
GIACOMINI
Technology in Comfort
UNDERFLOOR HEATING
Technical
Manual

GIACOMINI UNDERFLOOR HEATING

GIACOMINI S.P.A.
ITALY

Technical Manual

Giacomini
Designed for growth

Its no coincidence that Giacomini S.p.A. is acknowledged as much for its flair in design as its growth as to a world leader, especially in the brass product sector with ranges of Lever ball, Gate and Radiator Valves being prime examples. From just one small unit, founded in 1951 by Alberto Giacomini on the Western side of Lake Orta, the company has expanded to multiple factories producing a wide range of products in metal and plastic.

Brass production is shared between two Giacomini factories, at Castelnuovo del Garda for hot forging and in San Maurizio d'Opaglio, the headquarters for all manufacturing, assembling, testing, packing, stocking and shipping. Another production unit has recently been opened for the manufacture of pipes and fittings in plastic materials.

GIACOMINI SALES (U.K) LTD
UK

Now supplying 85 countries worldwide, recognition stems from high quality production tailored to a variety of markets, compliance with appropriate Standards and Approvals by important International Institutes. With 75% of production exported, Giacomini's dynamic attitude and product reliability is well demonstrated.

Also clear is its concern for efficient production and outstanding design, using the most up-to-date computerised technology and systems in the hands of highly qualified personnel. This enables solutions for all constructive problems at the initial stage of research and development; with support from sophisticated laboratory equipment for hydraulic, mechanical, thermal and chemical testing, plus specific product checks and continuous supervision during production.

Closely aligned to testing, which is automatically carried out on 100% of the pieces, repetitive mechanical, hydraulic and thermal checks provide a constant measure that ensures consistency of quality and performance over the long term.

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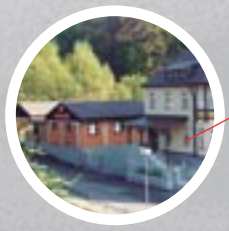
FRANCE

GIACOMINI ESPAÑA SL.
SPAIN

GIACOMINI PORTUGAL LTDA.
PORTUGAL

ARNEMA S.R.O.
CECH REP.



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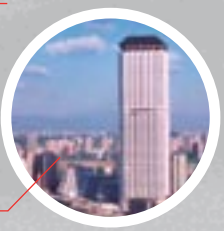


Underfloor Heating
How it works

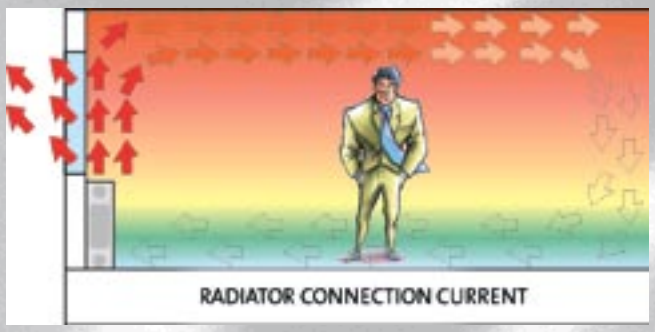
A radiator system transfers energy into a room or space largely by convection.

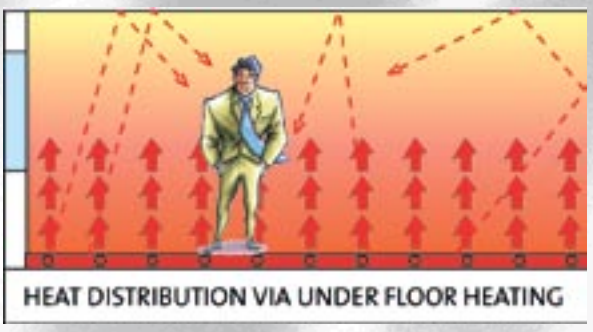
This convection results in the floor being the coolest part of the room leaving a mass of warm air at ceiling level. It also picks up fine dust particles from the floor and distributes it into the air and over furnishings.

Whereas an underfloor system heats almost entirely by radiation. This is the most natural and comfortable form of heating, like the Sun, Radiant energy is emitted by the floor, partly reflected by each surface and partly absorbed.

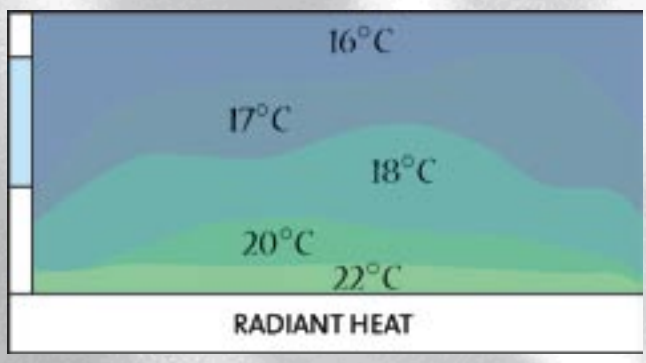
Where it is absorbed, that surface becomes a secondary heat emitter.

