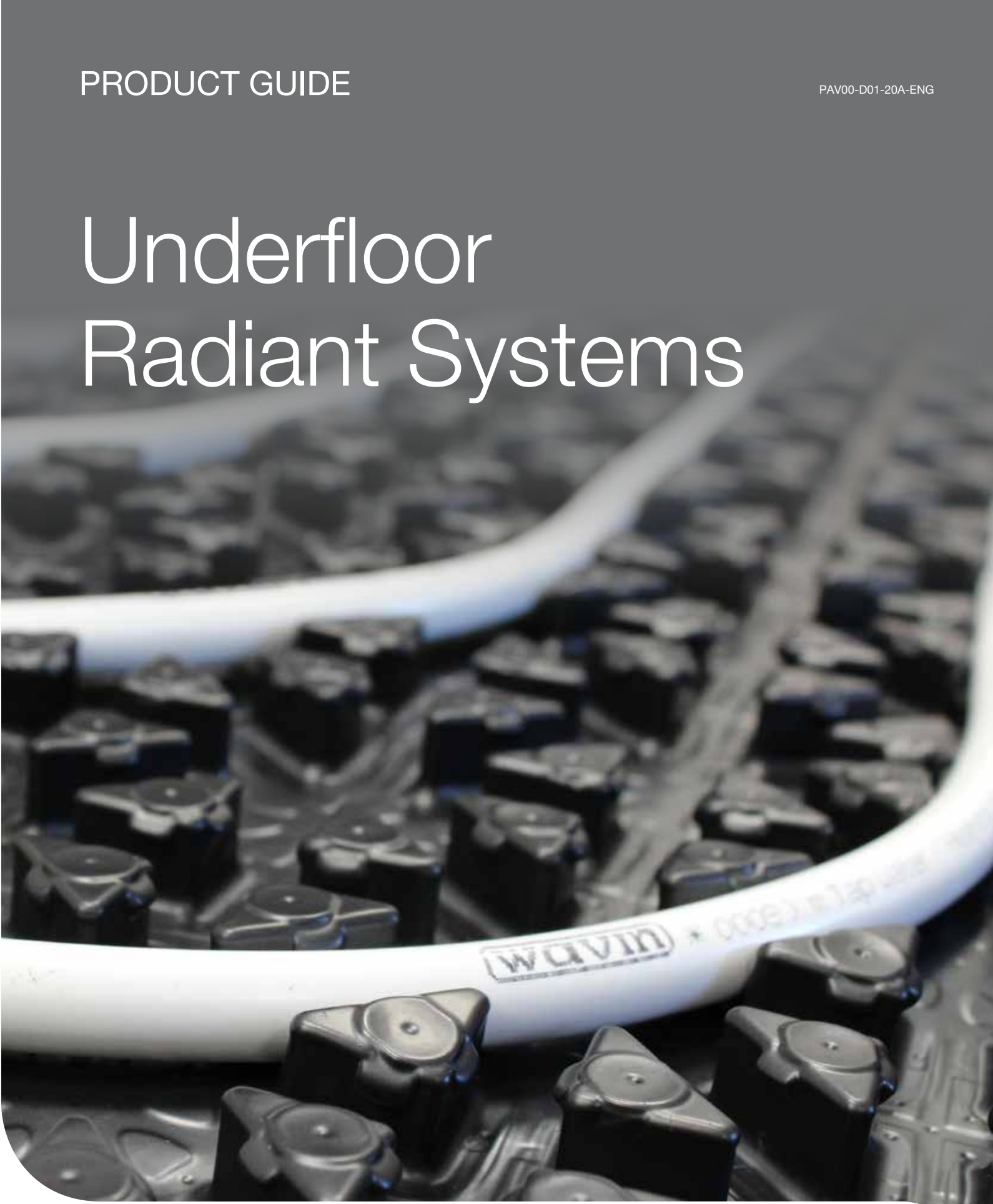
PRODUCT GUIDE

PAV00-D01-20A-ENG

Underfloor Radiant Systems



wavin

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Company presentation

Wavin Italia SpA

Wavin Italia SpA is part of the European Wavin Group, a world leader in plastic piping systems for residential, non-residential and civil engineering works.
It was founded in 1993 through the acquisition of Plastistamp by the Wavin Group. In subsequent years, the company, based in Santa Maria Maddalena, in the province of Rovigo, experienced a period of great expansion.
In 2000 it acquired MCM, a company that produces the EMU line of siphons and, in June 2004, it acquired Chemidro, a brand specialising in the production of supply systems for the distribution of sanitary and heating water, with particular focus on radiant heating and home comfort (underfloor, ceiling and water heating and cooling in addition to air treatment with dehumidification and controlled mechanical ventilation).
Two years later, Wavin Italia completed the acquisition of AFA, the Italian distributor of the PB Acorn (today Hep2O) supply and heating system.
Today, Wavin Italia has over 200 employees and a total area of more than 70,000 m^2, 9,000 of which dedicated to production.

The Wavin group

TheWavin Group is headquartered in Zwolle, Netherlands, and has a direct presence in 25 European countries. With 40 manufacturing systems and a total of about 5,500 employees, the Group generates annual revenue of about € 1.2 billion and, outside Europe, operates through a global network of agents, licensees and distributors. In 2012, Wavin became part of Mexichem Group, a Latin American leader in the petrochemical and pipeline systems industry.
Wavin provides effective solutions for the basic needs of daily life: safe distribution of drinking water, sustainable management of rainwater and sewage and energy-efficient heating and cooling for buildings.
Wavin's leadership in Europe, its local roots, constant commitment to innovation and technical assistance are big advantages for our customers. In fact, we guarantee full compliance with the highest standards of sustainability and reliability of supplies, allowing our partners to achieve their goals.

Market leader

Founded in 1955 based on an innovative idea by J.C. Keller, director of the company that managed the Dutch water supply, its more than 60 years of experience allows Wavin to connect the impossible to the possible.
Its innovations in plastic piping systems and water management solutions are the result of its on-going commitment and ability to bridge the gap between new challenges and known and traditional solutions.
The excellent performance and quality of its products guarantee that Wavin systems will have a long service life.

The activities and commitment of the Wavin Group are supported by four pillars:

Innovation
From the very beginning, Wavin has had a strong focus on innovation. In fact, the development of a new product or new solutions is the result of a dedicated team, able to transform ideas into reality. Wavin's challenge is to offer the market innovative technological solutions using plastic components, which is what the company is best at producing.

Sustainability
Wavin invests in research to offer real answers to the construction industry's future environmental challenges. In fact, climate change demands increasingly advanced and safe solutions for managing the storm water cycle, from collection to its natural reuse. Sustainability that the company guarantees not only through its products, but that also applies to its production processes in the Group's factories.

Social commitment
Since 2005, Wavin and UNICEF are active partners in providing essentials such as drinking water and sanitation to children around the world. Over the years, Wavin has supported several projects (in Mali, Papua New Guinea, Nepal and Bhutan), offering its products, but most of all providing money and expertise to bring drinking water to more than 200 schools and 60 health facilities, and to improve sanitation for over 96,000 people (especially children).

Comfort
Wavin devotes particular attention to solutions that ensure environmental comfort, where temperature, humidity and noise levels are the main factors that determine the state of well-being of the home environment. Soundproofed drain systems along with radiant heating and cooling systems are the ideal solutions for those who distinguish themselves in offering comfort.
It is precisely in this way that Wavin Italia distinguishes itself through the solutions of the Chemidro brand by offering a wide range of radiant heating and cooling systems articulated in numerous underfloor solutions that are ideal for any type of building and need, thermal insulation panels, dry solutions and low profile panels ideal for renovations and acoustic solutions.
Wavin offers innovative ceiling heating and cooling solutions that provide energy saving and environmental sustainability, such the CD-4 system, which allows realising radiating surfaces to measure, as a function of individual project, the CD- 10 system and the WD-10 and WW-10 wall systems.

Wavin by Chemidro offers its own CE-marked underfloor systems that, in addition to product quality, also provide the end user a guarantee of the thermal resistance characteristics of the insulating panel.
The solutions offered are the most technologically advanced, the production processes ensure reliability and Wavin technicians offer a wealth of knowledge with few equals in Europe.
All this for the benefit of our customers who can thus compete more successfully in the market.

The training centre

wavin | academy

Wavin Italia's point of pride is the Wavin Academy Training Centre, an innovative facility launched in 2014 where industry professionals and employees discover Wavin's multiple solutions and keep up-to-date on new products and new technologies. Each week, it organises training courses developed to enhance the professionalism of plumbing distributors, installers, designers, heating and cooling engineers, architects and students, who can participate in dedicated courses based on the type of application and design.
The courses are taught by highly qualified Wavin instructors with specific areas of expertise, who are available to respond to the many requests of the participants to train personnel who can propose, design and install Wavin's many solutions and ensure complete customer satisfaction.

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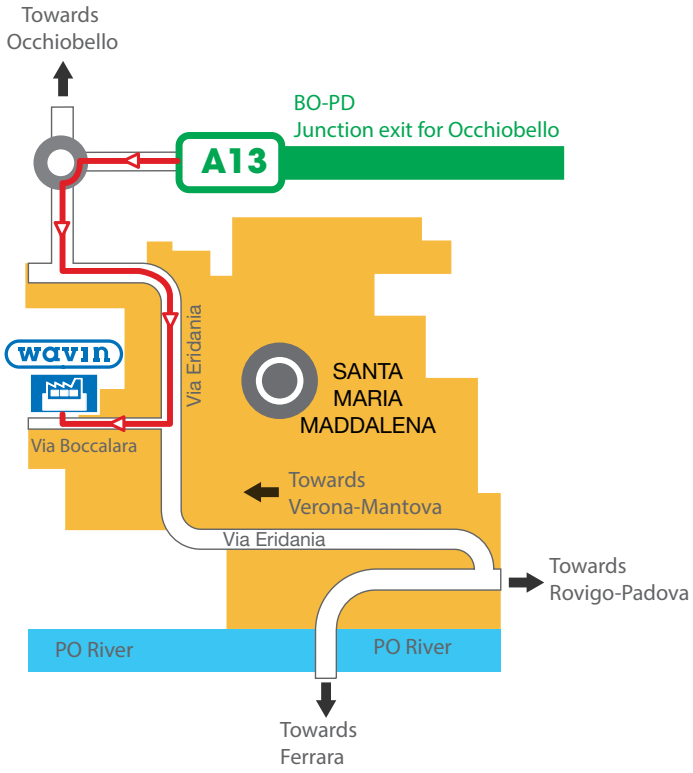
How to reach us:

Wavin Academy is located in our company, just 8 km from the old town centre of Ferrara and 1 km from the Occhiobello exit of the A 13 Bologna-Padua motorway.

Airport: Bologna Guglielmo Marconi (BLQ) 45 Km - Venezia Marco Polo (VCE) 104 Km

Motorway: A13 BOLOGNA-PADUA 1 Km

Ferrara - 8 km / Bologna - 50 Km
Rovigo - 25 Km / Padova - 60 Km



Underfloor radiant systems

1. Well-being, radiant systems, legislation

With the evolution of materials, construction techniques and people's needs, the ultimate goal of building construction is increasingly to provide a place to live or work that is also comfortable. The concepts of environmental well-being and comfort are thus increasingly important and become the goals to achieve in terms of acoustic, lighting and thermal comfort and air quality.
In this part we provide a general, easy-to-read overview of how to measure and achieve well-being. Obviously, this is a simplification because the conclusions discussed here are the final result of very complex considerations ranging from applied physics to the current standards.

Thermo-hygrometric well-being

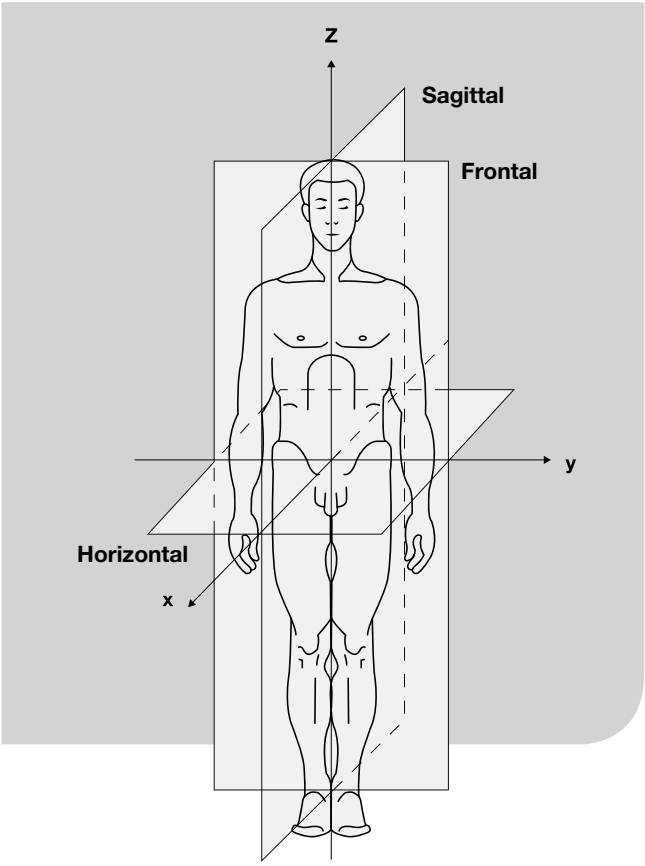
It is difficult to define the quality of life in a space because well-being is a subjective perception. Commonly, environmental well-being is defined as a condition in which people are neither too cold nor too warm and, thus, in a neutral state.
What we perceive is based on the thermal equilibrium of the human body and, in fact, feeling of cold or warm is nothing more than the expression of the condition in which we find ourselves. Our body is in a neutral condition, and therefore comfortable, when the energy we produce, depending on the type of physical activity we are doing, called metabolic activity, is equal to the energy that we release to the environment. If, for example, we are sitting in an office, our bodies have an, albeit low, metabolic activity, but at the same time we are releasing mechanical and thermal energy into the environment through respiration, convection, conduction, irradiation and evaporation from the skin. If the sum of these energy losses, which are affected by many factors as we shall see below, is equal to our energy metabolism, we are in condition of comfort.

The factors that affect well-being

The energy exchanges that occur between our bodies and the environment, and which, as seen above, affect comfort, are therefore basically of two types: environmental and physical.
The parameters related to people are:
- metabolism, which, as mentioned, depends on the person's type of physical activity, measured in METs (metabolic equivalents);
- the type of clothing, which for obvious reasons will vary depending on intended use of the space, the person's role, the type of activity performed (for example, an office manager will surely dress differently than a receptionist) measured in CLOs (clothing units).

The environmental parameters are:
- relative humidity of the environment measured as a %;
- air speed in m/s;
- air temperature in °C;
- mean radiant temperature in °C.

The mean radiant temperature is given by the temperatures of the surfaces that surround the person, corrected with view factors. In fact, the influence of the temperature of a surface on an occupant varies depending on the position of the surface in relation to the person. For example, in Figure 1, the temperature of a surface placed along the X axis (such as a window or wall), and thus in front of the person, will have a greater weight in the calculation of the mean radiant temperature than the temperature of a surface placed along the Z axis (for example, ceiling or floor). The influence of the temperature of the various surfaces also varies in relation to the occupant's position, sitting, standing or lying.
From the mean radiant temperature and the air temperature, we derive the operating temperature, which is taken into account in the analysis of environmental comfort defined in the UNI EN 7730 standard where, based on this temperature and other factors, it is possible to establish the degree of comfort that can be achieved. It seems clear that the operating temperature is particularly influenced by radiant systems. As we will see later, if positioned correctly radiant systems achieve excellent results without the risk of increasing or decreasing the air temperature too much and thus avoiding high vertical temperature differences (see below).



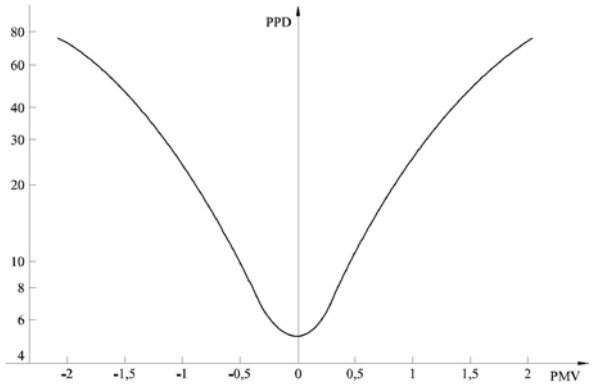
Measuring well-being

Even though well-being is subjective, there are methods for establishing if we are comfortable or not based on several parameters.
The UNI EN 7730 standard describes the method for measuring comfort and the first value to be defined is PMV, the Predicted Mean Vote that the people in a space would give to the feeling of warmth they are experiencing. In fact, PMV is based on the thermal energy balance we spoke of above and ranges from a value of -3 to +3 based on how the person feels.
PMV is thus linked to another parameter: PPD, the Predicted Percentage Dissatisfied, or the percentage of people who will be dissatisfied with the thermal condition in which they find themselves. For example, a PMV of 0.5 corresponds to a percentage of dissatisfied of 10%.
The same standard establishes the comfort classes, A, B and C. For these classes, benchmarks are indicated and even the limit values of discomfort to maintain (see next point). In any case, it is advisable to maintain PPD values below 10%

PMV Index

+3	Hot
+2	Warm
+1	Fairly warm
0	Neither warm nor cold
-1	Fairly cold
-2	Cold
-3	Very cold

Indication of the percentage of dissatisfied



Comfort Classes

Category	Thermal state of the body as a whole		Local discomfort			
	PPD %	PMV	DR %	vertical difference of air temperature	PD % caused by hot or cold floor	radiant asymmetry
A	<6	-0.2 < PMV < +0.2	<10	<3	<10	<5
B	<10	-0.5 < PMV < +0.5	<20	<5	<10	<5
C	<15	-0.7 < PMV < +0.7	<30	<10	<15	<10

Discomfort elements

In addition to the calculation described above, in seeking environmental well-being, we must also take into account the thermal discomfort caused by other factors: discomfort due to draughts, the vertical difference in air temperature, the temperature of hot or cold floors, the temperature of hot or cold walls and the temperature of hot or cold ceilings.

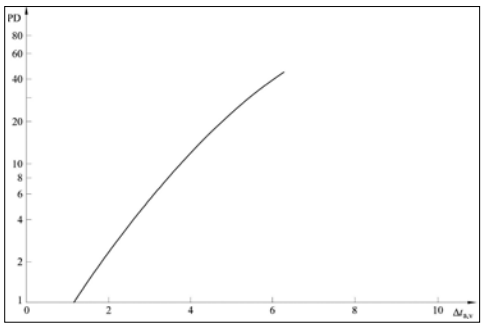
It is advisable to maintain these parameters below:

- draught speed <0.3 m/s
- vertical difference of air temperature < 5 °C
- floor temperature between 19 °C and 29 °C
- temperature difference of a hot wall from the other structures < 23 °C
- temperature difference of a cold wall from other structures < 10 °C
- temperature difference of a hot ceiling from other structures < 5°C
- temperature difference of a cold ceiling from other structures < 14 °C

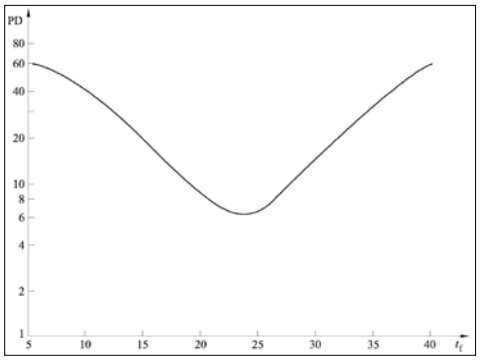
Radiant systems

Unlike traditional convection systems that change the temperature of the air, radiant systems are characterised by an emission of energy by a warm emitter system to a cold absorber system. A fundamental characteristic of these systems is that the flow of heat emitted by irradiation is much higher than emitted by convection which, though minimal, still exists, as we see in the points that follow. The exchange of energy between two bodies with different temperatures does not affect the air but only the two surfaces involved. In fact, an underfloor system exchanges heat with the surrounding structures such as walls, windows, ceilings, etc. This causes an increase in the surface temperature of the surfaces and benefits the mean radiant temperature mentioned previously.
To achieve comfort, it should be considered that, in addition to exchanging or subtracting heat from the surrounding surfaces, the system also acts on the occupants of a space.
Among the various advantages of a system of this kind, we can point to the absence of air movement, the modularity of the system, the quality of the comfort - given that we can change only the temperature of the structures without changing the air temperature - and the uniformity of heat distribution.
Not least, a great advantage of irradiation is on large volumes, where we do not warm or cool the entire volume of air, but only exchange heat with the surfaces, with obvious energy saving.

