 x 2	52,3	104,6	156,9	209,3	261,6	313,9	366,2	418,5	470,8	523,2
139,7 x 2,6	43,4	86,8	130,2	173,6	217,0	260,4	303,8	347,2	390,6	434,0
168,3 x 2,6	52,3	104,6	156,9	209,2	261,5	313,7	366,0	418,3	470,6	522,9

External inlet-coefficient $\alpha_e = 10 \text{ W}/(\text{m}^2 \times \text{°K})$

5.4 Insulation

To minimise the unwanted thermal emission from piping, the minimum insulation thicknesses should be maintained.

The following rules must be observed:

- DIN 4108 Thermal insulation in buildings;
- energy Saving Ordinance (EnEV);
- thermal Insulation Ordinance (WSchutzV).

Furthermore, national regulations should be observed as necessary.

In addition, insulating the piping can prevent water condensing, outside corrosion, unwanted warming of the medium being transported and unwanted noise production and transmission.

Cold water pipes must be insulated so that the potable water quality is not affected through warming.

For the insulation of **inoxPRES** pipes only insulation materials which contain less than 0,05% water soluble chloride ions may be used. Insulation materials of AS quality in accordance with AGI-Q135 are well below this value and thus suitable for use with **inoxPRES**.

Guideline values for minimum insulation material thickness are shown in table 12.

TABLE 12: MINIMUM INSULATION MATERIAL THICKNESS FOR PIPING

Piping cold water		Piping hot water	
Type of installation	Insulation material thickness in mm $\lambda = 0,040 \text{ W}/(\text{m} \times \text{°K})$	OD in mm	Insulation material thickness in mm $\lambda = 0,040 \text{ W}/(\text{m} \times \text{°K})$
Piping uncovered, not heated (i.e. cellar)	4	139,7	100
Piping uncovered without hot water lines	9	168,3	100
Piping in channel, no hot water lines	4		
Piping in channel, along with hot water	13		
Piping in wall slit, risers	4		
Piping in wall gap, along with hot water	13		
Piping on concrete floor	4		

5.5 Soundproofing (DIN 4109)

Noise in potable water and heating installations is produced mainly in tap fittings and sanitary items. The piping can then transfer this sound to the building itself, subsequently producing the irritating airborne sound. By using soundproofed holders, and by soundproofing the piping, the sound transfer can be greatly reduced.

5.6 Fire prevention

inoxPRES pipes are classed as a non-flammable material in building material class A in accordance with DIN 4102-1.

5.7 Potential equalisation

All parts of metallic water and gas piping which can conduct electricity have to be included in the main potential equalisation of a building.

inoxPRES are conductive systems and must therefore be included in the potential equalisation.

The responsibility for this work lies with the persons installing the electrical system.

5.8 Dimensioning

The objective of pipe system calculation is to achieve perfect functioning of the system with economical pipe diameters.

The following regulations should particularly be observed:

Potable water installations:

