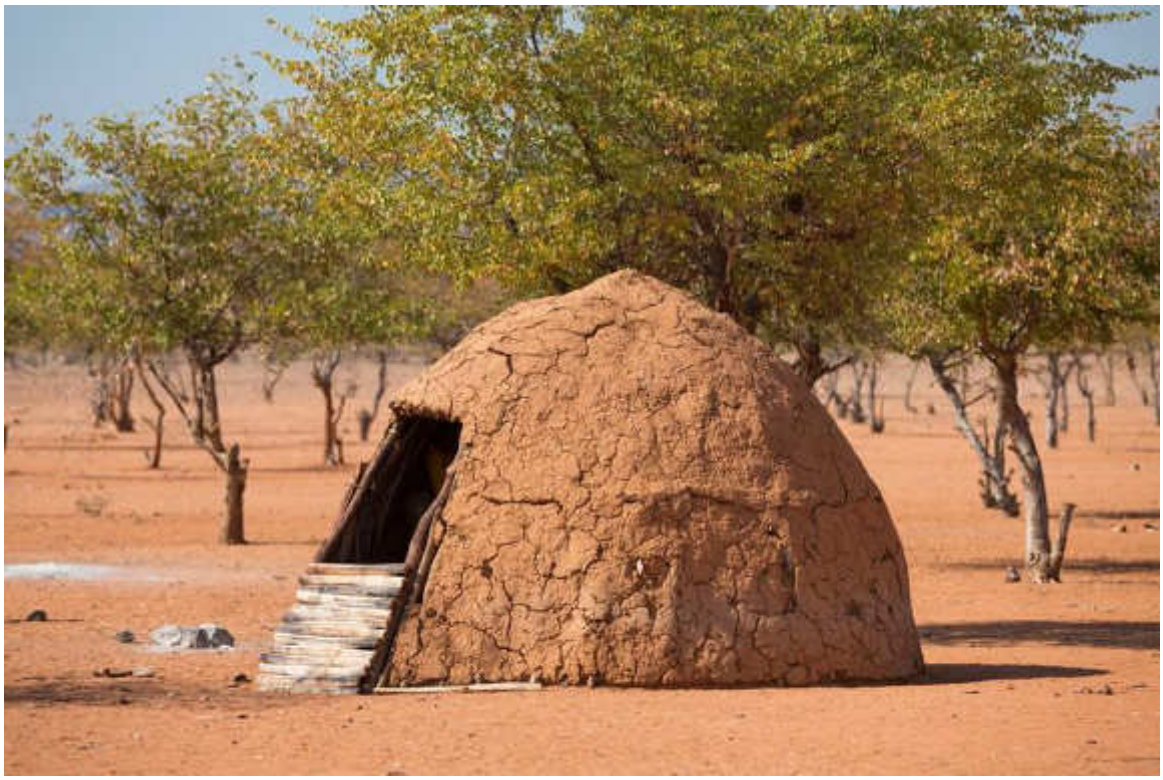
The construction material clay

Clay is a natural construction material with many health promoting qualities and energetic advantages for a healthy and perfectly comfortable indoor climate.

Thousands of years ago humans were already using clay for the construction of housing. Even then, people benefitted from the clays positive qualities such as heat storage, the pleasant cooling effect during summer and its recyclability, since it hardens naturally instead of chemically.



Right up to the end of world war 2 clay was a dominant construction material fulfilling requirements according to the German DIN standards. However, the construction boom of the 50s and 60s demanded quicker materials such as concrete or gypsum, resulting in clay increasingly loosing its significance. During the early seventies, the DIN standards ruling clay construction in Germany were withdrawn.

In the late 90ies however the classical construction material clay experienced a true revival due to an obvious return to energy-efficient resources with health promoting aspects. In August 2013, the German DIN requirements were re-applied and the market is annually growing on a two-digit scale ever since. In the past few years, clay has been continuously developed further especially in the fields of clay mortar, clay plaster and clay surfaces. Nowadays there´s barely a difference between the surface and material qualities of gypsum or limestone and clay plaster.

Advantages of clay

Medical

- The enormous sorption capacity provides a consistent indoor air humidity of 50% creating a pleasant and comfortable healthy indoor climate
- Actively acts against the drying out of mucous membranes
- Prevents common colds
- Acts against itchy eyes caused by dryness
- Prevents headaches
- Alleviates sleeping disorders
- Acts against muscular tensions and blockages
- Alleviates allergy- and asthma symptoms
- Acts against low energy levels and lack of concentration
- An anti-static effect reduces fine dust, meaning clay doesn't charge up attracting dust and dirt particles
- Binds pollutants from the air
- Absorbs odors
- Reduces electrical smog
- Antiallergic

Structural qualities

- Clay stores the developed heat from the day and emits it during evening hours with falling room temperatures, this way heating periods can be reduced by up to approximately 6 weeks.
  15% energy savings
- In summer time clay naturally reduces room temperatures by up to 8° through cooling by the evaporation developed during the sorption process.
- The enormous sorption capacity stops overly high air humidity preventing mold as a result.
- Good capillary conductivity for humidity transport within the masonry.
- For inner insulations, incurring melt water is transported into the room by the clay.

Ecological

- Reusable
- Unbeatable positive CO^2 balance (only a fraction compared to gypsum- or lime products)
- Easily recyclable
- Resource widely available

Clay dry construction system RIVIERA

The patented water-based low-temperature ceiling heating/cooling system, produced in an industrial dry surface-pressing process.

Easy installation according to standards and rules, energy-saving natural heat and cold, healthy & comforting room climate.

1) 22mm ESB-Plus P5 or OSB 3 board with tongue and groove as substructure
2) Clay system construction panel, size: 375x375x25mm, acc. DVL TM 07 (type A) for laying of water pipes
3) Three-layer pipe according to DIN 16968 and DIN 4726, PB 12x1,3mm
4) Clay upper-plaster acc. DIN 18947, application thickness 3-5mm with incorporated scrim
5) Clay paint acc. DVL TM 06 as sprayable and brushable ready-mix

Ceiling heatings

Ceiling and floor heating are the dominant low lemperature surface heatings in Germany. Floor heating is preferably installed in private new buildings. Ceiling heatings however, are preferably installed in private reconstructional and new industrial buildings. In cities like Frankfurt/ Main or Munich approximately 80% of all new office and administrative buildings are equipped with a ceiling heating system, nowadays. Why so? Both, industrial and private new buildings have a well-insulated envelope nowadays and consequently only little outward energy loss (transmission loss). An equally important energy saving factor is the reduction of venting loss, e.g. heat loss due to air exchange during venting. This loss is higher in the industrial sector as the required air exchange rate is higher, too. Also, in reality the office temperature usually is controled by window tilting.
Ceiling heatings reduce this problem as heat is transfered almost completely by radiation. Air is not primarily used as transmitter of thermal energy and even though temperature is evenly felt it actually is about 2-3K lower. Consequently less energy is getting lost due to heating air during venting!

Further advantages of a ceiling heating used in the industrial sector:

- Heating surfaces can very efficiently be used for cooling in summer, because cold air falls downwards, as is known!
- Ceiling heatings react fast, are well controllable and can heat high rooms without noticable temperature differences (same top and bottom temperatures) in an optimum way. Example: gym heating by radiating ceiling panels
- As ceiling heatings do not use air as heat transmitter there is no indoor dust/air movement and the air keeps its natural humidity.
  The room climate is suited for allergics and reduces the risk for coughs and sneezes.
- Radiant heat from above counteracts tense muscles in the shoulder area as studies proove, prevents head aches and increases concentrativeness.
- Cold feet under the desk as at convection heating? Ceiling heatings solve even this problem, as the striking heat waves are reflected at walls, floor, etc. and as secondary radiation equally warm the

areas directly invisible from the ceiling. Light acts in a similar way; switching on the ceiling light lightens the area under the desk, too!

- As there are no limitations regarding interior design, furniture and floor covers are arbitrary and can be exchanged if requested. Perfectly suited for combination with wood floors!

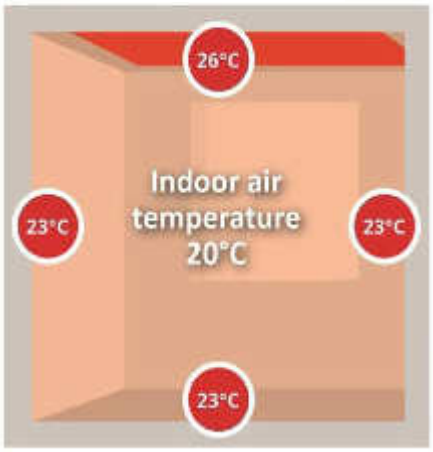
Also the private building sector has become aware of the advantages of ceiling heatings in the past few years and the market share in this section increases significantly year by year. Nevertheless, despite diverse disadvantages for new buildings floor heating still is the dominant systems. the lower price is the decisive factor.
This is different in the reconstructional sector. Subsequently installed floor heatings usually are inefficient and expensive. Therefore and on account of further advantages wall and ceiling heatings are prefered for reconstructions nowadays. Meanwhile there are several manufacturers specialized in low-budget systems for the private sector.

Functionality

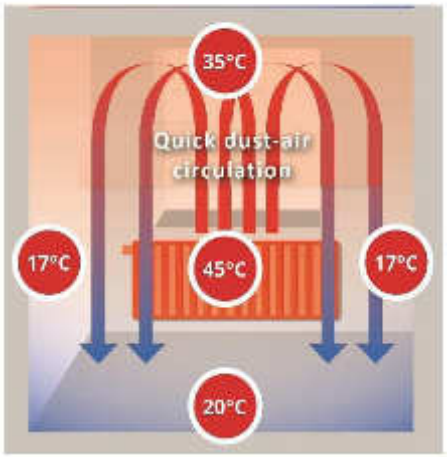
The heat of a ceiling heating comes from above, as we know it from nature. Like heat from the sun it is evenly and healthy distributed as thermal radiation into every corner of the room. As the heat waves radiating from the ceiling most intensively strike the opposite floor this very quickly grows warm and reaches almost the same surface temperatures. Thus cold feet due to a cold floor are a thing of the past. With a ceiling temperature of maximum 29°C, which is below the surface temperature of the human body, the head always remains pleasantly cool.

As the air is heated only passively, the indoor air temperatue reduces by 2 – 3 °C withhout effecting comfort or coziness in a negative way. Here one speaks of the operative temperature, the mean value of air temperature and the average surface temperature of all surrounding areas.

Cealing heating



Convective heating



Pleasant heat savouring an incredibly pleasant and healthy indoor climate, no ascending air in a heated room, even temperature in every corner of the room saving energy with a heating system that takes not subducting any space at all- the unique ceiling heating by ArgillaTherm® provides all this and even more.

The ArgillaTherm® heating system combines the advantages of conventional low-temperature panel heatings with the positive properties of the construction material clay relying on an innovative patented –panel heating with the positive properties of the construction material clay and relying on an innovative patented plate system for easy montage according to all relevant rules and standards.

The comfort

Radiant heat is the healthiest and most pleasant existing form of heat transfer. We know it from the sun and a tiled fireplace for instance. What is decisive here is, firstly that all areas are heated as evenly as possible and secondly that there is no occurring air circulation. The virtually all around even room temperatures create an ideal feeling of comfort, since the human body experiences temperature differences between head and feet as extremely unpleasant.

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Another decisive factor is a fair indoor air humidity, remaining at an ideal 50% achieved by the use of the construction material clay!

Panel heatings in comparison

property	Floor heating	Wall heating	Ceiling heating
Portion of heat radiation	50%	70%	98%
Portion of convection, ascending air	50%	30%	2%
Even heat distribution	Very good	satisfactory	Very good
Energy efficiency	good	good	Very good
Indoor dust-air-movement	Very high	moderate	Very low
Cooling when connected to cold creator	insufficient	moderate	Very good
Limitations at furnishing	moderate	Very high	Very low
Long heating up and down	Very high	Very low	Very low
controllability	insufficient	Very good	Very good

Advantages of der ArgillaTherm® ceiling heating at a glance

- ✓ As common for underfloor heatings the heating pipe is layed without any coupling, which is in accordance with actual rules and standards.
- ✓ Compatible with all exsisting software for project planning and design without limits regarding project size.
- ✓ free choice for integration of lamps or ceiling cleanouts for sprinklers, smoke alarms, speakersl etc.
- ✓ unrivalled low consumption rate
- ✓ easy montage and various fixing options.
- ✓ High occupancy rate due to the modular dry construction system, total system height only 52mm.
- ✓ Use of standard system components and total system design confirming to standards.
- ✓ Low initial cost and no need for expensive preplanning.
- ✓ Healthy and energy-saving due to use of construction material clay as backing material.

✓

Advantages due to use of clay

- ✓ suitable for allergy sufferers and asthmatics, providing maximum of cosiness, living comfort and air purity.
- ✓ Perfectly suited for the use as cooling ceilin g as potentially occuring condensation water is becoming absorbed. A powerful (up to 100 W/m³) cooling ceiling persistently cooling also in summer!
- ✓ The constant relative humidity of about 50% provides a healthy room climate, preventing coughs and sneezes and mould formation.
- ✓ Absorption of pollutants, e.g. VOCs (volatile organic compounds) which can evaporate from wood.
- ✓ Absorbation of smells.
- ✓ Antistatic effect, i.e. the clay neutralizes staticly loaded dust- und dirt particles and reduces fine dust.
- ✓ Extremely positive CO2-balance (only about 1/100 in comparison to gypseous or lime products).
- ✓ Due to the condensation cold occuring in summer clay keeps the room comfortably cool in a natural way.

Energy saving in numbers

20 % due to the higher portion of radiant heat

The room air temperature is heated passively by the heat radiation from rigid surfaces and objects and thus decreases by about 2 –3 K without reducing the feeling of comfort and cosiness.. The rule of thumb applies: 1K reduction correlates to 6-7% energy saving.

5% due to the construction material clay

The heat arising indoors over the day ascends to the ceiling by convection. Heat sources can be people, electrical devices or sunlight, for example. The high-compressed clay system construction plates by ArgillaTherm®store this thermal energy and the sandwich construction prevents the heat migrating to the ceiling. When the room temperature drops below the temperature of the clay layer the stored energy is recycle das radiant heat into the room. The heating period reduces by up to 6 weeks in transitional seasons. For further information see: Handbuch Lehmbau, Baustoffkunde, Techniken Lehmarchitektur; Prof. Dr. Gernot Minke

15 % due to the small difference between average water and radiant temperature

The heating pipe is located only about 5mm below wall surface embedded in the clay ceiling material.
The difference between average water and average ceiling surface temperature amounts to just 2,5K.
1K lower flow temperature correlates to about 2,5% energy saving.

System flow temperatures

According to required heating load, laying and inclination the flow temperatures amount to

: 27 – 45°C at Heating and

: 8 – 22°C at Cooling.

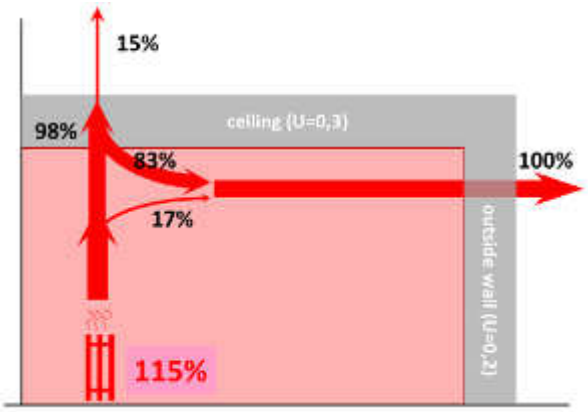
Response time / thermal inertia

Depending on the type of heating system, the response time comes to about 5-10 minutes; the clay ceiling material with a total coating thickness of 25mm, is fully heated after approximately 60 minutes. In case of an interruption of heat supply the system holds surface temperature depending on the environment for about 60 minutes without any considerable drop of temperature. In case of an application of thermal pumps interruptible electrical heating rates (thermal pump rates) without buffer storage can be used trouble-free.

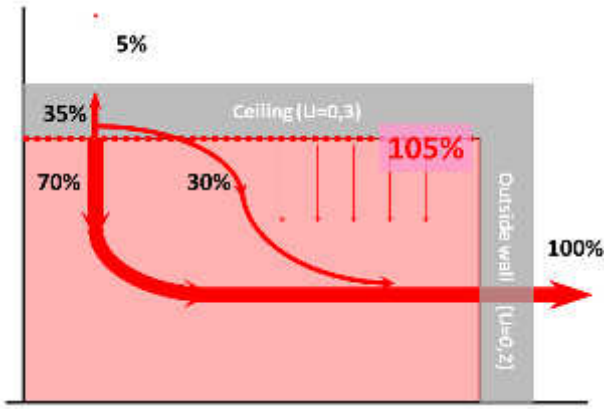
Vagrant heat / core activation

In a multi-storey apartment building the building envelope, an efficient heating technology and also the matter of vagrant heat are important. For intermediate ceilings EnEV does not specify any minimum insulation value so far., it only regulates the building containment (cellar, roof & external walls).So, loss in a ground apartment is balanced as heat credit for the apartment above and does not lead to an significantly increased total energy consumption. Although the reconstruction of external walls significantly reduces the outward thermal transferthe upward heat transfer remains the same. The consequence: The portion of vagrant heat increases. As a transparent assignment of heating cost is a good argument for the lettability of an apartment more and more estate agents and lessors pay attention to this subject.

Comparison; heating systems with high portion of convection / ceiling heatings bonded to masonry and ceiling heating by ArgillaTherm



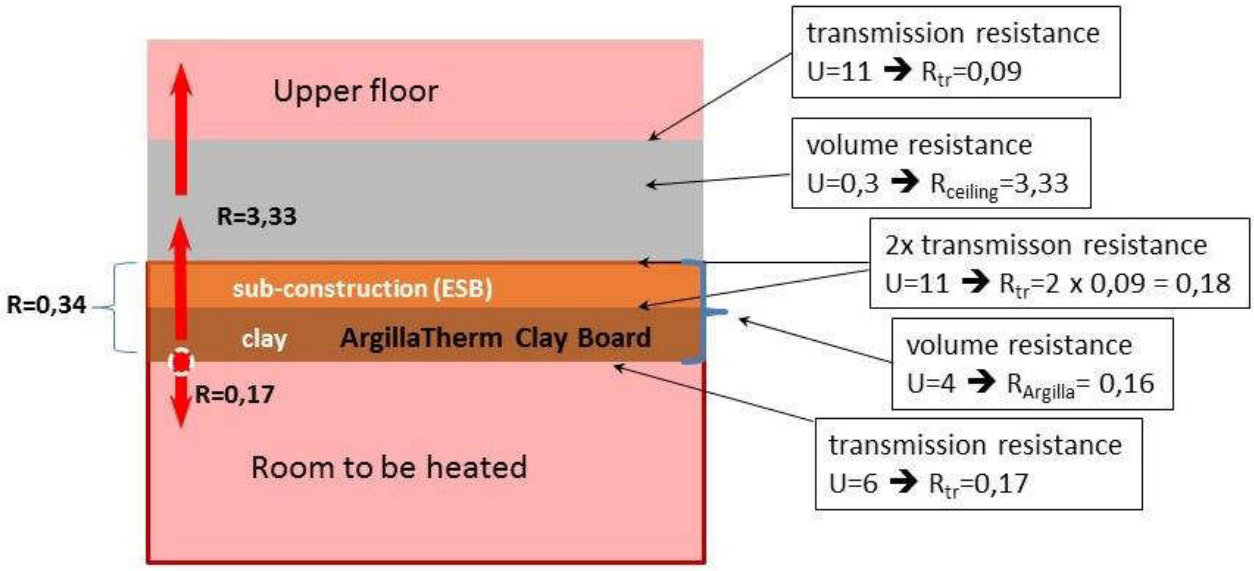
Heating systems with large proportions of convection and core activation



Ceiling heating by ArgillaTherm

The vagrant heat on a typical winter day can be described by 2 portions: firstly the portion stored in the intermediate ceiling and secondly the portion disappearing to the upper floor. Due to the sandwich construction both are clearly lower at the ceiling heating by ArgillaTherm in comparison to heatings with a high portion of convection/core activation.

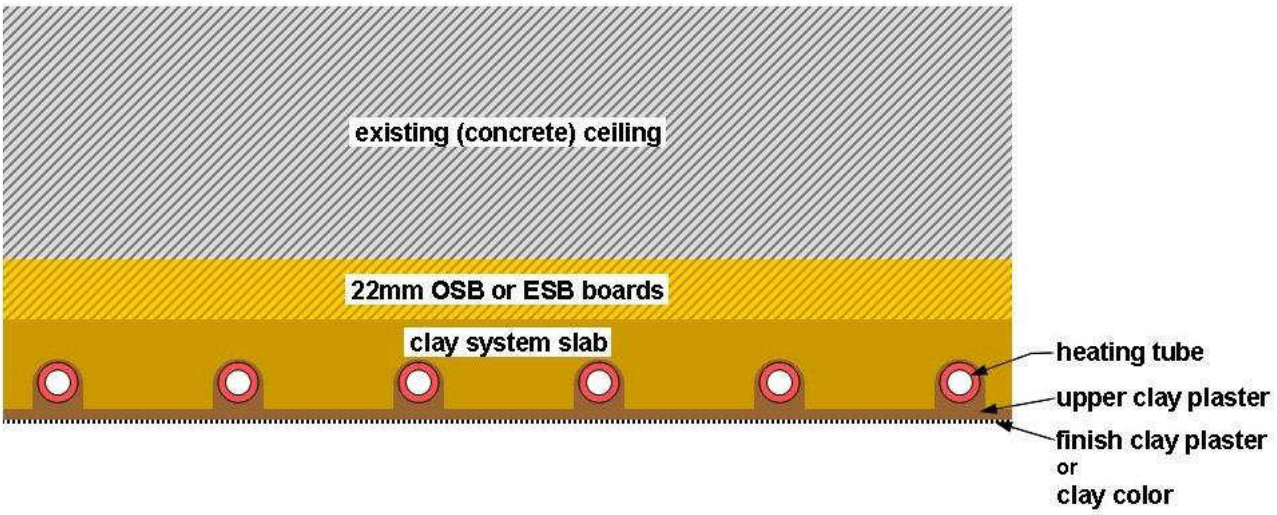
Thermal resistance of the ArgillaTherm ceiling heating in detail



The downward transfer resistance amounts to only about half of the total upward resistance (transfer and volume resistance). Therefore approximately 2/3 of the heat goes directly into the room and 1/3into the clay of the ArgillaTherm system construction panel. Therefrom amost of itcomes back straight away as the resistance to the floor above is clearly higher than the one back into the clay panel.

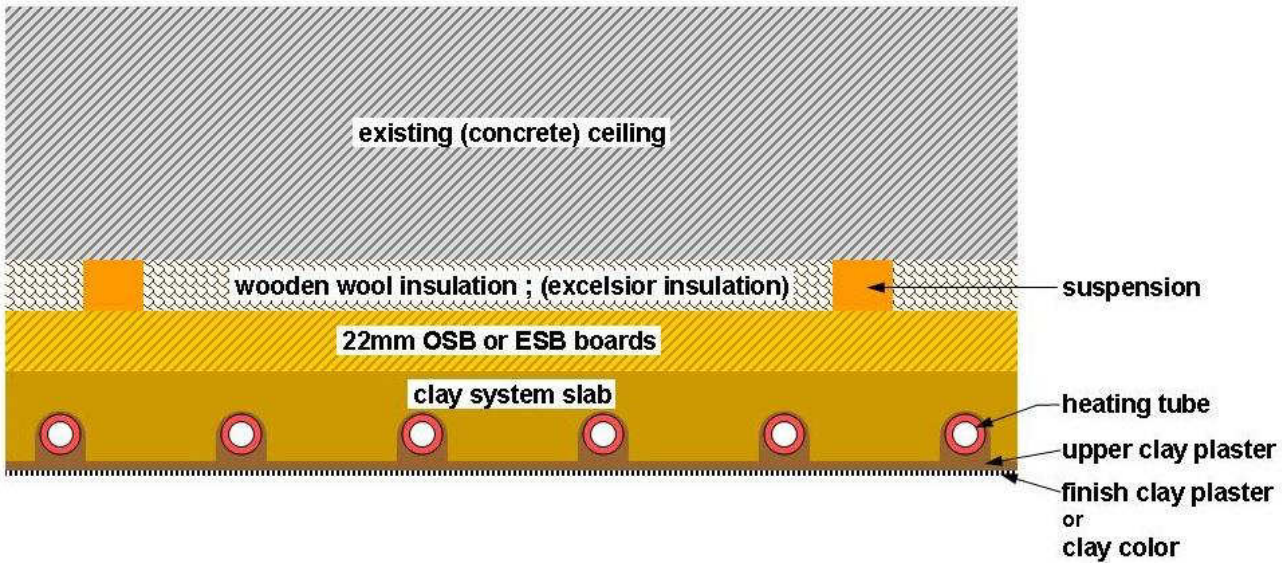
Fixing options / system setup

Option 1: direct fixing to ceiling / total thickness 52mm



option 2: fixing to suspension and wood-wool insulation (e.g. attic ceiling)

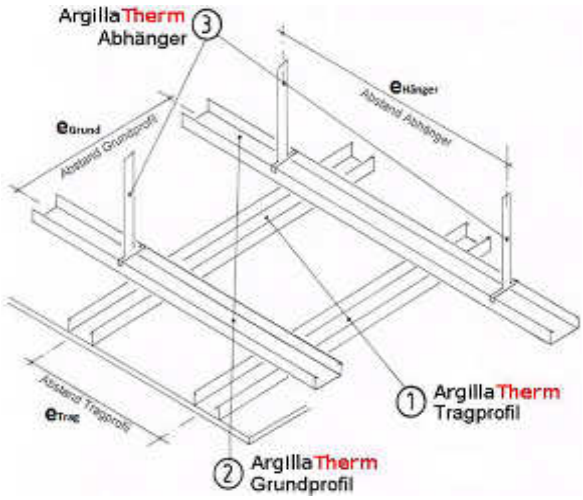
thickness: 52mm plus. suspension thickness

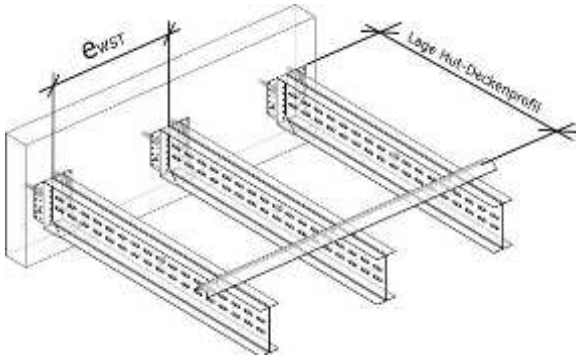


option 3: Approved metal suspension in light-weight construction mode

a) with Nonius-joint for fixing to ceiling
b) self-supporting for fixing to wall for clear reduction of foot fall sound

Ask for our free design tool.

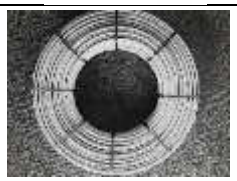




System products

System product	Article number	image
ArgillaTherm® clay system construction panel RIVIERA W11.8 with pressed-in glass fibre scrim, dimensions: 375 x 375 x 25mm	WSBP000001	
ArgillaTherm® clay compensation plate Bulk density approx. 620Kg/m³, 750 x 750 x 25mm	ZLBP757525	
ArgillaTherm® clay upper plaster no1-2 acc. DIN 18947, 25Kg bag as dryware for 1,2m² ceiling area	ZLOP120025	
ArgillaTherm® clay paint no. 3-1 sprayable and brushable ready-mix, 10l for 35m² ceiling area, pure white	ZLFA310010	
Wood-wool edge insulation strip size 50 x 10mm, 10m per roll	ZRDS501000	
Glass fibre scrim, MW 7 x 7mm, 105g/m², 100cm wide, 100m per roll	ZGSGG77000	
Stainless-steel load distributor for fixing of clay system construction panels, 5 x 50mm, 100 off per box	ZLTE055100	
Stainless-steel – collated flat countersunk head screw T-Star Plus T20 with partial thread 5 x 45mm, 200 off per box	ZETS054500	

Heating technology

Heating technology	Art.-no.	image
ArgillaTherm® electronic ceiling temperature regulator AT-3R, 5 to 40°C, heating/cooling including 4m remote sensor	ZAT3RR000	
ArgillaTherm® ceiling temperature regulator AT-R1W, 5 to .40°C, heating/cooling including 4m remote sensor	ZATR1W000	
ArgillaTherm® three-layer polybutene pipe acc. DIN 16968, PB 12 x 1,3 mm, oxygene impervious acc. DIN 4726	WHR1213250	
Clamp ring for heating circuit distributor ¾“ Eurokonus to PB-pipe 12x1,3mm	WKRV341200	
Pipe hook 90° with 2 fixing lugs for pipes with outer diameter of 10-16mm	ZRSB901017	
ArgillaTherm® electrothermal drive for heating cicuit distributor 230V, 2,5 Watt power input, 4,5mm swing, power-off closed	ZSATS51001	
ArgillaTherm® terminal block 230V for 6 thermostates with a total of 14 power drives for heating and cooling	ZKL6K0000	

Technical planning and basics

For planning and design of ArgillaTherm ceiling heating the relevant rules and standards are to be considered.

