KAN-therm SYSTEM

Wall heating

Designer's and Customer's Guide

EN 05/2016

TECHNOLOGY OF SUCCESS

ISO 9001






About KAN

Innovative water and heating installations

KAN company was founded in 1990 and from the very beginning it has been deploying modern technologies to water and heating installations.

KAN is a renowned Polish manufacturer and supplier of modern solutions and installation KAN-therm systems for internal systems of hot and cold water, central heating, floor heating as well as firefighting and technological installations. Since being founded, KAN has been building its position on strong pillars: professionalism, innovations, quality and growth. Today the company has almost 600 employees of which a large part is a highly specialized engineering personnel responsible for KAN-Therm System development, on-going technological process improvement and customer service. Qualifications and engagement of the employees guarantee highest quality products manufactured in KAN factories.

KAN-therm System distribution is based on the network of business partners in Poland, Germany, Russia, Belarus, Ireland, Czech Republic, Slovakia, Hungary, Romania and Baltic countries. The expansion and dynamic growth of new markets are efficient enough to ensure the export of KAN-therm products to 23 countries and the distribution network includes Europe, most of Asian territory and also reaches Africa.

KAN-therm System is an optimal, comprehensive installation multisystem that includes the most modern and complementary technical solutions related to water, heating, technological and firefighting pipe installations. It is a perfect vision of a comprehensive system based on many year experience and passion of KAN designers and also a rigorous quality control of materials and final products.

KAN-therm SYSTEM
- special award:
Perła Najwyższej Jakości
and awards:
Teraz Polska 2014,
Złote Godło Quality International
2015, 2014 i 2013.

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Wall heating

01 Surface installations

Water, low-temperature heating an cooling surface systems that use floor or wall surfaces as a heat (or cold) source in rooms are gaining more and more popularity. The increase in energy prices requires the use of installations and heating devices that are modern but also cost-effective, manufactured and used in accordance with any environmental protection regulations.

This method of room heating is often selected due to its energy-saving features and comfort. Thanks to good, optimal temperature distribution you can lower the room temperature without loss of heating comfort, which results in the decrease of supplied heat energy. Low temperature of installation supply also affects the heat loss decrease. After 2 years of operation the investment costs can be depreciated. Therefore the surface heating can be one of the most cost-effective methods of room heating.

Other benefits are as important. Aesthetic qualities - such heating is invisible and enables free room arrangement. It is also "clean", because limitation of convection currents eliminates dust circulation and settling. You should also note the reliability and durability of this system, limited only by heat source life. It is also important to highlight the quality of such heating systems supplied by low-temperature, "clean" gas boilers or other alternative heat sources (geothermal, solar energy, etc.).

KAN-therm System offers a series of modern technical solutions for the installation of energy-saving and durable water heating and surface cooling systems. It enables construction of even the most customized floor, wall or ceiling installation and also an installation for external surface heating. KAN-therm System is a complete system, because it includes all components (pipes, insulations, switchboards, cabinets, automatic devices) required to assemble an efficient and economic heating.

In contrast to high-temperature panel heating, surface heating does not cause an excessive, harmful, positive air ionization.

02 Wall heating and cooling with **KAN-therm** System

2.1 General

KAN-Therm surface heating components are well suited for various types of heating and cooling systems mounted in vertical construction bulkheads. KAN-Therm water wall heating has all the benefits of surface heating and is additionally characterized by the following features:

- it may operate as the only and standalone room heating or be a complementary heating in case of insufficient surface of floor heating within a room. It may also support radiator heating, increasing comfort in rooms (used in the case o heated object modernization),
- it ensures a uniform (close to an ideal for human body) distribution of temperature in the room which results in high heating comfort,
- due to uniform heat absorption coefficients in heating and cooling, vertical bulkheads are perfect for dual systems (heating/cooling),
- heat emission is done by favourable radiation (approx. 90%),
- the heating surface temperature may be higher than in the case of floor heating (up to 40°C), which results in higher heat distribution, average heat efficiency is 120-160 W/m^2 (it is assumed it does not exceed max. temperature of the wall surface),
- due to lower thickness of the heating/cooling panel or small (or zero) thermal resistance of external wall layers, the thermal inertia is smaller and the temperature adjustment is much easier.

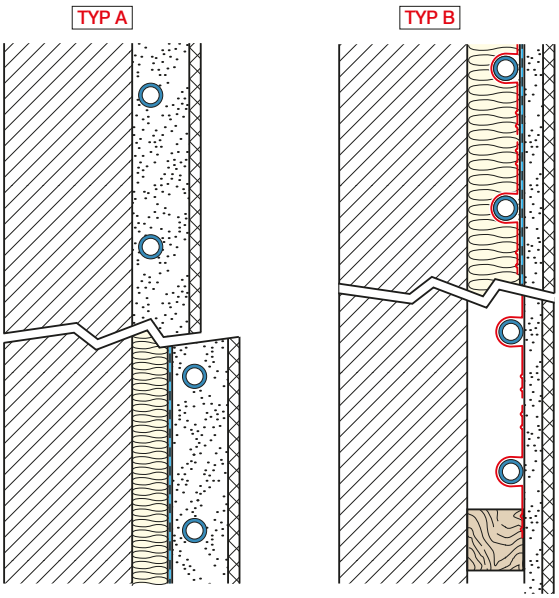
2.2 Construction of the KAN-therm wall heating/cooling system

2.2.1 Types of surface heater constructions - classification of wall solutions

- Type A - the heating pipes are located in the plaster layer.
- Type B - the heating pipes are in the upper part of thermal insulation layer or in an air gap.

1. Wall heating/cooling - A-type construction

2. Basic elements of the wall heating/cooling



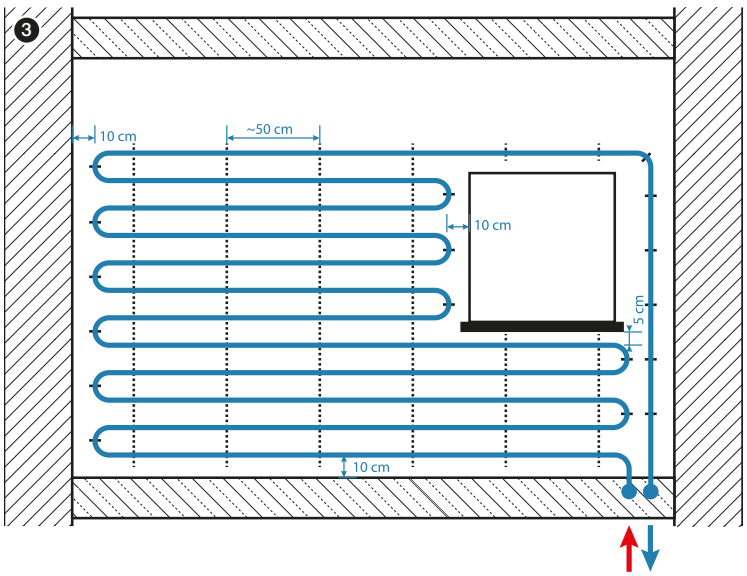
1. Wall
2. Layer of thermal insulation (or air gap)
2a. Air gap
3. Layer of plaster
4. Wall lining or gypsum finish coat layer

2.2.2 General instructions

- The wall heating is mounted on external walls with heat transfer coefficient $U \leq 0.35$ W/m^2×K. If the heat transfer coefficient exceeds 0.4 W/m^2×K, the wall should have an extra insulation.
- It is recommended to mount the unit near window openings, ex. under sills. It is also possible to mount the unit on internal walls.
- KAN-therm System pipers with the following diameters should be used:
  PB or PE-RT with anti-diffusion cover - 8×1 mm
  PE-Xc or PE-RT with anti-diffusion cover - 12×2, 14×2, 16×2 mm
  PE-RT/Al/PE-RT - 14×2, 16×2 mm
- Recommended pipe distances - (Ø12-16 mm): 5; 10; 15; 20 cm, (Ø8 mm): 6; 8; 10; 12; 14; 16; 18; 20 mm.
- In the case of distances of 5 and 10 cm the pipes can be laid in double meandering.
- You should avoid covering the heating surfaces with furniture, paintings, curtains.
- Before installing the wall surface heaters all installation and electrical works nearby must be finished.

Minimum distances from the heating pipes to adjacent bulkheads and construction openings are shown in the picture.

3. Assembly distances in wall heating

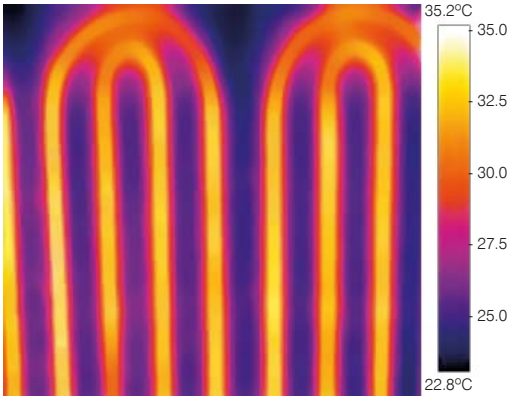


The places of contact of heating walls and adjacent construction bulkheads should be dilated.

The coil supplying pipes should be led in insulation or in a protective pipe.

When the floor turns into a wall, the pipe should be led in a 90° tray or a system bend should be used.

Heating loops are supplied by KAN-therm splitters to surface heating. The coils can also be supplied in Tichelmann system, assuming the uniform lengths of individual circuits attached to the system.