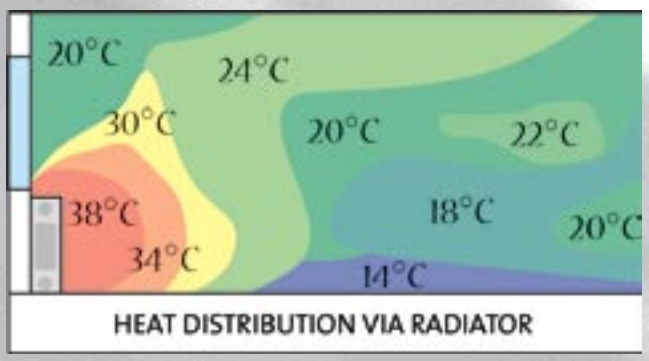
After a while all surfaces and furnishings themselves radiate energy and the room becomes evenly and uniformly warmed.





The energy reaches into every corner of the room or space which means – no cold spots, no warm ceilings or cold feet. In buildings with high ceilings the temperature actually reduces as the height increases, whilst with other systems the convection effect increases the temperature at high level giving a high heat loss through the roof. In addition to this, with underfloor heating the comfort level is achieved with an air temperature which is 2 Deg C lower than Convection Heating Systems. These factors mean that when designing an underfloor heating system, little allowance is required for buildings with high ceilings such as churches, barns, sports halls and similar buildings.





The Benefits of Underfloor Heating

Can reduce running costs by 30%

- ✓ It is the most comfortable form of heating
- ✓ It is safe, unobtrusive, freeing wall space and quiet in operation
- ✓ It is virtually maintenance free
- ✓ It is easy to control

And it's healthier, underfloor heating reduces humidity within floors coverings preventing dust mites from surviving or ensuring that they rise to the surface of the covering where regular cleaning removes them. The reduction in air movement with underfloor heating also reduces the ingress of airborne and carpet or floor covering fungi spores leading to an allergy free environment.

The system is installed within the buildings floor construction. The system comprises of a cross link polyethylene (PEX) pipe or polybutylene (PB) pipe, specifically manufactured for underfloor heating by Giacomini, installed within the floor in a specific design configuration with Giacomini system components to suit the floor type.

Water at temperatures of 45 – 65 Deg C is circulated through a network of underfloor pipework heating the floor to a temperature of 23 – 32 Deg C and turning the floor into a low temperature heat emitter.

It can be installed in any type of floor construction, screeded concrete, structural concrete, timber joisted and timber floating floors with nearly all floor coverings.

Control of the system can be provided in a number of ways depending on the system requirements, single zone and multi zone giving the right amount of heat to the right place at the right time.

Typical screed floor installation

Suitable for a whole range of different applications

The Giacomini underfloor heating system can be tailored to virtually any building type as seen below,

- ✓ Private houses
- ✓ Extensions
- ✓ Conservatories
- ✓ Schools
- ✓ Museums
- ✓ Factories
- ✓ Offices
- ✓ Warehouses
- ✓ Zoos
- ✓ Sports halls
- ✓ Swimming pools
- ✓ Leisure centres
- ✓ Club houses
- ✓ Day care centres
- ✓ Hospitals
- ✓ Hotels
- ✓ Prisons
- ✓ Churches
- ✓ Barn conversions
- ✓ Libraries
- ✓ Restaurants
- ✓ Changing rooms
- ✓ Fire/Police stations
- ✓ Play groups
- ✓ Car showrooms
- ✓ Garden centres
- ✓ Public houses
- ✓ Doctors surgeries
- ✓ Holiday villages
- ✓ Nurseries

Typical installation

Giacomini underfloor heating for solid floor types

Solid floor underfloor heating systems include all floor constructions that have the underfloor heating pipework embedded in a concrete or screed.
They include concrete structural floors and concrete screeded floors as well as Block and Beam floors with a screed finish.

The structure of the concrete floor will depend upon the structural requirements of the floor. A typical concrete floor section is shown pointing out the different elements of the floor structure and showing the Giacomini Underfloor Heating pipework within the structure.

