APPTEC
RAISED FLOOR SYSTEM

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2018

RADIANT

RADIANT HEATING SYSTEM

RAISED FLOOR SYSTEM

RADIANT MODULES

"Radiant" is a patented technological system that allows you to combine the advantages of a raised access floor with those of radiant heating.
These advantages are obtained by assembling our Radiant modules in the factory with the raised floor panels. In this way, the installation of the heating or cooling system is achieved through a totally "dry" installation, avoiding the use of cement or adhesive used in traditional construction and consequent savings.
Thanks to use of radiant heat exchangers, it is possible to obtain on the surfaces within an environment a constant average temperature of about 22/23°C. This system allows you to avoid annoying air movements and the handling of dusts that would be very harmful, especially in terms of health.

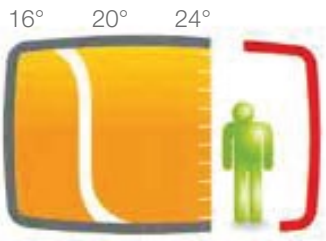
THE "RADIANT" PANEL, READY TO USE, CONSISTS OF:

- a module of thermally insulating material, square in shape;
- a conduit for fluids with inlet an outlet, in addition to a thermal diffusion plate;
- a panel composed of a support in calcium sulphatem, coupled to a finishing surface made of thermally conductive material.

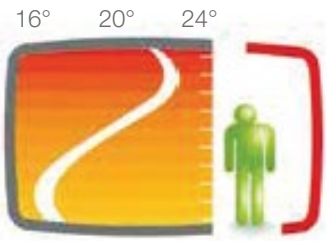
Advantages offered by panel systems.
The main advantages that panel system can offer concern:
• ithermal well-being;
• the quality of the air, with imperceptible convective motions in the air;
• the hygienic conditions, comfortable and clean enviroments with no dust movements, cause of allergic phenomena;
• the enviromental impact;
• heat usable at low temperatures;
• energy saving, reduction of a management costs;
• almonst zero maintenance;
• always clean walls and curtains.

THE COMFORT

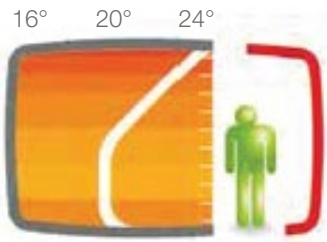
It is important remember that most people spend most of their life in an enviroment with artificial climate. To ensure well-being for the human body, the vertical distribution of the air temperature must be like that ideal well-being curve shown below. Looking at the figures with a radiant floor panels and a radiant wall panels, the curves are very similar at the ideal curve, in the figure radiant ceiling panles, although deviating from the ideal curve in the part of the graph, at mean height comfort is acceptable. While high conditioning systems heating with radiators and heating with convectors involve a breakdown of temperatures that do not correspond to physiological needs.
The stratification of the air in the enviroment, resulting from many “traditional” convectors, La stratificazione dell’aria nell’ambiente, conseguente ai molti convettivi “tradizionali”, causa temperatures to rise from the floor to the ceiling.
This conditions is negative for energy savings and causes an unfavorable comfort contidion.