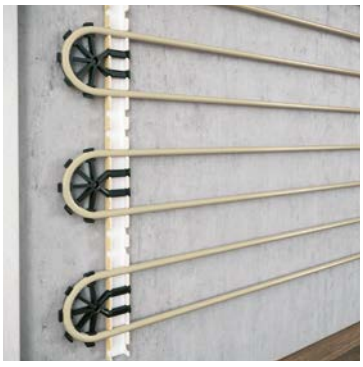
To locate heating pipes in existing wall installations you can use a thermal camera or a special thermosensitive foil.

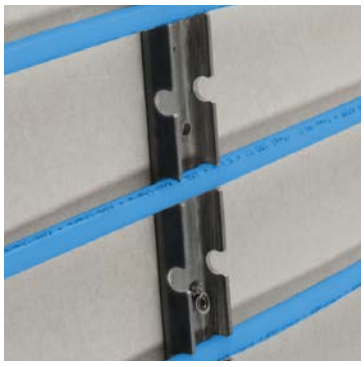
2.3 KAN-therm wall heating/cooling systems

As in the case of floor surface heating there are two methods of wall heating/cooling installation: "wet" or "dry".

2.3.1 KAN-therm Rail Wall "wet" system

In the case of installing the heating/cooling panel with the "wet" method (type A), KAN-therm Rail System includes mounting the surface installation pipes using Rail plastic slats, attached to thermal installation or directly to the wall surface using the wall tape, metal pins or wall plugs.





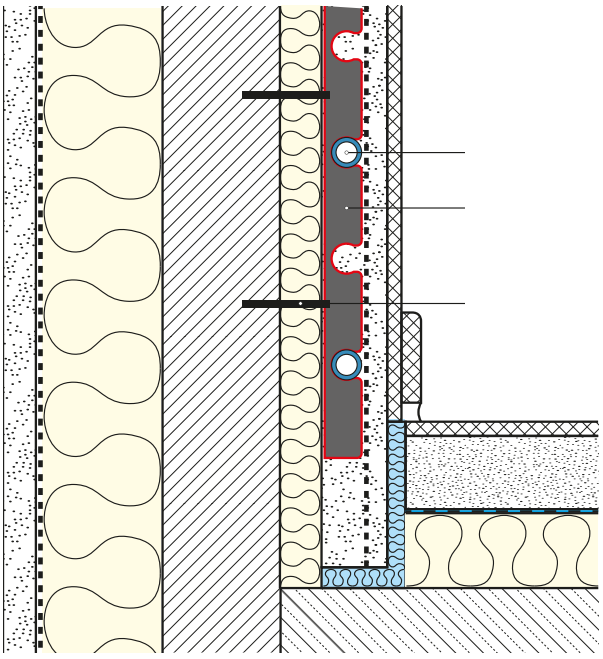
Application:

- heating/cooling in residential and general buildings,
- heating/cooling in renovated objects.

Heating pipes with diameter of 8, 12, 14 or 16 mm are mounted on the wall in assembly strips and then coated with a layer of plaster with total thickness of 30-35 mm, creating the heating panel. Minimum thickness of the plaster above the pipe surface is 10 mm.

KAN-therm Rail Wall heating installation/wall cooling construction

1. Wall lining (wallpaper, ceramic tiles)
2. Plaster
3. Construction mesh 7×7 mm
4. KAN-therm heating pipe
5. Assembly rail
6. Wall plug
7. Wall constructions
8. Thermal insulation
9. External plaster
10. Dilatations



Wall heater components

- PB, PE-Xc and PE-RT pipes with anti-diffusion covers or PE-RT/Al/PE-RT pipes of the KAN-therm system,
- KAN-therm Rail assembly strips for pipes with diameter of 8, 12, 14 or 16 mm,
- Plastic arc leading to 8×1 mm pipes,
- 90° plastic or metal guides for pipes with diameter of 12-18 mm,
- Electrical conduits for pipes with diameter of 8-16 mm,
- Dilation wall tape.

Installation guidelines

- For pipe installation use KAN-therm Rail assembly strips for diameters 8, 12, 14 or 16 mm attached by plug walls. Assembly guide distance is max. 50 cm,
- The heating panel plaster should have a good thermal conductivity (min. 0.37 W/m^2×K), temperature resistance (approx. 70°C for cement-lime plasters, 50°C for gypsum plasters), flexibility and low expansion,
- The type of plaster should be adapted to the room. Cement-lime or gypsum plasters can be used, also clay mortars,
- Recommended are the ready-to-use plasters, ex. KNAUF MP-75 G/F,
- The air temperature during plaster work should not be lower than 5°C,
- The plaster should be laid in stages: the first layer should completely cover the heating pipes. Apply fibreglass plumbing mesh (40×40 mm) onto the fresh layer and apply the second layer with thickness of 10-15 mm. The mesh stripes must be overlapped and also overlap adjacent surfaces (approx.10-20 cm),
- The maximum width of the heating area is 4 m, height max. 2 m.
- The approximate area should not exceed 6 m2/heating circuit, also the max. permissible pipe lengths in loops must be observed - see 2.4.9.
- During plastering the heating pipes should be filled with water under pressure (min. 1.5 bar),
- Plaster heating can be initiated when it is dry (time is specified by the plaster manufacturer - from 7 days for gypsum plasters to 21 days for cement plasters),
- The plaster may be painted, covered with a wallpaper, structural paint or ceramic cladding.

2.3.2 KAN-therm TBS Wall "dry" system

Water surface heating based on KAN-therm TBS system panels belongs to the dry system, qualified as a B-type construction in accordance with PN-EN 1264. The heating pipes are placed in profiled, grooved styrofoam boards and then covered with dry screed boards with thickness depending on designed loadbearing surface. The heat coming from heating pipes is evenly distributed to dry screed boards through steel radiating laths placed in board grooves.

Application:

- Heating in residential and general buildings,
- Heating in renovated objects.

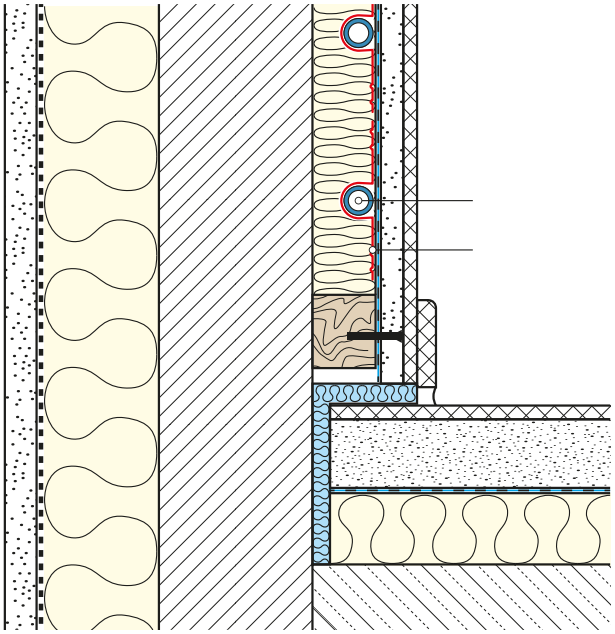
KAN-term TBS System is characterized by:

- low height,
- construction lightness that enables assembly on low-bearing constructions, wooden constructions,
- speed of assembly, resulting from the way of installation and no need to care for screed,
- immediate readiness to work after installation,
- possibility of use in existing buildings, renovations.

Heating pipes with diameter of 16 mm are placed in KAN-therm TBS board grooves equipped with steel sheet radiators. TBS boards are attached between horizontal slats or steel 25 × 50 mm profiles to the wall surface. Such construction is covered with PE foil that serves as acoustic and anti-humidity insulation, then plasterboards are attached to slats.

KAN-therm TBS Wall heating installation/wall cooling construction

1. Wall lining (wallpaper, ceramic tiles)
2. Dry plaster (plasterboard)
3. PE foil
4. KAN-therm heating pipe
5. Steel profile (radiator)
6. TBS 16 system board
7. 25×50 mm wooden slat
8. Wall constructions
9. Thermal insulation
10. External plaster
11. Dilatations

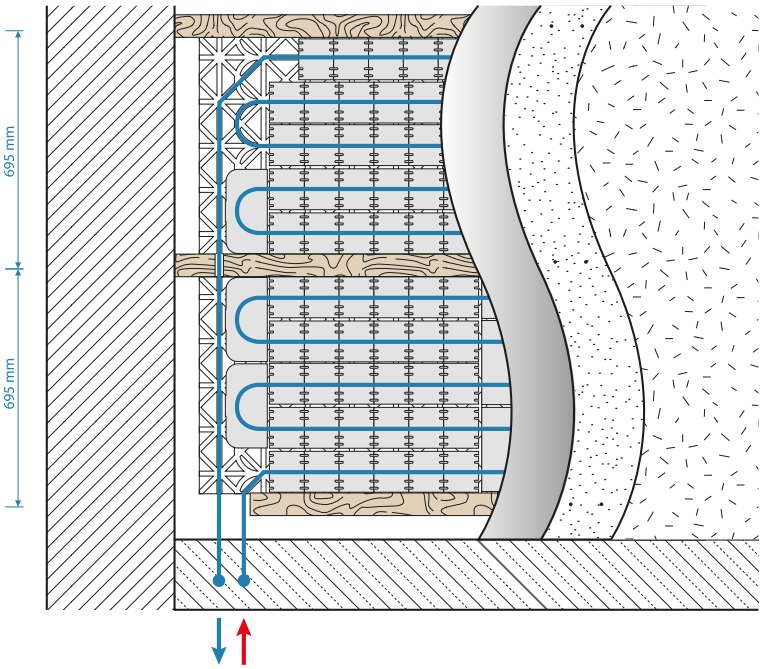


Wall heater components:

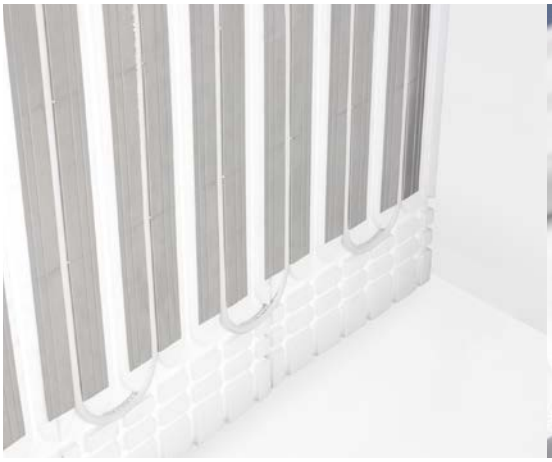
- KAN-therm TBS panels with dimensions 1000×500×25 mm, with steel sheet laths (radiators),
- Wooden slats or 25×50 mm steel profiles,
- KAN-therm System PE-RT/Al/PE-RT boards with diameter of 16×2,
- PE foil with 2 m width and 0.2 mm thickness,
- Electrical conduits for pipes with diameter of 16 mm,
- Dilation wall tape,
- Dry plaster, plasterboads.

KAN-therm TBS Wall heating installation/wall cooling cross-section

1. Layer of wall lining (tiles, structural paint, wallpaper, etc.)
2. Dry plaster (plasterboard)
3. PE foil
4. Steel radiator (lath)
5. KAN-therm heating pipe
6. Wooden slats
7. KAN-therm TBS board



KAN-therm TBS 16 board with steel radiating laths



Installation guidelines:

- The wall surface selected for heating must be clean, smooth and vertical,
- KAN-therm TBS panels are mounted between slats to the wall surface using proper glues for styrofoam boards,
- The slat distance is (in axes) 695 mm,
- The pipes should be laid with distance 166 or 250 mm,
- The PE foil should have a 20 cm overlap.

2.4 "Dry" system, KAN-therm Wall gypsum-fibre boards.

2.4.1 System characteristics

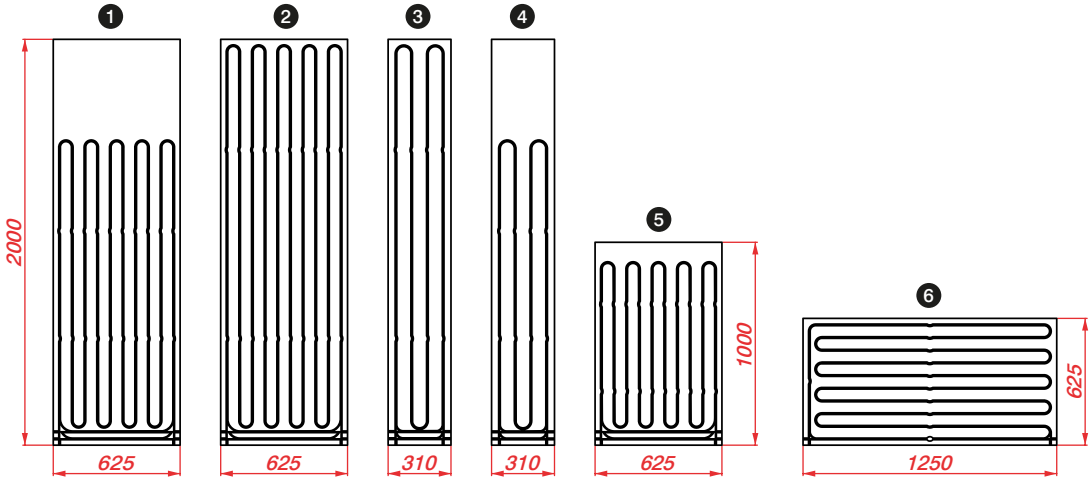
The basic element of KAN-therm Wall system are gypsum-fibre boards used for heating&cooling, wall or ceiling installations.

The boards consist of gypsum and cellulose fibre obtained in paper recycling process. Both natural materials are mixed with water without additional binding substances, pressed under high pressure and then impregnated with a water-proof substance and cut to proper formats. The material composition ensures that the gypsum-fibre board is universal, non-flammable and has a high mechanical resistance, therefore it can also be used in humid rooms.

No glues are used to manufacture gypsum-fibre boards, to the boards are odourless and do not contain any harmful substances.

Heating&cooling panels of the KAN-therm Wall system in "dry" construction are gypsum-fibre boards with milled grooves and built-in polybutylene PB or polyethylene PE-RT pipes with diameter of 8×1 mm used in the KAN-therm system.

Heating&cooling panels of the KAN-therm Wall system are available in several sizes with different pipe distances and various filling of the board through the pipe. Thanks to such configuration it is very easy to prepare a heating&cooling installation even on most geometrically complex wall surfaces. Inactive wall surfaces may be covered with complementary gypsum-fibre boards available in KAN-therm Wall System offer.



Panel no.	Panel name and type	H. × width × thickness [mm]	Product code	Pipe length in panel [m]
1	WALL HEATING PANEL WITH PIPE PB 8×1 (75%)	2000×625×15	K-400110	15.8
2	WALL HEATING PANEL WITH PIPE PB 8×1 (100%)	2000×625×15	K-400105	20.4
3	WALL HEATING PANEL WITH PIPE PB 8×1 (100%)	2000×310×15	K-400120	8.3
4	WALL HEATING PANEL WITH PIPE PB 8×1 (75%)	2000×310×15	K-400130	6.4
5	WALL HEATING PANEL WITH PIPE PB 8×1 (100%)	1000×625×15	K-400140	9.4
6	WALL HEATING PANEL WITH PIPE PB 8×1 (100%)	625×1250×15	K-400150	11.8
OPTIONAL	WALL COMPLEMENTARY PANEL - COVERING BOARD without grooves	2000×625×15	K-400160	—
OPTIONAL	WALL HEATING PANEL - COVERING BOARD with grooves, without pipe	2000×625×15	K-400170	—

Each heating&cooling board has a some redundant pipes, co called service sections, that enable making a hydraulic connection into larger heating&cooling sets. Service sections are attached at the base of each board. To make a hydraulic connection of single boards into larger sets, the service sections should be extended from the groove and then profiled properly towards the main pipes.

2.4.2 Technical specifications of gypsum-fibre boards

Tolerances at fixed humidity for standard size boards

Length, width	±1 mm
The difference of diagonals	≤ 2 mm
Thickness: 15	± 0,3 mm

Thickness, mechanical parameters

Panel thickness	1150 ± 50 kg/m^3
Water vapour transmission rate (μ)	13
Heat flow λ	0.32 W/mK
Heat capacity c	1.1 kJ/kgK
Brinell hardness rating	30 N/mm^2
Absorbability after 24 h	< 2%
Coefficient of thermal elongation	0.001%/K
Expansion at relative air humidity by 30% [20°C]	0.25 mm/m
Humidity at 65% relative air humidity and 20°C	1.3%
Fire classification acc. to PN EU	A 2
pH coefficient	7-8

2.4.3 Range of application

The heating&cooling boards of the KAN-therm Wall system are used to make wall linings inside buildings. It is also possible to mount the boards on the ceiling.

Heating&cooling boards can be used in execution of any construction concepts, from cellars to attics, including:

- steel or wooden particle walls,
- partition walls in apartments,
- external walls,
- fire-resistant walls,
- covers/shaft walls,
- wall linings (external and internal),
- dry plaster,
- in the case of composite boards - for heating,

- ceilings,
- ceiling linings,
- attics (ceiling linings, sloping ceilings and knee walls).

KAN-therm Wall System boards can also be used as all-purpose fire-retardant construction boards and as finishing heating boards for rooms with elevated humidity.

Fire protection

Gypsum-fibre boards with thickness of 15 mm, approved by European Technical Approval ETA-03/0050, are classified as non-flammable construction material, class A2-s1 d0, in accordance with EN 13501-1.

	Areas of application	Category
1	Rooms and corridors in residential buildings, hotel rooms with bathrooms.	A2, A3
2	Rooms and corridors in office buildings, clinics	B1
	Sale areas up to 50m, basic areas in residential, office or similar buildings	D1
3	Corridors in hotels, nursing homes, boarding schools, surgery rooms without heavy equipment.	B2
	Rooms with tables, ex. classrooms, cafés, restaurants, canteens, reading rooms, waiting halls.	C1
4	Corridors in hospitals, nursery homes, etc. treatment rooms, surgery rooms with heavy equipment	B3
	Rooms for large number of people, ex.: concert and congress halls, schools, churches, theatres, cinemas, council rooms, etc.	C2
	Continuous movement areas, ex.: museums, exhibition halls, utility buildings, hotels.	C3
	Rooms for large number of people, ex.: churches, theatres, cinemas, council rooms	C5
	Sports halls, dancing halls, gyms, stages.	C4
	Sales rooms in shops and markets.	D2

2.4.4 Transport and storage

Depending on the order, KAN-therm Wall System gypsum-fibre boards are provided on pallets or pads. Unless it is otherwise agreed, the gypsum-fibre boards are delivered on pallets, covered with foil to ensure protection against humidity and contamination.

