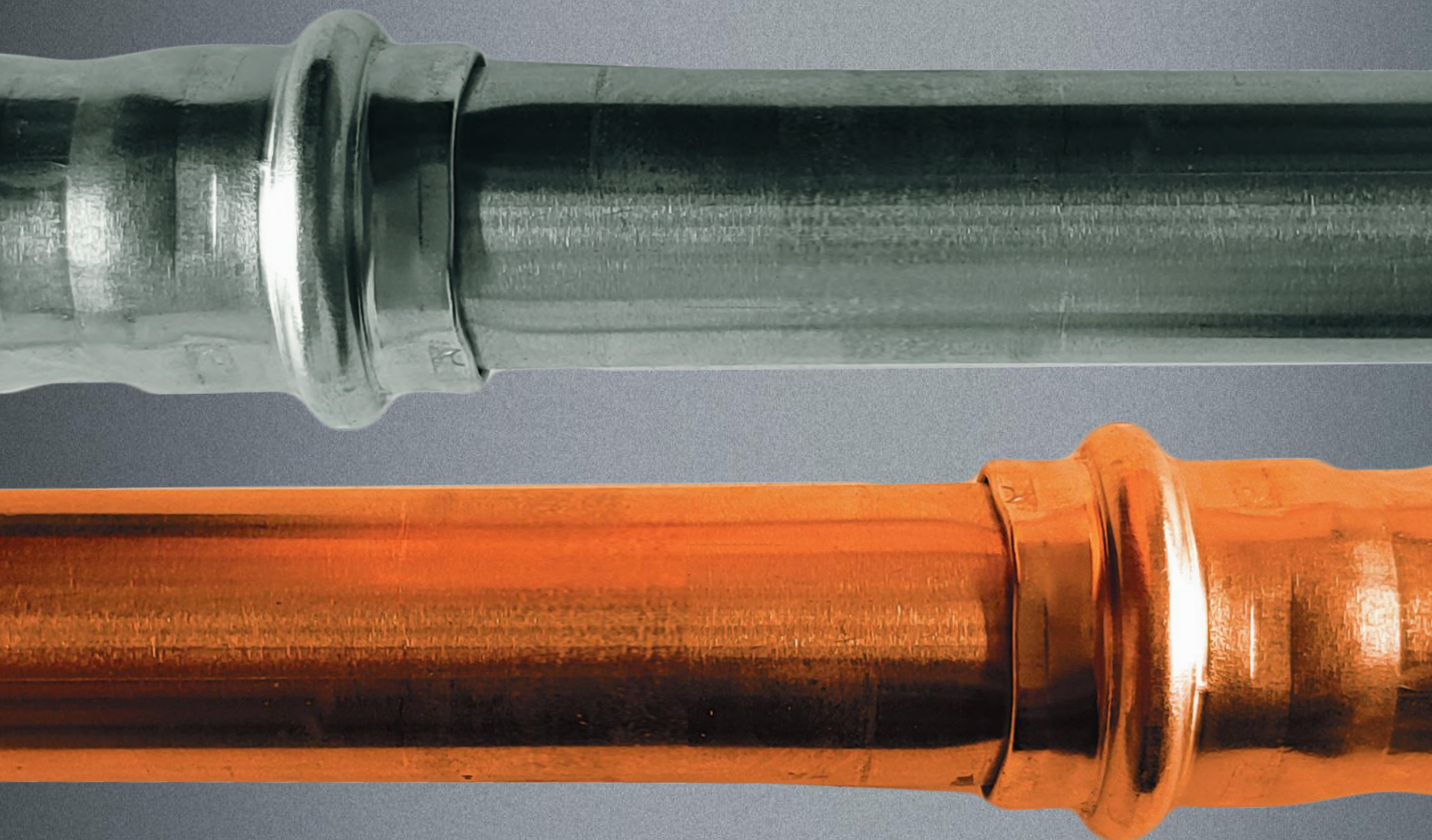




Press fitting **UNIKO** systems **Technical Handbook**



**M & V PROFILE
COMPATIBLE**

















inoxPRES

UNIKO®

AES PRES UNIKO®

AES PRES UNIKO® GAS

ROM
RACCORDERIE METALLICHE

	Country/ Region	Certification body	Dimensions		Country/ Region	Certification body	Dimensions		Country/ Region	Certification body	Dimensions
inoxPRES UNIKO			Ø 15-54 mm	aesPRES UNIKO			Ø 12-54 mm	aesPRES UNIKO GAS			Ø 15-54 mm
			Ø 15-54 mm				Ø 12-54 mm				Ø 15-54 mm
							Ø 12-54 mm				Ø 15-54 mm

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.

In 2010 Raccorderie Metalliche extended the production of press fitting systems to copper (**aesPRES**) and copper-nickel materials (**marinePRES**)

Extensive investment in buildings and very modern machinery in operation ensure the current annual capacity of approximately 12 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 9001:2015.

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



Figure 2 - EN ISO 9001:2015 RM Certification

1.2 Press fitting systems in water, heating and cooling installation

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

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



















Product Range	Material	O-Ring	Diameters	Note
 inoxPRES	STAINLESS STEEL AISI 316L (1.4404)	 EPDM	ø 15 ÷ 108 mm	--
 inoxPRES GAS	STAINLESS STEEL AISI 316L (1.4404)	 NBR - HNBR	ø 15 ÷ 108 mm	--
 inoxPRES HT FREE	STAINLESS STEEL AISI 316L (1.4404)	 FKM	ø 15 ÷ 54 mm	Silicone Free
 inoxPRES STEAM	STAINLESS STEEL AISI 316L (1.4404)	 STEAM	ø 15 ÷ 54 mm	See the dedicated technical handbook
 inoxPRES OVERSIZE	STAINLESS STEEL AISI 316L (1.4404)	 EPDM	ø 139,7 ÷ 168,3 mm	--
 steelPRES	GALVANISED CARBON STEEL	 EPDM	ø 12 ÷ 108 mm	--
 aesPRES	COPPER-BRONZE	 EPDM	ø 12 ÷ 54 mm	--
 aesPRES GAS	COPPER-BRONZE	 NBR	ø 15 ÷ 54 mm	--
 MARINEPRES	COPPER-NICKEL	 FKM	ø 15 ÷ 108 mm	--

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 ÷ 168,3 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 - UNIKO 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 2.8 Pressing tools).

Press fittings in dimensions $\varnothing 12 \div 35$ mm must be pressed with jaws, $\varnothing 42 \div 54$ mm must be 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.

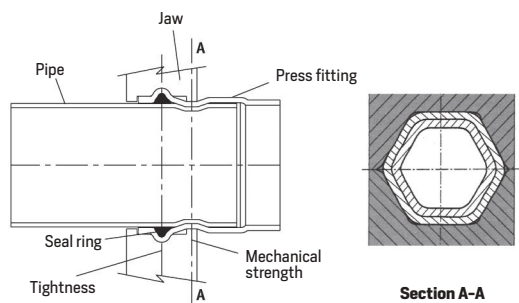


Figure 4 - Section through an **inoxPRES UNIKO / aesPRES UNIKO** connection with jaw still in position. Dimensions of $\varnothing 12 \div 35$ mm produce a hexagonal pressing profile.

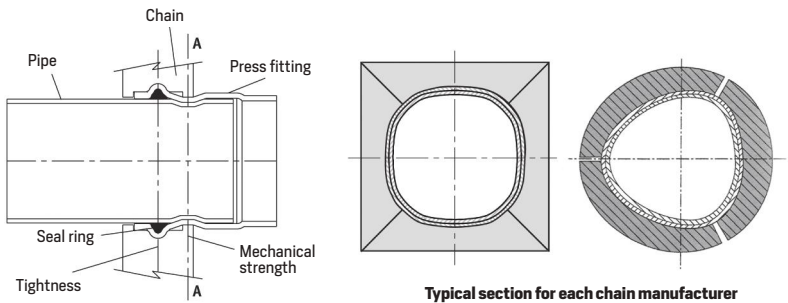


Figure 5 - Section through an **inoxPRES UNIKO / aesPRES UNIKO** connection with collar still in position. Dimensions of $\varnothing 42 \div 54$ mm produce a defined profile, typical for each chain manufacturer.

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

2.2 inoxPRES UNIKO press fittings

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

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 UNIKO** press fitting

2.3 inoxPRES UNIKO piping

inoxPRES UNIKO pipes are available in different materials, with various approvals according to the various applications. The longitudinally welded pipes are thin-walled, manufactured according to DVGW worksheet GW 541, EN 10217-7 (DIN17455) and EN 10312.

The different types of piping materials are:

- austenitic high-alloy Cr-Ni-Mo steel in AISI 316L (1.4404) material, DVGW certified;
- "nickel-free" ferritic stainless steel of AISI 444 (1.4521) material, DVGW certified;
- high-alloy austenitic Cr-Ni steel of AISI 304L (1.4307) material, not DVGW certified.

The applications according to the different materials are:

- drinking water installations with DVGW certification, pipes made in AISI 316L (1.4404) or AISI 444 (1.4521) "nickel-free" material;
- for applications where DVGW certification is not required, AISI 304L (1.4307) can also be used, such as in heating, cooling, compressed air, drinking water systems where DVGW certification is not required, etc.

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

inoxPRES UNIKO pipes are classified as non-combustible pipes according to material class A; they are supplied in lengths of 6 meters or 3 meters depending on the material and are closed with plastic plugs/caps at the ends.

