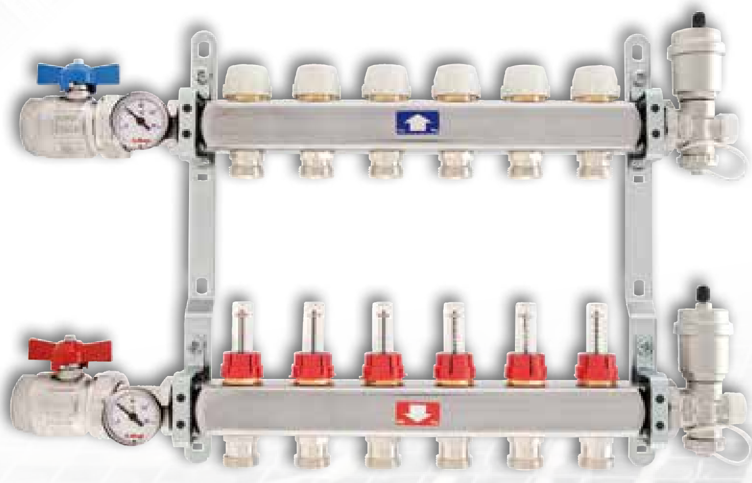
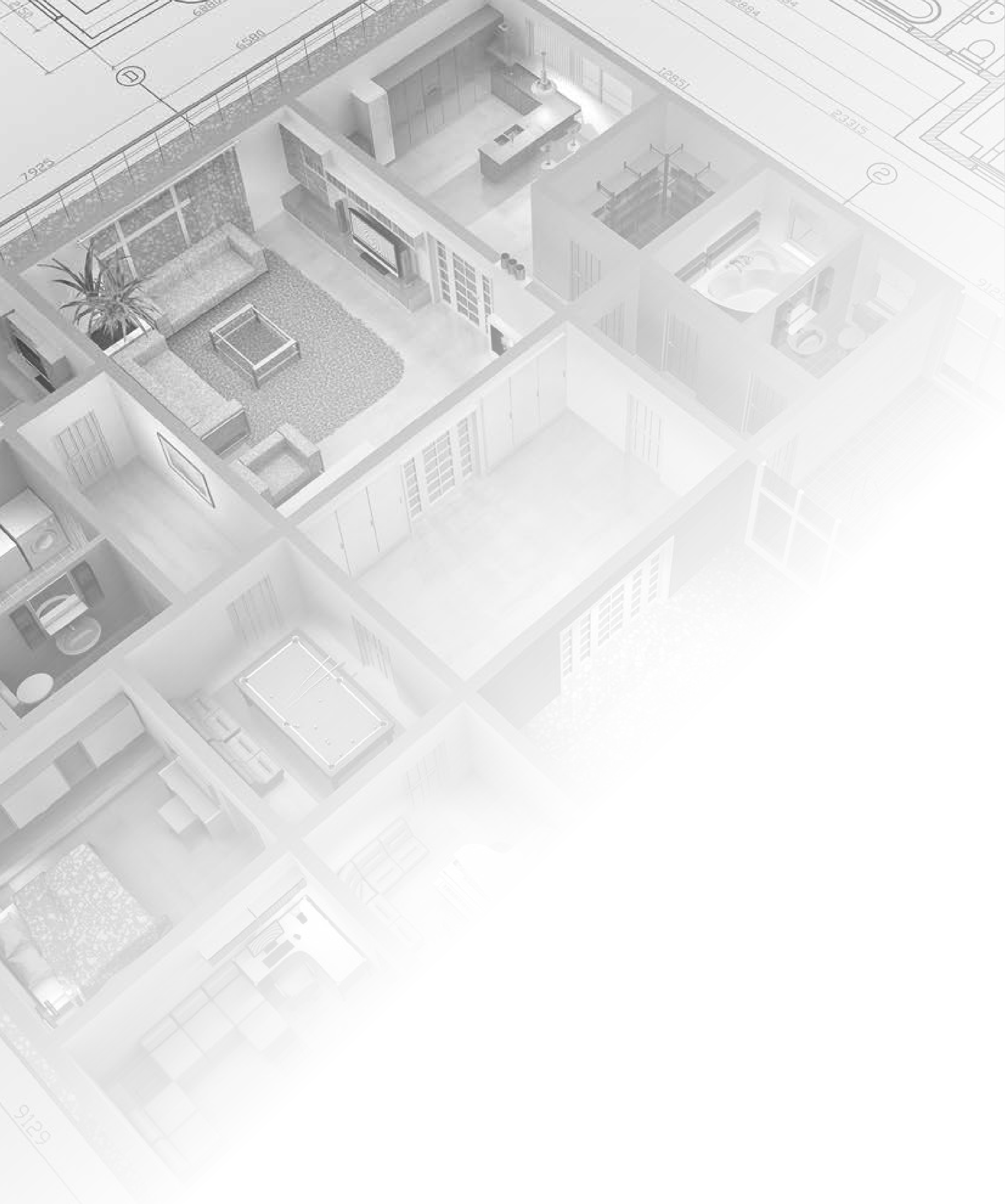
STAINLESS STEEL MANIFOLDS FOR RADIANT SYSTEMS

CREATION AND DIFFUSION OF THE STAINLESS STEEL MANIFOLD

USE DIAGRAMS OF STAINLESS STEEL MANIFOLDS





CREATION AND DIFFUSION OF THE STAINLESS STEEL MANIFOLD
USE DIAGRAMS OF STAINLESS STEEL MANIFOLDS

Creation and diffusion of the stainless steel manifold

The use of steel manifolds for domestic and commercial heating systems has its origin in the German market.
The manifolds made of AISI 304 stainless steel (1.4301 according to the German DIN nomenclature) began being studied and produced in the late 1990s; they were made from a tubular profile and featured alternating parallel flat sections with threaded holes used to install the components designed to balance and intercept the individual circuits.

