Press fitting systems for saturated steam plants

inoxPRES®

RACCORDERIE METALLICHE

Certified Company

DNV

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.: 10000457222-MSC-ACCREDIA-ITA
Initial certification date: 23 November 2015 (based on OHSAS 18001)
Valid: 07 December 2021 – 23 November 2024
Expiry date of last certification cycle: 23 November 2021
Date of last re-certification: 08 October 2021

This is to certify that the management system of
RACCORDERIE METALLICHE S.p.A. - Sede Legale e Operativa
Strada Sabbionetana, 59 - 46010 Campitello di Marcaria (MN) - Italy
and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Occupational Health and Safety Management System standard:
ISO 45001:2018

This certificate is valid for the following scope:
Production and marketing of metal fittings, welded, threaded, press-on and insulating collars and fixing systems for pipes and radiators. Marketing mix of valves and air vent, products and complementary accessories for use hydro-thermal health, according to national/international customer specifications and internal specifications established. Marketing of metal pipes made of steel and other metals.
(IAF 17, 29)

Place and date: **Vimercate (MB), 07 December 2021**

For the issuing office: **DNV - Business Assurance Via Energy Park, 14, - 20871 Vimercate (MB) - Italy**

Zeno Beltrami
Management Representative

Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
ACCREDITED UNIT: DNV Business Assurance Italy S.r.l., Via Energy Park, 14 - 20871 Vimercate (MB) - Italy - TEL. +39 68 99 905. www.dnv.it

ISO 45001:2018 - DNV

DNV

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.: CERT-00317-94-AQ-MIL-SINCERT
Initial certification date: 10 November 1994
Valid: 08 October 2021 – 07 October 2024

This is to certify that the management system of
RACCORDERIE METALLICHE S.p.A. - Sede Legale e Operativa
Strada Sabbionetana, 59 - 46010 Campitello di Marcaria (MN) - Italy
and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Quality Management System standard:
ISO 9001:2015

This certificate is valid for the following scope:
Manufacture and trade of welding, threaded and press metal pipe fittings and dedicated insulation system; collars and clamping systems for pipes and radiators. Trade of mixing valves and automatic float air vents, products and accessories for heating and plumbing uses in conformity with national/international standards, specifications furnished by the customer and established company specifications
(IAF 17, 29)

Place and date: **Vimercate (MB), 06 October 2021**

For the issuing office: **DNV - Business Assurance Via Energy Park, 14, - 20871 Vimercate (MB) - Italy**

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ISO 9001:2015 - DNV

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificato no./Certificate No.: 90476-2010-AE-ITA-SINCERT
Data prima emissione/Initial date: 22 dicembre 2010
Validità:/Valid: 24 dicembre 2019 - 23 dicembre 2022

Si certifica che il sistema di gestione di/This is to certify that the management system of

RACCORDERIE METALLICHE S.p.A.
Strada Sabbionetana, 59 - 46010 Campitello di Marcaria (MN) - Italia
e i siti come elencati nell'Appendix che accompagna questo certificato / and the sites as mentioned in the appendix accompanying this certificate

È conforme ai requisiti della norma per il Sistema di Gestione Ambientale/
Has been found to conform to the Environmental Management System standard:
ISO 14001:2015

Valutato secondo le prescrizioni del Regolamento Tecnico RT-09/
Evaluated according to the requirements of Technical Regulations RT-09

Questa certificazione è valida per il seguente campo applicativo:
Produzione (attraverso le fasi di taglio, deformazione e filettatura) e commercializzazione di raccorderia metallica, a saldare, filettata, a pressare e relativo isolante; collari e sistemi di fissaggio per tubi e radiatori. Commercializzazione di valvole mix e a sfogo d'aria, prodotti/accessori complementari per impieghi idro-termo sanitari, in accordo a normative nazionali/internazionali, specifiche fornite dal cliente e specifiche interne consolidate
(IAF: 17, 29)

This certificate is valid for the following scope:
Production (through cutting, deformation and thread phases) and marketing of metal fittings, welded, threaded, press-on and insulating collars and fixing systems for pipes and radiators. Marketing mix of valves and air vent, products and complementary accessories for use hydro-thermal health, according to national / international customer specifications and internal specifications established
(IAF: 17, 29)

Luogo e Data/Place and date: **Vimercate (MB), 09 gennaio 2020**

Per l'Organismo di Certificazione/ For the Certification Body
DNV GL - Business Assurance Via Energy Park, 14, - 20871 Vimercate (MB) - Italy

Zeno Beltrami
Management Representative

La validità del presente Certificato è subordinata al rispetto delle condizioni contenute nel Contratto di Certificazione/
Lack of fulfilment of conditions as set out in the Certification Agreement may render this Certificate invalid.
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ISO 14001:2015 - DNV

RACCORDERIE METALLICHE

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1.0 Steam distribution plants

1.1 What is the steam?

A fluid is in a saturated steam state when:

- the liquid phase and the vapour phase are in equilibrium with one another;
- in this condition, the number of particles passing from the liquid phase to the gaseous phase are equal to the number of those that condense into the liquid.

Water is the liquid referred to in this manual, to be transformed into saturated steam.

1.2 Processes where saturated steam is used

In industrial environments, steam plants are used in very large quantities.
Among the many applications, we summarize below some of the most classic uses:

- electricity generation in thermoelectric power plants;
- production of pulp and paper;
- petrochemical industry;
- food industry such as dairy products, bakery products, pasta, oilseeds, confectionery, cured meats, processing and packaging. Production processes such as blanching, peeling, baking, distillation, pasteurisation, cellophane dehydration are some of the most common productive phases where the steam is used;
- refining of sugar;
- beverage and foodstuff bottling lines for the cleaning and sterilisation of containers;
- pharmaceutical, hospital and medical sectors: in the medical field, thermal sterilisation of materials and equipment (a typical operating temperature of 165°C) is essential for keeping instrumentation under sterile conditions;
- laundry and ironing: in these applications, the typical operating temperature is 135°C for process water heating and for raising the humidity level.

1.3 Steam as a heat transfer fluid

At the theoretical level, any fluid can be used as a heat transfer fluid. However, fluid that accumulates and transfers heat must have some characteristics to allow it to be used in the industrial environment.
The main characteristics a fluid must possess to transfer heat are as follows:

- not be dangerous: the fluid should not be a direct or indirect source of danger. The choice therefore excludes flammable, toxic and radioactive fluids, and all fluids in general that require dangerous working phases;
- be economical: large-scale industrial use requires that the cost of the fluid that accumulates and transfers heat and the required facilities – including maintenance and management – are as low as possible;
- not be corrosive: the fluid must not be corrosive to pipes, tanks and equipment;
- present a high coefficient of heat exchange: the higher the coefficient of heat exchange, the smaller the exchange surfaces;
- present high heat transfer capacity: with equal thermal power, the flow rates are reduced.

Notwithstanding the above, the saturated steam generated by water is the most suitable fluid for accumulating and transporting heat.
The only hazard associated with the use of steam is in relation to the pressure and temperature at which steam is produced and distributed.

1.3.1 The different grades of steam purity

Steam is classified according to the different grades of purity, which is why it is used in different application fields.

1.3.2 Plant steam

Plant steam is understood to be steam with the lowest qualitative grade and with the greatest potential for contamination.
The factors influencing steam quality are:

- incoming water to the boiler is not purified;
- dosing of chemical substances used in the plant and poor water treatment management;
- steam generator management with control of load, levels, dissolved salt solutions, operating parameters (pressure, temperature, etc.);
- the contamination resulting from other production processes.

Industrial steam is characterised by the presence of additives such as anti-corrosive agents, high pH, and relatively high operating pressure (between 3 and 10 bar).

1.3.3 Filtered steam

Filtered steam is the typical steam classified as "culinary": it is produced from the plant steam through microfiltration using an extremely thin stainless steel element. Normally the filter has a 5 µm mesh to block solid particles and droplets of water. The use of filters does not eliminate the potential risk of contamination from the extraction of impurities from the boiler and cross contamination.
The amount of contaminants that can be detected downstream of the filter is due to many factors including the maintenance regime and the speed of the steam flow.