DIN EN 12831	Method for calculation of normative heating load
DIN EN 1264	Water based surface embedded heating and cooling systems
DIN EN ISO 11855	Building environment design – Design, dimensioning, installation and control of embedded radiant heating and cooling systems
DIN 16968	Pipes of polybutene (PB), general quality requirements
DIN 4726	Plastic pipelines, maximum permissible value for diffusion resistancy
VDI 2035	Prevention of damages in boiler heating systems
DIN EN 60730	Automatic electrical controls
DIN 18947	requirements for clay mortar for plastering of walls and ceilings
DVL TM 06	sdata sheet for clay -thin-layer coating of walls and ceilings
DVL TM 07	Technical data sheet for rquirements, fields of application, performance characteristics and test methods für indoors- fabricated clay construction plates

The works of all lcrafts contributing to the construction process are to be coordinated.

scheduling: energy consultant/architect/planner

Executing crafts: heating installer/dry wall builder/construction company

Design of ceiling heating

For reasons of comfort and according to the standard the ceiling temperature should be limited to 29°C at normal room height. This correlates with a target room temperature of 19°C for a heating load of about 60W/m2.

A ceiling heating of system RIVIERA is always designed in such a way that this figure is achieved at a flow temperature of 35°C. Lower heating loads are shown either by reduction of the system temperature or by reduction of the area of clay system construction panels at constant system temperatures (areas are layed with clay compensation plates). In case higher heating loads are required at reconstructions of old buildings this can be achieved by increased flow temperatures, too. The temperature assymetry to be expected might reduce the feeling of comfort and should be checked for each individual case, but usually is no problem at high ceilings in old buildings.

The system RIVIERA ist o be installed using a special PB 12x1,3mm water pipe by ArgillaTherm.

property	design option I	design option II
Pipe dimension	12 x 1,3 mm	12 x 1,3 mm
max. length per heating circuit	80 m	100 m
max. flow rate per heating circuit	70 l/h	90 l/h
Pressure difference	150 mbar	250 mbar

Standard design ceiling heating at 60 W/m², target room temperature 20°C

The difference between flow and return should amount to 5K. Shorter pipes and higher heating loads rereduce it accordingly.

example: design option I with 60W/m²:
The heating circuit has a pipe length of 48m.
==> required flow rate equals: 70 l/h* 48/80 = 42 l

At a flow temperature of 35°C the average ceiling temperature amounts to 2,5 K below the mean value of the heating water. At increase of the flow temperature this value increases proportionally the figures important for heating capacity release are shown in the following table.

flow temperature in°C	return temperature in °C	ceiling temperature in °C	room temperature in °C	Heating capacity In W/m²
45,0	36,7	36,7	20	100
42,5	35,0	35,0	20	90
40,0	33,3	33,3	20	80
37,5	31,7	31,7	20	70
35,0	30,0	30,0	20	60
32,5	28,3	28,3	20	50
30,0	26,7	26,7	20	40
27,5	25,0	25,0	20	30

Flow temperatures and heating load for ceiling montage

example: room size 20 m²
heat requirement 1000 W
==> heating capacity = 50W/m² ==> flow = approx. 33°C

Design of ceiling cooling

The ceiling heating system RIVIERA is sperfectly suited for room cooling by feeding cold water in summer. Cold can be generated by for instance by. reversible heat pumps or a groundwater cooling in combination with a heat exchanger. An effective low-price and comfortable cooling without noise and strong dust-air-movement is possible by a ceiling cooling surface, only!

The essential advantages of system RIVIERA are:

- The water pipe is in direct contact with the clay, potentially occuring condensation water is capillary drained off by the clay immediately.
- Potential condensation water at the ceiling surface is absorbed and recycled into the room at decreasing room humidity. The system is saturated after only 48-72 hours.
- The occupation rate iis clearly higher in comparison to prefabricated ceiling cooling systems.

The cooling capacity depends on the temperature difference (room minus flow). At a target room temperature of 24°C and a floow temperature of 16°C the coolingg capacity is 48 W/m^2.for example. For further pairs of values see table below.

Please note: The temperature difference should not exceed 8 K, as here is the risk of condensation water being generated normally at the heating circuit distributor.

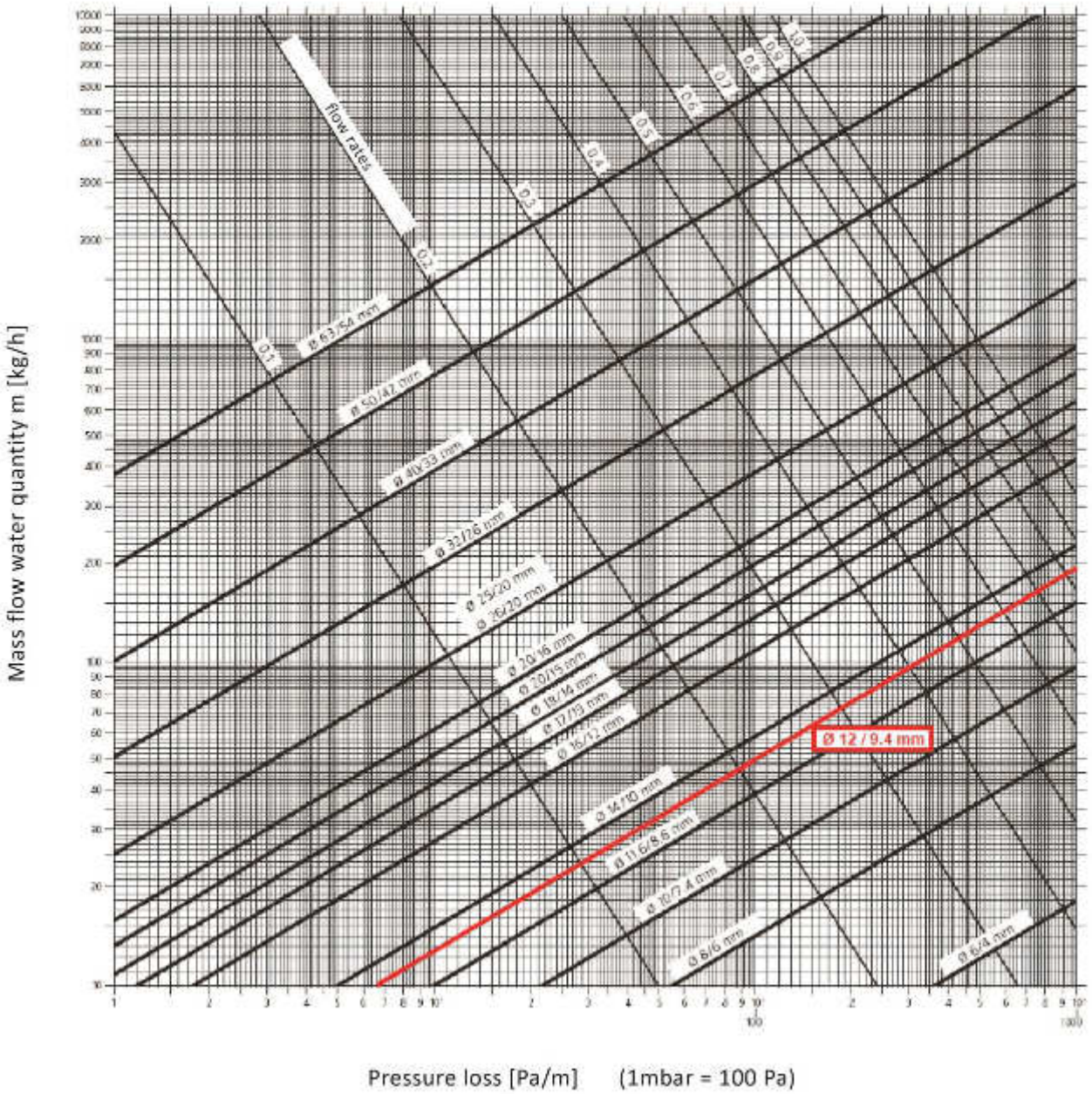
flow temperature	Room temperature 18 °C	Room temperature 20 °C	Room temperature 22 °C	Room temperature 24 °C
8°C	60 Watt	72 Watt	84 Watt	96 Watt
10°C	48 Watt	60 Watt	72 Watt	84 Watt
12°C	36 Watt	48 Watt	60 Watt	72 Watt
14°C	24 Watt	36 Watt	48 Watt	60 Watt
16°C	12 Watt	24 Watt	36 Watt	48 Watt
18°C		12 Watt	24 Watt	36 Watt
20°C			12 Watt	24 Watt
22°C				12 Watt

Ceiling cooling capacities at various flow and room temperatures with a water flow volume of 90l/h, pressure difference 250mbar von 90 l/h, pressure difference 250 mbar

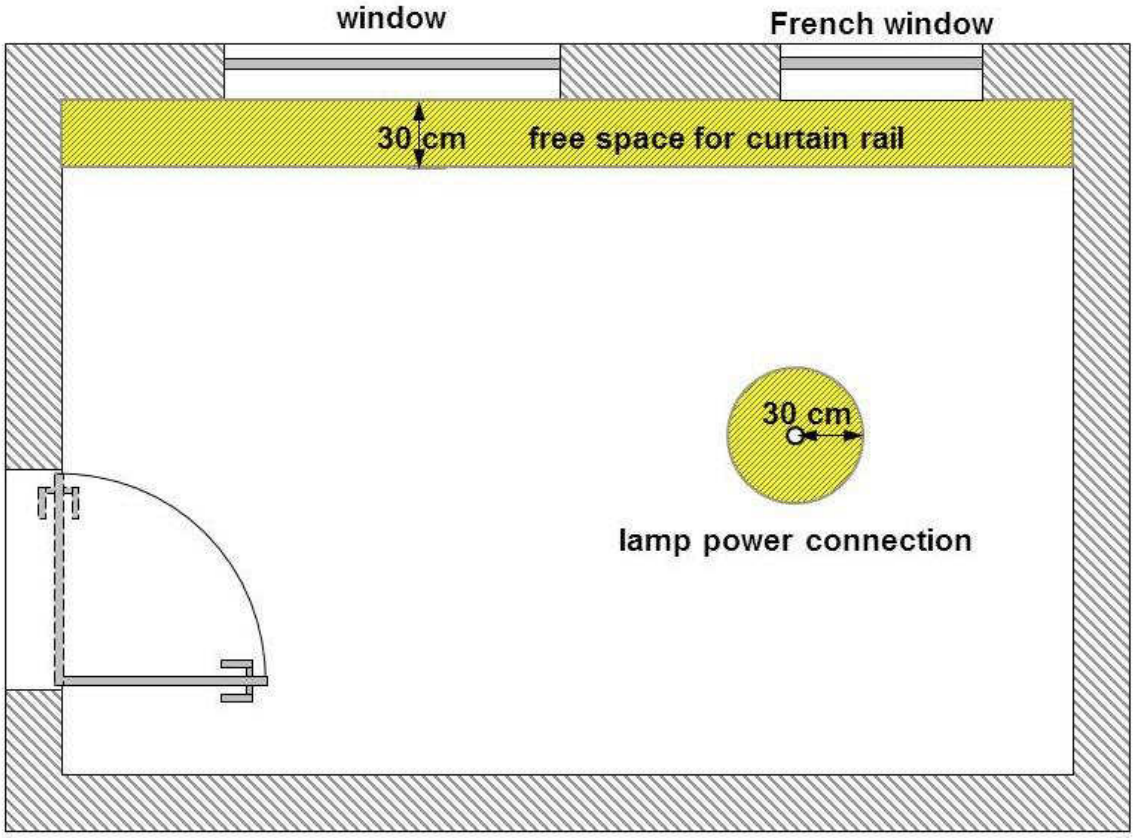
Self-cooling effect of clay

Clay has an enormous sorption capacity, meaning the absorption of water from air inside the room or masonry, transporting it and emitting it back into the room with drying out air. The clay system construction panels by ArgillaTherm and clay plaster located above them can absorb up to 70g/m² of water (e.g. on a sultry summer day) in just 12 hours. For instance, in a 25m² office, should these be emitted again during the day, a cooling capacity of 1kWh is achieved by natural evaporation. This value corresponds to a cooling capacity of 3-4 W/m².

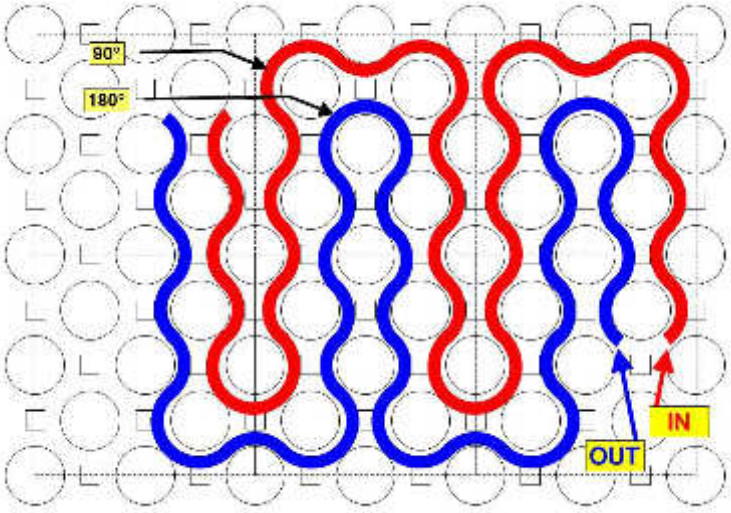
Pressure loss diagram (T = 40 °C, surface roughness ε = 0.007 mm)



Example for laying of water pipe

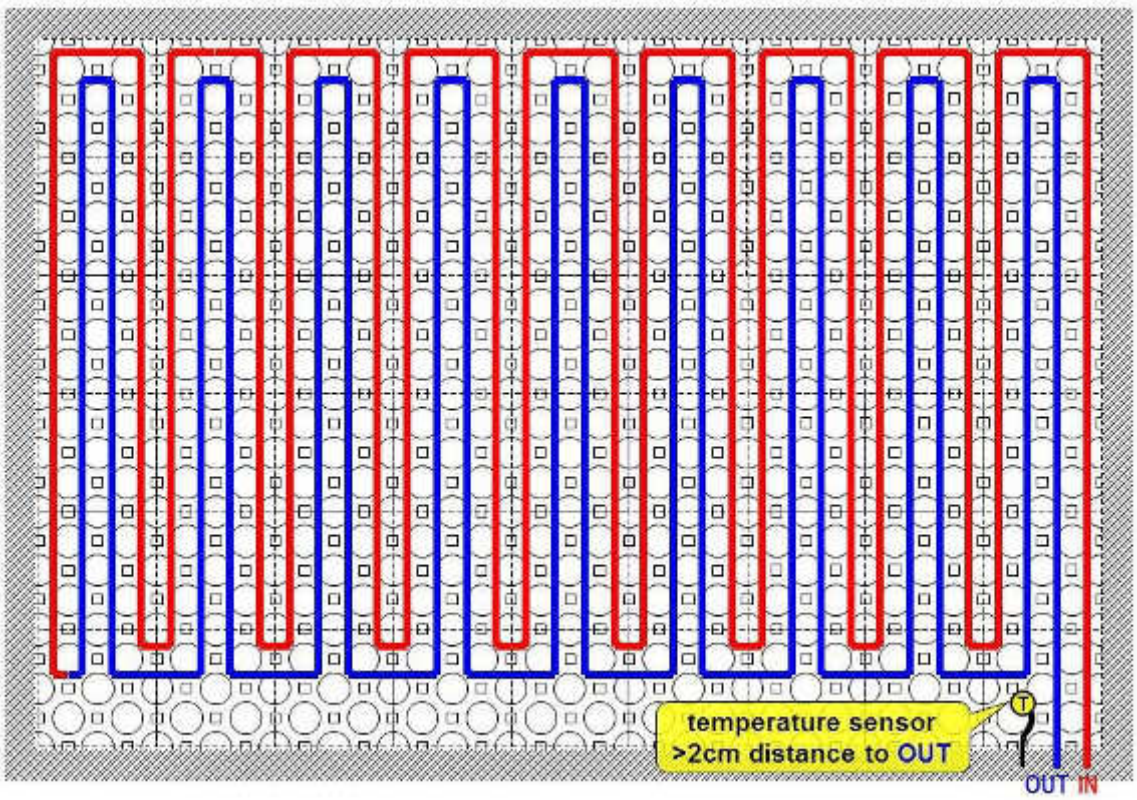


Plan for sufficient clearing for curtain rails or lamp cut-outs prior to laying of water pipe!

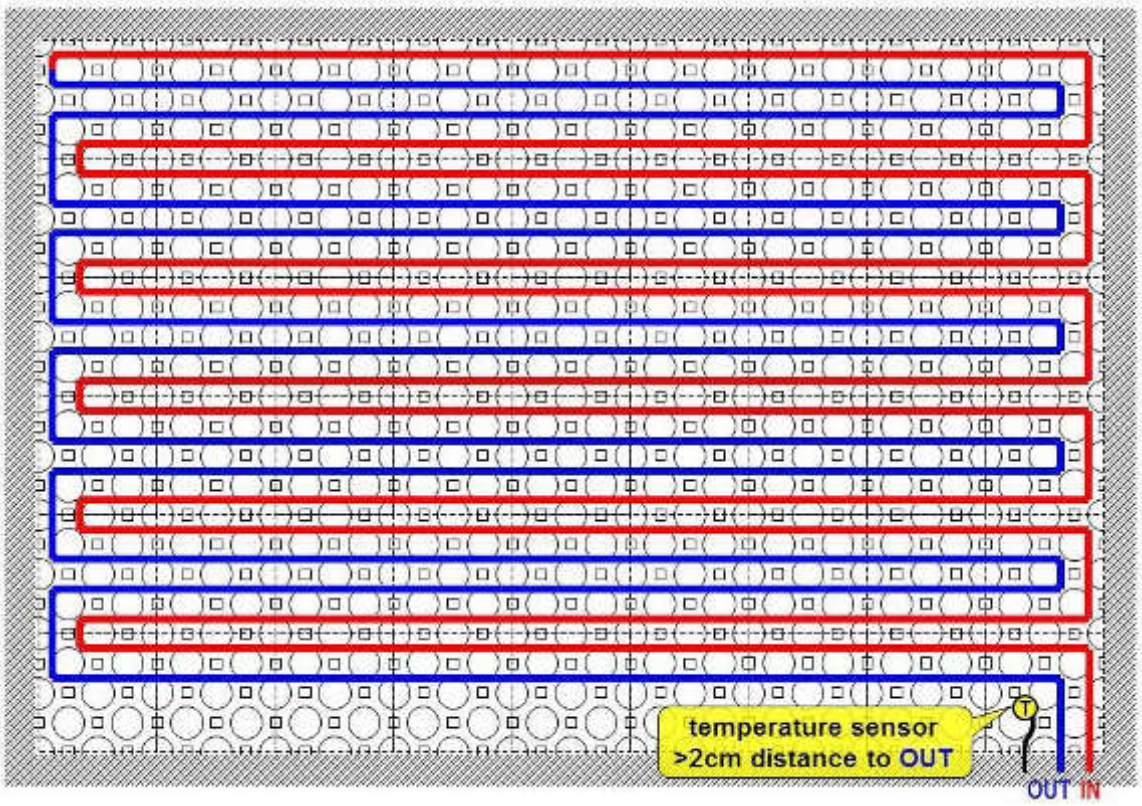


1m clay system construction panel length corresponds to 1,10m water pipe

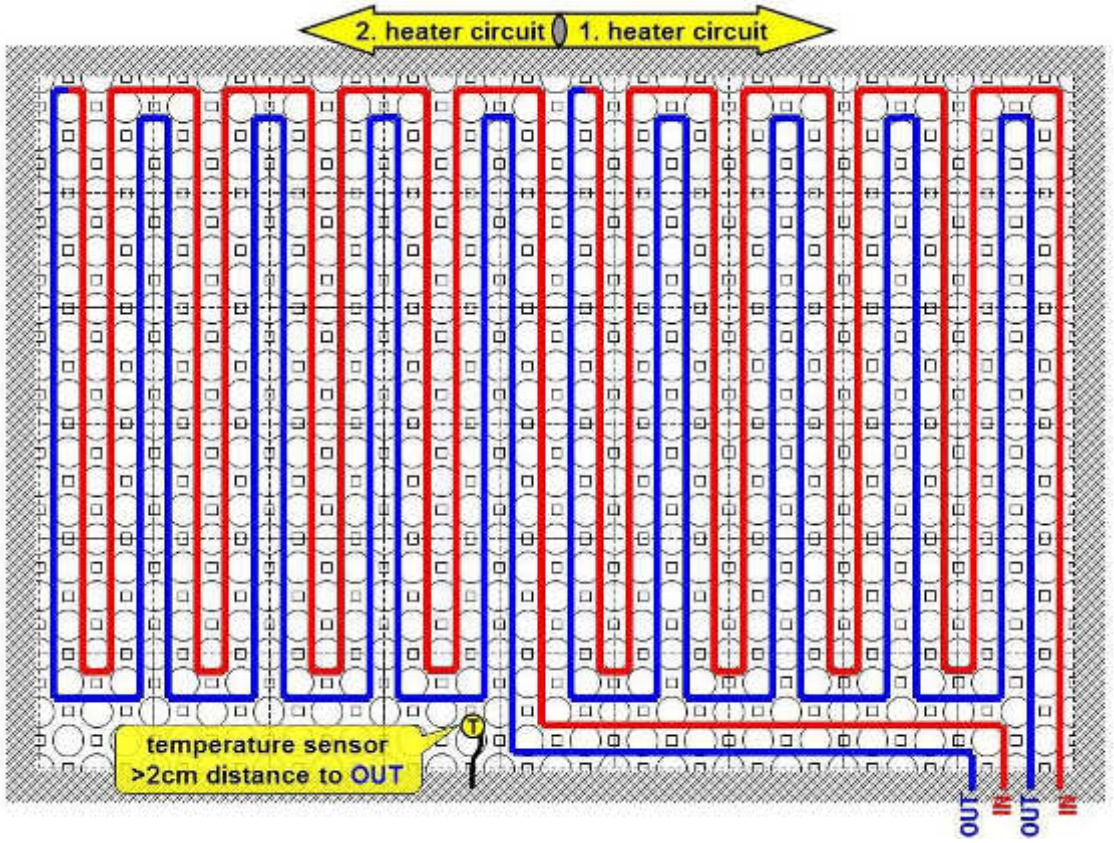
Complete laying - vertical laying of pipe with one heating circuit in a room

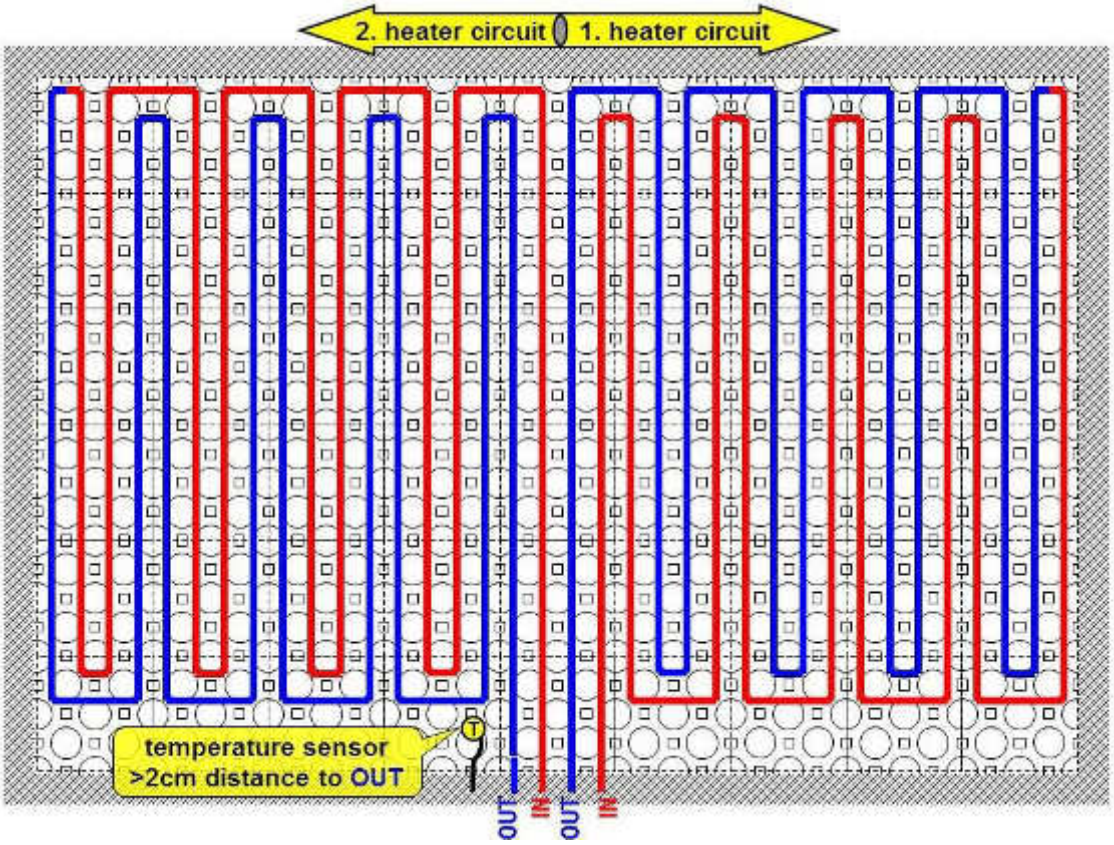


Complete laying – horizontal laying of pipe with one heating circuit in a room



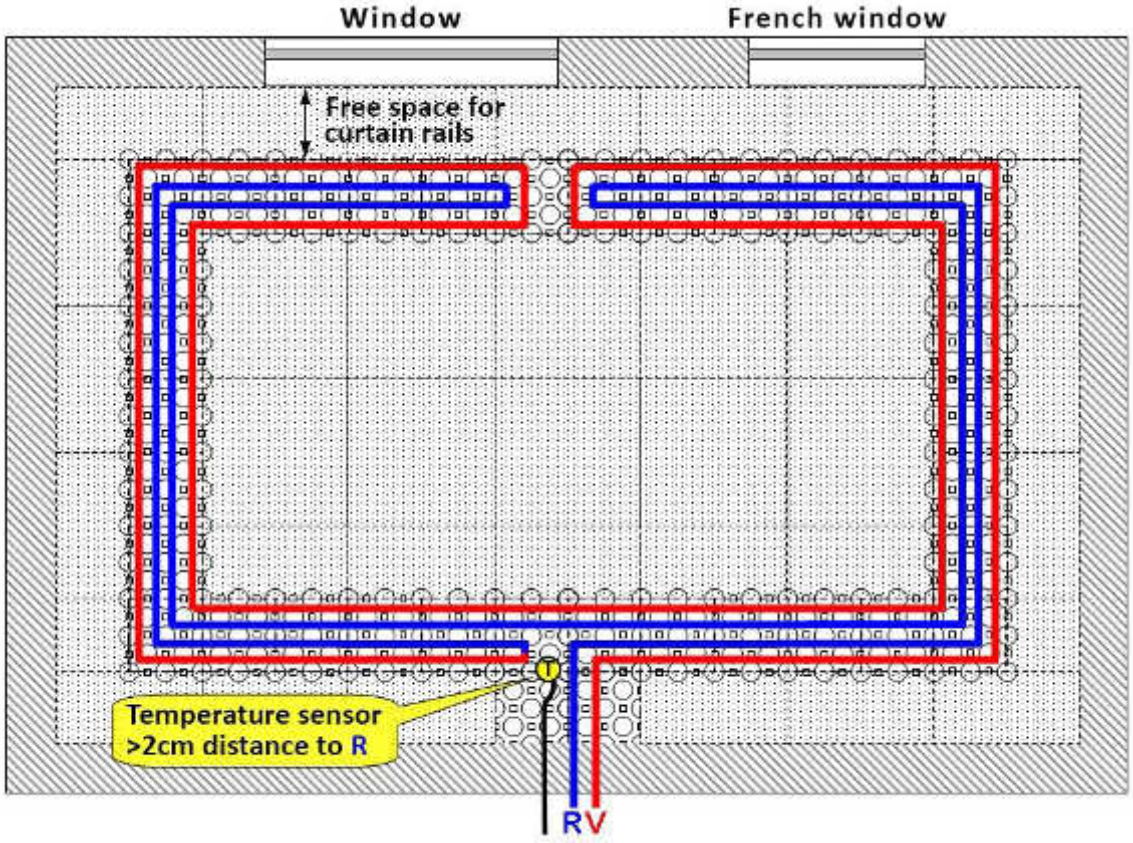
Complete laying – vertical laying of pipe with two heating circuits in a room