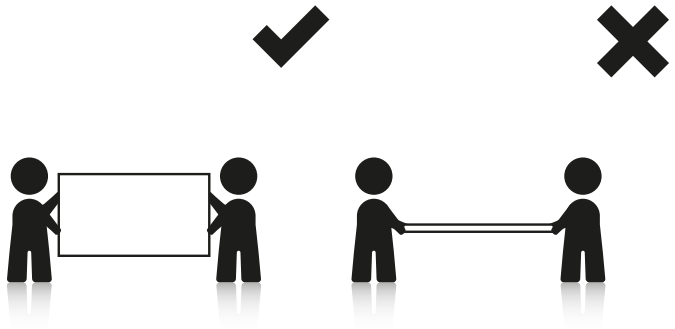
When the boards are stored, you should consider the ceiling load-bearing capacity, assuming that the board density is approx. 1150 ± 50 kg/m^3.

Gypsum-fibre boards should be generally stored in horizontal position on flat and dry floor and protect them from humidity, especially from rainfall.

Humid boards can be mounted only when they are completely dry. During laying the boards you should choose the flat floor. Storing the boards in vertical position may lead do deformations and damage of edges.

Note!

The boards should be transported horizontally using the fork-lift trucks or other transport trucks. Single boards should be carried only in horizontal position.



2.4.5 Assembly

Dry construction of KAN-therm Wall system is executed by mounting the heating&cooling boards to special bearing construction made of metal or wood. It is also possible to mount the boards directly on wall surfaces by gluing them - in this case the surfaces must be even.

Supporting constructions of walls and ceilings

The supporting construction may be made of wood (laths, wooden frame construction) or steel profiles. If the mounting is done using brackets, the supporting construction must not be flexible. If required, the construction should be stiffened. The supporting construction must have a wide contact area to gypsum-fibre boards of KAN-therm Wall system. The contact of all board edges must be at least 15 mm.

The wood for the supporting construction must be applicable for construction purposes and dry during the assembly.

Only steel profiles protected from corrosion should be used, with minimum thickness of 0.6 mm, meeting the requirements of PN-EN 14195 and 13964.

Also the connecting elements and places should be properly protected from corrosion.

Maximum distances of supporting construction elements for gypsum-board boards in any application are shown in the table below.

Spacing for Fermacell gypsum-fibre boards with thickness of 15 mm.

Area of application /type of construction	Utility class, includes the air humidity	Max. space of axes supporting laths / supporting profiles in mm
Vertical areas (partition walls, wall linings)	—	313
Linings of ceilings, roofs and suspended ceilings	Rooms used in homes [1]	400
	Construction and/or the use at temporary high air humidity [2]	350

[1] Ex. humid rooms used in homes in residential areas or rooms with temporarily increased air humidity.

[2] Ex. in case of wet screed or plaster, however not in rooms with constantly high air humidity (ex. wet rooms, etc.).

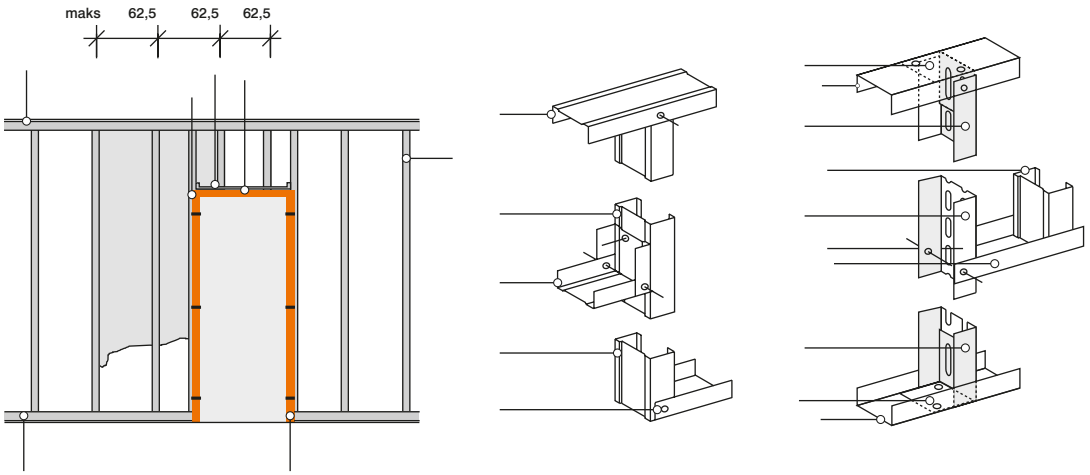
Boundary conditions

- the assembly space provided apply regardless of the direction of assembly,
- the linings cannot be overloaded by additional weights (ex. insulation materials),
- the point load up to 0.06 kN (based on DIN 18181:2008-10) should be considered for each metre of width of each board,
- in the case of fire protection dimensions you should observe the data included in proper fire testing certificates.

When the supporting construction is mounted on the wall, the construction should go along the longitudinal edge of the wall board.

In the case of ceiling mounting it is required that the wooden or metal construction ran across the longitudinal edge of the wall board. If in the case of ceiling mounting the supporting profiles are parallel to the longitudinal edge of the board, the board may flex during the system operation.

The diagram of mounting the frame to the supporting construction
(dimensions in cm)
1. UW profile
2. CW profile
3. CW or UA stiffening profile
3a. UA stiffening profile
3b. UA square
4. UW latch
5. Frame
6. Connector



If the wooden supporting construction is used for the KAN-therm Wall heating&cooling boards with dry method, the following recommendations should be followed:

- The wood should be applicable for wooden constructions and dry during the assembly.
- The minimum cross-section of the laths should be 30 × 50 mm.
- The construction of the wooden frame should not be flexible.
- The space of axes of the bearing construction should not be more than 313 mm.

If the steel supporting construction is used for the KAN-therm Wall heating&cooling boards with dry method, the following recommendations should be followed:

- All metal profiles and connecting elements should be protected from corrosion.

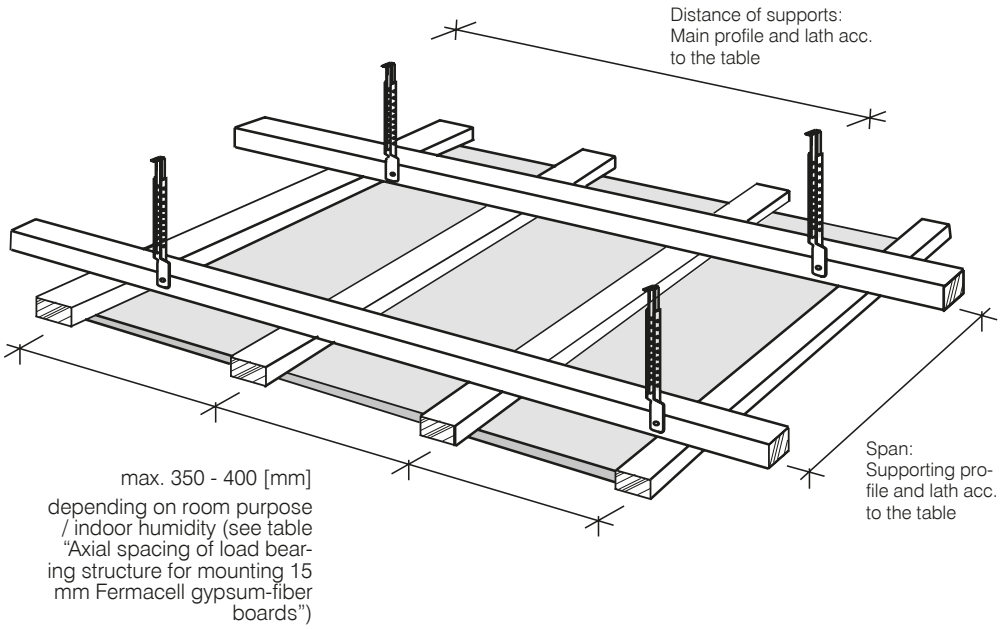
- The frame should be prepared in accordance with BS 18182:
- The thickness of the sheet used for metal profiles should be 0.6 mm - 0.7 mm.
- C and U profiles should be attached vertically to the wall and to the front.

The details on the construction are given in technical documentation of the profile manufacturers.

Note!
When heating&cooling boards of KAN-therm Wall system are assembled, you cannot make cross gaps. The side offset of at least 30 cm should be maintained.

Ceiling linings made of gypsum-fibre boards

When ceilings are mounted, you should prepare the construction supporting elements in accordance with the table below. Parameters of other supporting constructions must be calculated not to exceed the permissible deflection, which is 1/500 of the distance. The table below includes the permissible deflection. The distances of supporting profiles or supporting laths depend on board thickness.



The distances and cross sections of profiles and laths for ceiling and suspended ceiling linings

Supporting construction in mm		Permissible distance in mm [1] At total capacity load [4]		
		Up to 15 kg/m²	Up to 30 kg/m²	Up to 50 kg/m²
		Steel sheet profiles [2]		
Main profile	CD 60 × 27 × 0,6	900	750	600
Supporting profile	CD 60 × 27 × 0,6	1000	1000	750
		Wooden laths (width × height)		
Main laths attached directly	48 × 24 50 × 30 60 × 40	750 850 1000	650 750 850	600 600 700
Main suspended laths	30 × 50 [3] 40 ×60	1000 1200	850 1000	700 850
Supporting laths	48 × 24 50 × 30 60 × 40	700 850 1100	600 750 1000	500 600 900

[1] The concept of profile or main lath distance means the distance between hangers, and in the case of profiles or supporting laths the axial distance of profiles or supporting laths, see Fig.