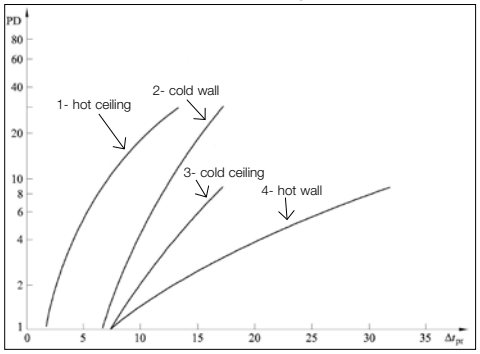
Vertical difference of air temperature



Percentage of dissatisfied based on the temperature of the floor

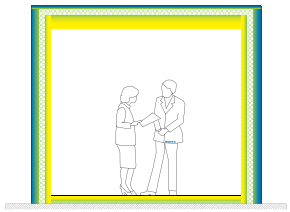


Percentage of dissatisfied based on the temperature difference between air and ceilings or walls



How radiant systems work

1. The structures of a space have internal temperatures that depend on the outside temperature, the ambient temperature and the transmittance of the structure itself. In the figures, , the colour scale from blue to red indicates cold to hot.
2. Convection system in heating: heats the ambient air. If the structures have a very cold surface, to reach the appropriate operating temperature, the ambient temperature must be increased a lot. This can cause a high vertical temperature difference and possible air stratification.
3. Convection system in cooling: cools the ambient air. If the structures have a very hot surface, to reach the appropriate operating temperature, the ambient temperature must be lowered a lot. This can cause a vertical temperature difference and stratification, making air distribution difficult.
4. Underfloor system in heating: exchanges energy with adjacent structures, increasing their surface temperature. This increases the mean radiant temperature until reaching the desired operating temperature, all without excessively increasing the air temperature and causing the stratification.
5. Underfloor system in cooling:subtracts energy from the adjacent structures, decreasing their surface temperature. This reduces the mean radiant temperature until reaching the desired operating temperature, with the advantage of an adequate air temperature without air movement.
6. Wall system in heating : particularly suitable as a supplement in bathrooms, where the demand for heating comfort is highest, or in stairwells. The small convective air movements, represented by the red arrow, assist the performance of the system in terms of winter power.
7. Wall system in cooling: the cooling yield is equal to heating, a characteristic not common to other types of systems. Particularly suitable as a supplement on outer walls of spaces exposed to solar radiation.
8. Ceiling system in heating: the best solution for latest generation buildings. Particularly fast and responsive, it has the lowest output temperature of radiant systems. Especially suitable for spaces where the occupants are lying down such as hospital admissions and patient rooms.
9. Ceiling system in cooling: the system allows working with higher surface temperatures than other radiant systems. In fact, the ceiling system is, among the irradiation systems, the one that provides the highest cooling performance in terms of emitted power. Particularly suitable in highly crowded spaces.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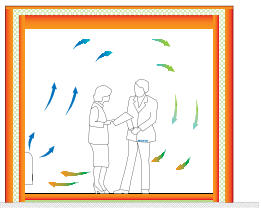
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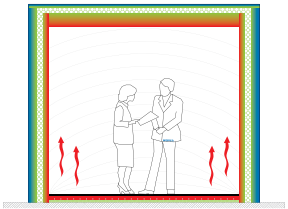
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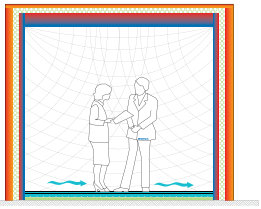
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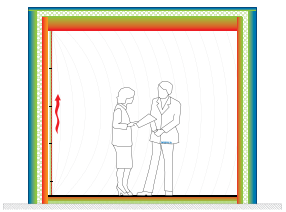
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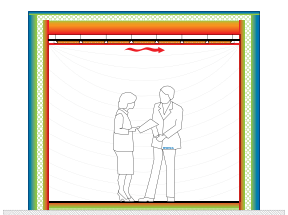
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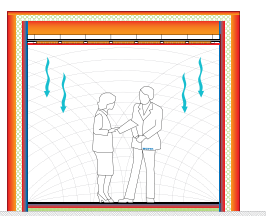
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Thermal output of radiant systems

After having explained how radiant systems work in the previous part and having mentioned the small convective air movement that this type of system generates, here we discuss the thermal output that the Standard takes into account.

Heating

Underfloor system
10.8 Watts per m² for each °C of difference between the ambient and surface temperatures of the system

Wall system
8.0 Watts per m² for each °C of difference between the ambient and surface temperatures of the system

Ceiling system
6.5 Watts per m² for each °C of difference between the ambient and surface temperatures of the system

Cooling

Underfloor system
6.5 Watts per m² for each °C of difference between the ambient and surface temperatures of the system

Wall system
8.0 Watts per m² for each °C of difference between the ambient and surface temperatures of the system

Ceiling system
10.8 Watts per m² for each °C of difference between the ambient and surface temperatures of the system

As you can see, the three systems, floor, wall and ceiling, differ in terms of performance because of the action of the above-mentioned convective air movements. This results in different characteristics that make them suitable for different types of systems. For example, it is clear that the ceiling system is the ideal solution for cooling systems.
Beyond these characteristics, without going into details, one should consider that the average temperature of the water circulating in the system is about 5 °C lower than the surface temperature in the underfloor system and about 3 °C lower in the wall and ceiling system.

For a better understanding, here is an example:

To provide 35 W/m2 in cooling	Surface temp.	Average Water Temp.
underfloor system	20.7°C	15.7°C
wall system	21.6°C	18.8°C
ceiling system	22.8°C	19.8°C

In this case, the ceiling system is by far the most efficient system, with a surface temperature far from the dew point and an output 4 °C higher than the underfloor system.

Standards for radiant systems

The UNI EN 1264 standard, which consists of 5 parts, is the technical standard that defines all of the elements that make up an underfloor, wall and ceiling system. This same standard provides the methods for calculating the emissions of these system referred to in the preceding paragraph. Below we summarise the key points, with particular regard to underfloor systems, indicating the parts that can be helpful in designing and installing these systems.

In addition to the aforesaid standard, we can add EN ISO 11855 which also consists of 5 parts that are similar to the previous standard, but applies exclusively to floor systems.

Finally, it is important that we mention UNI 11371 which, although not specifically relating to radiant systems, covers them as it relates to “Screeds for parquet and wood flooring” and is particularly recommended in the case of wooden coverings:

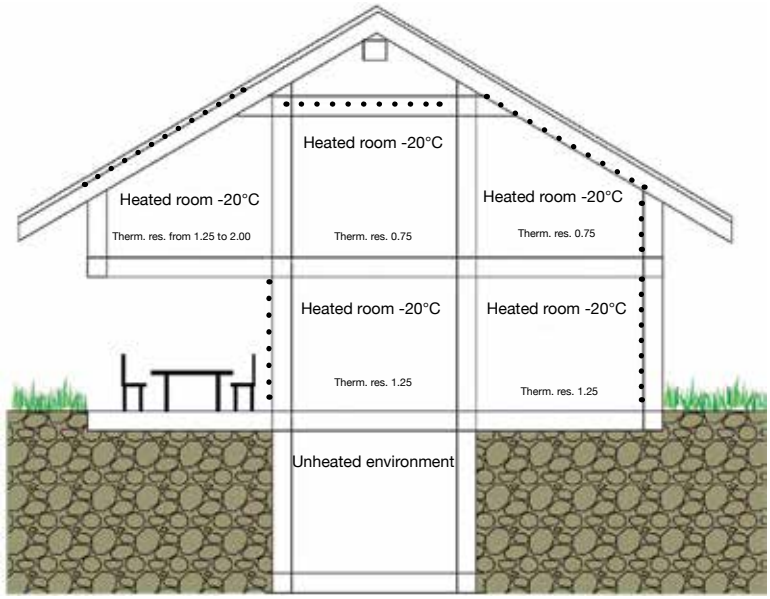
- Fixing to the slab underneath the radiant panels when the screed thickness is under 30 mm;
- A water vapour barrier that overlaps by 100 mm, turned under the PE sheet of the perimeter strip, appropriately sealed and with SD > 40 m, to be installed under the radiant panels.

Functioning of the systems

Particular attention is paid to the thermal resistance of the insulating layer placed between the system and the outside or the underlying environment.
The Standard considers the insulating layer to be the one placed immediately below the piping, even if resulting from the coupling of two or more panels. The thermal resistances to consider are:

	Underlying heated environment	Underlying environment unheated, not continuously heated or directly on the ground*	Temperature of the underlying outside air		
			Outside design temperature $T_d \geq 0$ °C	Outside design temperature 0 °C > $T_d \geq$ -15 °C	Outside design temperature -5 °C > $T_d \geq$ -15 °C
Thermal resistance (m^2·K/W)	0.75	1.25	1.25	1.50	2.00

*With a ground water level of ≤5 m, the value should be increased



Safety

A safety device must be installed on heating systems that, independently of the control unit, can also operate in the absence of electric current to cut off the supply of hot water to system circuits, so that the temperature around the heating elements does not exceed 55 °C for screeds based on cement or calcium sulphate. These values can be reduced for other types of coverings, for example to 45 °C for asphalt support layers. In any case, the manufacturer's specifications must be followed for all types of coverings.
Cooling systems require a dew point detection device to cut off the supply of cold water before the formation of condensation, while the temperature around the cooling elements must not reach the dew point.

Clearances

The system piping must be positioned more than:
- 50 mm away from adjacent structures;
- 200 mm away from chimneys and open fireplaces, open or walled-up shafts and lift shafts.

Expansion edge strips

Before pouring the screed, an edge strip should be laid along the walls and any other component of the building that penetrates into the screed, such as doors, pillars and treads.

The edge strip must extend from the support base to the upper layer of the floor finish, and allow the screed to move by at least 5 millimetres.

If there are more insulation layers, the edge strip must be laid before laying the upper layer. When the screed is cast, the edge strip must be secured in order to avoid any change of position. The upper section of the edge strip, above the floor finish should not be cut before the floor covering is completed, or before the filling is cured in the case of textile or plastic coverings.

Expansion joint in screeds

Heated screeds on which stone or ceramic coverings are applied must be divided with joints into surface areas no larger than 40 m2 and with a maximum length of 8 metres. In the case of rectangular rooms, the areas may exceed these dimensions but with a ratio between the two sides of at most two to one. Each irregular area must have joints so that there are only rectangular areas with the above-specified dimensions.

If contraction joints are made, their depth should not exceed one third of the thickness of the screed, taking into account the position of the pipes and sealing such joints after initial heating.

Movement joints and edge strips can only be crossed by supply pipes (output and return of a circuit), and only at the same level. In this case, they must be covered by a tube of flexible insulation about 30 cm long.

As far as possible, expansion joint strips must start from edges, in points where there are enlargements or narrowings of the screed surface. Expansion joint strips or "trowel cut" joints must be made on doors or corridors.

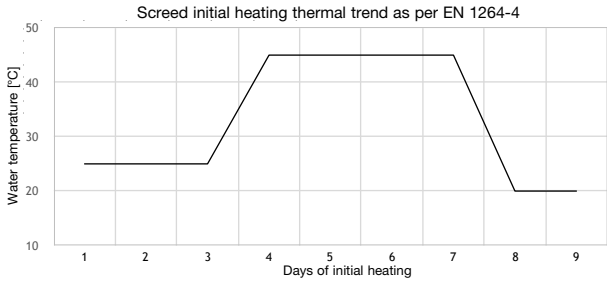
Leak testing

Leak testing can be performed with water or compressed air.
Before installing the support layer, the circuits must be leak tested with a pressure test.
The pressure used in the test must not be less than 4 bar and not more than 6 bar for standard systems.
If asphalt screeds are laid, the system must be de-pressurised during laying (editor's note: In other cases the system must remain under pressure)
The absence of leaks and the pressure used must be specified in a test report.
Where there is risk of frost, suitable precautions must be taken, such as the use of anti-freeze products or heating of the building.
When normal operation starts, the antifreeze should be drained and disposed of in compliance with current regulations and the system must be rinsed at least 3 times with clean water.

Initial heating

This must be done on cement-based screeds at least 21 days after installation, on calcium sulphate screeds at least 7 days after installation and on asphalt screeds at least one day after installation.
In any case, the manufacturer's specifications must be followed for all types of coverings.
The initial heating begins at a supply temperature ranging between 20 °C and 25 °C, which must be maintained for at least 3 days. Then, it is necessary to set the maximum design temperature, which must be maintained for at least 4 more days.
The heating start-up process must be documented.

Thermal curve of initial heating according to UNI EN 1264-4



2. Types of underfloor radiant systems

Underfloor systems are certainly the best known radiant systems.
They can be realised with different types of products that, depending on their characteristics, result in systems that are more or less efficient systems in terms of thermal output and are more or less practical to install.

However, one important parameter that characterises these systems has always been poorly analysed, to the extent that UNI EN 1264-3 standard says it is not necessary to take into account: thermal inertia.

However, regulatory developments in terms of energy savings and technical evolution in terms of products for screeds have now made thermal inertia a critical parameter; in fact, as early as the design stage it is worth taking it into consideration in order to choose the system that best fits the needs of the building.

On this basis, we distinguish radiant underfloor systems primarily based on their thermal inertia, grouping them in the following pages of this chapter into three large families, which we will now analyse.

Low-inertia residential systems

Today, new buildings and well-renovated buildings have a common fundamental characteristic: low thermal loads in the winter season. These are the so-called buildings in class B, A or higher.
Often the only relevant loads remain those of the summer season, due to the presence of the sun, or the people who occupy the building, and the electrical equipment that is used. These loads are characterised by a high variability, being able to change very quickly.

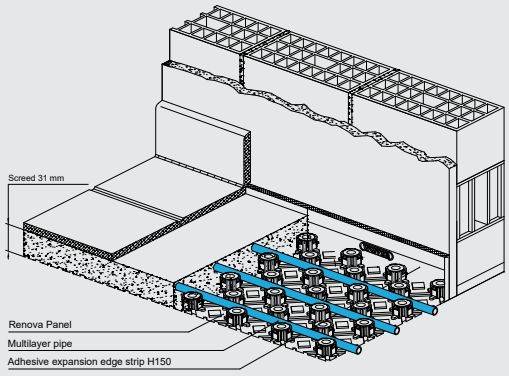
A building with low winter loads requires a heating system that can be controlled efficiently and quickly, in order to prevent the building from overheating once the condition of comfort is reached.
In turn, a building with highly variable summer loads requires an air conditioning system that can be controlled efficiently and quickly, in order to quickly cool a space in which the loads are quickly increased.
To do this, the heating and/or cooling system must have low thermal inertia.

Underfloor systems that are able to meet this need are either dry systems or those that can exploit the new materials made available by technical evolution in the construction industry.
These are products that are compatible with screeds with a single centimetre of thickness over the pipe and that, given their recent evolution, are not yet considered by the UNI EN 1264 standard that, while it considers the use of special products, in fact, remains written for systems with traditional sand and cement screeds.
The thermal response of these systems, starting from the system turned off, is on the order of tens of minutes to reach full capacity.

The Chemidro systems that allow realising low-inertia systems are the RENOVA and RENOVA ULTRA systems.

These systems are applicable to residential buildings, offices, commercial spaces, schools and health facilities.

LOW-INERTIA RESIDENTIAL SYSTEM
Screed of 31 mm



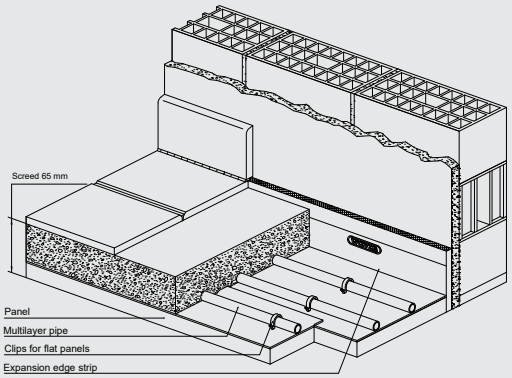
Residential systems

These are the traditional systems for which the UNI EN 1264 standard was, in fact, written.
They are suitable for all buildings with standard thermal loads or with modest variations of the same thermal loads. They are realised using traditional sand and cement screeds enriched with special fluid or fibre additives, with a minimum thickness of 45 mm over the pipe, or self-levelling calcium sulphate-based screeds with a minimum thickness of 30 mm above the pipe.
The thermal response of these systems, starting from the system turned off, is on the order of hours to reach full capacity.

Many Chemidro systems allow realising standard residential systems and they are, in turn, divided into Premium, Professional or Basic products depending on the characteristics and performance that they are able to offer.

These systems are applicable to all buildings with residential-type mechanical loads, whether homes or offices or commercial spaces, schools or health facilities.

RESIDENTIAL SYSTEM
Screed of 65 mm



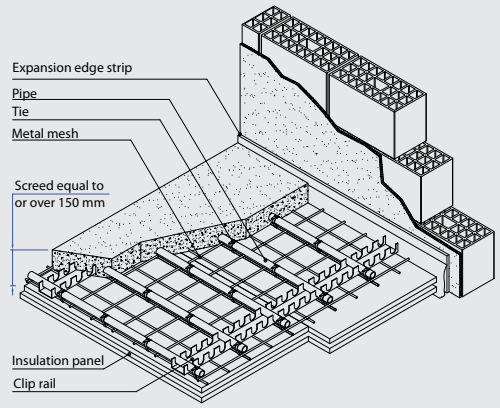
Industrial system

This is a system developed for the best combination with screeds for industrial buildings, characterised by the presence of one or more electro-welded meshes embedded in the concrete in order to support high mechanical loads, typically with a thickness of at least 150 mm or more.
The thermal response of these systems, starting from the system turned off, is a matter of days to reach full capacity.

The Chemidro industrial system can be realised with different construction methods, depending on the stratigraphy of the screed.

This system is applicable to all buildings with industrial-type mechanical loads, or the presence of electro-welded mesh and thick screeds, whether industrial sheds or spaces for craft work or used for the passage of vehicles.

INDUSTRIAL SYSTEM
Screed of 150 mm or more



3. Low-inertia residential systems

RENOVA system, bonded

The bonded RENOVA System is designed for radiant systems with low-thickness screed and thus low thermal inertia.

Created specifically for renovations, with applications over existing floor coverings, its use is also being extended to new housing, particularly in low-energy-consumption homes, precisely because of its low thermal inertia (see the introductory section "Underfloor Radiant Systems").

The system is realised through the combination of the special RENOVA panel with special high mechanical resistance screeds, for which the panel has been specially designed and for which Wavin Italia SpA has carried out a series of tests with reference to the Technical Construction Standards of the Ministerial Decree 14 January 2008.

This combination allows extremely reduced thicknesses above the pipe (10 mm) providing the system a number of advantages:

- **Low system thickness**: 31 mm + covering;
- **Economical realisation**: the low thickness allows installation over the existing floor, avoiding demolitions;
- **Low thermal inertia**: thanks to the reduced thickness, the system comes up to full capacity quickly, making the system particularly suitable both for heating and cooling.
- **Energy savings**: thanks to the low thermal inertia, but also to the use of standard 17-mm pipe, for which the system was designed, one avoids the higher power consumption of the circulators due to the typical pressure losses that would otherwise occur in smaller diameter pipes.

Preliminary precautions

If installing the bonded RENOVA system, in order to ensure a successful casting, it is very important to check the conditions of the sub-floor, especially in the case in which the covering of the existing floor is removed, or you want to apply the system on rough sub-floor. In particular it is important that:

- The bearing area is load bearing, compact, dry and flat. Otherwise, discuss any treatments with the screed supplier (for example, cellular concrete sub-floor without tear resistance requires casting 5 mm of self-levelling cement-based compound);
- The bearing area be impermeable to water. Otherwise, treat the surface with acrylic primer, even repeatedly, to ensure complete impermeability; discuss any other preliminary treatments (such as washing/ degreasing) with the supplier;
- To ensure the adhesion of the bond of the RENOVA panel maintain the maximum cleanliness the sub-floor during application of the panel (a dusty surface is not a compact surface);
- Ensure that the sub-floor is maintained at a temperature higher than 10 °C, the temperature below which the bond loses its properties;

NOTE: Laying in conditions that make adhesion of the bond difficult (such as sub-floor temperatures below 10 °C), or use of other pipes (such as Polysuper pipe) may require anchoring the panel to the sub-floor (for example with steel nails with straps or insulation nails) before casting the screed, to prevent the panel from floating.

With the RENOVA panel**, we recommend the use of Polystop pipe**, because its malleability allows installation without stresses that can lead to the lifting of the panel or lift part of the bends of the pipe itself.

Installation

In order to obtain a radiant system with the maximum performance, after taking the preliminary precautions listed above, it is necessary to follow this procedure:

- Install the specific lowered expansion edge strip without PE film;
- Install the RENOVA panel starting from the side walls and fitting one panel on the other using perimeter bosses;
- If using expansion edge strip of standard height, with PE film, take care that the strip does not go to cover the hole in the top of the bosses of the RENOVA panel;
- Install the pipe on the RENOVA panel realising the circuits as per the installation diagram;
- Perform the leak test;
- Ensure that the panel is in contact with the sub-floor and secure it in the case of lifting;
- Evaluate and position the expansion joint strips according to the UNI 1264 standard and/or according to the screed manufacturer's instructions;
- Proceed to pour the special screed to a thickness of 10 mm above the pipe;
- Carry out screed heating tests as per UNI 1264 and/or as indicated by the screed supplier.
- Install the floor covering.