TABLE 1: INOXPRES UNIKO PIPES - DIMENSIONS AND CHARACTERISTICS

Pipe outside diameter x wall thickness mm	Nominal width DN	Pipe inside diameter mm	Mass kg/m	Water volume 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

2.4 aesPRES UNIKO press fittings

aesPRES UNIKO press fittings are made in DHP Cu-DHP 99.9 (CW024A) copper and in CuZn21Si3P (CW724R) bronze from \varnothing 12 to \varnothing 54 mm included.

aesPRES UNIKO 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.



Figure 9 - aesPRES UNIKO press fitting

2.5 aesPRES UNIKO GAS press fittings

aesPRES UNIKO GAS \varnothing 15 ÷ 54 mm press fittings are made in DHP Cu-DHP 99.9 (CW024A) copper and in CuZn21Si3P (CW724R) bronze. **aesPRES UNIKO GAS** press fittings are certified according to the requirements of the DVGW work sheet G 5614.

They are different from **aesPRES UNIKO** (drinkable water system version) for the following features:

- HNBR yellow o-ring, fitted at the end of production;
- the yellow indelible marking with RM Gas and pressure field MOP5 GT5, next to the **aesPRES UNIKO** brand.



Figure 10 - aesPRES UNIKO GAS press fitting

A mixed installation (components from different manufacturers) is not permitted if gas pipes are installed. In Germany, for gas systems, compliance is to be provided to TRGI.

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

2.6 aesPRES UNIKO - aesPRES UNIKO 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 2: MECHANICAL FEATURES FOR COPPER TUBES - EN 1057

Resistance class	Delivery condition	\varnothing (mm)
R220	Annealed - Rolls	12 ÷ 22
R250	Semi-hard - Bars	12 ÷ 28
R290	Hard - Bars	12 ÷ 54

Resistance class	Minimum traction resistance Rm (MPa)	Minimum elongation at fracture (%)
R220	220	40
R250	250	20
R290	290	3

Tube sizes to be used with **aesPRES UNIKO** and **aesPRES UNIKO GAS** press fittings are included in the annex table.

TABLE 3: AESPRES UNIKO PIPES - DIMENSIONS AND CHARACTERISTICS - EN 1057 / DVGW GW 392

Pipe outside diameter x wall thickness mm	Nominal width DN	Pipe inside diameter mm	Mass kg/m	Water volume l/m	Supplied condition aesPRES UNIKO	Supplied condition aesPRES UNIKO GAS
12 x 1	10	10	0,309	0,079	Roll 25/50 m (R 220)	--
15 x 1	12	13	0,393	0,133	o	Bar 5 m (R290)
18 x 1	15	16	0,477	0,201	Bar 5 m	
22 x 1	20	20	0,589	0,314	(R 250 - R 290)	
28 x 1,5	25	25	1,115	0,491	Bar 5 m (R 250 - R 290)	
35 x 1,5	32	32	1,410	0,804		
42 x 1,5	40	39	1,704	1,194	Bar 5 m (R 290)	
54 x 2	50	50	2,918	1,963		

2.7 Sealing elements

2.7.1 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.

The black EPDM and the yellow HNBR sealing ring from $\varnothing 15 \div 54$ mm are supplied with an additional safety feature that during pressure tests will lead to leakage in the case of accidentally unpressed connections.

- 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.

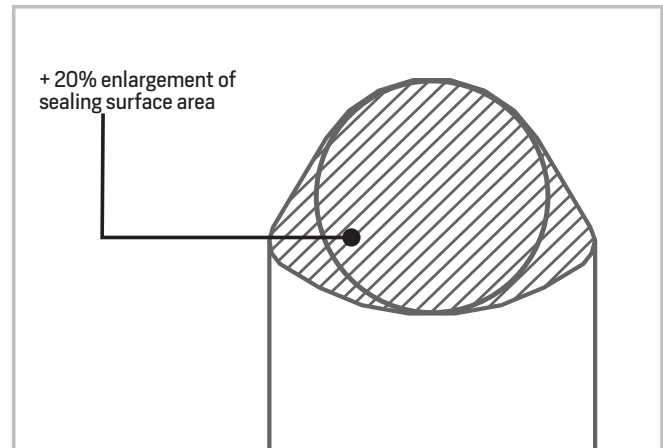


Figure 9 - Sealing ring profile

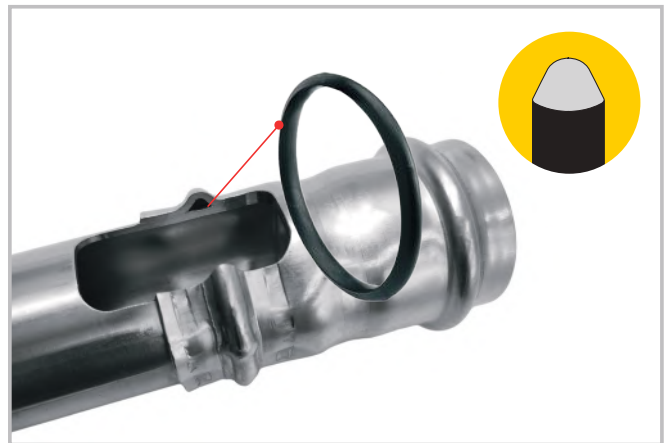


Figure 10 - Security EPDM sealing ring ($\varnothing 15 \div 54$ mm).




2.7.2 Materials, characteristics, applications

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

Additional fields of application, such as gas, solar and steam, 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 three different sealing rings; their characteristics and fields of application are shown in table 4.

The black EPDM standard sealing ring only is factory-fitted in the siliconised version in **inoxPRES UNIKO** and **aesPRES UNIKO** press fittings.

TABLE 4: SEALING RINGS - FIELDS OF APPLICATION AND TECHNICAL DATA

Technical term	Colour	Operating temperature Min / Max degrees 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 (Class 1÷4)	YES
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	NO

[*] Up to -30°C for occasional / non-continuous work periods

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.

2.8 Pressing tools

2.8.1 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 $\varnothing 12 \div 35$ mm must be pressed with jaws, $\varnothing 42 \div 54$ mm must be 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.

Press fitting installation temperature with electrical pressing tools: from -20°C up to $+40^{\circ}\text{C}$

Press fitting installation temperature with battery pressing tools: from -10°C up to $+40^{\circ}\text{C}$



Figure 11 – Klauke UAP332BT



Figure 12 – Novopress ACO203 BT

2.8.2 Approved pressing tools

RM approves the tools produced by Klauke and Novopress listed in the tables 5, 6 and 7 below, with their respective jaws and chains. The **aesPRES UNIKO GAS** system is tested and guaranteed only through the use of pressing machines, jaws and chains in the table below:

TABLE 5: JAWS AND CHAINS FOR PRESSING AESPRES UNIKO GAS

Profilo	Modello - KN	Marchio	Dimensione
V	Mini 19 KN	Mini Klauke	$\varnothing 12 \div 35$ mm
		Mini Novopress	
	STD 32 KN	Viega Klauke Novopress	$\varnothing 12 \div 35$ mm jaws $\varnothing 42 \div 54$ mm chains
M	Mini 19 KN	Mini Klauke	$\varnothing 12 \div 35$ mm
		Mini Novopress	
	STD 32 KN	Klauke Novopress	$\varnothing 12 \div 35$ mm jaws $\varnothing 42 \div 54$ mm chains

TABLE 6: MANUFACTURER KLAUKE

Type	Piston strength	Dimension range	Weight	Compatible with jaws from	
MAP2L_19 MAP2119BT	19 KN	12 ÷ 35 mm	~ 1,7 Kg	--	
UAP2 - UAP3L	32 KN	12 ÷ 54 mm	~ 3,5 Kg	Novopress EFP2 - EFP201 - AFP201 - EFP202 - AFP202 - ECO1 - ACO1	
UNP2	32 KN	12 ÷ 54 mm	~ 3,5 Kg	Novopress EFP2 - EFP201 - AFP201 - EFP202 - AFP202 - ECO1 - ACO1	
UAP4 - UAP4L UAP432BT	32 KN	12 ÷ 54 mm	~ 4,3 Kg	Novopress EFP2 - EFP201 - AFP201 - EFP202 - AFP202 - ECO1 - ACO1 12-54 mm	
AH- P700LS	PKUAP3	32 KN	12 ÷ 54 mm	~ 12,3 Kg	Novopress EFP2 - EFP201 - AFP201 - EFP202 - AFP202 - ECO1 - ACO1 12-54 mm
	PKUAP4	32 KN	12 ÷ 54 mm	~ 12,6 Kg	

TABLE 7: MANUFACTURER NOVOPRESS

Type	Piston strength	Dimension range	Weight	Compatible with jaws from
ACO102 - ACO103	19 KN	12 ÷ 35 mm	~ 1,7 Kg	--
EFP2	32 KN	12 ÷ 54 mm	~ 6,1 Kg	EFP201 - AFP201 - ECO1 - ACO1
EFP201 - EFP202 EFP203	32 KN	12 ÷ 54 mm	~ 4,4 Kg	ECO1 - ACO1
AFP201 - AFP202	32 KN	12 ÷ 54 mm	~ 4,3 Kg	EFP2 - ECO1 - ACO1
ECO202 - ACO202 ECO203 - ACO203	32 KN	12 ÷ 54 mm	~ 3,3 Kg	ECO201 - ACO201 - ECO1 - ACO1
ACO202XL ACO203XL	32 KN	12 ÷ 54 mm	~ 4,6 Kg	ECO202 - ACO202
ACO3	36 KN	15 ÷ 54 mm	~ 5,0 Kg	ECO3
ECO301	45 KN	12 ÷ 54 mm	~ 5,0 Kg	ACO3

2.8.3 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 (at least once a year or after 10.000 pressing cycles for standard pressing machine). What is more any moving part (drive rolls) and pressing jaw and chain surfaces (internal profiles) are to be daily serviced, cleaned and lubricated.

