valu-technik

Radiant floor heating system

UNI EN 1264 Certificate

www.iip.it

aquatechnik®

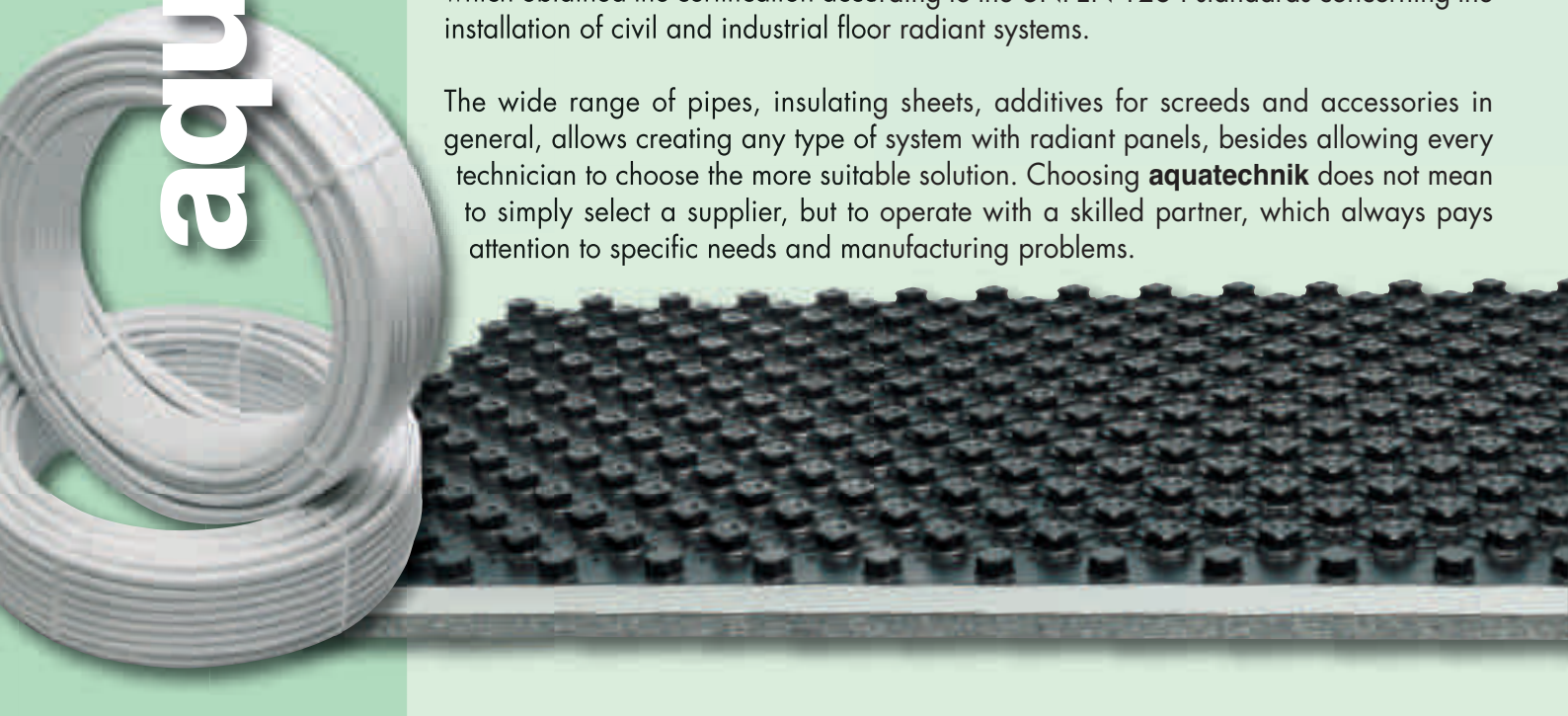
aquatechnik®

aquatechnik led the success of radiant heating systems in European countries: in the '80s, it had already conceived a complete system including pipes, components and devices for regulation purposes, which met the most varied needs in designing this plant-engineering typology.

In this way, the **valu-technik** system was created; it makes use of the principle of radiant heat exchange and allows obtaining house comfort levels higher than any other heating/conditioning system. The continuous evolution of the materials, the constant improvement of the components, in addition to a thirty-year experience and the most varied implementations, allowed aquatechnik to improve the **valu-technik** system, with the passing of time, to make it increasingly performing and suitable for the standards in force. Also concerning the summer version of the radiant system, aquatechnik was one of the first companies to offer this innovatory type of installation, and obtained great appreciation by the international market.

The constant attention by the company to new technologies and to the worksite needs, whose purpose is to continuously improve technical solutions and products, allowed **aquatechnik** to supply the market with a complete and high-quality range of products, which obtained the certification according to the UNI EN 1264 standards concerning the installation of civil and industrial floor radiant systems.

The wide range of pipes, insulating sheets, additives for screeds and accessories in general, allows creating any type of system with radiant panels, besides allowing every technician to choose the more suitable solution. Choosing **aquatechnik** does not mean to simply select a supplier, but to operate with a skilled partner, which always pays attention to specific needs and manufacturing problems.



The methodology

The heating methodology with radiant panels was conceived around the '50s/'60s with design and installation types that were extremely different from the current ones, and with questionable results in terms of wellbeing, wealth and practicality. The systems created in those years, indeed, were characterised by extremely detached pipe centre distances (20 cm to 30 cm), and conveyed very high temperature fluids (about 70°C). A consequence of the aforesaid operating conditions consisted in very hot floors, with inhomogeneous temperatures that were higher than bearable temperatures from the point of view of wellbeing perception. Another typical factor of the systems conceived in the '50s/'60s was the exploitation of individual circuits to heat several premises, thus preventing the temperatures from differentiating within the various rooms.

With the passing of time, a set of factors, such as technological evolution, analysis and development of new building materials (leading to the subsequent improvement of the insulating factor) and renewal of design concepts allowed improving the limits of past systems.

All the aforesaid improvements led to the rediscovery and the revaluation of the systems with radiant panels.

Nowadays, indeed, the installation of supply pipes with narrow centre distances and water flowing at a temperature included between 25°C and 40°C, allow heating the premises by creating a comfortable and healthy habitat, maintaining very low floor temperatures, which are lower than the maximum temperatures that were established by the standards. Indeed, the technology with radiant panels is one of the most used and appreciated applications, as it was recognised as the best possible heating method at environmental comfort level.

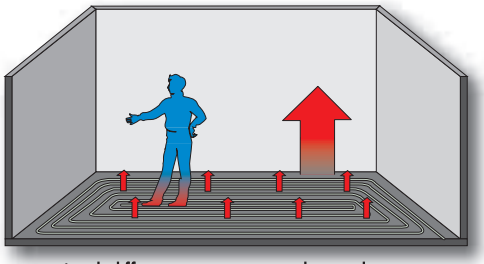
aquatechnik, leading company within the plumbing and heating industry, offers a complete, innovatory and tested installation for floor radiant systems.

The wide range of pipes, insulating sheets, additives for screeds and components allows creating any type of system with radiant panels.

The large number of plants, the constant use of high-quality accessories certified according to the UNI EN 1264 standard and the continuous development of new products allowed the company to impose itself within the industry as the ideal partner to realize this plant-engineering typology.

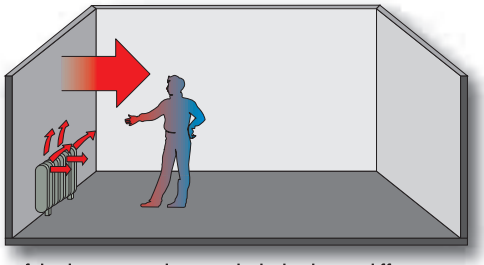
Heat transmission

If you consider the processes that are used by the human body to exchange heat, you can identify:



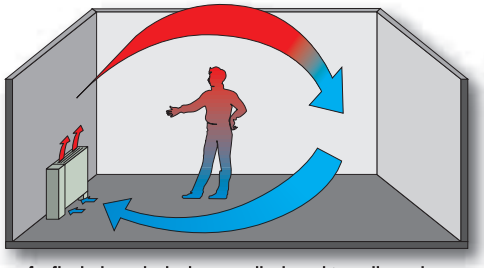
RADIATION

Two or several bodies (also without contact) with different temperatures exchange electromagnetic waves one to the other (heat particles) in order to unify/balance the relevant temperatures.