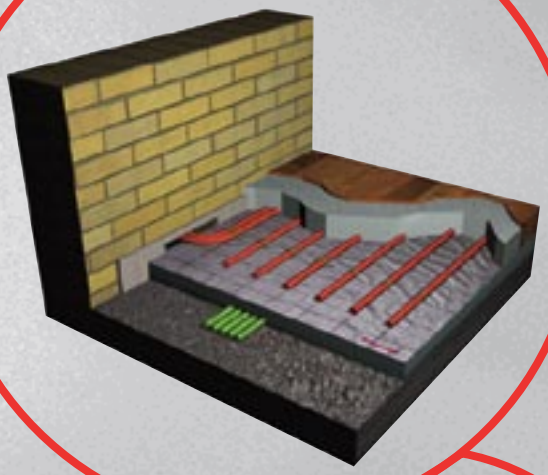
The sub base will usually be made up of two layers, the first being a compact or consolidated hard-core which will have a binding layer on top. A damp proof membrane (DPM) is usually included at this level; this is essential to stop moisture transfer into the concrete base.
Insulation is then laid which is necessary to meet current building target U values to comply with current building regulations as well as to reduce the heatloss from the underfloor heating pipework to the floor below.

Giacomini pipe PE-X or PB pipework is then laid, held in place with one of the anchorage types and the concrete. The makeup and the thickness of the concrete will be determined from its structural requirements of the floor. Concrete used for this type underfloor heating should not include any insulating materials. The heating pipework is positioned giving a minimum cover of 30mm.

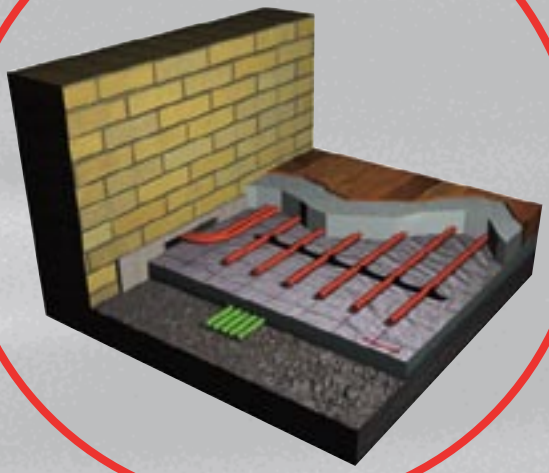
Screeded floors will be laid onto a sub-base, which can be a concrete base or a block and beam sub floor.

Construction of the floor above the sub-base including the Giacomini Underfloor Heating will be the same for both block and beam and concrete sub-bases. Within or directly on top of the sub-base a damp proof membrane should be included. The Giacomini Underfloor Heating pipework is then installed using a suitable anchoring method. Finally the screed is laid following the appropriate British Standards and codes of practise. Screed materials should not include any insulating properties and a minimum thickness of 30mm above the pipework is required.

U Clip System



Clip Rail System



Floor Joints e selections

With underfloor heating other than for ceramic floor finishes there is little need to include expansion joints within the floor. Expansion joints should be included in the floor if the final floor finish is to be ceramic tile or similar. These are only required if the floor area is greater than 40m2 and then the floor area should be divided into bays with a maximum length of 8m.