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



Figure 13 - Equipment - jaw

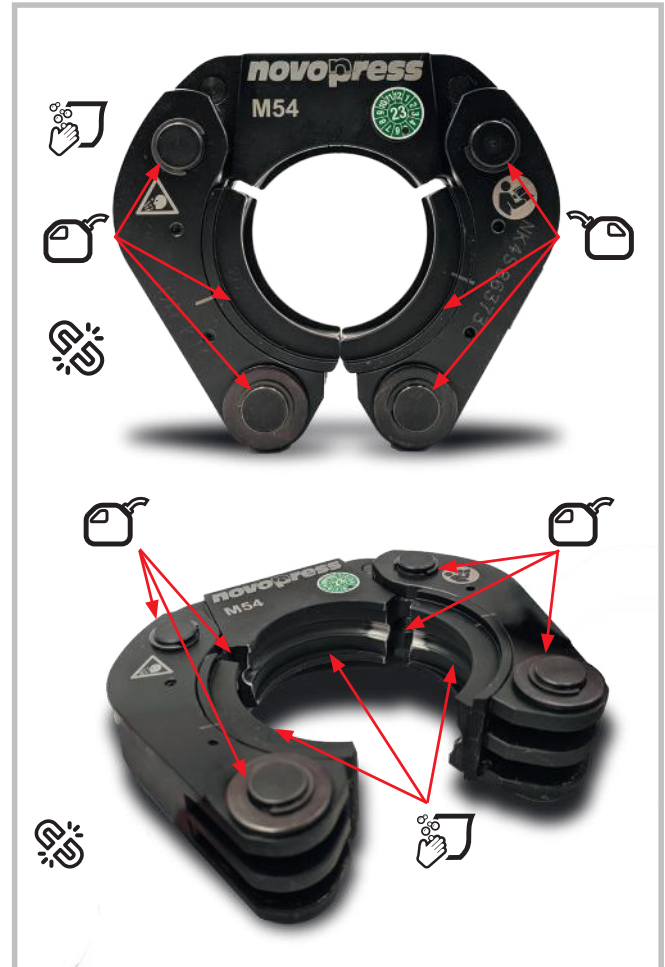


Figure 14 - Equipment - chain



Keep the chain clean



Keep the pins lubricated with oil



Attention it can be broken

3.0 Areas of use

TABLE 8a: FIELD OF APPLICATION FOR PRESS FITTING SYSTEMS INOXPRES UNIKO / AESPRES UNIKO

Application	System	O-ring	Notes	PN max. (bar)	T °C
Drinking water	inoxPRES UNIKO (pipe AISI 316L / 444)	EPDM black	-	16	0 / +120 °C
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	-	16	0 / +120 °C
Heating	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	-	16	0 / +120 °C
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	-	16	0 / +120 °C
Extinguishing water ⁽¹⁾	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	Dimensions $\varnothing 15 \div 54$ mm	16	Room temperature
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	Dimensions $\varnothing 15 \div 54$ mm	16	Room temperature

⁽¹⁾ 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 UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	Dimensions $\varnothing 22 \div 54$ mm	16	Room temperature
	aesPRES UNIKO ⁽³⁾ (copper pipe tab. 4-5)	EPDM black	Dimensions $\varnothing 22 \div 54$ mm	16	Room temperature

⁽²⁾ 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.

⁽³⁾ Only for wet plant installation hazard classes LH, OH1, OH2 and OH3.

Cooling	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	-	16	-20 / +120 °C
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	-	16	-20 / +120 °C
Solar	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	FKM green	-	6	-20 / +220 °C
	aesPRES UNIKO (copper pipe tab. 4-5)	FKM green	-	6	-20 / +220 °C
Methane gas Natural gas LPG (gaseous state)	aesPRES UNIKO GAS (copper pipe tab. 4-5)	HNBR yellow	Dimensions $\varnothing 15 \div 54$ mm	5	-20 / +70 °C
Compressed air	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	⁽⁴⁾ EPDM black Class 1÷4 (residual oil < 5 mg/m ³) FKM green Class 5 (residual oil > 5 mg/m ³)	System not silicone-free (not suitable for varnishing systems)	16	Room temperature
	aesPRES UNIKO (copper pipe tab. 4-5)	⁽⁴⁾ EPDM black Class 1÷4 (residual oil < 5 mg/m ³) FKM green Class 5 (residual oil > 5 mg/m ³)	System not silicone-free (not suitable for varnishing systems)	16	Room temperature

⁽⁴⁾ According to ISO 8573-1/2010 standard

Nitrogen in gaseous state	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	Only for industrial use (medicine excluded)	16	Room temperature
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	Only for industrial use (medicine excluded)	16	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 217/68/CE pressure systems.

TABLE 8a: FIELD OF APPLICATION FOR PRESS FITTING SYSTEMS INOXPRES UNIKO / AEPRES UNIKO

Application	System	O-ring	Notes	PN max (bar)	T °C
Argon in gaseous state	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	Only for industrial use (medicine excluded)	16	Room Temperature
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	Only for industrial use (medicine excluded)	16	Room Temperature
Dry carbon dioxide in gaseous state	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black	Only for industrial use (medicine excluded)	16	Room Temperature
	aesPRES UNIKO (copper pipe tab. 4-5)	EPDM black	Only for industrial use (medicine excluded)	16	Room Temperature
Saturated Steam	inoxPRES UNIKO (pipe AISI 316L / 304L)	FKM green	-	Max 2 bara Max 1 barg	Max 120 °C
Vacuum	inoxPRES UNIKO (pipe AISI 316L / 444 / 304L)	EPDM black FKM green	-	- 0,8 bar (up to a max. of -0,95/-0,98 bar)	Room Temperature
	aesPRES UNIKO (copper pipe tab. 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 217/68/CE pressure systems.

3.1 Applications

3.1.1 Potable water, treated water, hydrant systems

The **inoxPRES UNIKO** press fitting system is manufactured using high alloy austenitic Cr-Ni-Mo stainless steel with the material number AISI 316L [1.4404]. Thanks to its high resistance to corrosion and suitability in terms of hygiene, **inoxPRES UNIKO** 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 UNIKO** press fitting system.

The **aesPRES UNIKO** 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:

- $\text{pH} \geq 7,4$ or
- $7,0 \leq \text{pH} \leq 7,4$ e $\text{TOC} \leq 1,5 \text{ g/m}^3$

The TOC, Total Organic Carbon, is the concentration index of the total organic substances present in the water.

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

inoxPRES UNIKO and **aesPRES UNIKO** 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.
- fire hydrant systems (reference UNI 10779/2021).

The use of anticorrosion or antifreeze additives requires the approval of RM.

inoxPRES UNIKO and **aesPRES UNIKO** 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 15 - inoxPRES UNIKO - Drinkable water



Figure 16 - aesPRES UNIKO - Heating installation

3.1.2 Heating

The **inoxPRES UNIKO** and **aesPRES UNIKO** 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 UNIKO** and **aesPRES UNIKO**).

They are suitable for both on-wall and in-wall installation (with appropriate protections).

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

The use of anticorrosion or antifreeze additives requires the approval of RM.

Further information on corrosion protection can be found on page 39, chapter 7.0.

3.1.3 Cooling and refrigeration circuits

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

The use of anti-corrosion or antifreeze additives requires the approval of RM (excluding glycols on page 21, table 10).

For corrosion protection and insulation follow the indications in the worksheet AGI Q151.

3.1.4 Compressed air and inert gas

The **inoxPRES UNIKO** and **aesPRES UNIKO** 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 UNIKO** system is recommended.

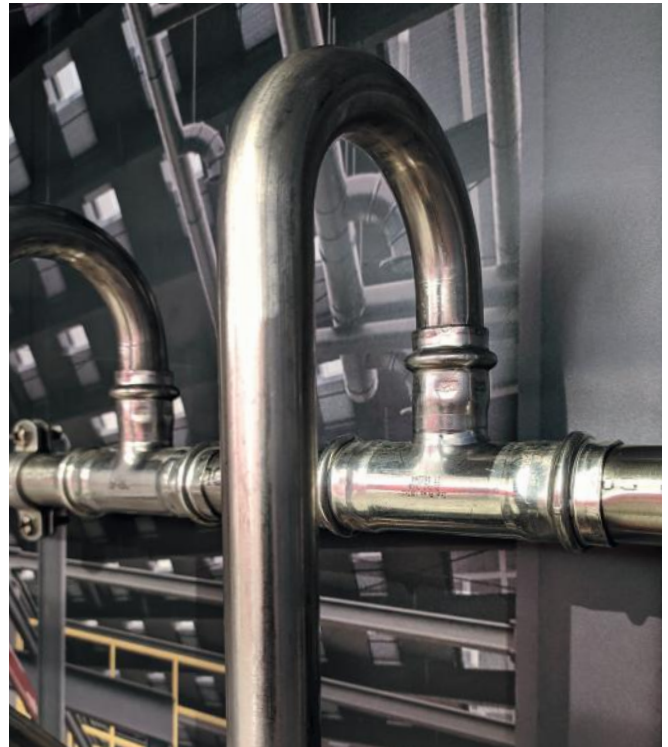


Figure 17 - **inoxPRES UNIKO** - Compressed Air

3.1.5 Natural Gas / LPG installation

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

- **aesPRES UNIKO GAS** \varnothing 15 ÷ 54 mm OD with factory-fitted yellow HNBR sealing ring is approved in Germany for natural and liquid gases according to the requirements of the DVGW worksheet G 260, the DVGW work sheet G 5614 and the EN 682 standard.
- **aesPRES UNIKO GAS** fittings in dimensions 42 and 54 mm must be pressed with pressing collars/chains; pressing with jaws is not permitted.