NOTE: The products to be used for screeds must be declared by the supplier as suitable for installation over 10-mm thick pipes, such as Knauf NE425 Knauf, Kerakoll Keratech R30, Mapei Ultraplan Maxi or Q-Mix Q-Mas Slim Bio.

Renova Ultra system

The RENOVA ULTRA System is designed for radiant systems with low-thickness screed, thus low thermal inertia, but associated with an insulation layer so as to comply with the standard UNI EN 1264-4 with regard to the minimal insulation required underneath a radiant system.
However, meeting this requirement is not simple since one of the prerequisites for the system, in order to maintain a screed thickness of 10 mm over the pipe is that "the bearing area be load-bearing", which is no longer the case when a layer of flexible insulation is placed below the RENOVA panel. In this case, therefore, it would be necessary to increase the thickness of screed above the pipe so as to avoid possible cracking, thus losing the advantages of low inertia.
In order to find the correct solution, Wavin Italia SpA carried out a series of tests with reference to the Technical Construction Standards of the Ministerial Decree of 17 January 2008.
The result is the RENOVA ULTRA Panel, a knob panel made of high-density EPS with rigid covering sheet. Bosses are small and evenly spaced in order to reduce the size of the areas with reduced screed thickness. EPS added with graphite helps reduce the insulation thickness (i.e. reduces the flexing layer thickness) while maintaining a high thermal resistance. The EPS high density ensures high mechanical resistance and lower compression load stress.
The panel originates from the combination with a 14 mm-thick pipe to minimise the overall system thickness, while achieving acceptable hydraulic load losses.
This combination allows maintaining the reduced thickness above the pipe (10 mm) providing the system a number of advantages:

- **Compliance with the UNI EN 1264-4 standard**: the coupled insulating panels meet the requirements of the most typical installations, above a heated environment, a non-heated environment or directly on the soil;
- **Low thermal inertia**: thanks to the reduced thickness, the system comes up to full capacity quickly, making the system particularly suitable both for heating and cooling.
- **Guarantee of mechanical resistance**: the use of the RENOVA ULTRA panel, coupled to a screed with the characteristics referenced in tests carried out by Wavin Italia SpA, for use compatible with the characteristics referenced in the same tests, guarantees a finished floor free of defects and durable over time;
- **Installation speed**: the use of the RENOVA ULTRA panel already coupled to the insulating panel allows installation in one step rather than two, first installing an insulating panel and then the bonded RENOVA panel.

Preliminary precautions

When installing the RENOVA ULTRA system, the system becomes a floating floor and the conditions of the type of sub-floor are no longer important, provided, of course, that the sub-floor is able to support the weight of the system itself.

With the RENOVA ULTRA panel, **we recommend the use of POLISTOP BASIC DN14 pipe**, because its malleability allows installation without stresses that can lead to the lifting of the panel or lift part of the bends of the pipe itself.

Installation

In order to obtain a radiant system with the maximum performance, after taking the preliminary precautions listed above, it is necessary to follow this procedure:

- Install the expansion edge strip, with PE film, of appropriate height;
- Install the RENOVA ULTRA panel starting from the side walls and fitting one panel on the other using perimeter bosses;
- Take care the PE film on the edge strip overlaps the RENOVA ULTRA panels, covering their perimeter;
- Install the pipe DN14 on the RENOVA ULTRA panel realising the circuits as per the installation diagram;
- Perform the leak test;
- Evaluate and position the expansion joint strips according to the UNI 1264 standard and/or according to the screed manufacturer's instructions;
- Proceed to pour the self-levelling compound in the minimum thickness recommended by the manufacturer;
- Carry out screed heating tests per UNI 1264 and/or as indicated by the screed supplier.
- Install the floor covering.

NOTE: For screeds, we recommend products with minimum characteristics similar to those declared for the products used in the tests carried out by Wavin Italia SpA such as, for example, Knauf NE425, Kerakoll Keratech R30, Mapei Novoplan Maxi, Laterlite PaRis SLIM.

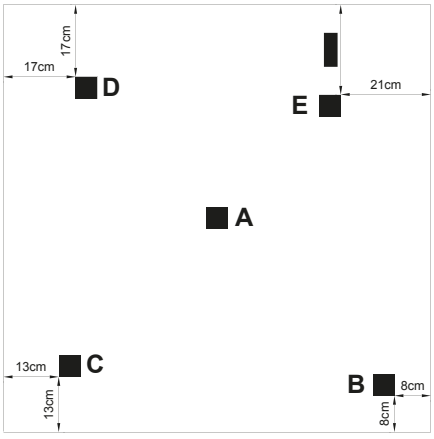
Laboratory tests on the RENOVA system.

In order to define the mechanical stresses on the RENOVA and RENOVA ULTRA systems (hereinafter “the RENOVA systems”, Wavin Italia SpA has conducted a series of laboratory tests.

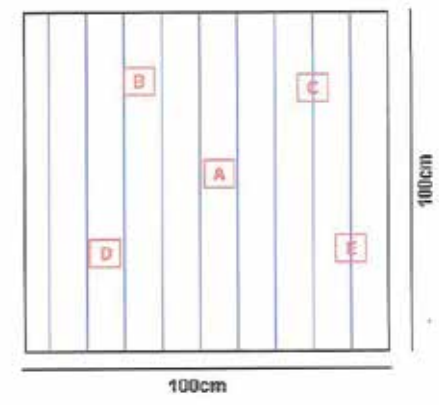
In the absence of a specific standard for radiant screeds, the tests were conducted with reference to the Technical Construction Standards of the Ministerial Decree of 17th January 2018.
The mechanical characteristics of the high-resistance, reduced fluid screed were obtained through the determination of the flexural and compression strength, determined on regularly formed and cured specimens in compliance with the UNI EN 13892-2 standard, the obligatory reference for this category of products.

	Value measured
Characteristic flexural strength	>8 N/mm^2
Characteristic compression strength	>26 N/mm^2

Concentrated Load Tests. The purpose of the test is to simulate the reaction of the RENOVA Systems to stresses deriving from the action of concentrated loads, such as furniture or furnishings.
The concentrated load tests were carried out on 100x100 cm panels with a punch of suitable dimensions according to the Ministerial Decree of 17 January 2018 for concentrated vertical loads.



Note: Test for bonded Renova

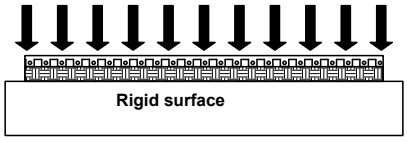


Note: Test for Renova Ultra

	Bonded RENOVA System	RENOVA ULTRA System
Minimum first cracking load	>14 kN/mm^2	>6 kN/mm^2
Average first cracking load	>17 kN/mm^2	>7 kN/mm^2
Deformation due to first cracking	3 ÷ 4 mm	3 ÷ 5 mm

Note: the Ministerial Decree of 17 January 2018 sets test values for the entire floor. The values reported are relative to tests performed for the sole layer corresponding to the RENOVA Systems, as if it were the whole floor instead of just a section of it.

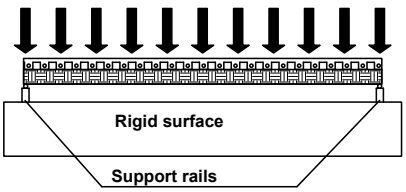
Uniformly Distributed Load Tests. The purpose of the test is to simulate the application of the RENOVA Systems on rigid sub-floors, such as a concrete floor "protected" by a floor covering, such as a ceramic covering.
The uniformly distributed load tests were carried out on 100x100 cm panels placed on a contrast surface (rigid support) according to the Ministerial Decree of 17 January 2018 for uniformly distributed vertical loads.



	Bonded RENOVA system	RENOVA ULTRA System
First cracking load	>320 kN/mm²	>7 kN/mm²
Maximum sustained load	>320 kN/mm²	>320 kN/mm²
Maximum deformation without cracking	>6 mm	~1 mm

Note: the limit of 320 kN/mm² corresponds to the physical limit of the machine used for the test in which, in the case of bonded RENOVA, corresponds to the deformation of 6 mm cited. At these values there was still no cracking.

Bending tests. The purpose of the test is to simulate the application of the RENOVA System on elastic sub-floor, such as a wooden floor in a renovation.
In the absence of a specific reference standard, the tests were carried out by uniformly imposing a load on 100x100 cm panels placed on two side support rails, in order to determine the values of uniformly distributed vertical loads and the related deflection.



	Bonded RENOVA system	RENOVA ULTRA System
First cracking load	>25 kN/mm²	~2,86 kN/mm²
Maximum sustained load	>70 kN/mm²	>34 kN/mm²
Maximum deformation without cracking	~6 mm	~0.35 mm

Note: this behaviour is related to a case in which the supports are 1 metre apart from each other, which is much more severe than a real situation.

Conclusions.
The Technical Construction Standards of the Ministerial Decree of 17th January 2018, paragraph 3.1.4 Variable Loads, define two different stresses acting on the floors of structures, variable loads, concentrated vertical loads Qk [kN] or uniformly distributed vertical loads qk [kN/m²], with limits from 2 to 7 depending on the intended uses, and permanent non-structural loads G2 with limits between 0.4 and 2 kN/m².
One can therefore say that, based on the values obtained, the samples are "compatible" with the minimum expected stresses specified by the law for an intended use up to Cat. D2 with regard to concentrated vertical loads Qk, and for any intended use with regard to evenly distributed vertical loads qk.

COUPLING TABLE		LOW-INERTIA RESIDENTIAL	
		PANELS	
		Renova	Renova ultra
PIPES	POLYSTOP BASIC multilayer pipe 14x2 mm	✗	✓
	POLYSTOP pipe 17x2 mm	✓	✗
	POLYSUPER PE-Xa 5-layer pipe 17x2 mm	!	✗
	POLYSUPER PE-Xa 5-layer pipe 20x2 mm	✗	✗
	POLYSUPER PE-Xa 5-layer pipe 25x2.3 mm	✗	✗
	POLYSTOP BASIC pipe 16x2 mm	!	✗
	POLYSUPER BASIC 5-layer pipe 17x2 mm	!	✗
MANIFOLDS	Tempower	✓	✓
	Stainless Steel	✓	✓
	Plastic 1”1/4 in packages	✓	✓
ACCESSORIES	Clips for 10-20-30 mm flat panels	✗	✗
	Clips for knob panels	✗	✗
	Adhesive clip rail	✗	✗
	Plastic nails 60 mm	✗	✗
	Nylon Zip ties	✗	✗
	Expansion edge strip H=150	✗	✓
	Expansion edge strip H=80	✓	✗
	Expansion edge strip H=250	✗	✗
	Polyethylene sheet 200 µm	✓	✓
	Expansion joint strip	!	!
	Anti-shrinkage metal mesh	✗	✗
	Synthetic fibres for screed	✗	✗
	FLUTERM additive	✗	✗
	Pair of fittings for designer radiators	✓	✓
	Pipe couplings	✓	✓
	1” nipple and pipe adaptors	✗	✗
	Corrosion inhibitor additive - biocide	✓	✓
	System cleaning additive	✓	✓

4. Residential systems

General information

The category of Residential Systems includes all traditional underfloor radiant systems with traditional 45-mm sand and cement screeds or calcium sulphate-based self-levelling screeds with a minimum thickness of 30 mm. Therefore, these are systems with standard thermal inertia.

These are the traditional systems for which the UNI EN 1264 standard was, in fact, written. Therefore, by following the directions, in particular those described in Part 4 dedicated to installation, one will obtain a proper system.

These systems can be realised with many different products, especially in terms of panels and pipes.
They can be distinguished by the type of panel used:

- **Flat panels:** greater thermal output;
- **Knob panels**: greater ease of installation;

Preliminary precautions

The traditional systems are all designed to realise floating floors; in this way, the conditions of the type of sub-floor are no longer important, provided, of course, that the sub-floor is able to support the weight of the system itself.

It is recommended that:

- The bearing area be dry. Especially in the case of a cellular cement screed, it is important that water in the screed be evaporated before proceeding to the installation of the radiant system. Otherwise, the structures are likely to retain moisture for a long time, with possible degradation of the materials of the structures themselves;
- The bearing area is flat. A screed of radiant floor covering of variable thickness leads to different response times, as well as increased cost, particularly in the case of a self-levelling screed.

Installation

In order to obtain a radiant system with the maximum performance, after taking the preliminary precautions listed above, it is necessary to follow this procedure:

- Install the expansion edge strip;
- Install the panel, starting from the side walls and connecting one panel to the other using the side fastening system provided (bonding the upper sheets, interlocking of the perimeter grooves, interlocking the male/female perimeter bosses;
- Install the pipe on the panel realising the circuits as per the installation diagram;
- Ensure that the panel is in contact with the sub-floor and secure it in the case of lifting;
- Perform the leak test;
- Evaluate and position the expansion joint strips according to the UNI 1264 standard and/or according to the screed manufacturer's instructions;
- Proceed to pour the screed to a suitable thickness above the pipe. For sand and cement screeds, respect the proper water/cement ratio of 0.55;
- Carry out screed heating tests as per UNI 1264 and/or as indicated by the screed supplier. In particular:
    - At least 21 days after the laying of sand and cement screeds;
    - At least 7 days after the laying of calcium sulphate-based screeds;
    - Maintain at 20 to 25 °C for at least 3 days, and then raise to the maximum design temperature, to be maintained for at least 4 days;
- Install the floor covering.

REFLEX ULTRA system

System based on the REFLEX ULTRA panel, a flat panel.

It can be used with any type of pipe, which is fixed to the panel with clips, at any installation centre distance.

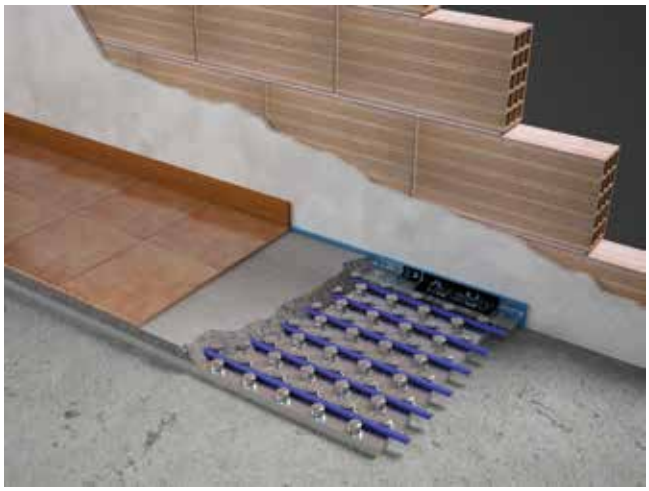
The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.

SIMPLE ULTRA system

System based on the SIMPLE ULTRA panel, a knob panel.

It can be used with any type of pipe, so long as with a diameter of 16 or 17 mm and also with a pipe of 20 mm diameter, though with a deformation of the surface sheet; the pipe is retained in position by the panel itself, with installation centre distances that are multiples of 5 cm.

The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.

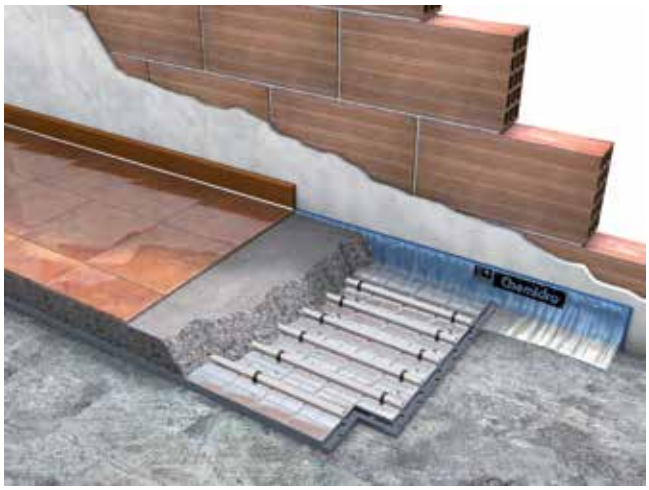


MASTER ULTRA system

System based on the MASTER ULTRA panel, a flat panel.

It can be used with any type of pipe, which is fixed to the panel with clips, at any installation centre distance.

The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.



SIMPLE WHITE system

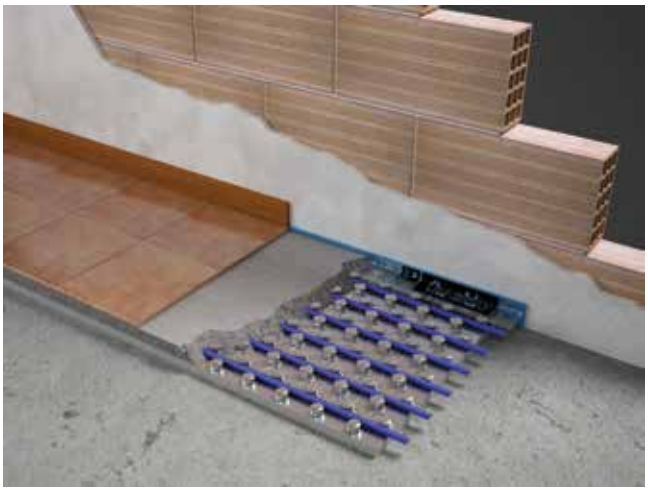
System based on the SIMPLE WHITE panel, a knob panel.

It can be used with any type of pipe, so long as with a diameter of 16 or 17 mm, which is retained in position by the panel itself, with installation centre distances that are multiples of 5 cm.
The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.

ACUSTIC ULTRA 30-2 system

System based on the ACUSTIC ULTRA 30-2 panel, a knob panel.
This system attenuates foot traffic noise.

It can be used with any type of pipe, so long as with a diameter of 16 or 17 mm and also with a pipe of 20 mm diameter, though with a deformation of the surface sheet; the pipe is retained in position by the panel itself, with installation centre distances that are multiples of 5 cm.
The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.



ROLLER - ROLLER ACUSTIC system

System based on the ROLLER and ROLLER ACUSTIC panels, flat panels.

It can be used with any type of pipe, which is fixed to the panel with clips, at any installation centre distance.
The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.

COMPACT BASIC system

System based on the COMPACT BASIC panel, a knob panel.

It can be used with any type of pipe, so long as with a diameter of 16 or 17 mm and also with a pipe of 20 mm diameter, though with a considerable deformation of the boss; the pipe is retained in position by the panel itself, with installation centre distances that are multiples of 5 cm.
The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.

SIMPLE-L system

System based on the SIMPLE-L panel, a knob panel.

It can be used with any type of pipe, so long as with a diameter of 16 or 17 mm and also with a pipe of 20 mm diameter, though with a deformation of the surface sheet; the pipe is retained in position by the panel itself, with installation centre distances that are multiples of 5 cm.
The support layer can be sand and cement, provided that FLUTERM® is added, and the minimum thickness over the pipe is 40 to 45 mm, or 30 to 35 mm calcium sulphate-based (as per DIN 18560-2 for screeds of flexural strength class F4, i.e., ≥4 N/mm2, laid on insulating layers of thickness lesser/greater than 40 mm, for vertical service loads ≤2 kN/m2).
It is necessary to provide the expansion edge strip and appropriate expansion joint strips.