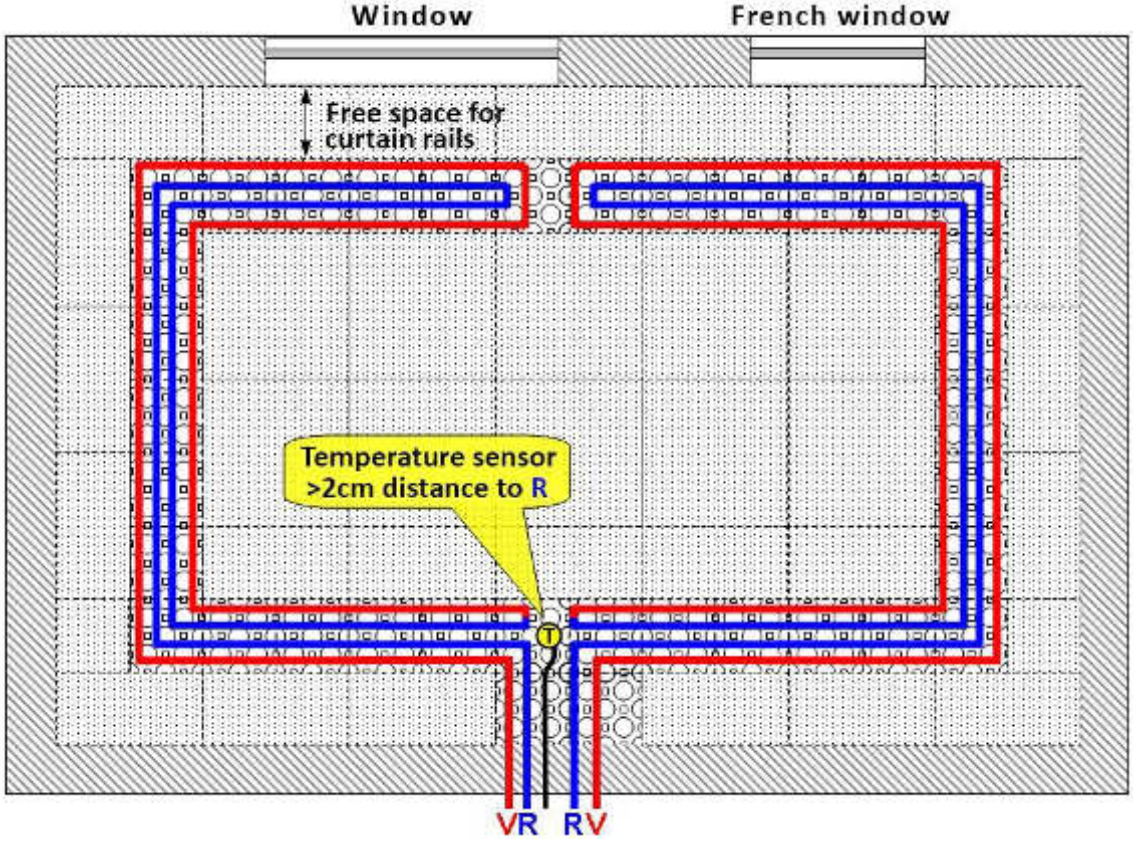




Partial laying – combination with mit ArgillaTherm® clay-lightweight board at well-insulated gut isolierten objects

Example: laying for a KfW55-standard, with one or two heating circuits

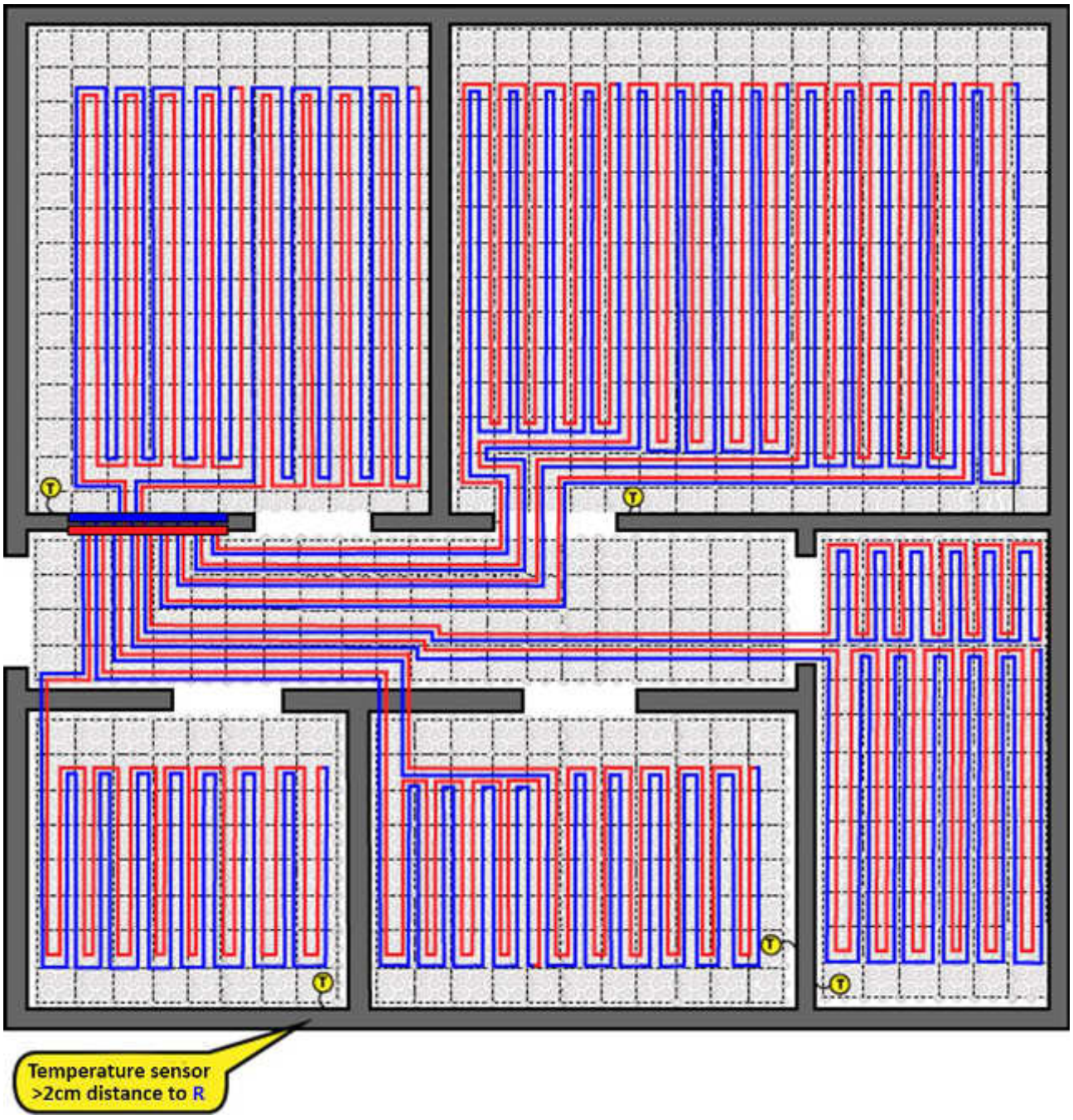




Example of heating circuit layingng (complete laying with clay system construction panels)
95m² apartment with a total of 11 heating circuits
Heating load distributor in corridorr (above) with connection via corridor ceiling

Room temperature regulation

Ceiling temperature remote sensor AT-F100-1 → thermostat AT-3R → distributor block → drive



Connection to existing heating facilities

For connection to existing heating facilities the following options are recommended:

1. **Control unit with 3 or 4-port-mixer and pump.**
   The flow temperature of the existing heating is reduced to the required flow temperature of the Argillatherm ceiling heating by means of a control station. The pump provides the required pressure and volume stream controled via remote sensor of the room thermostat. The heating circuit length and volume streams are similar to those at connections by to heating circuit distributors.
2. **RTL-control box with flow control in conjunction with ArgillaTherm room thermostat**
   The remote sensor measures the ceiling temperature sending it to the room thermostat. The room thermostat controls the drive in the RTL-Box (recommended brand is Kombibox RTL-TH Basic by Simplex, Art.-no. F11836), which ist o be installed in the returnrun. As here no additional pump for the heating water is used a hydraulic bancing with the existing heating system by adjusting the pressure differences is necessary. Heating systems usually are set-up with a pressure difference of less than 100mbar. Therefore the following parameters are to be applied:
   Maximum length of heating circuit = 60m
   volume per hour = 60l
   Pressure difference in heating circuit = 80mbar
   The capacities are as hspecified on page 12.

Structural analysis

Ceiling loads are calculated and designed according to DIN 1055t. This standard specifies acapacity of eine Tragfähigkeit von 1,5 or. 2,0kN/m² respectively for residentual buildings. For older buildings with beam ceilingt he load dimensioning is similar and normally amounts to 1,5kN/m². 1kN corresponds to about100kg.

Weight of clay system construction panel	36,50 KG/m²
Weight of clay compensation plate	17,00 KG/m²
Weight of fixings, water pipe and clay plaster	20,00 KG/m²
weight fixings, pipe, clay plaster and22mm OSB/ESB-plate	33,20 KG/m²

example: ceiling 20m² layed with 50% clay system construction panels und 50% compensation plates

==> 10m² x 69,70KG (36,5KG + 33,20KG) und 10 x 50,20KG (17KG + 33,20KG) = 1.199 KG

==> 59,95KG/m² average weight

Das maximum weight amounts to 69,7 KG/m² (at complete laying with clay system construction panels).

Room acoustics

In nuseries,, schools, administrative objects, etc. the requirements as specified in standard DIN 18041 (acoustic quality and reverberation time, irespectively in rooms) must be met.. For this reason a clay paint with a high portion of marble powder (grain size<1mm) is applied. Hereby an average sound absorption coefficient of 0,2 is achieved, meaning a significant reduction of room acoustics. In case of higher requirements sound absorber plstes instead of the clay compensation plates are used. The demarcation is carried out by aluminium angle profiles.

Material calculation

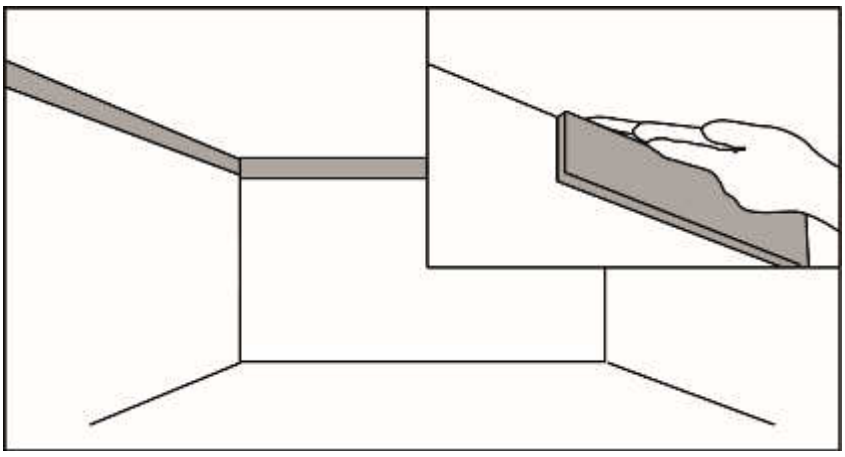
example: ceiling heating RIVIERA directly fixed, finishing by clay paint
requirements: room size: 20m²
Heating capacity: 400 Watt ≙ 20 Watt/m² (KfW55-Standard)

Wood-wool edge insulation strip (50x10mm)	18-20m
22mm ESB-Plus P5 or OSB boards with tongue and groove as substructure	20 m²
Lclay system construction panel for laying of water pipes	7 m²
Clay system compensation plates for filling of pipe-free areas	13 m²
Stainless-steel – load distributors 5 x 50 mm and stainless-steel clamping screw 5 x 45mm	300 off
ArgillaTherm® three-layer polybutene-pipe acc. DIN 16968, PB 12x1,3mm,	70 m
ArgillaTherm clay plaster no.1-2 acc. DIN 18947, 25kg dry bagware	16 bags
Glass fibre scrim, MW 7 x 7mm, 105g/m², 100cm wide	22 m²
Electronic ceiling temperature regulator AT-3R or analogue regulator AT-R1W for heating and cooling incl. 4m remote sensor AT F100-1	1 off
ArgillaTherm clay paint no. 3-1 sprayable and brushablee ready-mix	1 bucket

Assembly instructions ceiling heating system RIVIERA

Water-based low-temperature wall/ceiling heating system on a clay basis

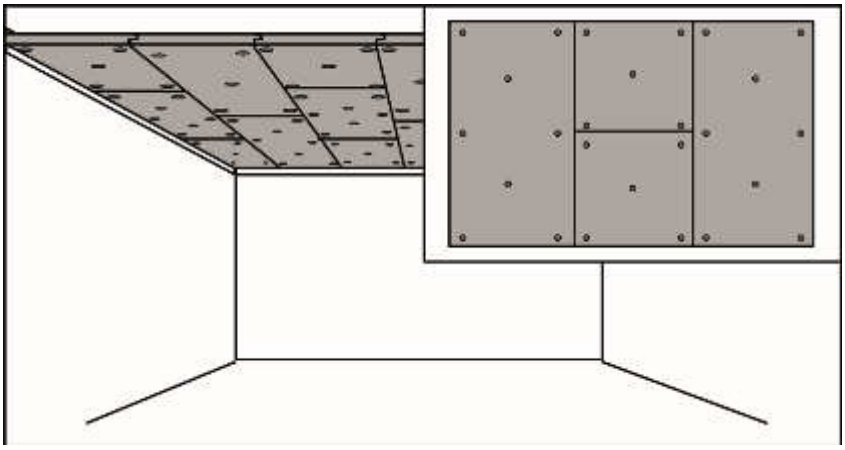
For montage to ceilings, walls or inclinations



Install insulation strips for outer edges 50x10mm, circumferentially around the room.

The use of wood-fiber material is recommended.

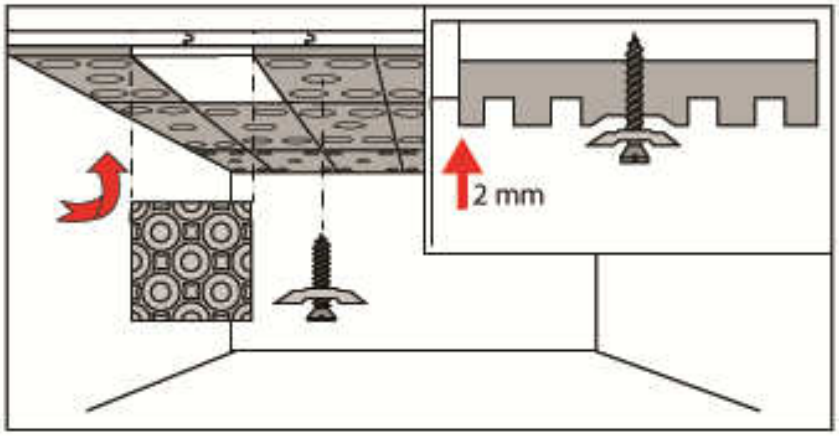
Execution: construction company/ drywall constructors



Mount ESB-Plus P5 or OSB 22mm chipboards directly to ceiling using Fischer frame plugs (SXR 8x80T or SXR 8x100T) or nail anchors (6x30/50), (ceiling admission by multiple mounting) or mount to a suspension.

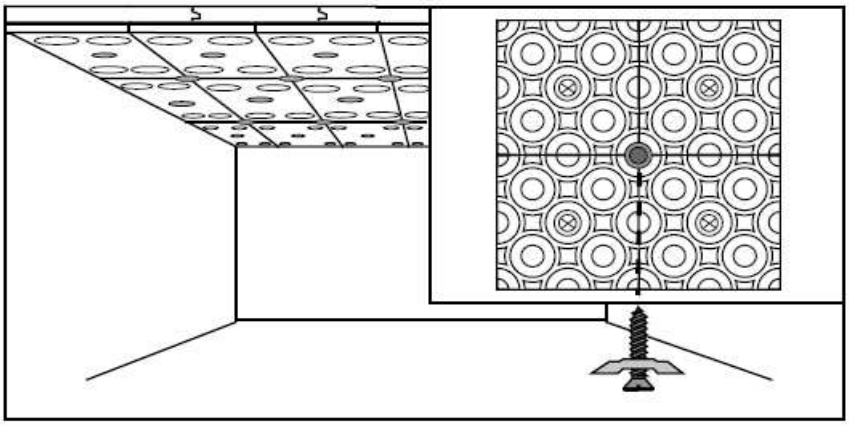
Always handle chipboards with a **tongue and groove** connection.
Leave out any areas for lamps, cable bushings etc., prior to installation
SD-value(ESB-Plus):0,88m

Execution: construction company/ drywall constructors



Lay panels (amount according to design) onto cross joints and fasten only centrally with a screw. Cover remaining surfaces with the ArgillaTherm compensation plates and also install onto cross joints. Imperatively use the ArgillaTherm stainless-steel load-distributors 5/50 and stainless-steel construction screws 5/45. Set slip clutch to 4-5 Nm. The over torque comes to 8,50 Nm.

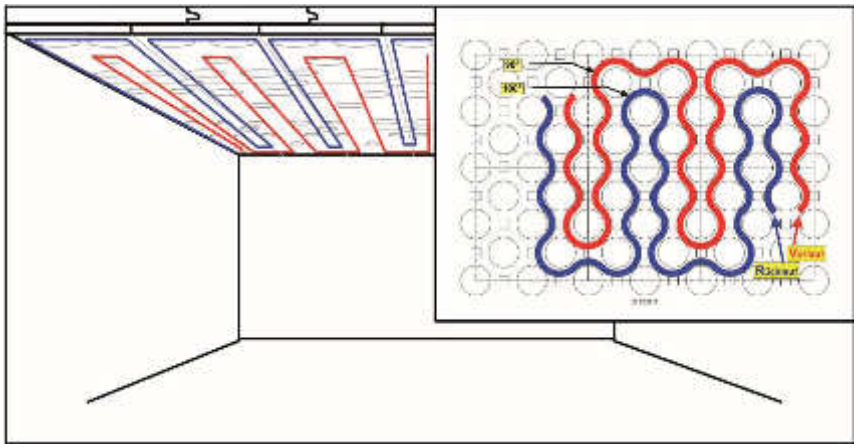
Execution: construction company/ drywall constructors



After full a coverage of the ceiling, bolt all crossing- and connection points of the clay system panels to the clay compensation plates.

Urgently note: Edges of clay system and compensation panels should not be placed directly over the edges of the chipboards.

Execution: construction company/ drywall constructors

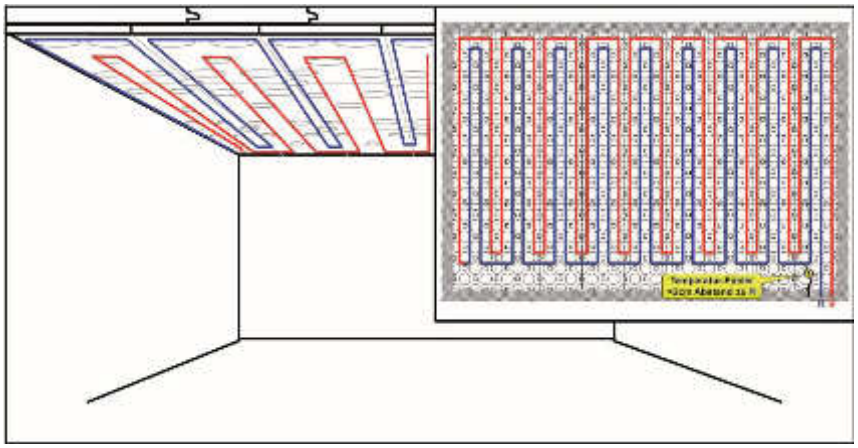


Conduct a meandering shaped installation of the ArgillaTherm® PB-synthetic pipes into grooves of clay panels; starting at the heating circuit manifold or the return temperature limiter. For installation pull pipe outwards at every inversion.

Lable heating circuits (VL1, RL1,etc.)
Perform a leak test with compressed air.

Imperativley use a pipe reel !

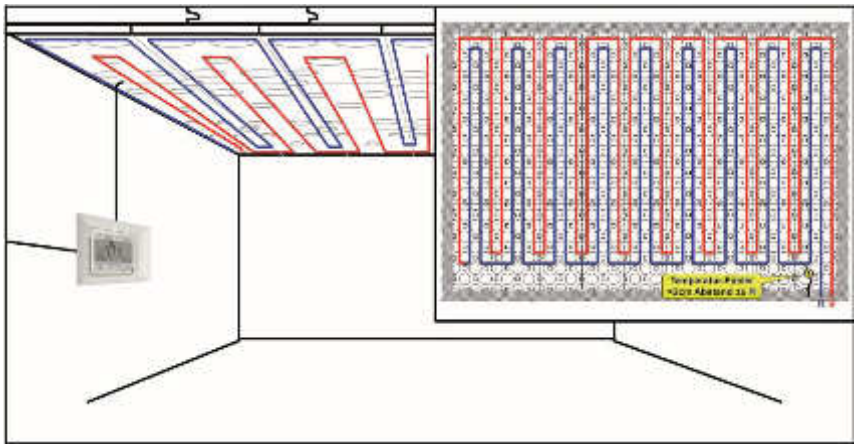
Execution: Heating engineer



Installation of the ceiling sensor without a protective tube into the groove.

Place white sensor head at least **2cm away** from closest return pipe and at least **10cm away** from closest flow pipe! Leave a distance of at least 10cm to the wall.

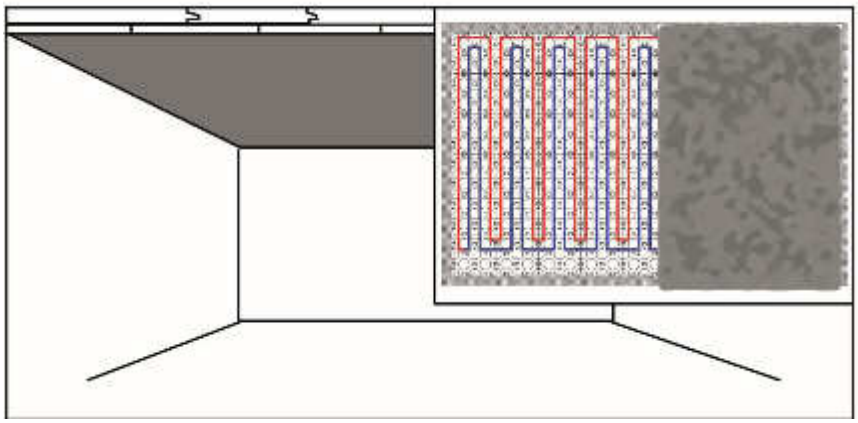
Execution: Heating engineer



Installation of the ArgillaTherm® room thermostat (free choice of location). Using a cable (we recommend 5x 1,5mm²), connect the ceiling sensor and thermostat to the control valves of the heating circuit manifold.

For the use of a return temperature limiter (recommendation: Simplex F11836) the thermostat is to be connected to the temperature limiter.

Execution: Heating engineer/ electrician

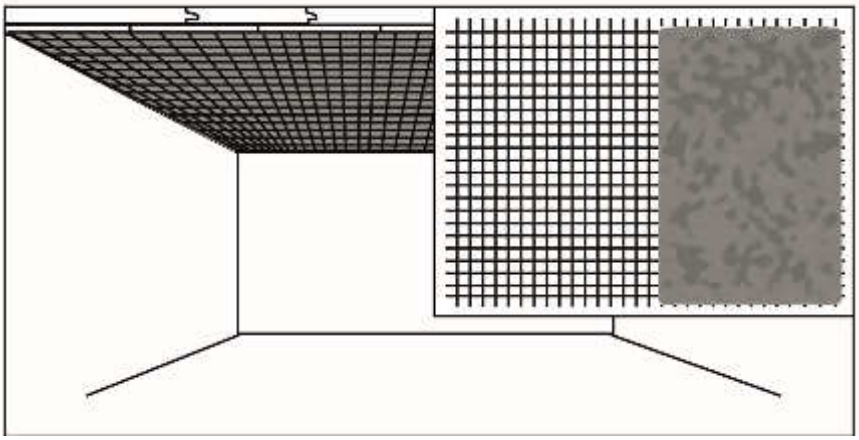


Sufficiently wet clay panels!

Forcefully fill up grooves of the clay construction panels with the ArgillaTherm® finish plaster Nr.1-2 and allow to dry.

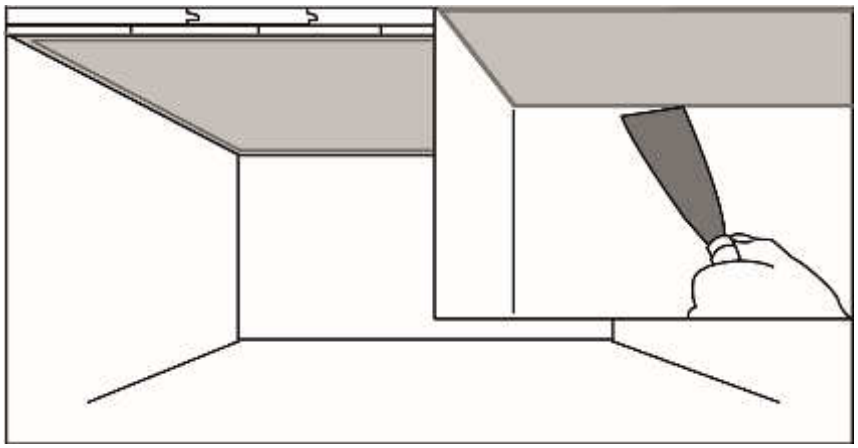
Caution: The filling up of the grooves should take place immediately or shortly after the installation of heating tubes. Damp work such as screeds or plasters should be completed **prior** to the installation of the clay panels.

Execution: construction company/ drywall constructors



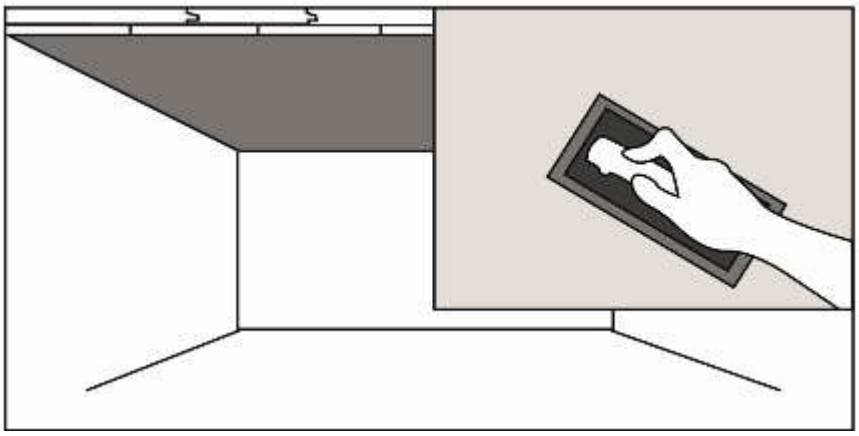
Apply a 3-5mm compensation layer of clay finish plaster Nr. 1-2 using a suitable toothed trowel and incorporate the reinforcement mesh sufficiently overlapping. Apply a following 2mm final layer of plaster and let it absorb. The surface should be evened out as best as possible!