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

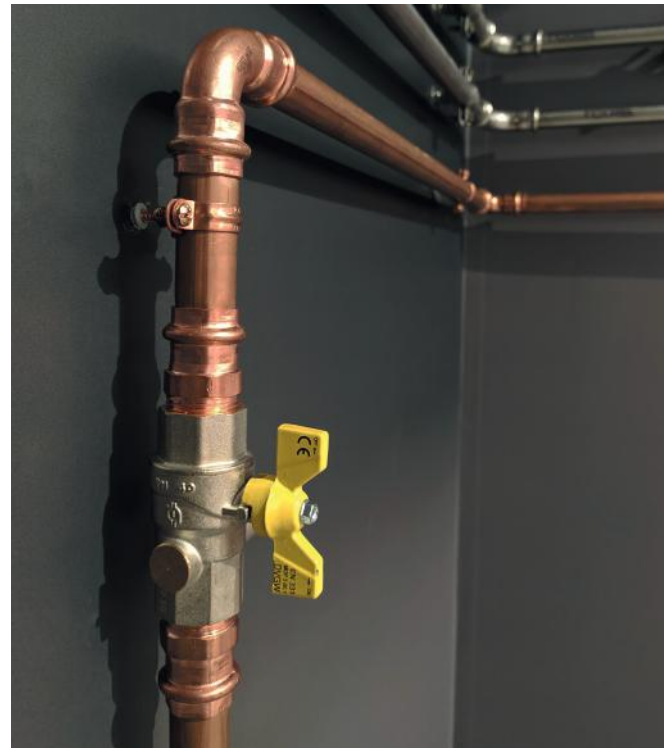


Figure 18 - AesPRES UNIKO GAS - Gas installation

3.1.6 Solar, vacuum, steam, condensation

inoxPRES UNIKO and **aesPRES UNIKO** 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.

inoxPRES UNIKO 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. 2 absolute bar [1 relative bar].

3.1.7 Industrial applications

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

3.1.8 Extinguishing systems, sprinkler installations

inoxPRES UNIKO and **aesPRES UNIKO** systems with black EPDM sealing ring can be used in extinguishing systems (reference norm UNI 10779/2021). In addition, the press fitting systems are suitable for wet and dry sprinkler installations (ref. EN 12845), with diameters from \varnothing 22 up to 54 mm, according to the below table.

TABLE 9: PRESS FITTING IN EXTINGUISHING SYSTEMS AND SPRINKLER INSTALLATIONS

APPLICATION	INOXPRES UNIKO	AESPRES UNIKO
Extinguishing systems	✓	✓
Sprinkler system (dry installation)	✓	✗
Sprinkler system (wet installation)	✓	✓

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.

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

3.1.9 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 10: 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	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
SOLARLIQUID L	STAUB & CO. – SILBERMANN GmbH	Solar
STAUBCO® COOL N	STAUB & CO. – SILBERMANN GmbH	Heating Cooling cycles
STAUBCO® COOL L	STAUB & CO. – SILBERMANN GmbH	Heating Cooling cycles
Glysofor N	WITTIG Umweltchemie GmbH	Heating Cooling cycles
Glysofor L	WITTIG Umweltchemie GmbH	Heating Cooling cycles

NOTE: please follow the manufacturer's utilization notes, EPDM sealing o-ring with maximum 40% glycol and 60% water.

4.0 Processing

4.1 Storage and transport

inoxPRES UNIKO and **aesPRES UNIKO** system components have to be protected against dirt and damage during transport and storage. The ends of the pipes are factory-fitted with plugs/caps to prevent dirt.

The pipes must be stored in a device with a protective coating or plastic alloy, so that they do not come in contact with other materials. Moreover, pipes as well as press fitting must be stored in a covered area protected against effects of humidity in order to prevent corrosion and/or oxidation of the surface to avoid.

4.2 Pipes - cutting to length, deburring, bending

The pipes should be cut to length using professional pipe cutters which are suitable for the material in use. Alternatively, fine-tooth hacksaws or suitable electric saws may be used. The cut has to be perpendicular to avoid negative impact on the mechanical resistance between fitting and pipe.

Only use suitable tools that are suitable for the material to be processed. Particular attention must be paid, for example, to the choice of the right saw blades or cutting wheels that are used.

The cutting and deburring tools must be clean, free from adherence or chips. After cutting / deburring, the cutting edges or pipe ends must be cleaned or freed from chips or impurities.

Not permitted are:

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

To avoid damaging the sealing ring when inserting the pipe 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 ($R \geq 3,5xD$).

Copper pipes according to EN 1057 can be bended with the following minimum bending radius:

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.





Figure 19 - Cutting the pipe to length



Figure 20 - Deburring the pipe

BENDING MACHINES

DN	Radial bending Allowed	Axial bending Not Allowed
12 mm		
15 mm		
18 mm		
22 mm		

The instructions of use and operation of the bending machines have to be carefully observed.

4.3 Marking the insertion depth

Sufficient mechanical strength of the press fitting connection will only be achieved if the insertion depths shown in table 11 are adhered to. These insertion depths are valid for pipes or fittings with insertion ends (i.e. fittings without pressfit end) and must be marked using a suitable marking tool.

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

**TABLE 11:
INSERTION DEPTH AND MINIMUM DISTANCES**

Pipe outside diameter mm	A (*) mm	D mm	L mm
12	18	20	56
15	22	20	64
18	22	20	64
22	24	20	68
28	24	20	68
35	27	20	74
42	36	40	112
54	41	40	122

(*) Tolerance: ± 2 mm

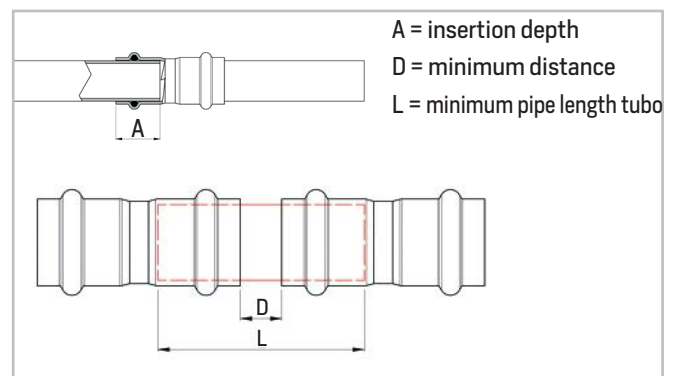


Figure 21 - Insertion depth and minimum dimensions

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.



Figure 22 - Marking the insertion depth

4.5 Making the press connection 12 - 54 mm

Using light pressure and making a turning movement at the same time, press the pipe into the press fitting up to the marked insertion depth. If the tolerances are so narrow that additional force is required to insert the pipe into the press fitting, then water or soapy water may be used as a lubricant.

Oil and grease are not permitted for use as lubricants.

Pressing is carried out using suitable electromechanical/ electrohydraulic pressing tools and dimension-matching pressing jaws or collars/chains. Tested and approved pressing tools or pressing jaws/collars/chains are listed under table 5, 6 and 7 approved pressing tools.



Figure 23 - 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.



Figure 24 - Inserting pipe into the press fitting



Figure 25 - Making the press connection

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

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

React immediately in the event of an unusual press pattern.

Completely pressed systems with faulty press patterns or profiles cannot be fully recognized as a complaint.

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



Figure 26 - Checking the press connection

4.6 Minimum distances and space requirement for pressing

To carry out pressing correctly, there must be a minimum distance between the pipe and the building, and from pipe to pipe, as shown in tables 12 and 13.

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

Pipe	Figure 27		Figure 28			Figure 29				Figure 30	
	A	D	A	D	D1	A	C	D	D1	D	E
12	56	30	75	30	35	85	155	30	35	40	60
15	56	30	75	30	35	85	155	30	35	40	60
18	60	30	75	30	40	85	165	30	40	40	60
22	75	40	80	40	40	85	165	40	40	40	61
28	82	40	90	40	45	90	180	40	45	40	63
35	85	40	90	40	45	90	180	40	45	40	66