- UNI 9182:2010
- UNI EN 806:2008/2012

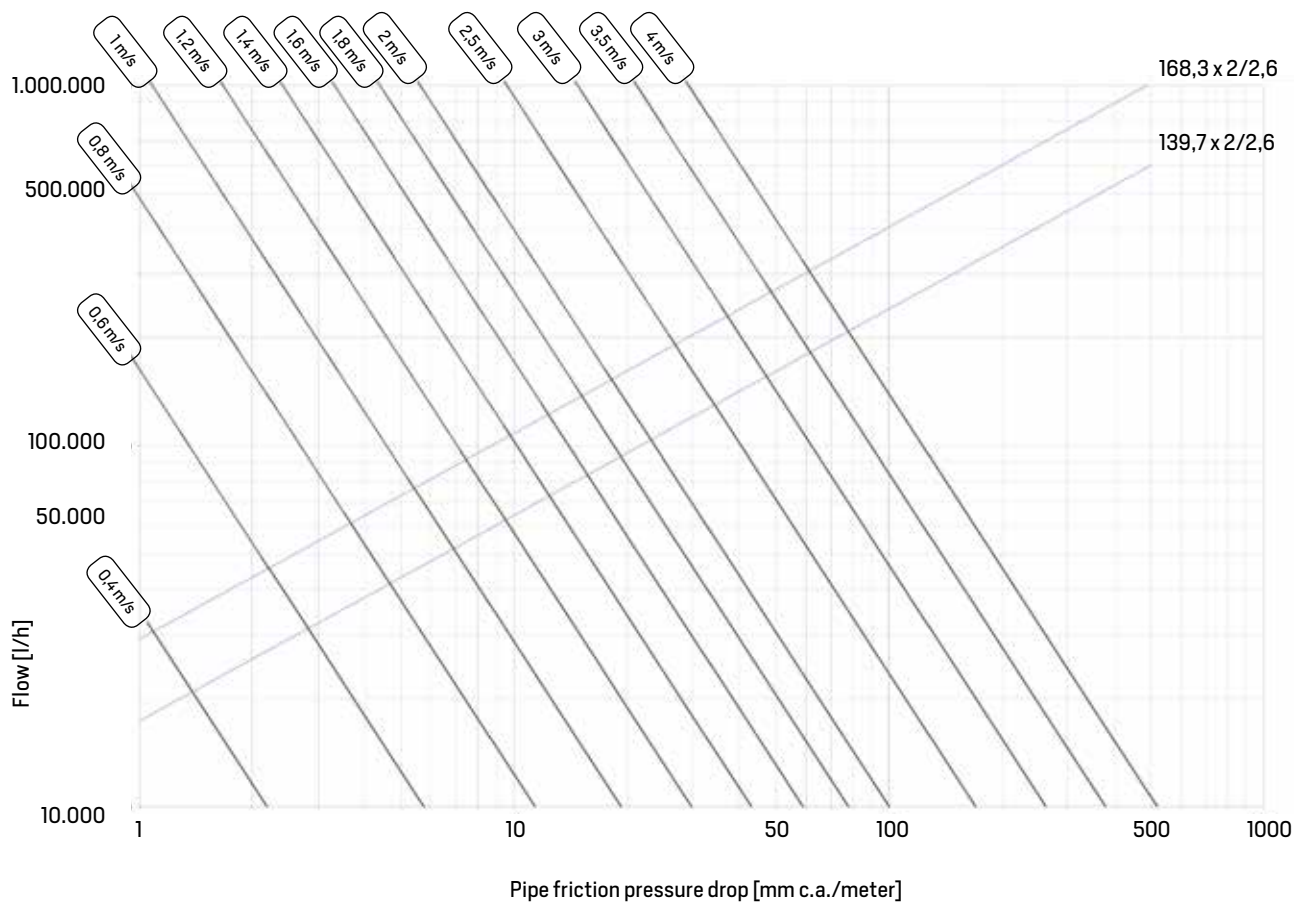
It is also important to respect the CEN / TR 16355: 2012 standard (Recommendations for prevention of Legionella growth in installations inside buildings conveying water for human consumption).

Heating installations:

- UNI EN 12828:2014

The pipe friction pressure drop for **inoxPRES** piping is shown in table 13.

TABLE 13: PIPE FRICTION PRESSURE DROP FOR INOXPRES



5.9 Trace heating

When trace heating is used, the temperature of the pipe inside wall may not exceed 60 °Centigrade.

For thermal disinfection purposes a temporary temperature increase to 70 °Centigrade (1 hour per day) is permitted. Pipes which are fitted with drainage valves or back-flow prevention valves must be protected against excessive pressure increase resulting from warming. The fitting instructions issued by trace heating manufacturers are to be followed exactly.