Execution: construction company/ drywall constructors



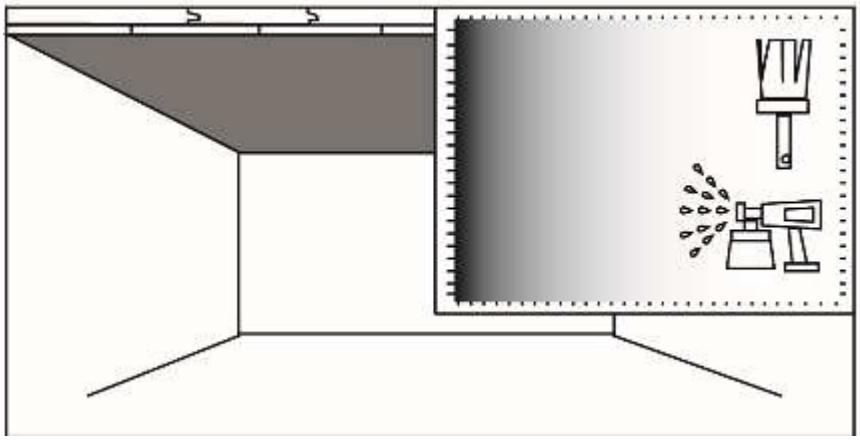
Create a circumferential connection joint to the wall all around the edges of the room by making cuts with a trowel immediately after.

Execution: construction company/ drywall constructors



After sufficient drying off, even out the surface using a sponge board or a special felting machine (surface quality Q2).

Execution: construction company/ drywall constructors



Application of the clay color by two-layered painting or spraying.

For a uniform appearance, the application of the clay color, should be completed on the entire surface using a single mixture, on a single working day.

Execution: construction company/ drywall constructors

System requirements

- ✓ Constructional prerequisites and general trades must be regarded and considered accordingly.
- ✓ For direct attachment to the ceiling or a ceiling suspension: It is necessary to ensure a sufficient static or load capacity.
- ✓ For direct attachment to ceiling: masonry requirements according to DIN 18560 (DE) are to be complied by. Surfaces are not allowed to have any considerable unevenness. Basis of this, are values according to DIN 18202 (DE).
- ✓ For installation of a substructure to ceiling, suitable Fischer long-shaft dowels SXR 8×80 T or SXR 8×100 with a safety screw (Fischer company, ETA-admission for concrete and masonry) or nail anchors 6x30/50 are to be used.
- ✓ For mounting and securing of clay system panels, depending on the ceilings substructure construction, sufficient fastening products with load capacity distributors by ArgillaTherm® are to be used. Designated depressions in the clay panels are to be utilized for this (do not drill outside of them).
- ✓ Objects that need to be fastened to the ArgillaTherm clay surface heating-system, such as lights or smoke detectors should be screwed on only and are not allowed to be nailed on. The precise location of heating elements and electrical cables must be determined previously using a thermofoil.
- ✓ Drillings on the ArgillaTherm clay ceiling heating system are only to be performed without percussion. Hammer blows, percussion drills, hammer drills and impact wrenches must not be used here as well as for wood panel ceilings to prevent potential development of cracks caused by this.

System warranty

In case of a professional montage by ArgillaTherm® certified specialized trades, consideration and compliance of system requirements and exclusive use of listed products according to assembly instructions, the company ArgillaTherm GmbH provides a

20 year warranty for the clay surface-heating system RIVIERA .

Exclusions

The warranty by ArgillaTherm generally excludes all deficiencies of the clay surface heating system that

- are based on building movements, due to building settlements or forces of nature
- are caused by damaged heating materials or sensors required for control and their electrical cables.
- were caused by vibrations of tools such as hammer blows, percussion drills, hammer drills and impact wrenches of which the use is explicitly prohibited.

Clay dry construction system RIVIERA

The patented water-based low temperature wall heating- and cooling system, manufactured in a unique dry surface-pressing process.
Easy assembly according to standards and rules, energy-saving, natural heating and cooling. Healthy & comforting room climate.

1) 22mm ESB-Plus P5 board with tongue and groove as a substructure

2) Clay system construction panels, size: 375x375x25mm, according to DVL TM 07 (type A) for laying of water pipes

3) Three-layered polybutene pipe according to DIN 16968 and DIN 4726, PB 12x1,3mm

4) Clay-upper plaster according to DIN 18947, 3-5mm application thickness with incorporated scrim

5) Clay paint according to DVL TM 06 as spray- and brushable ready-mix

Wall heating

Ceiling and underfloor heating are dominant low temperature surface heating systems in Germany. underfloor heating is primarily installed in private new buildings. Ceiling heating however, is primarily installed in private reconstructional and new industrial buildings. Nowadays approximately 80% of all new office and administrative buildings are equipped with ceiling heating systems in cities like Frankfurt/ Main or Munich. Why so? Both, industrial and private new buildings have a well-insulated envelopes nowadays and consequently only have little outward energy losses (transmission losses). An equally important energy saving factor is the reduction of venting loss, e.g. heat loss due to air exchange during venting. This loss is higher in the industrial sector as the required air exchange rate is higher as well. Also, in reality, the office temperature is usually controlled by window tilting.
Ceiling heating reduces this problem as heat is transferred almost completely by radiation. Air is not primarily used as a transmitter of thermal energy and even though the temperature is perceived as even, it is infact 2-3K lower. Consequently, less energy is lost due to heating air during venting. For reasons of comfort (to avoid hot feet or heads) a surface- or rather radiative temperature of 29°C is no to be exceeded. This is clearly specified by DIN EN 1264. In good floor or ceiling heating systems it is difficult to figure out where the heat is coming from. Reason being the surface temperature of the human body of about 32°C.
In this point wall heating is clearly distinguished from underfloor or ceiling heating. The surface- and radiant temperatures are respectively arbitrary and not limited by any standards to achieve the tile stove-like cozy warmth feeling. In practice the temperatures are about 35°C to 45°C, thus targeted higher than the surface temperature of the human body. Thick feet or heads are not an issue as radiation comes from the side and there is no difference in temperature between the head and feet as a result. Nevertheless, temperatures above 45°C should be avoided because a very intensive radiation feels uncomfortable after a while.

The advantages of wall heating in comparison to underfloor or ceiling heating:

- Higher thermal output due to significantly higher surface and radiative temperatures respectively and thus a lower need of heating surface and material.
- The user has a free choice of positioning. Radiant heat decreases with increasing distance to the wall heating surface.
- Fast reactions times and well controllability.

The disadvantages of wall heating in comparison to underfloor or ceiling heating:

- Blocking of wall heating surfaces is not allowed; large furniture or pictures are a no-no.
- The wall mounting must comply with certain requirements and must be well insulated to avoid thermal energy loss outwards through the masonry.
- Even though the portion of convection (ascending warm air and hence dust/air movement) amounts to 20% less than at floor heating it is approximately 30% higher than at a ceiling heating.
- Deep rooms are not suited for wall heating as the temperature difference between the nearest and furthest area becomes too high.
- Active cooling is possible conditionally, only.

The comfort

Radiant heat is the healthiest and most pleasant existing form of heat transfer. We know it from the sun and a tiled fireplace for instance. What is decisive here is, firstly that all areas are heated as evenly as possible and secondly that there is no occurring air circulation. The virtually all around even room temperatures create an ideal feeling of comfort, since the human body experiences temperature differences between head and feet as extremely unpleasant.

Another decisive factor is a fair indoor air humidity, remaining at an ideal 50%.

Functionality

The ArgillaTherm® wall heating system combines the advantages of conventional low-temperature panel heating systems with the positive features of the construction material clay counting on an innovative, patented plate system for easy montage according to standards and rules.

Surface heating in comparison

characteristics	Floor heating	Wall heating	Ceiling heating
Portion of thermal radiation	50%	70%	98%
Portion of convection, ascending air	50%	30%	2%
Constant heat distribution	Very good	Satisfactory	Very good
Energy efficiency	Good	Good	Very good
Very high	Very high	Moderate	Very low
Cooling when connected to cooling generator	Insufficient	Moderate	Very good
Restrictions due to furnishing	Reasonable	Very high	Very little
Long heating-up and cooling down phases	Very high	Very little	Very little
Controllability	Insufficient	Very good	Very good

Overview of ArgillaTherm® wall heating advantages

- ✓ The modular type of construction allows an almost complete coverage of the ceiling with heating elements, windows and doors can easily be left open. Thus it is usually sufficient to have the system on the window exterior wall only.
- ✓ Due to the sandwich construction design the masonry is thermally decoupled the heating is not inert.
- ✓ Low prices, particularly only 60% of comparable systems.
- ✓ Extremely easy assembly, affiliated with a low humidity inlet into the building through dry construction and installation can be conducted with a minimum effort and at a low cost.
- ✓ As common for underfloor heating the heating pipe is layed without any coupling, which follows current rules and standards.
- ✓ Compatible with all existing software for project planning and design without limits regarding project size.
- ✓ The total structural height amounts to 52mm only.
- ✓ Use of standardized system components and standard conformity of the complete system.
- ✓ No expensive conceptual planning is necessary
- ✓ Health supporting characteristics und energy savings due to the use of clay as carrier material.

Advantages through clay

- ✓ Suitable for allergy sufferers and asthmatics, providing maximum of well-being, living comfort and air purity.
- ✓ The constant relative humidity of about 50% provides a healthy room climate, preventing coughs, sneezes and mould formation.
- ✓ Absorption of pollutants, e.g. VOCs (volatile organic compounds) which can evaporate from wood.
- ✓ Absorbtion of odours.
- ✓ Antistatic effect, i.e. the clay neutralizes staticly loaded dust- und dirt particles and reduces fine dust.
- ✓ Extremely positive CO2-balance (only about 1/100 in comparison to gypsums or lime products).
- ✓ Due to the condensation cold occurring during summer, clay keeps the room comfortably cool in a natural way.

Energy savings in numbers

20 % due to the higher portion of radiant heat

The room air temperature is heated passively by heat radiation from rigid surfaces and objects and thus decreases by about 2 –3 °C,without reducing the feeling of comfort and well-being. The rule of thumb applies: 1°C reduction equals 6-7% energy savings.

15 % due to the small difference between average water and radiant temperature

The heating pipe is located only about 5mm below the wall surface embedded in the clay wall material.
The difference between average water and average wall surface temperature amounts to just 2,5K.
1°C lower flow temperature correlates to about 2,5% energy savings.

System flow temperatures

Depending on individual heating requirements, density of coating and differentiation, the system flow temperature amounts to

27 – 55°C in Heating and

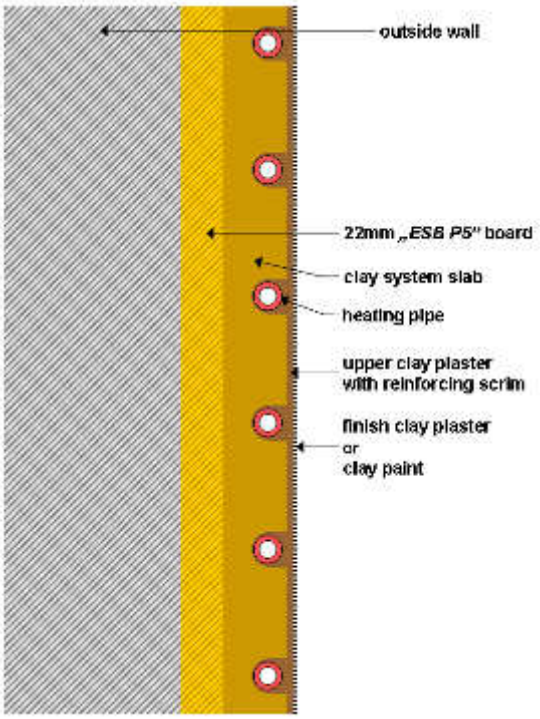
8 – 22°C in Cooling.

Response times / thermal inertia

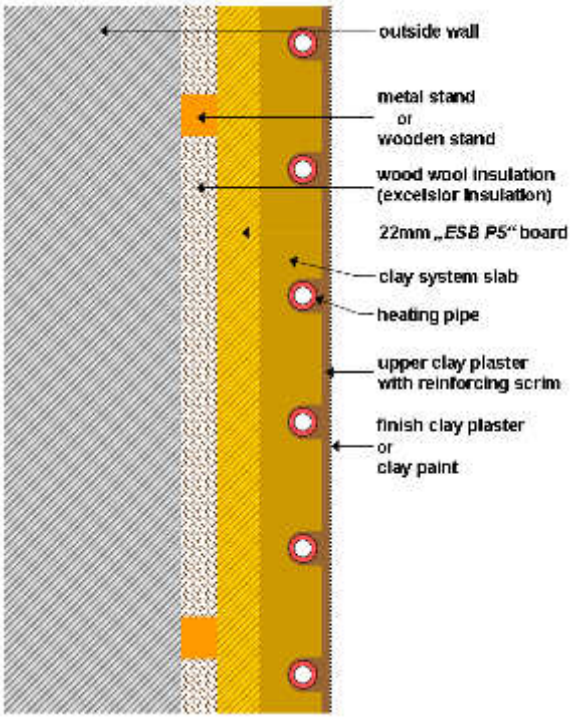
Depending on the type of heating system, the response time comes to about 5-10 minutes; the clay ceiling material with a total coating thickness of 25mm, is fully heated after approximately 60 minutes. In case of an interruption of heat supply the system holds the surface temperature depending on the environment for about 60 minutes without any considerable drop of temperature. In case of the application of thermal pumps interruptible electrical heating rates (thermal pump rates) without buffer storage can be used trouble-free.

Fixing options / System settings

Option 1: direct fixation to wall / structural height 52mm



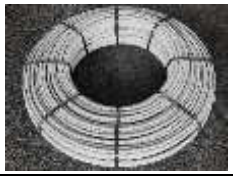
Option 2: fixing with substructure formwork and cavity insulation
structural height 52mm plus stand depth of substructure formwork



System components

Components	Article no.	Image
ArgillaTherm® clay system construction panel RIVIERA W11.8 with press fitted glass fiber reinforcement, size: 375 x 375 x 25mm	WSBP000001	
ArgillaTherm® clay compensation plate, bulk density approximately 620Kg/m³, 750 x 750 x 25mm	ZLBP757525	
ArgillaTherm® clay upper plaster no.1-2 acc. DIN 18947, 25Kg bag as dry ware for 1,2m² wall surface	ZLOP120025	
ArgillaTherm® clay paint no. 3-1 sprayable and brushable ready-mix, 10l for 35m² wall surface, pure white	ZLFA310010	
Edge insulation strip of wood-fiber material, size 50 x 10mm, 10m per roll	ZRDS501000	
Glass fiber mesh, MW 7 x 7mm, 105g/m², 100cm wide, 100m per roll	ZGSGG77000	
Stainless steel- load distributor for fixing of clay system construction panels, 5 x 50mm, 100off per box	ZLTE055100	
Stainless-steel – collated flat countersunk head screw T-Star Plus T20 with partial thread 5 x 45mm, 200 off per box	ZETS054500	

Heating technology

Heating technology	Article no.	Image
ArgillaTherm® electronic wall temperature regulator AT-3R, 5 to 40°C, heating/cooling including 4m remote sensor	ZAT3RR000	
ArgillaTherm® analogue wall temperature regulator AT-R1W, 5 to .40°C, heating/cooling including 4m remote sensor	ZATR1W000	
ArgillaTherm® three-layer polybutene pipe acc. DIN 16968, PB 12 x 1,3 mm, oxygen impervious acc. DIN 4726	WHR1213250	
Clamp ring for heating circuit distributor ¾“ Eurokonus to PB-pipe 12x1,3mm	WKRV341200	
Pipe hook 90° with 2 fixing lugs for pipes with outer diameter of 10-16mm	ZRSB901017	
ArgillaTherm® electrothermal drive for heating circuit distributor 230V, 2,5 watt power input, 4,5mm swing, power-off closed	ZSATS51001	
ArgillaTherm® terminal block 230V for 6 thermostats with a total of 14 power drives for heating and cooling	ZKL6K0000	
ArgillaTherm® dew point sensor with 10m connecting cable for terminal block ZKL6K0000	ZKL6KTS000	

Technical planning and basics

For planning and dimensioning of ArgillaTherm wall heating the following relevant rules and standards apply:

DIN EN 12831	Method for calculation of normative heating load
DIN EN 1264	Water based surface embedded heating and cooling systems
DIN EN ISO 11855	Building environment design – Design, dimensioning, installation and control of embedded radiant heating and cooling systems
DIN 16968	Pipes of polybutene (PB), general quality requirements
DIN 4726	Plastic pipelines, maximum permissible value for diffusion resistance
VDI 2035	Prevention of damages in boiler heating systems
DIN EN 60730	Automatic electrical controls
DIN 18947	Requirements for clay mortar for plastering of walls and ceilings
DVL TM 06	Data sheet for clay -thin-layer coating of walls and ceilings
DVL TM 07	Technical data sheet for requirements, fields of application, performance characteristics and test methods for indoors- fabricated clay construction plates

The works of all crafts contributing to the construction process are to be coordinated.

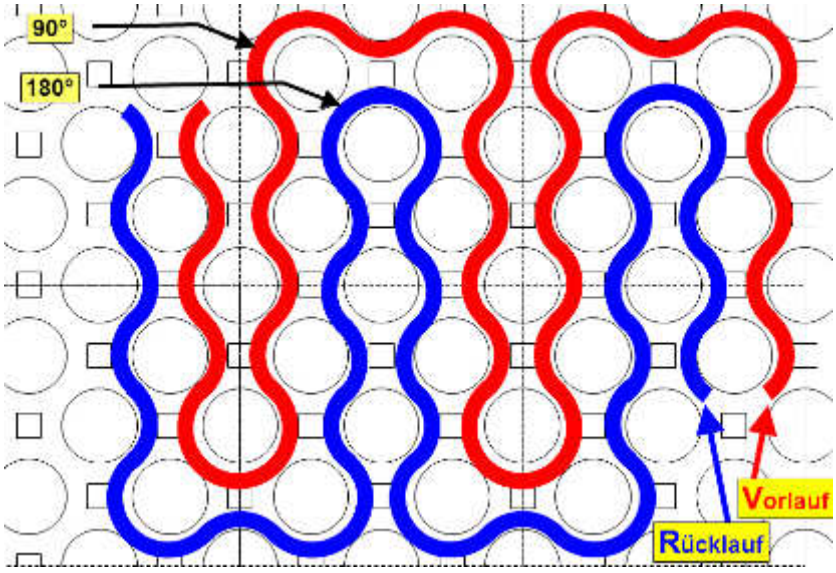
scheduling: energy consultant/architect/planner

Executing crafts: heating installer/dry wall builder/construction company

Dimensioning of wall heating

There are 2 aspects in which wall heating differs from ceiling heating. Firstly, there are no temperature limitations. Here any flow temperature can be applied. Secondly, wall heating has an additional convective portion, thus its specific power is higher than with ceiling heating systems. For reasons of comfort the flow temperature should be limited to 55°C

The RIVIERA system is to be carried out with water pipe PB 12x1,3mm by ArgillaTherm.



Characteristic	Dimensioning option I	Dimensioning option II
Pipe dimensions	12 x 1,3 mm	12 x 1,3 mm
Max. length per heating circuit	80 m	100 m
Maximum flow rate per heating circuit	70 l/h	90 l/h
Pressure difference	150 mbar	250 mbar

Standard-design wall heating at 70 W/m², room temperature 20°C

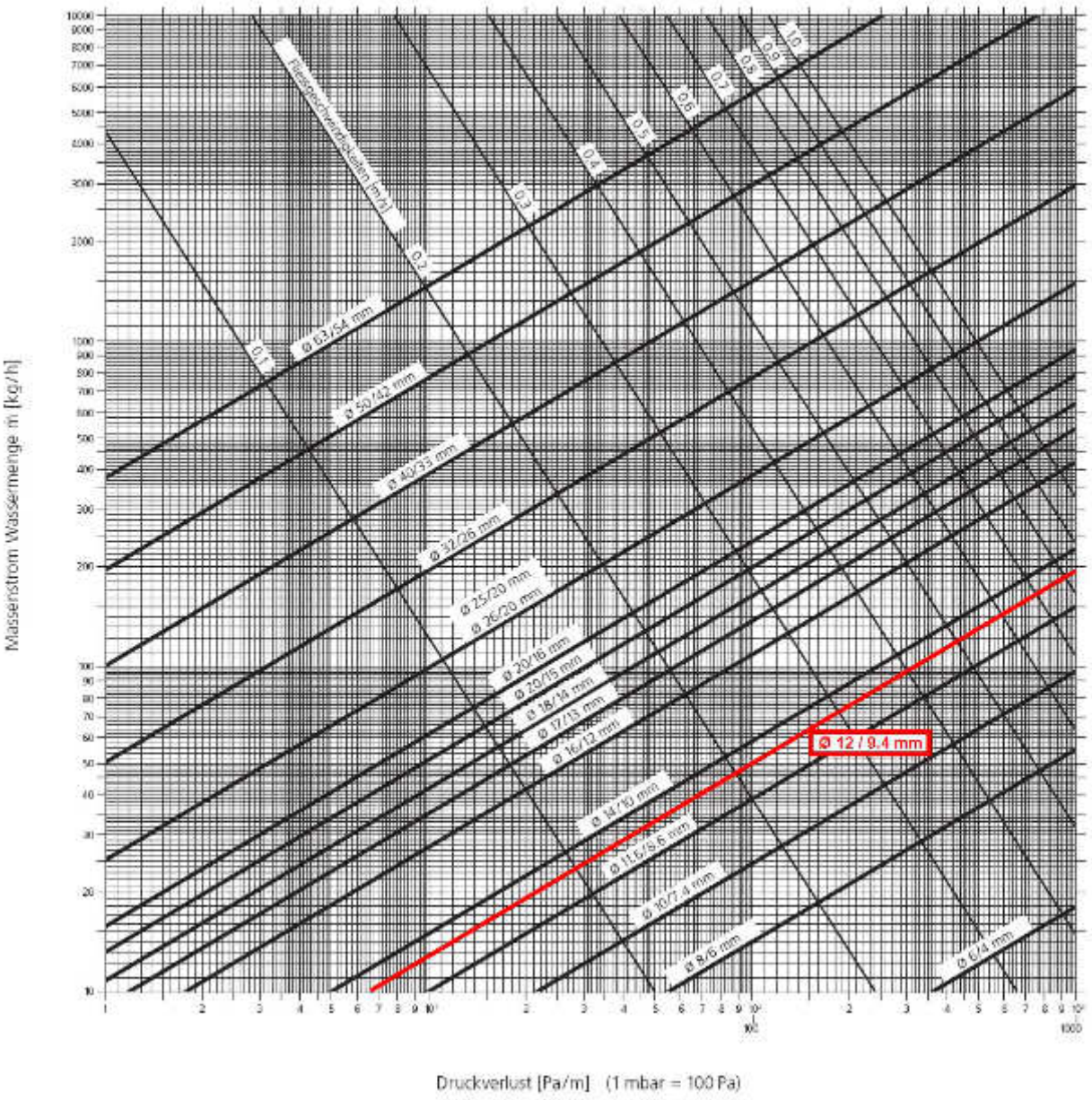
Example: Design option I with 70W/m²:
The heating circuit has a pipe length of 48m.
==> The required flow amounts to: 70 l/h* 48/80 = 42 l

At a flow temperature of 35°C the average wall temperature is about 3 K below the average of the heating water. Increasing the flow temperature increases this value proportionally. For figures important for heating capacity please see following table.