TABLE 13: MINIMUM DISTANCES 42 - 54 mm

Pipe	Figure 30		Figure 31		
	D	E	A	B	C
42	50	80	150	150	110
54	50	85	150	150	110

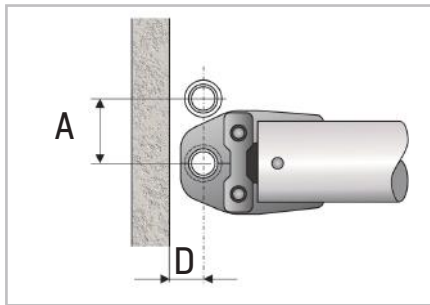


Figure 27 - Minimum distances and space requirements

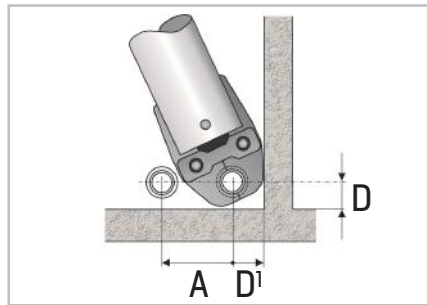


Figure 28 - Minimum distances and space requirements

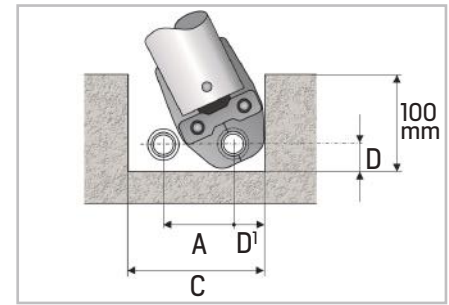


Figure 29 - Minimum distances and space requirements

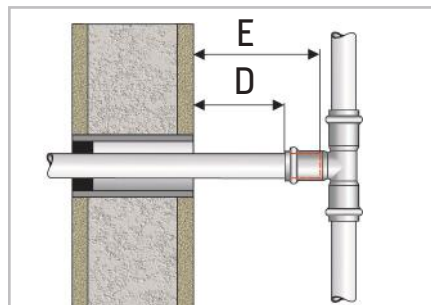


Figure 30 - Minimum distances and space requirements

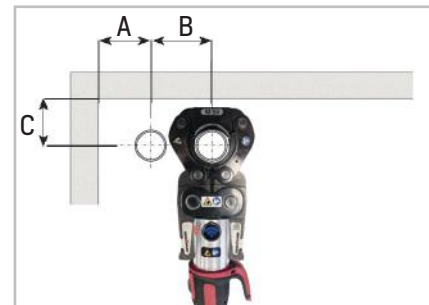


Figure 31 - Minimum distances for chains / collars

4.7 Thread or flange connections

Press fittings can be connected using normal trade threaded fittings in accordance with ISO 7-1 (thread standard DIN 2999) or ISO 228 (thread standard DIN 259) or with fittings made of stainless steel or non-ferrous metals. When sealing threaded connections, no sealant containing chloride (for example teflon tapes) may be used. The flanges available from the **inoxPRES UNIKO** 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.

IMPORTANT

For security reasons, the transition from Raccorderie Metalliche press fitting systems' to the multilayer pipe systems' should be realized through a threaded connection. All that, in order to avoid single cases of losses after pressing, caused by fittings' matching of different manufacturers and of different materials (brass / steel).

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.

For fixing and installing the pipes, please follow the UNI EN 806-4 standards and the supplementary national standard DIN 1988-200. Crucial are also the fluids and the temperature. For gas / sprinkler installations and firefighting waters, the dimensions mentioned in table 14 are not valid.

The maximum permitted support distances for **inoxPRES UNIKO** and **aesPRES UNIKO** pipes are shown in table 14.

TABLE 14: MAXIMUM PERMITTED DISTANCES BETWEEN SUPPORTS - EN 806-4

DN	Pipe outside diameter (mm)	Horizontal spacing in meters (recommended)	Vertical spacing in meters (recommended)
10	12	1,2	1,8
12	15	1,2	1,8
15	18	1,2	1,8
20	22	1,8	2,4
25	28	1,8	2,4
32	35	2,4	3,0
40	42	2,4	3,0
50	54	2,7	3,6

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 UNIKO** and **aesPRES UNIKO** in table 15. 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 32 a - c.

TABLE 15: LENGTH VARIATIONS INOXPRES UNIKO / AEPRES UNIKO

L [m]	Δt [°K]										
	10	20	30	40	50	60	70	80	90	100	
inoxPRES UNIKO	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	
aesPRES UNIKO	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	

Total linear expansion

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

ΔL = linear expansion in mm

L = pipe length in m

α = linear expansion coefficient

inoxPRES UNIKO $\alpha = 0,0165 \text{ mm} / (\text{m} \times ^\circ\text{K})$

aesPRES UNIKO $\alpha = 0,017 \text{ mm} / (\text{m} \times ^\circ\text{K})$

Δt = temperature difference in $^\circ\text{K}$

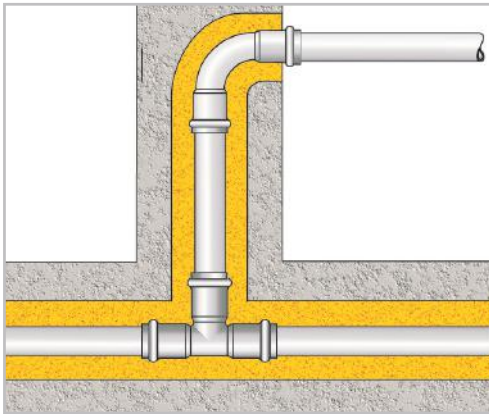


Figure 32a - Creation of expansion spaces

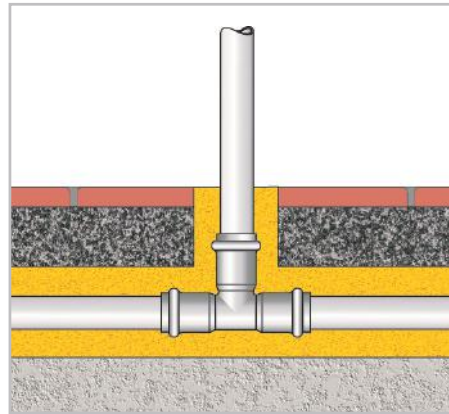


Figure 32b - Creation of expansion spaces

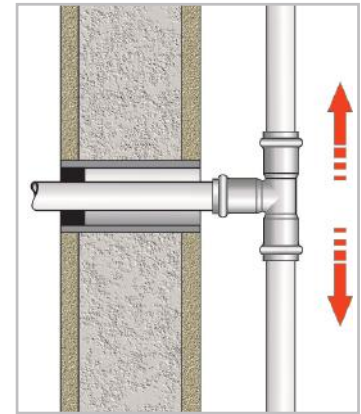


Figure 32c - Creation of expansion spaces

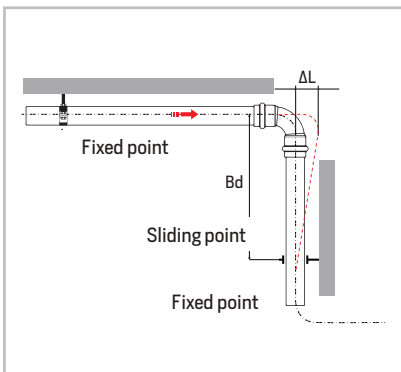


Figure 33 - Orthogonal-shaped expansion reach

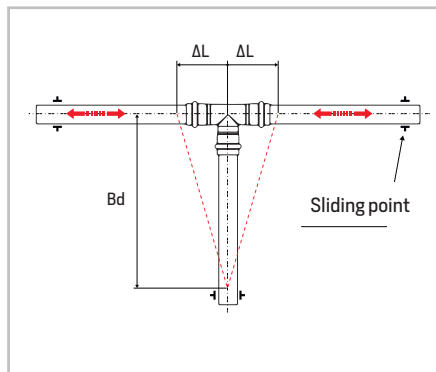


Figure 34 - Expansion compensation branch

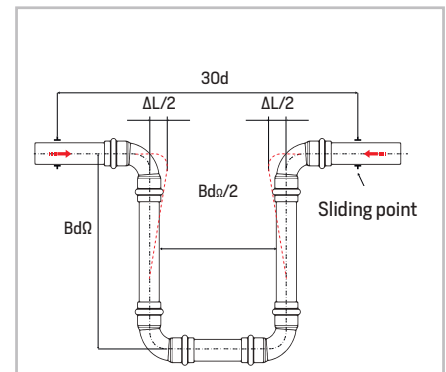


Figure 35 - U-bend $Bd\Omega = Bd / 1,8$

Calculation formula Orthogonal - bend and T - junction (figure 33 e 34)

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

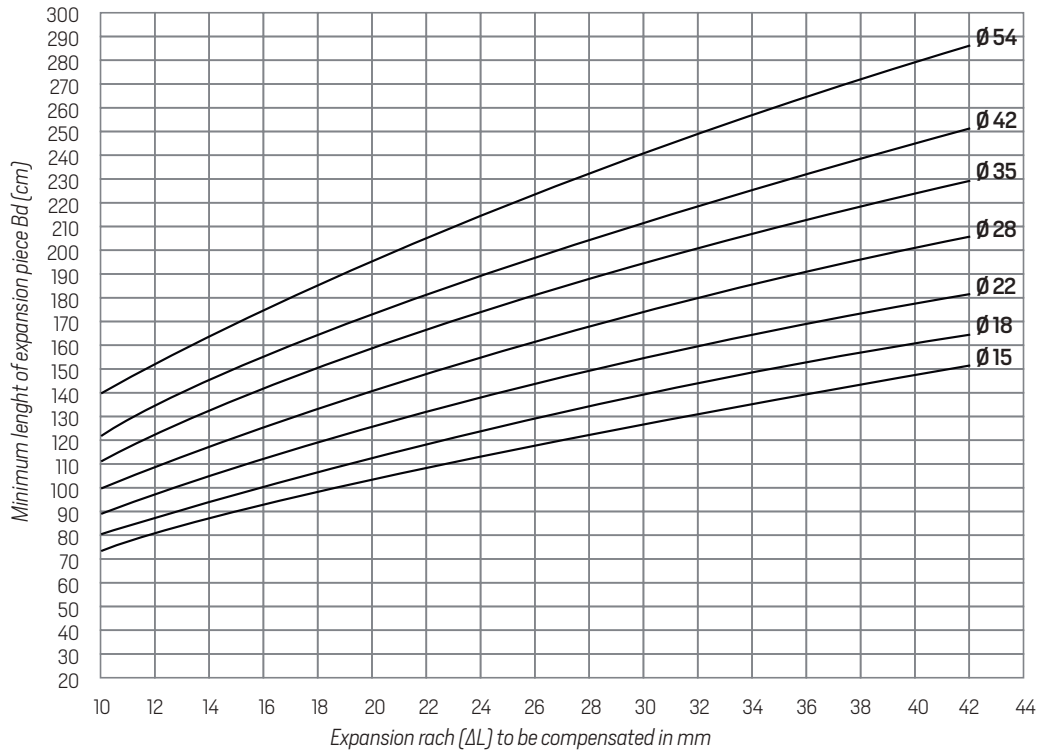
- k = constant material
inoxPRES UNIKO = 60 for σ [sigma] 190 N/mm²
aesPRES UNIKO = 51 for σ [sigma] 140 N/mm²
- da = outer diameter pipe in mm
- ΔL = linear expansion in mm