6.0 Start-up

The following guidelines have to be taken into account in Germany when carrying out the start-up and pressure testing:

Potable water systems:	DIN 1988 part 100 ZVSHK worksheet "Tightness Testing of Potable Water Piping with Compressed Air, Inert Gas or Water" (Dichtheitsprüfung von Trinkwasser-Installationen mit Druckluft, Inertgas oder Wasser) BTGA rule 5.001 VDI 6023
Heating systems	DIN-VOB 18380

6.1 Pressure testing

In the case of piping for potable water, the pressure testing (see page 28) has to be carried out in accordance with DIN EN 806, DIN 1988 part 100 and worksheet GW534, using filtered potable water. The potable water system must stay completely filled until taken into operation. The presence of remaining quantities of water in the piping greatly increases the danger of corrosion in metal piping (three phase corrosion). This effect is avoided keeping the system completely filled with water up to commissioning function otherwise the risk of corrosion would greatly increase due to the residual water remaining in the system (in the case of metal exposed to both water and air). If a potable water system is not used soon after the pressure testing, then the pressure testing should be carried out using compressed air or inert gases.

6.2 Flushing the system and starting up

According to DIN 1988 Part 100, EN 1717 and VDI 6023 is to prevent corrosion in potable water pipes, rinsing with a water-air mixture is required. Normally the potable water system is flushed through with a waterair mixture so as to avoid corrosion. From a corrosion point of view, **inoxPRES**, potable water installations, however, only require simple flushing with filtered potable water, since thanks to the special connection technique no additional substances such as cutting oil and fluids are required.

For hygienic reasons a high standard system flushing procedure may be required (for example, hospital, care centre). The pressure testing, flushing and start-up of the system have to be documented. The system operator has to be instructed with regard to correct working practices.

6.3 Regular checks

Maintenance of the potable water quality can only be assured by regular monitoring of the system; for this reason the operator should be offered a maintenance contract.

7.0 Corrosion

7.1 inoxPRES

The corrosion behaviour of **inoxPRES** press fitting systems is determined by the Cr-Ni-Mo steel with material n°1.4404 (AISI 316 L). The following properties result from it:

- suitability for all potable water;
- absolutely hygienic;
- suitable for mixed installations;
- suitable for treated, softened and desalinated water.

7.1.1 Bimetal corrosion (mixed installation) – DIN 1988 sez. 200

inoxPRES can be combined with all non-ferrous metals (copper, brass, red brass) in one mixed installation without taking flow rules into account.

Bimetal corrosion can only appear on zinc-coated components if they are in direct contact with **inoxPRES** components. Bimetal corrosion can be prevented by installing a spacing section made of non-ferrous material > 80 mm (for example a shut-off valve).

7.1.2 Crevice, pitting corrosion (three phase corrosion)

Unacceptably high chloride content in water and building materials can lead to corrosion traces on stainless steels. Crevice or pitting corrosion can only occur in water with a chloride content which is above the levels of the potable water legislation (max. 250 mg/l). The chloride content of the potable water can be obtained from the local water company.

inoxPRES components are in danger of crevice or pitting corrosion if:

- following pressure testing the system is emptied and some water remains in the piping which is open to the atmosphere. The slow evaporation of the remaining water may lead to an unacceptable increase in the chloride content level and thus initiate pitting (three phase corrosion) at the 'water-material- air' interface. If the system cannot be put into operation shortly after pressure testing with water, then the pressure testing should be carried out using air. See section 6.1 Pressure testing for more details;
- an increase in the water temperature is caused from the outside via the pipe wall (for example electrical trace heating). There may be an increase in chloride ions in the deposits which form on the inside pipe wall during this type of operation. See section 5.9 Trace heating for more information;
- non-approved sealants or plastic tapes containing chloride are used. The transfer of chloride ions from sealant materials to the potable water can lead to local increase in chloride and thus to crevice corrosion. See section 4.7 Thread or flange connections for more information;
- if the material is sensitised through incorrect heating. Any heating of the material which leads to tarnishing changes the microstructure of the material and can lead to intercrystalline corrosion. Hot bending or cutting the pipes using a grinder is not permitted.