1.3.4 Clean steam

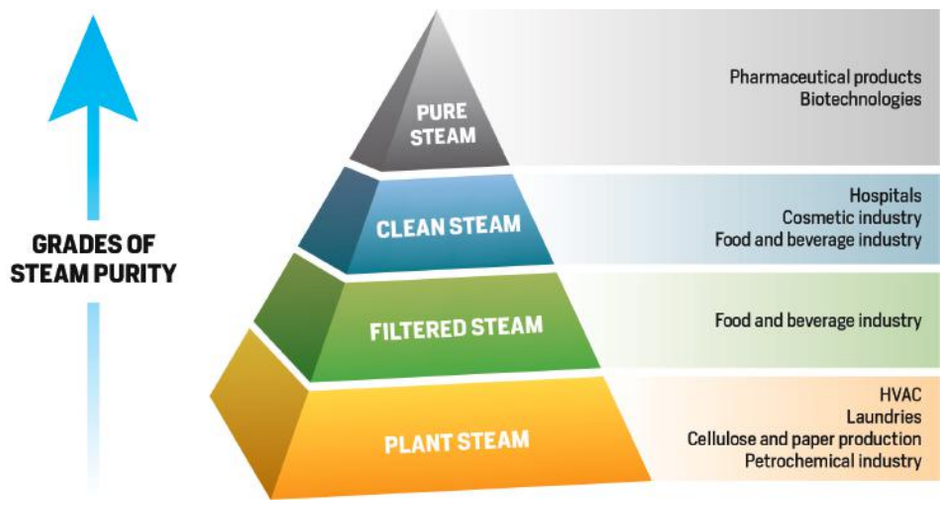
Clean steam is the grade of steam purity that is used for sterilisation in hospital environments, for food and beverages.

Clean steam is generated from decontaminated water in a dedicated steam generator. IT is free of low pH additives (between 5 and 7) and is produced and distributed at low pressures (max. 3 bar).

When it comes to "clean" steam, we refer to UNI EN 285:2016, which specifies the requirements and tests for large steam sterilisers, essentially used in sanitary sterilisation for medical devices and their accessories.

1.3.5 Pure steam

Pure steam is the evolution of clean steam aimed at the pharmaceutical industry and biotechnology. The characteristics of purity and quality found in pure steam are in fact beyond what is required by current legislation concerning the food and beverage industry.



Classification of steam purity grades and their applications.

1.4 Water for steam production

The parameters of the water used for steam production are influenced by the type of steam you want to produce.
These parameters should be periodically monitored to ensure the required quality.
The key parameters to be controlled are:

- oxygen and carbon dioxide are aggressive gases and cause corrosion: they are eliminated by thermal degassing;
- electrical conductivity, a body's ability to let an electric current flow: conductivity increases as the concentration of ions (dissolved salts) increases;
- "hardness" is a value that expresses the total content of calcium and magnesium ions; this is an important parameter for assessing the possible formation of incrustations following salt precipitation;
- iron: the precipitation of iron ions generates incrustation and corrosion;
- pH: is the measure of acidity/basicity of water; it must be maintained by adding alkalinisers at an optimum value of 9.0 to 9.3 to limit corrosion of the metals.

1.4.1 Industrial steam production

For industrial steam production, filtered, colourless water is used with the characteristics listed in the table below, depending on the pressure of the generator (boiler).

TABLE 1: WATER SUPPLY OF STEAM GENERATOR

MAX OPERATING PRESSURE	BAR	>0.5<20	>20
General requirements		colourless, transparent and free of suspended solid particles	
pH value at 25°C		> 9	> 9
Conductivity at 25°C	µS/cm	only guideline values determined for the water supply	
Sum of the alkaline-ferrous metals ($Ca^{2+} + Mg^{2+}$)	mmol/litre	< 0.01	≥ 0.01
Oxygen (O_2)	mg/litre	0.05	≥ 0.02
Carbonic acid (CO_2) composition	mg/litre	< 25	< 25
Total Iron (Fe)	mg/litre	< 0.2	< 0.1
Total copper (Cu)	mg/litre	< 0.05	< 0.01
Oxidisability (Mn VII ->Mn II) of which $KMnO_4$	mg/litre	< 10	< 10
Oil, grease	mg/litre	< 1	< 1
organic substances	-	see note 1	

Note 1 Organic substances are generally mixtures of different compounds. The composition of such mixtures and the behaviour of their components at operating conditions of the the boiler are difficult to envisage. Organic substances may decompose into carbonic acid or other acid products, which increase conductivity and cause corrosion and deposits. They can also cause foam and/or sediment formation, which must be minimised. Total TOC (Total Organic Carbon) content must also be minimised.

Table 2: PLANT WATER - LIMIT VALUES

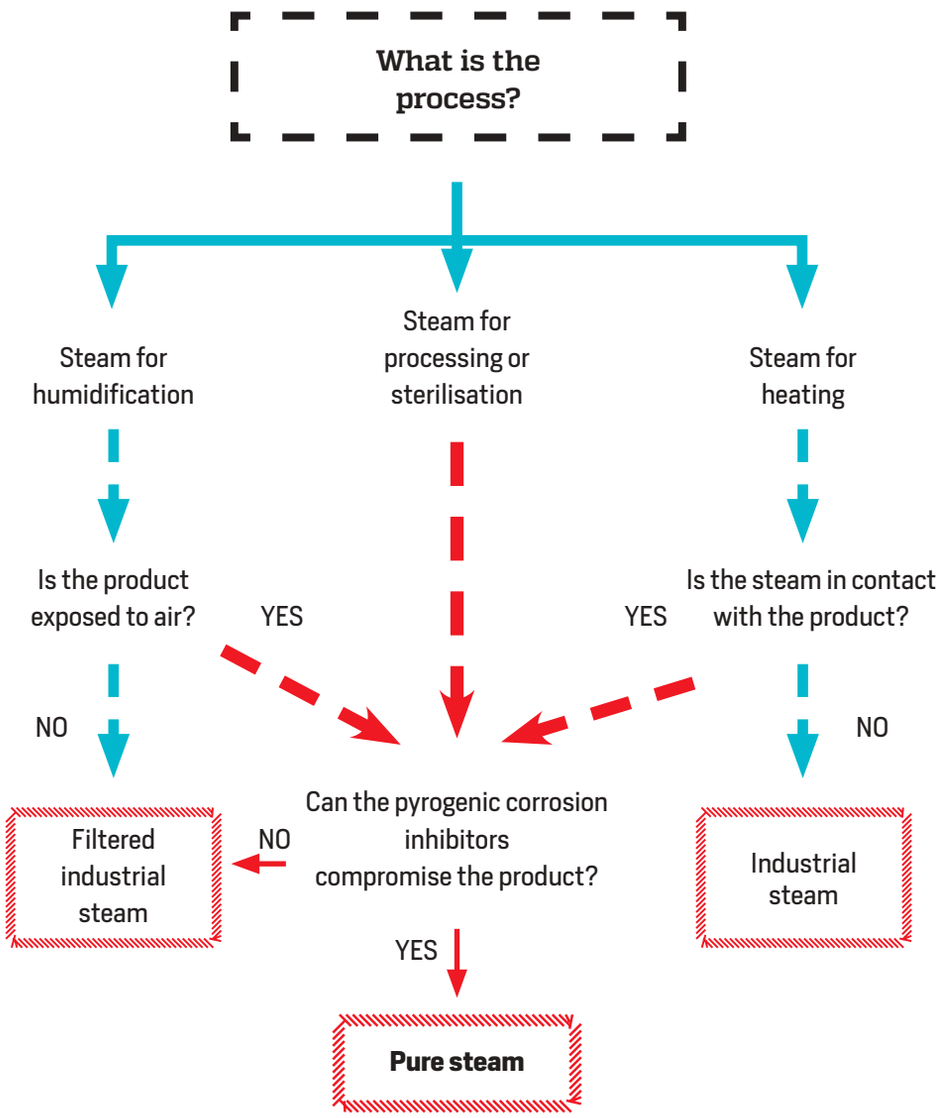
		WATER SUPPLY CONDUCTIVITY > 30 µS/cm		WATER SUPPLY CONDUCTIVITY < 30 µS/cm
MAX. OPERATING PRESSURE	BAR	> 0.5 < 20	>20	> 0.5
General requirements		colourless, transparent and free of suspended solid substances		
pH value at 25°C		10.5 ÷ 12	10.5 ÷ 11.8	10 ÷ 11
Acidity	mmol/litre	1 ÷ 12	1 ÷ 10	0.1 ÷ 1.0

1.4.2 Pure steam production

Pure steam production is carried out through a stainless steel tubular heat exchanger where heating is carried out with industrial steam circulating within the casing.
Prior to use, the "pure" steam is conveyed to a chamber where the fluid slows down to avoid the condensation droplets being drawn to the users. Adopting this measure, "sterile" steam is obtained without additives and impurities.