Calculation formula U bend (Figure 35)

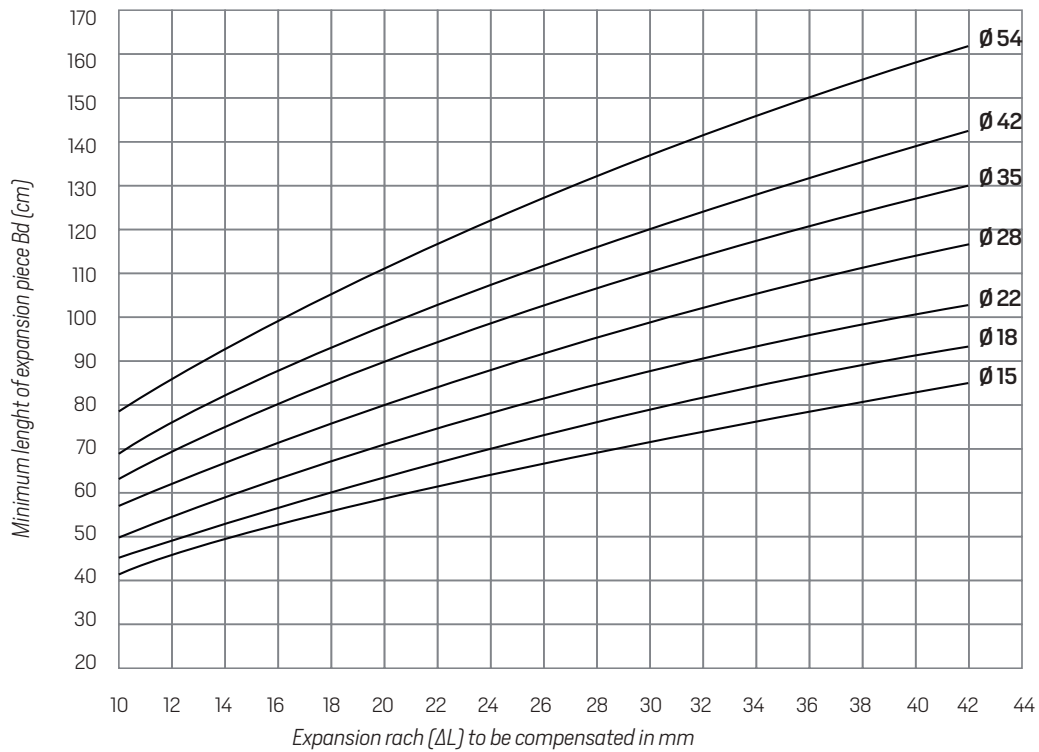
$$Bd\Omega = k \times \sqrt{(da \times \Delta L)} \text{ [mm]} \text{ or } Bd\Omega = Bd / 1,8$$

- k = constant material
inoxPRES UNIKO = 34 for σ [sigma] 190 N/mm²
aesPRES UNIKO = 28 for σ [sigma] 140 N/mm²
- da = outer diameter pipe in mm
- ΔL = linear expansion in mm

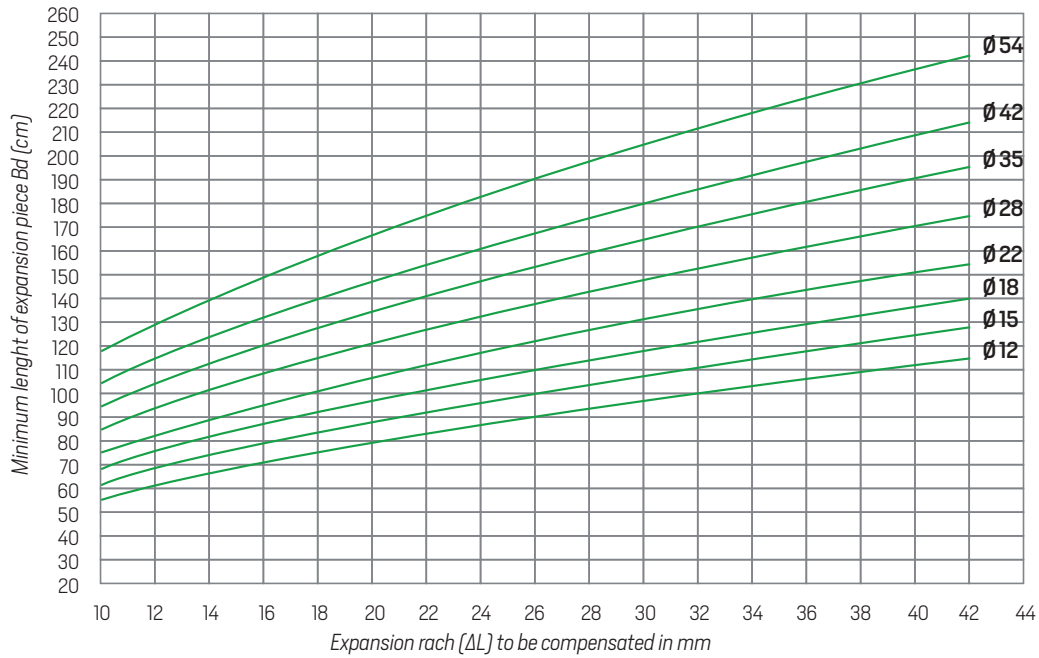
**TABLE 16: CALCULATION OF THE EXPANSION REACH $\phi 15 \div 54$ mm
(Bd) INOXPRES UNIKO**



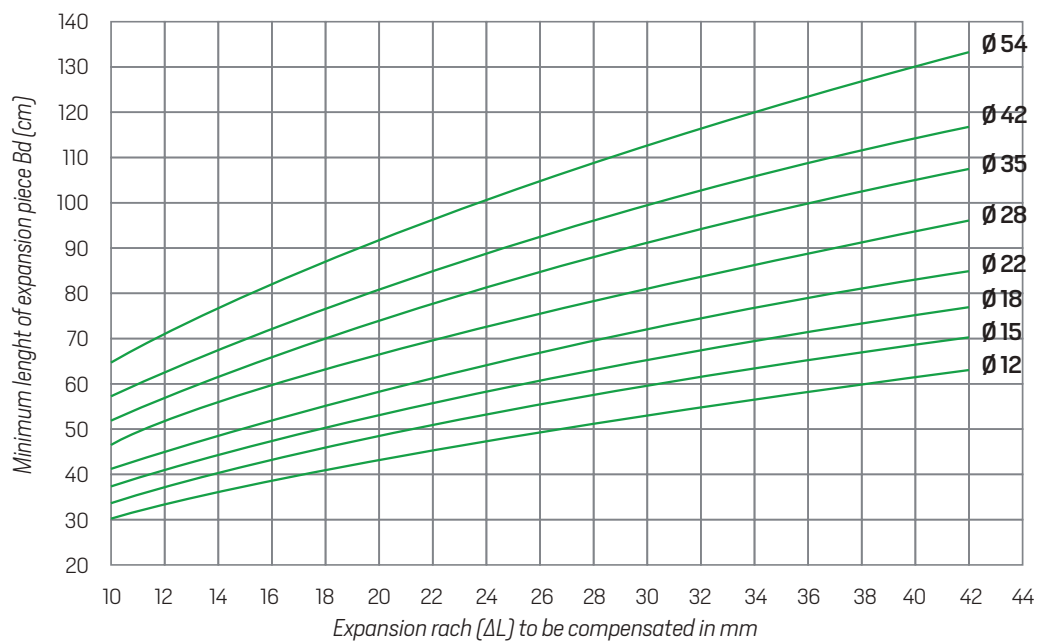
**TABLE 17: EXPANSION PIECE FOR U-BEND $\phi 15 \div 54$ mm
(Bd Ω) INOXPRES UNIKO**



**TABLE 18: CALCULATION OF THE EXPANSION REACH $\phi 12 \div 54$ mm
(Bd) AESPRES UNIKO**



**TABLE 19: EXPANSION PIECE FOR U-BEND $\phi 12 \div 54$ mm
(BdΩ) AESPRES UNIKO**



5.3 Thermal emission

Depending on temperature difference, warm piping releases heat into the environment. The thermal emission from **inoxPRES UNIKO** pipes can be seen in table 20.

TABLE 20: THERMAL EMISSION FROM INOXPRES UNIKO PIPE (W/m) UNCOVERED

d x s (mm)	ΔT TEMPERATURE DIFFERENCE (° K)									
	10	20	30	40	50	60	70	80	90	100
15 x 1	4,7	9,3	14,0	18,6	23,3	28,0	32,6	37,3	41,9	46,6
18 x 1	5,6	11,2	16,8	22,4	28,0	33,6	39,2	44,8	50,4	55,9
22 x 1,2	6,8	13,7	20,5	27,4	34,2	41,0	47,9	54,7	61,5	68,4
28 x 1,2	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

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

The thermal emission from **aesPRES UNIKO** pipes can be seen in table 21.