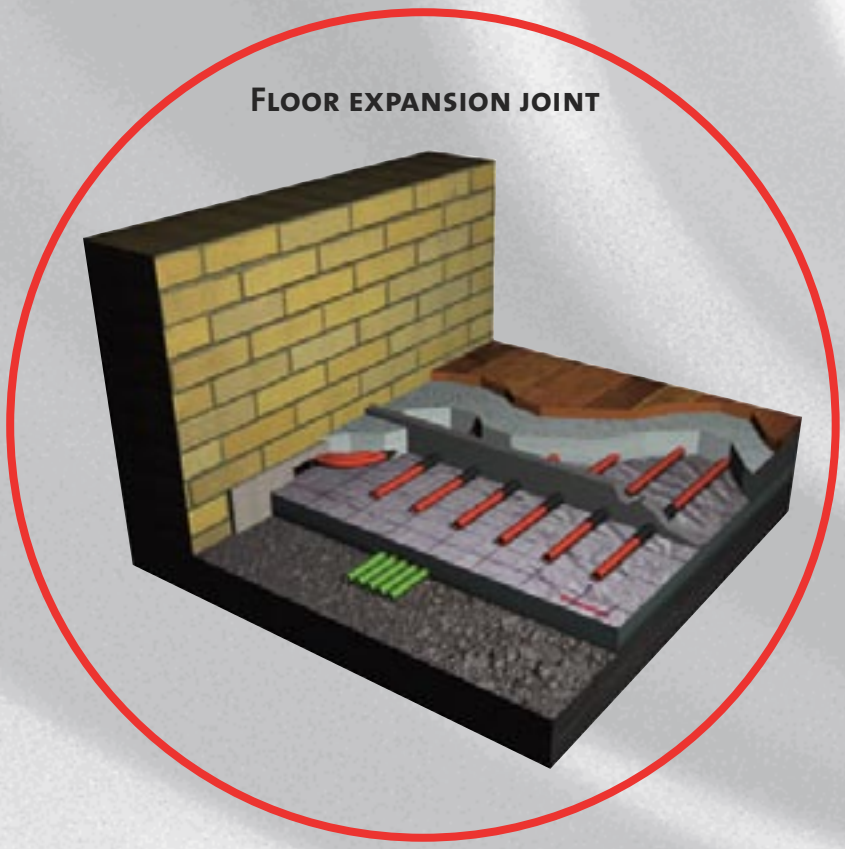
Floor Sectioning

There may be other joints within the floor structure required as part of the structural design of the floor. In this case the pipework passing through the joint should be sleeved. With screeded floors crack inducers may be included in the top surface of the screed (these may include 5mm cuts in the screed surface) and the pipework should be sleeved as it passes through these areas.

Concrete or Screed Curing

It is essential that the concrete or screed is allowed to fully cure before the underfloor heating system is first put into operation. Any operation of the heating system prior to curing will reduce the moisture content of the screed or concrete and may result in failure of the floor. The operation of the floor must be carefully programmed into the build programme to allow time for the underfloor heating system to be run before the final floor finishes are laid.

Floor expansion joint



Plated Underfloor Heating System

Underfloor heating systems may be successfully installed within suspended floors provided the floor is constructed to suit the application. Therefore it is essential that planning begins at an early stage in the project and the building contractor is informed of the construction required for the radiant panel. This underfloor heating plated system can be easily adapted to accommodate a number of special floor details including sprung floors, acoustic pads and cross battens.

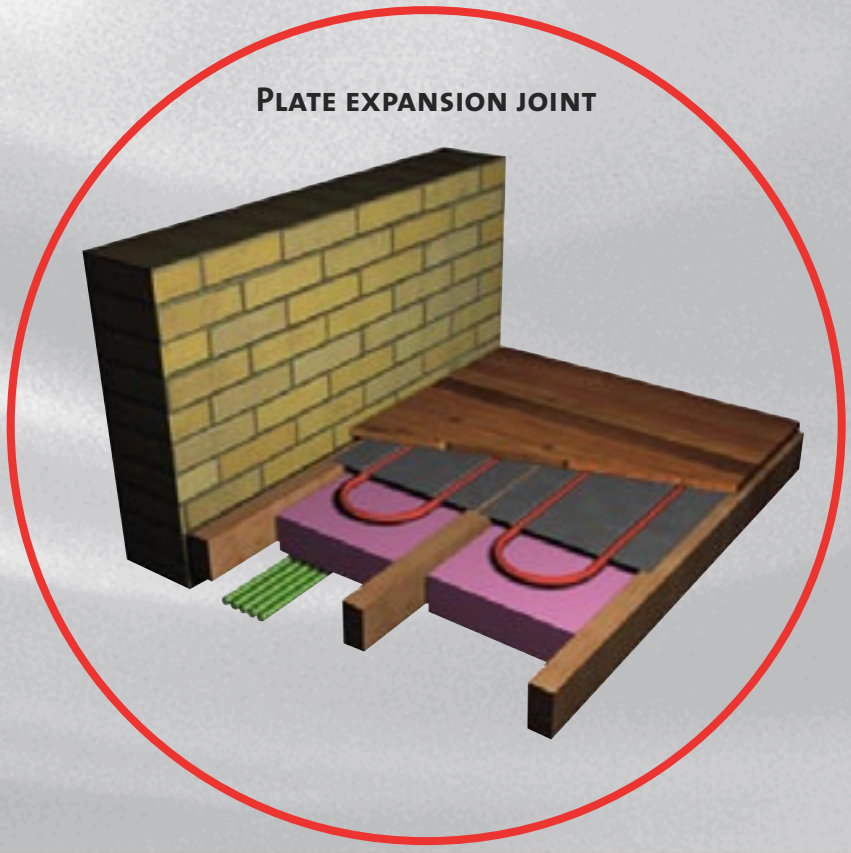
Suspended floor systems include both joisted floors with conventional joists supported on end walls of sleeper walls as well as solid floors with battens fixed to the floor. The underfloor heating system consists of aluminium diffusion plates fitted between the joists or battens. The diffusion plates are grooved to accept the heating pipework.