7.1.3 Corrosione esterna

inoxPRES components are in danger of outside corrosion if:

- non-approved insulation materials or lagging are used. Only those insulation materials and lagging are approved which are of AS quality in accordance with AGI Q 135, having a percentage weight of max. 0,05% in water soluble chloride ions;
- **inoxPRES** is subjected to contact with gases or fumes containing chloride (e.g., galvanising shops, swimming pools);
- **inoxPRES** comes into contact with building materials which contain chloride, together with dampness;
- a concentration of chloride develops through water evaporation on warm piping (swimming pool atmosphere).

inoxPRES components can be protected against outside corrosion by means of:

- closed cell insulation material or lagging;
- coating;
- painting;
- avoiding installation in areas where the risk of corrosion is higher (e.g., floor without cellar space underneath).

The planner or the fitter carries the responsibility for the selection and installation of the corrosion protection measures.

TABLE 28: MATERIAL COMPATIBILITY - TWO-METAL MATCHING

Systems	Materials	PIPES							
		Stainless Steel		Carbon Steel	Copper		Cupronichel		
		Open circuit	Close circuit	Close circuit	Open circuit	Close circuit	Open circuit	Close circuit	
inoxPRES	stainless steel			1)					
steelPRES	carbon steel		3)			2)		2)	
aesPRES	copper-bronze			1)					
marinePRES	cupronichel			1)					

Accepted matching
 Attention to the enclosed notes
 Forbidden matching

NOTES:

1) single joints in stainless steel/copper/copper-nickel are accepted, inside a carbon installations, while any net in stainless steel/copper/copper-nickel is to be separated from carbon with a non ferrous transition separator;

2) any carbon net is to be separated from stainless steel with a non ferrous transition separator any carbon net is to be separated from carbon with a non ferrous transition separator (ex. valve, bronze/brass joints);

3) any kind of carbon steel piping's stretch must be separated from inox with a kind of non-ferrous transition's spacer ex. valve, bronze/brass joints).

Compatibilities in the table refer to the water transportation under standard conditions (PN 16 bar, T 20 °C).

The table is not binding: as for corrosion, simply assess surfaces of the different components and the real operating conditions.

8.0 Disinfection

The disinfection of potable water systems may be required in case:

- germs are detected;
- of increased hygienic requirements.

The **inoxPRES** press fitting system must be disinfected using hydrogen peroxide (H₂O₂) in accordance with DVGW worksheet W 291 – disinfection of water supply systems.

If disinfection is carried out using chlorine, then the prescribed concentrations and disinfection periods shown in the overview below must be strictly adhered to.

Chlorine content (free chlorine)	50 mg/l	100 mg/l
Disinfection period	max. 24 h	max. 16 h

The working temperature of the disinfectant substance must never exceed 25 °C in any point of the plant. Following disinfection with chlorine the system must be flushed thoroughly with potable water until a residue-free chlorine value of < 1 mg/l in the entire potable water system is reached.

Due to the danger of corrosion through incorrect disinfection measures using chlorine, we do recommend either disinfection using hydrogen peroxide or thermal disinfection.

Disinfection measures should always be carried out by experienced, trained professional staff only.

The disinfection treatment must also be extended to existing lines if they be expanded or repaired.

9.0 Hygiene

The implementation of the new potable water regulations (TrinkwV) places great emphasis on the hygieneconscious planning, realisation and operation of potable water systems. It is necessary to put particular attention to the to the applicable regulations in each country where the installation is done, with particular reference to aspects of plant level, sanitizing and maintenance.

The following measures are suitable both for the assurance of the required potable water quality and the minimising of the danger of germs occurring:

- usage of suitable material;
- when calculating the pipe network, select the smallest possible widths;
- hygiene-conscious system layout (looped systems); are to avoid “dead branches” and branches that appear to be unidirectional critical from the point of view of hygiene;
- no stagnation piping (drainage pipes, collective safety devices);
- single safety devices are preferable;
- separate extinguisher systems from potable water network;
- ensure target temperature is reached in entire potable water heater;
- size and calibrate the re-circulation pipes;
- verify the possibility of inserting traits bypass on the main line in cases of complex lines, so that it is possible to make a thorough washing without stopping the system thus increasing the effectiveness of the disinfection treatment;
- protect cold water piping against heating;
- hygiene-conscious handling of materials;
- document the piping system;
- maintain the system regularly (maintenance contract).