The extreme resistance of stainless steel and the resulting possibility of creating machined **items with low thickness** immediately attracted the interest of the market. If we think that a brass manifold is made with an average wall thickness of about 3 mm and that for a stainless steel manifold only 1.5 mm is required (Fig.1), it is easy to understand how the latter is definitely **lighter** and therefore **cheaper** than the first.

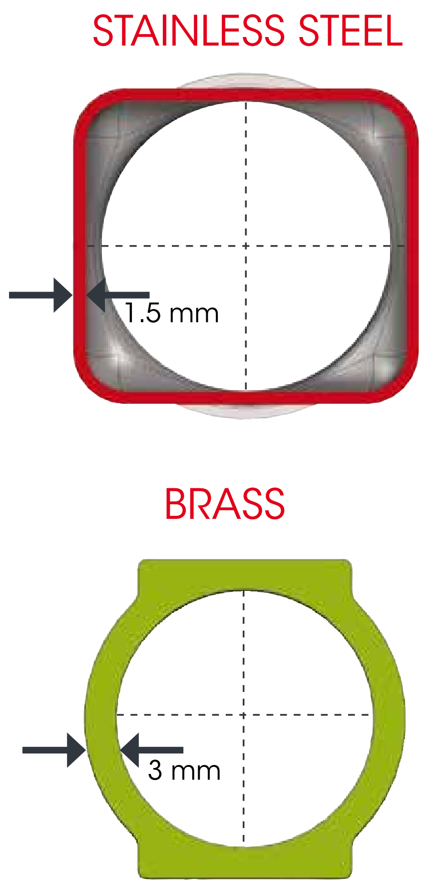


Fig. 1 - Steel and brass manifold thickness

The profile with alternating flat sections (Fig. 2), although interesting from an economic point of view, had a technical limitation: its maximum obtainable flow rate.

Due to the section restrictions between one outlet and the next, the maximum flow rate of this product was not very different from that of brass and polymer manifolds. The maximum value was around 3.5 m^3/h.

Over time, with the introduction of new production techniques, an important innovation was achieved: **the profile with continuous parallel flat sections**. Thanks to this design improvement, the stainless steel manifold was able to ensure a **much higher flow rate** than that achieved till then, guaranteeing up to a maximum level of 5 m^3/h.

3.5 m^3/h

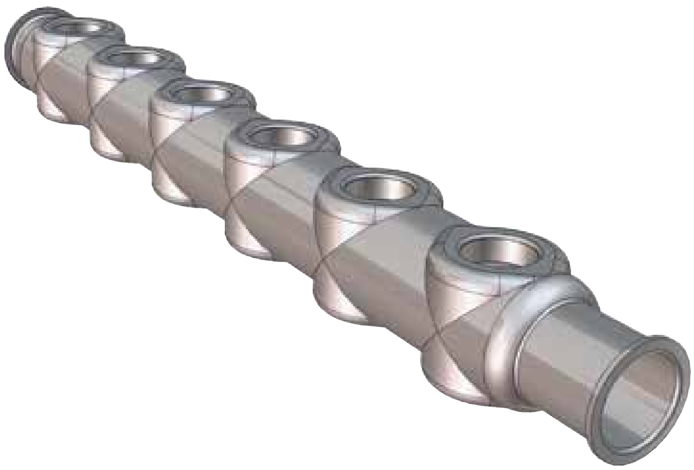


Fig. 2 - Stainless steel manifold with alternating parallel flat sections

5 m^3/h

Fig. 2 - Stainless steel manifold with continuous parallel flat sections

Creation and diffusion of the stainless steel manifold

In the early 2000s, the brass manifold was dominating the German market unchallenged, as well as that of the rest of Europe, mainly due to the fact that the majority of the systems were made using radiators.
The distribution manifold was often obtained directly with moulding procedures, and high flow rates were not necessary to provide the thermal load required by the designer.

Over time, however, two phenomena that largely contributed to the success of the stainless steel manifold occurred:

1. the technological evolution of heating systems, with the use of radiators gradually being replaced by the use of **radiant floor systems**

2. the increase of the cost of raw materials needed to produce brass manifolds (during 2006 the basic price of a brass bar increased by 50% due to macro-economic trends not dependent on actual metal consumption).

The increase in the number of radiant panel systems forced the production of more complex distribution manifolds (Fig. 5) equipped with more accessories than those used combined with radiators (Fig.4).