Sprung Floor: With battens loose laid onto blocks supported on a solid base, the underfloor heating is fitted in the normal manor but using double sided tape to hold the plates in position. The use of tape avoids dislodging the battens when fixing the plates.

Acoustic Pads: To reduce sound transmission from the floor an acoustic pad is included in the floor make up. This pad should be fitted to the top of the joist or batten with the diffusion plate being fixed to the pad with double sided tape. Fixings must not penetrate the pad as this will lead to acoustic bridging.

Cross Battens: If joist centres are not suitable for installing of the diffusion plate the floor can be cross battened with the battens being fixed at 400mm centres. The underfloor heating system can be installed upon the cross battens. Outputs from the plated system are limited to 70W/m² and floor loadings are unaffected by this type of system but will depend upon the floor construction for installation.

Plate expansion joint



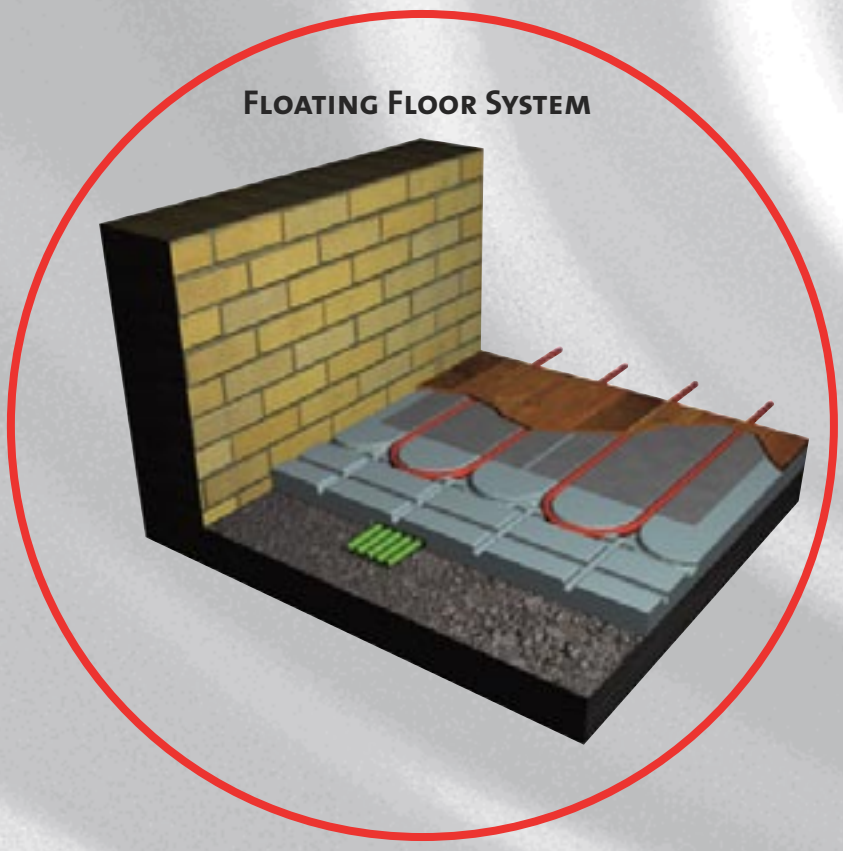
The Giacomini Floating Floor System

Floating floors reduce the overall loading within a building reducing the weigth of the floor compared to other floor system. Floating floors also provide good acoustic properties reducing sound transmission between floors.

Insulation panels are pre-grooved at 200mm centres and a bell shaped groove is at one end of the panel to allow the pipe to turn at the end of its run.

The grooves are made so an aluminium plate can be installed that spread the heat from the pipe to the underside of the floor. The panels are produced in a range from 30mm - 60mm in thickness and provide good acoustic properties. The installation of this system is very simple, panels are laid with the bell at each end of the room with the panels butt jointed and cut to size.

Once the panels are in place the aluminium plates are fitted within the grooves in much the same way as the plated system leaving a gap at each end for pipe turns. Once the plates and pipe are fitted a flat plate is used to cover the pipe turns and assist with heat distribution.



Final Floor Finishes

When selecting the final floor finish that is to be installed onto the Giacomini Underfloor Heating system, consideration must be given to the suitability of the floor finish and the affects that it may have regarding the performance of the underfloor heating. Three factors must be taken into account, thermal resistance, temperature constraints imposed by the floor finish and the suitability of the floor finish and the floor structure. There are four basic types of floor finish which should be considered, ceramic which includes natural stone materials such as flag stones and plastic or vinyl floor coverings, timber and timber products and carpet. These can be taken in turn:

Ceramic floor products, such as tiles have a low thermal resistance, typically 0.02m2K/W and will function well with a Giacomini Underfloor Heating system. This low thermal resistance also applies to natural stone products as well as manufactured or artificial stone products such as flagstones. This low thermal resistance is the reason for this type of floor finish feeling cold to the touch (without the benefit of underfloor heating).