[2] Profiles available commercially made of steel sheet (according to DIN EN 18182 or DIN EN 14195).

[3] Only in relation with supporting laths, 50 mm wide and 30 mm high.

[4] When the total capacity load is determined, you should consider possible additional weights, such as lighting or built-in elements.

Individual elements of the supporting construction must be connected using special, recommended connecting elements: bolts or threaded nails screwed across or brackets in the case of wood (DIN EN 1050-3) and special fittings in the case of steel profiles.

To prepare the suspended ceilings commercially available fittings should be used, such as nonius hangers, band iron with openings or slots, wires or threaded rods.

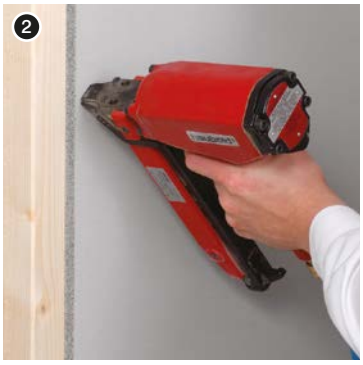
To mount the supporting construction to the massive ceiling you should use certified wall plugs, recommended for high loads.

The cross section of the hangers should be adapted to ensure static safety of the suspended ceiling. The abovementioned should be followed in relation to fire-fighting constructions and constructions with double lining.

Fitting elements and distance of anchorages

Heating&cooling boards can be attached directly to the supporting construction by:

- fixing with bolts for steel supporting construction (Fig. 1),
- fixing with bolts for wooden supporting construction (Fig. 1),
- fixing with brackets for wooden supporting construction (Fig. 2),
- fixing with brackets for gypsum-fibre boards (double lining) (Fig. 3).



Attaching the boards with bolts and brackets

A special feature of KAN-therm Wall system boards (gypsum-fibre) is the fact that they can be fixed to the supporting construction with bolts and brackets mounted right at the board edges (approx. 10 mm), without breaking effect.

In the case of steel construction made of steel profiles (thickness of 0.7 mm) the gypsum-fibre boards should be screwed in using dedicated self-drilling screws without drilling any holes. Using other screws may make the board assembly more difficult. The screws should be screwed using an electric drill (power 350 W, speed of rotation 0-4000 rpm) or an ordinary drill with screwing tip. In the case of profiles made of thicker sheet, ex. stiffening profiles, you should use self-drilling screws with drilling tip.

In the case of wooden construction the gypsum-fibre boards must be attached with dedicated screws. For wooden supporting constructions it is much easer and faster to fix the boards using brackets.

When the boards are fixed, you should obey the rule that at least 2 parallel board edges should be on the supporting construction. All fixing elements should be inserted deep enough into the gypsum-fibre board and mudded with joint filler.

The boards must be fixed in such way to avoid tension. When boards are fixed, you should keep the order of fixing on supporting construction axes - beginning from the board centre and moving toward the edge or fixing from one edge to another.

Note!
It is forbidden to fix the boards first in the corners and then from one side to another.

In the case of two-layer lining it is possible to fix the external layer of boards using brackets or screws directly to the first layer, regardless of the supporting construction. The external layer of the boards is fixed using the joint offset (≥ 20 cm). To connect gypsum-fibre boards you should use brackets-expansion staples with wire thickness ≥ 1,5 mm and shortened arm. The length of bracket arms should be lower by 2-3 mm than the total thickness of two layers of boards.

The distances of brackets and screws are given in the table below.

The distance and use of fixing elements for non-supporting particle walls per 1 m² of the particle wall with gypsum-fibre boards

Board thickness/construction	Brackets-staples (galvanized and resin impregnated) d ≥ 1.5 mm, spine width ≥ 10 mm			Fermacell self-drilling screws d = 3.9 mm		
	Length [mm]	Span [cm]	Use [pcs./m2]	Length [mm]	Span [cm]	Use [pcs./m2]
Metal - single-layer lining 64" (15 mm)	—	—	—	30	25	20
Metal - 2-layer lining/second layer attached to the construction						
First layer: 12,5 mm or 15 mm	—	—	—	30	40	12
Second layer: 10 mm, 12,5 mm or 15 mm	—	—	—	40	25	20
Wood - single layer lining 64" (15 mm)	≥ 44	20	24	40	25	20
Wood - 2-layer lining/second layer attached to the construction						
First layer: 15 mm	≥ 44	40	12	40	40	12
Second layer: 12.5 mm or 15 mm	≥ 60	20	24	40	25	20

Span and use of fixing elements in ceiling constructions with gypsum-fibre boards per m² of the ceiling

Board thickness/construction	Brackets-staples (galvanized and resin impregnated) d ≥ 1.5 mm, spine width ≥ 10 mm			Fermacell self-drilling screws d = 3.9 mm		
	Length [mm]	Span [cm]	Use [pcs./m2]	Length [mm]	Span [cm]	Use [pcs./m2]
Metal - single-layer lining 64" (15 mm)	—	—	—	30	20	16
Metal - 2-layer lining/second layer attached to the construction						
First layer: 12,5 mm or 15 mm	—	—	—	30	30	12
Second layer: 10 mm, 12,5 mm or 15 mm	—	—	—	40	20	16
Wood - single layer lining 64" (15 mm)	≥ 44	15	20	40	20	16
Wood - 2-layer lining/second layer attached to the construction						
First layer: 15 mm	≥ 44	30	12	40	30	12
Second layer: 12.5 mm or 15 mm	≥ 60	15	22	40	20	16

Attaching boards to smooth surfaces.

Requirements for the surface

The surface must be dry and hard, strong enough, should not shrink and should be insulated from humidity and protected from possible wetting. The surface cannot be made of clay. In the case of hard foams you should consult the manufacturer.

Before attaching the boards you should remove the loose plaster, old paint coatings, remains of the wallpaper, wallpaper glue, boarding oil and contamination. If the use of cast asphalt/wet screed was foreseen, the assembly of gypsum-fibre boards using the gypsum glue and pointing can be initiated only when it is bound.

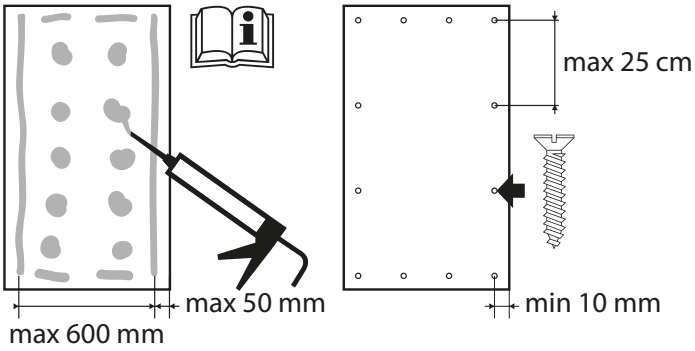
Due to special properties of gypsum glue the surface that easily absorbs humidity, ex. cellular concrete, does not require any special initial processing. Small irregularities of the walls (up to 20 mm) can be flattened using the gypsum glue directly during the board assembly. In the case of larger irregularities it is necessary to flatten the whole surface.

If you are unsure about the surface load capacity, you should use mechanical supports, such as wooden laths, etc.

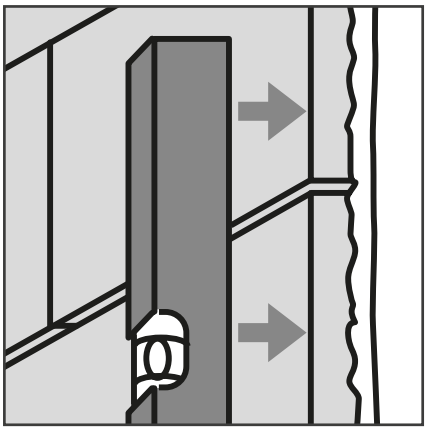
Assembly on moderately flat surface

Such surface is generally made of bricks, limestone and sand stones, hollow bricks.

The gypsum glue is applied in patches onto the reverse side of the board or directly on the wall. The distance of glue patches/bands should not exceed 600 mm in the case of gypsum-fibre boards. The distance from the band to the edge of the board should not exceed 50 mm.



Assembly on very flat surface



This method should be considered in the case of cellular concrete walls or surfaces with very flat concrete areas.

Slightly diluted gypsum glue is applied in bands onto the reverse side of the gypsum-fibre board is such way that the distance from the band to the edge is no more than 50 mm.

The gypsum glue should not enter the joints. The distance between bands for gypsum-fibre boards with thickness of 15 mm (d=10 mm) should not exceed 600 mm.

A board covered with gypsum glue should be lightly pressed to the wall and set vertically, ex. by pressing with a spirit level.

Before the assembly of boards the cellular concrete wall should be cleaned thoroughly, ex. using a brush.

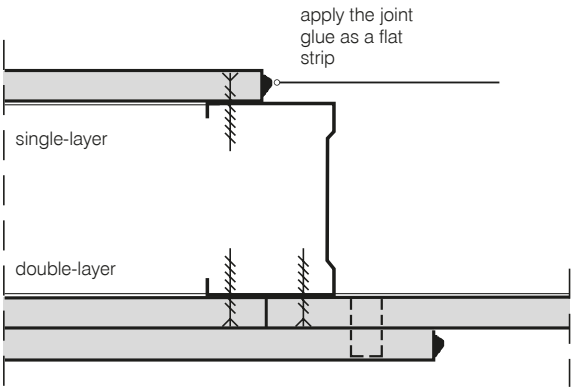
The gypsum glue should bind the board with the surface in all places. In the points of board joints in the door, shelf or sink areas the boards must be completely covered with gypsum glue. Those components should be attached to a massive surface. Static fixing is related to the wall.