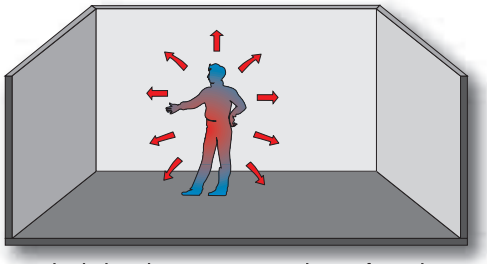
CONDUCTION

Heat exchange occurs by means of the direct contact between the bodies having different temperatures.



CONVECTION

Heat exchange occurs by means of a fluid where the body is usually dipped (usually air, but water, as well), at a different temperature.



EVAPORATION

It is the heat exchange that distinguishes biological organisms: it occurs by transferring heat to the air by effect of the evaporation of breathing and/or perspiration.

As for the systems with radiators, and especially air systems, heat is almost completely transferred by convection. The systems with radiant panels operate in a different way, as they exploit the principle of heat exchange by radiation and by convection in a small amount, in particular concerning the summer cooling function.

The ideal comfort

There are several factors that contribute to create the ideal comfort for our metabolism: temperature and distribution of the air in the room, temperature of the surfaces on contact with the person, speed of air movement within the room, and relative humidity. The systems with radiant panels adapt and streamline all conditions that are necessary for the physiological wellbeing of the person in all seasons. The aforesaid systems, indeed, can also be exploited for summer cooling: a single system for wellbeing all year long. The comparison between traditional systems and systems with radiant panels shows what follows:

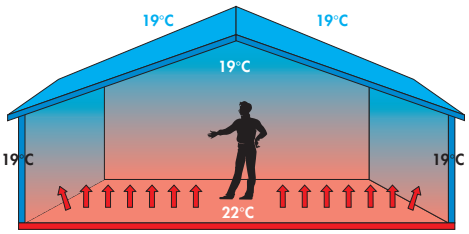
■ system with winter function

the use of radiators and/or fan coils creates a situation with inhomogeneous room temperature, besides creating bothersome, noisy and sometimes noxious turbulences. Furthermore, there are more significant heat losses, which are caused by the installation of heating devices often next to windows or non-insulated areas. The use of systems with radiant panels, on the contrary, creates a homogeneous room temperature, thus removing the turbulence factor, as well as remarkably limiting heat losses.

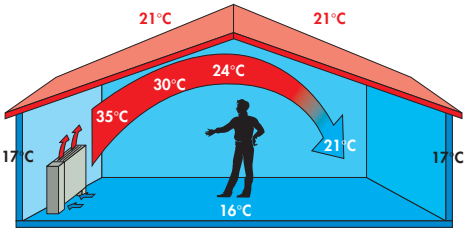
■ system with summer function

the use of air-conditioners and/or fan coils creates a situation of artificial wellbeing, thus causing a turbulence effect and high noise levels. On the contrary, the use of radiant panels allows a homogeneous distribution of temperatures, with the advantage of lowering the average temperature of the surfaces surrounding the person (floor, walls, ceiling). The concomitant operation by combined dehumidifiers obtains an optimal air humidity level.

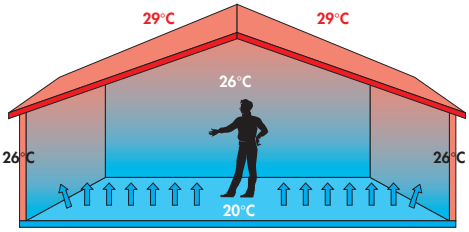
FLOOR-PANEL SYSTEM - Programmed temperature at 20°C



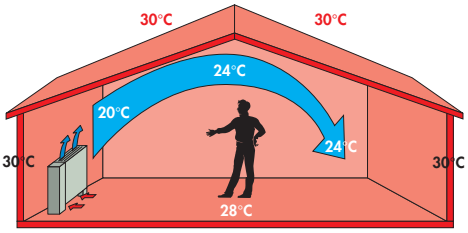
RADIATORS - Programmed temperature at 20°C



FLOOR-PANEL SYSTEM - Programmed temperature at 25°C - Relative humidity 60%



FAN COILS - Programmed temperature at 25°C - Relative humidity 50%



The advantages

The **valu-technik** system includes a set of pipes and completion materials to create winter heating and summer cooling systems with radiant circuits installed in floors, walls or false ceilings. It was conceived and designed to operate with low temperature fluids; heat exchange by radiation and the homogeneity of heat distribution over the entire usable floor allow obtaining considerable comfort advantages compared with traditional systems equipped with heating appliances within the rooms and as many energy saving advantages.

■ environmental hygiene

The system with radiant panels does not make use of convective motions, so it removes air movements that cause dust raising. In this way, allergy risks are considerably reduced. The heat transferred to the surfaces within the surrounding room will also reduce the humidity rate, thus preventing the diffusion of micro-organisms, such as mite, and removes the problems connected with the formation of condensation and mildew on the walls. The contact with the floor is pleasant thanks to the warmth it emanates, and the risks of accident against the heating appliances are remarkably reduced. Thanks to the aforesaid hygienic-sanitary features, the systems with radiant panels are ideal solutions not only in houses, but also in public structures, such as schools, hospitals, and nursing homes.

■ aesthetical aspects

The system with radiant panels completely removes the constraint of radiators, thus making spaces freer and more harmonious, and allow architectural designs that fully exploit the entire surfaces, besides removing the phenomenon of wall blackening next to the radiators.

Energy saving

Thanks to its specific features, the system with radiant panels allows saving more energy than a traditional system with radiators or with other heating appliances. The aforesaid saving derives from several factors that are strictly connected not only with technology, but also with energy containment standards that have been developed in the last few years.

As for the aspects that are connected with the creation of the systems:

- the main energy saving factor is allowed by the insulating factors of the entire envelope (as it is specifically required by the standards in force). The systems with radiant panels are characterised by the presence of insulating sheets that must be installed on the floor. They are also used as a support to lay the hydraulic circuits. The aforesaid sheets considerably contain the heat loss downwards;
- **remarkable reduction in heat loss**: heat stratification next to the ceiling has been solved.

In case of very high buildings or characterised by considerable air cubage (industrial sheds, churches, theatres, etc.), the saving percentage can exceed 50%.

As for the aspects that are connected with the operation of the systems:

- one of the main energy saving factors derives from the low operating temperature of the system. Indeed, the systems with radiant panels, thanks to the large heat exchange surface that, practically speaking, involves the entire usable area inside a building, operate at a temperature that is included between 30°C and 40°C, differently from the traditional systems with radiators that usually operate at a 70°C temperature. It allows two considerable advantages: first, the use of lower water temperatures suggests the use of alternative heat sources, such as photovoltaic panels, besides making advantageous to use heat sources whose output increases as the water temperature required by the system decreases, such as condensing boilers or heat pumps that, in their turn, assure considerable energy saving. Second, you need to consider the saving in terms of heat loss reduction concerning supply pipes. Indeed, as the delivery fluid temperatures decrease, the energy loss will reduce within the section that is necessary for connecting the heat source to the manifolds;
- within the rooms, the average operating temperature is at least 1°C lower with respect to traditional heating systems: with the same perceived sensation of warmth, the system with radiant panels allows keeping the air in the rooms at lower temperatures, because the floor and the walls are warmer. The lowering of 1°C coincides with energy saving equalling about 7% per year. Similarly, the sound absorption values must be taken into consideration according to the type of sound-absorbing insulating material that is used in the insulating sheets. The costs of servicing are considerably reduced, in particular during the heating period, thus allowing significant savings in economic terms.




Applications

The **valu-technik** system is suitable for the following applications:

- civil houses, renovations
- shopping centres, shops, restaurants, hotels, swimming-pools
- places of worship, industrial sheds, gyms, sports halls, laboratories
- hospitals, nursing homes
- cultivation greenhouses, football fields
- animal breeding
- ramps, car parks, large anti-ice and -snow squares
- airports, stations

Feasibility conditions

The following elements will be absolutely necessary to install floor heating/cooling systems in private houses (as for other systems, consult a Design Study):

- the executive heat-system design in compliance with the laws;
- the minimum technical space to install the components;
- absence of obstructive elements (insufficient heights, floors with excessive undulations, metal beams that cannot be overcome, presence of electrical raceways, etc.).