Temperature constraints do not apply to ceramic type floor finishes and these can be run at maximum design temperatures, 29 Deg C in general areas and 35 Deg C in bathroom, perimeter and wet areas.
Different thermal expansion is a consideration between the ceramic floor finish and the screed must be taken into account during the floor design. This differential expansion limits the areas that can be laid without the inclusion of a thermal expansion joint. Underfloor heating BS EN 1264 limits this area to 40m² with a maximum length of 8m after which the area should be split using a flexible expansion material.

Another important consideration is the propagation of cracks within the screed and the potential for cracks to extend into the floor finish. All screeds will crack and it is the limiting of the propagation of these cracks that must be considered. Two possible solutions are available:

1) The inclusion of a reinforcing mesh within the upper surface of the screed. Such a mesh should be positioned approximately 25mm from the upper surface of the screed.

2) A fibre bonded screed can also be used to help limit crack propagation, in this type of screed small fibres are added to the screed mix, which provide bridging across any developing crack.

Ceramic tiles can also be used with other Giacomini Underfloor Heating system types such as a suspended timber plated system, in this case the ceramic tiles are bonded to a floor decking fixed to the floor joists. The structural stability of such a floor is an important factor in the design of the floor, as any deflection of the sub-floor will lead to cracking of the tile finish. To allow for some minor movement within the sub-floor a flexible adhesive must be used to bond the ceramic floor tiles to the floor decking.

To avoid damage to the screed and floor finish it is essential that the floor finish be laid on to a dry screed. After laying of the screed it must be allowed to cure for a minimum of 21 days and during the first 7 days of curing, the screed should be covered with polythene sheeting. Following curing and before the ceramic floor finish is laid, the Giacomini Underfloor Heating must be run starting at a low flow temperature of 25 Deg C.

This flow temperature should be elevated by 3 Deg C per day until the system design temperature is reached, this process should take about a week. After this period the underfloor heating is turned off and the final floor finish laid. If this action is not followed there is a possibility that moisture contained within the screed will be forced to the upper surface of the screed where it can not escape. This will cause the upper surface of the screed to expand whilst the lower parts of the screed will shrink. This differential movement will result in a 'Hump' in the floor structure.

In general vinyl and plastic type floor finishes have a low thermal resistance, 0.075 km^2/w and will function well with a Giacomini Underfloor Heating. There are a small number of specialist plastic floor finishes that can be classified, as plastic but these will have higher thermal resistance. Some sports hall floor coverings are made from a 'foamed' plastic and the thermal resistance of such coverings should be checked before their use with a Giacomini Underfloor Heating system. A resistance of 0.15 m2K/W (1.5 tog) will function satisfactory with a Giacomini Underfloor Heating system but above this value the design of the of the system must be checked. Vinyl and plastic floor coverings are flexible in nature and therefore differential expansion will not cause any problems to the suitability of the of the floor structure. Consideration must be given to the type of adhesive used must be given as these can be subjected to temperatures in excess of 35 Deg C and, therefore, must be suitable for such temperatures.

As with ceramic floor coverings a vinyl covering will seal the surface of the screed and therefore the curing and drying of the screed must be carried out before the floor covering is laid. If this procedure is not followed, damage to the screed or floor covering could result in either with moisture developing between the screed and the floor covering, resulting in bubbling of the vinyl or with the screed 'humping' as with a ceramic floor covering. The process is the same as for a ceramic floor with the screed being allowed to cure for a minimum of 21 days and then heated by the Giacomini Underfloor Heating until the moisture has been removed.

Starting with the flow temperature set to 30 Deg C and then elevated by 2 – 3 Deg C per day until the designed flow temperature has been reached and then held at this temperature for 5 days. After this period the heating is turned off and the floor covering can be laid.

Although care in selection of carpets and their associated underlay must be taken to avoid excessive thermal resistance they present few problems to Giacomini Underfloor Heating. The thermal resistance of the carpet and underlay combined should not exceed 0.15 m^2K/W (1.5 tog). Carpet is flexible and therefore does not present any differential expansion problems, it is also permeable to moisture to be expelled from the screed during the drying process.

Timber products present their own problems with regard to use with Giacomini Underfloor Heating which relate to the moisture content of the timber and the screed. Thermal resistances of timber products usually fall within the acceptable range for use with Giacomini Underfloor Heating.