1.5 Choosing the right steam type

Below is the logical path to follow for the correct choice of steam type to be used according to the production process.



(From ISPE Baseline Pharmaceutical Engineering Guide)

2.0 Saturated steam production plant components

The transformation of energy in the saturated steam plants is through a system consisting of the following 3 macro components:

- **heat generator (boiler):** this is the heart of the system. In it a solid, liquid or gaseous fuel is reacted with oxygen contained in the atmospheric air. From this chemical reaction of oxidation, heat is transferred to the heat transfer fluid (dry saturated steam) that will deliver heat to the users;
- **distribution lines**: the pipes allow the transfer of the heat transfer fluid from the generator to the users;
- in the **user equipment**, steam transfers the accumulated thermal energy to a second process fluid or to the working environment.

Production of pulp and paper

Pharmaceutical industry

Bottling line

Industrial plants

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Steam pressure control systems

3.0 System components

3.1 Press fitting - product definition

A distribution system this well branched and widespread requires an innovative application solution. Forget installation procedures such as welding or threading.
The press fitting system is simple and requires only the automatic crushing of a pipe on a fitting, without welding, gluing or crimping. This new system is fast and cheap, because it requires only half the time for installation and therefore provides significant time savings.
A plant built with press fitting is very durable because the steel tubes are inherently tougher and more rigid.

The advantages offered by the **inoxPRES** press fitting system specifically designed for the production of steam plants are summarised in the following points:

- easy assembly, practical and convenient (efficient);
- quick installation with savings on hours of labour;
- safe and approved (guaranteed system);
- no need for specialised personnel (no special skills required);
- safe and no use of naked flames.

These characteristics make the press fitting system particularly suitable for industrial applications (where technical regulations permit). Press fitting systems are an ideal solution for the production of steam circuits in view of the need to ensure the cleanliness of fluid flow. In addition, the **inoxPRES** range is the most suitable for the production of steam circuits: the fittings and piping are made of stainless steel, a "clean" material, highly resistant to corrosive processes and with high mechanical performance, without the risk of the fluid flow becoming contaminated. Reduced thickness with large cross section, drastically reduces load losses and allows higher flow rates and better performance than traditional systems.

The press fitting system is only designed for saturated steam and is not intended for applications with overheated steam. Furthermore, the pressfitting system cannot be used in the medical, pharmaceutical and food sectors.

3.2 Press fitting – inoxPRES: characteristics

The **inoxPRES** system is particularly efficient because it is made of AISI 316L (1.4404) stainless steel, among the best stain–less steel alloys available, and has been tested and approved by the main international certification bodies.

TABLE 3: INOXPRES TECHNICAL CHARACTERISTICS

OPERATING CONDITIONS WITH SATURATED STEAM	
Pressure	
Max	7 bar absolute (6 bar relative) ø 15 mm up to ø 108 mm
Temperature	
Max	+165°C (resistance of white STEAM o–ring)
DIMENSION RANGE	
ø 15 ÷ 108 mm	Standard in stock
FLUIDS AND PLANT COMPATIBILITY	
The STEAM o–ring is compatible with hydrocarbons, oils and other aggressive substances. It presents also a very high performance resistance to high temperatures (up to 250°C). It is always necessary to evaluate compatibility for uses that are outside the transporting of saturated steam.	

3.2.1 Press fitting – inoxPRES: fittings

inoxPRES press fittings are manufactured using high-alloyed austenitic stainless Cr-Ni-Mo steel AISI 316L (material number 1.4404).
The press fittings are indelibly marked with laser reporting the manufacturer name, diameter and internal code.
At the bulging ends of the press fittings a standard high temperature resistant white STEAM ring seal is inserted, specifically designed for saturated steam applications.
The range of press fittings is available with figures that have threaded terminals according to the standard EN 10226-1 (ex ISO 7/1).

The threading is suitable for sealing on the thread using teflon/hemp and where the following characteristics exist:
- conical male thread;
- cylindrical female thread.

3.2.2 Press fitting – inoxPRES: pipes

inoxPRES piping, with thin seamless walls, are made of high-grade austenitic stainless steel Cr-Ni-Mo AISI 316L (material no. 1.4404). The tubes are manufactured according to EN 10217-7 and EN 10312.
Inner and outer surfaces are made of smooth metal and are free of corrosion-promoting substances. **InoxPRES** pipes are classed as a non-flammable material belonging to fire class A. They are supplied in 6m bars, the ends of which are closed with plastic caps.

TABLE 4: INOXPRES PIPES - DIMENSIONS AND CHARACTERISTICS

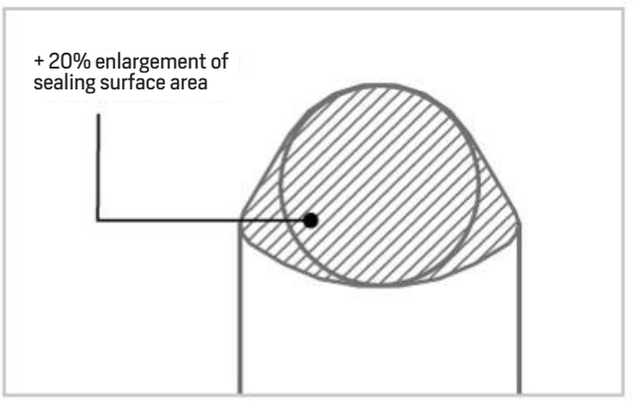
EXTERNAL DIAMETER X THICKNESS mm	NOMINAL DIAMETER DN	INTERNAL DIAMETER mm	MASS kg/m	STEAM CONTENT 165 °C / 7 bara (6 barg) l/m
15 x 1	12	13	0.351	0.038
18 x 1	15	16	0.426	0.058
22 x 1.2	20	19.6	0.624	0.087
28 x 1.2	25	25.6	0.790	0.149
35 x 1.5	32	32	1.240	0.232
42 x 1.5	40	39	1.503	0.345
54 x 1.5	50	51	1.972	0.590
76.1 x 2	65	72.1	3.550	1.176
88.9 x 2	80	84.9	4.150	1.639
108 x 2	100	104	5.050	2.453

TABLE 5: MECHANICAL CHARACTERISTICS INOXPRES PIPES	
Tensile strength	600 N/mm^2
Yield strength	220 N/mm^2
Elongation	40%
Linear expansion coefficient	1.7 x 10^{-5}
Surface roughness	≤ 1.0 µm
Fire resistance	according to DIN 4102-1-Class A

3.2.3 Press fitting – inoxPRES: seals

Traditional press fitting systems use round sealing rings (O-rings), which can easily be damaged in the event of unsuitable processing.
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;
- significant reduction in the risk of damage to the sealing ring;
- easy pipe insertion.



