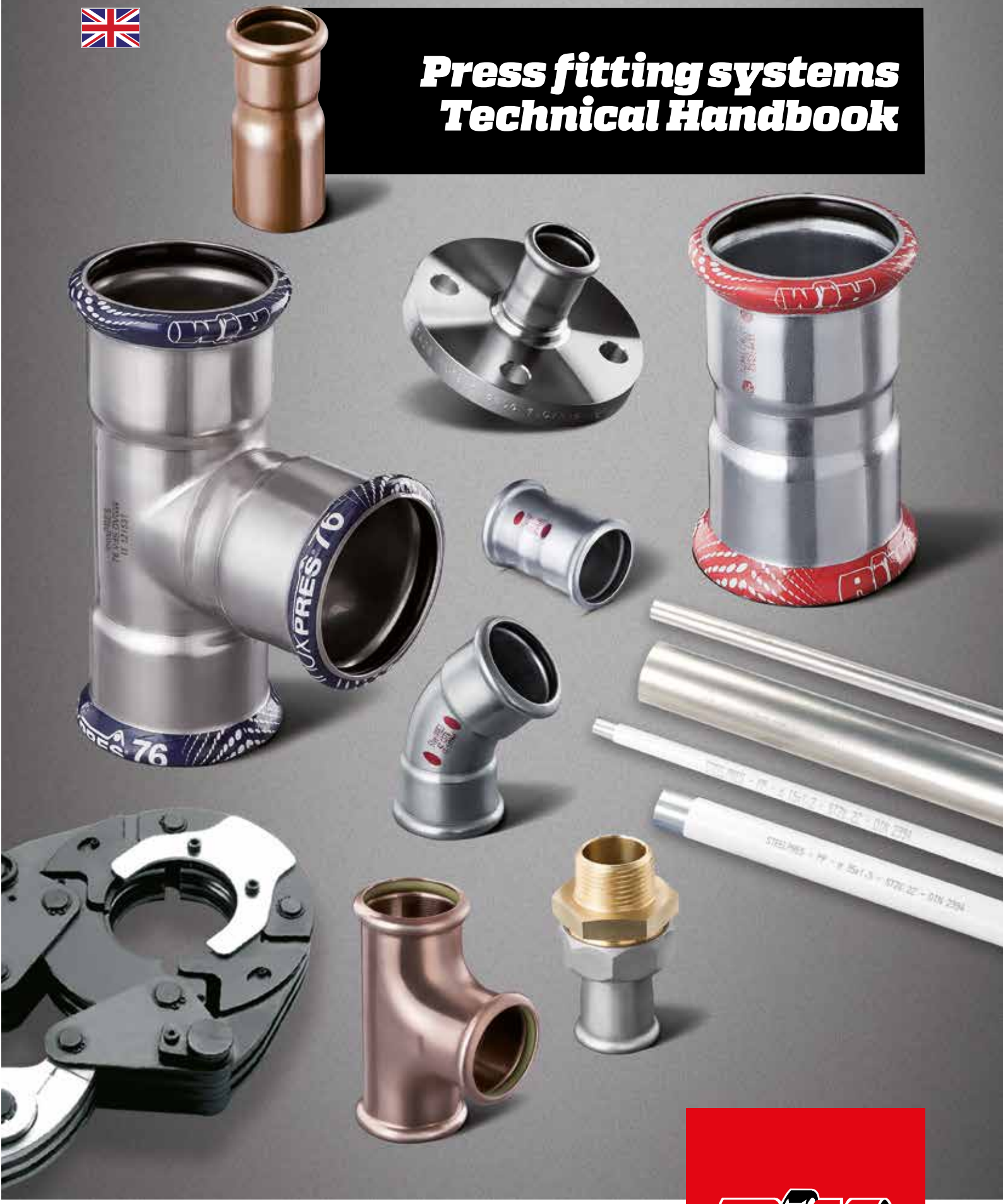
Press fitting systems Technical Handbook



inoxPRES® inoxPRES® GAS steelPRES®
AESPRES® AESPRES® GAS MARINEPRES®

RACCORDERIE METALLICHE

	Country/ Region	Certification body	Certificate number	Dimensions
inoxPRES		DVGW	DW-8511AU2084 (W 534)	Ø 15 - 108 mm
		DVGW	DW-7301 BM3426 (GW 541)	Ø 15 - 108 mm
		VdS	G 4060006 (VdS 2344 - VdS 2100)	Ø 22 - 88,9 mm
		DVGW	DW-7301BT0667	Ø 15-54 mm
		ÖVGW	W 1.402 (PW 300)	Ø 15 - 108 mm
		SVGW SSIGE	0007-4278 (TPW 132)	Ø 15 - 108 mm
		WRAS	1710345	Ø 15 - 108 mm
		Lloyd's Register	13/00035	Ø 15 - 108 mm
		CSTB	79 - 2217	Ø 15 - 108 mm
			38058/A0 BV	Ø 15 - 108 mm
		ETA	VA 1.22/19224 VA 1.12/18410	Ø 15 - 108 mm Ø 15 - 108 mm
			02/00014 03/00127	Ø 15 - 108 mm
		SITAC	1174/99	Ø 15 - 108 mm
		kiwa	K40834/04 K40835/03	Ø 15 - 108 mm
			TAP000017J	Ø 15 - 108 mm
		SINTEF	Nr. 1623	Ø 15 - 108 mm
		SABS	TEST REPORT ZH 173	Ø 15 - 108 mm
			A-42-2017	Ø 15 - 108 mm
			AT-15-7863/2014	Ø 15 - 108 mm
			HK/W/0541/01/2015	Ø 15 - 108 mm
			B-30-00323-16	Ø 15 - 108 mm
			MAC135317CS/001-002	Ø 15 - 108 mm
			TIFQ - 099AP04/00	Ø 15 - 108 mm
			WMK 25928 25929	Ø 15 - 108 mm
		ABS	14-GE1273370-PDA	Ø 15 - 108 mm

	Country/ Region	Certification body	Certificate number	Dimensions
marinePRES			MAC069514CS/001	Ø 15 - 108 mm
			TAP 000007B	Ø 15 - 108 mm
		Lloyd's Register	13/00035	Ø 15 - 108 mm
			38059/A0 BV	Ø 15 - 108 mm
		ABS	15-GE1308502-PDA	Ø 15 - 108 mm

	Country/ Region	Certification body	Certificate number	Dimensions
inoxPRES GAS		DVGW	DG-8531BP0295 DG-8531CL0163 (G5614)	Ø 15 - 108 mm
		DVGW	DW-7301 BM3426 (GW 541)	Ø 15 - 108 mm
		ÖVGW	G 2.827 (PG 500, PG 314)	Ø 15 - 108 mm
		SVGW SSIGE	05-088-06 (VP 614)	Ø 15-54 mm
			CA06-00231	Ø 15 - 108 mm
			A-69/2016	Ø 15 - 108 mm
			A0 202/C5/2016	Ø 15 - 108 mm
			C-16-3743-A	Ø 15 - 54 mm

	Country/ Region	Certification body	Certificate number	Dimensions
steelPRES		CSTB	79-1975_V1	Ø 15 - 108 mm
			V1005A	Ø 15 - 108 mm
			TAP000017J	Ø 15 - 108 mm
			A-42-2017	Ø 15 - 108 mm
			AT-15-7863/2014	Ø 15 - 108 mm
			B-30-00186-17	Ø 15 - 108 mm
		TSU	0026/104/2011	Ø 15 - 108 mm
		ABS	15-GE1329696-PDA	Ø 15 - 108 mm

	Country/ Region	Certification body	Certificate number	Dimensions
aesPRES		DVGW	DW-8511CL0331 (W534)	Ø 15 - 54 mm
		WRAS	1209071	Ø 15 - 54 mm
		SINTEF	nº 1988	Ø 15 - 54 mm
		kiwa	K83136/02	Ø 15 - 54 mm
		ETA	VA 1.22/20514	Ø 15 - 54 mm
		SITAC	SC0265-16	Ø 15 - 54 mm

	Country/ Region	Certification body	Certificate number	Dimensions
aesPRES GAS		DVGW	DG-8531CL0376 (G5614)	Ø 15 - 54 mm
			CA06.00293	Ø 15 - 54 mm
			C-16-3742-A	Ø 15 - 54 mm
			13/16	Ø 15 - 54 mm

RACCORDERIE METALLICHE

This version of the technical handbook replaces all previous editions.

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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 the **inoxPRES**, **steelPRES**, **aesPRES** and **marinePRES** press fitting systems described in this handbook for the applications defined has been– as far as required– tested and certified by WRAS, the DVGW in Germany and a wide range of other international organisations.

Figure 1 – Campitello head office and factory

DNV·GL

MANAGEMENT SYSTEM CERTIFICATE

Certificato No./Certificate No.:
CERT-00317-94-AQ-MIL-SINCERT

Data prima emissione/Initial date:
10 novembre 1994

Validità/Valid:
07 ottobre 2015 - 15 settembre 2018

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) - Italy

È conforme ai requisiti della norma per il Sistema di Gestione Qualità/
has been found to conform to the Quality Management System standard:

UNI EN ISO 9001:2008 (ISO 9001:2008)

Questa certificazione è valida
per il seguente campo applicativo:

Produzione 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

(Settore EA: 17 - 29)

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

(EA Sector: 17 - 29)

Luogo e Data/Place and date:
Vimercate, 14 ottobre 2015

ACCREDIA

Per l'Organismo di Certificazione/
For the Certification Body

Vittore Marangon
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.
DNV GL Business Assurance Italia S.r.l. Via Energy Park, 14, 20871 Vimercate (MB), Italy. Tel: 039 68 99 905. www.dnvgl.it/businessassurance

Figure 2 – EN ISO 9001:2008 RM Certification

RACCORDERIE METALLICHE

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 12-108 mm OD, 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 2.13 Pressing tools).

Press fittings in dimensions ø 12 ÷ 35 mm must by pressed with jaws, ø 42 ÷ 108 mm must by pressed with pressing collars/ chains.

The longitudinal and compression closing character of the connection is clearly illustrated in figures 4 and 5. 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.

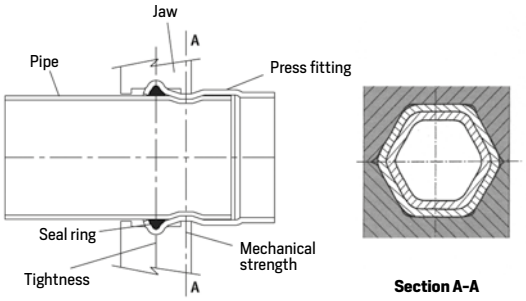


Figure 4 - Section through an **inoxPRES / steelPRES / aesPRES / marinePRES** connection with jaw still in position. Dimensions of ø 12 ÷ 35 mm produce a hexagonal pressing profile.