Timber is a natural material and in its raw state will have high moisture contents. If this were to be laid on the floor above the heating system the timber would warp and shrink when heated, causing excessive gaps between 'planks'. To avoid these problems the timber product moisture content should be no greater than 10% with kiln dried timber being most widely used. Where older 'well seasoned' timber is to be used this should be stacked in the heated area for a minimum of two weeks with the heating running at its normal operating temperature, which will ensure that the moisture content within the timber is removed.

As the floor is heated the residual moisture of the timber will be removed and the timber will shrink. The shrinkage is minimal as long as the timber used has a low moisture content and the surface temperature is limited to 27 Deg C.

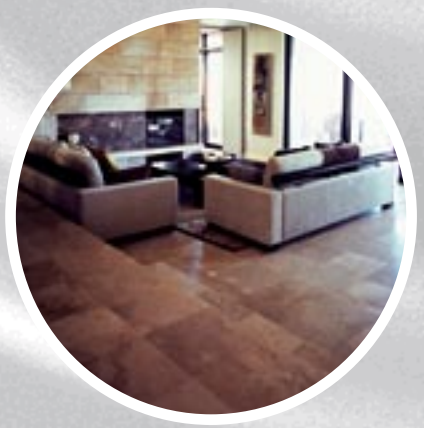
When laid onto a screed it is essential that the moisture within the screed be removed before the timber is laid otherwise the moisture within the screed will penetrate the timber resulting in the timber warping. The same process is used to dry the screed allowing it to fully cure for a minimum of 21 days. The Giacomini Underfloor Heating is first set at 25 Deg C and elevated by 3 Deg C per day until the designed operating temperature is reached. Operating temperatures must be held for at least 5 days before the Giacomini Underfloor Heating system is turned off and the flooring is laid.

Removal of the moisture from the screed before the floor covering is laid is an essential operation. A simple check that the moisture has been fully removed can be undertaken to confirm that all the moisture has been removed.

To check for moisture within the screed a moisture meter can be used. This should be the type of meter that is specifically designed for use with concrete and cement based materials. Readings must be taken over a 12 hour period and any changes in the moisture content should be noted. It is important to ensure that external influences such as direct sunlight or draughts do not affect the readings.

An alternative method of testing for excess moisture within the screed is to tape a metre square polythene sheet over the floor in the middle of the room. This is left in place overnight with the heating running and then checked the following day. If any moisture remains in the screed this will be visible as condensation on the underside of the polythene.

FLOOR COVERINGS



Stone and ceramic tiles

Carpet

Wood

Underfloor Heating Control

Underfloor heating requires water flow temperatures of approximately 45 Deg C – 60 Deg C depending on the design, heat loading and type of system. With a typical temperature drop across the underfloor heating flow and return of between 5 Deg C – 10 Deg C the return water temperature can be as low as 35 Deg C. This can be important when considering which boiler is to be used in conjunction with the Giacomini Underfloor Heating system which may need additional controls to provide protection from low return temperatures.

Single areas of underfloor heating can be effectively controlled by means of a room thermostat and a two port motorised valve. This control can be further enhanced by using a programmable room thermostat to provide both time and temperature control. Many programmable thermostats now have additional control features such as night set back and optimum start, which can be utilised with underfloor heating systems.
Individual rooms fed from the same manifold can be controlled by means of room thermostats and Giacomini Thermoelectric Actuators. Giacomini Thermoelectric Actuators are designed for a simple twist fitting to the regulating valves on the return header manifold.

When multiple room control is required the room thermostats can be wired through a Giacomini control centre.

Return water temperatures from underfloor heating can be as low as 35 Deg C (lower with weather compensated systems) and with some boilers this can reduce the life expectancy of boiler heat exchanger. This occurs because the flue gases will begin to condense at 54 Deg C which can lead to the nitrous and sulphurous oxides being converted to acids, which in turn, will attack the minerals of the boiler heat exchanger. To avoid this problem occurring a system by-pass will be included with the primary flow and primary return pipework. This by-pass will mix water from the boiler flow with the return to the boiler thus elevating the return temperature to above the 54 Deg C value.

Condensing boilers are manufactured from materials that resist the action of the acids contained within the flue gas condensate. This enables lower return water temperatures to the boiler and thereby providing higher efficiencies over conventional boilers. Condensing of the flue gases will also release the energy held in latent form further increasing boiler efficiency.

System components

PM100W

Control unit for electrical actuators with safety thermostat and 4 minutes delayed intervention.