The steam sealing ring is a special STEAM mix, that is white (ø 15÷108 mm) and resistant to high temperature, specially designed for the conveyance of steam.
The excellent mixing characteristics allow the o-rings to withstand **saturated steam up to a temperature of 165°C, maximum pressure of 7 bar absolute (6 bar relative).**

The **inoxPRES** range offers several solutions to facilitate different plant situations.

Flanged sleeve	
Sleeve with swivel flange	
Swan neck pipe	
Multiple socket connection for instrumentation	
Eccentric reducer	
Condensate collector	

4.0 Design of the steam transport network

The dimensioning of the steam ducts requires knowledge of the following parameters:

- steam flow rate;
- thermodynamic conditions of the steam.

The dimensioning and management of the system must be achieved by reducing the load losses as much as possible.
At the design stage, the basic parameters to be addressed are:

- fluid speed;
- the size of pipelines;
- the slope of the lines.

4.1 Fluid speed

The maximum permissible speed of the **dry saturated steam** must be maintained at around 10 m/s (<25 m/s) for all pipes with a diameter of up to 5"–6".

4.2 Piping dimensioning

The pipes are sized starting from the pressure required at the point of use under maximum flow conditions.
After setting the speed value in the pipeline, it is possible to define the diameter of the pipeline and its relative load losses.
In general, load losses must remain within the parameters shown below in table.

TABLE 6: LOAD LOSS IN RELATION TO PRESSURE

P (bar)	Load loss (bar/100 metres)
0 – 2	0.1 – 0.3 bar
2 – 10	0.3÷1 bar

When the supply pressure is set, the constant load losses are established, to calculate the pressure at the point of use. Then the speed will be checked, which must be maintained within the parameters indicated in paragraph 4.1.

The design choices will have an effect in terms of cost and efficiency of the final result. Both in the event of oversizing and undersizing, there will be problems that are summarised in the table below.

TABLE 7: DIMENSIONING OF PIPES

Oversized pipes	Undersized pipes
higher cost of piping than necessary	higher speed of steam
higher condensation volume	increased pressure drop
poor quality steam and thermal energy caused by condensation	pressure lower than that required at the point of use
higher thermal energy losses	insufficient steam volume at the point of use
	water hammering due to higher steam speed and greater risk of erosion

In addition to the distributed load losses obtained from dedicated norms, concentrated load losses that are valued through specific tables should also be considered. For each component, the length of the equivalent pipeline is added to the piping considered for the distributed losses.

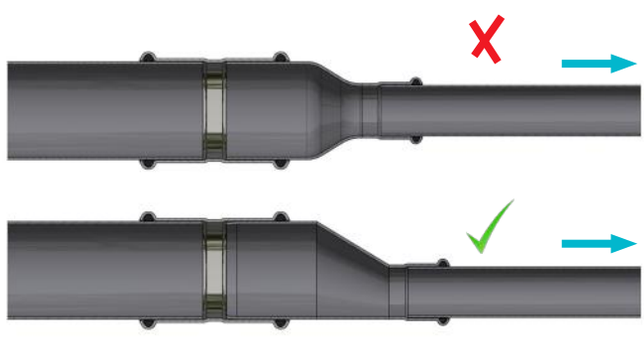
4.3 Expansion compensators

Straight tubular sections require the use of expansion compensators, fitted to prevent distortions to the pipes. The most widely used and recommended solution is the use of bellows expansion joints complete with guides. Compared to “omega” displacement compensators, they guarantee lower load losses and smaller dimensions.

4.4 Condensate discharge

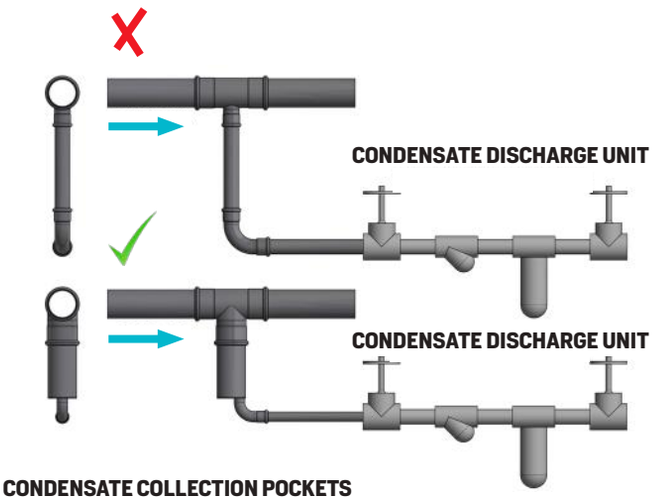
The pipes must always be installed with an appropriate slope to the point of use, to facilitate the discharge of the condensate that is being formed.
Diameter reductions must always be performed using eccentric reducers to avoid condensation stagnation inside the piping.

The drainage of the condensate at the various points of the plant, prevents stagnation and consequent water hammering (overpressure caused by the impact of condensate against an obstacle). Possible water hammering in the system can cause the breaking of filters, valves and components.



RIDUZIONI DI DIAMETRO SU TUBAZIONI VAPORE

The different drainages must be maintained at appropriate distances to discharge the condensate: an approximate distance of 30 – 50 meters must be observed between one drainage point and the next.

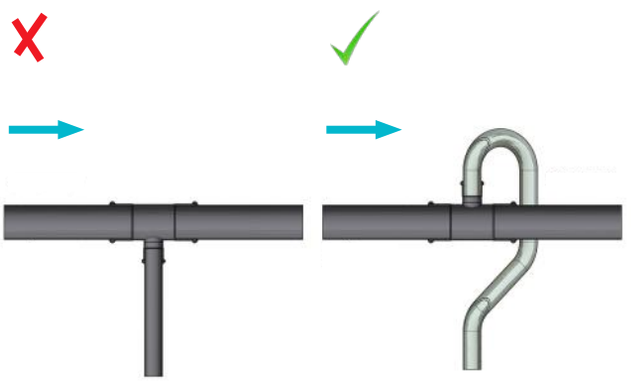


CONDENSATE COLLECTION POCKETS

4.5 User bypass

The bypass junctions at the top of the piping allows for the release of steam which is as dry as possible, without condensation residues that remain at the bottom of the main pipe.
In the event that decompression was carried out laterally or on the lower side, the condensate would enter directly into the equipment with the relative supply of "wet" steam .

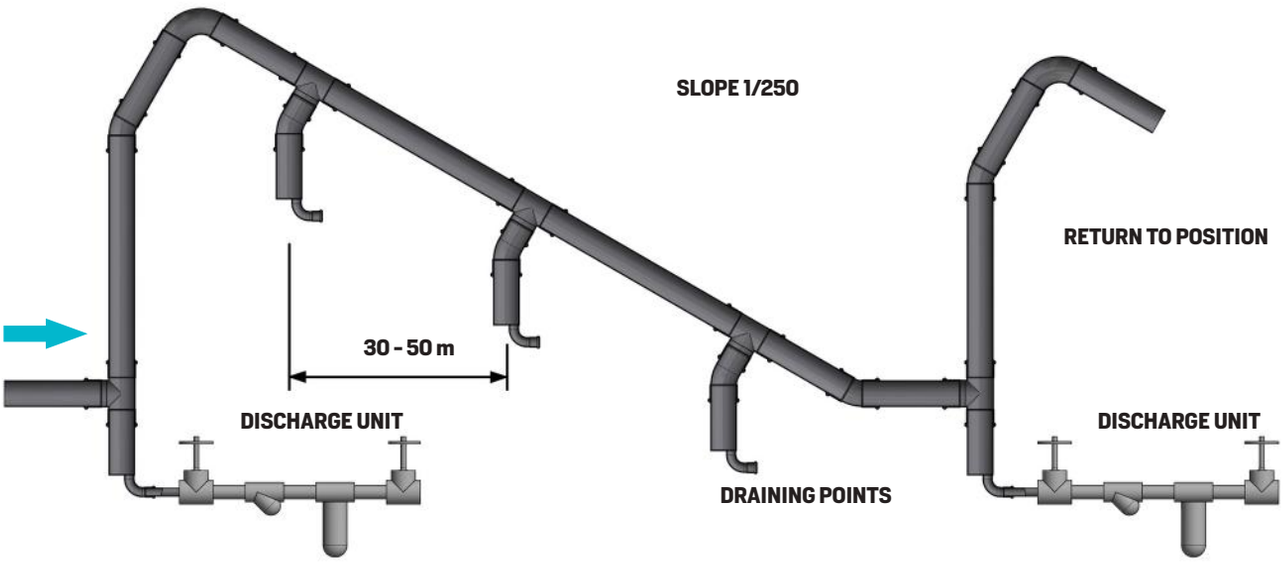
In the same way as the main line, also with the bypasses, it is necessary to provide drainage points with a relative automatic discharge device, suitably positioned downstream of the extraction point.