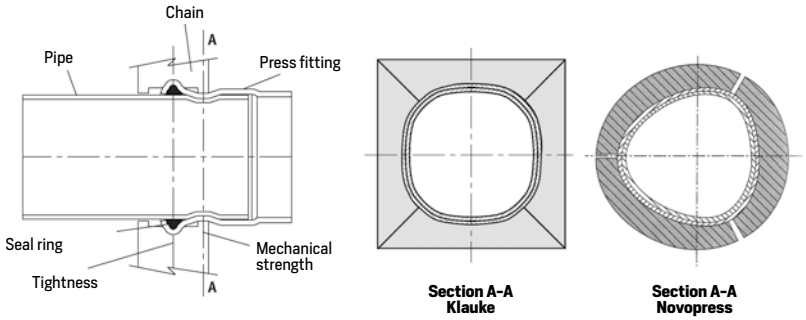


Figure 5 - Section through an **inoxPRES / steelPRES / aesPRES / marinePRES** connection with collar still in position. Dimensions of ø 42 ÷ 108 mm produce a defined profile.

The complete range of the press fitting systems **inoxPRES**, **steelPRES**, **aesPRES** and **marinePRES** is described in the relevant "Product range" catalogue.

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, DVGW test symbol 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 6 - **inoxPRES** press fitting

2.3 inoxPRES GAS press fittings

inoxPRES GAS press fittings 15 ÷ 108 mm outside diameter are tested in accordance with the requirements of the DVGW G 5614 guidelines and in Austria according to PG 500 and PG 314.

A mixed installation is not permitted if gas pipes are installed.
They differ from **inoxPRES** for potable water installations in that they have a factory-fitted yellow NBR/HNBR seal ring and are also indelibly marked **inoxPRES** in black and indelibly yellow marked with 'RM' and the pressure range 'PN 5 /GT 1'.

Figure 7 – **inoxPRES GAS** press fitting

Please verify the local laws/regulations regarding the use of **inoxPRES GAS** for gas applications in UK.

2.4 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), as well as tubes made of ferritic («nickel free») stainless steel with material number 1.4521 (AISI 444).
The tubes correspond to worksheet GW 541 of the German Association for Gas and Water, EN 10217-7 (DIN 17455) and EN 10312 and are therefore approved for:

- drinking water and gas (14404 AISI 316L);
- only for drinking water (1.4521 AISI 444);
- compressed air (1.4301 AISI 304).

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 and are closed with plastic plugs/caps at the ends.

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
15 x 1	12	13	0,351	0,133
18 x 1	15	16	0,426	0,201
22 x 1,2	20	19,6	0,625	0,302
28 x 1,2	25	25,6	0,805	0,514
35 x 1,5	32	32	1,258	0,804
42 x 1,5	40	39	1,521	1,194
54 x 1,5	50	51	1,972	2,042
76,1 x 2	65	72,1	3,711	4,080
88,9 x 2	80	84,9	4,352	5,660
108 x 2	100	104	5,308	8,490

2.5 steelPRES press fittings

steelPRES press fittings are made of unalloyed steel with material number E 195 (material nº 1.0034) up to 108 mm outer diameter. A galvanic zinc coating with a thickness of 6 ÷ 12 µm protects against external corrosion. Unlike the **inoxPRES** press fittings, **steelPRES** fittings are indelibly marked in red with the manufacturer name, diameter and internal code. The black EPDM sealing ring used for **inoxPRES** is also fitted into the formed ends of the press fittings.

Figure 8 – **steelPRES** press fitting

2.6 steelPRES piping

steelPRES pipes are longitudinally welded thin-walled precision steel tubes according to DIN EN 10305-3. The following materials are available:

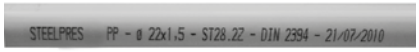
- E 220 CR2S4 (material nº 1.0215) pipes galvanised on the outside, the zinc coating is 6 ÷ 12 µm;
- E 190 CR2S4 (material nº 1.0031) pipes are sendzimir-galvanised on both sides; the zinc coating is 10 ÷ 20 µm.

The weld seam is smoothed in order to ensure a proper sealing surface. **steelPRES** pipes with PP – coat 1 mm thick, available in diameters ranging from 12 mm to 108 mm outer diameter (material E 220 CR2S4 – nº 1.0215), are classified in accordance with DIN 4102-1 building material class B2 – non-burning droplets.
steelPRES tube with PP-coating: maximum operating temperature of 120 ºC.
steelPRES pipes are supplied in lengths of 6 meters.

TABLE 2: STEELPRES 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	Pipe Outside diameter in mm
without PP-coating					with PP coating
12 x 1,2	10	9,6	0,320	0,072	14
15 x 1,2	12	12,6	0,408	0,125	17
18 x 1,2	15	15,6	0,497	0,191	20
22 x 1,5	20	19	0,824	0,284	24
28 x 1,5	25	25	1,052	0,491	30
35 x 1,5	32	32	1,320	0,804	37
42 x 1,5	40	39	1,620	1,194	44
54 x 1,5	50	51	2,098	2,042	56
76,1 x 2	65	72,1	3,652	4,080	78,1
88,9 x 2	80	84,9	4,290	5,660	90,9
108 x 2	100	104	5,230	8,490	110

TABLE 3: CHOICE OF STEELPRES - TUBES

316/005 galvanised on the outside, black inside	**316/003** galvanised on the outside, black inside + PP – coating	**316/002** galvanised inside/outside
Dimensions: ø 12 ÷ 108 mm	Dimensions: ø 12 ÷ 108 mm	Dimensions: ø 22 ÷ 108 mm
		
Heating – Solar Wet sprinkler system Compressed air – Inert gases	Heating Cooling	Wet sprinkler system Compressed air Inert gases

2.7 aesPRES press fittings

aesPRES press fittings are made in DHP Cu-DHP 99.9 (CW024A) copper and in CuSn5Zn5Pb2 (CC499K) bronze from ø 12 to ø 54 mm included. **aesPRES** fittings are indelibly marked with a laser system with the manufacturer name, the diameter and the DVGW control brand and with an internal code. At the press fitting swollen ends, a black EPDM o-ring is fitted.
In Great Britain the aesPRES system is certified with the WRAS quality brand from ø 15 ÷ 54 mm.

Figure 9 – **aesPRES** press fitting

2.8 aesPRES GAS press fittings

aesPRES GAS press fittings 15 ÷ 54 mm outside diameter are tested in accordance with the requirements of the DVGW G 5614 guidelines.
They are different from da **aesPRES** (drinkable water system version) for the following features:

- NBR yellow o-ring, fitted at the end of production;
- the yellow indelible marking with RM Gas and pressure field PN 5/GT1, next to the **aesPRES** brand.

In Germany, for gas systems, compliance is to be provided to TRGI.

Please verify the local laws/regulations regarding the use of **aesPRES GAS** for gas applications in UK.

Figure 10 – **aesPRES GAS** press fitting

2.9 aesPRES - aesPRES GAS copper piping

Piping for copper water and gas installation should comply with the standard EN 1057:2010, "Copper and copper alloys – Round tubes in copper without welding for water and gas in health-care and heating applications".

TABLE 4: MECHANICAL FEATURES FOR COPPER TUBES - EN 1057

Rif. EN 1173	State	Minimum traction resistance Rm (Mpa)
R220	Annealed	220
R250	Semi-hard	250
R290	Hard	290
	Breaking A dilation	
Rif. EN 1173	ø (mm)	A min. (%)
R220	12 ÷ 22	40
R250	12 ÷ 28	20
R290	12 ÷ 54	3
	Delivery condition	
R220	Annealed	Rolls
R250	Semi-hard	Bars
R290	Hard	Bars

Tube sizes to be used with **aesPRES** and **aesPRES GAS** press fittings are inluceded in the annexet table.

TABLE 5: AESPRES PIPES - DIMENSIONS AND CHARACTERISTICS - EN 1057 / DVGW GW 392

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	Supplied condition
12 x 1	10	10	0,309	0,079	Roll 25/50 m (R 220) or Bar 5 m (R 250)
15 x 1	12	13	0,393	0,133	
18 x 1	15	16	0,477	0,201	
22 x 1	20	20	0,589	0,314	
28 x 1,5	25	25	1,115	0,491	Bar 5 m (R250)
35 x 1,5	32	32	1,410	0,804	Bar 5 m (R290)
42 x 1,5	40	39	1,704	1,194	
54 x 2	50	50	2,918	1,963	

2.10 marinePRES press fittings

marinePRES press fitting are made in CuNi10Fe1.6Mn (WL 2.1972) copper-nickel from ø 15 to ø 108 mm included. **marinePRES** fittings are indelibly marked with a laser system with the manufacturer name, the diameter and with an internal code. At the press fitting swollen ends a green FKM o-ring is fitted.

Figure 11 - **marinePRES** press fitting

2.11 marinePRES piping

marinePRES piping, with thin seamless walls, are in CuNi10Fe1.6Mn copper-nickel. Tubes in copper-nickel are made in compliance with the standard DIN 86019. Inner and outer surfaces are bare metal and free of annealing colours and corrosion-promoting substances. **marinePRES** tubes are classified as non combustible, belonging to class A as fire reaction. They are supplied in 6 m long bars.

TABLE 6: MARINEPRES 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
15 x 1	12	13	0,392	0,133
18 x 1	15	16	0,476	0,201
22 x 1	20	20	0,588	0,314
28 x 1,5	25	25	1,114	0,491
35 x 1,5	32	32	1,408	0,804
42 x 1,5	40	39	1,702	1,195
54 x 1,5	50	51	2,206	2,042
76,1 x 2	65	72,1	4,146	4,080
88,9 x 2	80	84,9	4,874	5,660
108 x 2,5	100	103	7,389	8,332

2.12 Sealing elements

2.12.1 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.

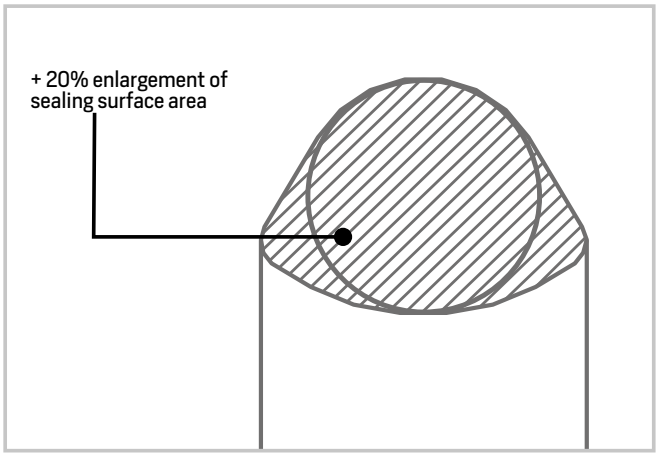


Figure 12 – Sealing ring profile

The black EPDM sealing ring from ø 15 ÷ 54 mm is supplied with an additional safety feature that during pressure tests will lead to leakage in the case of accidentally unpressed connections.