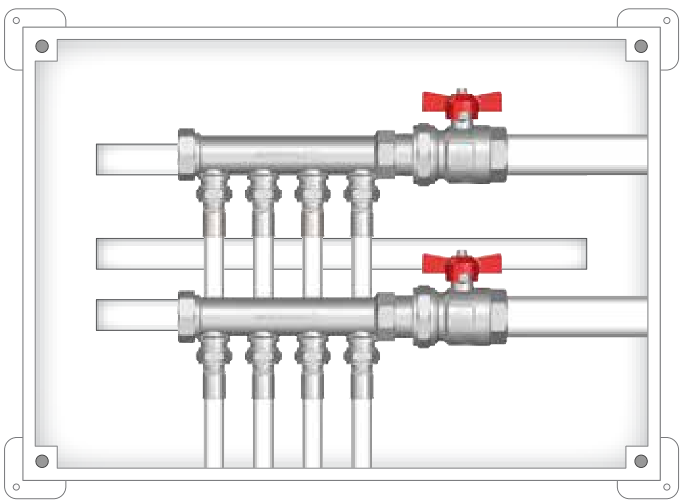


Fig. 4 - Manifold for radiator systems

Creation and diffusion of the stainless steel manifold

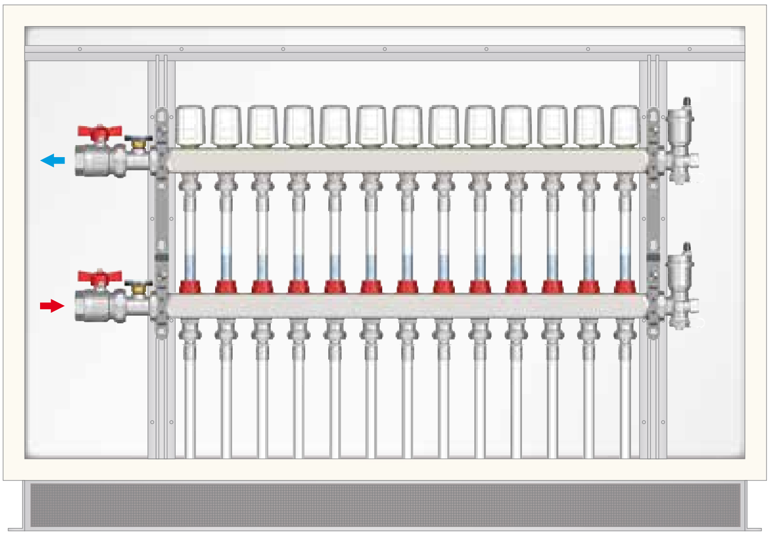


Fig. 5 - Manifold for radiant panel systems

In addition, radiant systems required higher flow rates than traditional systems. These purely technical needs, together with the sudden increase in the cost of brass manifolds (due to the increased price of the raw material), significantly favoured the diffusion of the new stainless steel manifold. All this, combined with the fact that German thermo-technical engineers and designers have always had an inclination for stainless steel, makes it easy to understand how the product in question actually conquered the water-based heating market in just a few years.

The following chart (Fig. 6) shows how, within about 15 years, the stainless steel manifold has become the undisputed leader, with a market share of more than 50%:

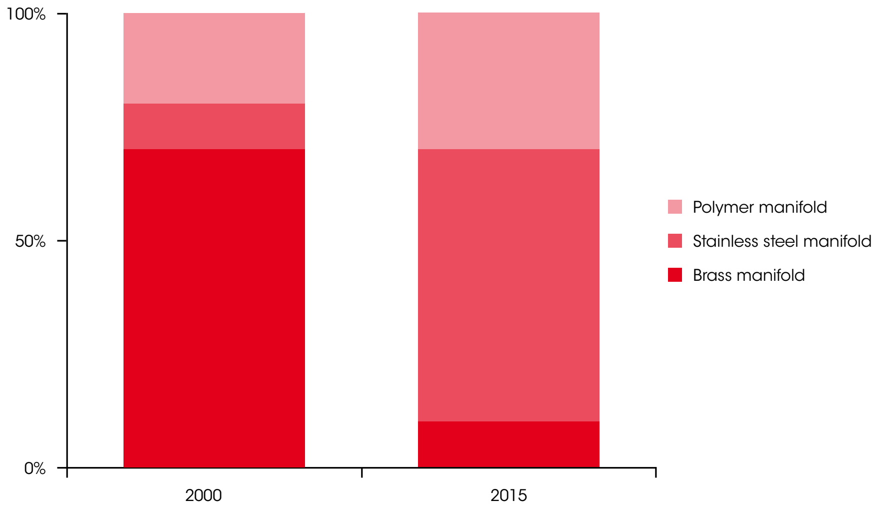


Fig. 6 - Market share of manifolds for radiant systems - German market [internal source]

Creation and diffusion of the stainless steel manifold

In recent years, following what happened in Germany, the rest of Europe has begun a slow but progressive technological change. Radiant system installations, thanks to energy saving policies imposed at EU level and increasingly implemented by the member countries, represent the state of the art of water-based heating systems. Stainless steel manifolds are spreading beyond the German borders, and the technical-productive level achieved allows us to confirm that this product is destined to become the standard in water-based installations.