INSTALLATION OF BYPASSES

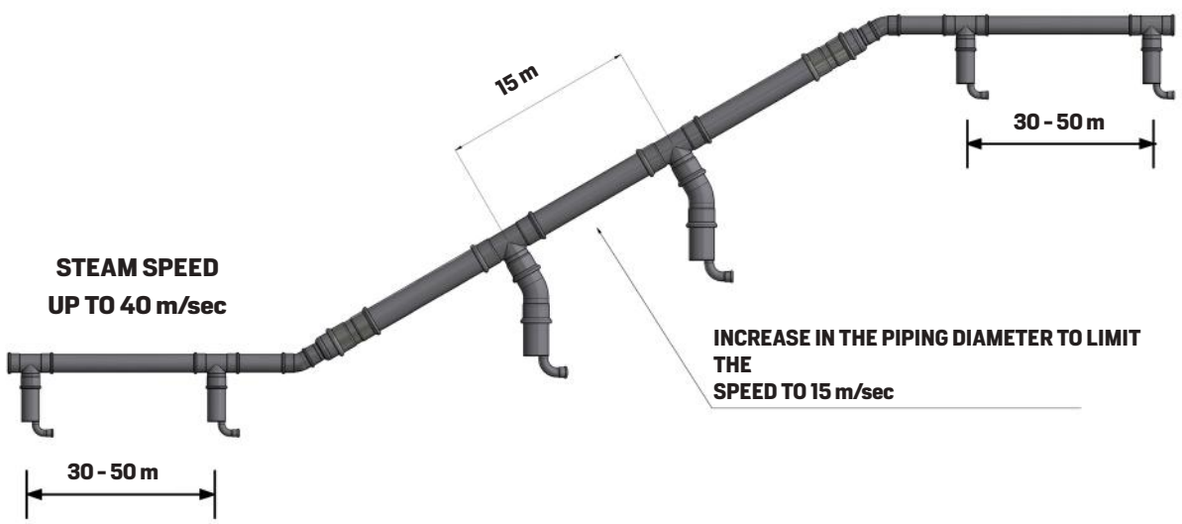
4.6 Slope of the pipes / uphill path sections

As far as possible, it is always preferable to use a continuous slope of the pipes which produces less load loss. In cases where this is not possible due to structural obstacles, it is possible to return to the height through vertical uprights, then proceed again with the sloping section towards the extraction point.



PREVENTION OF WATER HAMMERING

When this configuration is not feasible, proceed with an upward-facing pipeline, opposed to the flow created by the steam movement.
In the inclined upward section, it is necessary to keep the speed low and check that the pipe diameter is of the appropriate diameter so that the steam speed does not exceed 15 m/s.
In addition, in the inclined section, the distance between the two subsequent condensate drainage points should be kept at no more than about 15 m. This is to prevent the condensate from rising inside the tubing.



INSTALLATION OF A STEAM PIPE OVERCOMING OBSTACLES

4.7 Thermal insulation

The piping of the distribution network must be thermally insulated to minimize heat dissipation and condensation formation.

5.0 Pipe fixing, distances between clamps

Pipe supports serve to fix the pipe to the ceiling or wall and should compensate for 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 must 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 press fitting pipes are shown in table 8.

TABLE 8: MAXIMUM PERMITTED DISTANCES BETWEEN SUPPORTS - EN 806-4

DN	Pipe outside diameter (mm)	Horizontal spacing in meters (indicative)	Vertical spacing in meters (indicative)
12	15	1,2	1,8
15	18	1,2	1,8
20	22	1,8	2,4
25	28	1,8	2,4
32	35	2,4	3,0
40	42	2,4	3,0
50	54	2,7	3,6
65	76,1	3,0	3,6
80	88,9	3,0	3,6
100	108	3,0	3,6

6.0 Expansion compensation

Metal pipelines expand in different ways under the influence of heat and according to the material they are made of.
The longitudinal change under various temperature differences in the **inoxPRES** press fitting pipe is shown 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 the figures on page 19.

TABLE 9: INOXPRES LENGTH VARIATION

	L [m]	Δt [°K]									
		70	80	90	100	110	120	130	140	150	160
inoxPRES	1	1.2	1.3	1.5	1.7	1.8	2.0	2.1	2.3	2.5	2.6
	2	2.3	2.6	3.0	3.3	3.6	4.0	4.3	4.6	5.0	5.3
	3	3.5	4.0	4.5	5.0	5.4	5.9	6.4	6.9	7.4	7.9
	4	4.6	5.3	5.9	6.6	7.3	7.9	8.6	9.2	9.9	10.6
	5	5.8	6.6	7.4	8.3	9.1	9.9	10.7	11.6	12.4	13.2
	6	6.9	7.9	8.9	9.9	10.9	11.9	12.9	13.9	14.9	15.8
	7	8.1	9.2	10.4	11.6	12.7	13.9	15.0	16.2	17.3	18.5
	8	9.2	10.6	11.9	13.2	14.5	15.8	17.2	18.5	19.8	21.1
	9	10.4	11.9	13.4	14.9	16.3	17.8	19.3	20.8	22.3	23.8
	10	11.6	13.2	14.9	16.5	18.2	19.8	21.5	23.1	24.8	26.4
	12	13.9	15.8	17.8	19.8	21.8	23.8	25.7	27.7	29.7	31.7
	14	16.2	18.5	20.8	23.1	25.4	27.7	30.0	32.3	34.7	37.0
	16	18.5	21.1	23.8	26.4	29.0	31.7	34.3	37.0	39.6	42.2
	18	20.8	23.8	26.7	29.7	32.7	35.6	38.6	41.6	44.6	47.5
	20	23.1	26.4	29.7	33.0	36.3	39.6	42.9	46.2	49.5	52.8

Elongation of the pipe

ΔL = L x α x Δt
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

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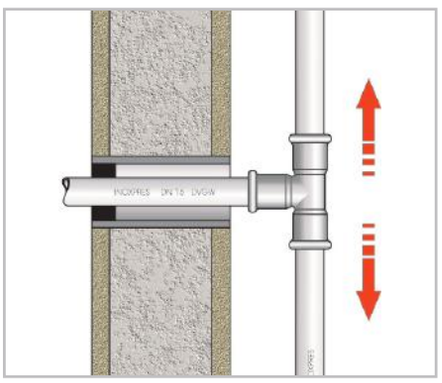