Figure 13 – Security EPDM sealing ring (ø 15 ÷ 54 mm).

- Tightness / pressure tests are to be carried out before the pipes are covered (e.g. for insulation purposes);
- Tests are to be carried out in accordance with DVGW worksheet W534 and the ZVSHK data sheet "Tightness Tests for drinking water installations with compressed air, inert gas or water";
- When conducting pressure tests with air, follow the technical rules for gas installations "DVGW-TRGI";
- The correct assembly of the press-fit connections is the responsibility of the installer / company. Unpressed-untight is to be understood as an additional help in order to identify an assembly error – in this case, the non-pressing of fittings. A precondition for that is the proper implementation of the prescribed tightness and pressure tests; it does not absolve the installer from his obligation to carry out visual and noise controls to make sure that the assembly has been done properly.

These visual and noise controls are to be duly recorded on the respective test certificate.

2.12.2 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 7.

The black EPDM standard sealing ring only is factory-fitted in the siliconised version in **inoxPRES** and **steelPRES** press fittings. The green FKM sealing ring only is factory-fitted in **marinePRES** press fittings.

TABLE 7: SEALING RINGS - FIELDS OF APPLICATION AND TECHNICAL DATA

Technical term	Colour	Operating temperature Min / Max degress centigrade	Operating pressure maximum in bar	Approvals and certification basis	Fields of application	Factory-fitted
EPDM	black	-20 / +120 °C	16	KTW W 270 DVGW W 534	Potable water Heating Cooling and refrigeration circuits Treated water Desalinated water Rainwater Compressed air (Classe 1÷4)	YES
NBR HNBR	yellow	-20 / +70 °C	5	G 260HTB DVGW G 5614	Natural gas Methane gas GPL (gaseous state)	YES
FKM	green	-20 / +220 °C	16	-	Solar Compressed air (Class 5) Naval	YES (for marinePRES)
MVQ	red	-20 / +180 °C	16	-	Industrial applications following approval by RM	NO

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.

2.13 Pressing tools

2.13.1 Basics

Pressing tools basically consist of the pressing machine (= drive machine) 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 so standardised the jaw attachment that pressing jaws from other manufacturers can also be used.

Press fittings in dimensions ø 12 ÷ 35 mm must by pressed with jaws, ø 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.

Figure 14 – Klauke UAP3L

Figure 15 – Klauke UAP100L

Figure 16 – Novopress ACO203

Figure 17 – Novopress ACO403

2.13.2 Approved pressing tools

RM approves the tools produced by Klauke and Novopress listed in the tables 8 and 9 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
MAP1 – MAP2L		15 KN	12 ÷ 22 mm	~ 2,5 Kg	--
UAP2 – UAP3L		32 KN	12 ÷ 54 mm	~ 3,5 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
UNP2		32 KN	12 ÷ 54 mm	~ 3,5 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01
UAP4 – UAP4L		32 KN	12 ÷ 54 mm PN16 76,1 ÷ 108 mm PN10	~ 4,3 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01 12 ÷ 54 mm
UAP100 – UAP100L		120 KN	76,1 ÷ 108 mm	~ 12,7 Kg	--
AH-P700LS	PKUAP3	32 KN	12 ÷ 54 mm	~ 12,3 Kg	Novopress EFP2 – EFP201 – AFP201 – EFP202 – AFP202 – EC01 – AC01 12 ÷ 54 mm
	PKUAP4	32 KN	12 ÷ 54 mm PN16 76,1 ÷ 108 mm PN10	~ 12,6 Kg	
	PK100AHP	120 KN	76,1 ÷ 108 mm	~ 20,2 Kg	--
EHP2/SANB		0,75 KW	76,1 ÷ 108 mm	~ 69 Kg	--

With regard to the Klauke pressing tool UAP4 / UAP4L, the limitation on PN 10 is to be observed for the kingsize dimensions 76 ÷ 108 mm outer diameter.

TABLE 9: MANUFACTURER NOVOPRESS

Type	Piston strength	Dimension range	Weight	Compatible with jaws from
AC0102	19 KN	12 ÷ 22 mm	~ 1,7 Kg	--
EFP2	32 KN	12 ÷ 54 mm	~ 6,1 Kg	EFP201 - AFP201 - EC01 - AC01
EFP201 - EFP202	32 KN	12 ÷ 54 mm	~ 4,4 Kg	EFP2 - EC01 - AC01
AFP201 - AFP202	32 KN	12 ÷ 54 mm	~ 4,3 Kg	EFP2 - EC01 - AC01
EC0202 - AC0202 EC0203 - AC0203	32 KN	12 ÷ 54 mm	~ 3,3 Kg	EC0201 - AC0201 - EC01 - AC01
AC0202XL AC0203XL	32 KN	12 ÷ 54 mm PN16 76,1 ÷ 108 mm PN10	~ 4,6 Kg	EC0202 - AC0202
AC0401 AC0403	100 KN 120 KN	76,1 ÷ 108 mm	~ 13 kg	--
AC03	36 KN	15 ÷ 54 mm	~ 5,0 Kg	EC03
EC0301	45 KN	12 ÷ 54 mm PN16 76,1 ÷ 108 mm PN10	~ 5,0 Kg	AC03
HCP	190 KN	76,1 ÷ 108 mm	~ 70 Kg	--

With Novopress pressing tool AC0202XL / AC0203XL / EC0301 , the limitation on PN 10 is to be observed for the king size dimensions 76 ÷ 108 mm outer diameter.

inoxPRES GAS fittings in sizes 76 ÷ 108 mm must be pressed with pressing collars/chains and UAP100 / UAP100L / AC0401 / AC0403 pressing machine only (others pressing machines are not approved).

2.13.3 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.

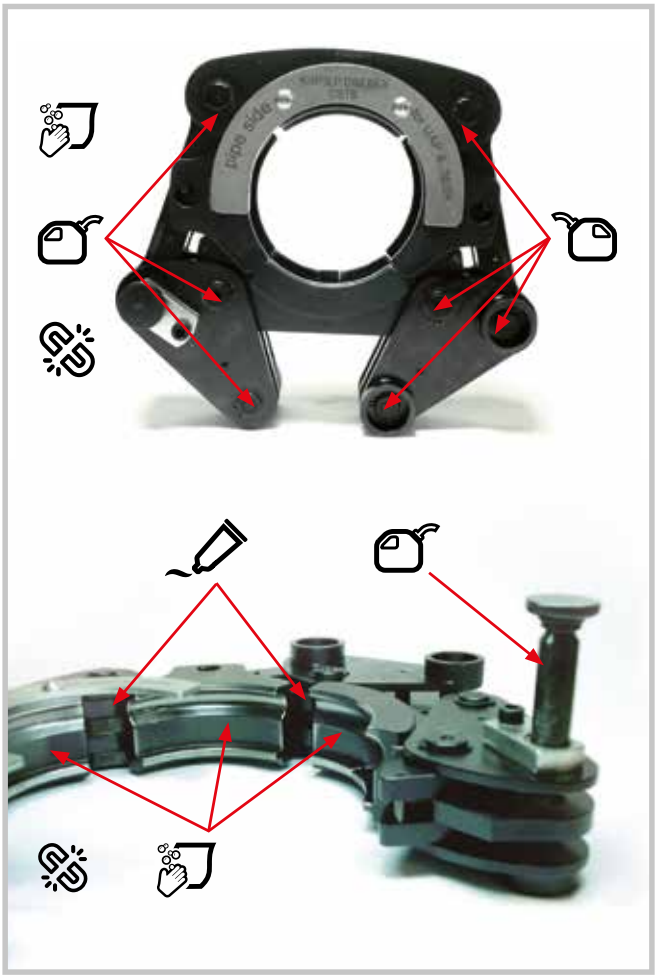


Figure 18 – Klauke equipment

Figure 19 – 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 10: FIELD OF APPLICATION FOR PRESS FITTING SYSTEMS INOXPRES / STEELPRES / AESPRES

Application	System	O-ring	Notes	PN max. (bar)	T °C
Drinking water	**InoxPRES** (pipe AISI 316L or Type 444)	EPDM black	-	16	0 / +120 °C
	aesPRES (copper pipe table 4-5)	EPDM black	-	16	0 / +120 °C
Heating	**steelPRES** (pipe 316/005)	EPDM black	Only use internally black pipes, galvanised on the outside.	16	0 / +120 °C
	InoxPRES	EPDM black	-	16	0 / +120 °C
	aesPRES (copper pipe table 4-5)	EPDM black	-	16	0 / +120 °C
Extinguishing water [1]	**inoxPRES** (pipe AISI 316L pipe AISI 304 pipe AISI 444)	EPDM black	Dimensions ø 15 ÷ 108 mm	16	Room temperature
	aesPRES (copper pipe table 4-5)	EPDM black	Dimensions ø 15 ÷ 54 mm	16	Room temperature

[1] For joints till ø 54 mm use press machines whose driving force accounts for ≥ 32 KN. For king size fittings (ø 76 ÷ 108 mm), use press machines whose driving force accounts for ≥ 100 KN.
For each country, must be checked with local laws and regulations concerning the use of the press fitting in extinguishing systems and sprinkler installations.

Sprinkler system [2]	**inoxPRES** (pipe AISI 316L [3] pipe AISI 304 pipe AISI 444)	EPDM black	Dimensions ø 22 ÷ 108 mm [3]	16	Room temperature
	steelPRES [4] (pipe 316/002 - 316/005)	EPDM black	Dimensions ø 22 ÷ 108 mm	16	Room temperature
	aesPRES [4][5] (copper pipe table 4-5)	EPDM black	Dimensions ø 22 ÷ 54 mm	16	Room temperature

[2] For joints till ø 54 mm use press machines whose driving force accounts for ≥ 32 KN. For king size fittings (ø 76 ÷ 108 mm), use press machines whose driving force accounts for ≥ 100 KN.
[3] Certified VdS PN12,5 Ø 22 up to 76,1 mm - PN16 Ø 88,9 mm material AISI 316L (wet and dry)
VdS certification and EN 12845 norm define the possible areas of application for sprinkler systems.
For each country, must be checked with local laws and regulations concerning the use of the press fitting in extinguishing systems and sprinkler installations.
[4] Only for wet plant installation [5] hazard classes LH, OH1, OH2 and OH3.