System design

Every heating/cooling system requires a heat-system design complying with the laws, carried out by an authorised thermotechnical engineering company.
The work phases are divided into two parts:

A Estimate of the economic costs
B Executive project concerning all relevant specifications.

A To perform an estimate, the following elements will be necessary:

1. Scale plans of the building and its insulation type
2. End flooring type
3. Circuit and heating/cooling equipment adjustment type

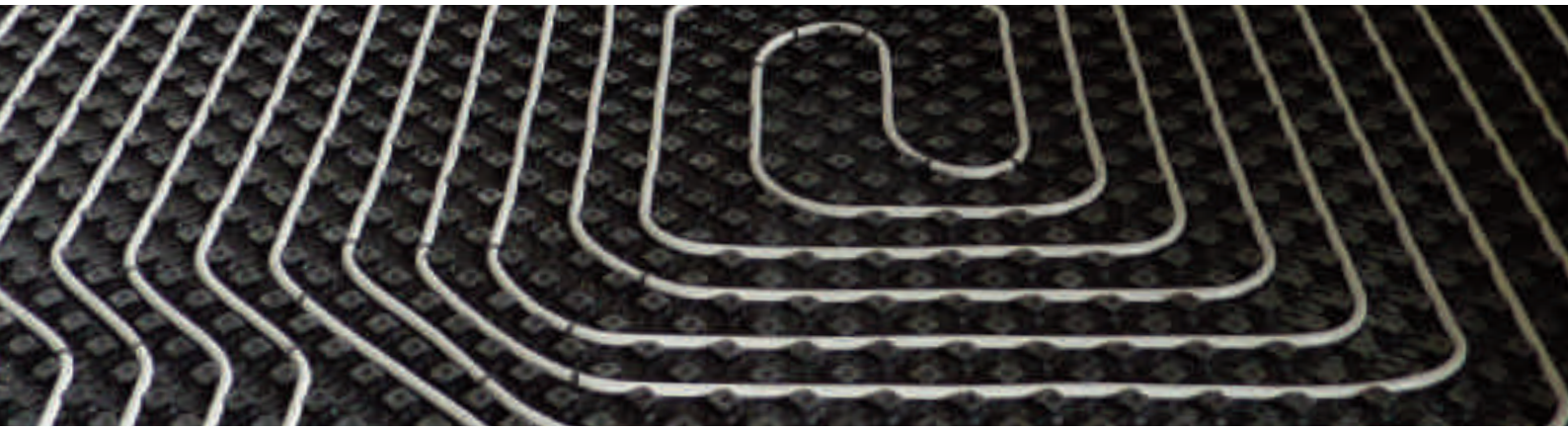
B To obtain an executive project, you will need:

1. The same data that are necessary for the estimate (if they were not supplied before)
2. Positioning of the appliances (manifolds, adjustment devices, thermal power stations, etc.)
3. Structural data about the house (glasses, floors, walls, insulations, etc.)
4. Other data upon demand of the designer.

Every executive project must be complete with the necessary data to create and to signal expansion joints (if necessary) and the operating notes, if any.

The operation

The system with radiant panels is created by installing an insulating material above the slab. The heating conductors (pipes) are installed above the insulation material and will be completely buried into the supporting layer (the "screed"). Finally, the screed will be covered with the final coating (tiles, parquet, fitted carpet, etc.).
The heat exchange principle at the base of the relevant operation involves the circulation of low-temperature warm water (usually included between 30°C and 40°C) within the piping circuit generating heat. The aforesaid heat is conveyed to the screed by conduction and to the surrounding by radiation.
The system with radiant panels used in winter for heating purposes, after suitable design checks, can be used to cool the surrounding during summertime.
The low temperature water (on average, about +15°C) flows within the same pipes that form the floor circuits; in this way, the thermal energy in the air and in the structure will be absorbed and drained by the radiant effect of the cooled flooring.
As for the cooling operation by means of radiant panels, the quantity of relative humidity that is to be found in the room becomes extremely important. The installation of specific probes positioned in the houses (able to simultaneously detect the relative humidity and the room temperature) allows the regulating control units to control the switching ON and OFF of the dehumidifiers and to establish the lowest possible delivery temperature of the fluid inside the pipes.
The floor radiant system, besides being considered the best heating system for winter conditions, proves to be an excellent solution for summer cooling, as well. A single, invisible and low-consumption system that air-conditions the rooms during an entire year; all its versions are healthy and comfortable.



Installation instructions

Step 1 – Fastening of the baseboard

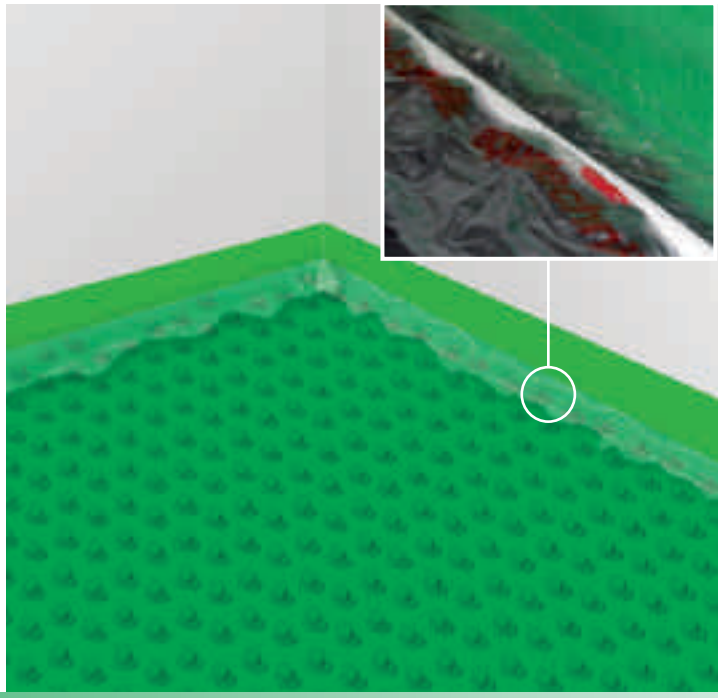
Fasten the insulating baseboard over the entire perimeter of the house (columns and/or low walls included).

Step 2 – Installation of the insulating sheets

The system with radiant panels provides for covering the surface to be heated by laying thermal-insulation sheets: they have the double function of insulation by containing and absorbing possible heat losses and acoustic dispersions. **aquatechnik** distributes different types of sheets; all of them comply with the standards in force and were conceived to assure a perfect connection one to the other. The sheets are available in the following versions:

- made with shaped polystyrene provided with vapour barrier (also with a layer of soundproofing material);
- made with shaped polystyrene without vapour barrier;
- made with smooth polystyrene with vapour barrier;
- made with thermoformed polystyrene with vapour barrier (also with a layer of soundproofing material).

It will be necessary to install the shaped sheets in a more careful way, as possible cuts or shaping operations must be carried out with special attention and without splitting.

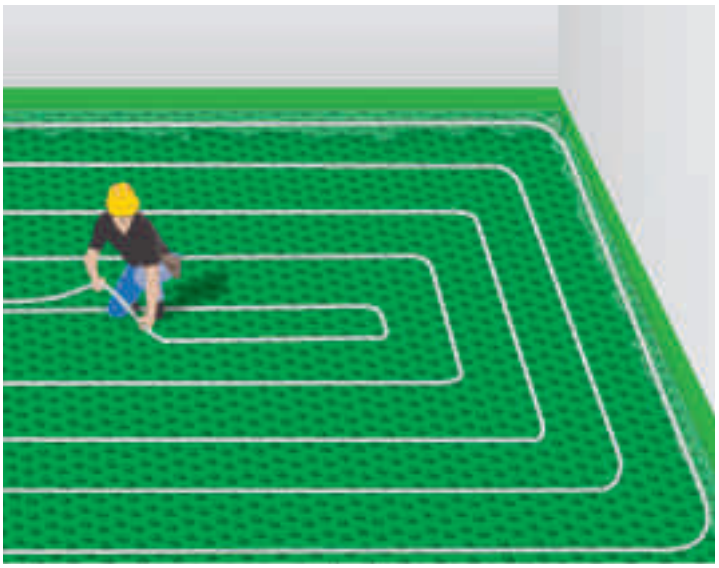


WARNING

- The baseboard strap must be higher than the sheet to prevent possible penetrations of the subsequent casting of concrete under the same sheet.
- Do not create air pockets between the baseboard strap and the sheet.
- Make sure that the surface where the sheets are installed is levelled and free from inclinations.
For further information, see the technical data sheets.