COUPLING TABLE		RESIDENTIAL							
		PANELS							
		Reflex Ultra	Simple Ultra	Master Ultra	Roller / Roller Acustic	Simple White	Simple Acustic Ultra	Compact Basic	Simple-L
PIPES	POLYSTOP BASIC multilayer pipe 14x2 mm	✗	✗	✗	✗	✗	✗	✗	✗
	POLYSTOP pipe 17x2 mm	✓	✓	✓	✓	✓	✓	✓	✓
	POLYSUPER PE-Xa 5-layer pipe 17x2 mm	✓	✓	✓	✓	✓	✓	✓	✓
	POLYSUPER PE-Xa 5-layer pipe 20x2 mm	✓	!	✓	✓	!	!	!	!
	POLYSUPER PE-Xa 5-layer pipe 25x2.3 mm	✗	✗	✗	✗	✗	✗	✗	✗
	POLYSTOP BASIC pipe 16x2 mm	✓	✓	✓	✓	✓	✓	✓	✓
	POLYSUPER BASIC 5-layer pipe 17x2 mm	✓	✓	✓	✓	✓	✓	✓	✓
MANIFOLDS	Tempower	✓	✓	✓	✓	✓	✓	✓	✓
	Stainless Steel	✓	✓	✓	✓	✓	✓	✓	✓
	Plastic 1”1/4 in packages	✓	✓	✓	✓	✓	✓	✓	✓
ACCESSORIES	Clips for 10-20-30 mm flat panels	✓	✗	✓	✓	✗	✗	✗	✗
	Clips for knob panels	✗	✓	✗	✗	✓	✓	✓	✓
	Adhesive clip rail	✗	✗	✗	✗	✗	✗	✗	✗
	Plastic nails 60 mm	✗	✗	✗	✗	✗	✗	✗	✗
	Nylon Zip ties	✗	✗	✗	✗	✗	✗	✗	✗
	Expansion edge strip H=150	✓	✓	✓	✓	✓	✓	✓	✓
	Expansion edge strip H=80	✗	✗	✗	✗	✗	✗	✗	✗
	Expansion edge strip H=250	✗	✗	✗	✗	✗	✗	✗	✗
	Expansion joint strip	✓	✓	✓	✓	✓	✓	✓	✓
	Polyethylene sheet 200 µm	✓	✓	✓	✓	✓	✓	✓	✓
	Anti-shrinkage metal mesh	✓	✓	✓	✓	✓	✓	✓	✓
	Synthetic fibres for screed	✓	✓	✓	✓	✓	✓	✓	✓
	FLUTERM additive	✓	✓	✓	✓	✓	✓	✓	✓
	Metal inserts	✗	✗	✗	✗	✗	✗	✗	✗
	Galvanised steel sheet th. 1 mm	✗	✗	✗	✗	✗	✗	✗	✗
	Pair of fittings for designer radiators	✓	✓	✓	✓	✓	✓	✓	✓
	Pipe couplings	✓	✓	✓	✓	✓	✓	✓	✓
	1” nipple and pipe adaptors	✗	✗	✗	✗	✗	✗	✗	✗
	Corrosion inhibitor additive - biocide	✓	✓	✓	✓	✓	✓	✓	✓
	System cleaning additive	✓	✓	✓	✓	✓	✓	✓	✓

5. Industrial systems

INDUSTRIAL system

The underfloor system is by far the system that minimises energy consumption in high-rise buildings, including industrial buildings. This distinct advantage has led the popularity of this system in this type of building.

The INDUSTRIAL system is the system designed for this type of building and is designed to best exploit the characteristics typical of their screeds, generally concrete and characterised by the presence of one or more electro-welded meshes, depending on loads to be supported.

Industrial screeds are generally at least 150 mm thick, even reaching up to 250-300 mm in airplane hangars. Therefore, these are systems with very high thermal inertia. However, this is not a problem in buildings that normally must remain heated well over eight hours a day and that typically have thermal loads that hardly vary due to their high surface/perimeter ratio.

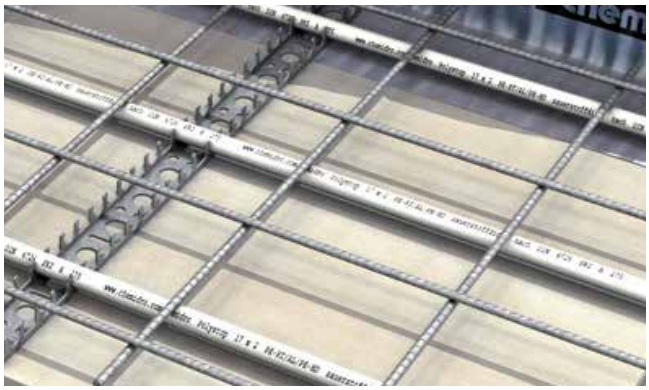
Preliminary precautions

This system is generally installed above a lean concrete subfloor. It is recommended to verify the height of the water table and to take precautions in the event of its rising.

Installation

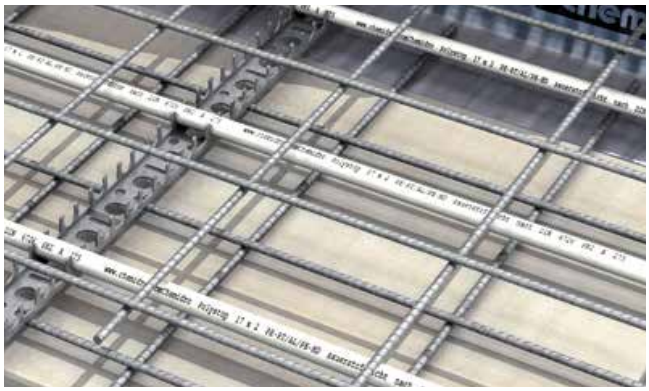
The industrial system can be realised in two ways, first as a flat system, the second (and preferred) by exploiting the presence of the electro-welded mesh.

- Install the expansion edge strip;
- If deemed appropriate, lay a sheet of polyethylene on the bottom to protect the insulating panel;
- Install the INDUSTRIAL panel starting from the side walls and bring the panels together by using the abutting edges;



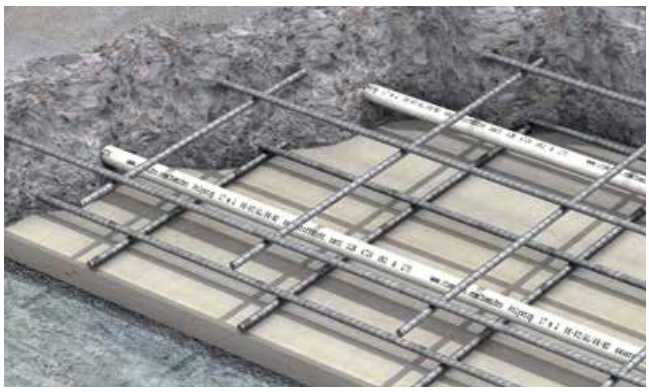
If you choose the **flat system** proceed as follows:

- Install clip rails every 200 cm; fix the bars to the INDUSTRIAL panel with the nails provided (3 per bar, one every 100 cm);
- Install the pipe, realising the circuits as per the installation diagram: the type of laying to use is "serpentine coil", with installation centre distances based on the diameter of the pipe and the consequent minimum radius of curvature (the most common type requires a centre distance of 200 mm with 20-mm pipe);
- Lay the (first) electro-welded mesh;
- Lay any other electro-welded meshes;



If you choose the **mesh system** proceed as follows:

- Lay the (first) electro-welded mesh;
- Above the electro-welded mesh, install clip rails every 500 cm; fix the bars to the mesh with suitable zip ties (3 as per bar, one every 100 cm);
- Install the pipe, realising the circuits as per the installation diagram: the type of laying to use is "serpentine coil", with installation centre distances based on the diameter of the pipe and the consequent minimum radius of curvature (the most common type requires a centre distance of 20 cm with 20-mm pipe); fix the pipe to the mesh with the zip ties provided, one every 100 cm, in order to avoid the pipe lifting during casting;
- Lay any other electro-welded meshes;

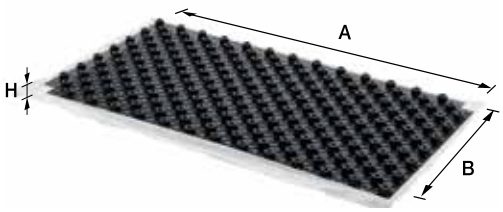


After installing the pipe, proceed with checks of the system, the casting of the screed and first start-up:

- Perform the leak test;
- Proceed to pour the concrete screed (be careful not to turn the pump sideways to the pipes to avoid pulling them).
- After spreading and levelling the screed, proceed to making structural cuts;
- Carry out screed heating tests per UNI 1264 and/or as indicated by the screed supplier.

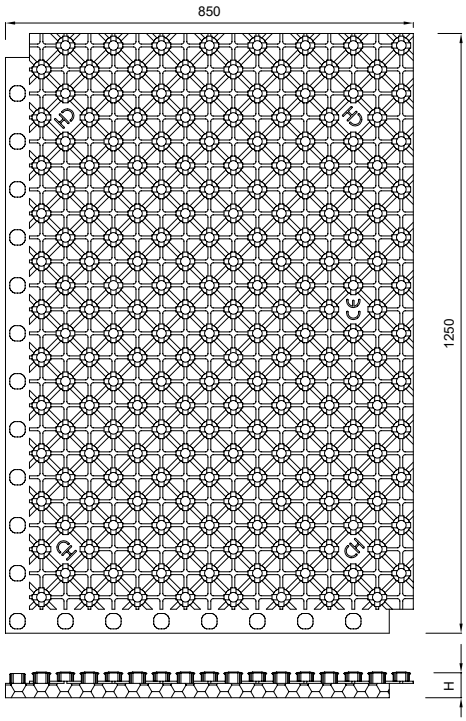
	COUPLING TABLE	INDUSTRIAL
		PANELS
		Industrial
PIPES	POLYSTOP BASIC multilayer pipe 14x2 mm	✗
	POLYSTOP pipe 17x2 mm	!
	POLYSUPER PE-Xa 5-layer pipe 17x2 mm	!
	POLYSUPER PE-Xa 5-layer pipe 20x2 mm	✓
	POLYSUPER PE-Xa 5-layer pipe 25x2.3 mm	✓
	POLYSTOP BASIC pipe 16x2 mm	✗
	POLYSUPER Basic 5-layer pipe 17x2 mm	✗
MANIFOLDS	Tempower	✗
	Stainless Steel	✗
	Plastic 1”1/4 in packages	✓
ACCESSORIES	Clips for 10-20-30 mm flat panels	✗
	Clips for knob panels	✗
	Adhesive clip rail	✓
	Plastic nails 60 mm	✓
	Nylon zip ties	✓
	Expansion edge strip H=150 mm	✗
	Expansion edge strip H=80 mm	✗
	Expansion edge strip H=250 mm	✓
	Expansion joint strip	✗
	Polyethylene sheet 200 µm	✓
	Anti-shrinkage mesh	✗
	Synthetic fibres for screed	✗
	FLUTERM additive	✗
	Metal inserts	✗
	Galvanised steel sheet th. 1 mm	✗
	Pair of fittings for designer radiators	✗
	Pipe couplings	✗
	1” nipple and pipe adaptors	✓
	Corrosion inhibitor additive - biocide	✓
	System cleaning additive	✓

6. Panels for underfloor systems



Registered Design No. 2056374

Dimensional drawing



RENOVA panel

Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 16 61	-	200		1200	800	22	0.96

Specifications

Panel RENOVA, composed of a rigid plastic sheet provided with special bosses that allow installations with special high modulus and high flexural strength screeds which allow reduced thickness above the pipe, obtaining systems particularly suitable for renovation; the lower part of the sheet is provided with an adhesive layer in order to apply the panel to the pre-existing layers of paving. The knob bosses are designed for use with DN17 mm pipes and suitable for installation centre distances that are multiple of 50 mm; suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels themselves.

Use

The RENOVA panel consists of a moulded rigid plastic sheet with special perforated bosses, and is designed to allow the installation of an underfloor radiant system with screed in buildings with low available thickness or where a low thermal inertia of the radiant system is required.

- The rigid covering sheet, with shaped bosses with special holes, allows the passage of the screed material inside the bosses themselves, allowing filling and thus obtaining a uniform thickness of the screed;
- The bosses, shaped with appropriate reinforcement lines, allow a high degree of compressive strength during installation;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the 17-mm pipe of the radiant system while ensuring it is held in position;

We recommend coupling with Polystop pipe in order to avoid tensions and possible lifting.
To be used with specific screeds, see pages 19, 22, 23.

Technical characteristics

Properties	Reference standard	Unit of Measure	Value
Material	EN 13165	-	-
Usable length	EN 822	mm	1200 ±7
Working width	EN 822	mm	800 ±5
Thickness (H)	EN 823	mm	22 ±2
Minimum insulation thickness	EN 823	mm	-
Compressive strength at 10% deformation	EN 826	kPa	≥ 200*

* Equivalent value for the rigid sheet compared to EPS bosses.

Installation

Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, with interlocking DN16 and 17
Pipe centre distance for installation	50 mm

RENOVA ULTRA panel

Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 16 64	EPS400	400	0.27	1400	800	20	1.12
10 16 65	EPS300	300	0.75	1400	800	35	1.12
10 16 66	EPS300	300	1.25	1400	800	50	1.12

Specifications

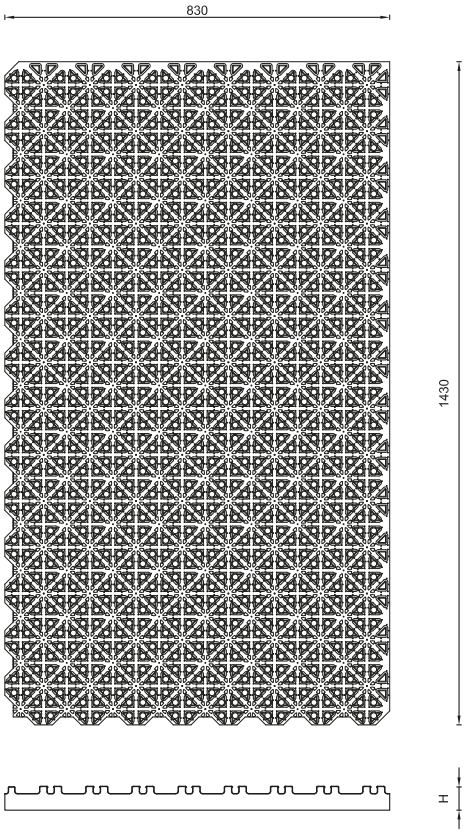
RENOVA ULTRA panel, composed of a rigid plastic sheet provided with special triangular bosses that allow the pipe to be installed diagonally, as well installations with special high elastic modulus screeds and high flexural strength screeds which allow reduced thickness above the pipe, obtaining systems particularly suitable for renovation; the lower part of the sheet is coupled with a graphite EPS back panel, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); the bosses are designed for use with DN14 mm pipes and suitable for pipe centre distances that are multiple of 50 mm; suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels and eliminating the possibility of formation of thermal bridges.

Use

The RENOVA ULTRA panel consists of a moulded rigid plastic sheet with special triangular bosses, and is designed to allow the installation of an underfloor radiant system with screed in buildings with low available thickness or where a low thermal inertia of the radiant system is required.

- The rigid sheet covering with moulded bosses allows for diagonal installation;
- The bosses, shaped with appropriate reinforcement lines, allow a high degree of compressive strength during installation;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the 14-mm pipe of the radiant system while ensuring it is held in position;
- The insulating material coupled to the panel is designed to ensure the mechanical resistance of the screed while, at the same time, meeting the thermal resistance requirements of the standard with minimum possible insulation thickness.
- To be used with specific screeds, see pages 21, 22, 23.

Dimensional drawing



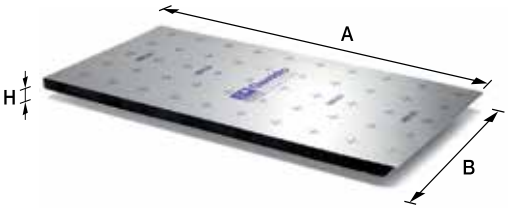
Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1400 ± 7
Working width	EN 822	mm	800 ± 5
Thickness (H)	EN 823	mm	20/35/50 ± 2
Minimum insulation thickness	EN 823	mm	5/20/35 ± 2
Compressive strength at 10% deformation	EN 826	kPa	400/300/300
Dimensional stability 23 °C, 50% R.H.	EN 1604	%	≤1
Water vapour resistance (μ)	EN 12086	-	100 - 160
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.031
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.27 /0.75/1.25
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		kg/m2	0.43/0.94/1.54

Installation

Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, interlocking DN14
Pipe centre distance for installation	50 mm

REFLEX ULTRA panel



Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
11 11 10	EPS 200	200	0.30	1000	500	10	0.50
11 11 23	EPS 200	200	0.75	1000	500	23	0.50
11 11 39	EPS 200	200	1.25	1000	500	39	0.50
11 11 46	EPS 200	200	1.50	1000	500	46	0.50

Specifications

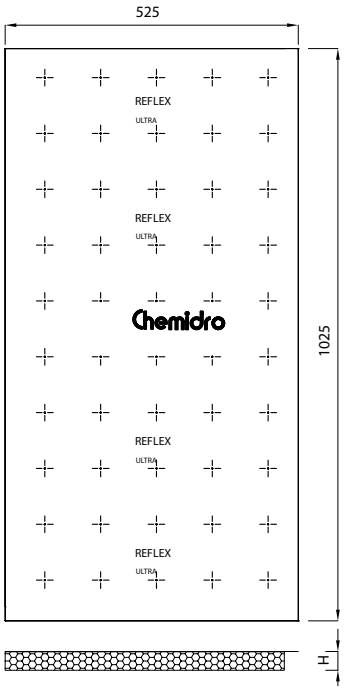
REFLEX ULTRA panel, made in the shape of a flat panel by coupling an aluminium sheet with a panel in graphite sintered polystyrene foam, CE marking according to UNI EN 13163 (for thicknesses equal to or exceeding 20mm), which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); the surface sheet, in special aluminium alloy with a thickness of 0.3 mm to allow the best heat diffusion, is provided with serigraphic guide to facilitate the operations of installation of the pipe; It is also equipped with two self-adhesive edges which allow a perfect coupling and alignment between the panels themselves eliminating any possibility of formation of thermal bridges.

Use

The REFLEX ULTRA panel consists of a flat sheet of EPS with graphite covered with an aluminium sheet, designed to offer an underfloor radiant system with the maximum performance.

- The aluminium covering provides the best heat distribution;
- The use of an EPS sheet allows obtaining panels with the minimum thermal conductivity possible for this material;
- The minimum conductivity, in combination with a production with exact thickness, allows having the minimum possible insulation thickness while meeting the thermal resistance requirements of the standard;
- The flat shape provides the pipe of the system the best contact with the screed and thus the highest thermal output.

Dimensional drawing

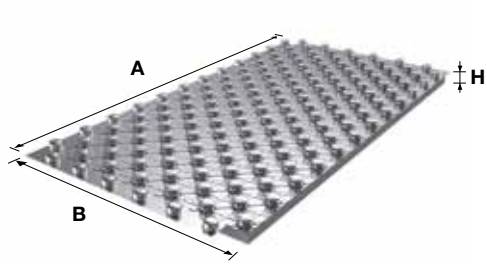


Technical characteristics

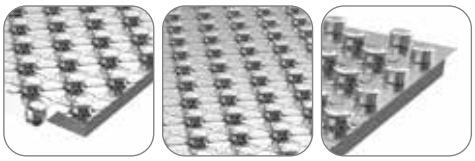
Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1000 ±6
Useful width	EN 822	mm	500 ±3
Thickness (H)	EN 823	mm	10/23/39/46 ±2
Minimum insulation thickness	EN 823	mm	10/23/39/46 ±2
Squareness	EN 824	mm/m	≤ 5
Compressive strength at 10% deformation	EN 826	kPa	≥ 200
Dimensional stability (test 23 °C, 50% RH)	EN 1603	%	≤ 0.5
Water vapour resistance (μ)	EN12086	-	40-100
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.031
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.30/0.75/1.25/1.50
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m2	0.30/0.69/1.17/1.38

Installation

Coupling	self-adhesive edge
Fastening of the pipes	with plastic clips
Pipe centre distance for installation	any (guides on the panel every 10 cm)



Registered Design No. 2056374



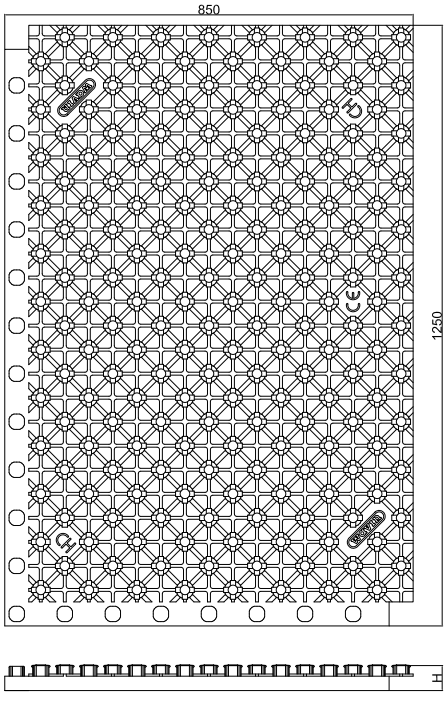
SIMPLE ULTRA panel

Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 16 71	EPS150	200	0.50	1200	800	32	0.98
10 16 72	EPS150	200	0.75	1200	800	39	0.98
10 16 74	EPS150	200	1.25	1200	800	54	0.96
10 16 75	EPS150	200	1.50	1200	800	61	0.96

Specifications

SIMPLE ULTRA **panel**, made of a rigid plastic sheet with bosses coupled with a panel in graphite sintered polystyrene foam, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); suitable for installation centre distances that are multiple of 50 mm; equipped with suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels themselves and eliminating any possibility of formation of thermal bridges.

Dimensional drawing



Use

The SIMPLE ULTRA **panel** consists of a moulded EPS sheet with bosses and covered with a rigid plastic protective film and is designed to offer maximum simplicity of installation of an underfloor radiant system.

- The rigid sheet covering allows a high degree of compressive strength;
- The use of an EPS sheet allows obtaining panels with the minimum thermal conductivity possible for this material;
- The minimum conductivity, in combination with a production with exact thickness, allows having the minimum possible insulation thickness while meeting the thermal resistance requirements of the standard;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the pipe of the system while ensuring it is held in position.