10.0 Form Request of compatibility

DATA OF THE APPLICANT

Applicant / Company _____
 Name _____
 Address _____
 Contact person _____
 Date _____

DATA OF THE PROJECT

Description _____
 Set-up of the system _____
 Pipediameter _____
 Design manager _____
 Specification _____

SYSTEM FOR WHICH COMPATIBILITY IS REQUESTED

inoxPRES Pipe AISI 316L

FLUIDO DA VERIFICARE COMPATIBILITÀ

Attachments
 Technical data sheet
 Safety sheet
 Chemical analysis

Treatment of systems (e.g. cleaning, anti-corrosion, foil, etc.) _____

SYSTEM

Description/working environment _____

OPERATING CONDITIONS

Temperature	min ____ °C	max ____ °C
Pressure	min ____ bar	max ____ bar
PH	min	max
Medium proportion	% min	% max

OTHERS SUBSTANCES

Type of cycle	open <input type="checkbox"/>	closed <input type="checkbox"/>
Installation	outside closed spaces <input type="checkbox"/>	inside closed spaces <input type="checkbox"/>

11.0 Pressure test protocol

11.1 Pressure test protocol for drinking water systems in "wet conditions"

For **inoxPRES** press fitting systems

Project / Construction _____

Contractor / Representative _____

Project / Representative _____

Materials _____

Potable water temperature _____ °C Room temperature _____ °C

- ❑ The system must be filled with filtered and deaerated water
- ❑ Only the press system will be checked (Tanks, valves, etc. must be separated).

Leakage test

- ❑ After the initial filling a waiting period of at least 30 minutes for temperature equilibration will be observed
- ❑ The max. test pressure during the leakage test is of **6 bar**
- ❑ Pressure drop during the leak test
- ❑ Test accuracy of the pressure gauge **0,1 bar**
- ❑ A visual inspection of all pipe connections for a proper execution was carried out

System pressure test

- ❑ Test pressure is of at least **12 bar**
- ❑ Selected test pressure _____ bar
- ❑ Start of test _____ Clock test period (min. 45 minutes min.) _____ hours
- ❑ Pressure drop during the pressure test

Comments

A proper assessment has been done!

Both signatures are required for a properly conducted test!

Place _____

Date _____

Client signature

Contractor signature

11.2 Pressure test protocol for hot water heating systems

For **inoxPRES** press fitting systems

Project / Construction _____

Contractor / Representative _____

Project / Representative _____

Materials _____

Medium Potable water temperature _____ °C Room temperature _____ °C

- ☒ The system must be filled with filtered and deaerated water according to DIN EN 12828.
- ☒ Only the press system will be checked (Tanks, valves, etc. must be separated).

Test pressure

Test pressure to VOB part C, DIN 18380, according to the pressure of the safety valve.

- ☒ Selected test pressure _____ bar
- ☒ Start of test _____ Clock test period (min. 45 minutes) _____ Hours

Leakage test

- ☒ After the initial filling a waiting period of at least 30 minutes for temperature equilibration will be observed
- ☒ Pressure drop during the leakage test
- ☒ Test accuracy of the pressure gauge **0,1 bar**
- ☒ A visual inspection of all pipe connections for a proper execution was carried out

Comments

A proper assessment has been done!

Both signatures are required for a properly conducted test!

Place _____

Date _____

Client signature

Contractor signature

11.3 Pressure test protocol for potable water with compressed air

For **inoxPRES** press fitting systems

Project / Construction _____

Contractor / Representative _____

Project / Representative _____

Materials _____

Potable water temperature _____ °C Room temperature _____ °C

- The installation must be tested according to DIN1988-100 and VDI6023 with oil-free compressed air, nitrogen or carbon dioxide and then subsequently drained.
- Only the press system will be checked (Tanks, valves, etc. must be separated).