TABLE 21: THERMAL EMISSION FROM AESPRES UNIKO (W/m) PIPE (W/m) UNCOVERED

d x s (mm)	ΔT TEMPERATURE DIFFERENCE (° K)									
	10	20	30	40	50	60	70	80	90	100
12 x 1	4,1	8,2	12,3	16,4	20,5	24,6	28,7	32,8	36,9	41,0
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 2	18,5	36,9	55,4	73,8	92,3	110,8	129,2	147,7	166,1	184,6

External inlet-coefficient $\alpha_e = 11 \text{ W}/(\text{m}^2 \times \text{°K})$

5.4 Insulation

To minimise the unwanted thermal emission from piping, the minimum insulation thicknesses should be maintained. The following rules must be observed:

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

Furthermore, national regulations should be observed as necessary.

In addition, insulating the piping can prevent water condensing, outside corrosion, unwanted warming of the medium being transported and unwanted noise production and transmission. Cold water pipes must be insulated so that the potable water quality is not affected through warming.

The installer is responsible for the correct and professional insulation execution.

It is extremely important to ensure that the transitions, joints and fittings of the installation are sealed / glued to prevent humidity from penetrating in any condition.

For the insulation of **inoxPRES UNIKO** 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 UNIKO**.

Guideline values for minimum insulation material thickness are shown in table 22.

TABLE 22: MINIMUM INSULATION MATERIAL THICKNESS FOR PIPING

Piping cold water		Piping hot water	
Type of installation	Insulation material thickness in mm $\lambda = 0,040 \text{ W}/(\text{m} \times ^\circ\text{K})$	OD in mm	Insulation material thickness in mm $\lambda = 0,040 \text{ W}/(\text{m} \times ^\circ\text{K})$
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

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.

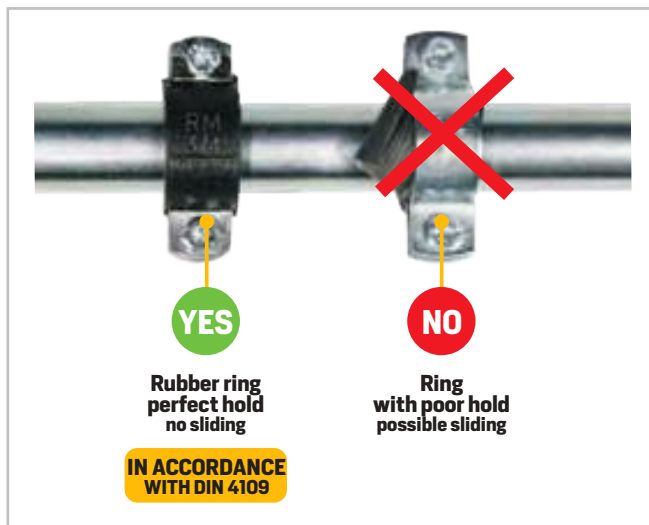


Figure 36 - rubber ring PRATIKO in conformity with DIN 4109 (Unit RM Series 355/G - 351/G - 555/G - 156/G)

5.6 Fire prevention

inoxPRES UNIKO / aesPRES UNIKO pipes are classed as a non-flammable material in building material class A 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 UNIKO and **aesPRES UNIKO** 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

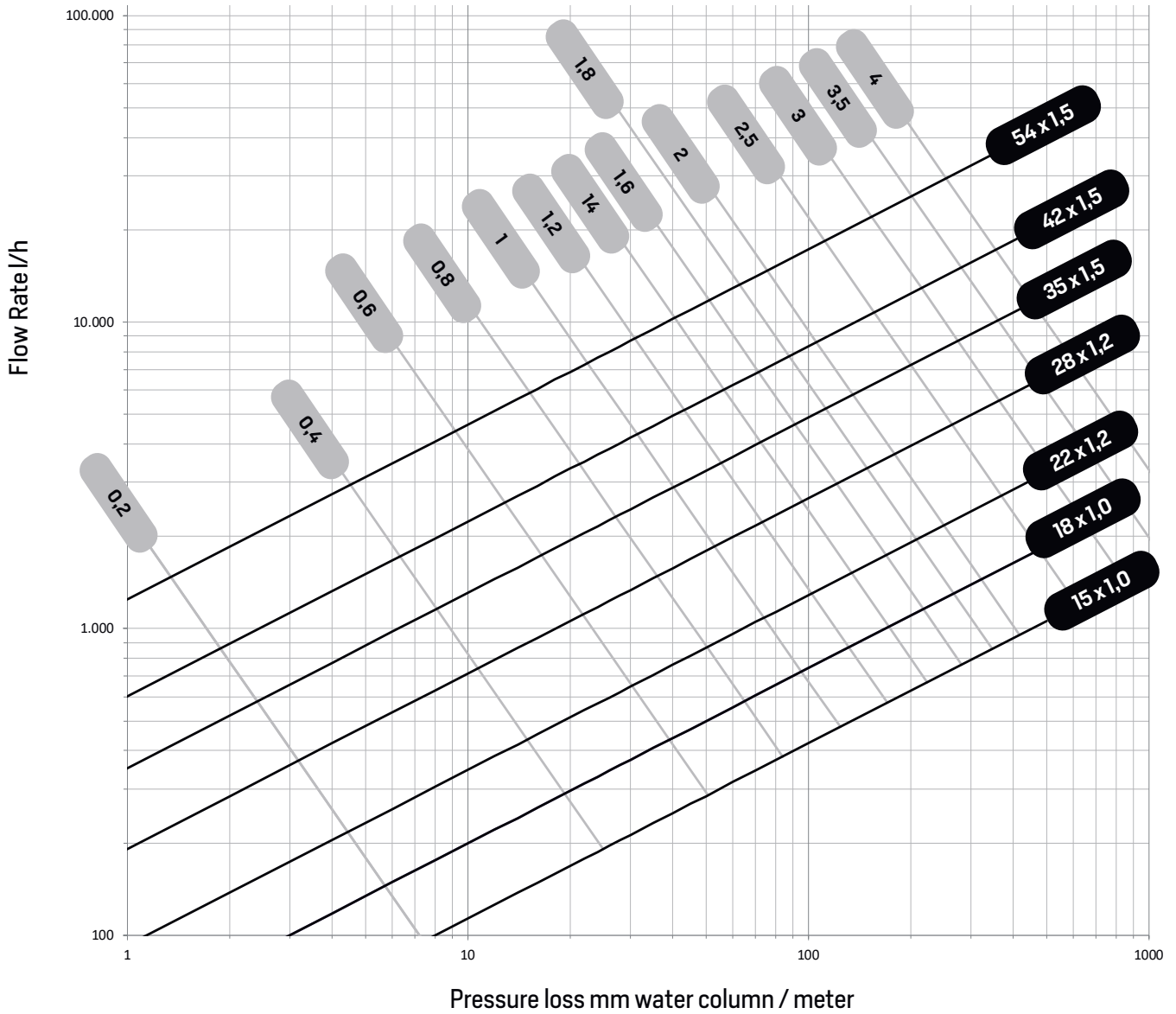
The pipe friction pressure drop for **inoxPRES UNIKO** / **aesPRES UNIKO** piping is shown in table 23 a - b.

5.9 Trace heating

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

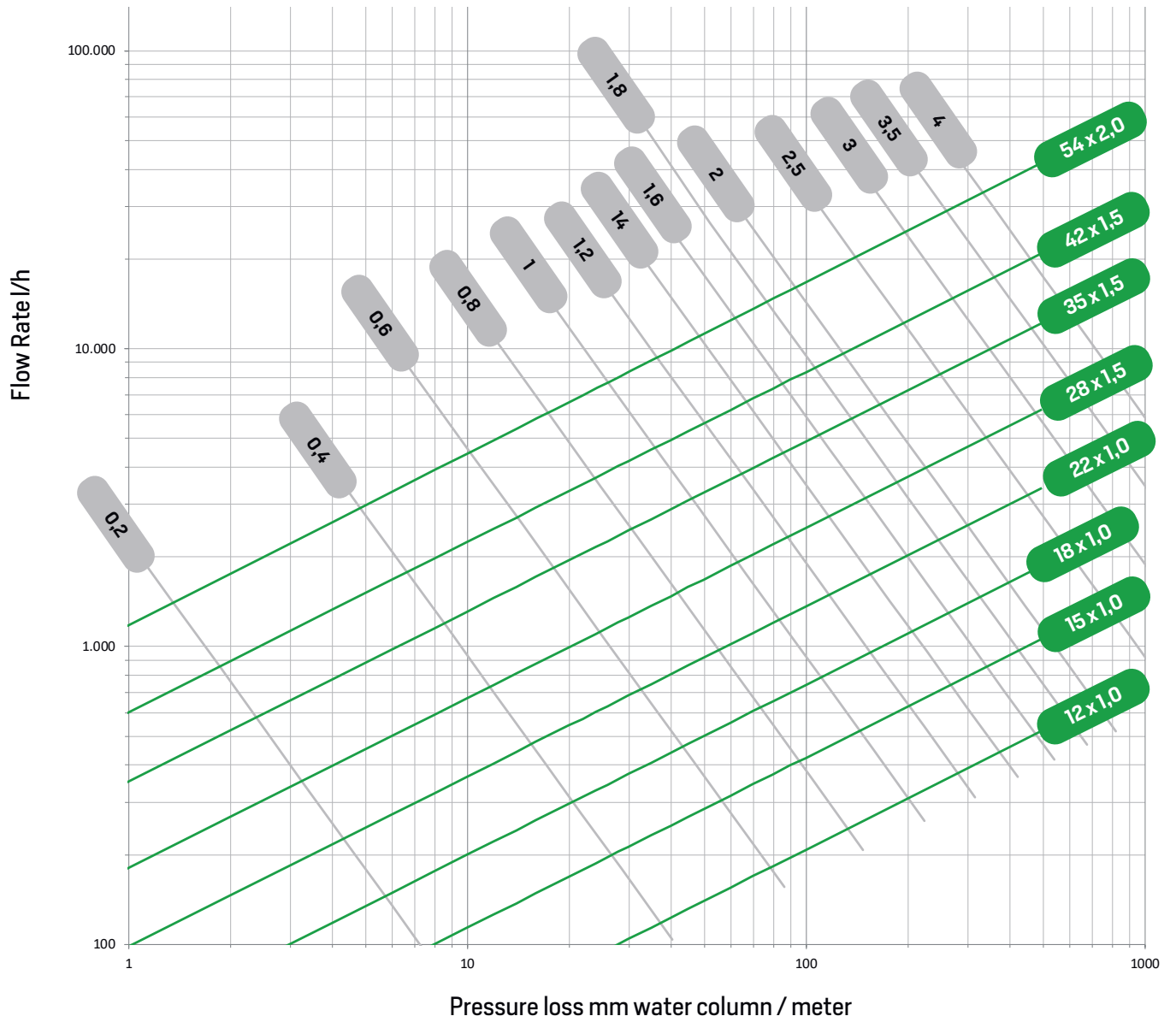
For thermal disinfection purposes a temporary temperature increase to 70 °C (1 hour per day) is permitted. Pipes which are fitted with drainage valves or back-flow prevention valves must be protected against excessive pressure increase resulting from warming. The fitting instructions issued by trace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