Step 3 – Installation of the circuits

Starting from the distribution manifold that is preferably installed in the centre of the supplied area, install the pipe by following the project logic.
The "spiral" circuits require alternate passes that allow the return to the manifold.

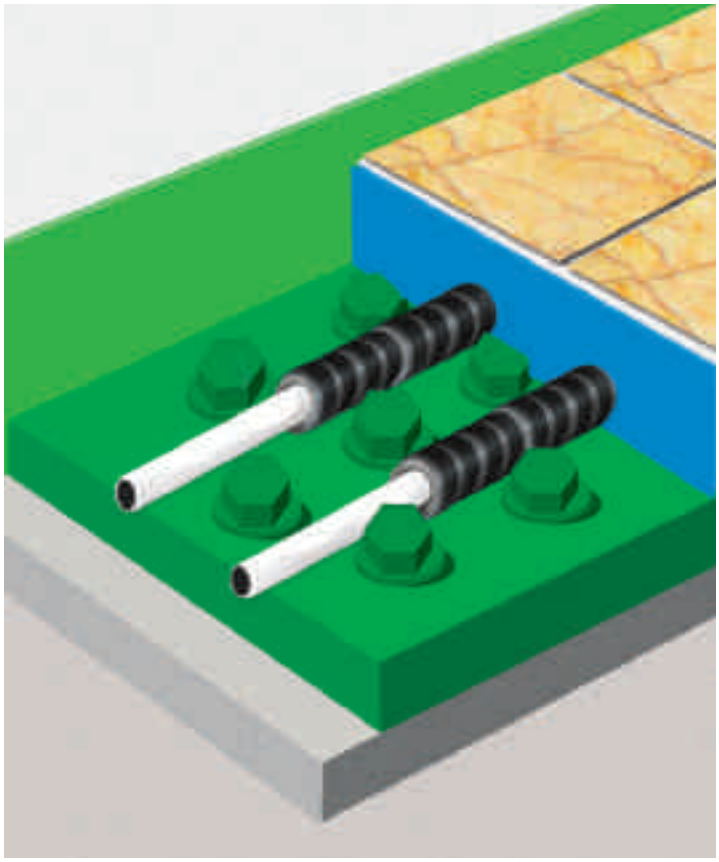


Step 4 - Expansion joints

All the materials used in building, as well as the components forming them, expand when heated, while they shrink in case of low temperatures.

Exactly for this reason, the expansion joints are necessary and allow the covered surface to dimensionally contract and expand, thus assuring its stability and duration over time. The expansion joints are screed interruptions absorbing and compensating the length variations of the materials used.

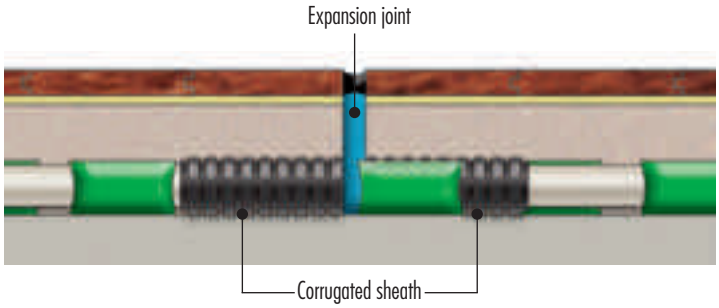
In any case, expansion joints over the perimeter are provided for in compliance with corporate directives, standards in force and project instructions of the system; the aforesaid expansion joints over the perimeter are obtained by installing the insulating baseboard along all vertical structures (walls, columns, staircases, etc.).



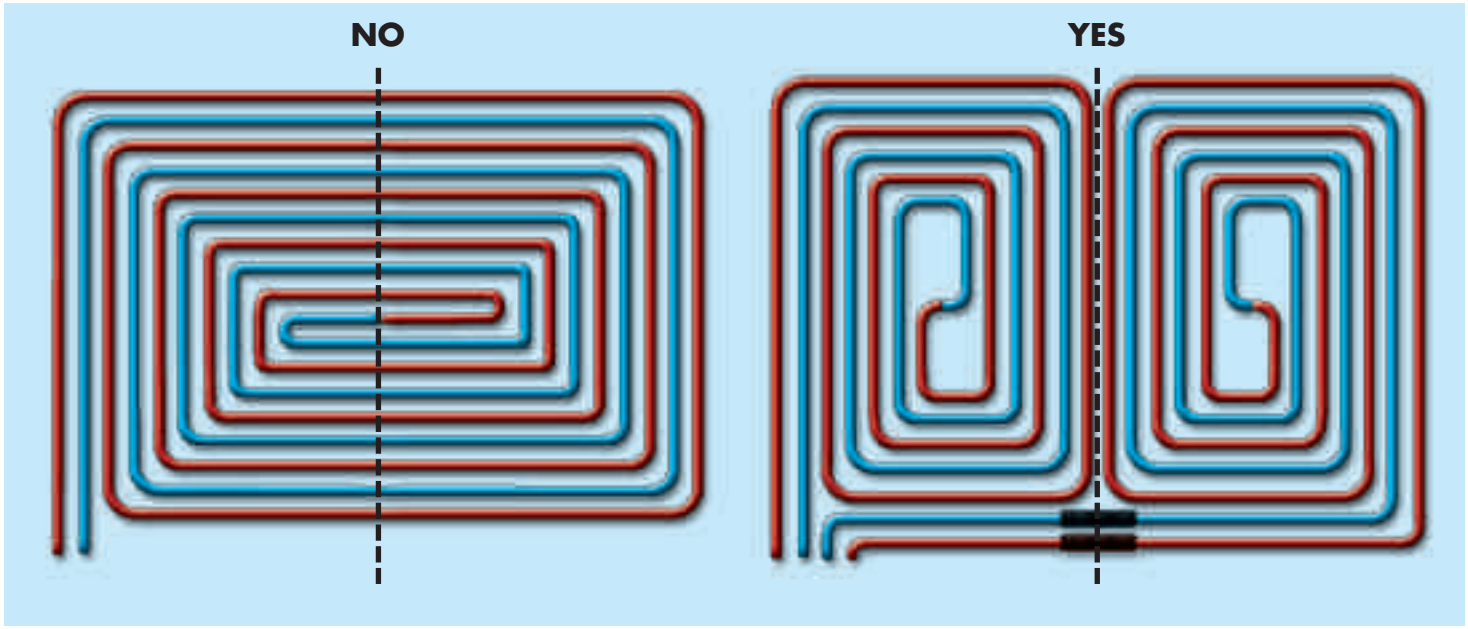
Execution of the expansion joints

The expansion joints are used to compensate for the expansions/contractions of the screed. They cross the entire concrete layer and must be executed in case of surfaces > 40 sqm or having a length > 8 m. Next to the above-mentioned joints, the pipe must be protected with a specific 30/40cm corrugated sheath (see the picture).

NOTE: it is advisable that the joint line arrangement does not cross the heating circuit, but only the supplying segments.



The layer and the specialised companies will be in charge of establishing the best way to observe the design of the expansion joint in final flooring (elastic material, rubber strip, silicone whose colour is similar to the grouting used, etc.).



Step 5 - Testing

Apply pressure to the system; the pressure must equal the double of the operating pressure, minimum 10 bar for at least 24 hours. After the aforesaid period, check the pressure of the entire circuit by using a specific manometer to verify any possible leak.
The pressure must keep stable also when casting the concrete. If the casting is carried out in environmental conditions with a freezing risk, it will be necessary to add a compatible antifreeze liquid to the water (for further information, se the Technical Data Sheets or call the Engineering Departments). Afterwards, the aforesaid liquid must be removed by washing the circuit at least three times.
It is absolutely necessary to prevent icing inside the pipes: always empty the system after casting the screed (step 6) or provide for an air test.
Fill in the test report. To perform a correct testing, it is advisable to read the practical recommendations listed below.

Step 6 - Screed and flooring

The building company is in charge of and responsible for casting the screeds covering the pipes, and law requirements must be complied with.
aquatechnik supplies fluidifying additives (VHF) and PP reinforcing fibres that must be mixed in the concrete. The minimum screed heights provided for by the standards in force will not be lower than 30 mm above the looped pipe.
It is necessary to let the screed dry (approximately, 3-4 weeks) before laying the final flooring.