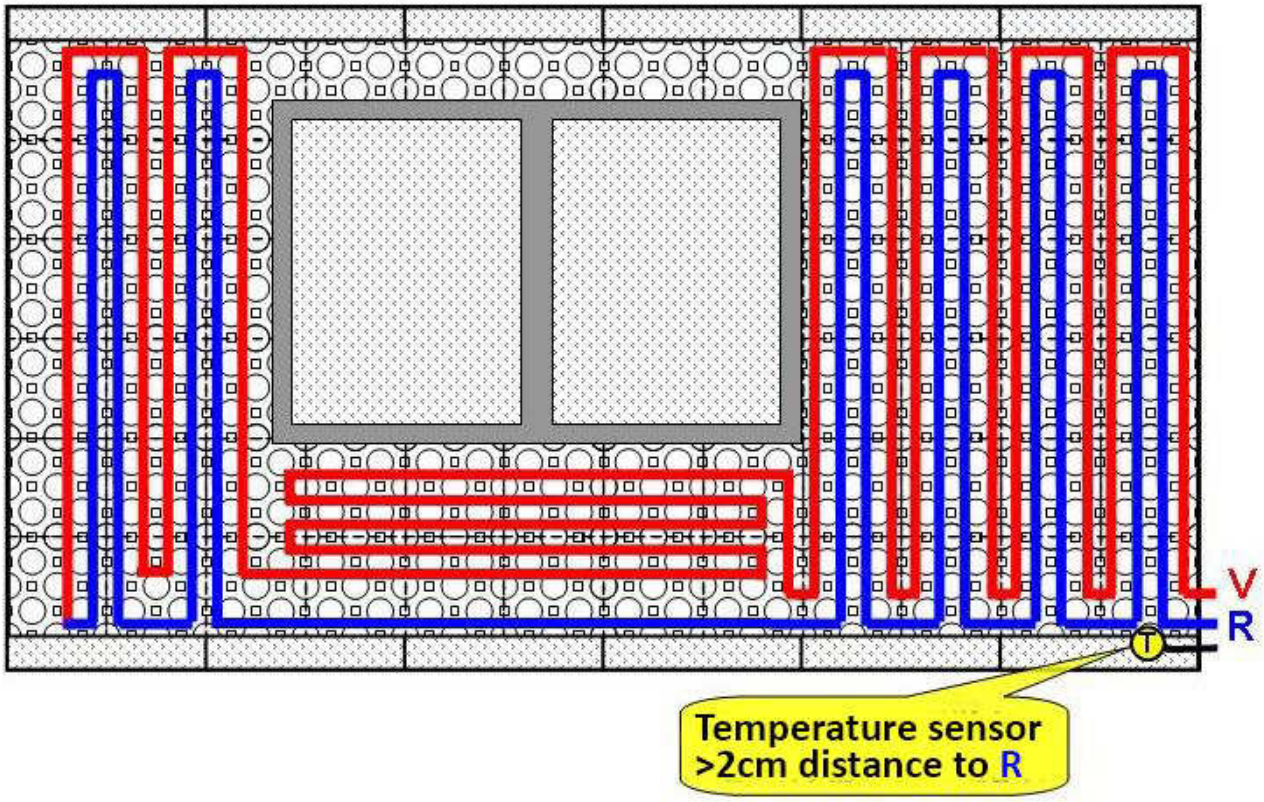
Flow temperature in °C	Return temperature in °C	Wall temperature in °C	Room temperature in °C	Heating capacity watt/m²
55,0	41,0	41,0	20	168
52,5	39,5	39,5	20	156
50,0	38,0	38,0	20	144
47,5	36,5	36,5	20	132
45,0	35,0	35,0	20	120
42,5	33,5	33,5	20	108
40,0	32,0	32,0	20	96
37,5	30,5	30,5	20	84
35,0	29,0	29,0	20	72
32,5	27,5	27,5	20	60
30,0	26,0	26,0	20	48
27,5	24,5	24,5	20	36

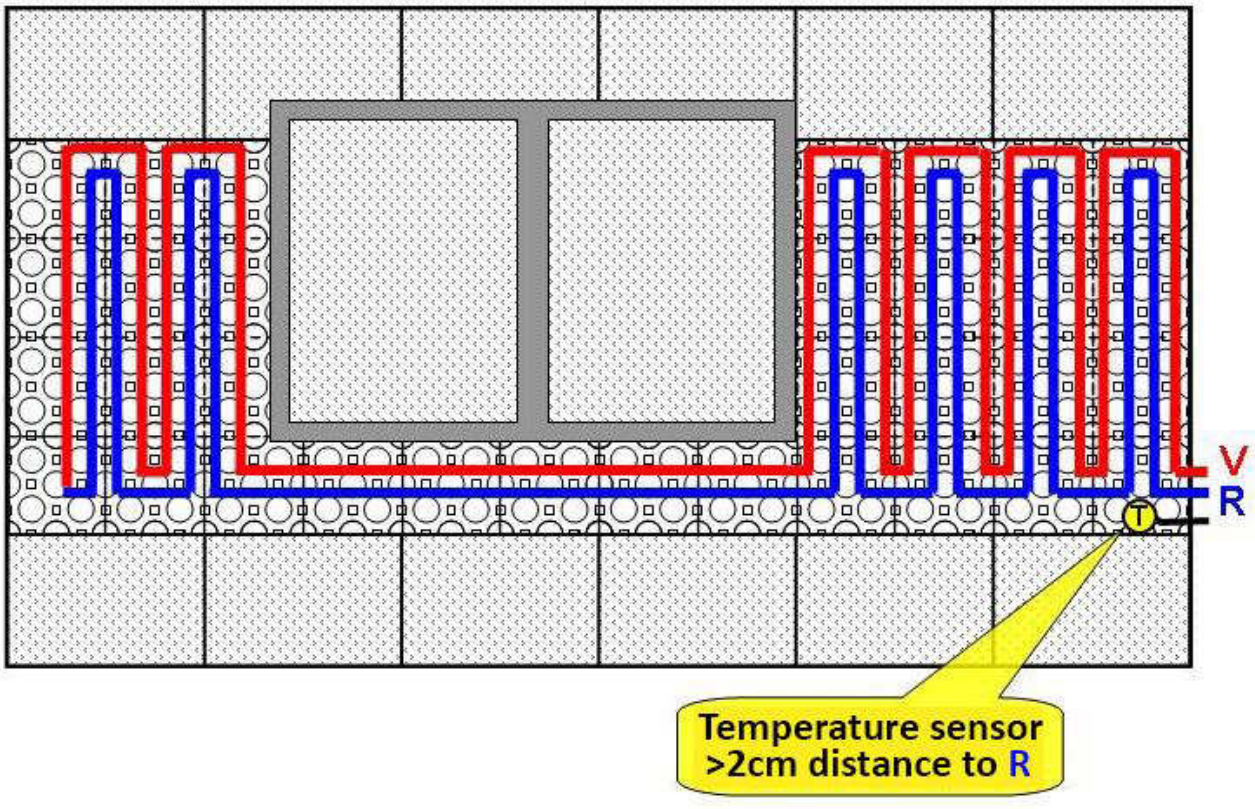
Flow temperatures and heating capacity

Pressure drop diagram (T = 40 °C, wall roughness ε = 0.007 mm)



Example for vertical laying of pipe width one heating circuit





Connection to existing heating facilities

For connection to existing heating facilities the following options are recommended:

1. **Control unit with 3- or 4-port-mixer and pump.**
   The flow temperature of the existing heating element is reduced to the required flow temperature of the Argillatherm wall heating system by means of a control station. The pump provides the required pressure and volume stream, controlled via remote sensor of the room thermostat. The heating circuit length and volume streams are similar to those with connections by.
2. **RTL-control box with flow control in conjunction with ArgillaTherm room thermostat**
   The remote sensor measures the wall temperature sending them to the room thermostat. The room thermostat controls the actuator in the RTL-Box (recommended brand is kombi box RTL-TH Basic by Simplex, Art.-no. F11836), which is to be installed into the return run. As here no additional pump for the heating water is used a hydraulic bancing with the existing heating system by adjusting the pressure differences is necessary. Heating systems are usually set-up with a pressure difference of less than 100mbar. Therefore, the following parameters are to be applied:
   Maximum length of heating circuit = 60m
   volume per hour = 60l
   Pressure difference in heating circuit = 80mbar
   The capacities equal those shown on page 9.

Substructure

For heating assembly to exterior walls the substructure must be sufficiently steam-permeable. ESB-Plus P5 plates are recommended as their resistance to steam diffusion (µ-value) is just 40. Thus SD equals 0,88m. The ESB-Plus P5 plates, size 129x62,5cm, are part of Argillatherms product range.

As a precaution the dew point should be calculated!

Material calculation

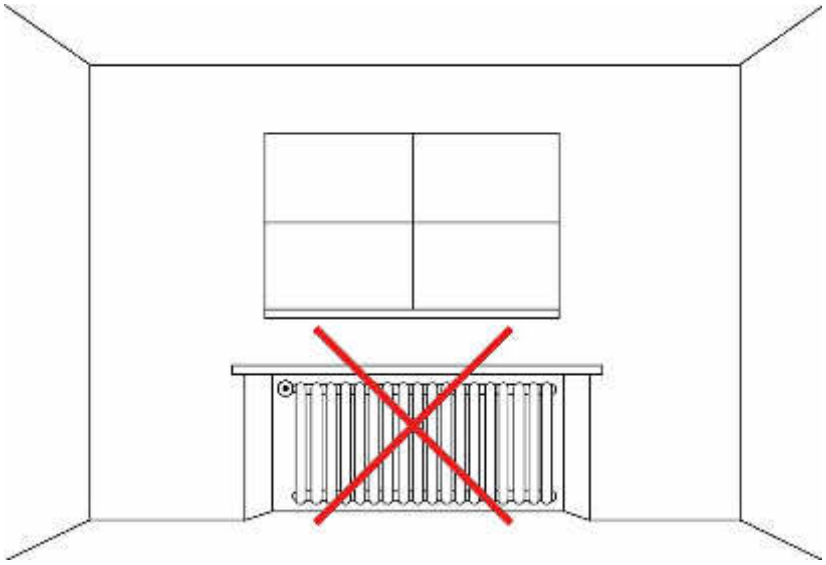
Example: wall heating RIVIERA with direct fixing without, without sub-insulation, finishing with clay paint..
Specification: room size: 20m² room heating load: 400 Watt ≙ 20 Watt/m² (KfW55-Standard)
Outside wall area excl. window: 10m², flow temperature: 45°C ≙ 117 Watt/m²

Edge insulation strip of wood-wool material (50x10mm)	10 m
ESB-Plus panels P5 22mm with tongue and groove as substructure	10 m²
Clay system construction panel for laying of water pipes	3,5 m²
Clay compensation plates for filling of pipe-free areas	6,5 m²
Stainless-steel – load distributor 5 x 50 mm and stainless-steel - screw 5 x 45mm	150 off
ArgillaTherm® three-layer polybutene-pipe acc. DIN 16968, PB 12x1,3mm	35 m
ArgillaTherm clay plaster no.1-2 acc. DIN 18947, 25kg bag dry ware	6 bags
Glass fiber mesh, MW 7 x 7mm, 105g/m², 100cm wide	11 m²
Electronic thermostat AT-3R or analogue thermostat AT-R1W for heating and cooling incl. 4m remote sensor AT F100-1	1 off
ArgillaTherm clay- paint no. 3-1 sprayable and brushable ready-mix	1 bucket

Assembly instructions wall heating RIVIERA

Water-based low-temperature wall heating system on clay basis

Assembly to walls



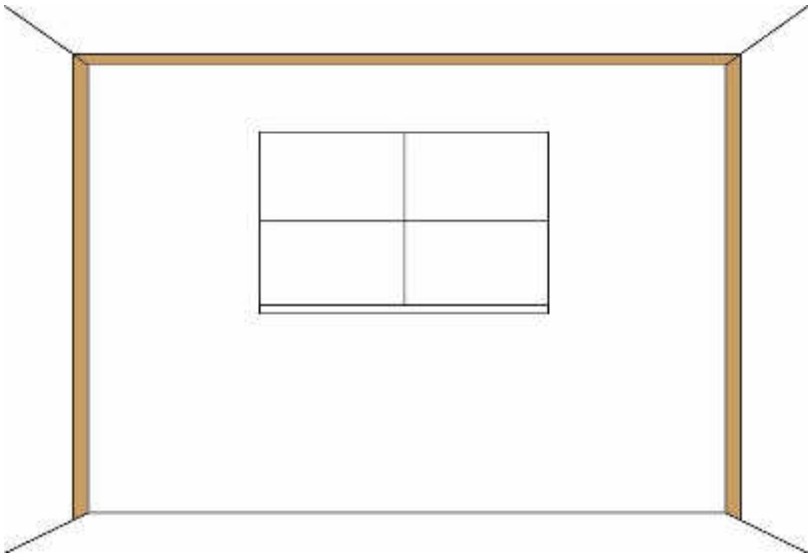
For restorations:

Remove radiator; brick up niche and plaster it.

Remove existing plaster from the window soffit.

Look for the power lines under the plaster using a cable finder and mark tracks to prevent damage.

Execution:Construction company/drywall constructors

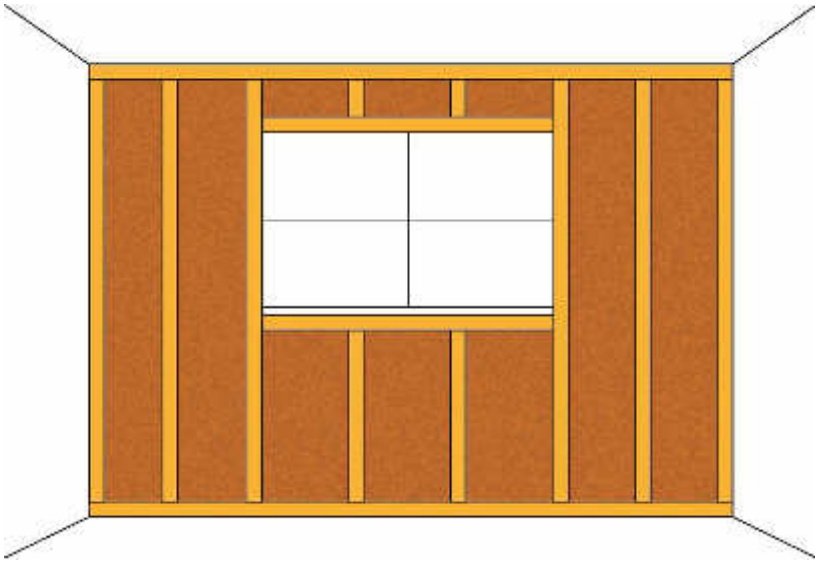


Edge insulation strips 50x10mm

Attach to cealing and walls (not to the floor).

The use of soft wood-fibre materials is reccomended.

Execution:Construction company/drywall constructors

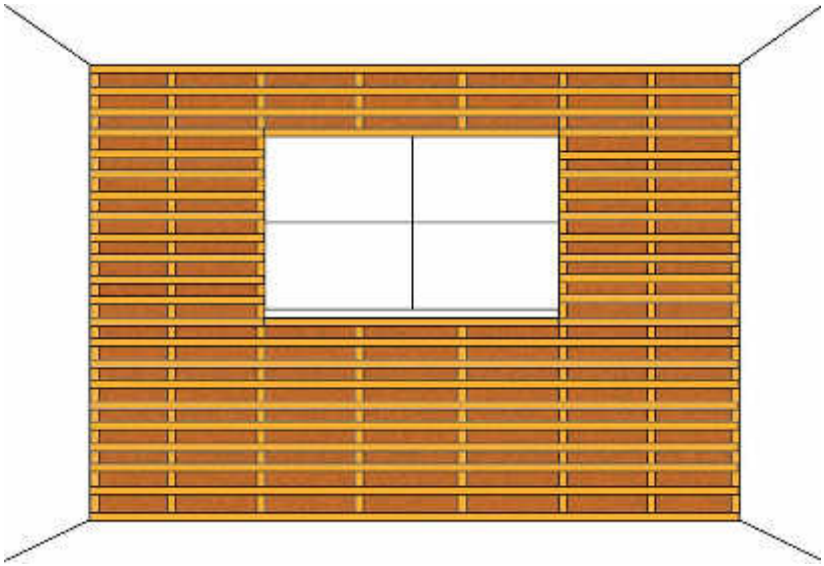


In case of insufficiently insulated exterior walls:

Install a substructure out of wood panels or metal profiles and insulate interspaces accordingly.

Recommendation: Wood-fibre insulation

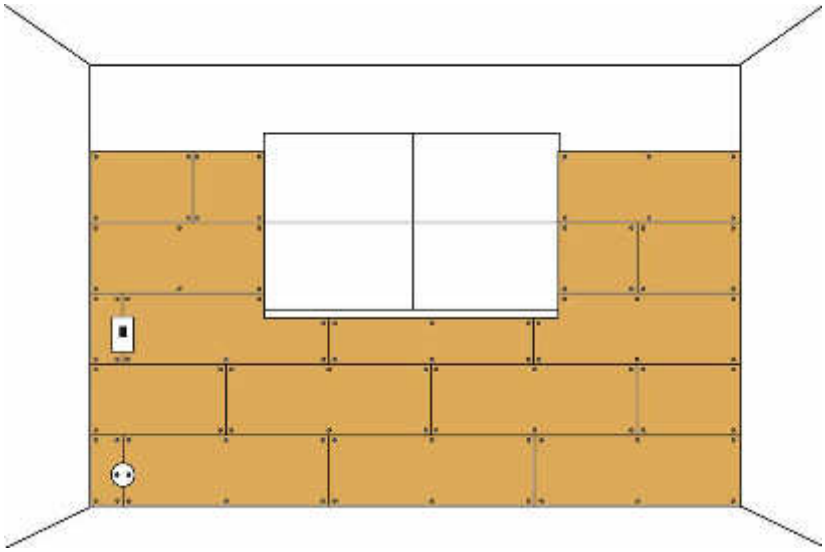
Execution:Construction company/drywall constructors



Installation without ESB-Plus chipboards

Double joisted installation using wooden slats or metal profiles with a distance of 18,75cm.

Execution:Construction company/drywall constructors



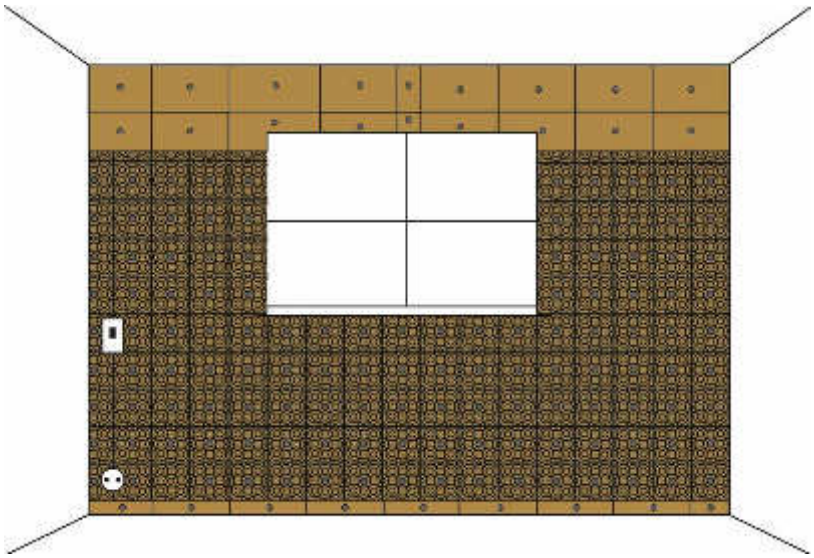
Assembly with ESB-chipboards

Install 22mm ESB-Plus P5 chipboards either directly to the masonry (in case of sufficiently insulated exterior walls) or onto the substructure using a suitable fixing material.

Always handle chipboards with a tongue and grove connection and install in a bond pattern. Gaps for sockets, switches etc. are to be created prior to this installation.

Important: Install the chipboards notched so they are not fitted flush with the window. This prevents cross-joints at the corners of the window.

Execution:Construction company/drywall constructors



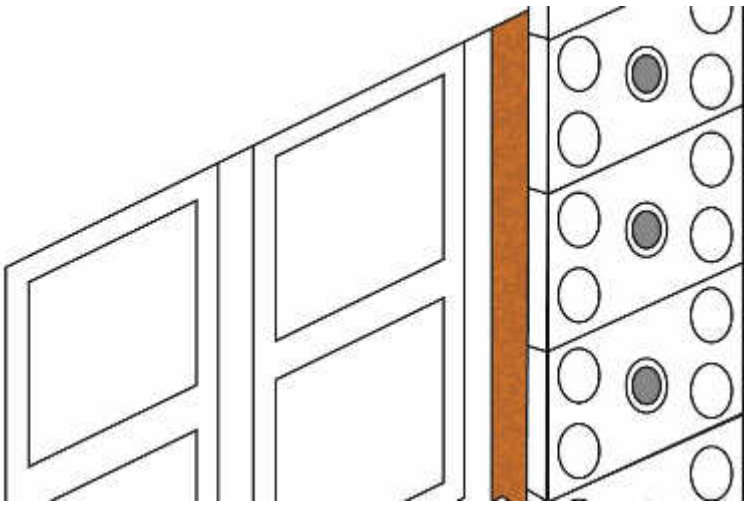
Lay panels (amount according to design) onto cross joints and fasten only centrally with a screw. Cover remaining surfaces with the ArgillaTherm compensation plates and also lay onto cross joints.

Use ArgillaTherm stainless-steel load distributors 5/50 and stainless-steel construction screws!

Important: Install the chipboards notched so they are not fitted flush with the window. This prevents cross-joints at the corners of the window.

Leave system and compensation panels overlapping in the window in the thickness of the soffit lining.

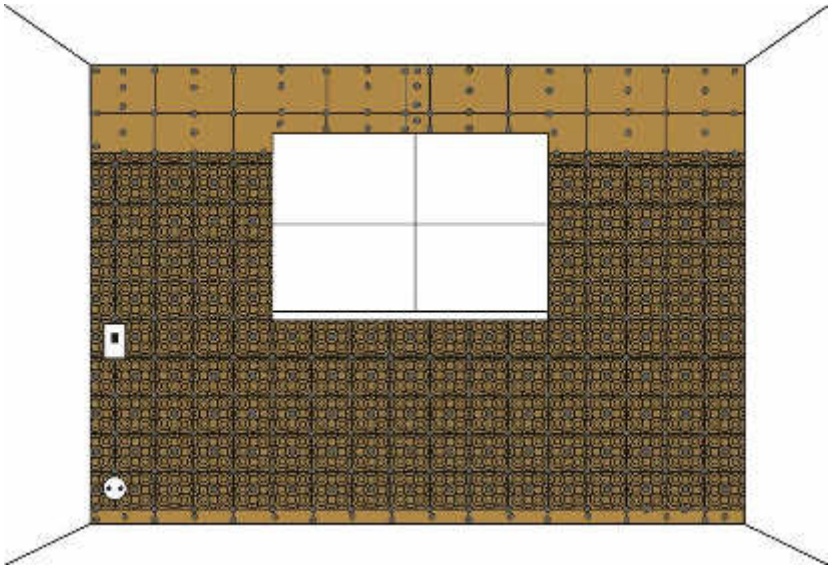
Execution:Construction company/drywall constructors



Attach joint profile to window.

Line window soffits either with clay compensation plates or woodfibre insulation plates.

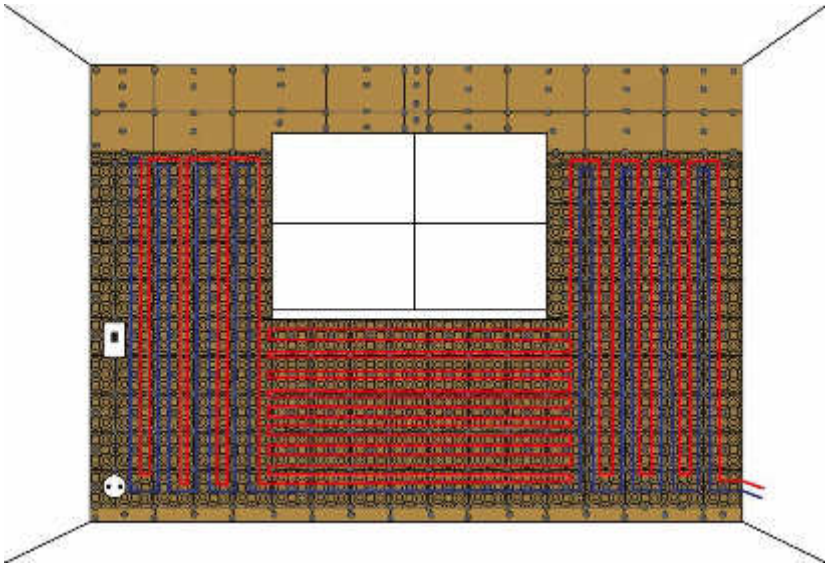
Execution:Construction company/drywall constructors



After full coverage of ceiling bolt all crossing- and connection points of clay system panels to the clay compensation plates.

Urgently note: Edges of clay system and compensation panels should not be layed directly over the edges of the chipboards.

Execution:Construction company/drywall constructors



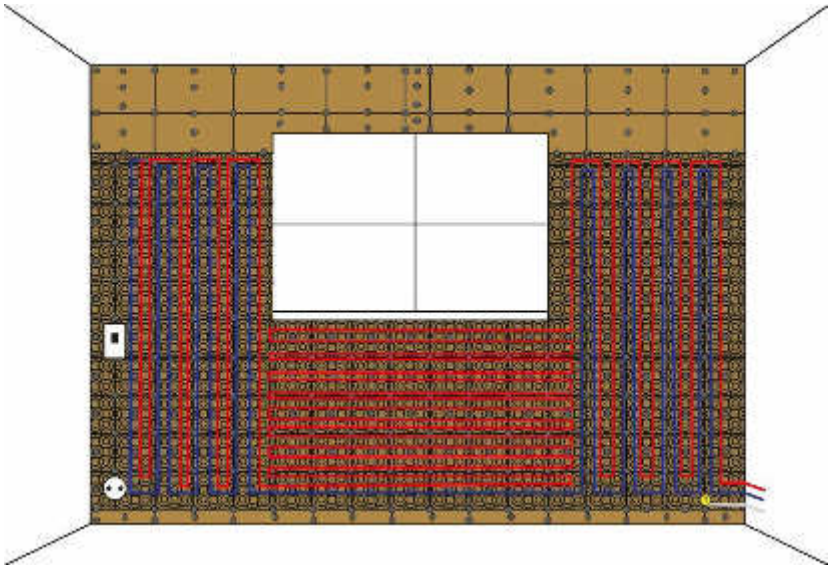
Meandering shaped installation of ArgillaTherm® PB-syntheic pipes into grooves of clay panels; beginning at the heating circuit manifold or the return temperature limiter. For installation pull pipe outwards at every inversion.

Lable heating circuits (VL1, RL1,etc.)

Perform a leak test with compressed air.

Important: Use a pipe reel !

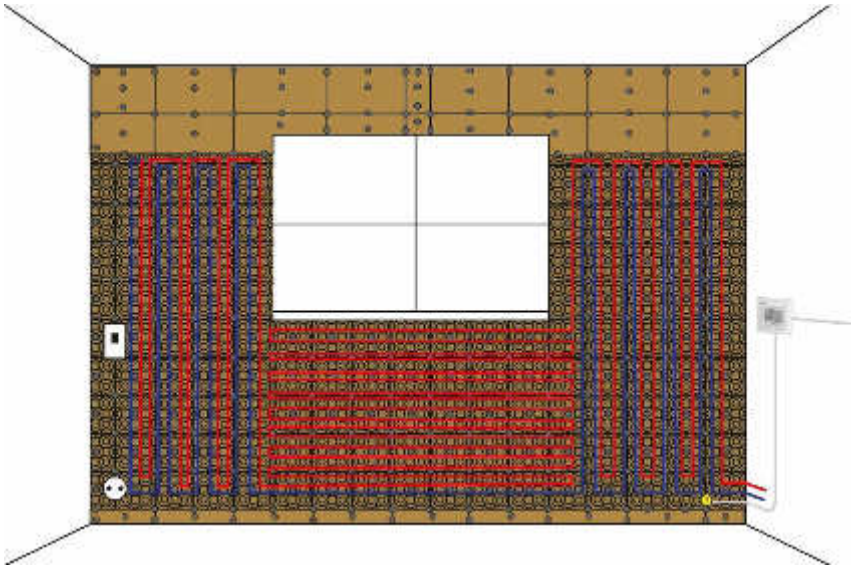
Execution: Heating engineer



Install wall sensors into the groove without empty conduits.

Place white sensor head atleast **2cm** apart from closest return pipe and at least **10cm** apart from closest flow pipe! Leave a distance of atleast 10cm to the wall.

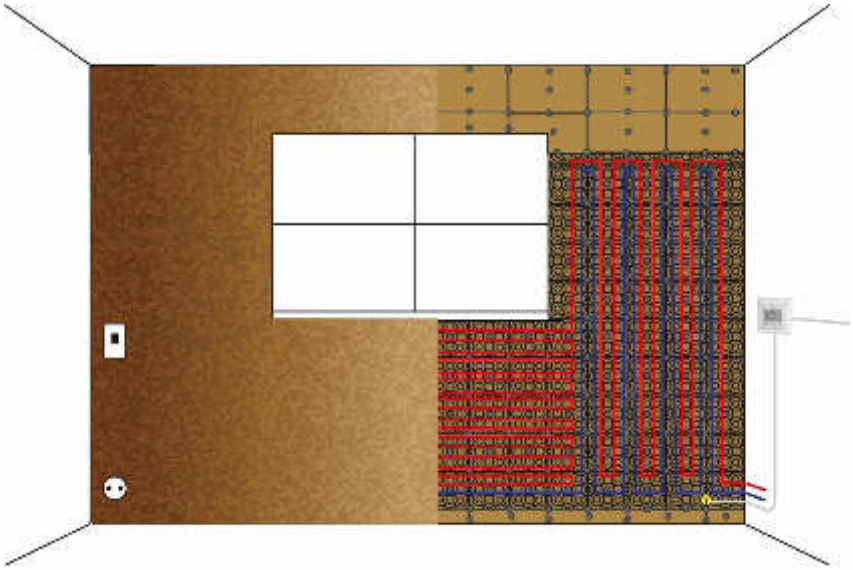
Execution: Heating engineer



Installation of the ArgillaTherm® room thermostat (free choice of location). Using a cable (we recommend 5x 1,5mm²), connect the ceiling sensor and thermostat to the control valves of the heating circuit manifold.

For use of a return temperature limiter (recommendation: Simplex F11836) the thermostat is to be connected to the temperature limiter.

Execution: Heating engineer

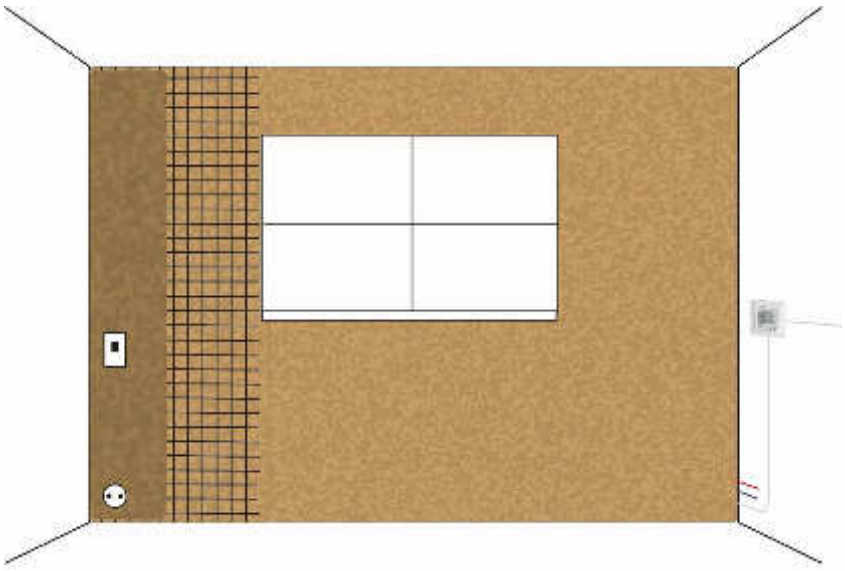


Sufficiently wet clay panels!