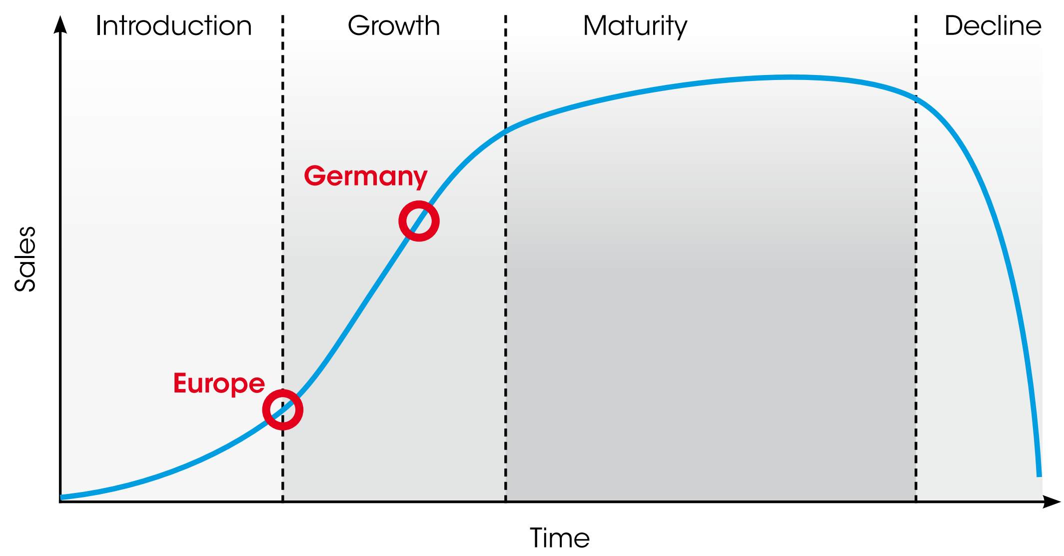


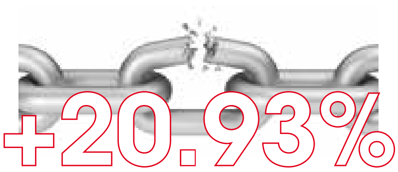
Fig. 7 - Life cycle and sales trends of stainless steel manifolds – [Internal source]

There are radiant systems made with stainless steel manifolds which have been operating for more than 10 years: the product has been tested repeatedly in the field and has obtained impeccable results.

THE BENEFITS

they are numerous, compared with traditional brass and polymer manifolds:

MECHANICAL STRENGTH



AISI 304L stainless steel has a rupture load equal to 520 N/mm2.
CW614N brass (used for manifolds) has a rupture load equal to 430 N/mm2.
The mechanical strength of stainless steel is 20.93% greater than that of brass.

GREAT LIGHTNESS

A pre-assembled stainless steel manifold weighs up to 50% less than a brass manifold having the same size and characteristics.

Creation and diffusion of the stainless steel manifold

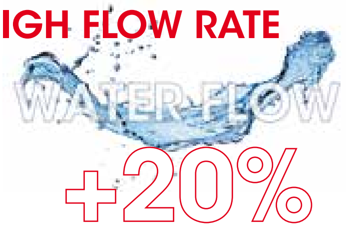
PURCHASE PRICE

A pre-assembled stainless steel manifold costs up to 15% less than a brass manifold with the same size and features.

ABSENCE OF CORROSION PHENOMENA

No stress-corrosion.
No electrolytic corrosion.

HIGH FLOW RATE

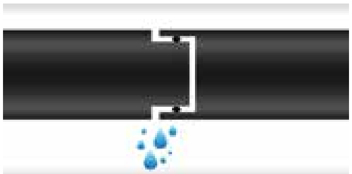


Stainless steel manifolds have a flow rate range of up to 20% higher than brass manifolds, thanks to their increased section.
The input flow rate for 1" stainless steel manifolds is 5m3/h; for brass manifolds of the same size, it is 4.2m3/h.

LOW AND HIGH TEMPERATURE

Composite material manifolds can operate only with low temperatures. If high temperature branch circuits are required, the distribution control unit needs to be equipped with metal manifolds.

ABSENCE OF JOINS



Manifolds using composite materials are provided with modules of polymer, which are usually reinforced with fibreglass and need to be connected together using fixing systems. The water-tightness between the different modules is guaranteed thanks to the use of elastomers. This means that every junction point can represent a potential leak point. Stainless steel manifolds are made of a **single piece with 2 to 13 outlets along the entire length of the bar**.

AESTHETIC PERFORMANCE AND VISUAL QUALITY

Stainless steel is a more aesthetically pleasing material if compared to brass or polymer.
IT IS furthermore universally recognised and perceived as a premium material.

Creation and diffusion of the stainless steel manifold

The possibility of combining an **expanded polyethylene shell** with the stainless steel manifold also makes the product suitable for use in radiant cooling systems.

Radiant floor systems are effective in countering the summer sensitive loads, but are unable to intervene against latent loads. Where there are flow temperatures between 15°C and 18°C, there is often condensation on the stainless steel bar; thanks to the polyethylene shell it is possible to avoid this phenomenon and therefore **the stainless steel manifold becomes the replacement of the polymer manifold, with the advantage of having a significantly higher flow rate than the latter** (which is very important in the radiant cooling systems).

Fig. 8 - Stainless steel manifold with expanded polyethylene shell

The possibility of having high flow rates, can **improve the performance of the system.**

It will therefore be possible to obtain a greater cooling capacity and to neutralise a greater level of heat.
Floor systems mainly work by radiation and are governed by the following formula:

$$dE/dt = \varepsilon \sigma A \text{ (room T – surface T)}$$

Where [ε σ] are constants, while [A] is the extension of heat exchange surface (i.e. the floor). The value [dE/dt] represents the amount of energy dissipated per time unit: to increase this amount, the temperature of the floor must be lowered. With a constant flow temperature towards the panels, this action is favoured by the increase in the heat exchange mass, i.e. by the available water flow rate.
The use of a stainless steel manifold, thanks to a large flow section (Kv = 5 m3/h compared to about 3.5 m3/h of a compact polymer manifold), allows the cooling capacity curve to move upwards obtaining a more significant drop in the ambient temperature:

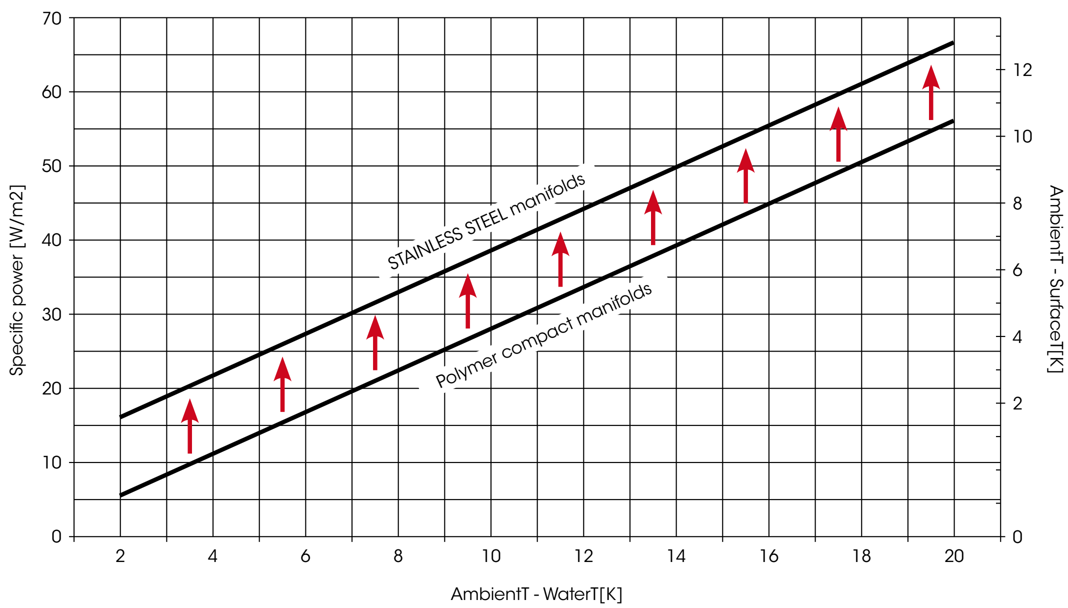


Fig. 9 - Cooling performance comparison between stainless steel and polymer manifolds [Internal source]

Creation and diffusion of the stainless steel manifold

The described benefits have enabled stainless steel manifolds to surpass brass and polymer manifolds in terms of performance and have contributed to their success.

The diffusion of this product will be evident in the next few years, thanks to the fact that new water-based systems (heating and cooling) are sized with high flow rate levels in order to limit the energy consumption. The possibility of working with high Kv levels will undoubtedly encourage the use of stainless steel manifolds against his competitors.

If we also consider that condensing boilers (heating only) and heat pumps (hot and cold) are becoming more and more frequently used, it is easy to see that the near future will be characterised by high capacity systems, assisted by stainless steel manifolds.

Use systems of stainless steel manifolds

Stainless steel manifolds can be used either for radiator systems (heating only) and radiant floor systems (heating and cooling).

Below, there is a representation of the use of these manifolds in typical heating and cooling systems (when combined with heat pumps).

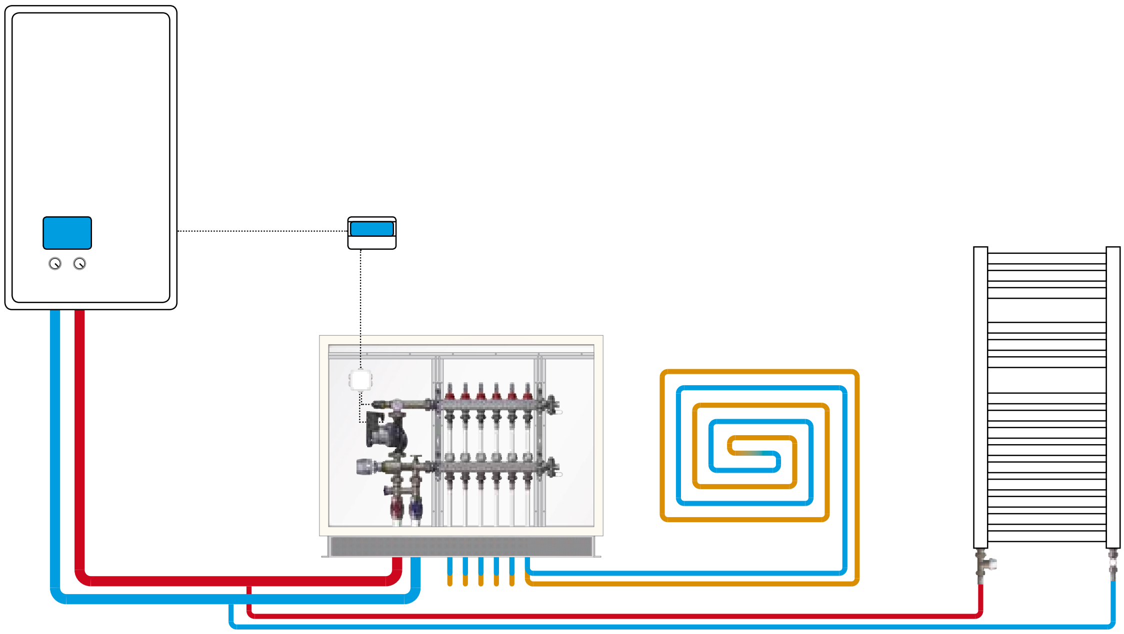


Fig. 10 - Stainless steel manifold with fixed point mixing system – Traditional boiler