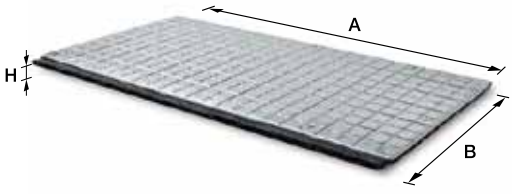
Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1200 ±7
Working width	EN 822	mm	800 ±5
Thickness (H)	EN 823	mm	32/39/54/61 ±2
Minimum insulation thickness	EN 823	mm	10/17/32/39 ±2
Squareness	EN 824	mm/m	≤ 2
Compressive strength at 10% deformation		kPa	≥ 150/200*
Dimensional stability (test 48h, 70 °C, 90% RH)	EN 1604	%	≤ 1
Water vapour resistance (μ)	EN12086	-	40 - 100
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.030
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.50/0.75/1.25/1.50
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m²	0.40/0.58/0.95/1.13

* The first value is that of the standard, referring only to the EPS. The second is the equivalent value for the bosses in EPS covered by the rigid sheet.

Installation

Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, with interlocking DN16 and 17, for deformation DN20
Pipe centre distance for installation	50 mm



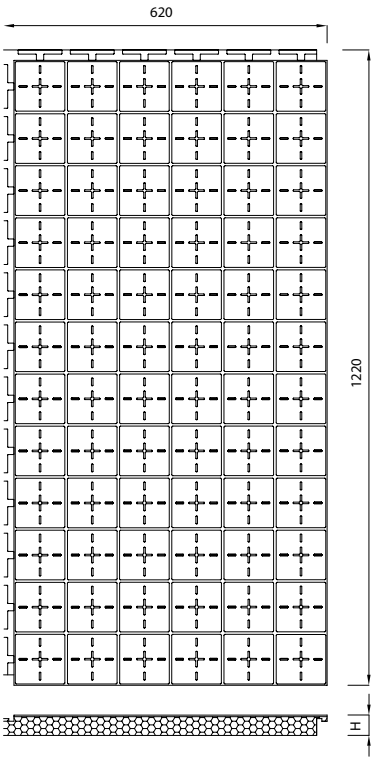
MASTER ULTRA panel

Code	Material	Comp. strength	Therm. Res. m^2K/W	A	B	H	Sur.
		10% kPa		mm	mm	mm	m^2
11 16 23	EPS 200	200	0.75	1200	600	23	0.72
11 16 39	EPS 200	200	1.25	1200	600	39	0.72

Specifications

MASTER ULTRA panel, manufactured in the shape of a flat panel produced by moulding sintered polystyrene foam with improved thermal conductivity, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); superficially provided with a robust polystyrene film with a thickness of 0.15 mm, hot bonded into a single uniform, compact structure, with surface marks for laying pipe and perimeter slots with complementary interlocking allow a perfect coupling and alignment between the panels themselves eliminating any possibility of formation of thermal bridges.

Dimensional drawing



Use

The MASTER ULTRA panel consists of a moulded EPS sheet with bosses and covered with a plastic protective film and is designed to offer high-performance underfloor radiant systems.

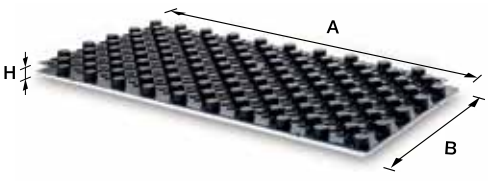
- The use of an EPS sheet allows obtaining panels with the minimum thermal conductivity possible for this material;
- The minimum conductivity, in combination with a production with exact thicknesses, allows having the minimum possible insulation thicknesses while meeting the thermal resistance requirements of the standard;
- The flat shape provides the pipe of the system the best contact with the screed and thus the highest thermal output.

Installation

Coupling	interlocking on the perimeter
Fastening of the pipes	with plastic clips
Pipe centre distance for installation	any (guides on the panel every 5 cm)

Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1200 ±7
Working width	EN 822	mm	600 ±4
Thickness (H)	EN 823	mm	23/39 ±2
Minimum insulation thickness	EN 823	mm	23/39 ±2
Squareness	EN 824	mm/m	≤ 5
Compressive strength at 10% deformation	EN 826	kPa	≥ 200
Dimensional stability (test 23 °C, 50% RH)	EN 1603	%	≤ 0.5
Water vapour resistance (μ)	EN12086	-	40-100
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.031
Declared thermal resistance (R_D)	EN 12667	m^2K/W	0.75/1.25
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m^2	0.69/1.17



SIMPLE SHEET panel

Code	Material	Comp. strength	Therm. Res. m^2K/W	A	B	H	Sur.
		10% kPa		mm	mm	mm	m^2
10 16 60	-	200	-	1200	800	22	0,96

Registered Design No. 2056374

Specifications

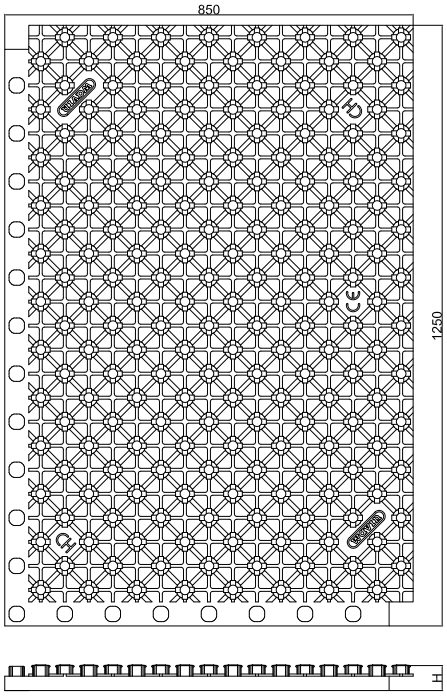
SIMPLE Panel, composed of a single rigid plastic sheet with bosses; suitable for installation of DN16 and 17 mm pipes, for centre distances that are multiple of 50 mm; suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels themselves.

Use

The SIMPLE panel consists of a rigid plastic sheet and is designed to offer maximum simplicity of installation of an underfloor radiant system.

- The rigid sheet covering allows a high degree of compressive strength;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the pipe of the system while ensuring it is held in position.

Dimensional drawing



Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	-
Usable length	EN 822	mm	1200 ±7
Working width	EN 822	mm	800 ±5
Thickness (H)	EN 823	mm	22/±2
Minimum insulation thickness	EN 823	mm	0/±2
Squareness	EN 824	mm/m	≤ 2
Compressive strength at 10% deformation		kPa	≥ 200*

* Equivalent value for the rigid sheet compared to EPS bosses.

Installation

Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, with interlocking DN16 and 17
Pipe centre distance for installation	50 mm

SIMPLE WHITE panel

Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 16 81	EPS150	200	0.40	1400	800	32	1.12
10 16 82	EPS150	200	0.75	1400	800	42	1.12
10 16 83	EPS150	200	0.95	1400	800	50	1.12
10 16 84	EPS150	200	1.25	1400	800	60	1.12

Specifications

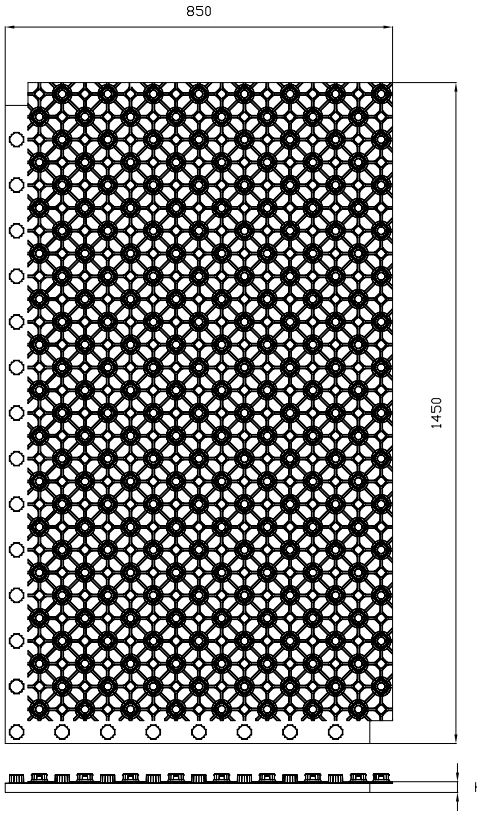
SIMPLE WHITE panel, made of a rigid plastic sheet with bosses coupled with a back panel in sintered polystyrene foam, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E, reaction to fire according to UNI EN 13501-1); suitable for installation centre distances that are multiple of 50 mm; equipped with suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels themselves and eliminating any possibility of formation of thermal bridges.

Use

SIMPLE WHITE panel consists of a moulded EPS sheet with bosses and covered with a rigid plastic protective sheet and is designed to offer high simplicity of installation of an underfloor radiant system.

- The rigid sheet covering allows a high degree of compressive strength;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the pipe of the system while ensuring it is held in position.

Dimensional drawing



Technical characteristics

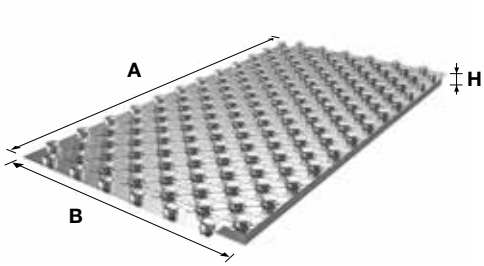
Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1400 ±7
Useful width	EN 822	mm	800 ±5
Thickness (H)	EN 823	mm	32/42/50/60 ±2
Minimum insulation thickness	EN 823	mm	10/20/28/38 ±2
Squareness	EN 824	mm/m	≤ 5
Compressive strength at 10% deformation		kPa	≥ 150/200*
Dimensional stability (test 48h, 70 °C, 90% RH)	EN 1604	%	≤ 1
Water vapour resistance (μ)	EN 12086	-	30 - 70
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.034
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.40/0.75/0.95/1.25
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m²	0.36/0.61/0.81/1.06

* The first value is that of the standard, referring only to the EPS. The second is the equivalent value for the bosses in EPS covered by the rigid sheet.

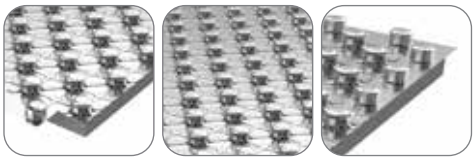
Installation

Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, with interlocking DN16 and 17
Pipe centre distance for installation	50 mm

ACUSTIC ULTRA panel



Registered Design No. 2056374



Code	Material	Acoustic characteristics	Therm. Res.	A	B	H	Sur.
			m²K/W	mm	mm	mm	m²
10 16 73	EPS-T+EPS	SD20-CP2	1.15	1200	800	52	0.96

Specifications

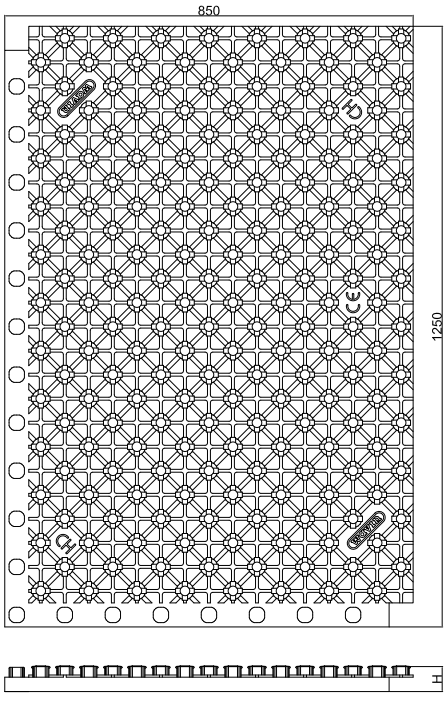
ACUSTIC ULTRA 30-2 panel, made of a rigid plastic sheet with bosses coupled with a back panel in sintered expanded and elastic polystyrene, both with addition of graphite, with a dynamic stiffness class SD20 (dynamic stiffness not exceeding 20 MN/m³) and compressibility class CP2, CE marking according to UNI EN 13163, which ensures the mechanical, thermal and acoustic characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); suitable for installation centre distances that are multiple of 50 mm; equipped with suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels themselves and eliminating any possibility of formation of thermal bridges.

Use

The ACUSTIC ULTRA 30-2 panel consists of a double-density moulded EPS sheet with bosses and covered with a rigid plastic protective sheet and is designed to offer high simplicity of installation of an underfloor radiant system combined with foot traffic noise attenuation.

- The rigid sheet covering with shaped bosses on the perimeter allows an optimal fit between panels, minimising the risk of formation of acoustic bridges;
- The use of a denser EPS in the upper part, that for filling the bosses, provides panels with good compressive strength during installation of the system;
- The use of low-density EPS-T in the lower part of the panel allows obtaining panels with foot traffic-noise attenuation properties;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the pipe of the system while ensuring it is held in position.

Dimensional drawing



Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS-T + EPS
Usable length	EN 822	mm	1200 ±7
working width	EN 822	mm	800 ±5
Thickness (H)	EN 823	mm	52 ±2
Minimum insulation thickness	EN 823	mm	30 ±2
Squareness	EN 824	mm/m	≤ 2
Dynamic stiffness	EN 29052-1	MN/m³	≤ 20 (SD20)
Compressibility	EN 12431	mm	≤ 2 (CP2)
Dimensional stability (test 23 °C, 50% RH)	EN 1603	%	≤ 0.2
Water vapour resistance (μ)	EN 12086	-	20-40/40-100
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.030
Declared thermal resistance (R_D)	EN 12667	m²K/W	1.15
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m²	0.65

Installation

Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, with interlocking DN16 and 17, for deformation DN20
Pipe centre distance for installation	50 mm

Legislation

Framework Law No. 447/1995 defines the fundamental principles for the protection of external and residential environments from noise pollution, and considers four types of noise: airborne, façade, foot traffic and systems. Therefore, in designing an underfloor radiant system, it is of fundamental importance to consider materials that allow compliance with the foot traffic noise levels established by the DPCM (Decree of the President of the Council of Ministers) of 5 December 1997, whose limits are listed below.

CLASSIFICATION OF RESIDENTIAL ENVIRONMENTS and PASSIVE ACOUSTIC REQUIREMENTS ACCORDING TO the DPCM of 5 December 1997		Index of the foot traffic noise level of floors (measured on site) L'n,w
Category A	residential buildings and similar	63
Category B	office buildings and similar	55
Category C	buildings used as hotels, guest houses and similar businesses	63
Category D	hospitals, outpatient clinics, nursing homes and similar	58
Category E	schools of all levels and similar	58
Category F	recreational or religious buildings and similar	55
Category G	commercial buildings and similar	55

Forecast calculation of the index of attenuation of the sound pressure level of foot traffic

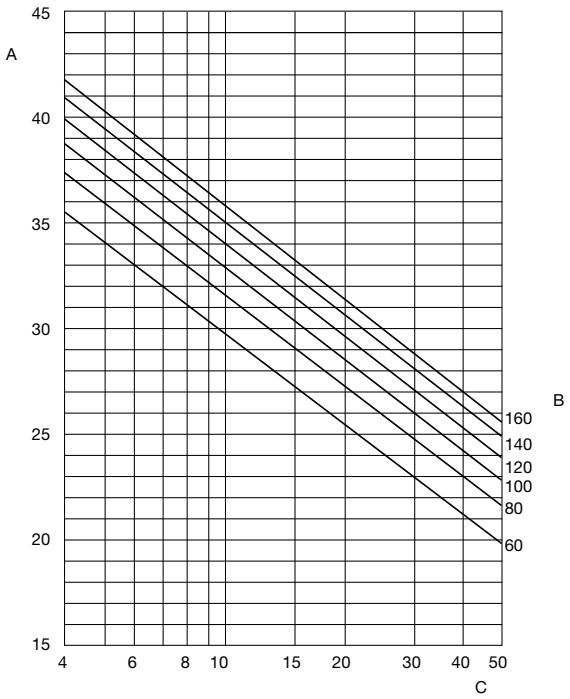
The use of floating floors with foot traffic sound pressure abatement properties is defined by the UNI EN 12354-2:2002 standard. This standard establishes that the use of a panel with acoustic characteristics varies its foot traffic abatement power based on the mass that is placed above the panel itself.

Below is an extract of the standard that shows the variation of acoustic performance based on the surface mass placed above the panel.

"Index of attenuation of the sound pressure level of foot traffic, ΔLw, of floating floors" .

The evaluation index of the attenuation of the sound pressure level of foot traffic, ΔLw, depends on the mass per unit area, m', of the floating floor and the dynamic stiffness per unit area, s', of the resilient layer, as per EN 29052-1"Acoustics - Determination of dynamics stiffness - Materials used under floating floors in dwellings", measured without any pre-load.

- For floating floors of concrete sand or calcium sulphate, the values can be deducted from Figure C.1 of UNI EN12354-2:2002, shown below.



Legend:

A. Evaluation index of the attenuation of the sound pressure level, ΔLw, in dB

B. Mass per unit of area of the floating floor, in kg/m²

C. Dynamic stiffness per unit area, s', of the resilient layer, in MN/m³

Noise diffusion
Common airborne noise is absorbed by the air and is reduced as a function of the distance from the source.
Foot traffic or classic impact noise (a glass shattering on the floor) is transmitted to neighbouring rooms by horizontal and vertical structures and is a function of the building structure.

Given the complexity and diversity of each structure in which one may operate, the mass-spring-mass model is used and the concept of floating floor is introduced.
In this model the screed of the floor (mass) is decoupled from the underlying structure because it rests on the ACUSTIC ULTRA 30-2 panel with certain damping characteristics (spring) and does not transmit sound vibrations to the underlying structure (mass).

Installation recommendations
The panels must be perfectly interlocked with each other to create a uniform plane without thermal and acoustic bridges; the panel must be placed on a smooth and clean sub-floor, and must be supported at the perimeter strip; in the vicinity of French doors and entry doors, it may be necessary to finish with a sealant between frame and panel.

Special care must be taken in realising the screed to avoid any contact with the surrounding walls, as this would inevitably create acoustic bridges that would become a preferred route for the passage of sound vibrations through the structure.

Acoustic performance of the ACUSTIC ULTRA 30-2 panel
The ACUSTIC ULTRA 30-2 panel has a dynamic stiffness class of SD20 (dynamic stiffness ≤ 20 MN/m^3) and a compressibility class CP2 (the best among those established in EN 13163).

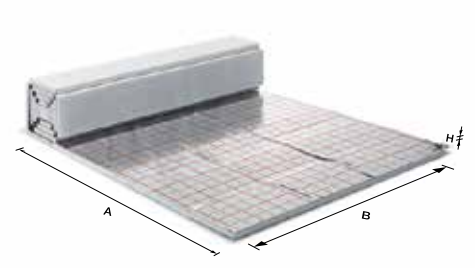
Dynamic stiffness describes the elastic and damping properties of a material, can be related to the acoustic energy introduced into the environment and depends on the thickness of the material. This value can be used for the forecast calculation of the sound pressure level from foot traffic of an individual space.
The compressibility class represents the material's ability to maintain its properties over time when subjected to a load and guarantees durability and physical characteristics over time.

Note that with, a dynamic stiffness class of SD20, you can obtain the following levels of foot traffic sound pressure reduction:

Surface mass* (kg/m^2)	Forecast foot traffic attenuation level (dB)
90	28
110	29
130	30

*The surface mass equals the mass of the screed placed above the panel per square metre. Indicatively, for a screed of 2000 kg/m3, the surface mass is, respectively, 50, 65 and 80 mm screed above the panel.

ROLLER panel



Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 17 20	EPS 150	150	0.55	10000	1000	20	10.00
10 17 30	EPS 150	150	0.85	10000	1000	30	10.00
10 17 40	EPS 150	150	1.15	10000	1000	40	10.00

Specifications

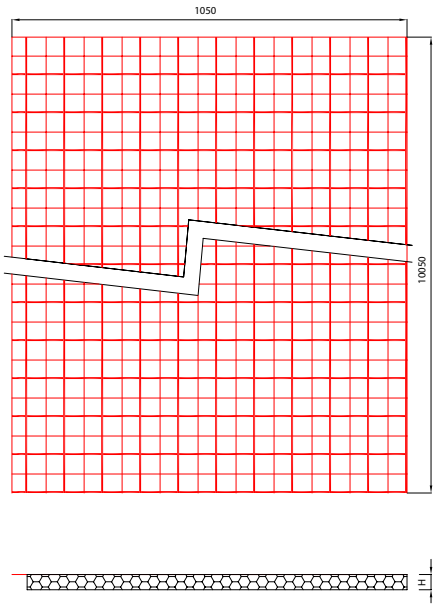
ROLLER Panel, produced in rolls consisting of flat panels in moulded-sintered expanded polystyrene, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); with a non-woven surface sheet provided with a self-adhesive edge, coupled as a single, uniform and compact structure, marked with pipe guide lines to facilitate pipe laying.