Figure A – Wall penetration detail

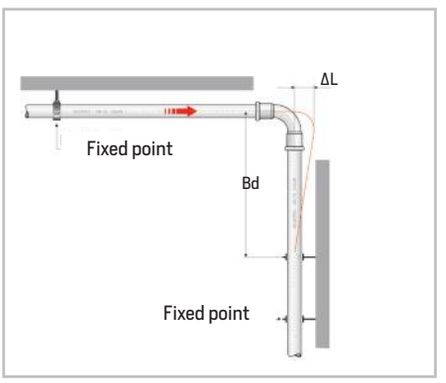


Figure B – Expansion compensation (Bd) using orthogonal shift

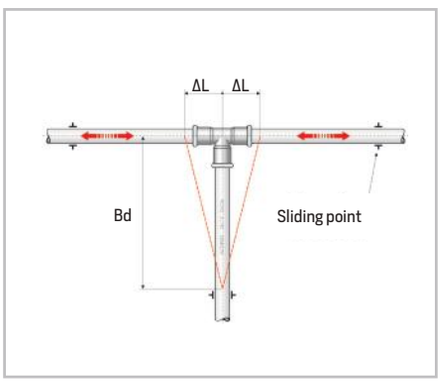


Figure 36 – Expansion compensation (Bd) using T units

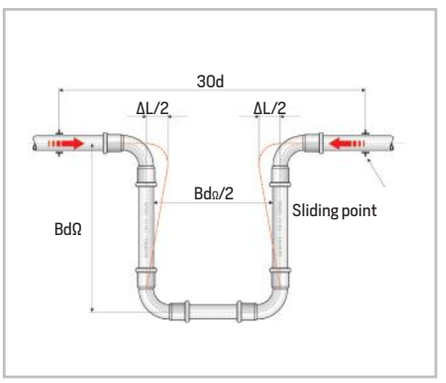


Figure D – U-bend expansion compensation (BdΩ = BdΩ / 1.8)

Expansion arm calculation for displacement (Figures B and C)

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

k = constant
inoxPRES = 60 for σ (sigma) 190 N/mm²
da = outer diameter pipe in mm
ΔL = linear expansion in mm

Calculation formula U bend (Figure D)

$Bd\Omega = k \times \sqrt{(da \times \Delta L)}$ [mm] or
$Bd\Omega = Bd / 1{,}8$

k = constant
inoxPRES = 34 for σ (sigma) 190 N/mm²
da = outer diameter pipe in mm
ΔL = linear expansion in mm

TABLE 10: CALCULATION OF THE EXPANSION REACH ø 15 ÷ 108 mm (Bd) INOXPRES

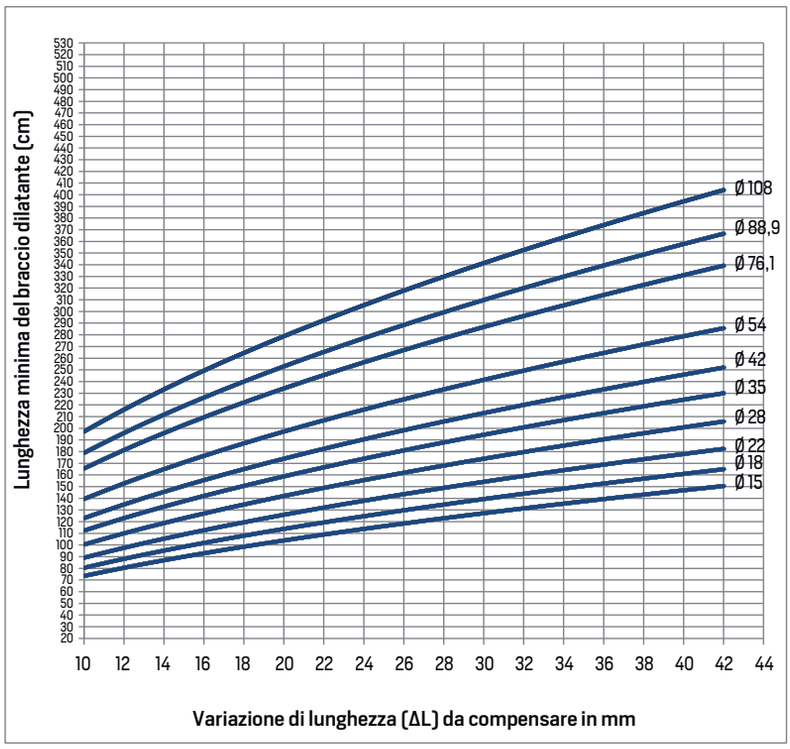
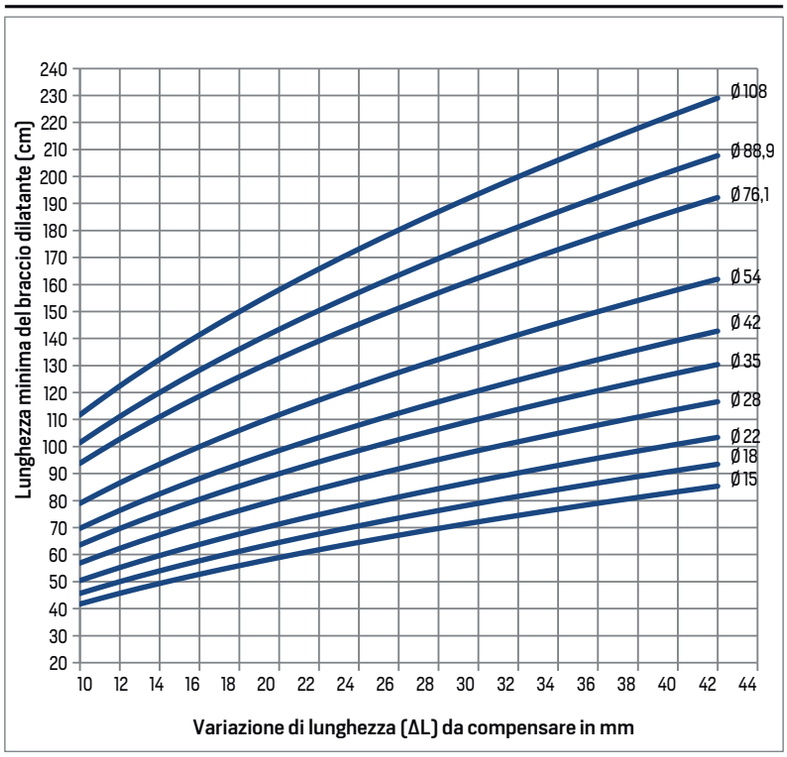


TABLE 11: EXPANSION ARM FOR U DILATOR ø 15 ÷ 108 mm (BdΩ) INOXPRES



7.0 Processing

7.1 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 cradle with a protective coating or protected with plastic material, so that they do not come in contact with other materials. Furthermore pipes and press fittings must be stored in an environment which is covered and protected from moisture exposure in order to prevent corrosion and/or oxidation of the surface.

Pipe cutting

7.2 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.

Deburring of the pipe

Not permitted are:

- tools which cause over-heating of the material and tempering of colours during cutting;
- oil-cooled saws;
- flame cutting or angle grinders.

To avoid damaging the sealing ring when inserting the pipe into the press fitting, the pipe must be carefully deburred, both inside and outside, following cutting to required 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.

The pipes can be bent by means of conventional bending tools up to an outer diameter of 22 mm (R ≥ 3.5xD).

No tube hot bending allowed.

7.3 Marking the insertion depth

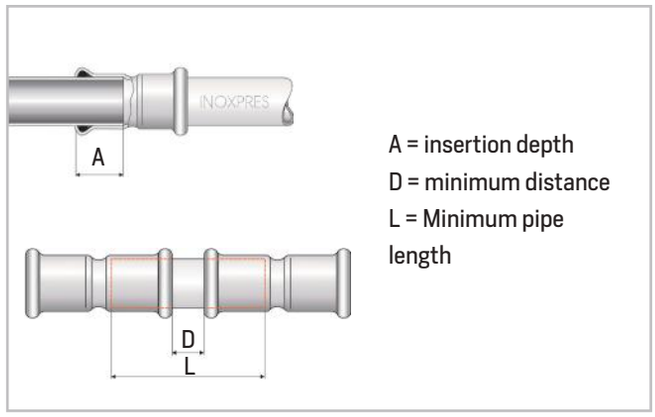
Sufficient mechanical strength of the press fitting connection will only be achieved if the insertion depths shown in table 12 are adhered to. These insertion depths are valid for pipes or fittings with insertion ends (i.e. fittings without pressfit end) and must be marked using a suitable marking tool.