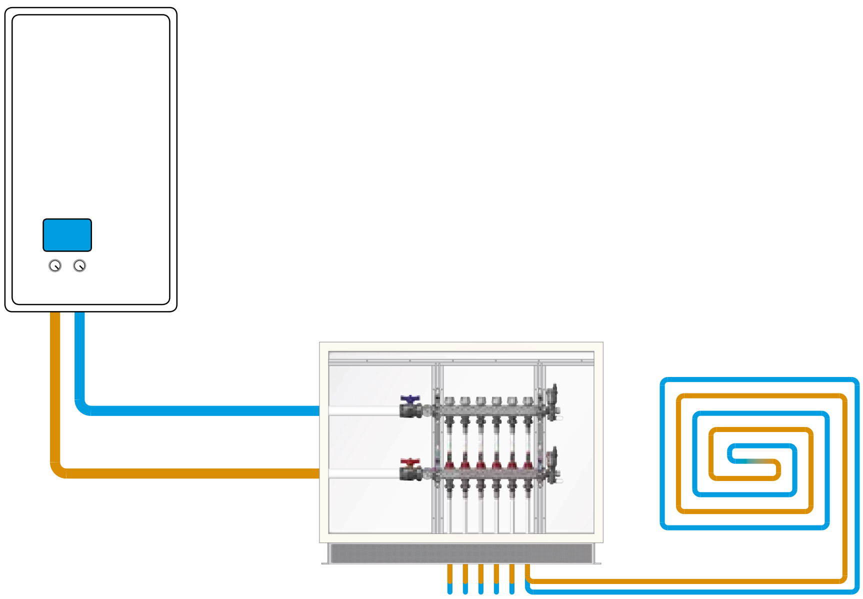


Fig. 11 - Stainless steel manifold – Condensing boiler

Use systems of stainless steel manifolds

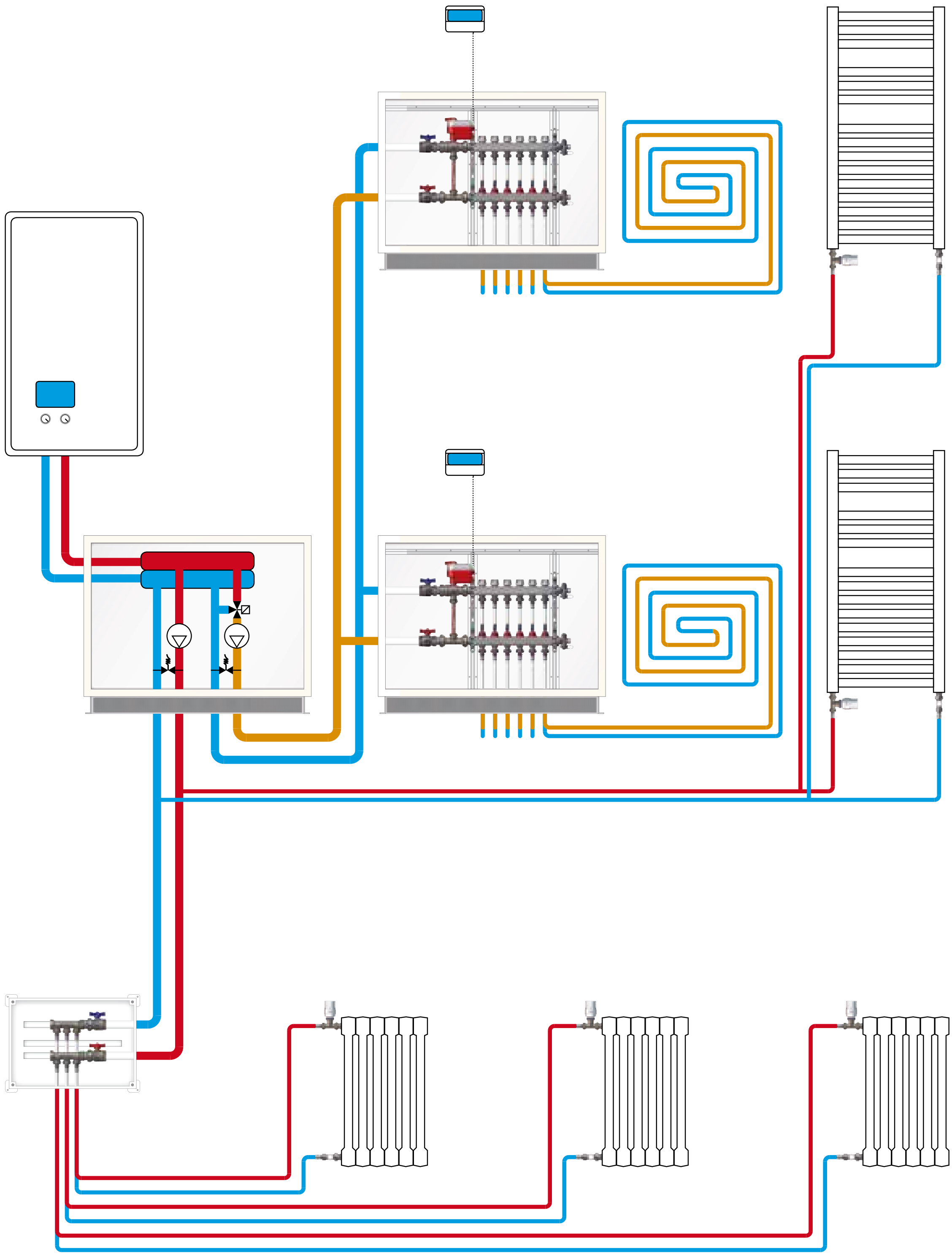


Fig. 12 - Stainless steel manifold – Condensing boiler and hydraulic separation manifold