Cooling	**inoxPRES**	EPDM black	-	16	-20 / +120 °C
	steelPRES (pipe 316/003)	EPDM black	Only use internally black pipes. Paying particularly attention to the external protection against corrosion by using a PP covered Pipe + primer (paint) / bandage.	16	-20 / +120 °C
	aesPRES (copper pipe table 4-5)	EPDM black	-	16	-20 / +120 °C
Solar	**inoxPRES**	FKM green	-	6	-20 / +220 °C
	steelPRES (pipe 316/005)	FKM green	Only use internally black pipes. Paying particularly attention to the external protection against corrosion by using appropriate insulation-coating.	6	-20 / +220 °C
	aesPRES (copper pipe table 4-5)	FKM green	-	6	-20 / +220 °C

TABLE 10: FIELD OF APPLICATION FOR PRESS FITTING SYSTEMS INOXPRES / STEELPRES / AESPRES

Application	System	O-ring	Notes	PN max (bar)	T °C
Methane gas Natural gas LPG (gaseous state)	**inoxPRES GAS** (tubo AISI 316L)	NBR / HNBR yellow	Dimensions: ø 15 ÷ 108 mm	5	-20 / +70 °C
	aesPRES GAS (copper pipe table 4-5)	NBR yellow	Dimensions: ø 15 ÷ 54 mm	5	-20 / +70 °C
Compressed air	**inoxPRES**	[5] EPDM black Class 1÷4 (residual oil < 5 mg/m³) FKM green Class 5 (residual oil > 5 mg/m³)	System not silicone-free (not suitable for varnishing systems)	16	Room temperature
	steelPRES	[5] EPDM black Class 1÷4 (residual oil < 5 mg/m³) FKM green Class 5 (residual oil > 5 mg/m³)	System not silicone-free (not suitable for varnishing systems) for systems requiring clean air – without dust formation – the use of the **inoxPRES** system is recommended	16	Room temperature
	aesPRES (copper pipe table 4-5)	[5] EPDM black Class 1÷4 (residual oil < 5 mg/m³) FKM green Class 5 (residual oil > 5 mg/m³)	System not silicone-free (not suitable for varnishing systems)	16 bar to dim. Ø 54	Room temperature
[5] According to ISO 8573-1/2010 standard					
Nitrogen in gaseous state	**inoxPRES**	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	steelPRES	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	aesPRES (copper pipe table 4-5)	EPDM black	Only for industrial use (medicine excluded)	16 bar to dim. Ø 54	Room temperature
Argon in gaseous state	**inoxPRES**	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	steelPRES	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	aesPRES (copper pipe table 4-5)	EPDM black	Only for industrial use (medicine excluded)	16 bar to dim. Ø 54	Room temperature
Dry carbon dioxide in gaseous state	**inoxPRES**	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	steelPRES	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	aesPRES (copper pipe table 4-5)	EPDM black	Only for industrial use (medicine excluded)	16 bar to dim. Ø 54	Room temperature
Steam	**inoxPRES**	FKM green	-	Max 1 bar	Max 120 °C
Vacuum	**inoxPRES**	EPDM black FKM green	-	- 0,8 bar (up to a max. of -0,95/-0,98 bar)	Room temperature
	steelPRES	EPDM black FKM green	for systems requiring clean air – without dust formation – the use of the **inoxPRES** system is recommended	- 0,8 bar (up to a max. of -0,95/-0,98 bar)	Room temperature
	aesPRES (copper pipe table 4-5)	EPDM black FKM green	-	- 0,8 bar (up to a max. of -0,95/-0,98 bar)	Room temperature

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.

3.1 Applications

3.1.1 Potable water, treated water

The **inoxPRES** press fitting system is manufactured using high alloy austenitic Cr-Ni-Mo stainless steel with the material number 1.4404 (AISI 316 L). Thanks to its high resistance to corrosion and suitability in terms of hygiene, **inoxPRES** can be used for all drinking water applications in accordance with German potable water legislation (TrinkwV). 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 **aesPRES** press fitting system is available in copper and bronze and it can be used for any drinkable water as it is bacterial-static, thus it inhibits the bacteria proliferation. Should copper tubes and joints used for hydro-sanitary systems, they should comply with limits imposed by the standard DIN 50930 Teil 6:

- pH ≥ 7,4 or
- 7,0 ≤ pH ≤ 7,4 e TOC ≤ 1,5 g/m³

The TOC, Total Organic Carbon, is the concentration index of the total organic substances present in the water.
The black EPDM sealing ring fullfils the standards of the KTW recommendations and meets the standards in accordance with DVGW worksheet W 270.
inoxPRES and **aesPRES** 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.

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

inoxPRES and **aesPRES** 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.

Figure 20 - **inoxPRES**- Drinkable water

Figure 21 - **inoxPRES** - Industry

3.1.2 Heating

The **inoxPRES**, **steelPRES** and **aesPRES** 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 °C and maximum pressure PN16: closed and open versions (**inoxPRES** and **aesPRES**), closed version (**steelPRES**).
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 anti-corrosion or antifreeze additives requires the approval of RM. For **steelPRES** press fitting system RM recommends the use of pipes only galvanised on the outside.

3.1.3 Cooling and refrigeration circuits

inoxPRES, **steelPRES** and **aesPRES** with black EPDM sealing rings are suitable for use cooling and refrigeration circuits in closed and open versions (**inoxPRES** and **aesPRES**), in closed version (**steelPRES**) with operating temperatures between -20 / +120 °C.

The use of anti-corrosion or antifreeze additives requires the approval of RM. For **steelPRES** press fitting system, RM recommends the use of pipes only galvanized on the outside with particular attention to the external protection of the plants in carbon steel (see chapter 4.7).

3.1.4 Compressed air and inert gas

The **inoxPRES**, **steelPRES** and **aesPRES** 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.

3.1.5 Natural Gas / LPG installation

The **inoxPRES GAS** and **aesPRES GAS** press fitting system are suitable for natural gas and LPG following the here below subscriptions:

- **inoxPRES GAS** 15 ÷ 108 mm OD with factory-fitted yellow NBR/HNBR sealing ring is approved in Germany for natural and liquid gases in accordance with the DVGW worksheet G 260. The certification basis here is provided by the DVGW worksheet G 5614 together with DIN EN 682.
- **aesPRES GAS** 15 ÷ 54 mm OD with factory-fitted yellow NBR sealing ring is approved in Germany for natural and liquid gases in accordance with the DVGW worksheet G 260. The certification basis here is provided by the DVGW worksheet G 5614 together with DIN EN 682.

- **inoxPRES** ed **aesPRES GAS** fittings in dimensions 42 and 54 mm must be pressed with pressing collars/chains; pressing with jaws is not permitted.
- fittings in sizes 76 ÷ 108 mm must be pressed with pressing collars/chains and UAP100 / UAP100L / AC0401 / AC0403 pressing machine only (others pressing machines are not approved).

Please verify the local laws/regulations regarding the use of **inoxPRES GAS / aesPRES GAS** for gas applications in UK.

Figure 22 – **steelPRES** – refrigeration circuit

3.1.6 Solar, vacuum, steam, condensation

inoxPRES, **steelPRES** and **aesPRES** with green FKM sealing rings with increased temperature and oil resistance can be used in the following fields of application:

- solar piping, temperature range -20 /+220 °C.
  The temperature range is only permitted for solar systems with water-glycol mixture.
- vacuum piping up to 200 mbar absolute (- 0,8 bar relative, up to a maximum of -0,95 / -0,98 bar).

In order to achieve optimum sealing of compressed air and vacuum piping, it is recommended that the sealing ring be moistened using water before assembly.

Green FKM sealing rings are supplied loose and the fitter has to use them to replace the factory-fitted black EPDM sealing rings.

For **steelPRES** press fitting system RM recommends the use of pipes only galvanised on the outside.
inoxPRES with green FKM sealing rings can be used in the following fields of application:

- steam and condensation piping, temperature of maximum 120 °C at steam pressure of max. 1 bar.

Figure 23 – **steelPRES** – Pipe PP coated

3.1.7 Industrial applications

Due to its higher temperature resistance, **inoxPRES** with red MVQ sealing rings is especially suitable for a multitude of media in industrial applications. An individual case approval from RM is required in this situation.

Figure 24 – **steelPRES**– Press fittings

3.1.8 Shipbuilding

inoxPRES and **marinePRES** are certified for different applications in shipbuilding.
The black EPDM standard sealing ring only is factory-fitted in the siliconised version in **inoxPRES** press fittings. The green FKM sealing ring only is factory-fitted in **marinePRES** press fittings.
Separate information is available if required.

3.1.9 Extinguishing systems, sprinkler installations

inoxPRES and **aesPRES** systems with black EPDM sealing ring can be used in extinguishing systems (reference norm UNI 10779/2014). In addition, the press fitting systems are suitable for wet and dry sprinkler installations (ref. EN 12845), with diameters from ø 22 up to 108 mm, according to the below table.

TABLE 11: PRESS FITTING IN EXTINGUISHING SYSTEMS AND SPRINKLER INSTALLATIONS

Application	inoxPRES	steelPRES	aesPRES
Extinguishing systems	OK	NO	OK
Sprinkler system (dry installation)	OK	NO	NO
Sprinkler system (wet installation)	OK	OK*	OK

*(Code 316/002 – 316/005 steelPRES pipes)

The press fitting systems used in extinguishing systems and sprinkler installations must be only in the configuration "above ground" (underground is excluded). With reference to EN 12845, copper can be used for wet sprinkler systems (no dry) with hazard classes LH, OH1, OH2 and OH3.

inoxPRES is certified to be used with sprinkler installations according to the VdS certification:
ø 22 ÷ 76,1 mm PN12,5 bar – ø 88,9 PN16 – Material AISI 316L – **inoxPRES** with standard EPDM o-ring for dry and wet sprinkler installations.

VdS certification requires the use of press machines with driving force accounting for ≥ 32 KN up to ø 54 mm while for King Size fittings (ø 76 ÷ 108 mm), only use press machines whose driving force accounts for ≥ 100 KN (furthermore, the evidence in the VdS approval must be observed).

For each country, must be checked with local laws and regulations concerning the use of the press fitting in extinguishing systems and sprinkler installations.