Ideal curve

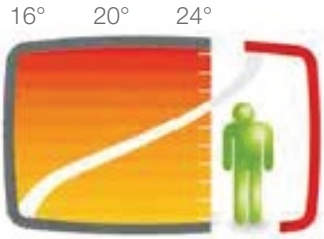


Heating with radiators



Radiant panels at ceiling

Ideal curve

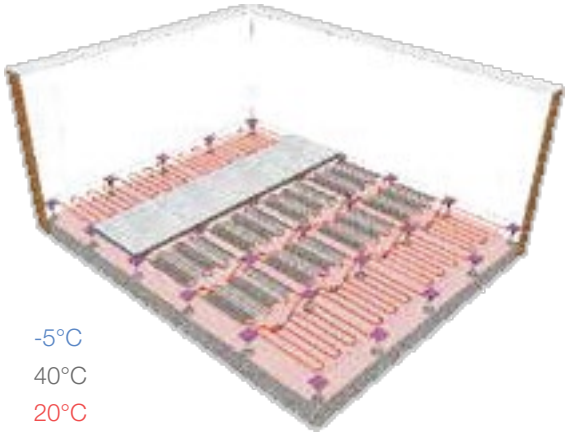


Heating with radiators

BENEFITS

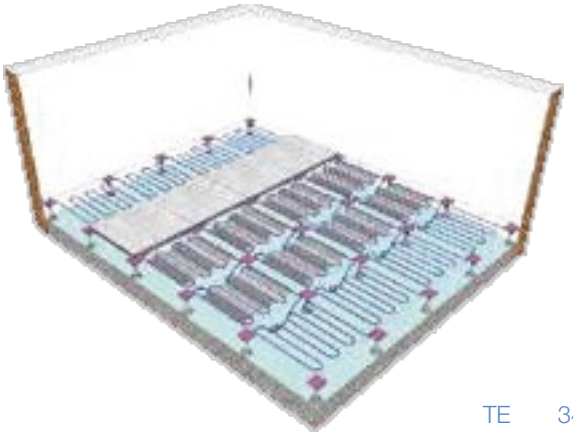
WINTER

The radiant surfaces transfer heat to the structures and at he human body mainly by radiation and in a minimal part by conduction, Le superfici radianti cedono calore alle strutture e al corpo umano principalmente per irraggiamento e in minima parte per conduzione, triggering a reciprocal thermal exchange. The air, in contact with the radiant surface, moves with diffuse and slow convective motions that don't cause disturbance, is less hot and less dry, contributing to the right functioning of the respiratory system and moderating allergic factors. In a house heated with radiant panels the temperature of the floor is around 26-28°C, the human body gives less heat to the enviroment, an air temperature of around 20-22°C is obtained by radiation and there is the feeling of living in a warmer enviroment.



TE	-5°C
TM	40°C
TI	20°C
TS	24-29°C
URI	60°C

SUMMER



TE	34°C
TM	12°C
TI	26°C
TS	21-24°C
URI	50°C

TE - External temperature
TM - Water temperature
TI - Internal temperature
TS - Superficial temperature
URI - Internal relativ humidity

In the last years construction has developed significant improvements in construction techniques,obtaining significant reductions in thermal loads. The regulations of the laws has allowed of buildings with much lower heat requirements, with great advantages in terms of yields and comfort. All this allowed to use the floor system also to obtain summer cooling. To cool an enviroment, cold water passes throught the pipes of the existing floor system, this produces a considerable amount of radiation drop in temperature. The system provides for the use of air treatment machines (dehumidifiers) which optimize relative humidity values and eliminate the possibility of condensation.

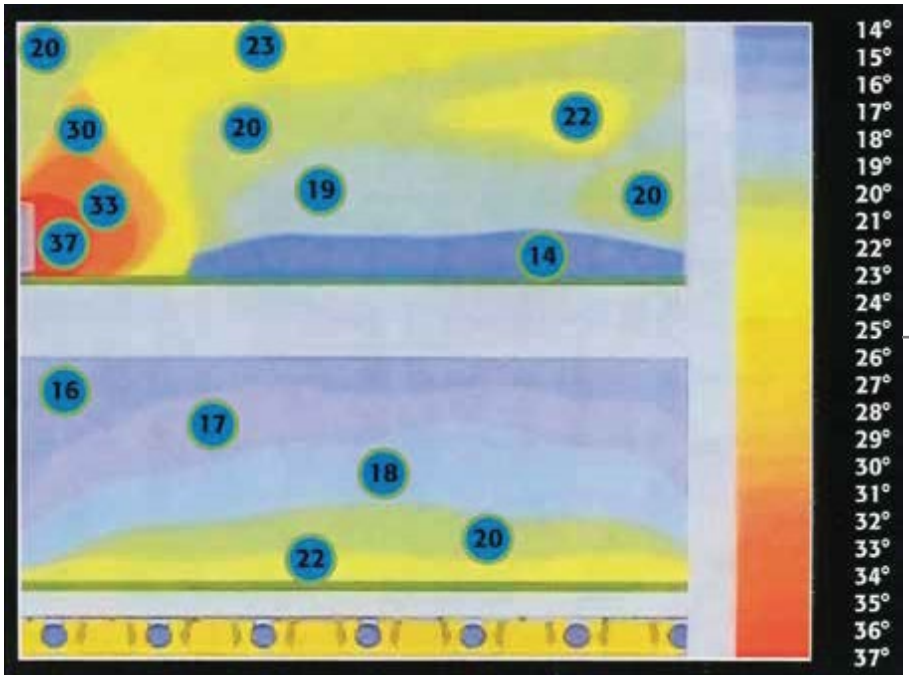
THERMAL WELL-BEING

As evidenced by the ideal curve already reported, in order to ensure conditions of thermal well-being in a room, areas that are slightly warmer on the floor and cooler on the ceiling must be maintained. The systems that best lend themselves to offering these conditions are radiant floor systems for the following reasons:
1. the specific position (on the floor) of the panels;
2. the fact that they give off heat mainly by radiation, thus avoiding the formation of convective currents of hot air on the ceiling and cold on the floor.