Making joints

A joint - the place where KAN-therm Wall system boards are connected can be made in two ways: as a glued joint or a mudded joint. Both techniques of making joints apply to boards with perpendicular edges.

Glued joint

Gypsum-fibre boards can be mounted only when dry. You should use only the **Fermacell** gypsum glue or greenline joint glue.



When joints are made, you should ensure that the board edges are free from dost and that the glue band is applied in the middle of the edge, not onto the frame. Pre-cut edges are the best for glued joints. The edges of boards cut at the site should be cut perpendicularly and must be perfectly straight.

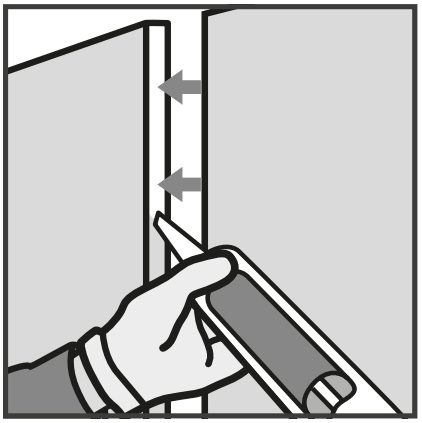


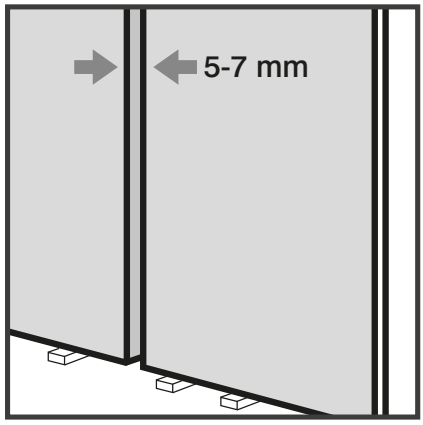
Fig. Moving the 310 ml cartouche along the board edge. Cut the nozzle in the case of the 15 mm board.

The first board is attached to the supporting construction. Then behind you should apply a flat band of joint glue from the cartouche onto the vertical edge of the board. Next you should press the second board to the first. When both boards are pressed, it is important that the glue fills the joint completely (excessive glue visible after pressing). The maximum width of glued joint must not exceed 1 mm. You should not press the boards to remove all the glue from the joint.

Depending on the room temperature and air humidity, the glue is cured after 18-36 hours; when it is cured, the excess of the glue should be completely removed using a putty knife or a wide trowel. Then the connections and fixing elements in boards should be mudded with joint filler for surfaces.

Mudded joint

To make a reliable and strong connection of the boards with perpendicular edges using the mudded joint technique, you should fill the gypsum-fibre boards with a special joint filler, ex. from **Fermacell**.



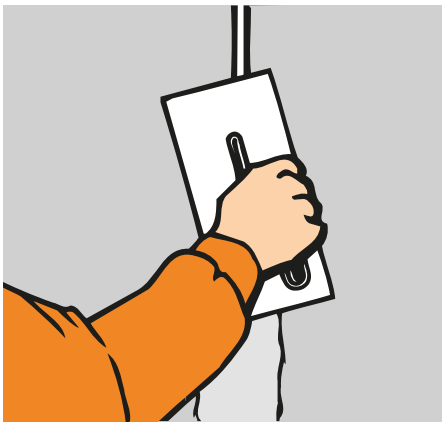
Whether or not the gypsum-fibre boards are attached to the supporting construction using screws or brackets-staples, you should assure the proper joint widths between the boards. In the case of KAN-therm Wall heating&cooling board with thickness of 15 mm, the joint thickness should be 7-10 mm.

The joints are mudded with a joint filler without need to use the reinforcing tape (except for plastering with a thin layer of structural plaster, below which you need to reinforce the joint with tape).

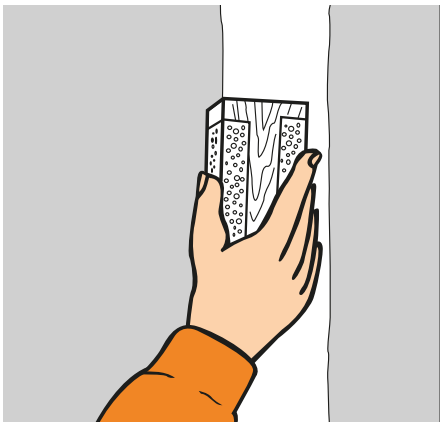
Screw heads or brackets-staples should be mudded using the same material.

Before mudding you should ensure that the joints are free from dust. You can start mudding only when the boards are dry, i.e. free from humidity coming from the building construction. If you plan any works with wet screed or plaster in the room, you should make joints only when they are dry.

The joint is made in two steps: initial mudding and final mudding. Final mudding can be done only when the first layer of putty is dry.



The putty for joints should be inserted into joints between boards until they are completely filled. To achieve connection from both sides, the mass is applied on one edge of the board and then distributed to the opposite edge. In this way the heads of fittings and various cracks get mudded. Possible irregularities can be ground (using the grinding mesh or sand paper type 60) after drying the putty applied in the first work cycle. The final mudding is done after removing grinding dust from the surface.



Gaps and connections

Gaps and connections should be considered at the design stage of the project. The following principles related to construction and design should be followed:

- Expansion gaps of the building should be continued in walls by making expansion gaps with the same possibilities of movement.
- The wall surfaces should be marked every 10 m according to DIN 18181 in both longitudinal and transverse direction by making expansion gaps.
- The connections with ceiling and walls should be done using the sliding connection.

Sliding connection

Connecting the heating&cooling wall boards with surrounding surfaces should be made as a sliding connection. Temperature-based elongation of wall elements is compensated by sliding connections. The connecting profile is visible within the sliding joint. The front edge of gypsum-fibre boards can be covered with an edge profile.

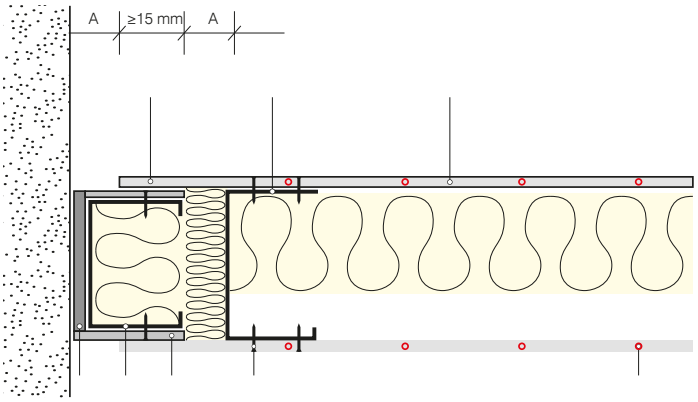


Fig. Sliding connection with the wall

1. Extreme wall
2. Inactive wall area
3. CW cut profile, galvanized
4. Flexible closing
5. Connecting profile
6. Complementary gypsum-fibre board
7. Quick assembly screw
8. Thermal insulation
9. KAN-therm pipe, PB or PE-RT 8x1 mm
10. KAN-therm Wall system heating and cooling board

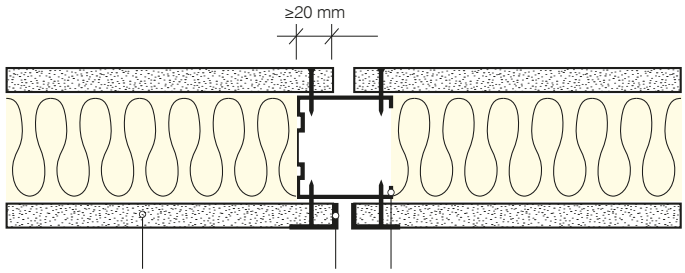
A Movement range 15 mm.

Open gap

An open gap can be used to separate the coverage for decorative purposes or to separate the narrowings. The gap can be covered with a profile.

Fig. Open gap

1. KAN-therm Wall system heating and cooling board
2. Edge profile or other (alternative)
3. Support profile

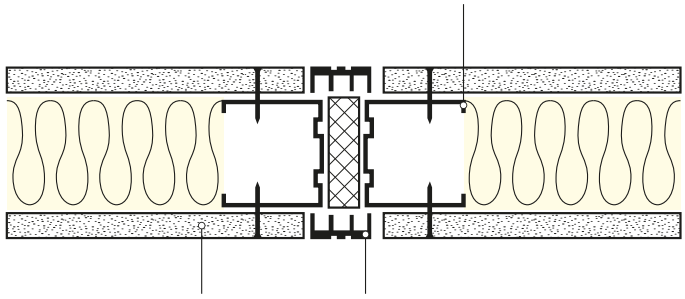


Expansion gap

Within an expansion gap you need to separate the whole wall construction. It is used in the case of covering the construction gaps or when the length of the wall needs to be separated into sections. In the case of KAN-therm Wall heating&cooling boards with dry method such separation should be done every 10 m.

Fig. Expansion gap

1. Flexible insulation insert (ex. mineral material)
2. Support profile
3. KAN-therm Wall system heating and cooling board
4. Fugue profile



Preparation of the surface to finish.

Before applying paint, wallpaper or tiles you should verify the condition of the surface for finishing. The board surface with joints must be dry, undamaged, without any stains or dust. Moreover, you should:

- remove the remains of gypsum and plaster,
- fill all connections with joint filler, final putty or gypsum filler for surface mudding,
- verify if all mudded areas are smooth - grind if required.