3.1.10 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 12: CHEMICAL COMPATIBILITY OF GLYCOLS

GLICOLE	Manufacturer	Areas of use
GLYKOSOL N	Pro Kühlsole GmbH	Heating Cooling cycles
PEKASOL L	Pro Kühlsole GmbH	Heating Cooling cycles
PEKASOLar 50	Pro Kühlsole GmbH	Solar
PEKASOLar 100	Pro Kühlsole GmbH	Solar
PEKASOLar F	BMS Energy	Solar
TYFOCOR	Tyforop Chemie GmbH	Heating Cooling cycles
TYFOCOR L	Tyforop Chemie GmbH	Heating Cooling cycles Solar
TYFOCOR LS	Tyforop Chemie GmbH	Solar
CosmoSOL	Tyforop Chemie GmbH	Heating Cooling cycles Solar
Antifrogen N	Clariant	Heating Cooling cycles
Antifrogen L	Clariant	Heating Cooling cycles
Antifrogen SOL–HT	Clariant	Solar
DOWNCAL 100	DOW	Heating Cooling cycles
DOWNCAL 200	DOW	Heating Cooling cycles

NOTE: please follow the manufacturer's utilization notes. For **steelPRES**, please only use internally black pipes.

4.0 Processing

4.1 Storage and transport

inoxPRES / **steelPRES** / **aesPRES** / **marinePRES** 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 (particularly in the area of the **steelPRES** press fitting systems).

Figure 25 – Cutting the pipe to length

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.

Figure 26 – Deburring the pipe

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 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. The pipes can be bent by means of conventional bending tools up to 22 mm outer diameter (R ≥ 3,5xD).
DN 12 – R=45 mm
DN 15 – R=55 mm
DN 18 – R=70 mm
DN 22 – R=77 mm.
No tube hot bending allowed.

4.3 Marking the insertion depth / stripping

Sufficient mechanical strength of the press fitting connection will only be achieved if the insertion depths shown in table 13 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. In the case of **steelPRES** PP-coated pipes, the insertion depth is defined through the stripping of the plastic coating using a suitable stripping tool.
When stripping the PP-sheathed tubes, use suitable tools which do not damage the raw surface.

TABLE 13:
INSERTION DEPTH AND MINIMUM DISTANCES

Pipe outside diameter mm	A (*) mm	D mm	L mm
12	18	20	56
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

4.4 Press fitting seal ring check

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. 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 8 – 9, approved pressing tools.

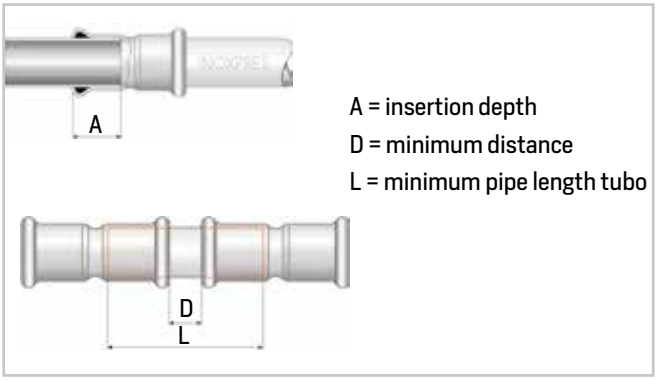


Figure 27 – Insertion depth and minimum dimensions

Figure 28 – Marking the insertion depth

Figure 29 – Stripping (**steelPRES** PP coated)

Figure 30 – Checking the sealing ring

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.

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 Equipment installations in Australia/New Zealand

Possibly tube and joint installations in Australia or New Zealand should comply with regulation AS/NZS 3500.1 and following amendments.

4.7 Protection of pipelines and connections from external corrosion - general

All pipes with hot or cold liquids must be protected externally by appropriate coatings so as to avoid any unwanted incidents, such as:

- condensation;
- condensation with external corrosion;
- corrosion by external influences;
- thermal dispersion.

Pipes and connections must be protected with varnish, plastic coatings, press-on tyres with adhesive tapes and thermal insulation (see Chapter 5.4 of the Manual).

Figure 31 – Inserting pipe into the press fitting

Figure 32 – Making the press connection

Figure 33 – Checking the press connection

Figure 34 – Varnish of the connections and pipes with primer.

To prevent external corrosion of **steelPRES** systems – especially where condensation water could increasingly occur (e.g. air conditioning and cooling units) – the following is recommended:

- use tubes with a propylene coating if tubes of non-alloy steel are used;
- proper protection of tubes/connections with the help of a coating with primer;
- proper protection of tubes/connections with the help of viscoelastic tape, consisting of butanol-mastic, supported by a film made of high-density polyethylene (entire thickness approx. 0,8 mm).

The butanol-adhesive tape (type RM code 850NS000000) has high tensile and high adhesive strength and is self-fluxing. It requires no adherent primer, lets surfaces perfectly repel water and insulates against atmospheric influences and free chemicals. The high tensibility provides the tapes with comprehensive applicability for all types of surfaces, even for irregular surfaces such as bends, T-piece, sleeves, etc.
For the application, it is sufficient that the surface is clean but not wet. The tape must be under pressure and cleaned depending on the situation. It extends over 700% compared to its original length, while the width at the end depends on the extension. It is recommended to overlap the tape with at least 10% of the tape width.

A coating protection with the help of tapes and/or varnish must always occur after a trial run of the system.

Important: the choice and the implementation of the type of protection against external corrosion is responsibility of the planner and installer.

Figure 35 – Protection of the connectors with butanol adhesive tape

Figure 36 – Protection against external corrosive materials:
A. Pipe with PP-coating
B. Varnish with primer
C. Protection with butanol adhesive tape

4.8 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 tables 14 and 15.

TABLE 14: MINIMUM DISTANCES AND SPACE REQUIREMENT 12 - 35 mm

Pipe Ø		Figure 37		Figure 38			Figure 39				Figure 40	
I	S	A	D	A	D	D1	A	C	D	D1	D	E
-	12 x 1,2	56	30	75	30	35	85	155	30	35	40	60
15 x 1	15 x 1,2	56	30	75	30	35	85	155	30	35	40	60
18 x 1	18 x 1,2	60	30	75	30	40	85	165	30	40	40	60
22 x 1,2	22 x 1,5	75	40	80	40	40	85	165	40	40	40	61
28 x 1,2	28 x 1,5	82	40	90	40	45	90	180	40	45	40	63
35 x 1,5		85	40	90	40	45	90	180	40	45	40	66

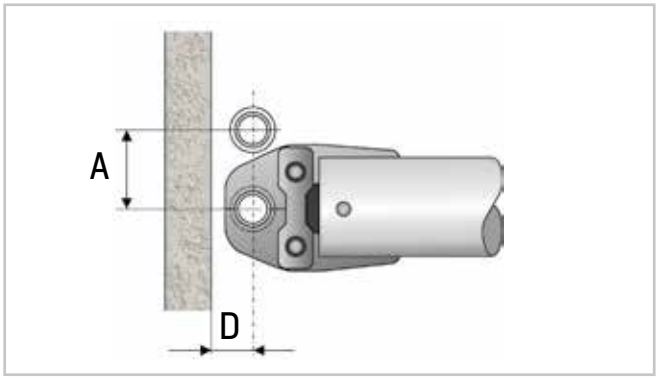


Figure 37 – Minimum distances and space requirements

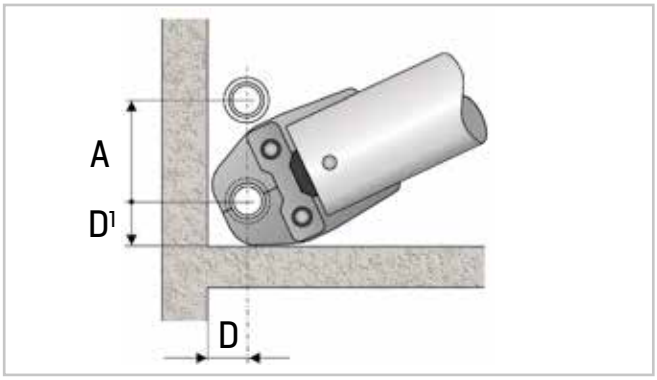


Figure 38 – Minimum distances and space requirements

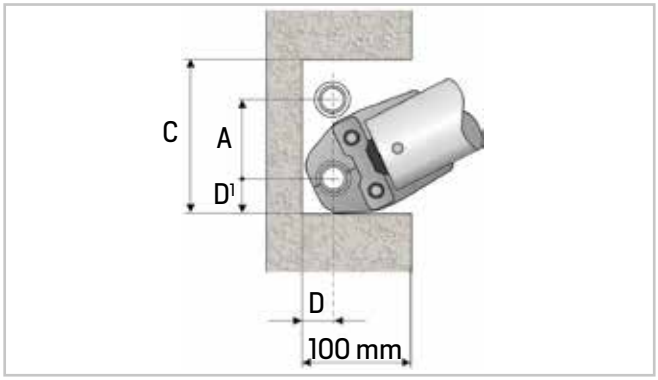


Figure 39 – Minimum distances and space requirements

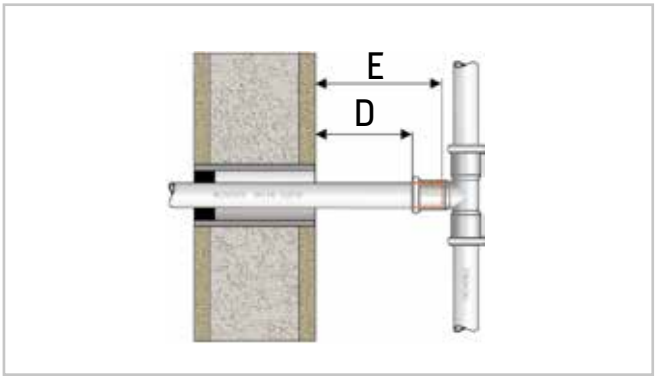


Figure 40 – Minimum distances and space requirements

TABLE 15: MINIMUM DISTANCES 42 - 108 mm

Pipe Ø	A	B	C
42 x 1,5	150	150	110
54 x 1,5	150	150	110
76,1 x 2	170	210	170
88,9 x 2	190	260	190
108 x 2	200	320	280

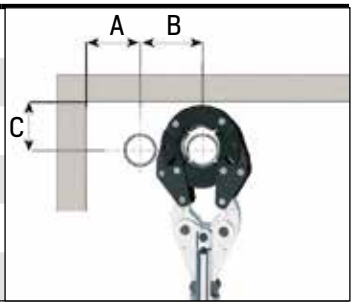


Figure 41 – Minimum distances for chains / collars

4.9 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** / **steelPRES** / **marinePRES** range can be connected to normal flanges at pressure stage PN 6 / 10 / 16. 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** / **steelPRES** / **aesPRES** / **marinePRES** pipes are shown in table 16.