Use

The ROLLER panel consists of a series of flat sheets in EPS covered with a plastic protective film and rolled, and is designed to offer a practical solution for the installation of an underfloor radiant system in spaces with large surfaces.

- The rolled form allows to have a panel with large surface area in a small space, easy to transport and simple to install by unrolling the panel itself;
- The flat shape provides the pipe of the system the best contact with the screed and thus the highest thermal output.

Dimensional drawing



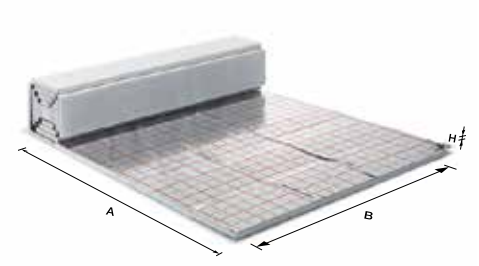
Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	10000 ±60
Working width	EN 822	mm	1000 ±6
Thickness (H)	EN 823	mm	20/30/40 ±2
Minimum insulation thickness	EN 823	mm	20/30/40 ±2
Squareness	EN 824	mm/m	≤ 2
Compressive strength at 10% deformation	EN 826	kPa	≥ 150
Dimensional stability (test 48h, 70 °C, 90% RH)	EN 1604	%	≤ 1
Water vapour resistance (μ)	EN 12086	-	40-100
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.035
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.55/0.85/1.15
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m²	0.50/0.75/1.00

Installation

Coupling	self-adhesive edge
Fastening of the pipes	with plastic clips
Pipe laying form	any (guides on the panel every 5 cm)

ROLLER ACUSTIC panel



Code	Material	Acoustic characteristics	Therm. Res.	A	B	H	Sur.
			m^2K/W	mm	mm	mm	m^2
10 17 21	ESP-T	SD30-CP2	0.50	10000	1000	20	10.00
10 17 31	ESP-T	SD20-CP2	0.75	10000	1000	30	10.00
10 17 41	ESP-T	SD15-CP2	1.00	10000	1000	40	10.00

Specifications

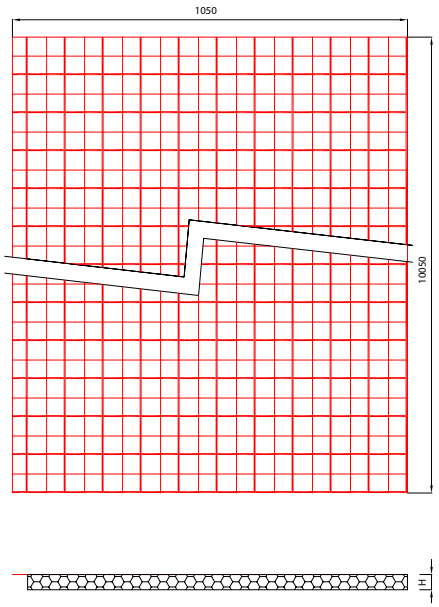
Roller Acustic Panel, produced in rolls consisting of flat panels in moulded-sintered expanded polystyrene, dynamic stiffness class SD15/20/30 (dynamic stiffness not exceeding 15/20/20 MN/m³) depending on thickness and compressibility CP2, CE marking according to UNI EN 13163, which ensures the mechanical, thermal and acoustic characteristics, free from recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); with a non-woven surface sheet provided with a self-adhesive edge coupled as a single, uniform and compact structure, marked with pipe guide lines to facilitate pipe laying. Only the rigid plastic sheet with bosses is also available.

Use

The ROLLER ACUSTIC panel consists of a series of flat sheets in EPS covered with a plastic protective film and rolled, and is designed to offer a practical solution for the installation of an underfloor radiant system in spaces with large surfaces.

- The rolled form allows to have a panel with large surface area in a small space, easy to transport and simple to install by unrolling the panel itself;
- The use of low-density EPS-T allows obtaining panels with foot traffic-noise attenuation properties;
- The flat shape provides the pipe of the system the best contact with the screed and thus the highest thermal output.

Dimensional drawing



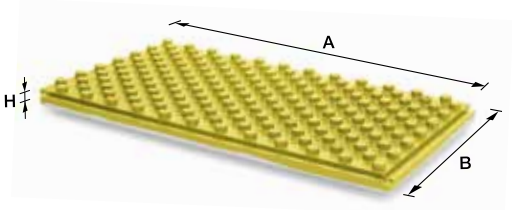
Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS-T
Usable length	EN 822	mm	10000 ±60
Working width	EN 822	mm	1000 ±6
Thickness (H)	EN 823	mm	20/30/40 ±2
Minimum insulation thickness	EN 823	mm	20/30/40 ±2
Squareness	EN 824	mm/m	≤ 2
Dynamic stiffness	EN 29052-1	MN/m^3	≤ 15 (SD15)/ ≤ 20 (SD20)/ ≤ 30 (SD30)/
Compressibility	EN 12431	mm	≤ 2 (CP2)
Dimensional stability (test 23 °C, 50% RH)	EN 1604	%	≤ 0.2
Water vapour resistance (μ)	EN 12086	-	20-40
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.040
Declared thermal resistance (R_D)	EN 12667	m^2K/W	0.50/0.75/1.00
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m^2	0.20/0.30/0.40

Installation

Coupling	self-adhesive edge
Fastening of the pipes	with plastic clips
Pipe laying form	any (guides on the panel every 5 cm)

COMPACT BASIC panel

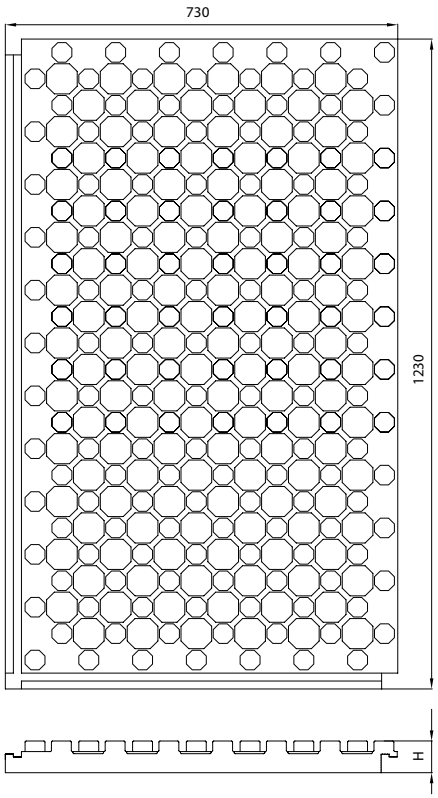


Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
11 12 35S	EPS 200	200	0.55	1200	700	35	0.84
11 12 45S	EPS 200	200	0.75	1200	700	45	0.84
11 12 60S	EPS 200	200	1.25	1200	700	60	0.84

Specifications

COMPACT BASIC panel, with knob surface bosses produced by moulding sintered expanded polystyrene, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); superficially provided with a polystyrene film, hot bonded into a single uniform, compact structure; the bosses have octagonal shape, elongated and flared to facilitate insertion and clamping of the pipe, allowed centre distances for pipe installation are multiple of 50 mm; perimeter slots with complementary interlocking allow a perfect coupling and alignment between the panels themselves eliminating any possibility of formation of thermal bridges.

Dimensional drawing



Use

The COMPACT BASIC panel consists of moulded EPS with knob bosses and covered with a plastic protective film and is designed to offer an efficient, streamlined solution to modern construction relating to the installation of underfloor radiant systems.

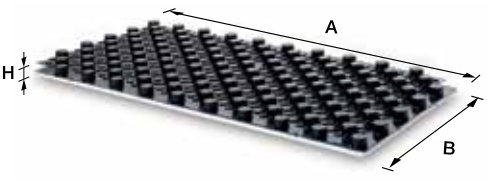
- The octagonal-shaped bosses, widened and flared, makes it easier the insertion of the pipe of the system.

Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1200 ±7
Working width	EN 822	mm	700 ±4
Thickness (H)	EN 823	mm	35/45/60 ±2
Minimum insulation thickness	EN 823	mm	11/21/36 ±2
Squareness	EN 824	mm/m	≤ 2
Compressive strength at 10% deformation	EN 826	kPa	≥ 200
Dimensional stability (test 48h, 70 °C, 90% RH)	EN 1604	%	≤ 1
Water vapour resistance (μ)	EN 12086	-	40-100
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.035
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.55 /0.75/1.25
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m²	0.60/0.81/1.32

Installation

Coupling	interlocking on the perimeter
Fastening of the pipes	on knobs, with interlocking DN16, 17 and 20
Pipe centre distance for installation	50 mm



Registered Design No. 2056374

SIMPLE-L panel

Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 16 41L	EPS 100	150	0.40	1200	800	32	0.96
10 16 46L	EPS 100	150	0.70	1200	800	42	0.96
10 16 47L	EPS 100	150	0.90	1200	800	50	0.96
10 16 48L	EPS 100	150	1.10	1200	800	57	0.96

Specifications

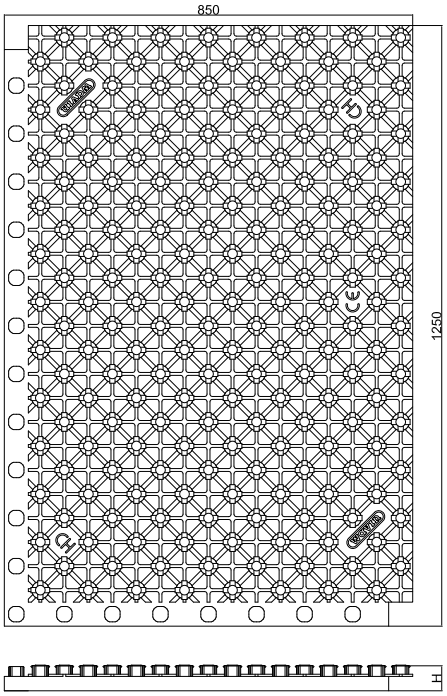
SIMPLE-L panel, made of a rigid plastic sheet with bosses, coupled with a back panel in sintered expanded polystyrene with improved thermal conductivity, CE marking according to UNI EN 13163, which ensures the mechanical and thermal resistance characteristics, free of recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501-1); suitable for installation centre distances that are multiple of 50 mm; equipped with suitably dimensioned perimeter bosses to allow a rigid connection by overlapping the panel's sides, ensuring a perfect coupling and alignment between the panels themselves and eliminating any possibility of formation of thermal bridges.

Use

The SIMPLE-L panel consists of a moulded EPS sheet with knob surface bosses, covered with a rigid plastic protective film; it is designed to offer an efficient, streamlined solution to modern construction relating to the installation of underfloor radiant systems.

- The rigid sheet covering allows a good degree of compressive strength;
- The bosses, shaped with appropriate finger grip clips, allow an easy insertion of the pipe of the system while ensuring it is held in position.

Dimensional drawing



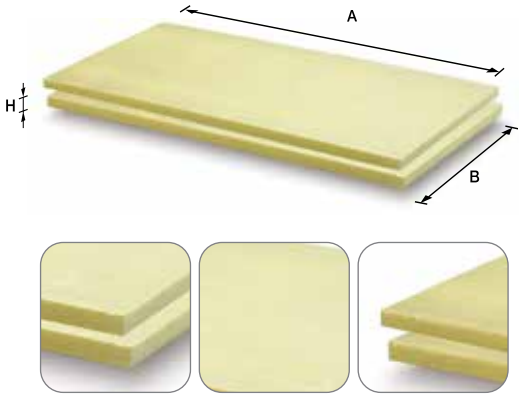
Technical characteristics

Properties	Reference Standard	Unit of Measure	Value
Material	EN 13163	-	EPS
Usable length	EN 822	mm	1200 ±7
Working width	EN 822	mm	800 ±5
Thickness (H)	EN 823	mm	32/42/50/57 ±2
Minimum insulation thickness	EN 823	mm	10/20/28/35 ±2
Squareness	EN 824	mm/m	≤ 2
Compressive strength at 10% deformation	EN 826	kPa	≥ 100/150*
Dimensional stability (test 48h, 70 °C, 90% RH)	EN 1604	%	≤ 1
Water vapour resistance (μ)	EN 12086	-	30-70
Declared thermal conductivity (λ_D)	EN 12667	W/mK	0.036
Declared thermal resistance (R_D)	EN 12667	m²K/W	0.40/0.70/0.90/1.10
Reaction to fire	UNI EN 13501-1	Euroclass	E
Thermal capacity	EN 10456	kJ/kgK	1.45
Surface mass		Kg/m²	0.29/0.50/0.65/0.79

* The first value is that of the standard, referring only to the EPS. The second is the equivalent value for the bosses in EPS covered by the rigid sheet.

Installation

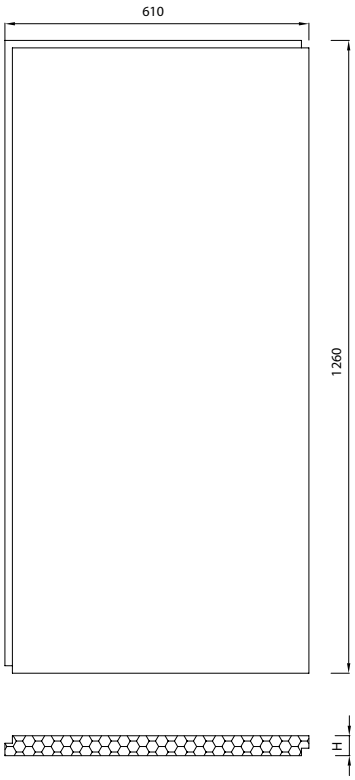
Coupling	interlocking with the first row of perimeter bosses
Fastening of the pipes	on knobs, with inter-locking DN16 and 17, for deformation DN20
Pipe centre distance for installation	50 mm



INDUSTRIAL panel

Code	Material	Comp. strength	Therm. Res.	A	B	H	Sur.
		10% kPa	m²K/W	mm	mm	mm	m²
10 18 22	XPS250	250	0.60	1250	600	20	0.75
10 18 33	XPS300	300	0.90	1250	600	30	0.75
10 18 43	XPS300	300	1.20	1250	600	40	0.75
10 18 53	XPS300	300	1.50	1250	600	50	0.75
10 18 63	XPS300	300	1.80	1250	600	60	0.75
10 18 83	XPS300	300	2.25	1250	600	80	0.75
10 18 A3	XPS300	300	2.80	1250	600	100	0.75
10 18 45	XPS500	500	1.20	1250	600	40	0.75
10 18 55	XPS500	500	1.50	1250	600	50	0.75
10 18 65	XPS500	500	1.80	1250	600	60	0.75
10 18 85	XPS500	500	2.25	1250	600	80	0.75
10 18 A5	XPS500	500	2.80	1250	600	100	0.75
10 18 57	XPS700	700	1.50	1250	600	50	0.75
10 18 67	XPS700	700	1.80	1250	600	60	0.75
10 18 87	XPS700	700	2.25	1250	600	80	0.75
10 18 A7	XPS700	700	2.80	1250	600	100	0.75

Dimensional drawing



Specifications

INDUSTRIAL panel, consisting of a flat panel in extruded polystyrene (XPS), CE marking according to UNI EN 13164, which ensures the mechanical and thermal resistance characteristics, free from recycled and Freon gas, flame propagation delay (Euroclass E reaction to fire according to UNI EN 13501); smooth surface coated with extrusion skin to guarantee waterproofing properties; thicknesses greater than 20 mm have an "L" shaping on the four edges, to allow the overlap of the panels and reduce the formation of thermal bridges.

Use

The INDUSTRIAL panel is made from a flat-extruded sheet of XPS covered on both sides by an impermeable protection film, and is designed to offer an effective solution for the installation of underfloor radiant systems in industrial buildings and large non-residential surfaces in general.

- The use of a high-density XPS allows obtaining panels with a low thermal conductivity but a high degree of compressive strength;
- The impermeable protective film allows the panel to be installed even in contact with the bottom lean concrete of the building;
- The flat shape provides the pipe of the system the best contact with the screed and thus the highest thermal output.

Technical characteristics

Properties	Reference Standard	Unit of Measure	XPS 250	XPS300	XPS500	XPS700
Material	EN 13164	-	XPS	XPS	XPS	XPS
Usable length	EN 822	mm	1250 ±10	1250 ±10	1250 ±10	1250 ±10
Working width	EN 822	mm	600 ±8	600 ±8	600 ±8	600 ±8
Thickness (H)	EN 823	mm	20 ± 2	30/40/50/60/80/100 ± 2	40/50/60/80/100 ± 2	50/60/80/100 ± 2
Minimum insulation thickness	EN 823	mm	20 ± 2	30/40/50/60/80/100 ± 2	40/50/60/80/100 ± 2	50/60/80/100 ± 2
Squareness	EN 824	mm	≤ 5	≤ 5	≤ 5	≤ 5
Compressive strength at 10% deformation	EN 826	kPa	250	300	500	700
Compression load for continuous stress	EN 1606	kPa	130	130	180	250
Dimensional stability (test 48h, 70 °C, 90% RH)	EN 1604	%	≤5	≤5	≤5	≤5
Water vapour resistance (μ)	EN 12086	-	≥ 150	≥ 150	≥ 150	≥ 150
Declared thermal conductivity $(\lambda)_D$	EN 12667	W/mK	0.033	0.034 30÷60 0.036 80÷100	0.034 40÷60 0.036 80÷100	0.034 50÷60 0.036 80÷100
Declared thermal resistance $(R)_D$	EN 12667	m^2K/W	0.60	0.90/1.20/1.50/ 1.80/2.25/2.80	1.20/1.50/1.80/ 2.25/2.80	1.50/1.80/ 2.25/2.80
Reaction to fire	UNI EN 13501-1	Euroclass	E	E	E	E
Thermal capacity	EN 10456	kJ/kgK	1.45	1.45	1.45	1.45
Surface mass		Kg/m^2	0.70	1.20/1.60/2.00/ 2.40/3.20/4.00	2.40/3.00/3.60/ 4.80/6.00	4.00/4.80/ 6.40/8.00

Installation

Coupling	by juxtaposition of shaped edges
Fastening of the pipes	on electro-welded mesh or clip rails
Pipe centre distance for installation	any (centre distance for bars 50 mm)

7. Pipes for underfloor systems

POLYSTOP pipe

Code	Material	Diameter	Thickness	Length
		mm	mm	mm
10 20 17	PE-RT (II) / Al / PE-RT (II)	17	2.0	100
10 25 17	PE-RT (II) / Al / PE-RT (II)	17	2.0	200
10 27 17	PE-RT (II) / Al / PE-RT (II)	17	2.0	500

Specifications

Multilayer PE-RT type II polyethylene pipe, characterised by high plasticity and resistance to high temperatures, produced in conformity with ISO 21003 (Class 4/8 bar according to ISO EN 10508). The intermediate aluminium layer is a total barrier to the oxygen absorption, and the PE-RT type II polyethylene outer pipe is particularly resistant to abrasions and to UV-rays.

Use

POLYSTOP pipe is a multilayer pipe of diameter 17 mm made from an inner layer of second-generation PE-RT (polyethylene for high temperatures type II), an intermediate layer in a particularly soft aluminium alloy designed specifically for radiant system pipes and an external protective layer of second-generation PE-RT, layers joined together by two additional layers of adhesive.
The pipe thus obtained is a particularly suitable pipe for underfloor heating systems because:

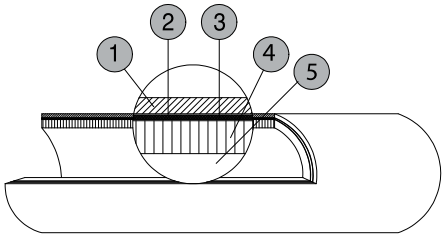
- It has all the low expansion and corrosion prevention characteristics of a multilayer pipe;
- The second-generation PE-RT (type II) is a particularly durable product especially at the typical temperatures of radiant systems;
- The use of PE-RT and a soft aluminium alloy allows an extremely easy installation of the pipe;
- The presence of the aluminium layer allows the installed pipe to maintain its position and to minimise the tensions on the bottom panel, which makes the pipe particularly suitable in the case of low-thickness panels.