MAXIMUM COMFORT:

- pleasant feeling of well-being;
- well air-conditioned working environment (basic condition);
- feel comfortable;
- energy saving.

The air conditioning of a room should be done uniformly, using large heat exchange surfaces such as floors, walls and ceilings.



Ambient temperature of heated room
with radiators

Ambient temperature of a heated room
with floor panels

AIR QUALITY

Panel heating is able to avoid two typical drawbacks of heating systems:
• the combustion of atmospheric dust, which can cause a sense of parchedness and irritation in the throat;
• the high circulation of dust, which (especially in unclean rooms) can cause allergies and breathing difficulties.

ENVIROMENTAL HYGIENE

Panel systems exert a positive action in maintaining good enrionmental hygiene conditions, as they avoid:
• the formation of wet areas on the floor, thus substracting thei ideal environment from mites and bacteria;
• the onset of mold (and related bacterial fauna) on the walls that border on warm floors.

ENVIRONMENTAL IMPACT

In new buildings and in recovery interventions with floor refurbishment, panel systems are the plants with the least environmental impact because:

• do not pose aesthetic constraints. The non-visibility of the panels is very important especially when historic or architectural buildings are to be air-conditioned, where the presence of heating elements can compromise the balance of the original forms;

• do not limit the freedom of furniture, thus allowing the most rational use of space;

• do not contribute to the degration of plasters, wooden floors and windows, as they do not soil the black carbon walls,do not allow the information of moisture on the floor and significantly limit the cases of internal condensation as they increase the temperature of the walls near the slabs with panels.

HEAT USABLE AT LOW TEMPERATURE

Thanks to their high dispersing surface, the panel systems can heat with low heat transfer medium temperatures. This feature makes their use convenient with heat sources whose yield (thermodynamic or economic) increases as the required temperature decreases, as in the case of:

• heat pumps;
• condensing boilers;
• solar panels;
• heat recovery systems;
• district heating systems, with the cost of heat linked (directly or indirectly) to temperature return of primary fluid.

TECHNICAL VERIFICATION:

• Total thermal energy emitted by the radiant floor, measured by the meter:
Q = 1225 W/h

• Hot water flow rate to the radiant system, measured by the pulse meter:
P = 198 l/h

• Delivery water temperature to the radiant system, measured by the electronic thermometer:
TM = 45,4°C