Gypsum-fibre boards are impregnated with a rain repellent. Additional impregnation or application of an additional layer is required only when the manufacturer of the finishing system recommends that due to the gypsum surface, ex. in the case of thin-layer plasters or structural coatings of paint or glue. In such a case you should use low-hydrated masonry primers. For multi-layer systems you should observe the drying time recommended by the manufacturers.

Conditions at the site

You should ensure that the humidity of gypsum-fibre boards does not exceed 1.3%. Boards gain that humidity within 48 hours if the air humidity in the room is kept below 70% and the temperature is above 15 deg.C. All screeds and plasters must be dry. The board surfaces must be free from dust.

Final finishing of KAN-therm Wall system gypsum-fibre boards (coating with paints. wallpapers,

plasters or tiles) should be done in accordance with Fermacell recommendations.

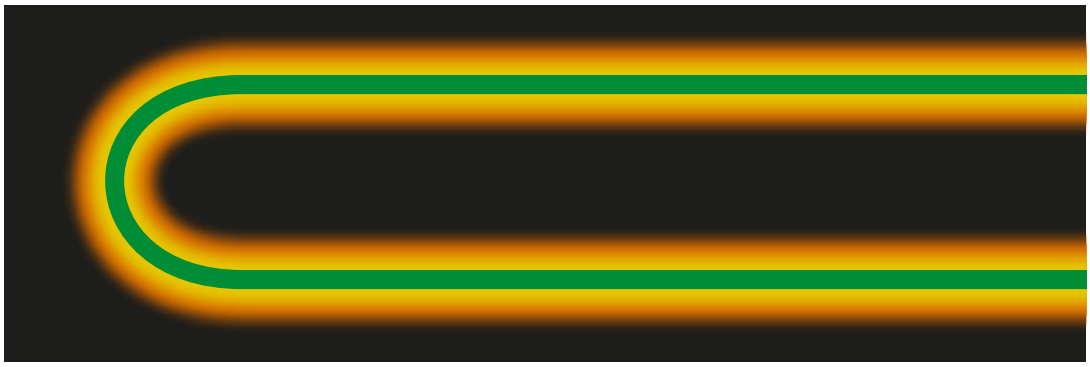
Note!

Before final finishing of KAN-therm Wall system gypsum-fibre boards (painting, applying wallpapers) you must:

- make a hydraulic connection for the heating&cooling boards,
- flush, fill and vent the pipe system in the boards,
- make a tightness test of the heating&cooling system.

Determining the location of heating pipes

The location of heating pipes can be determined using the thermosensitive foil during the heating process. For that purpose you should place the foil on the surface and switch on the wall heating. Thermal foils are re-usable.



2.4.6 Hydraulic connection of KAN-therm Wall system boards

In order to ensure proper information of heating&cooling construction of KAN-therm Wall system gypsum-fibre boards you need a design of board location based on the architectural project (consultations with an architect) and possible discussions with an investor related to additional equipment and furniture, ex. paintings, shelves, high furniture, etc. Using the information obtained, you need to determine the active heating&cooling areas.

The efficiencies of KAN-therm Wall System gypsum-fibre boards are shown in the efficiency tables for KAN-therm Wall System in the Annex to this document.

The tables are also available in KAN website.

Note!

The maximum permissible temperature of heating&cooling KAN-therm Wall System gypsum-fibre boards in continuous heating operation is +40°C. Higher temperatures may damage the wall boards.

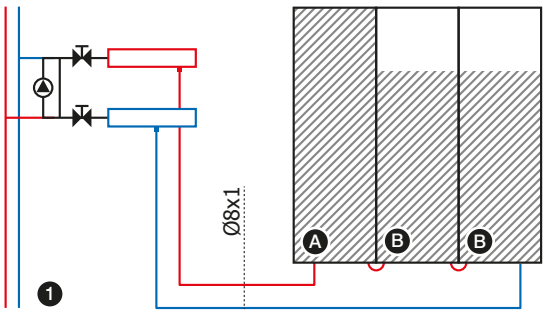
In order to ensure an optimum climate in the room during heating with KAN-therm Wall system boards you should consider maximum permissible temperatures of the wall surfaces.

The design should ensure the temperature shall not exceed +40°C.

In order to ensure optimum work of the heating&cooling hydraulic system made of KAN-therm Wall system gypsum-fibre boards, you should observe the following guidelines:

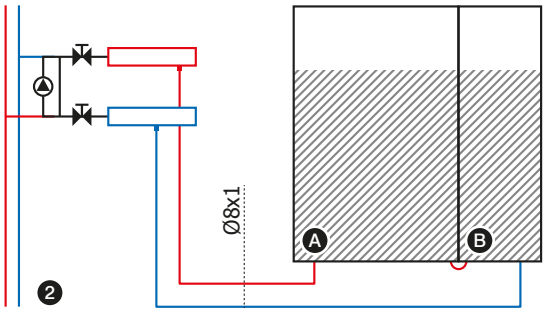
When you select/design the installation of the heating system with dry method (KAN-therm Wall System) you should note that the temperature can drop by 5°C. The permissible drop of pressure for the whole heating loop should not exceed 20 kPa.

Due to high pressure losses it is recommended to connect the boards one by one with max. total 8 mm pipe length of 40 rm. In the case of longer sections, i.e. above 40 rm, it is recommended to connect boards or board sets using the Tichelman system. Due to the control capabilities of the flowmeters used in KAN manifolds, the minimum 8x1 mm pipe length directly connected to single manifold circuit (including the connection line) is 30 m (note: does not apply to manifolds with control valves).



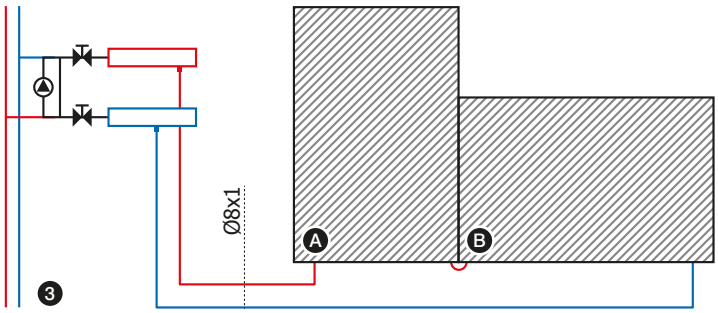
$30 \leq L1 + L2 + \ldots \leq 40$ m

Fig. 1	Area	Size (mm)	Q (W)	L (m)
Board A	100%	2000×310	59.3	≈8.3
Board B	75%	2000×310	44.5	≈6.4



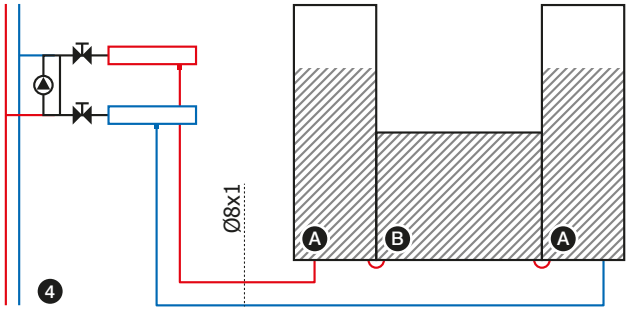
$30 \leq L1 + L2 + \ldots \leq 40$ m

Fig. 2	Area	Size (mm)	Q (W)	L (m)
Board A	75%	2000×625	92.5	≈15.6
Board B	75%	2000×310	44.5	≈6.4



30 ≤ L1 + L2 + … ≤ 40 m

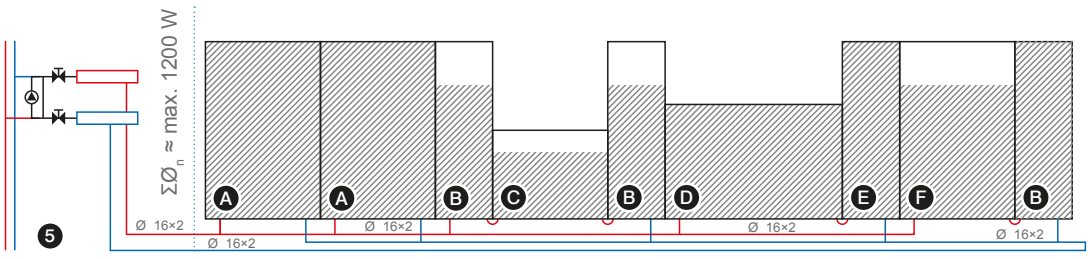
Fig. 3	Area	Size (mm)	Q (W)	L (m)
Board A	100%	1000×625	61.7	≈9.4
Board B	100%	625×1250	77.1	≈11.8



30 ≤ L1 + L2 + … ≤ 40 m

Fig. 4	Area	Size (mm)	Q (W)	L (m)
Board A	75%	2000×310	44.5	≈6.4
Board B	100%	1000×625	61.7	≈9.4

Boards with total nominal power of 1200W can be connected to one Tichelman circuit with splitter. In the case of Tichelman circuit it is recommended to connect single heating boards or sets of heating boards with similar pipe lengths - the lengths of individual boards or board sets cannot differ by more than 10%. To provide an optimal hydraulic adjustment of the system you should attach a set of heating boards with minimum total 8 mm pipe length of 40 rm.