Forcefully fill up grooves of the clay construction panels with the ArgillaTherm® finish plaster Nr.1-2 and allow to dry.

Caution: The filling up of the grooves should take place immediately or shortly after the installation of heating tubes. Damp jobs such as screeds or plasters should be completed prior to the installation of the clay panels.

Execution: construction company/ drywall constructors

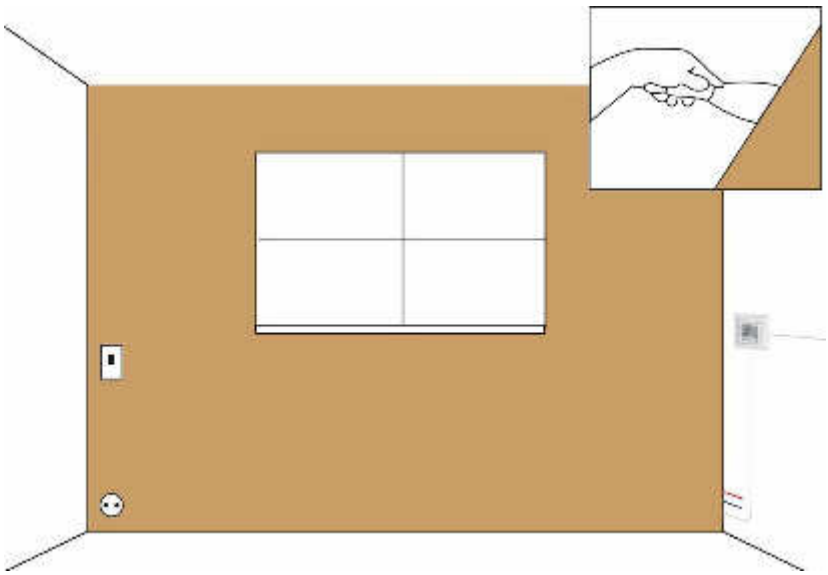


Apply a 3-5mm compensation layer of clay finish plaster Nr. 1-2 using a suitable toothed trowel and incorporate the reinforcement mesh sufficiently overlapping. Apply a following 2mm final layer of plaster and allow it to dry off slightly. For rounded edges, place the reinforcement mesh around edges of the window soffits.

In case of sharp edges incorporate suitable external corners and overlap with reinforcement mesh.

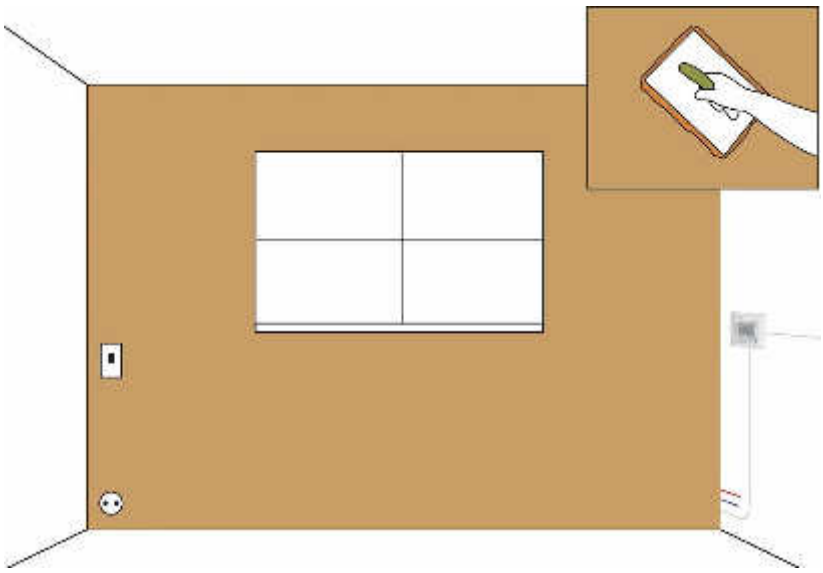
The surface should be evened out as best as possible!

Execution: construction company/ drywall constructors



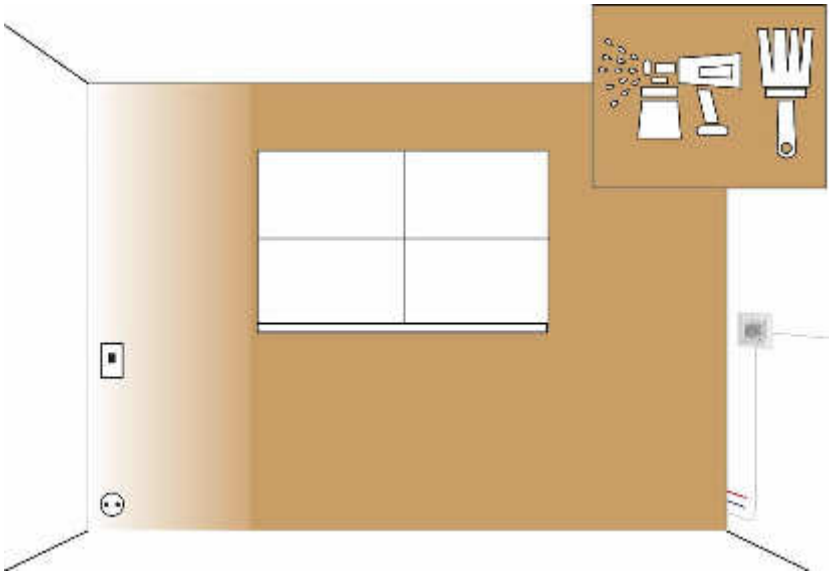
Create a connection joint to the wall immediately after by making cuts with a trowel.

Execution: construction company/ drywall constructors



After sufficient drying off (leather-hard) even out the surface using a suitable sponge board or special felting machine (surface quality 2).

Execution: construction company/ drywall constructors



Application of the clay color by two-layered painting or spraying.

For a uniform appearance, the application of the clay color, should be completed on the entire surface using a single mixture, on a single working day.

Execution: construction company/ drywall constructors

Final customer

System requirements

- ✓ Constructional prerequisites and general trades must be regarded and considered accordingly.
- ✓ For direct attachment to ceiling: masonry requirements according to DIN 18560 (DE) are to be complied by. Surfaces are not allowed to have any considerable unevenness. Basis of this, are values according to DIN 18202 (DE).
- ✓ For mounting and securing of clay system panels, depending on the ceilings substructure construction, sufficient fastening products with load capacity distributors by ArgillaTherm® are to be used. Designated depressions in the clay panels are to be utilized for this (do not drill outside of them).
- ✓ Objects that need to be fastened to the ArgillaTherm clay surface heating-system, such as lights or smoke detectors should be screwed on only and are not allowed to be nailed on. The precise location of heating elements and electrical cables must be determined previously using a thermofoil.
- ✓ Drillings on the ArgillaTherm clay ceiling heating system are only to be performed without percussion. Hammer blows, percussion drills, hammer drills and impact wrenches must not be used here as well as for wood panel ceilings to prevent potential development of cracks caused by this.

Systemgarantie

Bei fachgerechter Montage von ArgillaTherm® zertifizierten Fach-Handwerksbetrieben, Beachtung und Einhaltung der Systemvoraussetzungen und Einsatz der vorgegebenen Produkte unter Einhaltung der Arbeitsabläufe laut Montageanleitung, übernimmt die Firma ArgillaTherm GmbH eine

In case of a professional montage by ArgillaTherm® certified specialized trades, consideration and compliance of system requirements and exclusive use of listed products according to assembly instructions, the company ArgillaTherm GmbH provides a

20 year warranty for the clay surface-heating system RIVIERA .

Exclusions

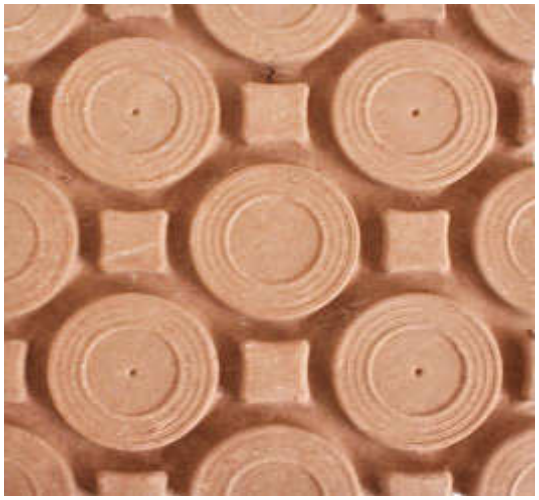
The warranty by ArgillaTherm generally excludes all deficiencies of the clay surface heating system that

- are based on building movements, due to building settlements or forces of nature
- are caused by damaged heating materials or sensors required for control and their electrical cables.
- were caused by vibrations of tools such as hammer blows, percussion drills, hammer drills and impact wrenches of which the use is explicitly prohibited.

Clay dry construction panel system RIVIERA

Dry construction panels as mounting aid for the water pipe

For installation to ceiling, wall or inclination



Characteristics

Clay dry construction panel with grooved structure for installation of the RIVIERA system water pipe. with pressed-in glass-fibre mesh. For installation to a wall or ceiling, or to inclinations, on wooden substructure. As a base for the ArgillaTherm clay finish-plaster No. 1-2.

Composition

Wooden grid, sands, clays, hemp fibres, glass-fibre mesh.

Key figures

Measurements	375 x 375 x 25 mm
Size accuracy	± 0,5 mm
Panel weight/ m²	approx. 5,15 kg / 36,50 kg
max. pipe capacity per m²	11,8 m
Compressive strength	min. 2,5 N / mm²
Flexural strength	min. 4 N/mm²
Bulk density	1.745 kg/m³
Steam diffusion resistance	min. μ = 5/10
Building material grade	A 1
Thermal conductivity of clay	1,05 W/mK
Abrasion	≤ 0,7
Steam sorption grade	WS III
Desiccation shrinkage degree	≤ 2 %

Forms of delivery

Packages	Content	Reach of System	Article number
180 plates per pallet	180 off	25,315 m²	WSBP000181

Measurements including pallet approx. 120 x 80 x 95 cm with edge protection and cardboard cover. Weight including pallet approx. 945 kg.

Storage

The material is indefinitely storable at dry storage.

Application

Clay dry construction panel for creation of clay dry plaster as mounting aid for the ArgillaTherm water-bearing PB-pipes and as a subsurface for the ArgillaTherm clay finish-plaster No. 1-2. Create sufficiently viable and even subsurfaces, e.g. out of laths 2 x 4 and 2,2cm ESB-panels. Install panels to it gaplessly, while fastening it at the centre of each panel and where a cross joint is formed. Subsequently install pipe and cover with the ArgillaTherm clay finish-plaster No. 1-2. The edge regions can be cut with an angle grinder or circular saw bench (recommended saw blade: EDESSÖ DP HKS 250x2,4/1), holes can be drilled with a diamond studded drill bit.

Please refer to the RIVIERA system instruction manual for more accurate processing directions.

Subsurface

The subsurface must be sufficiently viable and even. For construction parts that are in direct contact with outdoor air (roof surfaces, exterior walls etc.) consider capillary active and void-free thermal insulation and conduct a dew point calculation. Generally, use ESB-Plus panels as a substructure, which are to be handled by tongue and groove connection.

For construction parts that are not in direct contact with outdoor air there is usually no need for thermal insulation. If in doubt please refer to our application experts.

System products

ArgillaTherm water-bearing pipe system RIVIERA

Flexible, water-bearing PB-pipe (12 x 1,3 mm) according to DIN 16968 for fabrication as heating- and cooling tool in the ArgillaTherm system panel RIVIERA, impermeable to oxygen according to DIN 4726.

ArgillaTherm Clay finish-plaster No. 1-2

Suitable clay plaster-ready-mix according to DIN 18947.

ArgillaTherm Clay finish plaster No. 2-2

Ready-mix for creation of white clay thin-layer coating according to DVL TM 06.

Thermostat AT-3R

Thermostat according to DIN EN 60730, protection class II, for finery or flush mounting.

ArgillaTherm® GmbH
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0551 389356-0
info@argillatherm.de

Working conditions for construction and application areas of our products are very various. In our technical data sheets, we can only provide basic processing guidelines. These comply with our current state of knowledge. Planners and processors are obligated to examine suitability and potential applications for the intended use. For application scenarios that are not expressly mentioned in our data sheets, planners and processors are obligated to refer to the ArgillaTherm® application technology. If the processor uses the product beyond the area of application in the instruction manual, without previous consultation of the ArgillaTherm® application technology, they are completely liable for the potential resulting damages. All herein contained descriptions, sketches, photographies, data, conditions, weights etc. can be changed without prior notice and do not represent contractual agreements of the of the products characteristics.

Possible property rights as well as existing laws and regulations are to be considered by the recipient of our product under their own responsibility. The reference of brand names of other companies does not act as a recommendation and does not rule out the use of other similar products, if they have not been classified for application with our products in the system. Our information solely describes characteristics and benefits of our product and does not provide a guarantee. A guarantee for specific properties or the suitability of the product for a certain purpose cannot be derived from our information. We only assume liability for incomplete or incorrect statements within our informational material in case of gross culpability (intent or severe negligence); possible demands of the product liability law remain unaffected.

Clay- dry construction plate according to LP (type A) - TM 07 – MHK I – 0,6 - 25

Clay dry construction plate for paneling and sheathing

For installation to ceilings, walls or slants

Properties

Clay- dry construction plate with double-sided glass fiber - mesh for covering compensation areas (areas without heating medium) of the systems RIVIERA and TOSKANA. Suitable for paneling of frameworks or sheathing of wooden areas or masonries for instance. Can be fixed to walls, ceilings or slants. As dry-plastering plate for ArgillaTherm clay- upper plaster no. 1-2.

Composition

Clay, sands, hemp fibers, hemp shives, glass fiber mesh 12mm.

Characteristics

Dimension	750 x 750 x 25 mm
Dimensioning tolerance	MHK I (± 1,0 mm)
Weight plate / m²	8,70 kg / 15,50 kg
Bulk density	Bulk density class 0,7 (620 kg/m³)
Surface reinforcement	12mm glass fiber-mesh (both-sided)
Flexural strength vertical/horizontal	3,65 / 2,15 N/mm²
Surface strength	0,11 N/mm²
Water vapor diffusion resistancy	mind. μ = 5/10
Thermal conductivity	0,17 W/mK
Specific heat storage capacity	1,5 kJ/kgK
Fire classification	A 2
Water vapor absorption grade	WS III

Forms of delivery

Package	Range of coverage	Article no.
1 palette à 60 plates 750 x 750mm 60 plates 750 x 375mm	50,62 m²	ZLBP757525

Dimensions incl. palette approx. 120 x 80 x 170 cm (L x W x H) with edge protection and cardboard cover.
Weight incl. palette approx. 815 kg.

Storage

Unlimited at dry storage.

Application

The clay compensation plate can be used in the entire interior construction area on walls, ceilings and slants as compensation (on areas without heating medium) in conjunction with the heating systems RIVIERA and TOSKANA.

Handling

Machining of the plates

Cutting of plates by means of all common woodworking and brick processing machines, such as jigsaws, circular saws and cavity milling machines. Attention: increased dust occurrence! Pay attention to the appropriate health and safety standards!

Alternatively, plates can be broken across an edge. In this case conduct a one-sided cut of the scrim using of a cutting knife, break the plate and then cut the scrim on the other side. Finish the broken edges by means of a rasp or grid float, if necessary.

Montage

For montage to continuous wooden plates the butt joints should not be above the butt joints of the carrier board.

For fixing use stainless-steel load distributors- Art.-no55100 and suitable stainless-steel-screws.

System products

ArgillaTherm clay upper plaster no. 1-2

Machinable clay plaster ready-mix acc. DIN 18947.

ArgillaTherm clay paint no. 3-1

Sprayable and paintable clay paint as ready-mix.

ArgillaTherm® GmbH

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Water-bearing pipe 12x1,3mm RIVIERA System

Flexible pipe (PB 12 x 1,3 mm) according to DIN 16968 as thermal regulation device for the RIVIERA system

Oxygen impermeability acc. to DIN 4726

Characteristics

Flexible pipe as thermal regulation device for installation in the RIVIERA System, PB 12 x 1,3 mm.

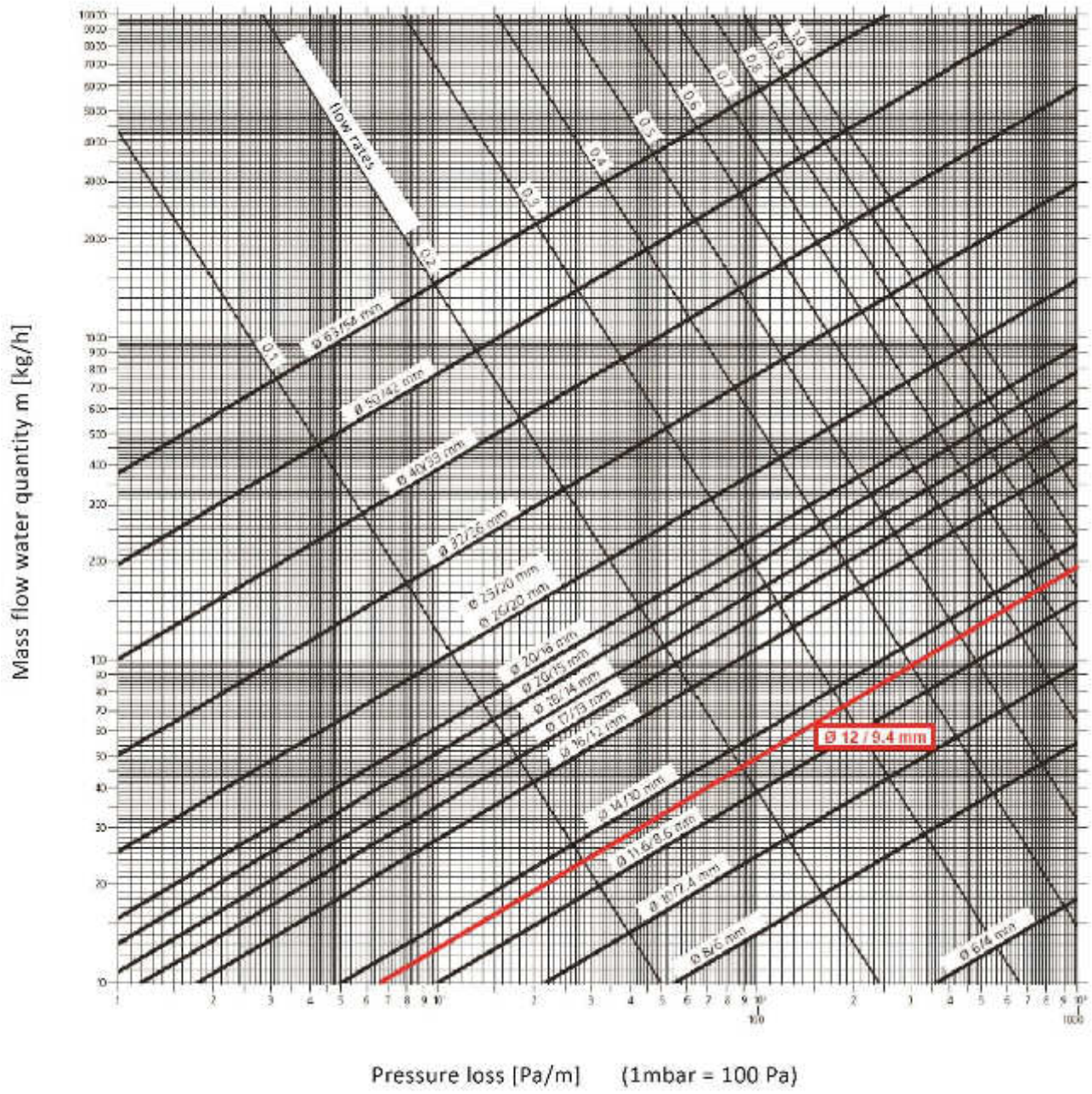
Material

Three-layered polybutene.

Key figures (According to DIN required values in brackets)

Outer pipe diameter	12 mm
Pipe wall thickness	1,3 mm
Rohrinnendurchmesser	9,4 mm
Smallest bend radius without bending aid	60 mm
Density	0,920 g/cm³
Weight per meter	42 g/m
Water content	0,069 l/m
Linear expansion coefficient	0,13 mm/(mK)
Thermal admission resistance	0,0059 m² K/W
Thermal conductivity at 20°C acc. to DIN 52612	0,22 W/mK
Maximum operative temperature, over 50 years	70 °C
Maximum operative temperature, max. 1 year	90 °C
Fail-safe temperature, max. 100 hours	100 °C
Maximum operating pressure, Application grade 4/5	8 bar
Inner surface roughness	0,007 mm
Oxygen impermeability acc. to DIN 4726	< 0,1 g/m³ d
Tensile stress at yield acc. to ISO 527	17-20 N/mm²
Tensile strength acc. to DIN 527	40 n/mm²
Ultimate elongation acc. to DIN 527	320 %
Young´s modulus at 20°C acc. to DIN 53328	450 N/m²
Tolerance inner diameter	+ 0,3 / - 0 mm
Tolerance outer diameter	+ 0,3 / - 0 mm
Tolerance wall thickness	+ 0,2 / - 0 mm
Ovality	max. 0,35 mm

Pressure drop chart (T = 40 °C, wall roughness ε = 0.007 mm)



Forms of delivery

Length in m	area m² in the RIVIERA System	Article number
250	ca. 21,19	WHR1213250

Storage

Material is indefinitely storable with dry and UV-protected storage.

Yield

Given lengths relate to the narrowest possible installation for the RIVIERA system. In practice the installation is based on the calculated length of the pipe and local conditions. For a low heating load installation is possible into every second or third groove to achieve an even heat emission.

Application

Flexible pipe for installation into the ArgillaTherm RIVIERA system panel. Install into the continuous groove in a meandering shape. Caution! Should incorrect handling cause a kink, pipe must be replaced! Press the pipe into the inversion in opposite installation direction at every turn. Subsequently coat with the ArgillaTherm clay final plaster.

Please refer to the RIVIERA system instruction manual for more precise processing directions.

System products

ArgillaTherm clay- dry construction board RIVIERA System

Dry construction board as mounting aid for flexible water-bearing pipe.

ArgillaTherm clay final plaster No. 1-2

Machinable clay plaster ready-mix acc. to DIN 18947.

ArgillaTherm clay finish plaster No. 2-2

Ready-mix for preparation of white thin layer coating according to DVL TM 06.

ArgillaTherm clay paint No. 3-2

Sprayable and brushable clay paint.

Thermostat AT-3R

Thermostat according to DIN EN 60730, protection class II, for finery or flush mounting.

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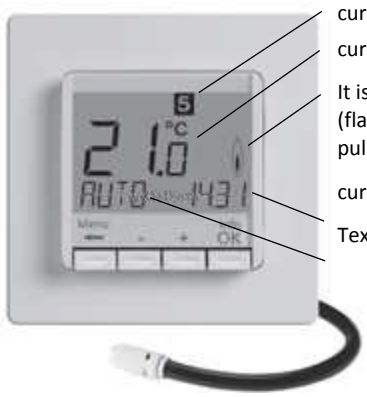
Thermostat AT-3R

According to DIN EN 60730, protection grade II

For finery or flush mounting for heating/cooling



Characteristics

The VDE-certified, programmable thermostat AT-3R by ArgillaTherm® is perfectly suited for the regulation of the low-temperature- ceiling/wall heating system RIVIERA. The indoor temperature only plays a minor role, since heat transfer takes place through an almost 100% proportion of thermal waves (radiation heat). The temperature is regulated depending on the ceiling temperature, measured by the remote sensor. Thus, possible external influences like draft cannot have a negative effect on the regulation behaviour. The regulator can be positioned all around the room or even outside of it.

- ✓ Single-lined text display for simplified usage
- ✓ Background lighting
- ✓ Real time clock (setting of year, month, day, time)
- ✓ Automatic summer7 wintertime changeover
- ✓ Max. 9 switching times per day (various per day)
- ✓ Pre-set and adjustable time programmes
- ✓ Optimal-start (temperature is achieved at set time)
- ✓ Relay changeover (for use in combination with a distributor strip heating/cooling EV 230 H/K..)
- ✓ Programmable with removed control panel
- ✓ Vacation function with date (vacation from…to)
- ✓ Short term timer (party) for temporary change of temperature
- ✓ Antifreeze
- ✓ Adjustment range terminable
- ✓ Safeguard for unauthorized parties
- ✓ Operating language adjustable
- ✓ Control method PWM or 2-Point (on/off)
- ✓ Minimal on- or. Switch-off time and hysteresis of output adjustable, for on/off regulation
- ✓ Valve protection
- ✓ Adjustment to valve opened/closed currentless

Key figures (according to DIN required values in brackets)

Power supply	230 V AC 50 HZ (195…253V)
Selectable temperature range	5 °C to 40 °C; in 0,5 °C steps
Display temperature range	0,1 °C steps
Output	relay change-over, non-floating
Switching current	heating: 10 mA... 5(2) A; 230 V~ cooling: 10 mA... 1(1) A; 230 V~
Output signal	PWM or 2-point (on/off)
PWM-cycle period	adjustable
Hysteresis	adjustable (for 2-points)
Minimal switching times	10 minutes
Power consumption	~ 1,2 W
Rate precision	< 4 min / year
Power reserve	~ 10 years
Remote sensor	AT-F100-1, length 4 m, extendable to 50 m
Ambient temperature	operation 0 °C to 40 °C (without condensation)
Storage	-20 °C to 70 °C (without condensation)
Impulse voltage for calculation	4 kV
EMV-emisson interferance testing	230 V voltage, 0,1 A power
Protection type	IP 30
Protection grade	II
Software grade	A
Pollution grade	2
°C for ball pressure testing	75 ± 2 °C
Energy grade*	IV = 2%
Measurements	Control panel 50 x 50 mm Blind frame 80,5 x 80,5 mm Installation depth 42 mm Coating thickness 17,5 mm Remote sensor head 20 mm x Ø 8 mm

* nach EU 811/2013, 812/2013, 813/2013, 814/2013

Forms of delivery

Box / 1 piece	Content	Article number
11,5 x 10 x 6,5 cm Weight: 280g	1 piece thermostat 1 privacy shade 2 screws 15 x 2 mm 1 remote sensor, 4m long 1 instruction manual	ZAT3RR000

Assembly

The device should only be opened by an electrician and installed according to the circuit diagram or instruction manual in the case cover. Herefore all safety regulations must be complied by. To meet protection grade II requirements, according installation measures must be undertaken. Installation only to non-conductive (synthetic-) flush-mounted boxes!
For cooling demands use ArgillaTherm® terminal strip 230V .
For solid and flexible conductors, transverse section 1 to 2,5 mm².
For flush mounting; use Gira case GIR AP-case 1f.rws-g 006103.

Remote sensor

Remote sensor (caution voltage! Extendable with 2-wired conduction for 230 V to approx. 50 m) in a way that it can record the ceiling temperature correctly. Avoid close parallel guidance with mains lead, e.g. in the cable duct. Dismantling of wires max. 8 mm.

Placement for RIVIERA System: Place white sensor head 2cm away from closest return pipe and not within close reach of flow!

Resistance chart remote sensor

Temperature	Resistance
10°C	66,8 kΩ
20°C	41,3 kΩ
25°C	33,0 kΩ
30°C	26,3 kΩ
40°C	17,0 kΩ
50°C	11,3 kΩ

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Thermostat AT-R1W

According to DIN EN 60730, protection class II

For finery mounting for heating/cooling

Properties

The analogue thermostat AT-R1W by ArgillaTherm® is perfectly suited for the regulation of the low temperature ceiling/wall heating system RIVIERA. As the heat is transfered almost completely by heat waves (radiant heat), room temperature is of minor importance. The temperature is regulated depending on the ceiling temperature, measured by a remote sensor. Therefore effects such as draft cannot have a negative influence on the regulation performance. The thermostat can be positioned anywhere indoor or even outside.