TABLE 23a : PIPE FRICTION PRESSURE DROP
INOXPRES UNIKO



Velocity m/s

**TABLE 23b : PIPE FRICTION PRESSURE DROP
AESPRES UNIKO**



Velocity m/s

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 45) 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. From a corrosion point of view, **inoxPRESUNIKO** 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. Stagnant water from the house supply piping must not access the potable water installation.

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. 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 UNIKO

The corrosion behaviours of the **inoxPRES UNIKO** press fitting system is dictated by the material used. The corrosion behaviour of **inoxPRES UNIKO** press fitting systems is determined by the Cr-Ni -Mo steel with material AISI 316L (1.4404) and Cr-Mo AISI 444 (1.4521). 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 UNIKO 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 UNIKO** 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 potable water and building materials can lead to corrosion traces on stainless steels. Crevice or pitting corrosion can 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. It must be considered that, although the chloride limit for drinking water is equal to 250 mg/l, on the basis of laboratory and construction site experiences, it is recommended not to exceed 100 mg/l. Situations of stagnation of the circulating fluid and dead branches in the system must be properly evaluated when planning and when managing the installation, taking into consideration the parameters about the quality of the water and all the conditions of the installation environment, which may generate corrosion phenomena. As per drinking water systems, it is important to grant a continuous flow, avoiding dead branches and stagnation conditions (EN 806-1). These conditions of application and use, help to preserve the materials of Inoxpres range during the time, helping their durability.

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

- following pressure testing the system is emptied and some water remains in the piping which is open to the atmosphere. The slow evaporation of the remaining water may lead to an unacceptable increase in the chloride content level and thus initiate pitting (three phase corrosion) at the 'water-material- air' interface. If the system cannot be put into operation shortly after pressure testing with water, then the pressure testing should be carried out using air. See section 6.1 Pressure testing for more details;

- an increase in the water temperature is caused from the outside via the pipe wall (for example electrical trace heating). There may be an increase in chloride ions in the deposits which form on the inside pipe wall during this type of operation. See section 5.9 Trace heating for more information;
- non-approved sealants or plastic tapes containing chloride are used. The transfer of chloride ions from sealant materials to the potable water can lead to local increase in chloride and thus to crevice corrosion. See section 4.7 Thread or flange connections for more information;
- if the material is sensitised through incorrect heating. Any heating of the material which leads to tarnishing changes the micro-structure 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 UNIKO 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 UNIKO** is subjected to contact with gases or fumes containing chloride (e.g., galvanising shops, swimming pools);
- **inoxPRES UNIKO** 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 UNIKO 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 aesPRES UNIKO

Corrosion behaviour of the **aesPRES UNIKO** system depends on the main material quality – copper – consisting of alloys of the system to be pressed.

The **aesPRES UNIKO** 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.

7.2.1 Bimetal corrosion (mixed installation)

aesPRES UNIKO system 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.

7.2.2 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.

7.2.3 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 UNIKO** 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.

7.3 aesPRES UNIKO GAS

The high resistance of **aesPRES UNIKO GAS** joint to outside corrosion does not require any additional anti-corrosion standard protection, except where special protection from corrosive agents is required.

According to VDE (German Association for electrical, Electronic & Information Technologies), **aesPRES UNIKO GAS** must be inserted in the main equipotential bonding (connection to be carried out by skilled personnel).

aesPRES UNIKO 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.

7.4 Material compatibility - two-metal matching

The summary table of the couplings between different materials in open and closed circuit systems is shown below.

TABELLA 24: MATERIAL COMPATIBILITY - TWO-METAL MATCHING

PRESSFITTING		PIPES			
Systems	Plant type	Stainless Steel	Carbon Steel	Copper	Cupronickel
inoxPRES UNIKO	open circuit				
	close circuit		1)		
aesPRES UNIKO	open circuit				
	close circuit		1)		

Accepted matching

Attention to the enclosed notes

Forbidden matching

NOTES:

- 1) 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).
Single carbon fittings in a stainless steel / copper / cupro system are not allowed.

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

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

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

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

Due to the danger of corrosion through incorrect disinfection measures using chlorine, we do recommend either disinfection using hydrogen peroxide or thermal disinfection. Disinfection measures should always be carried out by experienced, trained professional staff only.

The disinfection treatment must also be extended to existing lines if they be expanded or repaired. The ZVSHK leaflet "Flushing, disinfecting and commissioning of drinking water installations" must be used and observed.

9.0 Hygiene

The implementation of the new potable water regulations (TrinkwV) places great emphasis on the hygiene-conscious 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 UNIKO <input type="checkbox"/>	aesPRES UNIKO <input type="checkbox"/>
Pipe AISI 316L <input type="checkbox"/>	Copper pipe <input type="checkbox"/>
Pipe AISI 444 <input type="checkbox"/>	aesPRES UNIKO GAS <input type="checkbox"/>
Pipe AISI 304L <input type="checkbox"/>	Copper pipe <input type="checkbox"/>

MEDIUM WHOSE COMPATIBILITY NEEDS TO BE REVIEWED

Attachments	Technical data sheet <input type="checkbox"/>
	Safety sheet <input type="checkbox"/>
	Chemical analysis <input type="checkbox"/>
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 plant	Open <input type="checkbox"/>	Closed <input type="checkbox"/>
Installation	Outside closed spaces <input type="checkbox"/>	Inside closed spaces <input type="checkbox"/>

11.0 Pressure test protocol

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

For **inoxPRES UNIKO** / **aesPRES UNIKO** press fitting systems

Project / Construction _____

Contractor / Representative _____

Client / Representative _____

Materials _____

Potable water temperature _____ °C Room temperature _____ °C

Carrying out the pressure tests according to EN 806-4, VDI 6023 and the ZVSHK leaflet, leak tests of drinking water installations with compressed air, inert gas or water.

- ▶ 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 UNIKO** and **aesPRES UNIKO** press fitting systems

Project / Construction _____

Contractor / Representative _____

Client / Representative _____

Materials _____

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

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

Test pressure

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

- Selected test pressure _____ bar
- Start of test _____ Clock test period (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!
Both signatures are required for a properly conducted test!

Place _____

Date _____

Client signature

Contractor signature



11.3 Pressure test protocol for potable water with compressed air

For **inoxPRES UNIKO** and **aesPRES UNIKO** press fitting systems

Project / Construction _____
Contractor / Representative _____
Client / Representative _____
Materials _____
 Test fluid temperature _____
 Test temperature _____ °C Room temperature _____ °C

Carrying out the pressure tests according to EN 806-4, VDI 6023 and the ZVSHK leaflet, leak tests of drinking water installations with compressed air, inert gas or water..

- Containers, fittings or pressure vessels etc. must be separated from the line, openings have to be closed with metal plugs.
- A visual inspection of all connections / crimps for proper execution was carried out.

Preliminary test / leakage test

- Test pressure **150 mbar**
- Test time up to 100 liters of pipe line volume min. **120 minutes**
- The test time must be increased by 20 minutes for every additional 100 liters
- Pipe line volume in liters _____ Test duration in minutes _____
- Temperature compensation was expeted, only then started the test testing time
- Test accuracy of the pressure gauge **1 mbar / 1hPa**
- A visual inspection of all pipe connections for a proper execution was carried out
- No pressure drop detected during / after the leak test

Leakage test

- For nominal sizes ≤ DN50 maximum 3 bar; For nominal sizes > DN50 maximum 1 bar;
- Test period **10 minutes**
- Test accuracy of the pressure gauge **100 mbar/100 hPa**
- Temperature compensation was expeted, only then started the test testing time
- Selected test pressure _____ bar
- Start test
- A visual inspection of all pipe connections for a proper execution was carried out
- No pressure drop detected after the leak test
- The system / pipelines are tight

Comments:

A proper assessment has been made!

Both signatures are required for a properly conducted test!

Place _____

Date _____

Client signature

Contractor signature

12.0 Guarantee

The **inoxPRES UNIKO** and **aesPRES UNIKO** press fitting systems produced and distributed by RM are covered by a guarantee. For all the details related to the operative conditions, please contact our sales department.

Note



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



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