The marking of the insertion depth on the pipe must be visible directly next to the press fitting groove 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 12:
INSERTION DEPTH AND MINIMUM DISTANCES

Pipe outside diameter mm	A (*) mm	D mm	L mm
15	20	20	60
18	20	20	60
22	21	20	62
28	23	20	66
35	26	20	72
42	30	40	100
54	35	40	110
76.1	55	60	170
88.9	60	60	180
108	75	60	210

(*) Tolerance: ± 2 mm

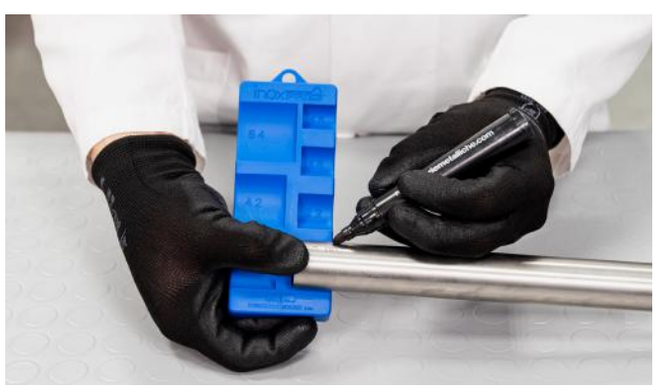


Minimum insertion depth and coupling

7.4 O-ring check of press fitting

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 it should be replaced with another sealing ring.



Marking the insertion depth

7.5 Making the press connection ø 15 - 108 mm

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. If the tolerances are so narrow that additional force is required to insert the pipe into the press fitting, then water or soapy water may be used as a lubricant.

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 13-14.

Checking O-rings

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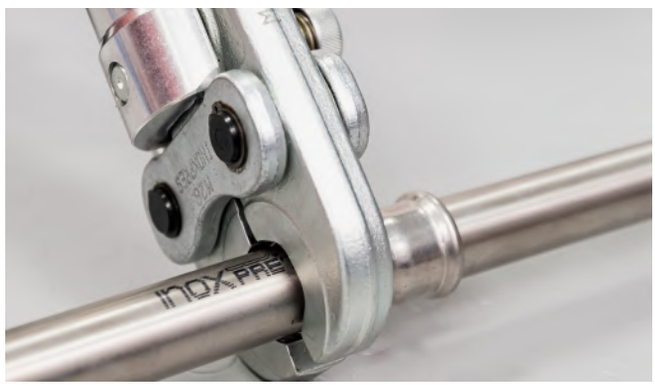
The matching pressing jaw is mounted in the pressing machine, or the appropriate collar/chain mounted on the fitting, depending on the dimensions of the press fitting. The slot of the pressing jaw/collar must be positioned exactly over the press fitting formed end.

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. React immediately in the event of an unusual press pattern. Completely pressed systems with faulty press patterns or profiles cannot be fully recognized as a complaint.

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.

Inserting the pipe into the press fitting



Assembly

7.6 Pressing tools

7.6.1 Basic indications

Pressing tools basically consist of the pressing tool and pressing jaws or collars/chains. Many of the pressing jaws/collars can generally be used with the pressing machines from one manufacturer. Additionally, many manufacturers of pressing tools have standardised the jaw attachment so pressing jaws from other manufacturers can also be used.

Press fittings in dimensions 15–35 mm must by pressed with jaws, 42–108 mm must by pressed with pressing collars/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.

Klauke UAP332BT

Klauke UAP100120BT

Novopress ACO203 BT

Novopress ACO403 BT

7.6.2 Approved pressing tools

RM approves the tools produced by Klauke and Novopress listed in the tables 13 and 14 below. These are pressing tools with the appropriate pressing jaws or collars/chains.

TABLE 8: MANUFACTURER KLAUKE

Type	Piston strength	Dimension range	Weight	Compatible with jaws from / Note
MAP1 – MAP2L	15 KN	15 ÷ 22 mm	~ 1,7 Kg	--
MAP2L_19 MAP2119BT	19 KN	15 ÷ 35 mm	~ 1,7 Kg	--
UAP2 – UAP3L UAP332BT	32 KN	15 ÷ 54 mm	~ 3,5 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
UNP2	32 KN	15 ÷ 54 mm	~ 3,5 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
UAP4 – UAP4L UAP432BT	32 KN	15 ÷ 54 mm	~ 4,3 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
UAP100 – UAP100L UAP100120BT	120 KN	76,1 ÷ 108 mm	~ 12,7 Kg	--
AH-P700LS PKUAP3	32 KN	15 ÷ 54 mm	~ 12,3 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
AH-P700LS PKUAP4	32 KN	15 ÷ 54 mm	~ 12,6 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
AH-P700LS PK100AHP	120 KN	76,1 ÷ 108 mm	~ 20,2 Kg	--
EHP2/SANB	0,75 KW	76,1 ÷ 108 mm	~ 69 Kg	--

TABLE 9: MANUFACTURER NOVOPRESS

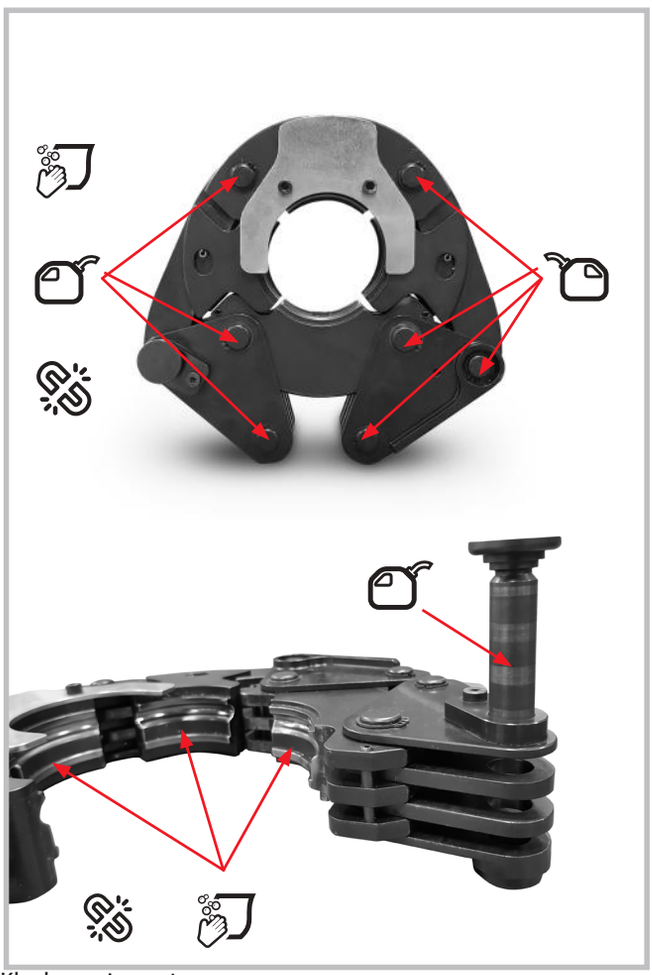
Type	Piston strength	Dimension range	Weight	Compatible with jaws from / Note
AC0102 – AC0103	19 KN	15 ÷ 35 mm	~ 1,7 Kg	--
EFP2	32 KN	15 ÷ 54 mm	~ 6,1 Kg	EFP201 – AFP201 – EC01 – AC01
EFP201 – EFP202	32 KN	15 ÷ 54 mm	~ 4,4 Kg	EFP2 – EC01 – AC01
AFP201 – AFP202	32 KN	15 ÷ 54 mm	~ 4,3 Kg	EFP2 – EC01 – AC01
EC0202 – AC0202 EC0203 – AC0203/BT	32 KN	15 ÷ 54 mm	~ 3,3 Kg	EC0201 – AC0201 – EC01 – AC01
AC0202XL AC0203XL/BT	32 KN	15 ÷ 54 mm	~ 4,6 Kg	EC0202 – AC0202
AC0401 AC0403/BT	100 KN 120 KN	76,1 ÷ 108 mm	~ 13 kg	--
AC03	36 KN	15 ÷ 54 mm	~ 5,0 Kg	EC03
EC0301	45 KN	15 ÷ 54 mm	~ 5,0 Kg	AC03
HCP	190 KN	76,1 ÷ 108 mm	~ 70 Kg	--

GENERAL NOTE: only equipment with crimping force PN 16 must be used.