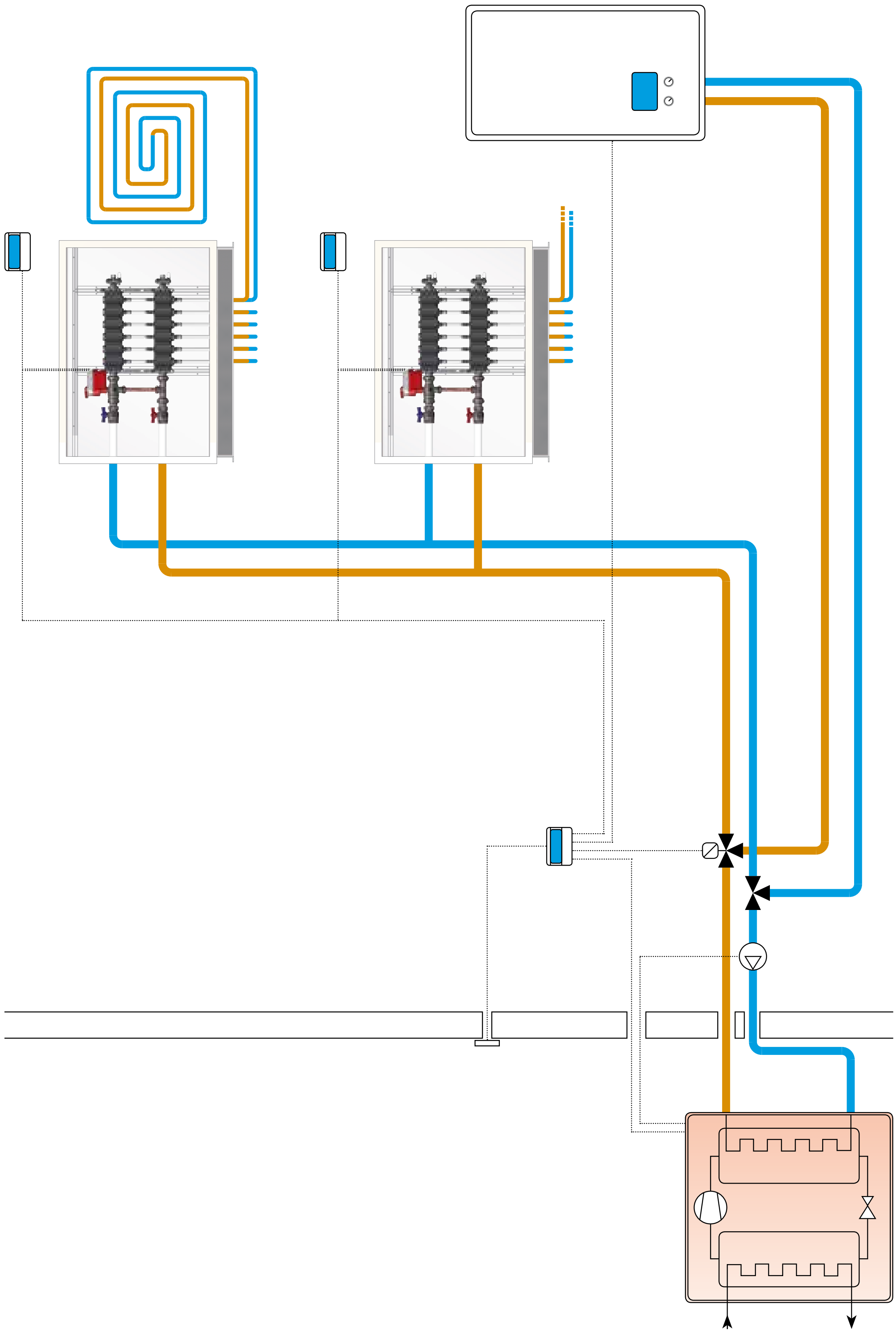
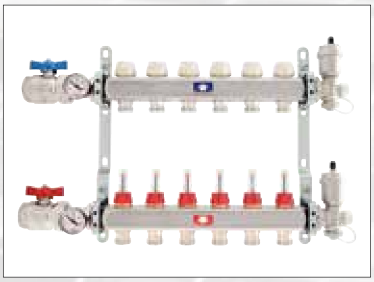
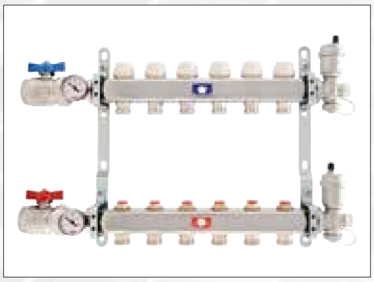
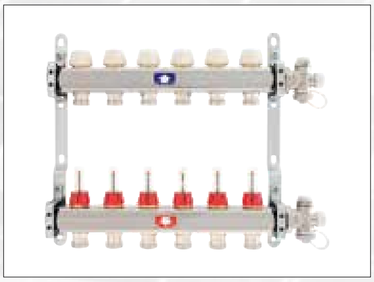
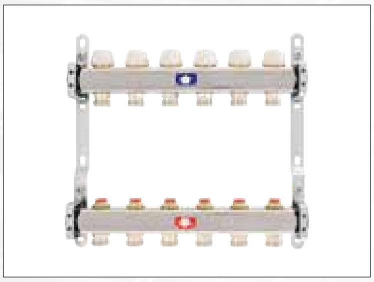