Step 7 – System loading

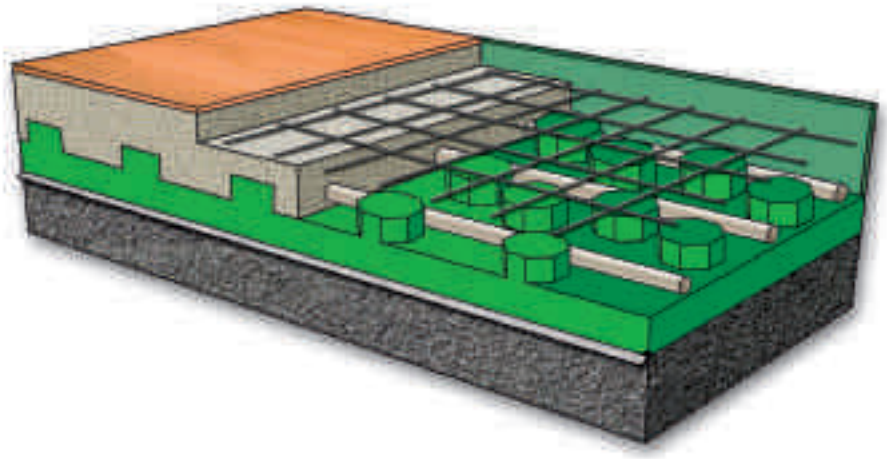
Fill the system with water by using the specific charging/descharging units that are positioned in the manifolds. Vent each circuit and wait for the total draining of the air. The aforesaid operation must be performed by starting to charge with all valves and holders being closed, except for the ones of a loop. After venting the first loop, act in the same way for the other loops and pay attention to keep charging closed circuits (valves and holders), whose operation has already been completed. In this way, you assure the correct loading of the system and its subsequent correct output.
Warning! The presence of air within the system reduces its outputs. Clear the system being extremely careful.

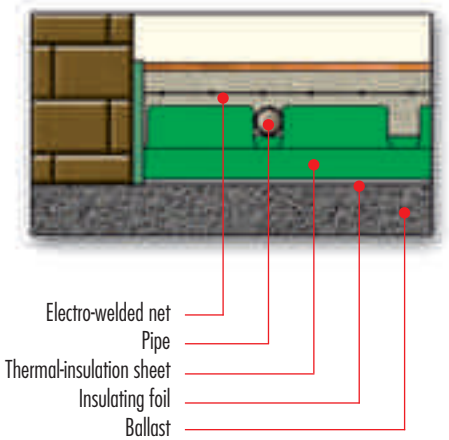
Step 8 - First start-up and balancing

The start-up operation must be performed after the complete drying of the screed and the final laying of the end flooring. Gradually start up the system in hot conditions, having the fluid temperature reach 25°C. After that, gradually increase the temperature (5°C per day) until reaching the maximum temperature that is provided for according to the thermotechnical project, and keep it for at least 4 days. With the system being fully operational, perform the hydraulic balancing, as it is provided for in the technical project.

VALU-TECHNIK SYSTEM WITH SHAPED INSULATING SHEET

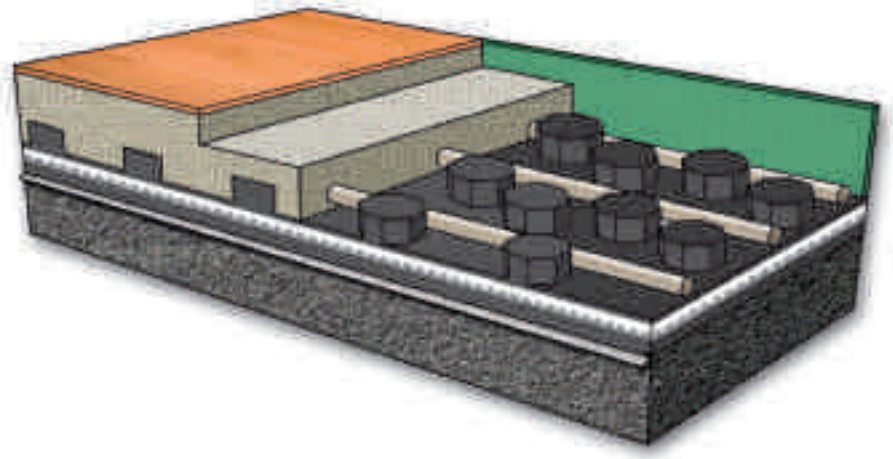
This version provides for the installation of insulating sheets onto the supporting concrete slab waterproofed with a nylon sheet. The aforesaid insulating sheets have a density equalling 30 kg/m^3 and a shaped surface to set the pipes with multiple 5cm centre distances. The circuits of the system are made with PE-X/Al/PE-X, PE-X/Al/PE-HD or PE-RT pipes.

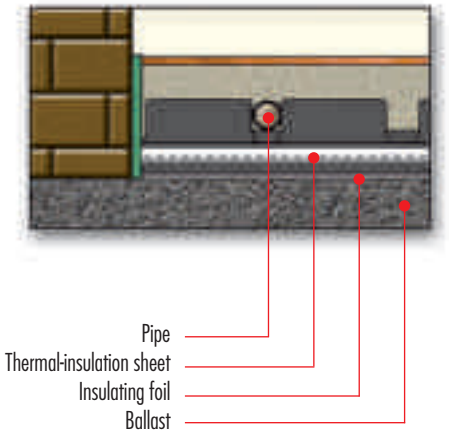




VALU-TECHNIK SYSTEM WITH SOUNDPROOFING THERMO-SHAPED INSULATING SHEET

This version provides for the installation of insulating sheets onto the supporting concrete slab waterproofed with a nylon sheet. The aforesaid insulating sheets have a density equalling 30 kg/m^3 and a shaped surface to set the pipes with multiple 5cm centre distances. The circuits of the system are made with PE-X/Al/PE-X, PE-X/Al/PE-HD or PE-RT pipes.





NOTE: wall-installation is also possible where a high energy supply is needed. Brackets and special components are available for the aforesaid type of application.

The components

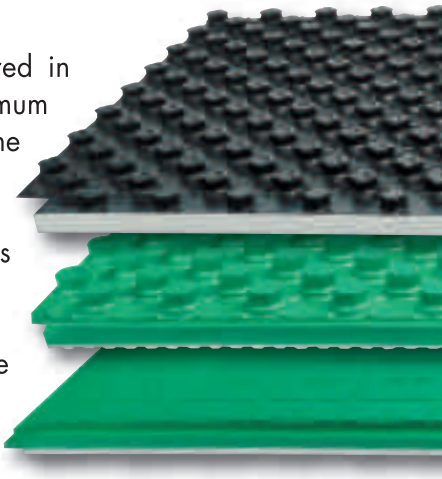
aquatechnik offers a complete range for this plant-engineering typology, including pipes, sheets, manifolds and any type of completion products.

The **multi-calor** pipe is a high-quality multilayer pipe; the intermediate layer among the 5 layers is made with a special aluminium alloy that, besides having the function of anti-oxygen barrier, allows the product ductility during the processing operations. The **multi-calor** pipe is suitable for all system types: heating, air-conditioning and sanitary; this feature allows recovering processing scrap. It complies with the European UNI EN 21003 standards and it was type-approved by the most important international institutes; it is a reference point for quality and performance results at European level.

The **multi-eco** pipe has the same layers as the **multi-calor** pipe; the difference is the reduced thickness of the aluminium alloy, which assures excellent malleability and a reduced cost with a performance that is always above the standards, even if slightly lower than the **multi-calor** pipe.

The **polipert** pipe is the only one without the internal aluminium layer, as it is completely made with plastic material. It includes 5 layers and the intermediate one is made of EVOH, whose function is to be an anti-oxygen barrier. Product low weight and the excellent flexibility allow an easy installation, even if it does not assure the same ductility of the products provided with the aluminium layer.