Leakage test

- After the initial filling a waiting period of at least 120 minutes for temperature equilibration will be observed
- The max. test pressure during the leakage test is of **150 mbar**
- Pressure drop during the leakage test
- Test accuracy of the pressure gauge **0,01 bar**
- A visual inspection of all pipe connections for a proper execution was carried out

System pressure test

- For nominal sizes <= DN50 maximum **3 bar**
- For nominal sizes DN50-DN100 maximum **1 bar**
- Selected test pressure _____ bar
- Start of test _____ clock Durata della prova (min. 45 minuti) _____ Hours
- Pressure drop during the pressure test

Comments

A proper assessment has been done!

Both signatures are required for a properly conducted test!

Place _____

Date _____

Client signature

Contractor signature

12.0 Guarantee

Raccorderie Metalliche S.p.A. – hereinafter RM – provides the following warranty ("Warranty") to installation companies for the pressing systems **inoxPRES**, **steelPRES**, **aesPRES**, **marinePRES** (the "Products") manufactured and distributed by RM, exclusively for the applications and uses permitted by RM in its Technical Handbook (published on the website www.racmet.com).

The warranty covers manufacturing and materials defects of the Products, provided that the Products have been correctly installed and used in accordance with the instructions contained in the RM Technical Handbook. In the event that a defect is detected and recognized as such by RM, the latter is liable for injury or damage compensation as follows:

- 1) Personal injury and property damage caused by RM Products, up to a total maximum amount of € 2,500,000.00 (two million five hundred thousand euros) for all events causing damage or harm reported within the calendar year, with the exception of the object of the warranty referred to in point 2 below.
- 2) The "repair and replacement" warranty which includes:
 - ❑ the supply of new products in perfect conditions;
 - ❑ the reimbursement of expenses necessary for any disassembly and reassembly;

This "repair and replacement" warranty is to be intended as valid up to the maximum total amount of € 100,000.00 (one hundred thousand) for all requests for repair and replacement carried out within a calendar year.

The Warranty starts from the date of the testing of the installation of the Products and ends at the latest 5 (five) years after the testing of the installation at the customer's premises by the installation company.

The Warranty is subject to the presentation of the proof of purchase of the Products, of the proof of the date of installation and of the testing of the same. The Warranty is only valid if testing takes place within 30 (thirty) days from the completion of the installation: in the absence of testing within the aforementioned period, the Warranty will expire.

The Warranty is valid and applicable only if:

- ❑ the installation company has complied with the requirements for installation, assembly and pressure tests applicable at the time of installation and in particular has complied with the limitations of use, as envisaged in the Technical Handbook;
- ❑ the installation has been carried out by qualified installers;
- ❑ only components and equipment indicated in the Technical Handbook have been used.

The Warranty does not cover defects arising from:

- inadequate or improper use;
- incorrect installation or installation that does not comply with the instructions provided;
- installation, in whole or in part, by the customer or any other person other than a qualified installer;
- wear and tear;
- lack of maintenance or insufficient maintenance;
- improper preservation during the use of the Products or during the storage of the Products at the installation company's premises;
- tampering, impacts, damages due to handling and transport operations;
- chemical, electrochemical or electrical interference;
- interventions that are incorrect or not in accordance with the instructions for use;
- use of unauthorized or non-standard parts;
- design errors.

Negligent behavior and accidental damage to the Products are not covered by this Warranty.

RM cannot in any case be held responsible towards the installation company for the following (direct or indirect) losses: any loss of profit, loss of goodwill, interruption/suspension of activity, loss of activity, loss of contracts and/or opportunities.

If an event occurs resulting in damage, the installation company must inform RM without delay about the nature of the event and give RM the opportunity to inspect the site of the event causing damage. The allegedly defective products must be made available to RM.

The interpretation of this Warranty is subject to Italian law.

The warranty for the pressing equipment is:

- 24 months from the date of production and in any case;
- 12 months from the date of purchase by the installation company.

This warranty is valid and effective only if the equipment serial number is indicated on the purchase invoice.