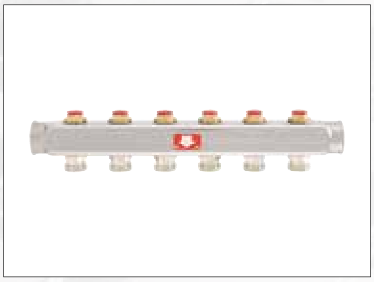
Fig. 12 - Stainless steel manifold – Condensing boiler and external heat pump

STAINLESS STEEL MANIFOLDS FOR RADIANT SYSTEMS

ITAP range of stainless steel manifolds





CONSISTING OF	
AISI304L stainless steel supply manifold	complete with flow meters or lockshield valves
AISI304L stainless steel return manifold	complete with shut-off valves designed to be controlled with electrothermal actuators
CW617N nickel-plated brass ball valve	full bore - complete with thermometer
End pieces	complete with automatic or manual drain valves and air vent valves
Metal brackets	assembled - heavy model (3 mm thick)

FLOW METER TACONOVA	
Includes the flow control mechanism. Ring for memory.	
Body	brass
Scale	0-5 l/m
Kv	1.1
Reading accuracy	+/- 10%
Maximum operating temperature	70°C
Threaded fitting	ISO228

SCREWDOWN FOR ELECTROTHERMAL ACTUATOR	
Kv	1.35
Suitable for thermostatic actuators with:	
Threaded fitting	M30x1.5
Closing course	11.7 mm

Suitable for the pre-regulation of each circuit.

LOCKSHIELD VALVE	
Adjustment (rounds)	**Kv (m³/h)**
0.25	0.09
0.5	0.19
0.75	0.27
1	0.36
1.5	0.60
2	0.83
3	1.45
RT (open)	1.65

Notes

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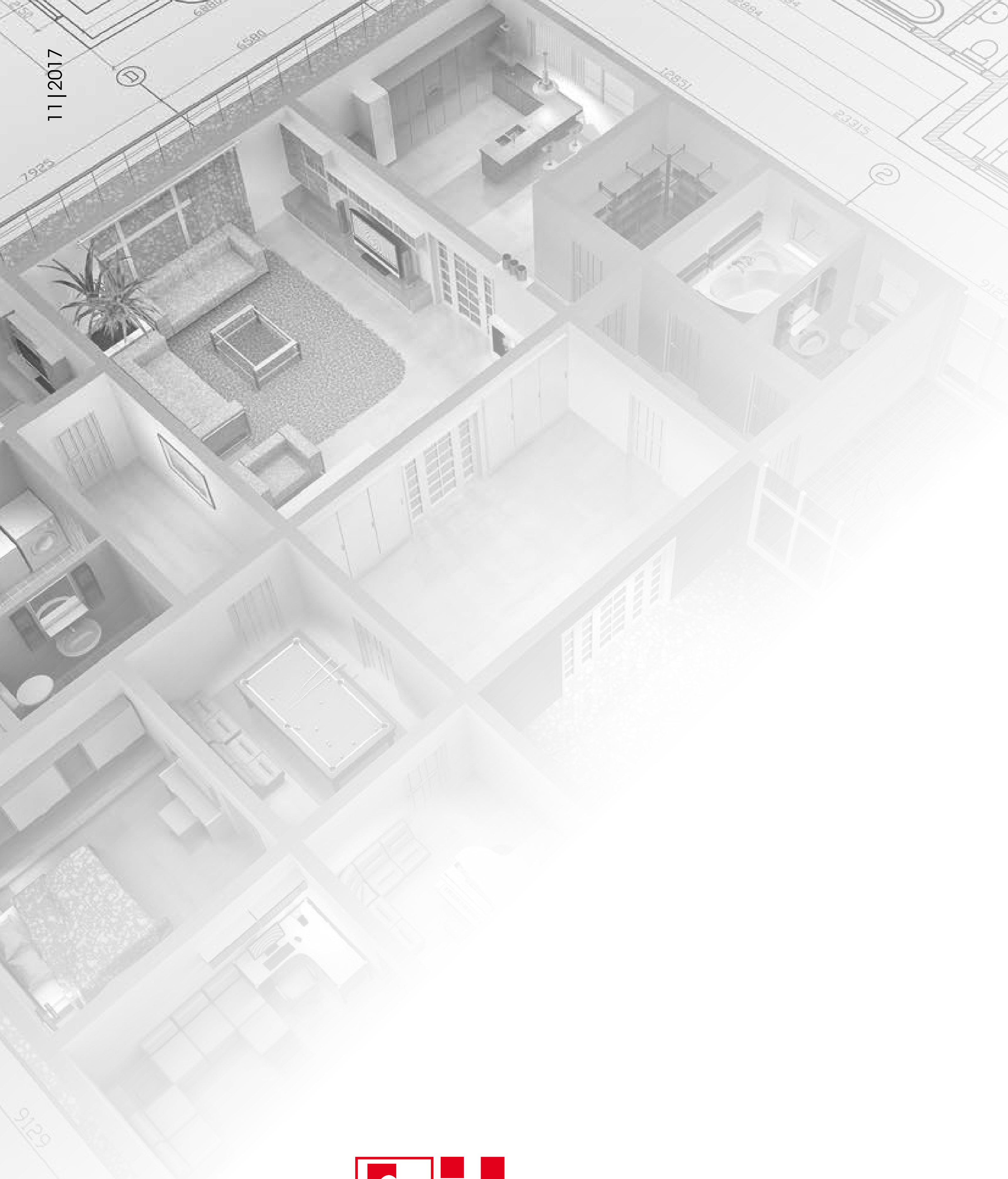

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