Tested in compliance with the European and DIN 16833, 16837 and 4726 standards, it is a specific product for heating plant-engineering and is primarily used in floor radiant systems, it offers an excellent quality/price ratio and is more suitable in case of processing operations with shaped sheets provided with thermoshaped and mechanical junction.



aquatechnik offers a wide range of insulating sheets, all of them are manufactured in compliance with the standards in force. Besides meeting all technical needs (minimum thickness: 10mm to 42mm), they adapt to site needs, thus facilitating the laying and the installation (sheets made with thermoshaped and shaped materials, smooth sheets, with shapes, with and without soundproofing material, with and without polyethylene protective film). The sheets have an important function of supporting and fastening the pipes, besides assuring the thermal insulation of the slab. The sole presence of the insulating sheets assures significant energy saving thanks to the thermal insulation action that preventing temperature dispersions both in summer and winter versions. The designer is in charge of selecting the sheets in compliance with the European standards (UNI EN 1264).

In addition, **aquatechnik** supplies a range of accessories to execute and complete the screed, including the thermal-insulation baseboard, the expansion joint, the additive for screeds, the synthetic fibres and the fastening clips. The company boasts a range of modular manifolds, suitable for the needs of all system types. The aforesaid manifolds, which are called valurapid, are available both in the individual version (Ø 26 output 16, Ø 32 output16-20-Eurocone) and in pre-assembled version (with valve, holder or flowmeter).

The **climarapid** mixing units allow simultaneously managing a high-temperature circuit and a low-temperature circuit, which makes use of the high-temperature circuit return. They are available in the climatic version and with fixed point, with flowmeter and Eurocone connection. Every mixing unit is provided from 4 to 12 connections.

The entire system complies with the international standards and regulations, and it was certified according to the UNI EN 1264 standard.

Practical recommendations

Manifolds

- Install the manifolds in central position with respect to the zones to be heated and/or cooled, to facilitate the distribution of the loops.
- Position the manifold inspection panels at a height from the finished floor equalling at least 15-20 cm to facilitate the processing operation while joining and connecting the pipes to the manifold.
- Position the manifolds in easily accessible areas to allow the relevant maintenance.
- Limit the number of loops to 10-12 (maximum) for every couple of manifolds to prevent problems concerning balancing and the flow rates of the same loops.
- Install the manifolds at a higher level than the panel laying surface to assure system venting.
- It is advisable to specify, for each manifold, the length of the loop and the room served by it.
- Install shut-off valves in delivery and return sides of the manifold.
- In the manifolds, install charging/descharging cocks with hose connection to vent the system while it is being filled.
- Install a thermometer at the input of the delivery manifold and one at the output of the return manifold to check the relevant temperatures and to be able to calculate the temperature difference between delivery and return sides.
- In the manifolds, install flow-rate gauges in every loop to facilitate the relevant balancing.
- In the manifolds, install thermometers in every loop to check the relevant ΔT temperature drop, as well as the relevant balancing.

Thermal-insulation baseboard

- It is important to install the perimeter strip along all vertical structures: walls, columns, staircase steps, etc.
- Fasten the perimeter strip to the vertical structures by using the specific adhesive.
- The perimeter strip must rise from the supporting base up to the surface of the finished floor, and allow a clearance of the supporting layer equalling at least 5 mm.
- The upper part of the perimeter strip standing above the finished floor has not to be cut before completing the final coating and, in case of a textile or plastic coating, until the additive has hardened.
- Cut the part in excess of the insulating baseboard only after laying the final flooring and before installing the skirting board.

Thermal-insulation sheets

- It is advisable to lay the radiant panels when the internal plasters have been finished to assure that the screed is clean to lay the final flooring.
- Install the insulating sheets granting minimum thermal resistances according to the thermal conditions underlying the floor-radiant heating structure and according to the UNI EN 1264 standard.
- Install the insulating sheets granting minimum sound resistance according to the sound conditions underlying the heating structure.
- It is advisable to use thermoshaped insulating sheets.
- Before laying the insulating sheets, it is important to check the conditions of the worksite. The surface of the concrete slab must be free from rubble, encrustation and should not have hollows.
- Before laying the insulating sheets, make sure that the slab is flat; if it is necessary, put a layer of dry sand on the irregular areas.
- Before installing the system with radiant panels, check that the available floor heights are the ones established by the reference standards (UNI EN 1264).
- It is advisable to lay a nylon sheet onto the concrete slab of the embankment to create a vapour barrier under the insulating panels.
- It is advisable to start installing the insulating sheets from the wall opposite to the door of the room to prevent trampling onto the sheets during the relevant installation.
- The insulating sheets must be laid close to the vertical baseboard; the nylon sheet sealed in the baseboard must be lifted and put onto the sheets. The aforesaid precaution is used to prevent screed penetrations towards the supporting concrete slab while casting the screed.
- It is advisable to start installing the insulating sheets from the left to the right, so that the side with the interlock downwards goes close to the perimeter baseboard; re-use the waste in the following rows by always restarting from the left to the right.
- While laying the sheets, couple them in a correct way to prevent possible grouting penetrations while casting the screed.

Pipes

- Organise and streamline circuit laying according to the project and the available pipe coils; write the length of the loops to have the least pipe waste as possible.
- It is advisable to use pipes provided with anti-oxygen barrier to prevent the corrosion of the metal components in the system.
- It is advisable to use pipes with the best thermal conductivity.
- When the pipes reach the worksite, they must be protected against possible dangerous elements and must be kept away from direct sunlight.
- It is preferable to create loops with spiral shape (snail), which allow increased floor temperature homogeneity, pipe laying easiness also in conditions of low external temperature, as you create 90° curves and not 180° curves, as it is the case of coil-shape laying.
- It is advisable to create one or several independent circuits for every room to be heated/cooled.
- It is advisable to intensify the centre distance of the pipes next to glass doors or, any way, highly dispersing walls.
- It is advisable to direct the delivery pipe of the circuits towards the external walls, that is, the coldest walls.
- Introduce ø 25/32 mm plastic-material elbows (electrician cable-gland type) into the pipes next to the connection to the manifold: these elbows, besides protecting the pipes, help in directing the pipes from the vertical position of connection to the manifold to the horizontal position of the floor, thus reducing the folding radius to assure the relevant whelming into the screed. The aforesaid precaution can be omitted by using pipes provided with multilayer anti-oxygen barrier because the aluminium assures maintaining the fold obtained in the pipe.
- Insulate the pipes next to the manifolds by using 6mm thick, closed-cell sheath, until reaching the nominal pass of the panel (the aforesaid precaution is compulsory in the systems with cooling function).
- Lay the pipes of the circuits at a distance longer than 5 cm from internal vertical structures and at 20 cm from steps, wooden staircases, fireplace perimeters, chimney flues, stoves, lift wells, etc.
- Lay the pipes of the circuits at a distance longer than 5 cm from external vertical structures in case of heating and at 10 cm in case of cooling.
- When reaching the centre of the circuit, as for the 180° reversal curve, keep a 20/25cm distance between the delivery and the return pipes to prevent the pipe from getting crushed while being folded.
- It is advisable to take pictures of possible joints where the aforesaid operation becomes necessary, before covering panel pipes with the screed.
- While laying the pipes, avoid bending radiuses that are too narrow in order not to reduce the internal section and increase pressure drops. The aforesaid precaution also allows preventing the pipe molecular structure from cracking due to crushing.
- In sanitary premises, it is advisable to distribute sanitary-fixture and draining systems along the perimeter to leave as much useful surface as possible to the radiant panel.
- It is not advisable or, at any rate, pay attention when laying the pipes under shower trays, toilet bowls, bidets and baths.

Thermal additive

- After installing the system, it will be necessary to cast the screed as soon as possible, to limit the risks of damaging the pipes.
- Before casting the screed, it will be necessary to provide for wooden catwalks to be laid onto the pipes to allow the passage of the operators and wheel-barrows and preventing damages to the same pipes.
- When you need to install the floorings, such as Venetian-style terraces, Palladian floors, stones, half stones and, at any rate, all floors that must be fastened with mortar, it is advisable to perform a first casting to cover the pipes (at least 3 cm above the pipes).
- The building company and the concrete mixing station are in charge of correctly dosing the product.
- The company in charge or the Works Management are entrusted with the structure of the screeds.
- If building mixtures are supplied as already mixed with other types of additives that are suitable for floor-mounted heating systems, do not use the VHF additive.
- Keep the product at a temperature not lower than +5°C. In case of freezing, heat the product at least at 30°C and stir before mixing up.
- Even if the VHF additive does not imply a toxicity risk, it is advisable to wear rubber shoes and gloves, as well as protective goggles during processing operations. In case of contact with the eyes, the skin and mucosa, rinse with abundant water.
- In case of fire, use water, sprayed water, foam, carbon dioxide, and dry powder.
- Keep out of reach of children.