L1 + L2 + … ≤ 40 m (applies to heating boards connected in series)

Fig. 5	Area	Size (mm)	Q (W)	L (m)
Board A	100%	2000×625	123.4	≈20.4
Board B	75%	2000×310	44.5	≈6.4
Board C	75%	1000×625	61.7	≈9.4

Fig. 5	Area	Size (mm)	Q (W)	L (m)
Board D	100%	625×1250	77.1	≈11.8
Board E	100%	2000×310	59.3	≈8.3
Board F	75%	2000×625	92.5	≈15.6

The connection of heating&cooling boards of KAN-therm Wall system and connecting them into the Tichelman circuit should be done using special Press/Click fittings available in the KAN-therm Wall System offer:

Note!

The press nozzles are made using the LBP technology and the connections can be pressed with jaws with U and TH outline.

2.4.7 Preparing the system to start-up

Flushing, filling and venting

The flushing process should be done right after fixing the active wall boards. At the end of the filling process you should align hydraulically individual bands of pipes or separate heating circuits with direct connection to the heating system splitter.

To remove air bubbles you should ensure the minimum value of volume stream during the venting process. The value is 0.35 l/min, which relates to 0.2 m/s flow rate.

Pressure test for tightness

The tightness test should be done after venting the whole heating&cooling system in accordance with the KAN tightness test protocol for surface heating and cooling. When the danger of frost arises, you should take appropriate measures to avoid damaging pipes due to freezing. In such case you can heat the room or use anti-freeze measures.

Note!

Before the start-up of the KAN-therm Wall heating&cooling board system you should vent the pipes and run the tightness test of the whole installation.

03 Components of the **KAN-therm** surface water heating&cooling system

KAN-therm System includes all elements required to build a water surface heating or cooling system:

- heating/cooling pipes,
- thermal insulation,
- pipe support systems,
- dilatation elements (dilatation tapes and profiles),
- heating circuit splitters,
- installation cabinets,
- devices for adjustment and automation,
- screed additives.

Components of the KAN-therm surface heating&cooling system

KAN-therm System offers many ways to mount heating pipes, that enable construction of various ceiling and wall heaters, made using the wet and dry method.

The supporting elements of heating pipes are complemented by various installation covers, splitters, mixing systems and complete wired and wireless automation systems.

All abovementioned elements are described in detail in the KAN-therm System Floor Heating System available in KAN website.

04 Designing the **KAN-therm** surface heaters

4.1 Thermal dimensioning – assumptions

The floor and wall heaters of KAN-therm System is based on the method defined in PN-EN 1264 "Water based surface embedded heating and cooling systems". It assumes that:

- the basis for calculation of heat stream density emitted to the room is the average logarithmic difference between the temperature of the heating medium and the air temperature in the room,
- there are no additional heating sources in the floor,
- the side heat flow is not included.

In accordance with PN-EN 1264 the heat stream density "q" emitted by the surface heater is determined using the following formula:

$$\mathbf{q} = \mathbf{K}_H \times \Delta\vartheta_H \ [W/m^2]$$

where,

$\Delta\vartheta_H$ - average logarithmic difference of temperatures [K],

$\mathbf{K}_H$ - constant based on two following coefficients, that include the construction of the surface (wall) heater:

- complex coefficient depending on the surface heating and heating pipe construction,
- coefficient depending on the heating surface finishing layer type,
- coefficient depending on the pipe distance,
- coefficient depending on the plaster layer thickness above pipes,
- coefficient depending in the external pipe diameter.

Average logarithmic difference of temperature $\Delta\vartheta_H$ is calculated depending on:

where,

$$\Delta\vartheta_H = \frac{\vartheta_z - \vartheta_p}{\ln\left[\frac{\vartheta_z - \vartheta_i}{\vartheta_p - \vartheta_i}\right]}$$

ϑ_Z - supply temperature of the surface (wall) heater, [°C],
ϑ_P - temperature of the agent return, [°C],
ϑ_i - air temperature in the room, [°C].

To facilitate calculations this dependence is provided in tables (for various values of temperatures of the air and agent temperature).

On the basis of $\Delta\vartheta_H$ value taken from the table and assumed parameters resulting from the construction of surface heater (plaster thickness, pipe diameter and distances, type of surface finishing) you can determine the value of heat stream emitted to the rooms.

4.1.1 Maximum surface temperature

In the case of wall heating the permissible wall temperature is 40ºC.

If the values of heat losses in rooms are higher than the values resulting from maximum efficiency of surface heaters, you should plan additional heaters. If possible, you could also design a complementary floor heating.

4.1.2 Supply temperature of the surface heating

Surface heating (floor, wall) is a low-temperature heating system. In the case of wall heating the maximum temperature of the heating water should not exceed 50°C (to calculate the external temperature) and the optimum water temperature drop in coils is 5°C to 10°C (permissible range 5÷15°C).

Therefore typical parameters of the water supplying the coils and returning from them (ϑ_z/ϑ_p) are:

50 °C / 45 °C
50 °C / 40 °C
45 °C / 40 °C
40 °C / 35 °C

The supply and return temperature for the whole installation is selected for the room with highest thermal demand.

4.1.3 Wall cooling - general rules:

KAN-therm Wall surface heaters can also be used as cooling areas.

To define the boundary conditions of surface cooling related to water vapour condensation and heating comfort you should use the i-x Mollier chart for humid air.

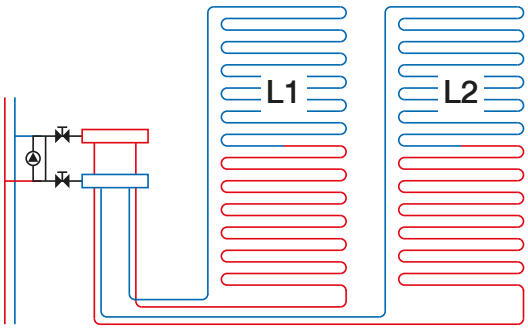
To avoid water vapour condensation on the cooling wall area, the installation supply temperature cannot drop below the dew point temperatures +2 K.

4.1.4 Thermal and hydraulic dimensioning of surface wall heaters

General rules of KAN-therm heating/cooling design are no different from heating&cooling dimensioning rules provided in part 4 - Design of the KAN-therm surface heaters.

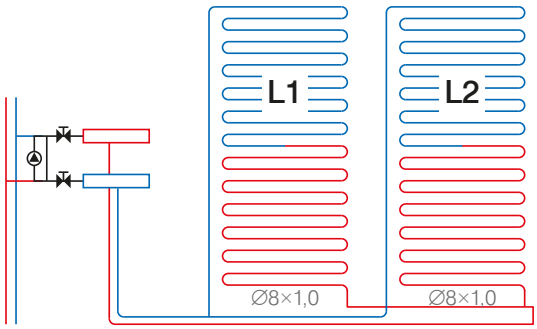
Additionally you should consider the following criteria:

- maximum temperature of the wall surface (heating) 40°C,
- minimum temperature of the wall surface (cooling) 19°C if it does not cause condensation,
- maximum temperature of the installation supply of 50°C,
- the water temperature drop in pipes from 5 to 10 K (for pipes with diameter of 12×2 mm, 14×2 mm, 16×2 mm) and from 2.5 to 7.5 K, average (recommended) 5 K (for pipes with diameter of 8×1 mm),
- pipe distance, depending on the diameter, with meandering,
- minimum water flow rate that ensures efficient installation venting is 0.15 m/s,
- average max. water flow rate 0.8 m/s (for pipes with diameter of 8x1 – 0.3 m/s),
- average maximum lengths of heating loops: 80 m for 14 × 2 mm pipes and 60 m for 12 × 2 mm pipes, 40 m for 8 x 1 mm pipes (including connecting sections).



Ø8×1,0

L1 ≠ L2 L1;L2 ≤ 40 m Ø8x1,0



Ø16×2,0

L1;L2 ≤ 40 m Ø8x1,0
L1 = L2 ±10%
Qmax Ø16×2,0 = 1200 W

— At internal walls the thermal resistance of all wall layers to the heating pipe surface should not be smaller than 0.75 $m^2 \times K/W$ (unless you wish to heat the neighbouring rooms).

To determine the heating efficiency of wall heaters in dependence on diameter "D", pipe distance "T" (10, 15, 20 and 25 cm), thickness "Su", plaster thermal properties and the average temperature [(tV+tR):2]-ti H(K) there are tables for the plaster with thickness of 20 mm (above the pipe surface) and conductivity coefficient = 0.8 W/mK and for the value of unit resistance of wall finishing layer conductivity R = 0.00; 0.05; 0.10; 0.15 $m^2 \times K/W$.

05 Installation adjustment

The principles of hydraulic adjustment of heating circuits for heating&cooling installation are the same as for the KAN-therm floor heating.

The pressure losses in heating pipes can be determined using the charts for linear resistance for KAN-therm heating pipes, available in the Annex. To adjust heating&cooling KAN-therm installation the same adjustment and automation elements are used as in the case of KAN-therm floor heating&cooling, i.e. adjustment valves or flow meters available in splitter construction, thermostat valves for control automation cylinders - also being a part of splitters, wired or wireless control equipment that includes i.a. control slats and heat thermostats.

06 Tightness tests, start-up

The principles of tightness tests are the same as in the case of floor heating.

The installation start-up should be done in accordance with heating/cooling surface installation KAN-therm protocol (available on KAN website).

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Surface heating
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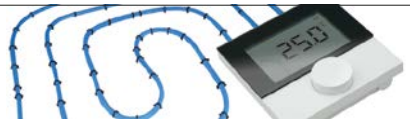

Football
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SYSTEM
KAN-therm

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