- ✓ Analogue temperature regulation by turning knob, range 5…40°C
- ✓ relay changer (for use in conjunction with manifold heating/ cooling EV 230 H/K)
- ✓ PWM mouth
- ✓ Heater switch (stand by, regulator stays on voltage, load is switched off)

Characteristics (DIN required figures in brackets)

Voltage feed	230 V AC 50 HZ (195…253V)
selectable temperature range	5 °C bis 40 °C
mouth	relay changer, bound potential!!!
Switching current	heating: 10 mA... 5(2) A; 230 V~ cooling: 10 mA... 1(1) A; 230 V~ equal to heating 5(2) possible
Output signal	Proportional controller (PI) (continous-like by PWM)
Heating switch on/off	1-terminal
Input at	~ 0,5 W

Heating switch = off	
Remote sensor	AT-F100-1, length 4 m, capable of being extended up to 50 m
Ambient temperature	In operation 0 °C bis 40 °C (without dew)
storage	-20 °C bis 70 °C (without dew)
Impulse voltage for design	4 kV
EMV-conducted emission check	230 V voltage, 0,1 A current
IP code	IP 30
Appliance class	II (see assembly)
Software class	A
Rate of pollution	2
°C for ball indentation test	75 ± 2 °C
Energy class*	1 = 1 %
size	Thermostat: 75 x 75 x 25,5 mm Remote sensor: 20 mm x Ø 9 mm
weight	90g

* acc. EU 811/2013, 812/2013, 813/2013, 814/2013

Packages

box / 1 piece	content	Article no.
11,5 x 10 x 6,5 cm weight: 280g	1 off thermostat 2 off screw 15 x 2 mm 1 off remote sensor, 4m long 1 off manual	ZATR1W000

Assembly

Electricians only are allowed to open the thermostat which must be installed in accordance with the circuit diagram shown in the housing cover and assembly instructions, respectively. Existing safety instructions are to be followede for that matter. For meeting the requirements of appliance class II the appropriate measures of installation are to be taken.
At cooling need use ArgillaTherm® manifold 230V.
For massive and flexible conducting mediums, cross section 1 to 2,5 mm².

Remote sensor

Install remote sensor (Attention: supply voltage!), capable of being extended up to about 50m with 2-core wire for 230 V, in such a way that it can measure the ceiling temperature in a correct manner. Avoid close parallel laying with power lines, e.g. in a cable channel. Skinning of wires max. 8 mm.

Positioning for system RIVIERA: Place the white sensor head min. 2cm away from nearest return pipe and not close to the flow!

Resistance chart remote sensor

temperature	resistance
10°C	66,8 kΩ
20°C	41,3 kΩ
25°C	33,0 kΩ
30°C	26,3 kΩ
40°C	17,0 kΩ
50°C	11,3 kΩ

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No. 1-2

Clay final plaster

According to DIN 18947 (DE) – LPM 02 f – S II – 1,8

Characteristics

Clay final plaster is a machinable ready-mix and complies with all requirements of DIN 18947 (DE).

Composition

Construction clay, sand 0-2mm, Miscanthus fibres 0-10mm

Key figures (following DIN required data in brackets)

Plaster application thickness	5 mm / 15 mm (min./max.)
Particle size group, oversize grain size	0/1, < 2 mm
Gross density class	1,8 (DE)
Drying shrikage rate	2,2 % (≤ 3 %)
Strength class	SII (DE)
Compressive strength	3,2 N/mm² (≥ 3,0)
Flexural strength	1,1 N/mm² (≥ 1,0)
Adhesive strength	0,20 N/mm² (≥ 0,15)
Steam diffusion resistance	μ < 8
Construction material grade	A 1 (DE)
Thermal conductivity	1,30 W/mK
Abrasion	0,6 g (≤ 0,7)
Fibres	Miscanthus up to 10 mm
Steam sorption grade	WS III (DE)

Forms of delivery

Containers	Content	System reach	Article number
25 kg per bag	25 kg	1,2 m²	ZLOP120025
40 25 kg bags per euro pallet	1000 kg	48 m²	ZLOP121000

Storage

Material is indefinitely storable at dry storage.

Yield

25 kg clay final plaster amount to 16 l render mortar.

For use on the ArgillaTherm clay system panels according to instructions this amount is sufficient for approx. 1,2 m².

Addition of water

Add approx. 4 l of water to 25 kg clay final-plaster for use on the ArgillaTherm clay system panels. The given amount of water is to be adjusted to surface, processing type and application intensity by the processor and should be rather dry for overhead application.

Application

Single- or multiple layered plaster, for indoor areas, for manual and machinery application to the ArgillaTherm clay system construction panels, clay flush mounting, all types of masonry and other solid construction materials. Smaller amounts can be mixed manually or with a motorized mixer, for use of machines under addition of water with all customary free fall- and compulsory mixers or closed plastering machine systems (e.g. G4 and G5).

Mixing duration

Motorized mixer	5 minutes
Free fall mixer	10 minutes
Compulsory mixer	5 minutes

An extension of the mixing duration makes the plaster smoother and enhances adhesion.

Plaster surface

Surfaces must be solid, clean and free of film forming release agents and sufficiently rough and dry, since clay plaster only sticks mechanically. Older clay surfaces like the ArgillaTherm clay system construction panels must be watered well previously, for other surfaces previous watering is only needed in case of an extension of the processing times. Do not wet sand lime bricks.

Plaster application

Apply a 3-5mm layer of plaster forcefully to a previously wet surface of the ArgillaTherm clay system construction panels with a trowel and smoother, insert a suitable reinforcement fabric sufficiently overlapping and even the pushed through clay mass out with a 2-3 mm plaster coating. Urgently note: The overlapping of the mesh should not be directly over edges of system panels, at least 10cm away!

After drying, prepare the surface using a sponge float or a special felting machine for application of the ArgillaTherm clay colour Nr.3-2 in the surface quality Q2.

Open periods

If covered up the mixed clay final plaster stays ready for use for a few days. Water can be added at any time to achieve the desired consistency.

System products

ArgillaTherm clay dry construction board RIVIERA system

Dry construction board as mounting aid for the flexible water bearing pipe.

ArgillaTherm water bearing pipe RIVIERA System

Flexible, water bearing PB pipe (12 x 1,3mm) according to DIN 16968 (DE) for processing as a heating- and cooling instrument in the ArgillaTherm system panel RIVIERA, oxygen tight according to DIN 4726 (DE).

ArgillaTherm clay finish plaster No. 2-2

Ready-mix for preparation of white thin layer coating according to DVL TM 06 (DE).

ArgillaTherm clay colour No. 3-2

Paint and sprayable clay colour.

Thermostat AT-3R

Thermostat according to DIN EN 60730, protection grade II, for flush and finery mounting for heating and cooling.

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No. 2-2

Clay finish-plaster

White thin layer coating following DVL TM 06

Properties

Clay colour plaster is a ready-mix for the preparation of a white thin layered plaster, following all requirements for thin layer coating according to DVL TM 06.

Composition

Grounded clay, sand 0-1mm, marble powder, cellulose

Plaster coating thickness	1 mm / 3 mm (min./max.)
Particle size group, oversize grain size	0/1, ≤ 1 mm
Gross density class	1,5
Drying shrinkage rate	1,3 %
Strength class	SII
Compressive strength	2,2 N/mm²
Flexural strength	1,1 N/mm²
Adhesive strength	0,2 N/mm²
Steam diffusion resistance	μ < 8
Construction material grade	A 1
Thermal conductivity	1,40 W/mK
Steam sorption grade	WS III

Forms of delivery

Packages	Content	System reach	Article number
25 kg per bag	25 kg	6-7 m²	ZFIP220025
40 25 kg bags per euro pallet	1000 kg	240-280 m²	ZFIP221000

Storage

Material is indefinitely storable at dry storage.

Yield

25 kg of clay colour plaster amount to approx. 17 l plaster mass.

For use on top of the ArgillaTherm clay final plaster according to instructions this amount is sufficient for approx. 6-7 m².

Addition of water

For 25 kg clay colour plaster, take approx. 5 l of water for use on the clay final plaster.

The given amount of water needs to be adjusted to surface, processing type and application intensity by the processor and should be rather dry for overhead application.

Application

Thin layered plaster colour for indoor areas, manual application to the ArgillaTherm clay final plaster, clay flush mounting, all types of masonry and other solid construction materials. Use a motorized mixer and add water little by little, until the desired mortar consistency is achieved. Soak for 30 minutes. Subsequently stir thoroughly and if needed, add small amounts of water to make it more liquid.

Plaster surface

The plastering surface must be dry, solid, free of film-forming release agents, sufficiently rough and even. Generally, a paintable surface quality of Q2 is required.

Plaster application

The clay plaster colour is applied evenly using a stainless-steel straightener. As soon as it has dried leather-hard, the surface is rubbed and levelled out with a sponge float. Moisten once again to refine the surface structure, with a spray bottle and rubbed finely with a sponge float. For a uniform appearance, the application of the ArgillaTherm clay finish plaster should be completed using one mixture on the entire surface on a single working day.

Open periods

Prepared mixtures should be used up within three days. To achieve a suitable consistency, water can be added at any time.

System products

ArgillaTherm clay dry construction panel RIVIERA System

Dry construction board as mounting aid for flexible water bearing pipe.

ArgillaTherm water bearing pipe RIVIERA System

Flexible, water bearing PB-pipe (12 x 1,3mm) according to DIN 16968 for processing as heating and cooling instrument in the ArgillaTherm RIVIERA system panels, impermeable to oxygen according to DIN 4726.

ArgillaTherm clay final plaster No. 1-2

Machinable clay plaster and ready-mix according to DIN 18947.

ArgillaTherm clay colour No. 3-2

Sprayable and brushable clay paint

Thermostat AT-3R

Thermostat according to DIN EN 60730, protection grade II, for finery and flush mounting for heating/cooling.

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standard assembly times of ArgillaTherm clay system ceiling

ground	minutes/m²
fixing of ESBplus/ OSB-panel onto concrete ceiling by means of frame or nail plugs	20
assembly of ESBplus/OSB-panels onto wood construction	15

system RIVIERA	minutes/m²
assembly of clay system panel onto OSB/ ESB incl. insulation strip	15
assembly of compensating plate onto OSB/ ESB incl. insulation strip	10
laying of heating pipe (maximum configuration 10 running metres per m²) incl. installation of ceiling sensor	13
application of plaster to refill the grooves of clay construction panels	7
application of clay finish plaster incorporating reinforcement fabric, finely grated, surface Q2, ready for application	40
Application of 2 layers of clay paint onto clay finish plaster	8

Specified figures refer to normal sized, rectangular rooms of approximately 20 m², are based on our up-to-date technical experiences and make up for rough calculation. Actual figures can significantly vary according to actual structural conditions.

ArgillaTherm
Natürliche Wärme aus Lehm

Test heating record sheet according to DIN EN 1264-4

Client _____

building/ estate _____

phase of construction/ floor/apartment _____

facility component _____

Specification:
The test heating is to be carried out as a functional check following DIN EN 1264-after complete drying of the clay upper plaster with incorporated scrim and before final surface finishing.
A flow temperature between 20°C and 25°C is to be kept for at least 3 days and thereafter the maximum design temperature for at least 1 day.
Application of final surface finish after cooling of the system!

Documentation

Type of heat distribution layer clay system construction panels and clay plaster

End of plaster works _____

Start of test heating (flow 25°C) _____

start of test heating (max. flow temperature) _____

End of test heating _____

Confirmation

_____	_____	_____
place, date	place, date	place, date
_____	_____	_____
Client stamp/signature	construction manager/architect stamp/signature	heating installer stamp/signature

ArgillaTherm®
Natürliche Wärme aus Lehm

test for leaks record sheet according to DIN EN 1264-4

client _____

building/ estate _____

phase of construction/_____floor/apartment

facility component-

_____

Specification

Die pressure test is carried out following DIN EN 1264-4 and VOB 18380.
The tightness of the heating/cooling circuits of the surface heater/cooler is checked by a hydraulic pressure test after drying o the levelling clay layer and before application of the clay upper plaster with incorporated scrim. The test pressure amounts to,minimum of 4bar and maximum of 6bar, notwithstanding the VOB specification of about double operating pressure, This pressure must remain during application of clay upper plaster.
The test for leaks is carried out after rinsing and bleeding oft he individual heating circuits.OIther facility components must be protected against high
Alternativly the test for leaks can be carried out by compressed air (max. 4 bar).

documentation

maximum allowable operating pressure	6 bar
test pressure - water	_____ (min. 4 bar, max. 6 bar)
test pressure - air	_____ (min. 3 bar, max. 4 bar)
test duration	_____ h

No pressure loss occured during test. All components are without plastic deformations.

confirmation

_____	_____	_____
place, date	place, date	place, date
_____	_____	_____
client/Bauherr stamp/signature	construction manager/architect stamp/signature	heating installer stamp/signature

ArgillaTherm®
Natürliche Wärme aus Lehm

Recommended retail prices

System products

System products	Art.-Number	UVP Without VAT. Per unit	images
ArgillaTherm clay system panel RIVIERA W11.8 with pressfitted glas-silk mesh, measurements: 375 x 375 x 25mm	WSBP000001	55,50€/m²	
ArgillaTherm clay system compensation plate, bulk density approx. 620Kg/m³, 750 x 750 x 25mm	ZLBP757525	27,50€/m²	
ArgillaTherm clay finish plaster Nr.1-2 according to DIN 18947, dry 1,2m² ceiling- or wall surface	ZLOP120025	9,95€/bag	
ArgillaTherm® clay-color Nr. 3-1 spray- and paintable ready-mix for 35m² ceiling or wall surface, pure white	ZLFA310010	49,50€/bucket	
Wood fiber edge insulation strips, size: 50 x 10mm, roll with 10m	ZRDS501000	7,95€/roll	
Glass silk mesh, MW 7 x 7mm, 105g/m², 100cm wide, roll with 100m	ZGSGG77000	89,50€/roll	
Stainless-steel load distributors for mounting the clay system panels, 5 x 50mm, 100 pieces per box	ZLTE055100	19,50€/box	
Stainless-steel load distributors countersunk multi head screws T-Star Plus T20 with partial thread 5 x 45mm, 200 pieces per box	ZETS054500	22,50€/box	

Heating technology

Heating technology	Art.-Number	UVP Without VAT. per unit	images
ArgillaTherm® electronic ceiling/wall- temperature-regulator AT-3R, 5….40°C, heating/cooling including 4m remote sensor	ZAT3RR000	89,50€/pcs.	
ArgillaTherm® analog ceiling/wall-temperature regulator AT-R1W, 5….40°C, heating/cooling including 4m remote sensor	ZATR1W000	64,50€/pcs.	
ArgillaTherm® three-layered polybutene pipe according to DIN 16968, PB 12 x 1,3 mm, oxygen tightness according to DIN 4726	WHR1213250	169,50€/roll	
Compression fitting for HK-distributors ¾“euro cone on PB-pipe 12x1,3mm	WKRV341200	4,90€/pair	
Pipe-span arch 90° with 2 lugs for pipes with outer perimeter 10-16mm	ZRSB901017	0,99€/**pcs.**	
ArgillaTherm® electrothermic actuator 230V, 2,5 watts power consumption, 4,5mm stroke, currentless closed.	ZSATS51001	13,50€/**pcs.**	
ArgillaTherm® terminal strip 230V, 6 channel, heating/cooling/input, humidity sensor	ZKL6K0000	129,50€/pcs..	
ArgillaTherm® dew sensor with 10m connection cable for terminal strip ZKL6K0000	ZKL6KTS000	22,50€/pcs.	
ArgillaTherm® terminal strip 230V, 6 channel without additional functions	ZKL6K0815	72,50€/pcs.	

Frequently asked questions

Ceiling heating, doesn't that mean the heat stays under the ceiling? How does the heat get inside the room?

Surely you have asked yourself how heat from the sun millions of kilometers away reaches the earth and why heat from a tiled fireplace is so cozy. The answer is „thermal radiation ". That´s exactly how a ceiling heater works! Heat is transferred by thermal waves and not by the air. Since there is no convection, no warm air can ascend.

Does a ceiling heater give me a hot head?

No, with modern low-temperature ceiling heaters the ceilings radiation temperature measures a maximum of 29°C. The human head usually has a surface temperature (not body temperature) of 32°C. As a result, the head remains comfortably cool.

Isn't it uncomfortable, with a warm ceiling and cold floors and walls in winter?

No, thermal waves strike the floor and solid surfaces directly without a loss of energy and heat them up in a very short amount of time. They are reflected from here meaning they pursue as indirect thermal waves (secondary radiation). The ground temperature under a table remains almost the same because of this. Since the thermal waves originate from the ceiling they strike the floor opposite from it most intensely, heating it up rapidly almost reaching the same surface temperatures. Underfloor heating usually takes an entire day for this.

Example for -10°C outdoor temperature, good insulation:

Temperature ceiling surface temperature = 26°C

Temperature wall surfaces (interior) = 23°C

Temperature wall surfaces (exterior) = 22°C

Temperature floor surface = 23°C

Perceived indoor (air) temperature = 23°C

Does it take long until I can feel the ceiling heating?

No, because only 5mm of the heating pipe is coated with a well conducting clay plaster and the system design prevents a warming up of the masonry (core activation), so heat is emitted into the room quickly.

Why does ceiling heating save energy?

Heat transition by thermal waves is the most effective and economical form of heating, since no heat is lost during transportation and radiation heat is perceived as being 3 °C warmer in comparison to convection heat. This saves about 20% of energy!!

The proportion of radiation heat of ceiling heating is at about 98% clearly the highest (underfloor heating is at only 50%, wall heaters at about 70%)

With ceiling heating (highest heat point) no energy in the form of circulating air (convection) can be deprived, which then ascends and is lost with ventilation or through leaky windows, doors or masonrys. Since the indoor temperature can be adjusted to 2-3°C lower than convection heating, heat losses through inner building envelopes are reduced. This saves additional energy!

What does low-temperature mean?

Low temperature heating only works on large surfaces. We know underfloor, wall and ceiling heaters with flow system temperatures of around 30°- 35°C. The advantage of this lies in its heat symmetry and the resulting comfort of this. The lower surface or radiation temperatures are, the better the heat symmetry (almost all around even temperatures) and feeling of comfort! The smaller the heating surfaces become e.g. with infrared heating in form of pictures, mirrors or panels, the higher the surface and radiation temperatures (mostly around 100°C). This impairs heat symmetry- and comfort levels.

Why is the ArgillaTherm® clay ceiling heater so commercial?

Besides savings through the transition of heat by thermal waves there are three further special advantages with saving energy:

1. The use of the construction material clay. The highly dense clay is an excellent heat storage, that saves the heat developed in the room, stores it and emits it during the evening hours in form of radiation heat. Hereby heating periods can be reduced by up to two months.
2. The extremely low differentiation between heating pipe- and celling surface temperature. The heating pipe is incorporated into a well conducting clay plaster and only has 5mm of it covered. So the differentiation of hot water and ceiling temperature is very low with only 2,5 Kelvin compared to other systems. Differences are measured in Kelvin, with one Kelvin corresponding to 1°C). 1°C lower flow temperature corresponding to 2,5% energy savings.
3. The system design prevents heat from travelling into the ceiling, which would lead to a masonry activation (underfloor heating). This usually leads to an unwanted inertia (long heating up and residual heating phases).

Can I use cheap and interruptible electrical heating rates (heating pump rates) without water buffer storage?

Yes, due to the clay structure.

The clay ceiling heater works according to the principles of layered heat. The heating pipe supplies the room with heat very quickly with its minimal coating. The clay layer of highly dense clay system panels above it, charges up with thermal energy during heating phases. This storage (approx. 25mm layer) is sufficient, to bypass switch-off intervals for cheap electrical heating rates of about one hour without a noticeable drop of temperature. After being switched back on the previous radiation temperature is reached within an extremely short time.

Is radiation heating dangerous?

No thermal radiation is the same as heat from a tiled fireplace, it's the healthiest existing form of heat transfer.

Why is clay being used?

Clay is a natural ecological construction material that hardens naturally by air drying and not through chemicals. This makes it completely recyclable at any time.

Clay is an excellent heat storage and a trustworthy regulator of indoor air humidity. It cools down the indoor air temperature by up to 8 °C in a natural way, absorbs pollutants, binds odors from the air and is antistatic.

To sum it up, you live healthier and more comfortable with clay!

Can I handle clay plaster meaning the surface in a normal way?

Yes, a clay surface can be handled just like any other plaster surface. Historical clay in timbered houses usually contains a balanced mixture of clay materials, supplements and fiber materials, which is why these surfaces are less tough. Nowadays clay plaster surfaces are comparable with gypsum or lime plaster.

Can I drill a whole into the ceiling (for a curtain rod or lamp) without damaging the heating pipe?

Yes, there are special thermal foils for this, which make heating tubes visible under the plaster. They work like a digital detection device.

GTC – general terms and conditions

Company ArgillaTherm® GmbH

Scope of application and conclusion of contract

The following terms and conditions apply for all transactions between the company ArgillaTherm® GmbH and its clients, that are entrepreneurs. According to these terms and conditions all natural/legal persons or joint partnerships with legal capacity, which execute their commercial or self-employed trades classify as entrepreneurs. The GTCs also apply for all prospective transactions between the company ArgillaTherm® GmbH and its aforementioned clients, insofar as a legal transaction of a similar nature is concerned. A clients' personal terms and conditions are hereby expressively contradicted. This also applies for prospective transactions. Accordingly, the ArgillaTherm® GmbH general terms and conditions apply. This also applies, if the client refers to alternative general terms and conditions in a written communication. Divergent or alternative terms shall only apply if they are expressively confirmed by us in writing. Such deviations shall only apply for the transactions, for which they have agreed. By placing an order the buyer makes a binding commitment that he wishes to acquire the ordered product. The customer is bound to his order for a duration of four weeks, calculated from the receipt of the order by the company of ArgillaTherm® GmbH. An extra confirmation of the receipt of the order doesn't take place even for orders in the electronic media sector. The conclusion of a contract takes place subject to our subcontractors supplying a correct and punctual delivery. This only applies should ArgillaTherm® be responsible for the non-delivery, particularly for a conclusion of a similar covering transaction with our suppliers. The customer shall be informed without delay about the unavailability of the service. Services or payments that have already been made will be reimbursed.

Offer

Our offers are non-binding, unless divergent or alternative agreements have been made. It is possible that technical progress, product modification or modification of operational procedures in the production by our subcontractors, may result in technical modifications in products supplied by us. If this only concerns a minor technical modification to the product supplied by us, such modifications remain reserved. Suggestions, information or recommendations by ArgillaTherm® or our employees are only binding through a written confirmation. Due to the diversity of applications, structural situations and installation conditions, not all varieties can be checked previously. Furthermore, delivered products interact with a variety of different construction materials and components. Our information shall not release contractual partners from the obligation to check themselves and enquire about each individual application and installation site of the supplied and/or requested products, to check the long-term operability of the products in terms of each application purpose and to take due care, possibly also by means of a prior test assembly, to make sure of the designated function during assembly and in the subsequent mounted state. Binding orders received by ArgillaTherm® GmbH employees, verbally, through electronic data transmission, per fax or written, shall be deemed accepted only if the order has been confirmed by us in writing.

Prices

Arranged prices apply in Euros and shall apply netto from our base in Göttingen, without installation or other fringe benefits. Additionally, delivery, transportation- or packaging charges as well as sales taxes from the time of accounting like export taxes apply. For reorders, prices from the original order shall only apply in case of a separate agreement. Where the parties have not come to any agreement on the remuneration for a service ArgillaTherm® GmbH and where, given the circumstances, the customer can only expect the rendering of that service in exchange for remuneration, the customer must pay the usual remuneration for this service. When in doubt ArgillaTherm® price lists and remuneration rates requested from us shall apply as usual.

Unless an explicit fixed price agreement has been made, we shall reserve the right, due to altered wage, material or sales costs, to make appropriate price increases to those deliveries made two months or more after conclusion of the contract. With on-demand orders this period shall be calculated between the time when the order is placed and when the goods are called up. Any bulk discount or any other discount accepted by us shall be valid for a maximum duration of one month after acceptance, unless otherwise agreed upon with the buyer in writing.

Delivery

We endeavor to meet the delivery times and/or dates and services indicated by us. Without relevant written guarantee, our indications are non-binding. They shall also be subject to us receiving our supplies from our suppliers on time, in sufficient quantities and in the proper fashion. Changes to orders shall lead to agreed dates and deadlines being lifted, unless a new schedule has been accepted in writing. This shall also apply where changes to orders are withdrawn again. The customer shall be responsible for costs incurred by the change request. Delivery and service periods will be appropriately extended in cases of force majeure and of all other circumstances which are beyond our control. The goods shall also be deemed delivered, even if they are not immediately called upon, 14 days at the latest, after we report shipping readiness. Should delivery be delayed for reasons for which the customer is responsible, he will be charged with the resulting storage expenses by ArgillaTherm® or third parties, starting 14 days after the notification of shipping readiness. At the same time the stock risk is transferred to the buyer.

After the unsuccessful expiry of an appropriate grace period, we are entitled to dispose of the goods in other ways and to supply the customer after an appropriately extended deadline. Should the buyer fail to accept the goods or provide a delivery address for longer than two weeks after notification, the company ArgillaTherm® GmbH, after previously setting a period of grace of 2 weeks of our choice, is entitled to withdraw from the contract or demand compensation instead of performance in the amount of 25% of the agreed price of the goods, plus relevant valid VAT´s. The delivery shall be carried out after the best judgement and without guarantee of the cheapest or quickest shipment. Unless otherwise agreed, the goods will be dispatched uninsured. The risk of conveyance will be passed over to the customer with delivery of the goods to the forwarder or carrier. We deliver in usual packaging; required special packaging charges shall be borne by the buyer. Takeback and remuneration of packaging takes place only after a separate written agreement. We shall be entitled, yet not obligated to insure goods on account of the customer. Freight and free shipments are made only after a separate written agreement. Individual agreements remain unaffected by the aforementioned provision. A condition for prices with the freight prepaid is an unhindered traffic flow. Six weeks after expiry of a non-binding delivery date or non-binding delivery period,

the buyer can ask the company ArgillaTherm® GmbH, to deliver within a suitable period. With this reminder, the company ArgillaTherm® GmbH is in arrears. The buyer can demand compensation due to damage resulting from the delay. At the end of the extension the buyer is entitled to withdraw from the contract by means of a written declaration or demand compensation instead of performance. The buyer can only demand compensation if the company ArgillaTherm® GmbH is guilty of intent or gross negligence. The buyer must prove
the existence and extent of the damage. The same shall apply to wasted expenses. Liability shall

be limited to the amount of the purchase price. Compensation for damages instead of performances shall be ruled out in cases where a performance obligation is excluded (impossibility). The company ArgillaTherm® GmbH is entitled to make partial deliveries. They shall be deemed to be independent deliveries and may be charged separately as such. Delivery free building site or free warehouse is restricted to deliveries without unloading and subject to an access road fit for heavy goods vehicles being available. The unloading must be done promptly and properly by the customer. Even a delivery date declared as non-binding is not a valid fixed date, unless previously expressively agreed upon in a written declaration. Financial statements with agreed partial deliveries (call-orders) shall oblige the customer to accept partial deliveries in roughly equal monthly rates, if no deviant agreements have been made.

Maturity date and payment

The company ArgillaTherm® GmbH shall be entitled to assign the claims arising from the business associations.
All payments with debt discharging effect are to be made to the mentioned bank account of the company ArgillaTherm® GmbH. The reserved property of the ArgillaTherm® GmbH company only expires after full settlement of the invoiced amount. Payments-for invoices-must be made strictly net without deductions within 30 days after delivery and date of invoice. Should the so-called term of payment of 30 days be exceeded, an interest of 9 % p. a. above the relevant base interest rate is to be payed for the open debt according to § 288 Abs.2 BGB. The company ArgillaTherm® GmbH reserves the express right to claim for further damages caused by delayed performance, according to applicable legal provisions. The expectance of cheques will in any case only be made as a matter of fulfillment, meaning payments shall only be deemed as completed, when the according sum has been transferred to our accounts irrevocably. If cheques are not credited by the drawee on the due date, all other existing claims shall also become due for immediate payment. If the buyer does not comply with his payment obligations or his commitments deriving from the retention of title or does not meet payment obligations punctually, the entire residual debt -including deferred claims- is due immediately. Offsetting by the customer due to his own claims to payments is excluded unless they are undisputable or legally binding. The enforcement of retention of title rights by the customer is excluded, unless it refers to the same contractual relationship or counter claims are undisputable or legally binding. Change of ownership of the company, of the customer or any other changes concerning the economic situation as well as any changes of address must be reported to us immediately in writing. They entitle us to demand immediate enforcement of payment or security because of due or deferred claims arising from any existing transitions, refuse further contractual services, withdraw from the contract or demand compensation fees instead of performance. In case of a cheque protest, lack of credibility can be accepted without further ado.