Synthetic fibres

- The use of synthetic fibres reduces screed cracking possibility, but cracking is not completely prevented: the execution of expansion joints, the correct installation of the insulating baseboard and the use of the thermal additive, as well as following the project instructions (metal nets, etc.) are compulsory and can never be replaced by the use of synthetic fibres.
- Avoid direct sunlight; keep in a fresh and dry place; keep away from all heat and ignition sources.
- The product, in compliance with long-term and chronic, acute toxicity provisions, is not noxious when applied in a correct way. Anyway, during handling operations, it is advisable to wear gloves. In case of skin inflammation, wash with abundant water.

Expansion joints

- It is compulsory to execute the expansion joints according to the corporate guidelines and with reference to the UNI EN 1264 standards in force.
- Execute the perimeter expansion joints by installing the perimeter strip along all vertical structures, walls, columns, steps, etc.
- Protect the pipe with a sheath (insulating or for electrical wires) when crossing the expansion joints and the walls.
- Peripheral expansion joints are usually enough, but in case of large rooms, it will be necessary to provide for specific expansion joints, always with reference to the guidelines established by the standards in force and, more precisely:
  a) the surface of each room has not to exceed 40 m^2.
  b) the maximum length of a room has not to exceed 8 m^2.
  c) the ratio of wall dimensions in each room has not to be higher than 1/2.
- Execute an expansion joint in all doors.
- The installer must have a plan specifying the position of the expansion joints.

Accessories

- To lay the pipe onto the smooth insulating sheets with barrier, it is advisable to use the specific fastening device for anchoring the clips in a quick way.
- To lay the pipe, it is advisable to use the specific unrolling device that facilitates the processing operation.
- To cut the pipe, it is advisable to use the specific shears with undamaged and well sharpened blades.
- To connect the multilayer pipe to the manifold with Eurocone outputs, it is advisable to ream the internal diameter by using the specific calibrator.
- To tighten the caps, both safety and Eurocone type, it is advisable to use the specific wrenches.

Casting of the screed

- Prepare the cement mixture by mixing the sand with the cement in the concrete mixer, and add the thermal additive with the concrete being already partially hydrated, into the mixing water. Complete the preparation of the mixture by adding water and mix for at least 10-15 minutes until reaching the optimal consistency.
- Comply with the dose of thermal additive established in the technical data sheets and according to the thickness of the screed.
- In case of mixing particular screeds, which are quick drying, self-levelling, synthetic or, anyway, rich in anhydride, call the suppliers to know the correct additive dosing.
- Absolutely exclude the pipe covering with screeds formed by cellular cement, concrete admixed with insulating bitumen or with expanded granules.
- Wait at least three weeks after casting the screed to lay the final flooring.
- In case of floor holes, they must be formed before installing the system with radiant panels to prevent the pipes from being accidentally drilled.
- Before laying wooden floors, it is important to check that the humidity of the screed is included within the values that were pre-established by the suppliers. So, it is advisable to switch ON the system before laying wooden floors. Besides, if you install raw woods, it is advisable to switch ON the system once again before the sanding operation and after glue drying. As for the specific times, call the flooring suppliers.
- If you need to install the system in winter, do not cast the screed in case of temperatures lower than 5°C and keep a temperature equalling at least 5°C for minimum 3 days after screed casting.

- The supporting layer (screed) made with self-levelling material can be cast at a minimum temperature of 0°C.
- **aquatechnik** is relieved from any responsibility concerning the structures of the screeds, of cement mixtures, of final flooring and from any other worksite responsibility.

Testing of the system

- It is extremely important to test the system before casting the screed and leave it under pressure during the relevant formation.
- Test the system at a recommended pressure of 10 bar, and restore the pressure from time to time until it has stabilised.
- During testing operations, it is advisable to perform some pressure charging and descharging cycles in the system before stabilising the pressure at the pre-established value. The aforesaid cycles allow identifying possible weaknesses in the pipes and in gasket seals between manifold couplings, etc.
- In case of freezing hazard, use the specific antifreeze solutions after checking their compatibility with the pipes, or completely drain the system, in case of water testing, after casting the screed.
- If there is no freezing hazard and you want to prepare the system to be switched ON, fill it by means of the specific charging/descharging units that are installed in the manifolds, as it is described in the following chapter.
- The absence of leakages and the testing pressure must be specified in a testing report.

Switching ON and balancing of the system

- Load the system by using the specific charging/descharging units installed in the manifolds. Fill loop by loop, and drain the air from a rubber pipe that is connected to the charging/descharging unit and use manual and automatic drain valves. The operation must be carried out by starting to fill, with all valves and holders being closed, except for the ones for a loop. After draining the first loop, act in the same way for the other loops and close valve and holders of the completed loops. The aforesaid procedure assures a correct tharging of the system and, as a consequence, a better output also preventing the malfunction of the circulating unit.
- While filling the system it is important to drain all the air that is present. System charging and venting operations are carried out as follows:
  1) close all holders and all valves in delivery and return manifolds.
  2) close the shut-off valves installed in the supply lines of delivery and return manifolds.
  3) connect a transparent rubber pipe to the draining cock of the return manifold (on the top).
  4) fill the water through the delivery manifold (low) by means of a pipe connected with the charging/descharging cock or through the Ø 1" opening of the shut-off valve.
  5) open the valve and the holder in the first circuit loading the water until fully removing the air; check the continuous exit of water by using the transparent rubber draining pipe previously connected with the return manifold.
  6) close both the valve and the holder in the previously loaded circuit.
  7) repeat the last two operations for all circuits.
- Before switching ON the system, check that the perimeter insulating strip was cut flush with the final floor, assuring that the screed freely operates (expands) against the vertical structures.
- Wait at least three screed-drying weeks before activating the system.
- Switch ON the system with an initial delivery temperature of 25°C to be kept for 3 days. After that, increase it until reaching the maximum design temperature (see the drawing), which has to be kept for at least 4 days.
- The system start-up process must be documented.
- In case of quick drying, self-levelling or synthetic casting screeds, activate the system after a period that complies with the specifications established by the supplier of the screed.
- While starting up the system, adjust the boiler thermostat at 50°C. The aforesaid precaution prevents water from circulating at a too high temperature within the panel system in case of adjustment malfunctions.
- Calibrate the circuits of the system by adjusting manifold holders and position the relevant opening according to design tables (see the drawing).
- As far as the boiler is concerned, you have always to provide for a safety probe to be installed in the delivery side of the panel system, which is independent from the control unit, and directly connected with the heat generator that will switch it OFF in case of overtemperatures.

Design activity

- To prevent physiological discomfort conditions, the surface temperature of the floor must be lower than the values established by the reference standards (UNI/CEN 130 and UNI EN 1264-2), max. 29°C in residential living areas, max. 35°C in marginal areas with the limit of 1 m depth from external walls.
  The 35°C max. temperature can also be reached in the so-called transit and/or passage areas (ex. access areas and corridors) and in toilets.
- To prevent useless heat accumulations and to reduce the already remarkable thermal inertia of this type of systems, during the design step, keep the value of the power supplied by the panel lower than the value provided for in reference standards (UNI/CEN 130 and UNI EN 1264), that is, max. 100 W/m^2.
- It is preferable to use modulating-type thermoregulations, that is, capable of adapting the system to the external climatic conditions. Indeed, differently from thermostatic thermoregulations, which are also called fixed-point because they always maintain the same water temperature within the system, the thermoregulations with climatic regulator assure the reduction of useless heat accumulations in the screed with the subsequent reduction of the thermal inertia in the same system. In addition, selecting modulating thermoregulation assures considerable energy saving when managing the system.