7.6.3 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 (normally once a year or after 10.000 pressing cycles for standard pressing machine, after 1.500 pressing cycles for King size pressing machine). What is more any moving part (drive rolls) and pressing jaw and chain surfaces (internal profiles) are to be daily serviced, cleaned and lubricated.
As indicated also on UNI 7129-1 norm.

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



Klauke equipment

Novopress equipment

Keep the chain clean

Keep the pins lubricated with oil

Attention it can break

8.0 Testing and approvals

In accordance with European Directive 2014/68/EU (PED), saturated steam pipes with diameter ≤ DN 100 used up to the maximum pressure of 7 bar absolute / 165ºC, according to "Table 7" of the aforementioned directive fall into the class "Article 4 (3)" (no CE marking required, manufactured according to the proper construction practice in use in the manufacturing country).

The **inoxPRES** system with Steam sealing O-ring has passed tests under pressure with thermal cycles at the TTR Institute and has been used in several other field installations.

TTR INSTITUTE SRL
Via Baden Powell 3/ter
21052 Busto Arsizio VA – Italy
Tel.: +39 0331 342533 – Fax: +39 0331 342534
Reg. Imprese - Cod. Fisc. - P.Iva 03118550122
Capitale Sociale Euro 115.436,00
R.E.A. di Varese 324649
Pec: ttrinstitute.pec@legalmail.it

Test report Nr: 1104859-001

Customer:	Raccorderie metalliche Spa Strada Sabbionetana , 59 46010 Campitello di Marcaria (MN) Italia
test:	Thermal Cycles (STEAM)
reference std:	Internal Standard
Incoming sample:	31-MAR-16
Tested sample	INOXPRES Ø28 ASSEMBLY :INOXPRES FITTINGS / INOXPRES PIPE 316L O-RING STEAM
Raw material :	INOXPRES PRESSFITTING SYSTEM
Sampling :	to customer charge
Nr Fittings tested:	19 FITTINGS
Order:	26019270
Date of test report:	02-mag-16

Note:

The test report exclusively refers to the tested items.
The test report must not be partially reproduced without the written approval of the laboratory responsible
Tested items will be available for a period of 15 days after the test report date.

Date start test:	29-mar-16

DECLARATION OF SUITABILITY FOR STEAM

(EN 10204 - 2.1_ rev 2 of 05-2022)

relating to press fitting systems and stainless steel pipes

INOXPRES STEAM

RACCORDERIE METALLICHE S.p.A.
Strada Sabbionetana, 59
46010 Campitello di Marcaria
Mantova (ITALY)

DECLARES

that the INOXPRES STEAM system press fittings and stainless steel pipes

- comply with UNI 11179 – "Press fittings for metal pipes";
- comply with DVGW G5614 – "Permanent pipe joints for metal gas pipes - Compression fittings";
- comply with the requirements of the European Directive 2014/68/EU (PED: Pressure Equipment Directive);
- are suitable for the construction of networks for the delivery of saturated steam;
  > maximum operating pressure 7 bar absolute (6 bar relative);
  > maximum operating temperature of +165 °C;
  > conveyed fluid: saturated water steam;

The INOXPRES STEAM press fitting system and its components are manufactured under the Quality Management System Certificate ISO 9001:2015.

Campitello di Marcaria, May 2022

Ceccardi Guido
Chief Executive Officer (CEO)

RACCORDERIE METALLICHE S.P.A.
Sede e Stabilimento:
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Campitello di Marcaria (MN) Italy

Tel. +39 0376 96001
Fax +39 0376 96422
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Cap. soc. € 5.000.000 i.v.
Registro Imprese MN 02066990173
Codice Fiscale 02066990173

Partita IVA 01591820202
R.E.A. 169204

raccorderiemetalliche.com

DECLARATION OF SUITABILITY FOR STEAM

(EN 10204 - 2.1_ rev 2 of 05-2022)

relating to press fitting systems and stainless steel pipes

INOXPRES STEAM

CONFORMITY TO PED DIRECTIVE

The INOXPRES STEAM system press fittings and stainless steel pipes

- are suitable for the construction of networks for the delivery of STEAM with the following parameters;
  > maximum operating pressure 7 bar absolute (6 bar relative);
  > maximum operating temperature of +165 °C;
  > conveyed fluid: saturated water steam

- complies with the requirements of the European Directive 2014/68/EU (PED: Pressure Equipment Directive) Article 4, paragraph 3 for the dimensional range between Ø15 mm and Ø108 mm, for which no CE marking is required, having regard to the table for pipelines for the transport of fluids of Group 2, in particular steam.

To guarantee product quality and compliance with PED, the INOXPRES STEAM press fitting system and its components are manufactured under the Quality Management System Certificate ISO 9001:2015, which requires regular periodic checks on products and factory (third party inspection conducted by an independent body).

Campitello di Marcaria, May 2022

Ceccardi Guido
Chief Executive Officer (CEO)

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relating to press fitting systems and stainless steel pipes

INOXPRES STEAM

CORRECT USE OF THE SYSTEM

The INOXPRES STEAM press fitting system is suitable for steam installations with a maximum working pressure of 7 bar absolute (6 bar relative) / maximum operating temperature of 165°C.

For correct use of the INOXPRES STEAM press fitting system, and successful installation please refer to the following documents:

- Press fitting Technical Manual of Raccorderie Metalliche;
  (on the website *www.racmet.com* the latest updated edition is always available)
- European Directive 2014/68/EU (PED: Pressure Equipment Directive);
- National regulations in force in the field of design, installation and maintenance of plants for transport of steam;

For the selection of pressing equipment, please refer to the Press fitting Technical Manual and use equipment declared compatible and suitable for use by Raccorderie Metalliche S.p.A.

Where required, the designer or installer must apply for the technical opinion of recognized body, which can approve the plant and choice of components installed.

Raccorderie Metalliche S.p.A. leaves it to the plant designer to assess the conformity of the INOXPRES STEAM press fitting system in accordance with territorial regulations and national laws that specify and regulate the design, installation and maintenance of systems intended for the transport of steam.

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DECLARATION OF SUITABILITY FOR STEAM

(EN 10204 - 2.1_ rev 2 of 05-2022)

relating to press fitting systems and stainless steel pipes

INOXPRES STEAM

PRESS FITTING SYSTEM CHARACTERISITICS

Taking note of the following regulations:
> Art. 7 – Ministerial Decree 37 of 22-01-08 – Rules for plant safety;
> Art. 5 – Law No. 447 of 06/12/91 – Regulation implementing Law No. 46/90;

CERTIFIES

- that the INOXPRES STEAM system consists of press fittings, STEAM o- rings, connecting pipes, pressing tools and suitable clamps or chains;
- that the material used for the production of INOXPRES STEAM press fittings and pipes is AISI 316, 1.4404, in compliance with EN 10088 – EN 10312 – EN 10217-7;
- that the INOXPRES STEAM press fittings are manufactured in compliance with UNI 11179;
- that all of the threads for the INOXPRES STEAM system are performed according to EN 10226-1 (DIN 2999 – UNI ISO 7/1) or UNI ISO 228/1 (DIN 259);
- that all the welds on the fittings for the INOXPRES STEAM system are 100% controlled, under pressure with automatic machines;
- that the STEAM seal can be used for saturated steam transport up to maximum working conditions P Max 7 bar absolute (6 bar relative) / maximum temperature 165°C;
- that the INOXPRES STEAM system components are not subject to CE marking as prescribed by Legislative Decree no. 93 of 25 February, 2000;

Campitello di Marcaria, May 2022

Ceccardi Guido
Chief Executive Officer (CEO)

Pozzetti Silvio
Head of Quality System

Pizzamiglio Fabrizio
Product Manager Plumbing & Heating Division

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The full references of our officials and business partners are available on our website.
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CODE 105 R2 0522 GBR