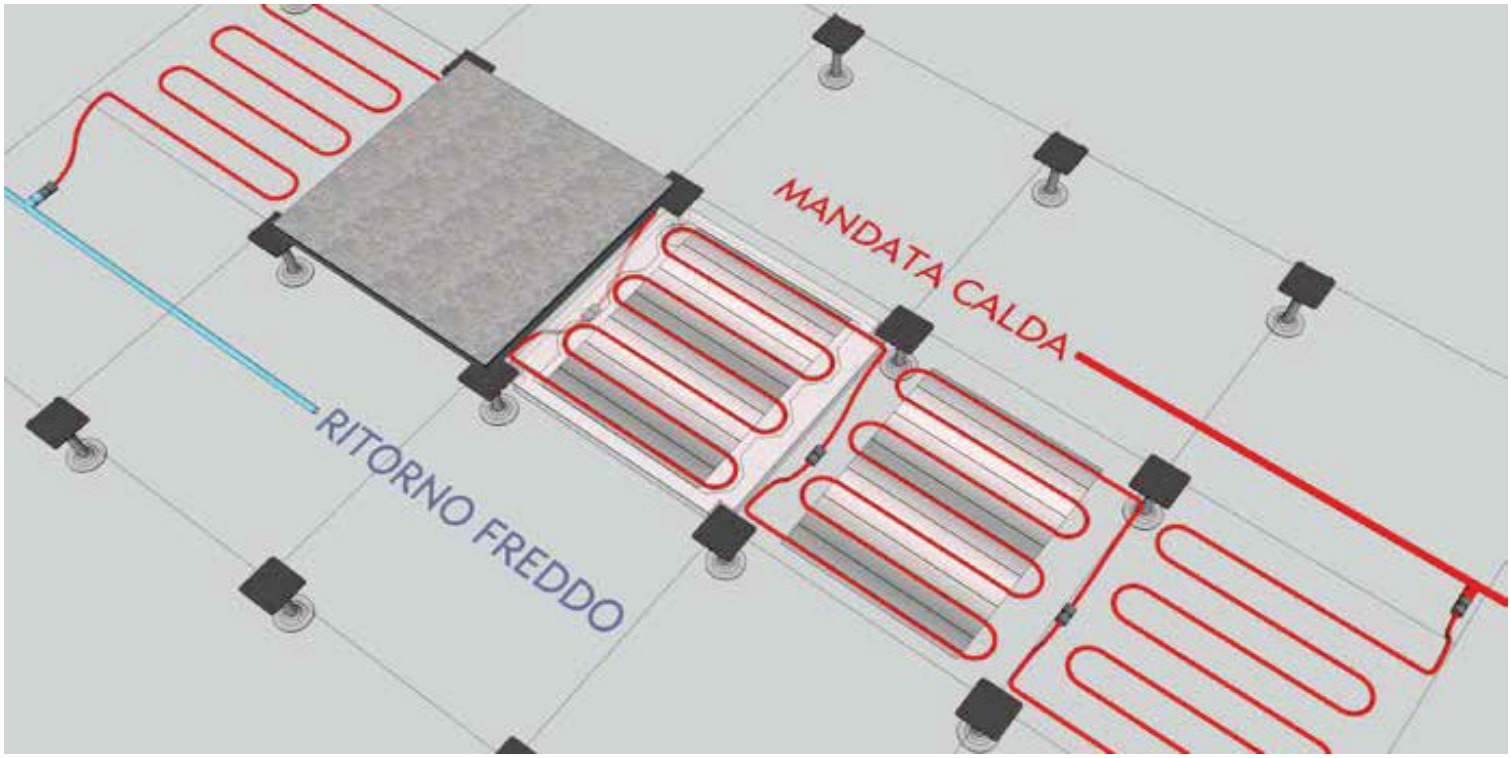
• Return water temperature from the radiant system, measured by the electronic thermometer:
TR = 40,1°C

Analytical verification of the energy measured by the meter:
Q = P x (TM - TR) x 1,163 = 198 x (45,4 - 40,1) x 1,163 = 1220 W/h

Total thermal energy emitted by 1 mq of floor:
Q TOTAL SQM = 1220 / 12,6 = 96,8 W/h mq

Useful thermal energy emitted into the environment to be heated, for square meter of floor:
Q TOTAL SQM = 96,8 - thermal energy lost towards the bottom of the floor
= 96,8 - 14,5 = 82,3 W/h mq (with air temperature under the floor of 25°C)
= 96,8 - 22,8 = 74 W/h mq (with air temperature under the floor of 15°C)

The temperature range considered underfloor (from 15 to 25°C) is reflected in most real situations.



LIMITS AND DISADVANTAGES OF INSTALLATIONS A PANEL

They essentially concern aspects related to the surface temperature of the floor, to thermal inertia of the plant and the difficulty of the design order.

THERMAL INERTIA AND TYPE OF USE PLANT

Panel systems are characterized by having a high thermal inertia because, to trandfer heat, using the structures in which the panels are embedded. In rooms heated with a certain continuity (and with good insulation under the panels) the thermal inertia of these systems does not pose any problems and allows:

- a good adaptation of the system to external climatic conditios;
- interruptions or slowdowns in operation, with activation and deactivation times of the system which normally must be anticipated by two hours.

ENERGY SAVING

Compared to traditional heating systems, panel systems allow appreciable energy savings essentially for two reasons:

1. the higher operating temperature which allows (at the same room temperature) average savings ranging from 5 to10%;
2. the lower thermal gradient between floor and ceiling which leads to higher energy savings the higher the height of the premises. Reasons (albeit less important) for energy saving can also be considered:

- th euse of low temperatures which reduces dispersions along the pipes;
- non-overheating of the walls located behind the radiators;
- the lack of convective motions of hot air on the glass surfaces. On avarage, panel systems (always in relation to traditional systems) they allow energy savings ranging from 10 to 15%.