TABLE 16: MAXIMUM PERMITTED DISTANCES BETWEEN SUPPORTS

DN	Pipe outside diameter (mm)	Support distance in metres (m) DIN 1988	Guideline (m)
10	12	1,25	1,50
12	15	1,25	1,50
15	18	1,50	1,50
20	22	2,00	2,00
25	28	2,25	2,50
32	35	2,75	2,50
40	42	3,00	3,00
50	54	3,50	3,50
65	76,1	4,25	4,00
80	88,9	4,75	4,50
100	108	5,00	5,00

5.2 Expansion compensation

Metal materials expand in different ways under the influence of heat.
The longitudinal change under various temperature differences in the pipe is shown for **inoxPRES**, **steelPRES**, **aesPRES** and **marinePRES** in table 17. 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 42 a – c.

TABLE 17: LENGTH VARIATIONS INOXPRES / STEELPRES / AESPRES / MARINEPRES

	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
steelPRES	3	0,36	0,72	1,08	1,44	1,80	2,16	2,52	2,88	3,24	3,60
	4	0,48	0,96	1,44	1,92	2,40	2,88	3,36	3,84	4,32	4,80
	5	0,60	1,20	1,80	2,40	3,00	3,60	4,20	4,80	5,40	6,00
	6	0,72	1,44	2,16	2,88	3,60	4,32	5,04	5,76	6,48	7,20
	7	0,84	1,66	2,52	3,36	4,20	5,04	5,88	6,72	7,56	8,40
	8	0,96	1,92	2,88	3,84	4,80	5,76	6,72	7,68	8,64	9,60
	9	1,08	2,16	3,24	4,32	5,40	6,48	7,56	8,64	9,72	10,80
	10	1,20	2,40	3,60	4,80	6,00	7,20	8,40	9,60	10,80	12,00
	12	1,44	2,88	4,32	5,76	7,20	8,4	10,08	11,52	12,96	14,40
	14	1,68	3,36	5,04	6,72	8,40	10,08	11,76	13,44	15,12	16,80
	16	1,92	3,84	5,76	7,68	9,60	11,52	13,44	15,36	17,28	19,20
	18	2,16	4,32	6,48	8,64	10,80	12,96	15,12	17,28	19,44	21,60
	20	2,40	4,80	7,20	9,60	12,00	14,40	16,80	19,20	21,60	24,00
aesPRES / marinePRES	3	0,5	1,0	1,5	2,0	2,6	3,1	3,6	4,1	4,6	5,1
	4	0,7	1,4	2,0	2,7	3,4	4,1	4,8	5,4	6,1	6,8
	5	0,9	1,7	2,6	3,4	4,3	5,1	6,0	6,8	7,7	8,5
	6	1,0	2,0	3,1	4,1	5,1	6,1	7,1	8,2	9,2	10,2
	7	1,2	2,4	3,6	4,8	6,0	7,1	8,3	9,5	10,7	11,9
	8	1,4	2,7	4,1	5,4	6,8	8,2	9,5	10,9	12,2	13,6
	9	1,5	3,1	4,6	6,1	7,7	9,2	10,7	12,2	13,8	15,3
	10	1,7	3,4	5,1	6,8	8,5	10,2	11,9	13,6	15,3	17,0
	12	2,0	4,1	6,1	8,2	10,2	12,2	14,3	16,3	18,4	20,4
	14	2,4	4,8	7,1	9,5	11,9	14,3	16,7	19,0	21,4	23,8
	16	2,7	5,4	8,2	10,9	13,6	16,3	19,0	21,8	24,5	27,2
	18	3,1	6,1	9,2	12,2	15,3	18,4	21,4	24,5	27,5	30,6
	20	3,4	6,8	10,2	13,6	17,0	20,4	23,8	27,2	30,6	34,0

Linear expansion in general

ΔL = L x α x Δt α

ΔL = linear expansion in mm

L = pipe length in m

α = linear expansion coefficient

inoxPRES α = 0,0165 mm / (m x °K)

steelPRES α = 0,0120 mm / (m x °K)

aesPRES / marinePRES α = 0,017 mm / (m x °K)

Δt = temperature difference in °K

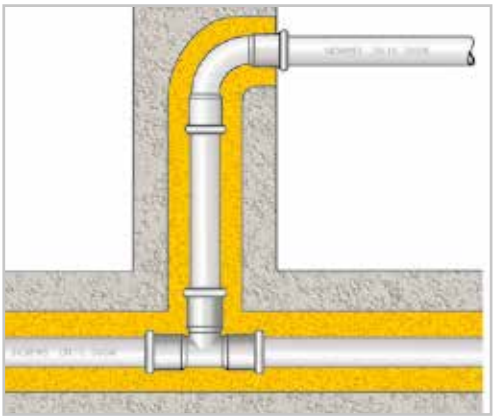


Figure 42a – Creation of expansion spaces

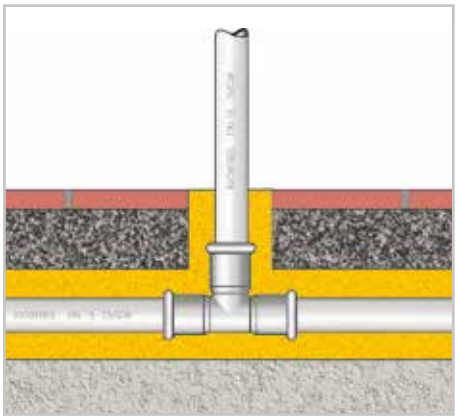


Figure 42b – Creation of expansion spaces

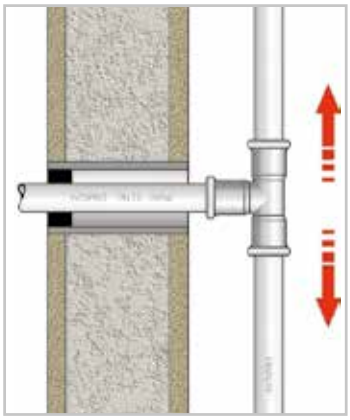


Figure 42c – Creation of expansion spaces

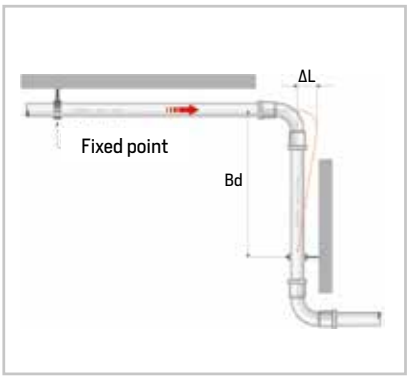


Figure 43 – Z-shaped expansion reach

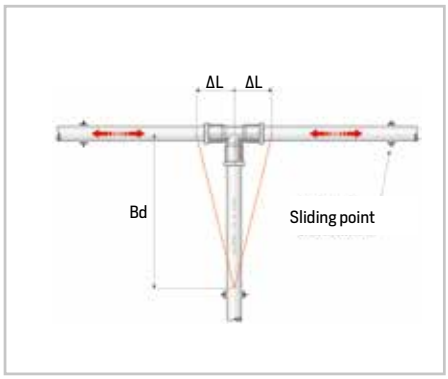


Figure 44 – Expansion compensation branch

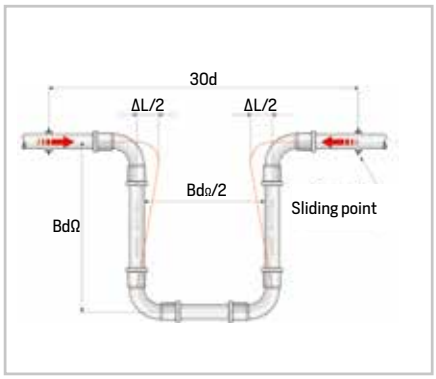


Figure 45 – U-bend **Bdω = Bdω / 1,8**

Calculation formula Z - bend and T - junction (figure 43 e 44)

Bd = k x √(da x ΔL) [mm]

k = constant
inoxPRES / steelPRES = 45
aesPRES / marinePRES = 62
da = outer diameter pipe in mm
ΔL = linear expansion in mm

Calculation formula U bend (figure 45)

Bdω = k x √(da x ΔL) [mm] or
Bdω = Bd / 1,8

k = constant
inoxPRES / steelPRES = 25
aesPRES / marinePRES = 34
da = outer diameter pipe in mm
ΔL = linear expansion in mm