Technical characteristics

Properties	Unit of Measure	Value
Material	ISO 21003	Multilayer
External diameter	mm	17
Internal diameter	mm	13
Aluminium pipe thickness	mm	0.2
Linear expandion coefficient	mm/mK	0.023
Thermal conductivity	W/mK	0.41
Application class ISO 10508	-	Class*4/ 8 bar
Internal surface roughness	mm	0.007
Minimum radius of curvature	mm	85
Water content	l/m	0.133
Weight	kg/m	0.133
Colour	-	sky-blue

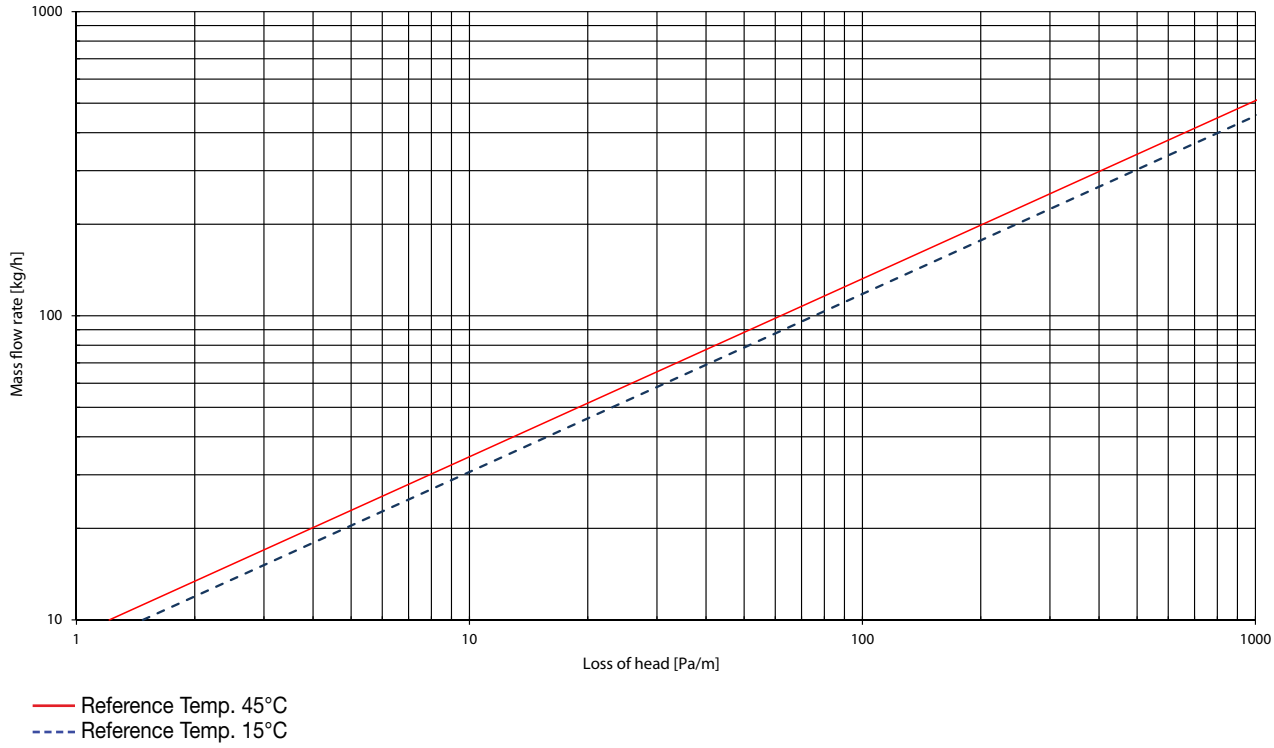
*Class 4= 60 °C/25 years + 40 °C/20 years + 20 °C /2.5 years + 70 °C/2.5 years + 100 °C/100 hours

Section



- Outer pipe in PE-RT type II
- Adhesive layer
- Aluminium intermediate layer (soft alloy)
- Adhesive layer
- Inner pipe in PE-RT type II

Pressure drop - flow rate diagram



POLYSUPER PE-Xa 5-LAYER pipe

Code	Material	Diameter	Thickness	Length
		mm	mm	mm
11 20 17	PE-Xa / EVOH / PE-RT (II)	17	2.0	100
11 28 17	PE-Xa / EVOH / PE-RT (II)	17	2.0	200
11 29 17	PE-Xa / EVOH / PE-RT (II)	17	2.0	500
11 29 20	PE-Xa / EVOH / PE-RT (II)	20	2.0	500
11 28 25	PE-Xa / EVOH / PE-RT (II)	25	2.3	300

Specifications

PE-Xa stabilized polyethylene 5-layer pipe, cross-linked by means of high pressure peroxide, manufactured according to EN ISO 15875 (application class 4/8 bar, according to ISO 10508). The intermediate layer is an EVOH oxygen barrier.

Use

POLYSUPER pipe is a 17-mm diameter pipe, but also available in 20 and 25 mm, consisting of an inner layer of PE-Xa, type A cross-linked polyethylene, an intermediate layer consisting of an EVOH oxygen barrier and an outer protective layer of second-generation PE-RT, the layers being bonded together by two additional layers of adhesive.
The pipe thus obtained is a particularly suitable pipe for underfloor heating systems because:

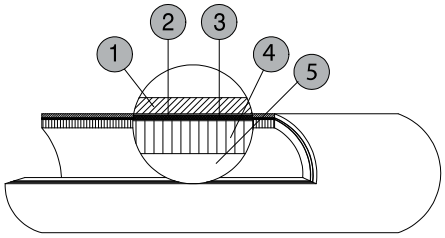
- The particular 5-layer construction allows the protection of the oxygen barrier that, not being outside, cannot therefore be damaged during job-site operations;
- PE-Xa is a particularly durable product especially at the typical temperatures of radiant systems;
- The use of PE-Xa allows easy installation of the pipe, especially when compared to other types of cross-linked polyethylene pipes.

Technical characteristics

Properties	Unit of Measure	Value
Material	ISO 15875	PE-Xa
External diameter	mm	17/20/25
Internal diameter	mm	13/16/20.4
Linear expansion coefficient	mm/mK	0.14
Thermal conductivity	W/mK	0.35
Application class ISO 10508	-	Class*4/ 8 bar
Dimensional class EN ISO 15875	-	C/C/A
Internal surface roughness	mm	0.007
Minimum radius of curvature	mm	85/100/125
Water content	l/m	0.133/0.200/0.327
Weight	kg/m	0.096/0.110/0.160
Colour	-	white

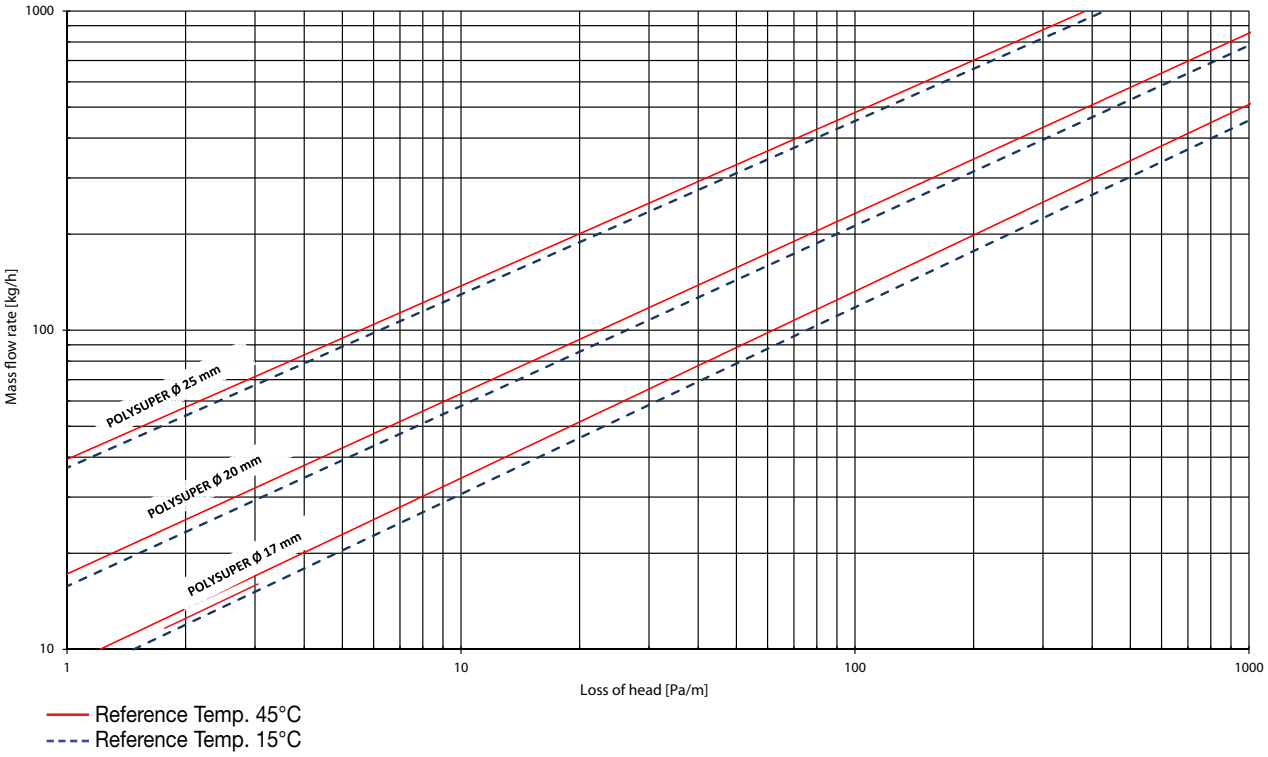
*Class 4= 60 °C/25 years + 40 °C/20 years + 20 °C /2.5 years + 70 °C/2.5 years + 100 °C/100 hours

Section



- Outer pipe in PE-RT type II
- Adhesive layer
- Intermediate EVOH layer
- Adhesive layer
- Inner pipe in PE-Xa

Pressure drop - flow rate diagram



POLYSTOP BASIC pipe

Code	Material	Diameter	Thickness	Length
		mm	mm	mm
10 28 14	PE-RT (II) / Al / PE-RT (II)	14	2.0	200
10 29 14	PE-RT (II) / Al / PE-RT (II)	14	2.0	500
84 15 16	PE-RT (II) / Al / PE-RT (II)	16	2.0	200
83 15 16	PE-RT (II) / Al / PE-RT (II)	16	2.0	500

Specifications

Multilayer pipe made of PE-RT type II polyethylene characterised by high resistance to high temperatures, produced in conformity with ISO 21003 (application class 4/10 bar, according to ISO 10508); the intermediate aluminium pipe constitutes an absolute barrier against the absorption of oxygen.

Use

The POLYSTOP BASIC pipe is a multilayer pipe of diameter 16 mm consisting of an inner layer of second-generation PE-RT (polyethylene for high temperatures type II), an intermediate layer in soft aluminium alloy and an external protective layer of second-generation PE-RT, layers joined together by two additional layers of adhesive.

The pipe thus obtained is a suitable pipe for underfloor heating systems because:

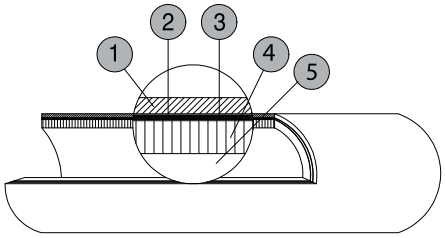
- It has all the low expansion and corrosion prevention characteristics of a multilayer pipe;
- The second-generation PE-RT (type II) is a particularly durable product especially at the typical temperatures of radiant systems;
- The choice of aluminium alloy allows the pipe to also supply high-temperature thermal systems;
- The presence of the aluminium layer allows the installed pipe to maintain its position and to minimise the tensions on the bottom panel, which makes the pipe particularly suitable in the case of low-thickness panels.

Technical characteristics

Properties	Unit of Measure	Value
Material	ISO 21003	Multilayer
External diameter	mm	14/16
Internal diameter	mm	10/12
Aluminium layer thickness	mm	0.2
Linear expansion coefficient	mm/mK	0.023
Thermal conductivity	W/mK	0.41
Application class ISO 10508	-	Class*4/ 10 bar
Internal surface roughness	mm	0.007
Minimum radius of curvature	mm	70/85
Water content	l/m	0,079/0,113
Weight	kg/m	0,091/0125
Colour	-	white

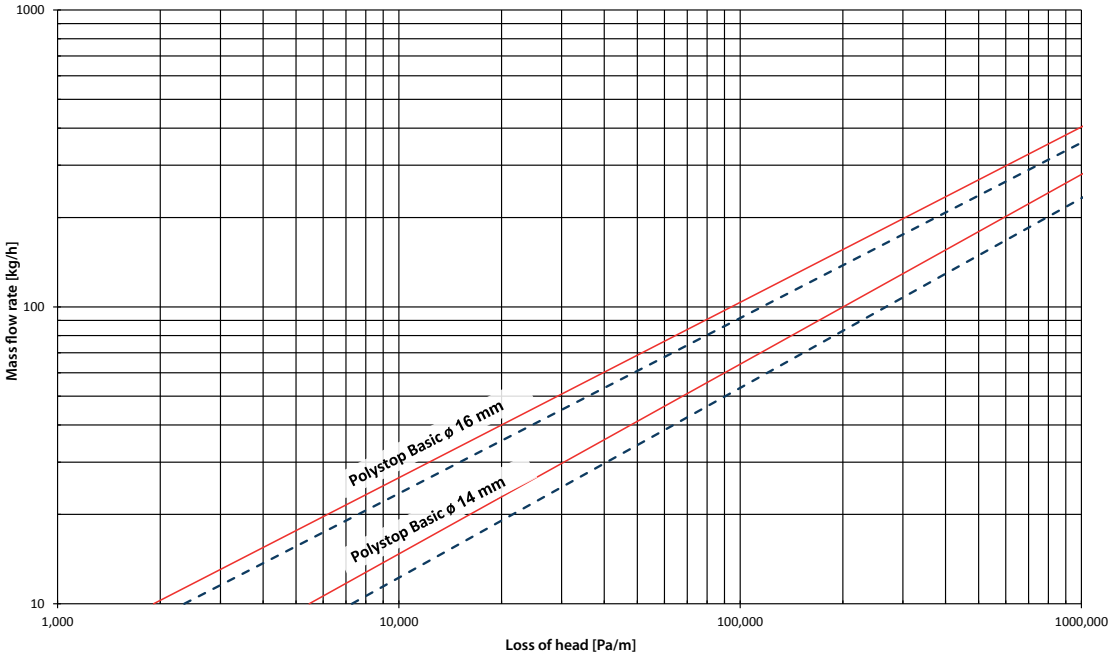
*Class 4= 60 °C/25 years + 40 °C/20 years + 20 °C /2.5 years + 70 °C/2.5 years + 100 °C/100 hours

Section



- Outer pipe in PE-RT type II
- Adhesive layer
- Aluminium intermediate layer
- Adhesive layer
- Inner pipe in PE-RT type II

Pressure drop - flow rate diagram



Reference Temp. 45°C
Reference Temp. 15°C

POLYSUPER BASIC 5-layer pipe

Code	Material	Diameter	Thickness	Length
		mm	mm	mm
12 28 17	PE-RT (II) / EVOH / PE-RT (II)	17	2.0	200
12 29 17	PE-RT (II) / EVOH / PE-RT (II)	17	2.0	500

Specifications

High temperature stabilized polyethylene PE-RT type II 5-layer pipe, manufactured according to EN ISO 22391 (application class 4/6 bar, according to ISO 10508). The intermediate layer is an EVOH oxygen barrier.

Use

The POLYSUPER BASIC pipe is a pipe of 17 mm diameter consisting of an inner layer of second-generation PE-RT (polyethylene for high temperatures type II), an EVOH intermediate layer consisting of an oxygen barrier and an external protective layer of second-generation PE-RT, layers joined together by two additional layers of adhesive. The pipe thus obtained is a suitable pipe for underfloor heating systems because:

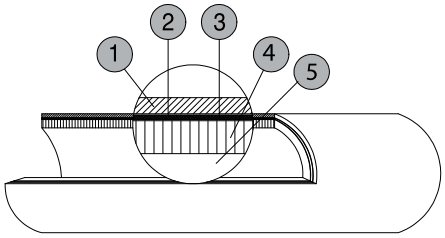
- The particular 5-layer construction allows the protection of the oxygen barrier that, not being outside, cannot therefore be damaged during job-site operations;
- The second-generation PE-RT (type II) is a particularly durable product especially at the typical temperatures of radiant systems;
- The use of PE-RT allows an extremely easy installation of the pipe.

Technical characteristics

Properties	Unit of Measure	Value
Material	ISO 22391	PE-RT
External diameter	mm	17
Internal diameter	mm	13
Linear expansion coefficient	mm/mK	0.14
Thermal conductivity	W/mK	0.40
Application class ISO 10508	-	Class*4/6 bar
Internal surface roughness	mm	0.007
Minimum radius of curvature	mm	85
Water content	l/m	0.133
Weight	kg/m	0.102
Colour	-	white

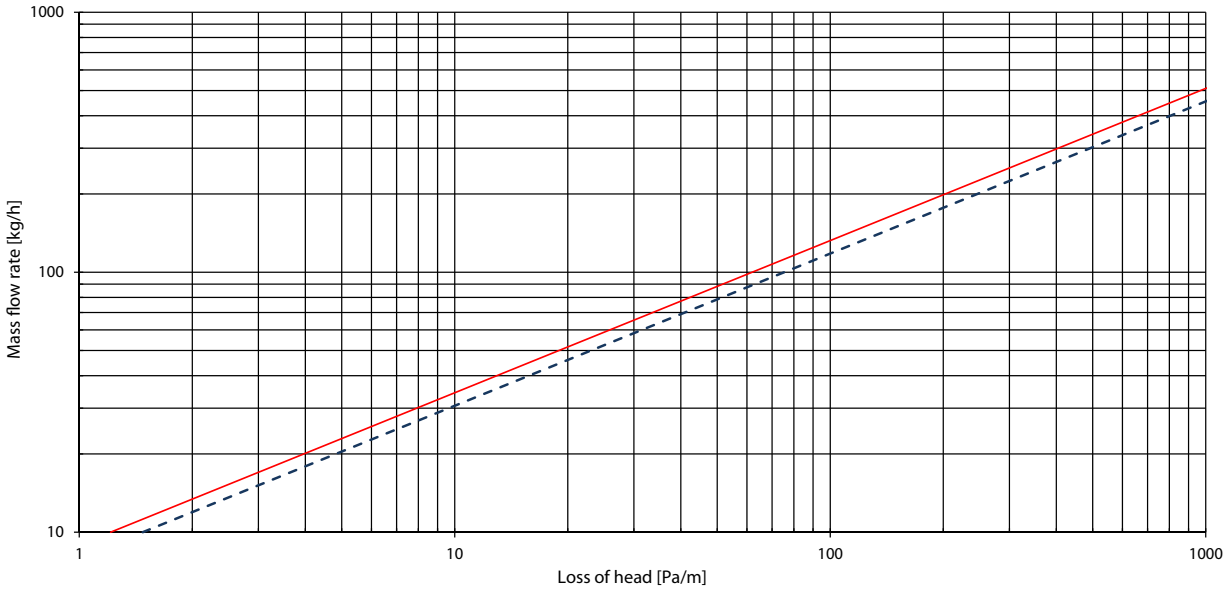
*Class 4= 60 °C/25 years + 40 °C/20 years + 20 °C /2.5 years + 70 °C/2.5 years + 100 °C/100 hours

Section



- Outer pipe in PE-RT type II
- Adhesive layer
- Intermediate EVOH layer
- Adhesive layer
- Inner pipe in PE-RT type II

Pressure drop - flow rate diagram



Reference Temp. 45°C
Reference Temp. 15°C

7. Accessories for underfloor systems

10 31 01

10 31 11

Clips for flat panels

Code	Material	Diameter Pipe mm	Thickness mm	H panel mm
10 31 01	Blue, plastic	16÷20	7.9	≥ 20
10 31 11	Black, plastic	16÷17	7.9	≥ 10

Specifications
Plastic clip for fastening the pipes to the flat panels.

Use
Clips for flat panels are plastic elements necessary for fastening the pipe to the panel in the position required by the design. They are pushed over the pipe and inserted in the panel with a special tool (tacker).
The standard clips, only usable with panels of 20 mm minimum thickness, are combined with a clip for panels of reduced thickness, but not less than 10 mm.

Straddle clips

Code	Material	Diameter Pipe mm	Thickness mm	H panel mm
10 32 00	Plastic	16÷20	2.7	≥30

Specifications
Plastic clip for fastening pipes to knob panels.

Use
Straddle clips for use with knob panels are plastic elements that hold the pipe below the bosses to prevent the pipe lifting. They are manually inserted in the panel to bridge between two adjacent bosses, drilling the top.
The solid structure and pointed shape of the two fixing nails also make it suitable for use on panels with rigid plastic sheet covering.

10 40 10

10 42 20

10 42 25

Clip rail

Code	Material	Adhesive	Type	Pipe diameter mm	Width mm	Length mm	Centre distance mm
10 40 10	Plastic	Yes	A	12÷22	50	1000	50/100
10 42 20	Plastic	Yes	B	20	50	2000	50
10 42 25	Plastic	Yes	C	25	50	2000	50

Specifications

Adhesive clip rail in plastic, for pipe installation with centre distances that are multiple of 50 mm; suitable to be laid directly on the panel or on the electro-welded wire mesh.

Use

Clip rails are used when the pipe is not secured to the insulation panel, either due to the poor capacity of the insulating panel to hold the clips or due to installation of the pipe disconnected from the panel.
They are mainly used for industrial systems, especially when the pipe is secured to the electro-welded mesh.
The clip rail 104010 has two alternate fixings: a small one for 12÷17mm pipes, and a large one for 16÷22mm pipes; this means that only 16 and 17 mm pipes can be laid with 50 mm centre distance, the others must be laid with 100 mm centre distance.