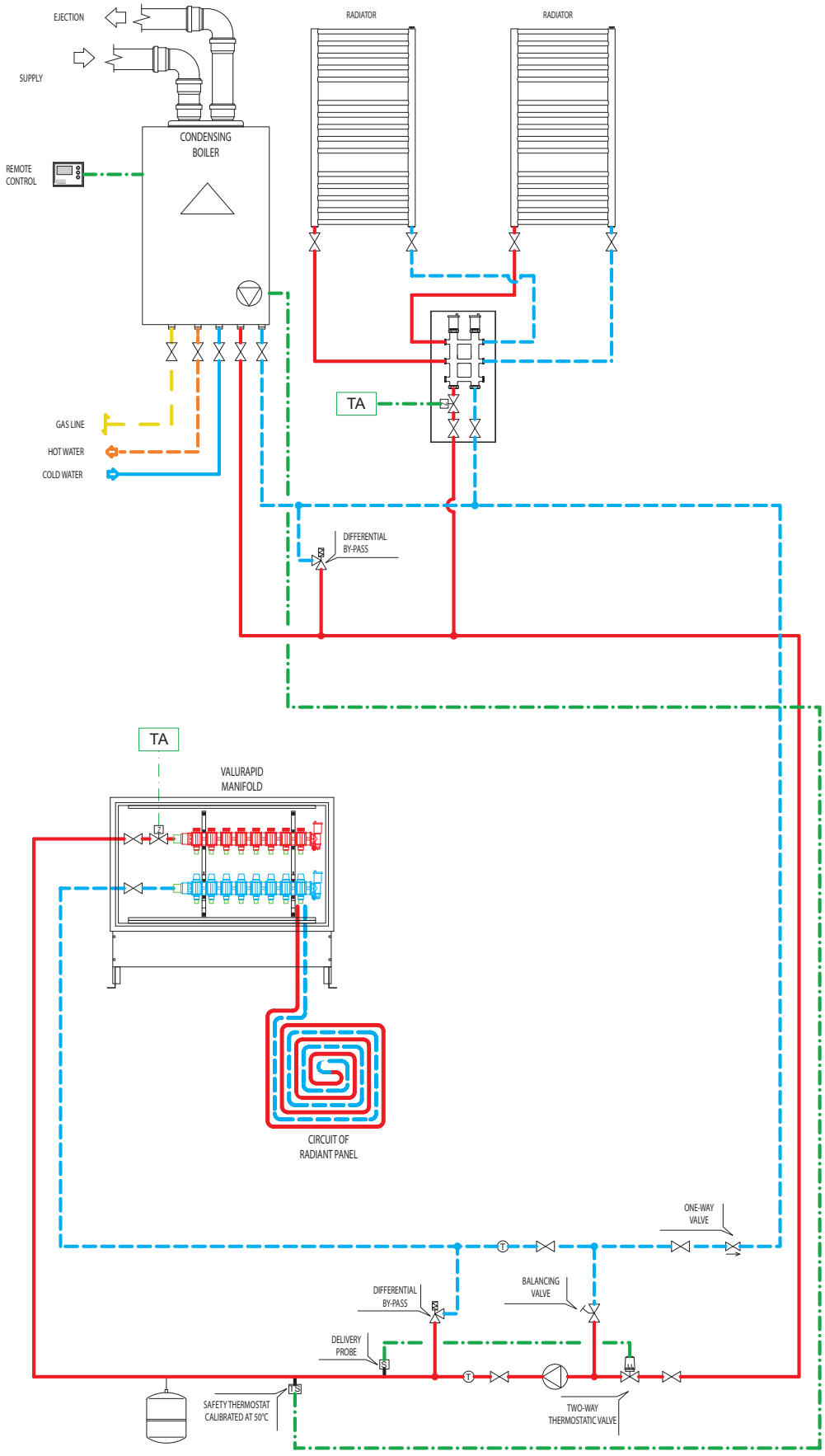
System management

- During the operating period, do not switch OFF the system and reduce system operation slowdowns as much as possible; in that case, do not exceed maximum 2 or 3 degrees of difference (ΔT) between comfort and attenuation temperatures.
- It is advisable to manage the system with modulating thermoregulations.

EXAMPLES OF GRAPHIC DIAGRAMS

Typical diagram for valu-technik floor heating system with radiant panels

Single-area system with fixed point at low temperature

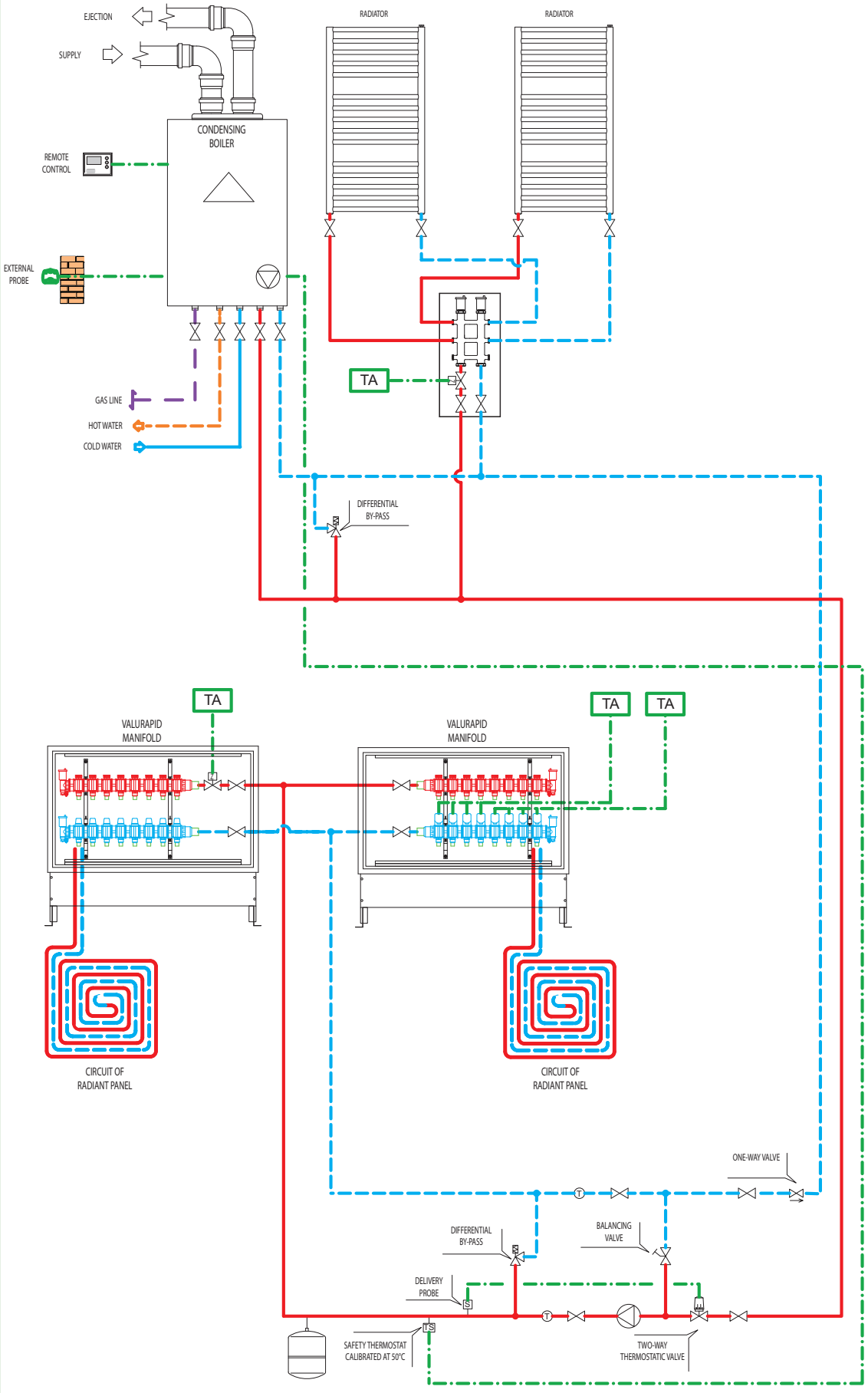


NOTE: DELIVERY TEMPERATURE ADJUSTMENT WITH FIXED POINT BY MEANS OF TWO-WAY THERMOSTATIC VALVE AND BALANCING VALVE
ROOM TEMPERATURE ADJUSTMENT BY MEANS OF ZONE SOLENOID VALVE CONTROLLED BY ROOM THERMOSTAT

EXAMPLES OF GRAPHIC DIAGRAMS

Typical diagram for valu-technik floor heating system with radiant panels

Fixed multi-area system at low temperature



NOTE: DELIVERY TEMPERATURE ADJUSTMENT WITH SLIDING FIXED POINT BY MEANS OF CONDENSING BOILER
ROOM TEMPERATURE ADJUSTMENT BY MEANS OF ZONE SOLENOID VALVE AND ELECTRO-THERMAL HEADS CONTROLLED BY ROOM THERMOSTAT

TESTIMONIALS

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