Gamma Oversize - Oversize Range




116/200

6 m sp. 2 mm

TUBO 316L / 1.4404

- PIPE
- ROHR
- TUBE
- TUBO

CODE	DIM. mm x mm	L m	
116139200	139,7 x 2,0	6	6,896
116168200	168,3 x 2,0	6	8,328




116/260

6 m sp. 2,6 mm

TUBO 316L / 1.4404

- PIPE
- ROHR
- TUBE
- TUBO

CODE	DIM. mm x mm	L m	
116139260*	139,7 x 2,6	6	8,957
116168260*	168,3 x 2,6	6	10,816


*DVGW certified



181/450

CURVA 45° FF

- 45° ELBOW FF
- BOGEN 45° II
- COUDE FF 45°
- CURVA 45° HH


CODE	De mm	
181139450	139,7	3052
181168450	168,3	4556



181/900

CURVA 90° FF

- 90° ELBOW FF
- BOGEN 90° II
- COUDE FF 90°
- CURVA 90° HH


CODE	De mm	
181139900	139,7	4082
181168900	168,3	6059



181/451

CURVA 45° MF

- 45° ELBOW MF
- BOGEN 45° IA
- COUDE MF 45°
- CURVA 45° HM


CODE	De mm	
181139451	139,7	2947
181168451	168,3	4346



181/901

CURVA 90° MF


- 90° ELBOW MF
- BOGEN 90° IA
- COUDE MF 90°
- CURVA 90° HM

CODE	De mm	
181139901	139,7	3984
181168901	168,3	5991



183/000
MANICOTTO


- COUPLING
- MUFFE
- MANCHON
- MANGUITO HH

CODE	De mm	
183139000	139,7	2031
183168000	168,3	2936



183/003
TAPPO DI CHIUSURA


- STOP END
- VERSCHLUSSKAPPE
- BOUCHON D'OBTURATION
- TAPÓN

CODE	De mm	
183139003	139,7	1380
183168003	168,3	2038



182
"T"


- EQUAL TEE
- T-STÜCK
- TÉ ÉGAL
- TE IGUAL HHH

CODE	De mm	 g
182139000	139,7	4129
182168000	168,3	6321



193/001
MANICOTTO
FLANGIATO
PN10


- ADAPTOR LOOSE FLANGE
- UBERGANGSLOSFLANSCH
- BRIDE TOURNANTE DE RACCORDEMENT
- BRIDA LOCA CON ADAPTADOR

CODE	De mm	 g
193139001	139,7	3352
193168001	168,3	4419



192
"T" RIDOTTO


- REDUCING TEE
- T-STÜCK MIT REDUZIERTEM ABGANG
- TÉ RÉDUIT
- TE REDUCIDA HHH

CODE	De mm	 g
192139076	139,7 x 76,1 x 139,7	3340
192139088	139,7 x 88,9 x 139,7	3435
192139108	139,7 x 108 x 139,7	3631
192168076	168,3 x 76,1 x 168,3	5050
192168088	168,3 x 88,9 x 168,3	5146
192168108	168,3 x 108 x 168,3	5340
192168139	168,3 x 139,7 x 168,3	5681



191
RIDUZIONE MF

- REDUCER
- REDUZIERSTÜCK
- REDUCTION
- REDUCCIÓN MH


CODE	De mm	 g
191139088	139,7 x 88,9	2319
191139108	139,7 x 108	2285
191168088	168,3 x 88,9	2660
191168108	168,3 x 108	2945
191168139	168,3 x 139,7	3392



Novopress
ACO 403 BT

- PRESSING MACHINE
- AKKU- PRESSGERÄT
- SERTISSEUSE A ACCUMULATEUR
- AKKU-MAQUINA


*2 pieces - 18V - 5,0 Ah

CODE	 Kg
196000023	22



Novopress
CATENA
ACO 401-403

- PRESSING COLLAR
- PRESSSCHLINGE
- CHAÎNE
- MORDAZA CADENA

CODE	De mm	 Kg
196139002	139,7	14,4
196168002	168,3	19,7

The full references of our officials and business partners are available on our website
raccorderiemetalliche.com



RACORDERIE METALLICHE

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