TABLE 18: CALCULATION OF THE EXPANSION REACH (BD) INOXPRES / STEELPRES

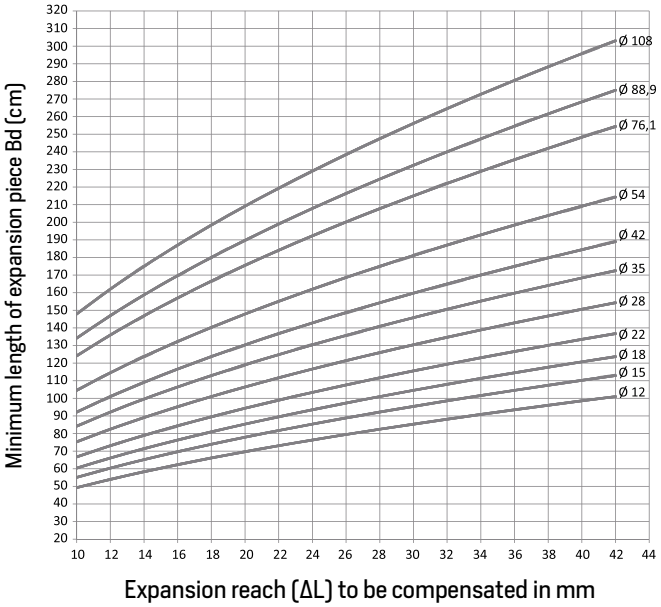


TABLE 19: CALCULATION OF THE EXPANSION REACH (BD) AESPRES / MARINEPRES

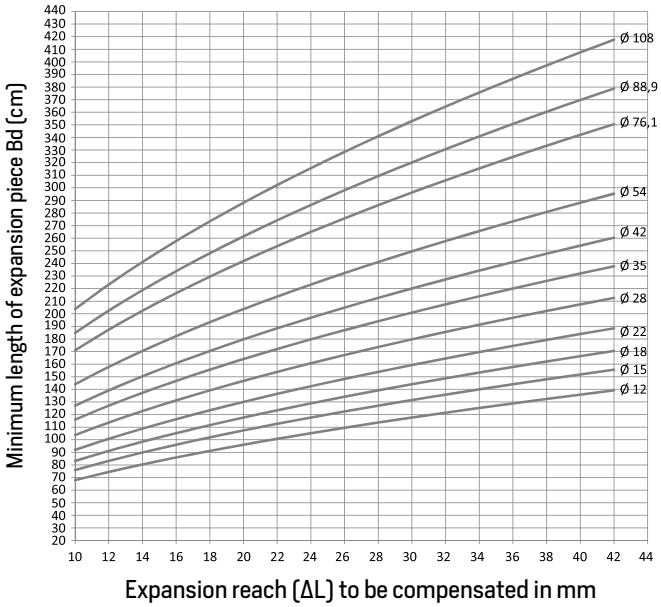


TABLE 20: EXPANSION PIECE FOR U-BEND (BdΩ) INOXPRES / STEELPRES

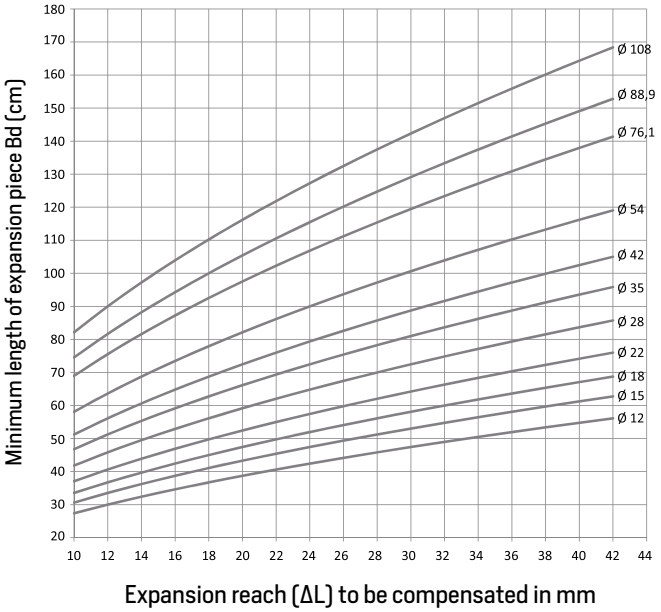
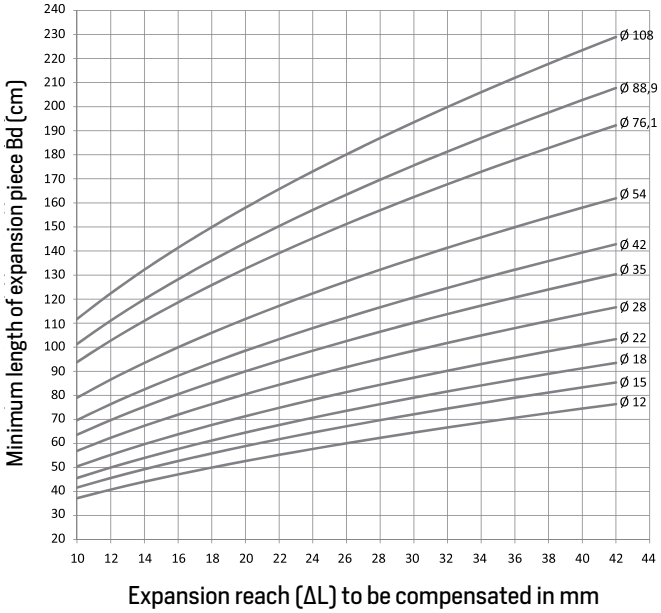


TABLE 21: EXPANSION PIECE FOR U-BEND (BDΩ) AESPRES / MARINEPRES



5.3 Thermal emission

Depending on temperature difference, warm piping releases heat into the environment.
The thermal emission from **inoxPRES** / **steelPRES** / **marinePRES** pipes can be seen in tables 23 – 23 and 24.

TABLE 22: THERMAL EMISSION FROM INOXPRES / STEELPRES PIPE (W/m) UNCOVERED

d x s (mm)		ΔT TEMPERATURE DIFFERENCE (°K)									
I	S	10	20	30	40	50	60	70	80	90	100
–	12 x 1,2	3,7	7,5	11,2	14,9	18,6	22,4	26,1	29,8	33,5	37,3
15 x 1	15 x 1,2	4,7	9,3	14,0	18,6	23,3	28,0	32,6	37,3	41,9	46,6
18 x 1	18 x 1,2	5,6	11,2	16,8	22,4	28,0	33,6	39,2	44,8	50,4	55,9
22 x 1,2	22 x 1,5	6,8	13,7	20,5	27,4	34,2	41,0	47,9	54,7	61,5	68,4
28 x 1,2	28 x 1,5	8,7	17,4	26,1	34,8	43,5	52,2	60,9	69,6	78,3	87,1
35 x 1,5		10,9	21,8	32,7	43,5	54,4	65,3	76,2	87,1	98,0	108,8
42 x 1,5		13,1	26,1	39,2	52,3	65,3	78,4	91,4	104,5	117,6	130,6
54 x 1,5		16,8	33,6	50,4	67,2	84,0	100,8	117,6	134,4	151,2	168,0
76,1 x 2		23,7	47,3	71,0	94,7	118,4	142,0	165,7	189,4	213,1	236,7
88,9 x 2		27,7	55,3	83,0	110,6	138,3	165,9	193,6	221,2	248,9	276,6
108 x 2		33,6	67,2	100,8	134,4	168,0	201,6	235,2	268,8	302,4	336,0

External inlet-coefficient αe = 10 W/(m² x °K)

TABLE 23: THERMAL EMISSION FROM STEELPRES PIPE IN PP (W/m) COVERED

S d x s (mm)	ΔT TEMPERATURE DIFFERENCE (°K)									
	10	20	30	40	50	60	70	80	90	100
12 x 1,2	3,7	7,5	11,2	15,0	18,7	22,5	26,2	30,0	33,7	37,5
15 x 1,2	4,6	9,1	13,7	18,2	22,8	27,3	31,9	36,5	41,0	45,6
18 x 1,2	5,4	10,7	16,1	21,5	26,8	32,2	37,6	42,9	48,3	53,7
22 x 1,5	6,4	12,9	19,3	25,8	32,2	38,7	45,1	51,5	58,0	64,4
28 x 1,5	8,1	16,1	24,2	32,2	40,3	48,4	56,4	64,5	72,5	80,6
35 x 1,5	9,9	19,9	29,8	39,8	49,7	59,7	69,6	79,6	89,5	99,5
42 x 1,5	11,8	23,7	35,5	47,3	59,2	71,0	82,8	94,7	106,5	118,3
54 x 1,5	15,1	30,1	45,2	60,3	75,3	90,4	105,5	120,5	135,6	150,7
76,1 x 2	21,0	42,0	63,1	84,1	105,1	126,1	147,1	168,1	189,2	210,2
88,9 x 2	24,5	48,9	73,4	97,9	122,3	146,8	171,3	195,7	220,2	244,7
108 x 2	29,6	59,2	88,8	118,5	148,1	177,7	207,3	236,9	266,5	296,1

External inlet-coefficient αe = 9 W/(m² x °K)

The thermal emission of **marinePRES** pipes are shown in the following table.

TABLE 24: THERMAL EMISSION FROM MARINEPRES (W/m) COVERED

M d x s (mm)	ΔT TEMPERATURE DIFFERENCE (°K)									
	10	20	30	40	50	60	70	80	90	100
15 x 1	5,1	10,2	15,4	20,5	25,6	30,7	35,9	41,0	46,1	51,2
18 x 1	6,1	12,3	18,4	24,6	30,7	36,9	43,0	49,2	55,3	61,5
22 x 1	7,5	15,0	22,6	30,1	37,6	45,1	52,6	60,1	67,7	75,2
28 x 1,5	9,6	19,1	28,7	38,3	47,8	57,4	67,0	76,5	86,1	95,7
35 x 1,5	12,0	23,9	35,9	47,8	59,8	71,8	83,7	95,7	107,6	119,6
42 x 1,5	14,4	28,7	43,1	57,4	71,8	86,1	100,5	114,8	129,2	143,5
54 x 1,5	18,5	36,9	55,4	73,8	92,3	110,8	129,2	147,7	166,1	184,6
76,1 x 2	26,0	52,0	78,0	104,0	130,1	156,1	182,1	208,1	234,1	260,1
88,9 x 2	30,4	60,8	91,2	121,6	151,9	182,3	212,7	243,1	273,5	303,9
108 x 2,5	36,9	73,8	110,7	147,6	184,6	221,5	258,4	295,3	332,2	369,1

External inlet-coefficient αe = 11 W/(m^2 x °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 25.

TABLE 25: MINIMUM INSULATION MATERIAL THICKNESS FOR PIPING

Piping cold water		Piping hot water	
Type of installation	Insulation material thickness in mm λ = 0,040 W/ (m x °K)	OD in mm	Insulation material thickness in mm λ = 0,040 W/ (m x °K)
Piping uncovered, not heated (i.e. cellar)	4	12	20
Piping uncovered without hot water lines	9	15	20
Piping in channel, no hot water lines	4	18	20
Piping in channel, along with hot water	13	22	20
Piping in wall slit, risers	4	28	30
Piping in wall gap, along with hot water	13	35	40
Piping on concrete floor	4	42	40
		54	50
		76,1	65
		88,9	80
		108	100

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.

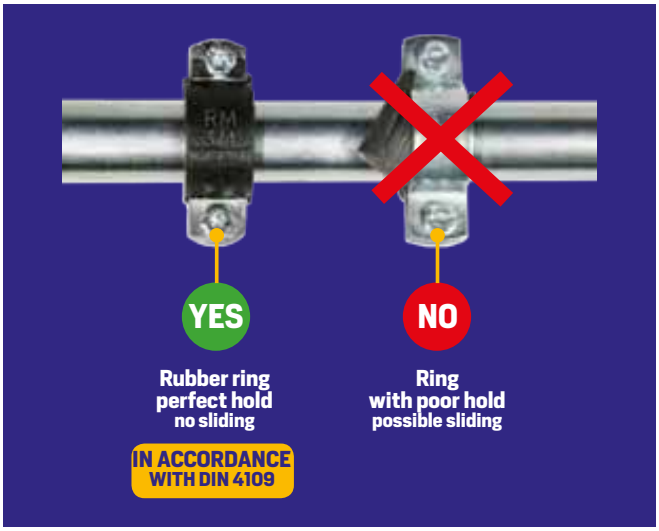


Figure 46 – Rubber ring PRATIKO in conformity with DIN 4109 (Unit RM Series 355/G – 351/G – 555/G – 156/G)

5.6 Fire prevention

inoxPRES / steelPRES / aesPRES / marinePRES pipes are classed as a non-flammable material in building material class A in accordance with DIN 4102-1. **steelPRES** pipes with PP coating are classed as a non-flammable dripping material in building material class B2 in accordance with DIN 4102-1. Further national requirements in terms of fire prevention are most effectively fulfilled by use of fire-retarding sealing techniques.