COOLING OF ROOMS

Panel systems also allow room cooling. However, they should be considered have two specific limits in this regard:
1. the limited cooling performance;
2. the inability to dehumidify.
The low cooling performance depends on the fact that in panel systems it is not possible to lower the too much floor temperature without causing surface condensation. For this reason it is difficult to obtain cooling capacities greater than 40-50W/m2.
The inability to dehumidify depends instead on the nature of the panel systems whose terminals, the floor cannot condense and evacuate part of the water contained in the air.
Hygrometric conditions of well-being can therefore only be obtained with the help of dehumidifiers: that is with additions to the panel system that entail acceptable costs and dimensions.

THE FUNDAMENTAL DIFFERENCES

RADIANT SYSTEMS

- optimal thermal insulation;
- low temperature vector fluid;
- perception of comfortable temperature;
- absence of convective motions;
- more spaces for furniture;
- air conditioning at man height;
- high energy savings.

TRADITIONAL SYSTEMS

- thermal insulation;
- high temperature vector fluid;
- perception of excessive temperature;
- high convective motions;
- occupied walls;
- total volume air conditioning;
- dispersion of energy.

THE DESIGN

The importance of correct design is a fundamental step to guarantee perfect operation plant. The processing of the design data must take into account the complex sizing needs of the system. The processing of the design data must take into account the complex sizing needs of the system:
- design temperature;
- temperature changes (external temperature - internal temperature);
- climatic zone;
- orientation of the structure;
- type of structure;
- dispersion of energy.

The executive drawing (plan) must be the result of an accurate planning which indicates:
- distribution of the panels;
- laying project;
- circuit length;
- number of circuits in each room;
- composition of the collector group;
- flow rate and head loss of the manifold group.

THE COMPONENTS OF THE SYSTEM

The radiant module joined to the raised floor panel forms the basis of the system, the functions it perfoms are mainly:
• insulation from the underlyng slab to avoid heat loss;
• contains the system components, pipes and thermal diffusion plates;
• raised floor panel.

The radiant module includes:
• **Radiant module** (fig.1) is made of thermally insulating material, made of polysterene, it has a quadrangular shape, with side of 570 mm, and thickness of 35 mm. It also includes a channel (fig.2) for housing the conduit for fluids with an entrance and an outlet.
• thermal diffusion **plates** (fig.3), in aluminum, 3/10 thickness, suitably shaped in order to contain the tube for fluids.
• **Pipe** (fig.4) for cross-linked polyethylene fluids with oxygen barrier.
• **Finishing panel** (fig.5) consisting of a high density calcium sulphate support, a finishing coating made of different material: ceramic stoneware, pvc, linoleum, marble and granite, textile floors (carpeting or other).

THE MODULE (fig.1)

The module is made of thermally insulating material, made of polystyrene, it has a quadrangular shape, with sides of 570 mm, and thickness of 35mm. 570 mm, e spessore di 35 mm.

THERMAL DIFFUSERS (fig.3)

The thermal diffusers are made of pure aluminum with a thickness of 3/10 and are obtained by cold profiling as well as by very high pressure printing.

THE COLLECTOR

The collector indispensable element is used for the distribution, regulation, interception of the system pipes.

WARDROBE

The collector must be contained and protected, the use of the cabinet is essential for the preservation of its integrity.

CONTROL UNIT

The heart of the plant management system, it determines correct climate management.

THE TUBE (fig.4)

The tube is an important part of the system, it allows the passage of the carrier liquid, it is important that the tube respects certain characteristics:
anti-wear, anti-deformation, anti-corrosion, anti-limescale and inalterability over time. The tube is subject to temperature changes, pressure changes and stresses due to continuos pressure durin walking.
RFT only uses:
pe-xc polyethylene is a thermoplastic resin that presents itsefl as a trasparent or white solid with excellent insulating propertiesand chemical stability.
The processed polyethylene is transformed into electronically cross-linked high density polyethylene (pex-xc). The tube complies with EN ISO 15875-2:2003, is built with the best material available on the market and manufactured with the utmost care through modern technology. The tube corresponds to DIN 4726 which provides for the waterproof barrier against the passage of oxygen. If this were not the case, oxygen would reach the liquid inside, compromising the metal parts hydraulically connected to the system (manifolds, fittings, exchangers...).