K481A

Electronic digital thermostat for the control of the ambient temperature with anti-freeze function, summer/winter switching and stand-by, night and off attenuation. It has a drive relay with exchange contact for the direct drive of an electrical actuator. Connection possibility by means of bus to GIACOKLIMA system.

KPM20

Adjustment regulator for GIACOKLIMA heating and cooling systems with control possibility of mixing valve and drive of circulator and electrical actuators R473 or R478 supplied at 24V~.

KD200

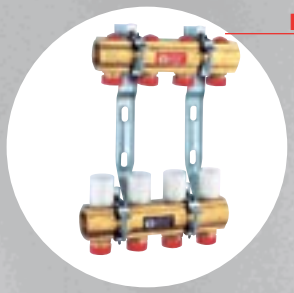
Display unit for visualization of the system variables and approach of time programs. To be used exclusively in combination with KM202 Controller.

KM201

Control and supervision unit for heating and cooling systems, where GIACOKLIMA control devices are used. It has an internal modem for remote control tasks of the system and no.

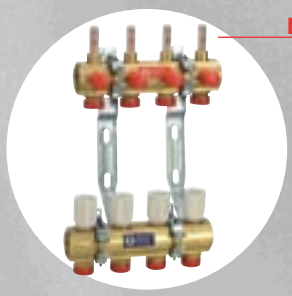
Components

R553D



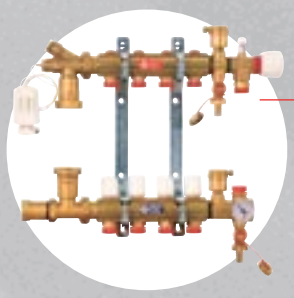
Pre-assembled manifold for underfloor heating, complete with: a flow manifold with balancing lockshield valves, a return manifold with valves assembled, two brackets R588 and a set of labels

R553F



Pre-assembled manifold with flow indicators and possibility of circuit balancing, composed by: a flow manifold with flow indicators sand mechanical memories, a return manifold with valves with termostatic option, two metallic brackets R588 and a set of labels.

R557



Pre-assembled manifold, complete with: a pair of manifolds R553S-R553V, two brackets R588L, a T-fitting R557A, a T-fitting 1" for thermostatic valve, a thermostat R462L2, an end piece R557N with R608 and R88I (R554A), a R554D 1", a differential valve R147, two pump isolating valves R252 and a tail piece R557P.

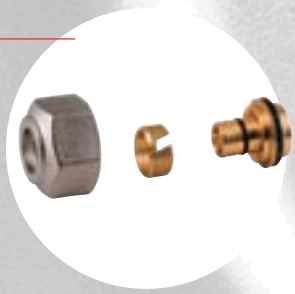
R501

Manifold cabinet with wall bearing.

R532

Plastic pipe adaptor.

R179



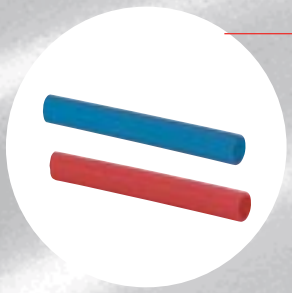
Electrical actuator, normally open, for valves with thermostatic option and manifolds.

R259D

Standard port ball valve with tail piece, red T handle, chrome plated.

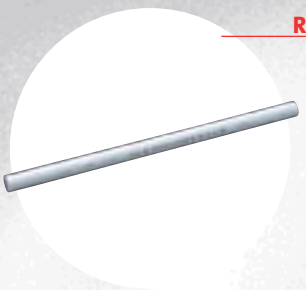
Components

R996



PE-X pipe.

R999

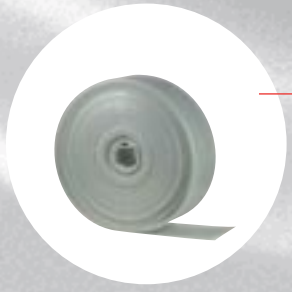


PE-X/Al/PE-X multilayer pipe.

R986

Polybutylene pipe without sleeve.

K369



Wall insulation.

R473

Eletrical actuator, normally closed, for valves with thermostatic option and manifolds.

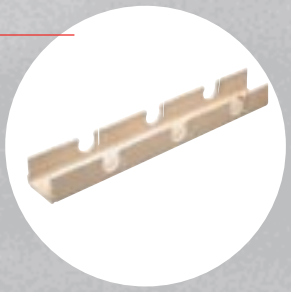
R478

Electrical actuator, normally open, for valves with thermostatic option and manifolds.

R983

Fixing clip for GIACOTHERM pipe.

K389



Fixing clip for GIACOTHERM pipe.

K363A

Flow temperature sensor.

Notes

Notes

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