5.7 Potential equalisation

According to DIN VDE 0100, 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, **steelPRES**, **aesPRES** and **marinePRES** 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:

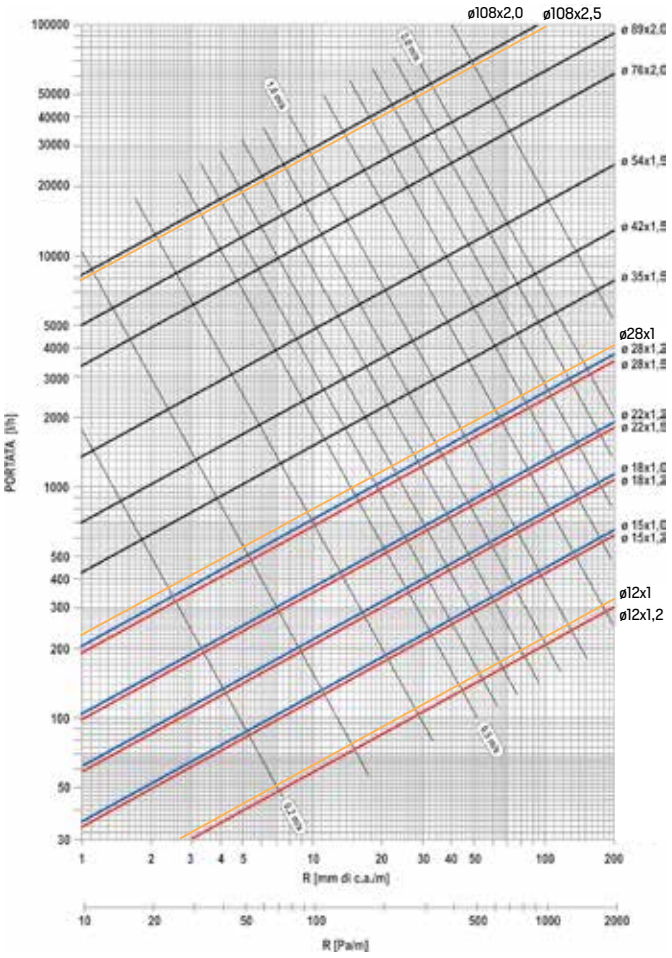
Potable water installations:
- DIN 1988 part 300
- EN 806 2008:2012
- DVGW W531-553
- VDI guideline 6023

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
- DIN 4751

Gas installations:
- TRGI / TRF

TABLE 26: PIPE FRICTION PRESSURE DROP FOR INOXPRES / STEELPRES / AESPRES / MARINEPRES



The pipe friction pressure drop for **inoxPRES / steelPRES / aesPRES / marinePRES** piping is shown in table 26.

5.9 Trace heating

When trace heating is used, the temperature of the pipe inside wall may not exceed 60 °C.
For thermal disinfection purposes a temporary temperature increase to 70 °C (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
Gas systems:	**DVGW** G 600 **TRGI** (technical regulations for gas installation) **TRF** (technical regulations for liquid gas)

6.1 Pressure testing

In the case of piping for potable water, the pressure testing (see page 46) 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.

- Tightness / pressure tests are to be carried out before the pipes are covered (e.g. for insulation purposes);
- Tests are to be carried out in accordance with DVGW worksheet W534 and the ZVSHK data sheet "Tightness Tests for drinking water installations with compressed air, inert gas or water"
- When conducting pressure tests with air, follow the technical rules for gas installations "DVGW-TRGI";
- The correct assembly of the press-fit connections is the responsibility of the installer / company. Unpressed-untight is to be understood as an additional help in order to identify an assembly error – in this case, the non-pressing of fittings. A precondition for that is the proper implementation of the prescribed tightness and pressure tests ; it does not absolve the installer from his obligation to carry out visual and noise controls to make sure that the assembly has been done properly. These visual and noise controls are to be duly recorded on the respective test certificate.

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). In this situation the ZVSHK / BTGA data sheets should be applied. Stagnant water from the house supply piping must not access the potable water installation. 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 behaviours of the **inoxPRES** press fitting system is dictated by the material used. The corrosion behaviour of **inoxPRES** press fitting systems is determined by the Cr-Ni -Mo steel with material nº 1.4404 (AISI 316L) and Cr-Mo nº 1.4521 (AISI 444). The following properties result from it:

- suitability for all potable water in accordance with German drinking water regulations;
- absolutely hygienic;
- suitable for mixed installations;
- suitable for treated, softened and desalinated water.

7.1.1 Bimetal corrosion (mixed installation) - DIN 1988 part 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 4.9 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 Outside corrosion

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.

7.2 inoxPRES GAS

The corrosion behaviour of **inoxPRES GAS** press fitting systems is defined by the material used; Cr-Ni-Mo steel with the material nº 1.4404 (AISI 316 L).

In the case of **inoxPRES GAS** components no further corrosion protection is normally required.

7.2.1 Outside corrosion

inoxPRES GAS components are in danger from 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 GAS** comes into contact with gases or fumes containing chloride (e.g., galvanising shops, swimming pools);
- **inoxPRES GAS** comes into contact with building materials which contain chlorides, under the influence of dampness;
- according to VDE (German Association for electrical, Electronic & Information Technologies), **inoxPRES GAS** must be inserted in the main equipotential bonding (connection to be carried out by skilled personnel).

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

- installing closed cell insulation materials 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.

7.3 steelPRES

The corrosion behaviour of the **steelPRES** press fitting system is defined by the unalloyed carbon steel used and is suitable for:

- closed heating systems;
- closed cooling and refrigeration circuits;
- compressed air system;
- closed solar cycles.

7.3.1 Inside corrosion

In closed heating/cooling systems there is generally no air and thus no danger of corrosion. The small quantity of oxygen which enters the system when it is being filled poses no problems since it reacts with the entire inside metallic surface of the system and is reduced in the process.
In addition, oxygen is released when heating water is heated, and is released through valves installed in the system.

The systems must be filled in accordance with VDI 2035. Oxygen increase can also be prevented by the use of oxygen binding materials. However, these must be approved by RM beforehand. When filling the systems, the pH value must not fall below 7,2 (drinking water).

7.3.2 Bimetal corrosion

In heating/cooling installations executed with **steelPRES** it is possible to insert single fittings made from different raw materials, including **inoxPRES** components, in any order.

Closed circuit networks entirely executed with **steelPRES** (pipes and fittings) must be separated from stretches made with **inoxPRES** (pipes and fittings) through the use of shut-off valves or bronze nipples (> 80 mm) for protection against corrosion.

7.3.3 Outside corrosion

steelPRES piping and fittings are protected against outside corrosion by means of a galvanic zinc coating. If **steelPRES** pipes (12 ÷ 108 mm OD) are also PP coated, then this provides additional corrosion protection. Nevertheless, over a longer period of time dampness may lead to outside corrosion on **steelPRES** components.
Contact with building materials / building materials can lead to corrosion.

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

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

steelPRES components should not be subjected to permanent dampness. For this reason felt lagging or coverings are not approved, since they retain water.

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

7.4 aesPRES / marinePRES

Corrosion behaviour of the **aesPRES** / **marinePRES** systems depends on the main material quality – copper – consisting of alloys of the two systems to be pressed.
The **aesPRES** system stands out for the following features:

- suitable for drinkable waters;
- hygienically safe as copper and its alloys prevent bacteria proliferation on their surfaces (bacterial-static action);
- suitable for mixed installations;
- suitable for treated, softened and desalinated water;

The **marinePRES** system is mainly suggested for application where chlorides are present, as in the case of saline water transportation.

7.4.1 Bimetal corrosion (mixed installation)

aesPRES and **marinePRES** systems can be matched with different materials, ferrous and not. It is important to pay attention to the ratio between cathode and anode areas as not to lead to conditions favourable to corrosion. Copper in fact in general is under cathode conditions and can lead to the component corrosion.
In the case of open loop installations, as to avoid corrosion in mixed installations, it is important to comply with the following general rules:

- consider the water flow, install copper and copper alloys downstream the installations made with ferrous materials;
- add non ferrous separators > 80 mm (ex. check valves, bronze or brass joints) between the two sections of different materials.

7.4.2 Perforating corrosion

The dotted corrosion (pin-head tube holing), depends on the growing water pollution in the last decades strictly linked to industrialization. Such an issued was totally solved with the introduction of copper tubes with no carbon residues.

7.4.3 Outside corrosion

Copper and copper alloys stand the outside corrosion risk and nothing is to be done at the protection level, while in the presence of sulphurs, nitrites and ammonia, tubes are to be protected. It is necessary to protect **aesPRES** / **marinePRES** details against external corrosion as follows:

- closed cell insulators;
- 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.

7.5 aesPRES GAS

The high resistance of **aesPRES GAS** joint to outside corrosion does not require any additional anti-corrosion standard protection.
According to VDE (German Association for electrical, Electronic & Information Technologies), **aesPRES GAS** must be inserted in the main equipotential bonding (connection to be carried out by skilled personnel).

aesPRES GAS components can be protected against outside corrosion by means of:

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

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

TABLE 27: 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 (H_2O_2) 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:

- material choice in accordance with DIN 50930-6;
- 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;
- install circulation piping with dimensions are in accordance with W 553;
- 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

Descrizione _____
Set-up of the system _____
Pipe diameter _____
Design manager _____
Specification _____

SYSTEM FOR WHICH COMPATIBILITY IS REQUESTED

inoxPRES ☐	steelPRES ☐	inoxPRES GAS ☐	aesPRES ☐
Tube 1.4404 (316L) ☐	Pipe of gal./internally black (316/005) ☐	Tube 1.4404 (316L) ☐	Copper tube ☐
Tube 1.4521 (444) ☐	Pipe of gal./internally gal. (316/002) ☐	aesPRES GAS ☐	marinePRES ☐
	Pipe of gal./internally black + PP coating (316/003) ☐	Copper tube ☐	Copper-nickel tube ☐

MEDIUM WHOSE COMPATIBILITY NEEDS TO BE REVIEWED

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	☐	Closed	☐
Installation	Outside closed spaces	☐	Inside closed spaces	☐

11.0 Pressure test protocol

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

For **inoxPRES** / **aesPRES** 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 (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** / **steelPRES** / **aesPRES** press fitting systems

Project / Construction _____
Contractor / Representative _____
Project / Representative _____
Materials _____
Medium Potable water temperature _____ºC Room temperature _____ ºC

- 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 (45 minutes min.) _____ 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!

Place _____ Date _____

_____ _____
Client signature Contractor signature

11.3 Pressure test protocol for potable water with compressed air

For **inoxPRES** / **aesPRES** 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 test period (45 minutes min.) _____ hours
- Pressure drop during the pressure test ☐

Comments

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.

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

RACCORDERIE METALLICHE

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