Tacker staples

Code	Material	For bar type	Thickness mm	Length mm	Quantity pcs/m
10 40 11	Plastic	A-B-C	5.1	41	4.0

Specifications

Plastic staple to fix clip rails 104010.

Use

The staples are used to fix the clip rails to the sub-floor insulation panel in industrial systems.
With 104010, it is possible to fix the staples with a tacker gun (not supplied by Wavin).
With 104220 and 104225 must be fixed by hand.

Nail for clip rails

Code	Material	For bar type	Head diameter mm	Thickness mm	Length mm	Quantity pcs/m
10 42 21	Plastic	A-B-C	14	7.4	65	0.7

Specifications
Plastic nail to fix clip rails.

Use
These nails are used to fix the clip rails to the sub-floor insulation panel in industrial systems.
In order to insert the nail in the insulation panel and, in the case where the panel has a thickness of less than the 60 mm length of the nail itself, even within the sub-floor, it may be necessary to provide a hole, to be made with a drill, below the adhesive bar.

Nylon zip ties

Code	Material	Width mm	Length mm	Quantity pcs/m
10 47 15	Plastic	4.8	250	1.0

Specifications
Nylon zip ties for fixing clip rails or pipes.

Use
The nylon ties are used to fix clip rails and the pipe to the electro-welded wire mesh in industrial systems.

Adhesive edge strip

Code	Material	Adhesive	PE film	Height	Thickness	Length
				mm	mm	m
10 41 51	PE-LD	Yes	No	80	8	53
10 41 50	PE-LD	Yes	Yes	150	8	50
10 41 52	PE-LD	Yes	Yes	250	10	50

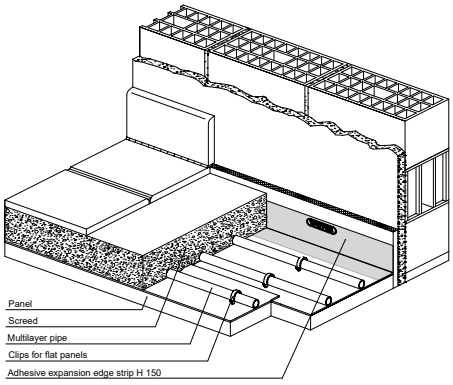
Specifications

Expansion edge strip in closed cell expanded polyethylene of density 23kg/m³, provided with PE-LD transparent film, thickness of 50 µm, heat sealed, the rear side is provided with a high grip adhesive, covered by a protective film.

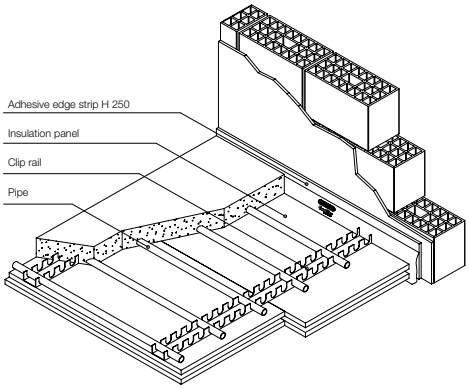
Use

The perimeter expansion strip is a low density polyethylene foam that is laid along the perimeter of the structures in the rooms in which an underfloor radiant system is installed, whether they are perimeter walls or columns, in order to compensate for the linear thermal expansion of the screed and thus prevent cracking of the surface covering layer.
Of three different heights, depending on the type of systems in which they are used: residential with low inertia, standard residential or industrial.
The rear side is provided with a layer of particularly tenacious adhesive, for fixing even to rough and dusty walls, and a film protecting the adhesive that is removed at the time of laying.
The front side is provided with a PE film that must cover the perimeter of the insulation placed on the ground, to prevent the screed from creeping under the insulation during pouring. The PE film is not only present on the lower expansion joint, designed for lowered low-inertia RENOVA systems (the PE sheet must not cover the hollow panel bosses) and DRY ULTRA systems (dry without screed).

Example of installation



Example of installation for strip H250



Technical characteristics

Properties	Unit of Measure	Value
Material	-	PE-LD
Thickness	mm	8/8/10
Height	mm	80/150/250
Volume mass	kg/m³	23
Transparent film overlap	mm	0/150/250
Roll length	m	53/50/50
Colour	-	sky-blue

Installation

Positioning	Along the entire perimeter of the radiant screed
Fixing to the wall	Remove the protective film on the back and stick to the wall
Cut on the upper section	The edge strip must be trimmed after laying the floor covering

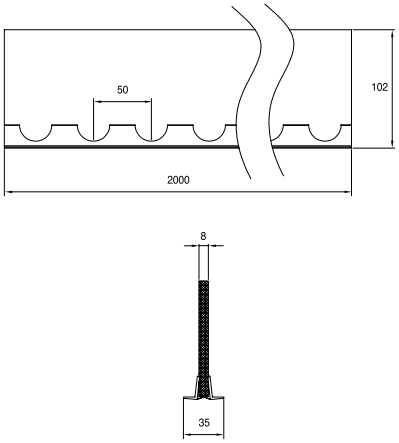
Expansion joint strip

Code	Material	Adhesive	Height	Thickness	Length
			mm	mm	m
10 41 70	EPP	Yes	100	8	2000

Specifications

Expansion joint strip, made of polypropylene closed cell foam, plastic support provided with an adhesive plastic support, specific for the realisation of the structural and expansion joints.

Dimensional drawing



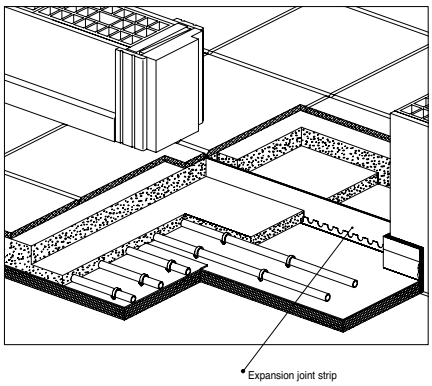
Use

The expansion joint strip is a foam polypropylene strip that is laid at the points in which expansion joints are made in the screed.
Provided at the base with rigid plastic guide, shaped to allow the passage of the pipes, with adhesive material on the bottom to be suitably positioned on the insulation panels.

Technical characteristics

Properties	Unit of Measure	Value
Material	-	EPP
Thickness	mm	8
Height	mm	100
Volume mass	kg/m^3	35
Length	m	2
Colour	-	grey

Example of installation



Installation

Positioning	As a room divider for surfaces greater than 40 m^2 and lengths greater than 8 m
Fixing	By means of an adhesive band positioned under the plastic profile
Use with flat panels	Place down and glue the panel upper base; cut in the pipe crossing points (crossing precautions as per UNI EN 1264)
Use with knob panels	Place down and glue on the floor base, cutting the panel in such a way as it rests on the sides of the joint; cut in the pipe crossing points. If not possible, place the expansion joint strip on the bosses, with crossing pipes running under the joint (crossing precautions as per UNI EN 1264)

FLUTERM-S additive

Code	Material	Dosage l/100kg
10 50 21	Liquid	1.0

Specifications
Polycarboxylates ethers-based liquid additive designed to considerably reduce the mixture water and accelerate the development of compressive strengths, particularly at short curing times. Superfluidifying additive; reduces water for fluid and super-fluid concrete; free from chlorides and dangerous substances, as per UNI EN 934-2.
DOSAGE: 1 litre for every 100 kg concrete

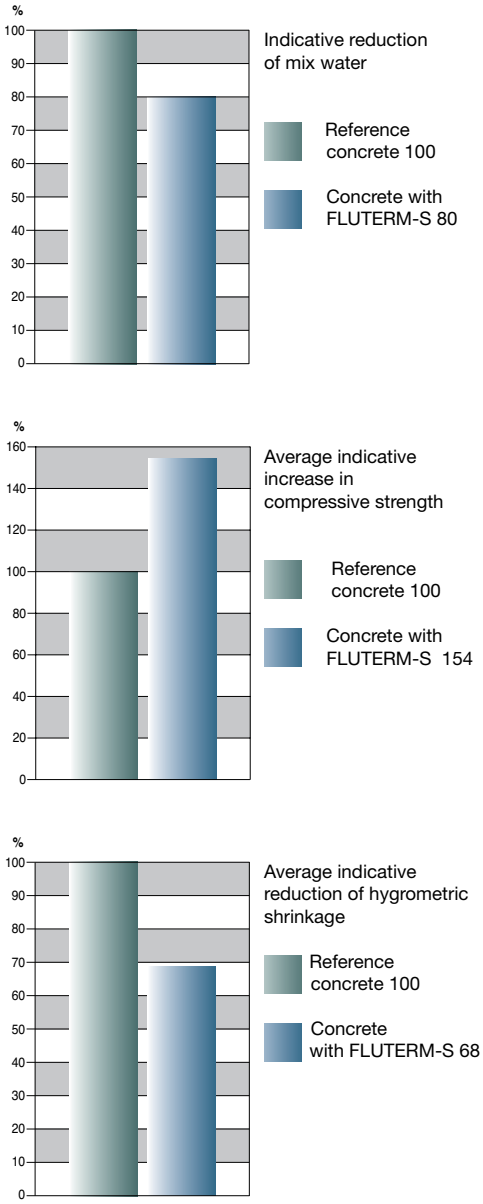
Use
FLUTERM-S is a special additive for sand and concrete screeds, improving their properties considerably. In fresh screeds, it acts as a lubricant, achieving fluid and super-fluid mixtures that massively reduce the typical mixture water. It prevents the formation of air bubbles, resulting in cured screeds that have greater mechanical resistance, are very dense and have a very high volume mass for optimal thermal conductivity (1.2 W/mK), as required for radiant system screeds.

Compatibility
FLUTERM-S is compatible with all Portland cements compliant with UNI EN 197-1 and ASTM standards and with retardant admixtures if necessary.
To make concrete, use clean sands (sand equivalent > 80%), with appropriate particle size and fines percentage (0,15 mm mesh from 2% to 10%) and fineness modules ranging from 2.4 to 3.0. FLUTERM-S is free from any substance that may trigger corrosion phenomena and is perfectly compatible both with pipes and panels of Wavin Chemidro systems.
It is not compatible with hydro-soluble naphthalene solphonates based additives (type FLUTERM).

Method of Use
The liquid additive must be poured into the cement mixer along with the mix water. The water reduction effect is greater if FLUTERM-S is added to moist concrete after adding 80-90% of the mix water.
Avoid adding the additive to the dry mix.

Shrinkage Containment
Following lab testing, FLUTERM-S, with a 10% mixing water reduction in the concrete mix, reduce hydrometric shrinkage by 32%, considerably reducing any curling phenomena that may typically occur after various weeks or months.
Using the FLUTERM-S additive does not mean users should not undertake any necessary measures to reduce the plastic shrinkage in fresh concrete caused by wind, low humidity and high temperatures, or not carry out the initial heating as specified by UNI EN 1264.

Performance comparisons



Synthetic fibres for screed

Code	Material	Tensile Strength MPa	Dosage kg/m³
10 48 10	Plastic	400÷450	1,0÷4,0

Specifications

Structural synthetic macro-fiber from a non-fibrillated monofilament based on a special blend of synthetic polypropylene-based polymers. Thanks to its ability to reduce plastic shrinkage and improve the durability of cement mixes intended for making screeds for civil use, it is used to make screeds for heated floors, in partial or total replacement of secondary continuous mesh reinforcement.
DOSAGE: from 1 kg/m³ for residential screeds up to 4 kg/m³ for screeds subject to significant loads.

Use

The synthetic macrofibers for screed consist of a special blend of polypropylene-based synthetic polymers and are a three-dimensional reinforcement that improves the durability and properties of cement conglomerates for realising screeds, sub-floors and prefabricated casting structures, with humid or extruded screeds, in order to increase ductility and reduce (in some cases totally eliminate) plastic shrinkage.
Synthetic fibres for screed can be used in any type of concrete for realising screeds, concrete slabs and sub-floors for interior flooring; conforms to the UNI EN 14889-2 standard.

Method of Use

The recommended dosage for most residential screeds is 1 kg/m³. The dosage range specified covers all applications in light, non-structural pre-fabrication of screeds, concrete slabs, etc. Therefore, we recommend carrying out preliminary tests to identify the ideal dosage for the work in hand.
The fibres are added together with aggregates and binders.
Starting mixing by adding the water necessary to obtain the desired workability.
After addition, mix for at least 5-7 minutes at maximum speed.

Technical characteristics

Properties	Unit of Measure	Value
Material	ASTM C1116	Synthetic polypropyl-ene-based polymers
Form	-	mono-filament
Specific weight	kg/dm³	1
Length	mm	29
Length/diameter ratio	-	37.17
Tensile strength	MPa	400÷450
Resistance to acids, bases and salts	-	very high

Anti-shrinkage metal mesh

Code	Material	A	B	Thickness	Mesh
		mm	mm	m	mm
10 48 05	galvanised steel	2000	1000	1.75	50x50

Specifications

Galvanised steel wire mesh to prevent shrinkage and uniformly distribute mechanical loads on the screed. Made with DN 1.75 mm wire with 50x50 mm mesh, in sheets of 2x1 m.

Use

The anti-shrinkage wire mesh when placed in the upper part of the screed, above the radiant system, increases flexural strength, resistance to contraction forces during drying and resistance to surface impact of screeds, thus limiting the formation of cracks and/or damage from hygrometric shrinkage.

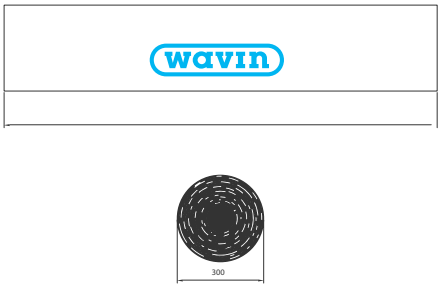
Polyethylene sheet

Code	Material	A m	B m	Thickness µm	Surface area m²
10 47 40	PE	67	3	200	200

Specifications

Vapour-barrier polyethylene sheet, 0.92 g/cm³ of density, 200 µm of thickness, supplied in centre folded rolls of 3 m in overall width and 66 m in length.
According to UNI 11371, it is necessary to lay a vapor barrier under the insulating panels of a screeds with radiant systems and wooden surface coatings.

Dimensional drawing

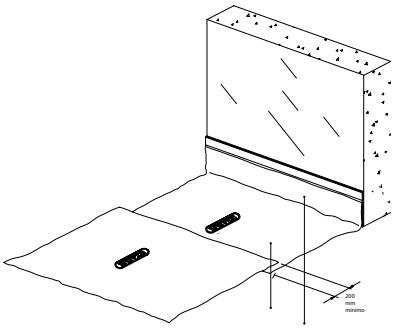


Use

The polyethylene sheet has the function of separating the various layers of material:

- In residential systems, if properly placed overlapping the edges and sealing them with adhesive tape, it is a barrier to vapour or rising humidity. According to UNI 11371, it is necessary to lay a vapor barrier under the insulating panels of a screeds with radiant systems and wooden surface coatings.
- In industrial systems, if properly placed on the lean concrete overlapping the edges and sealing them with adhesive tape, it is a barrier to rising humidity, although it is always a good idea to evaluate the use of bituminous membrane in its place.

Example of installation

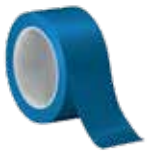


Polyethylene sheet
Edge strip
Minimum 200 mm

Technical characteristics

Properties	Unit of Measure	Value
Material	-	PE
Length	m	66.7
Width	m	3
Surface area	m²	200
Thickness	µm	200
Volume mass	g/cm³	0.92
Resistance to steam flow SD (m)	EN 12086	70*
Coefficient of resistance to steam flow (µ):	EN 12572	350000*

* Values obtained from literature.



Adhesive tape for polyethylene sheet

Code	Material	Length	Width
		m	m
10 47 41	PVC	66	50

Specifications
Adhesive tape in PVC, blue color, 50 mm wide and 66 m long.

Use
The tape is used to seal the edges of the polyethylene sheet, suitably overlapped, to form the vapor barrier.

Pair of fittings for designer radiators

Code	Description	Diameter Pipe mm	Thickness Pipe mm	Connections inches
10 91 10	Mechanical coupling	14	1.3	3/4”F

Specifications

Pair of 90° fittings with connection for designer radiators with diameter of 14 mm and 3/4" connectors compatible with adaptors for multilayer pipe 16 or 17 mm (code 73002 and code 106617).
ADAPTORS EXCLUDED.

Use

Pair of fittings, intended to supply designer radiators, to be connected to the same pipes that can be used for the radiant system.

Pipe couplings

10 91 17

10 65 30

10 91 21

Code	Description	Press shape	Diameter Pipe mm	Pipes Thickness mm	Connections inches
10 91 17	Compression coupling	CH	17	2.0	-
10 91 21	Compression coupling	U	20	2.0	-
10 65 30	Nipple for mechanical coupling	-	-	-	3/4”Ek

Specifications

Coupling for brass CW617N pipes according to the UNI EN 12165 standard.

Use

Fittings for the repair of pipes already installed in a radiant system.

Corrosion inhibitor additive with biocidal effect SANOTHERM 400

Code	Material	Dosage kg/100l
10 50 30	Liquid	1.0

Specifications
Additive to inhibit corrosion and fouling for radiant systems with specific biocidal effect to reduce the formation of biological sludge. Application increases the heat transmission in the system, improving efficiency and durability. We recommend adding new inhibitor at least once every 12-24 months.
DOSAGE: 1 kilogram for each 100 liters of system water.

Use
SANOTHERM 400 is a multifunctional additive with biostatic action for full protection from fouling, corrosion and microbiological growth, in any underfloor heating system, including those with aluminium parts.
Non-oxidising and non-foaming, it inhibits the growth and development of algae, bacteria and micro-organisms in heating circuits operating at low temperature, thus extending the life of the system and guaranteeing its maximum efficiency, with a consequent reduction in fuel consumption.
We recommend identifying systems protected with Sanotherm 400 and re-adding the additive in the case of large water changes, or at least once every 12-24 months depending on the age of the system to be treated and its leaks.

System cleaning additive SANOTHERM 700

Code	Material	Dosage kg/100l
10 50 40	Liquid	0.7÷1.0

Specifications
Alkaline additive that removes and disperses organic silt deposits, particularly suitable for cleaning underfloor radiant systems when the system does not contain aluminium, its alloys or zinc.
DOSAGE: 0.7÷1 kilograms for each 100 liters of system water.

Use
SANOTHERM 700 is a specific alkaline formulation for the removal and dispersion of deposits of biological or other organic silt. Organic fouling is caused by deposits that create obstructions, reduction of the diameter of the pipes and heat exchange. To restore the correct operation of the circuit you need to flush the fluid, clean it with Sanotherm 700 and refill.
Indicated for cleaning underfloor radiant heating systems and the like. The possible presence of aluminium and/or zinc leads to a reduction of residence times. The waste water from chemical cleaning must be disposed of in accordance with local laws.

8. Equipment for underfloor systems

TACKER tool

Code	Material	Pipe Size mm	Weight kg
15 10 10	Tacker to be used for flat panel clips	16÷20	3.1

Specifications

Tool designed to simplify and speed up the fastening of clips when laying the pipes on flat panels. It is made from steel, with clips loading guide and access window to the guillotine section.

Pipe decoiler

Code	Material	Pipe Size mm	Weight kg
15 20 00	Pipe Decoiler	16÷25	14.1

Specifications

Pipe decoiler that can be disassembled, made of steel, designed to simplify the laying of plastic pipes in rolls.

Pipe cutter

Code	Material	Pipe size mm	Weight kg
85 00 02	Wheel pipe-cutter	14÷75	0.8

Specifications

Wheel pipe cutter for cutting multilayer pipe.

Pipe cutter

Code	Material	Pipe Size mm	Weight kg
85 02 00	Pipe cutter with pipe holder	14÷26	0.5

Specifications
Multilayer pipe cutter with pipe holder.

89 71 01

Internal-external gauge Kalispeed

Code	Material	Pipe Size mm	Pipe thk. mm	Weight kg
89 71 01	Handle	-	-	0.14
89 72 16	Gauge	16	2.0	0.13
89 73 17	Gauge	17	2.0	0.15
89 73 20	Gauge	20	2.0	0.15
89 72 20	Gauge	20	2,5	0.17

Specifications
Handle and gauges for underfloor radiant system pipes.

Electric pressing tool

Code	Material	Pipe Size mm	Weight kg
86 00 18	Model ACO203 18V	16÷75	6.0
86 02 30	Model ECO203 230V	16÷75	7.5

Specifications
Tool for use with jaws for press fittings

Jaws PB2 Novopress NE

Code	Material	Press shape	Pipe Size mm	Weight kg
86 02 16	Jaw PB2	CH	16	1.9
86 02 17	Jaw PB2	CH	17	1.9
86 02 21	Jaw PB2	U	20	2.1
86 11 21	Jaw Mini	U	20	1,4

Specifications
Jaw for press fittings.

Notes

Notes

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