Complaints, warranty, liability

The buyer must report all noticeable false deliveries, defects, failures or the lack of warranted characteristics immediately, within a maximum of 3 days after delivery, in any case however before resale, use, processing, joining, mixing or installation, in writing. The buyer must check of our products before installation.
The buyer must report hidden lacks immediately after their discovery in writing. If the buyer does not fulfill this obligation, the merchandise shall be deemed approved. Warranty claims are then excluded to this extent. The same obligations affect the buyer, where the defects relating to the products supplied by the company ArgillaTherm® GmbH, or consequential damage caused by these products are recognized only after they have been installed or put into operation. The company ArgillaTherm® GmbH must always be given enough time and opportunity to inspect the defect or damage and visualize the cause of the damage, perform postmortem samples, even if long-term, physical, chemical or operational investigations and analyses are required. This equally applies if the company ArgillaTherm® GmbH commissions non-commercial experts or appraisers with these investigations, or wishes to undertake such services during liability obligation executions of the product liability insurance company of the business. No further modifications are to be made to faulty products or involved constructions before a visual inspection/evaluation. If the customer does not fulfill this obligation, the company ArgillaTherm® shall be liberated from any liability or warranty, in so far as the modification did not verifiably have an effect on the extent of the defect/damage, or its determination. Where the emergence of damage was contributed to by a technical, executional or planning error on the part of a customer or a third party, ArgillaTherm® GmbH shall be liable for the damage- irrespective of any other liability limitations - where this damage can be proven to have been caused by the defectiveness of the supplied product. This shall apply equally for improper and/or atypical handling or load on the product during use. The company ArgillaTherm® GmbH supplies products and systems for specialist retailers as well as for trained professional workers. It is assumed the ordering party and/or installer is familiar with, and knows how to use, the relevant rules of the business, standards and guidelines, knows the materials used and their properties and will install them appropriately in the correct technical fashion. Further-reaching special information on the products and their application exist in printed form and on the ArgillaTherm® website and can, if unavailable, be requested or consulted on request prior to ordering and realisation. We shall not be held liable for deployment of the products that deviates from those we describe or offer nor shall we will be held responsible for improper use of the products. In the event of a defect of ArgillaTherm® it shall only be permitted to return the goods to us with our approval. We shall not be obliged to accept returns sent without our approval. In this case the buyer shall bear the costs for their return. Where supplementary performance in the form of a new delivery takes place due to a complaint, the provisions on delivery shall apply accordingly. Where the defect is to be remedied through reworking, we shall be granted a period of three weeks in which to do this. On presentation of a defect, the buyer can initially demand supplementary performance. The right to choose whether a new item is to be delivered or the defect is to be remedied shall be taken by the company ArgillaTherm® GmbH at its own discretion. Only when subsequent performance fails twice shall the buyer be entitled to withdraw from the contract and or to reduce the purchasing price. With claims that go beyond the mere provision or reworking of products because other connecting building materials and building components are damaged, liability shall be limited to the measures required to restore the usual/former state of the product based on the version and suitable to the previous period of usage. Only when subsequent performance fails twice shall the buyer be entitled to withdraw from the contract and or to reduce

the purchasing price. With claims that go beyond the mere provision or reworking of products because other connecting building materials and building components are damaged, liability shall be limited to the measures required to restore the usual/former state of the product based on the version and suitable to the previous period of usage. ArgillaTherm is only liable for the damage by supplied products or information in the extent, as would have been achieved in case of an immediate notification, an investigation of cause, a repair or recreation. ArgillaTherm haftet nur in dem Umfang für Schäden aus gelieferten Produkten und Auskünften, wie dies unter Berücksichtigung einer schleunigen Bekanntmachung, Ursachenforschung, Reparatur oder Neuschaffung erreicht worden wäre. Liability is not accepted beyond the original degree of damage, for damage that increased as a result of temporal delay or failure of attendance. The right to withdraw from the contract shall not apply where the goods were manufactured according to special requests and specifications of the buyer or where a special order is involved with goods not usually stored at the warehouse or with goods clearly tailored for the personal needs of the buyer. The same shall apply once the properly delivered goods have been used. For products changed, modified or re-produced according to customer wishes we shall only guarantee that these products meet those specifications given to us, in a regular and suitable fashion. No warranty is given for operational- functional safety or possibility. Our collaboration in planning and consultations for design, installation and functionalities of the product are generally to be understood as an assistance only, without any claim to their correctness and to a full or partial extent of researched/reconsidered services. Special orders are orders of our products that are not expressively mentioned in our price lists by type, size, and design. These may vary from the ones in price lists conditional of manufacturing, other in print media and website existing seemingly similar products in the use of materials, and/or in the composition and/or size. We reserve the right of deviations, since they are conditional of manufacturing and conform with common functionalities, uses and ways of installation. Generally, it is to be assumed that special orders for installation or uses, require special work preparations, high expenditure of time and special planning before and after execution. The company ArgillaTherm® GmbH shall be liable for damages only in case of malice or gross negligence; it shall be liable for ordinary negligence only in the following cases: - In the case of fatal injury, bodily harm or negative health effects, - In the case of violation of obligations – whose fulfilment actually makes proper performance of the contract at all possible and on whose observation the customer can therefore depend – or in the case of violation of such customer rights the contract especially has to grant to the customer according to its content and purpose (so-called ‘cardinal duties’). The preceding limitations of liability apply also for the benefit of our legal representatives, leading employees as well as for our performing and vicarious agents even for their possible, immediate utilisation. It shall not be possible to transfer warranty rights to third parties. Should we be entitled to claim compensation instead of payment pursuant to § 281 of the German Civil Code (BGB) our claim to performance shall only then expire at variance with § 281 Section 4 of the German Civil Code (BGB) when compensation has actually been paid by the buyer/ordering party.

Title Retention

We shall retain title on the goods delivered by us until such time as the buyer has settled all claims arising from the commercial transaction with us, in particular until such time as the balance has been settled. In the event of the buyer acting in violation of the contract, in particular in the event of payment default, we shall be entitled to take back the delivery item; the buyer is obliged to surrender it. The act of taking back the delivery item shall not constitute cancellation of the contract unless we have explicitly declared cancellation in writing. In the event of seizure or other third party interventions the buyer shall inform us of these forthwith in writing so that we may take legal action pursuant to § 771 of the Code of Civil Procedure (ZPO). Unless the third party is obliged or able to refund us the judicial and extra-judicial costs arising from the action pursuant to § 771 of the Code of Civil Procedure (ZPO), the buyer shall be liable for the loss we have incurred through this. The buyer shall store and label our goods subject to retention of title. The buyer shall be entitled to have access to the delivered goods as part of proper business practice, specifically to install or sell them. In so doing the buyer is obliged to indicate title retention to his customers in writing. However, the buyer's entitlement shall cease should he fall into arrears with payment commitments. In this case, the buyer must give us the documents and information necessary to collect payment. Extraordinary injunctions, such as pledges or assignments as a security, shall only be operative with our express written approval. The buyer must immediately make notification of third party access to those goods subject to retention of title. In the event of execution, the ordering parties must immediately transmit a copy of the execution record to us and any solemn assurances that our retention of title on the seized item remains intact. The buyer shall be entitled to collect claims from resale until such time as we revoke this, which is permissible at any time. The buyer shall already now transfer all claims along with all secondary rights and securities to the company ArgillaTherm® GmbH, until outstanding claims have been settled, that buyer is entitled to from future sales, processing etc. of the goods supplied by the company ArgillaTherm® GmbH in respect of his customers, namely those amounting to the invoiced sum plus 20%, as well as any of his own claims for surrender from goods subject to retained title. The buyers processing or transformation of the delivery item shall not affect our title on that item. Where our goods subject to retention of title are processed, mixed or joined with items not belonging to us or used to produce a new item through transformation, the buyer shall hereby transfer to us collateral on our claims a proportion (of the invoiced amount) of their title (joint) ownership of the new item. Where the delivery item is inseparably joined to other items not belonging to us and where this extraneous item shall be regarded as a main item it shall be agreed that the buyer transfers to us a proportion of the joint ownership rights. The buyer shall hold trust in the sole or joint ownership rights so that any claims arising from this against the company ArgillaTherm® GmbH can be repudiated. Where the goods subject to retention of title are used by the buyer to fulfil a contract for services or for labour materials, the claims from the contract for services or labour and materials shall be assigned to us to the same extent as laid down in sections 4 and 5. We shall undertake to release the collateral to which we are entitled at the buyers request to the extent that the value of our collateral exceeds by more than 20% the claim to be safeguarded. The buyer shall undertake to insure the goods subject to retention of title at the buyers own cost against fire, water, theft and burglary. The rights ensuing from this insurance are then transferred to us. We accept this assignment. Cancellation of the contract is not required to assert rights under retention of title unless the debitor is a consumer.

Place of Jurisdiction and Performance

The place of performance for payments and deliveries as well as for all other claims is Göttingen.
The place of jurisdiction is Göttingen, including for matters concerning bills of exchange and cheques as well as for causes of action not relating to the contract but that concur with those of the contract. We shall, however, be entitled to also assert our claims at any other legally established place of jurisdiction. This shall also apply if the buyer establishes his domicile or usual place of residence outside the German Federal Republic or the domicile or usual place of residence of the buyer is not known at the time when proceedings are instituted.

Data Protection

The data necessary for business purposes shall be stored by the company ArgillaTherm® GmbH. As part of the credit analysis we perform credit rating data exchange with companies who issue credit information, taking into consideration their interests worthy of protection in line with legal data protection provisions.
ArgillaTherm® GmbH vouches that all persons entrusted with executing the contract shall also heed these regulations. However, ArgillaTherm® GmbH points out that with online orders, due to the structure of the internet, violations of data protection by other persons over which ArgillaTherm® GmbH has no influence, may occur. ArgillaTherm® GmbH can therefore not be held liable for such violations. Insofar as information is downloaded from our website, this information may only be used for private purposes. Use going beyond this, particularly the sale of such content, is not permitted. All details and information stated as part of our online range are non-binding. Insofar as the content of our website is protected by the rights of third parties, ArgillaTherm® GmbH shall not be held liable for the use of such information. It shall be incumbent upon the customer to ensure in each case whether data is free from protection rights. Insofar as links are given to other websites, ArgillaTherm® GmbH shall not be liable for the content thereof and disclaims any and all liability for the content on such pages.

Miscellaneous

Should individual incidental provisions in contracts with our customers or in these General Terms of Business be or become fully or partially invalid of ineffective, this shall not otherwise affect the validity of the contracts or the General Terms of Business. The invalid provision should be replaced by a regulation, which comes as close as possible to fulfilling the commercial purpose which was intended with the invalid provisions. The law of the Federal Republic of Germany shall apply with the exception of the UN Convention on Contracts for the International Sale of Goods and German international private law. The official language of the contract is German.

Status of content: 01.08.2016
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Clay dry construction system TOSKANA

The patented electrical low-temperature ceiling heating system, fabricated in an industrial dry surface pressing process.

Easy montage in accordance with rules and standards. Energy saving, natural heat. healthy & comforting room climate.

1) **22mm ESB-Plus P5 oder OSB 3 plate with tongue and groove as substructure.**

2) **System construction panel, size: 375x375x25mm, according to DVL TM 07 (type A) for laying of electrical resistance cables**

3) **Electrical resistor cable, twin-conductor, VDE-approved according to DIN IEC 60800 (ed.3):2009-07, ready-made in five different length and capacities.**

4) **Clay upper plaster according to DIN 18947, thickness 3-5mm with incorporated scrim**

5) **Clay paint according to DVL TM 06 as sprayable and brushable ready-mix**

Ceiling heatings

Ceiling and floor heating are the dominant low lemperature surface heatings in Germany. Floor heating is preferably installed in private new buildings. Ceiling heatings however, are preferably installed in private reconstructional and new industria buildings. In cities like Frankfurt/ Main or Munich approximately 80% of all new office and administrative buildings are equipped with a ceiling heating system, nowadays. Why so? Both, industrial and private new buildings have a well-insulated envelope nowadays and consequently only little outward energy loss (transmission loss). An equally important energy saving factor is the reduction of venting loss, e.g. heat loss due to air exchange during venting. This loss is higher in the industrial sector as the required air exchange rate is higher, too. Also, in reality the office temperature usually is controled by window tilting.

Ceiling heatings reduce this problem as heat is transfered almost completely by radiation. Air is not primarily used as transmitter of thermal energy and even though temperature is evenly felt itactually is about 2-3K lower. Consequently less energy is getting lost due to heating air during venting!

Further advantages of a ceiling heating used in the industrial sector:

- Heating surfaces can very efficiently be used for cooling in summer, because cold air falls downwards, as is known!
- Ceiling heatings react fast, are well controllable and can heat high rooms without noticable temperature differences (same top and bottom temperatures) in an optimum way.
  Example: gym heating by radiating ceiling panels
- As ceiling heatings do not use air as heat transmitter there is no indoor dus-air movement and the air keeps its natural humidity.
  The room climate is suited for allergy sufferers and reduces the risk for coughs and sneezes.
- Radiant heat from above counteracts tense muscles in the shoulder area as studies have proved, prevents head aches and increases concentrativeness.
- Cold feet under the desk as at convection heating? Ceiling heatings solve even this problem, as the striking heat waves are reflected at walls, floor, etc. and in terms of secondary radiation heat the

areas directly invisible from the ceiling. Light acts in a similar way; switching on the ceiling light lightens the area under the desk, too!

- As there are no limitations regarding interior design, furniture and floor covers are arbitrary and can be exchanged if requested. Perfectly suited for combination with wood floors!

Also the private building sector has become aware of the advantages of ceiling heatings in the past few years and the market share in this section increases significantly year by year.
This also applies for electrical systems in new buildings as well as well-insulated old buildings.

There are three reasons for this development:

1. The energy demand of well-insulated buildings is so low, that energy costs (electricity is more expensive than gas) are irrelevant.
2. The asset costs on the other hand are significantly lower as no heat generator, fuel tank, gas connector, chimney etc. are required.
3. Operating costs for service, maintenance and potential heat cost billings do not apply.

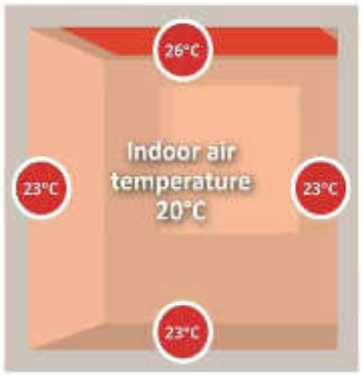
Functionality

Heat by the ArgillaTherm® ceiling heater comes from the place nature originally intended it to come from: from above. It is evenly and healthily spread into every corner of the room in the shape of thermal radiation.

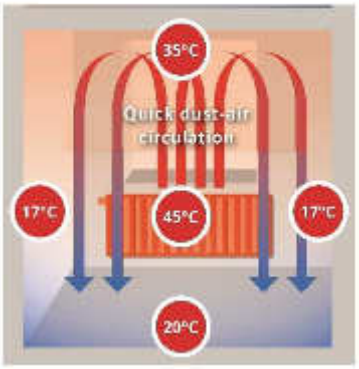
The ceiling being the source of the thermal waves, they strike the floor opposite from it most intensely, causing it to heat up rapidly, almost reaching the same surface temperatures. Cold feet due to a cold floor are a thing of the past now. With amaximum ceiling temperature of 29°C, which lies below the head surface temperature, the head always remains comfortably cool.

Because the air is passively heated, the indoor air temperature decreases by 2-3K, without affecting the feel-good effect or comfort factor. Here one speaks of the operative temperature, the mean value of air temperature and average surface temperature of all surrounding areas.

Cealing heating



Convective heating



Pleasant warmth, enjoy an incredible comfort and healthy indoor climate, with no ascending dry air and an even temperature in every corner of the room, while saving energy using a heater that takes up absolutely no space –the unique ceiling heating system by ArgillaTherm® offers you all this and much more.

The ArgillaTherm® heating-system joins the benefits of conventional low-temperature heaters with the positive properties of the construction material clay, relying on the newly developed, patented panel system for especially simple and quick assembly.

The comfort factor

Radiant heat is the most comfortable and healthiest existing form of heat transfer. We already know it from the sun or a tiled fireplace for instance. What is decisive here is firstly that all surfaces of the room are heated as evenly as possible and secondly that there is no occuring air movement. Virtually all around even room temperatures create an ideal feeling of comfort, since the human body experiences thermal differentiation between head and feet as extremely unpleasant.

Another crucial factor is a fair indoor humidity, remaining at a constant 50%, achieved by the use of the construction material clay.

Panel heatings in comparison

Property	Underfloor heating	Wall heating	Ceiling heating
Portion of thermal radiation	50%	70%	98%
Portion of convection/ascending air	50%	30%	2%
Consistent heat distribution	Very good	satisfactory	Very good
Energy efficiency	good	good	Very good
Indoor dust-air-movement	Very high	moderate	Very low
Limitations at furnishing	moderate	Very high	Very low
Long preflow and reflow	Very high	Very low	Very low
controllability	insufficient	Very good	Very good

Advantages of t he electrical ArgillTherm® ceiling heating at a glance

- ✓ Easy montage with manageable effort (installation when inhabited is possible).
- ✓ room by room conversion due to modular construction system.
- ✓ Considerably lower investment costs in comparison to water-based heating systems.
- ✓ low operating costs due to no need for system maintenance, no current transformer required due to use of 230V resistor cables.
- ✓ Easy integration of lamps or ceiling cleanouts.
- ✓ High occupancy rate due to the modular dry construction system, total thickness only 52mm.
- ✓ Application of standardized system components and total system designed conforming to standards
- ✓ No need for expensive preplanning.
- ✓ Health-conducive properties and energy savings due to the use of clay as backing material.

Advantages due to the use of clay at a glance

- ✓ Convenient system for allergy and asthma sufferers with a high degree of comfort, coziness and air purity.
- ✓ The constant relative humidity of about 50% provides a healthy indoor climate, prevents coughs and sneezes and mould formation.
- ✓ Absorbs pollutants, such as VOCs (volatile organic compounds) gassing out of wood.
- ✓ Binds smells out of air.
- ✓ Antistatic effect, i.e. the clay neutralizes statically charged dust and dirt particles and reduces fine dust
- ✓ unbeatable positive CO2-balance (less than about 1/100 in comparison to gypseous or chalk products).
- ✓ Due to the generated evaporative cold clay keeps the room pleasantly cool in a natural way in summerl.

Energy saving in numbers

25 % due to the decentral heating system

The heat is generated decentrall, yi.e. in the room the energy source current is completely converted ito heat. ..At water-based systems the heat is centrally generated by boiler, combiboiler or heat pump in the heating room.From here the heating water must be brought to the heating element in the respective room via closed circular pipeline. This is very inefficient in transitional seasons when usually only one or two rooms are heated.

20 % due to the almost 100% portion of radiant heat

The thermal waves strike all solid materials around the room directly, including surfaces and objects without a loss of energy and heat them up in an extremely short amount of time. Thus the heat is evenly spreadi nside the room, without any air being used up or moved around. The indoor air temperature is then passively heated up and thereby lowered by 2 –3 K without having an effect on ones well-being or comfort. Rule of thumb: 1K reduction correlates to 6-7% of energy saving.

5 % due to the construction material clay

The air developing inside a room during the day ascends towards the ceiling byconvection (warm air). Heat sources could be people, electrical devices or incident sunrays for example. The densely compacted clay system construction panels by ArgillaTherm® store this thermal power and emit it with falling room temperatures during the evening hours in form of thermal radiation. The heating phase during transitional seasons is thereby reduced by up to 6weeks. Extensive information regarding this can be found in: Handbuch Lehmbau, Baustoffkunde, Techniken Lehmarchitektur; Prof. Dr. Gernot Minke

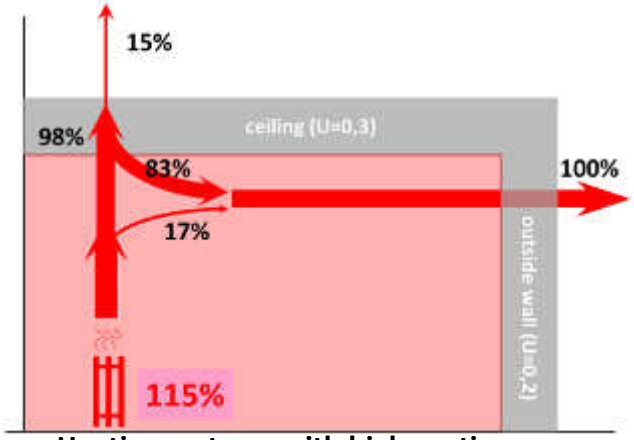
Response time / thermal inertia

The response time comes to approximately 5 minutes, the clay ceiling material with its total thickness of about 30mm is fully heated after about 60 minutes. In case of an interruption of heat supply the system holds the surface temperature depending on the environment for about 60 minutes without a considerable drop of temperatue. Thus cost-efficient electrical heating rates for fixed interruptible appliances (thermal pump rates) can be used.

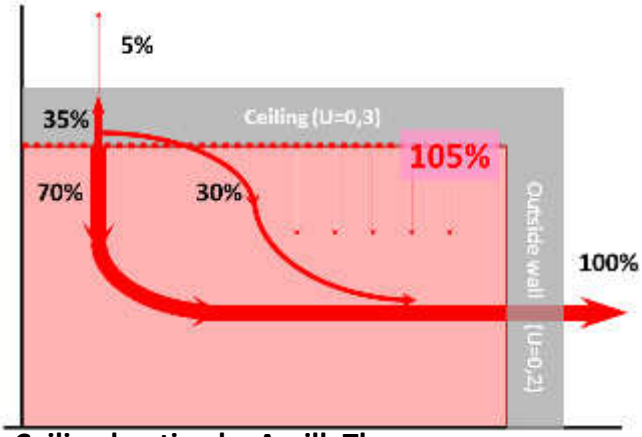
Vagrant heat / core activation

In a multistorey apartment building, building envelope and an efficient heating technology play a major role as well as the issue of vagrant heat. As there are no legal requirements regarding minimum- insulation data specified in EnEV rso far, there are only regulations on the building envelope (basement, roof and exterior walls). Losses in downstairs apartments are balanced as heat credits for upper apartments and do not lead to a considerably increased amount of energy consumption in total. Even though after a renovation of the exterior wall, heat transition to the outside is clearly reduced, the heat transition upward s remains steady. As a result the proportion of vagrant heat increases. Due to a transparent allocation of heating costs being useful for the rentability of an apartment, property managements and lessors are paying more and more attention to this issue.

Contrast; heating systems with high portion of convection / ceiling heating systems linked directly to the masonry (usually wet system concepts) in comparison to a ceiling heating system by ArgillaTherm



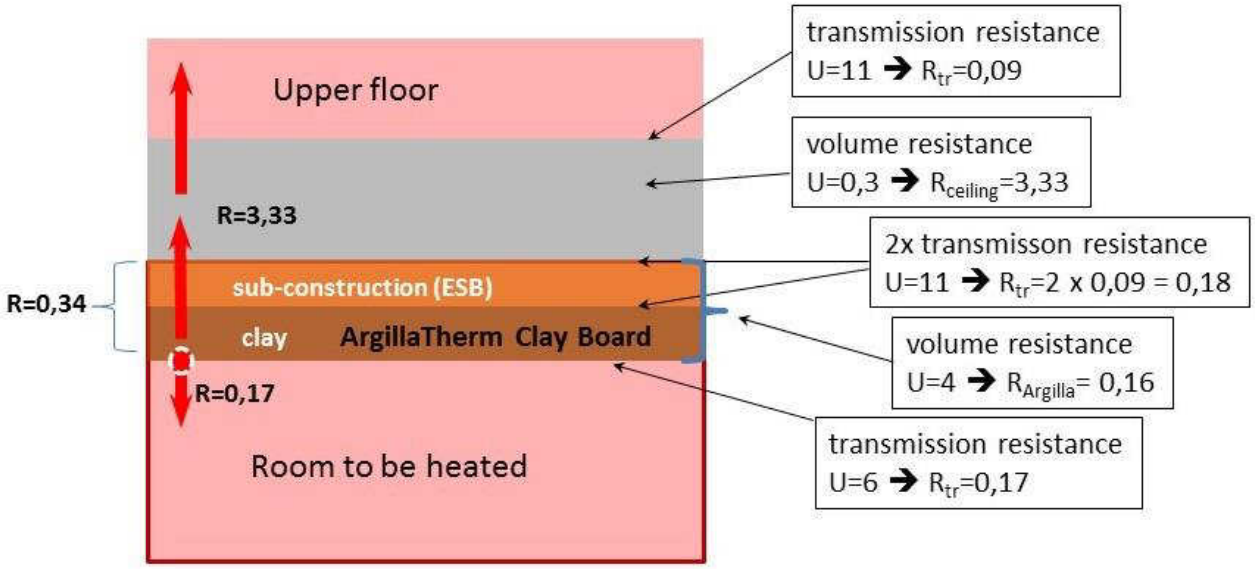
Heating systems with high portion of convection or core activity



Ceiling heating by ArgillaTherm

Vagrant heat on a typical winter day can be described by twocomponents: firstly, the proportion stored inside the false ceiling and secondly, the proportion of leakage through the upper floors. Both proportions are clearly reduced in the ceiling heating system by ArgillaTherm due to the sandwich like construction, compared to heating systems with a high proportion of convection or core activation.

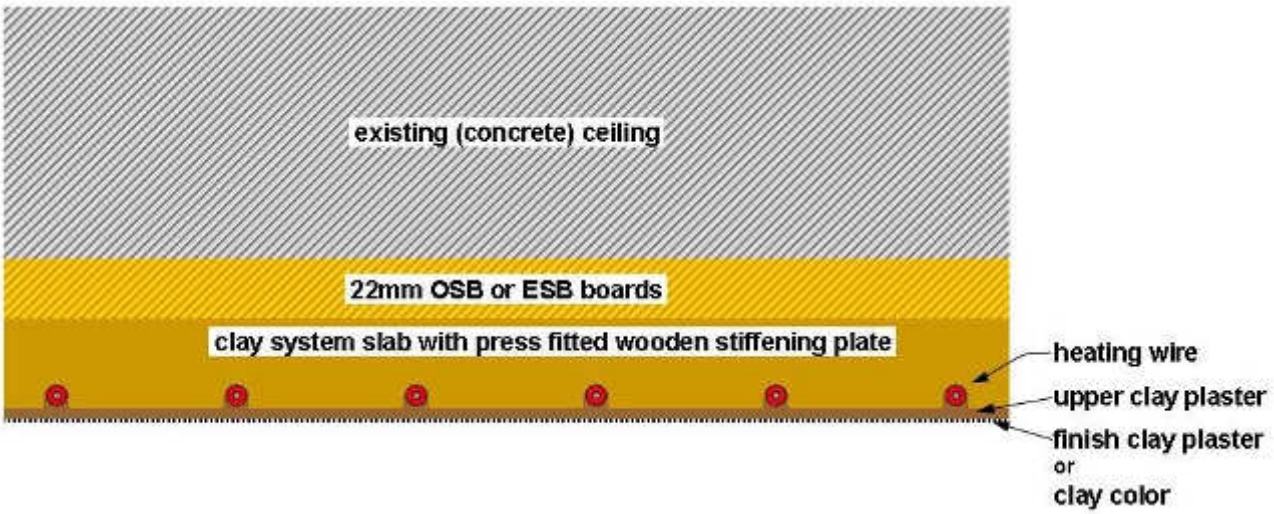
Details of thermal resistance of the ArgillaTherm ceiling heating system



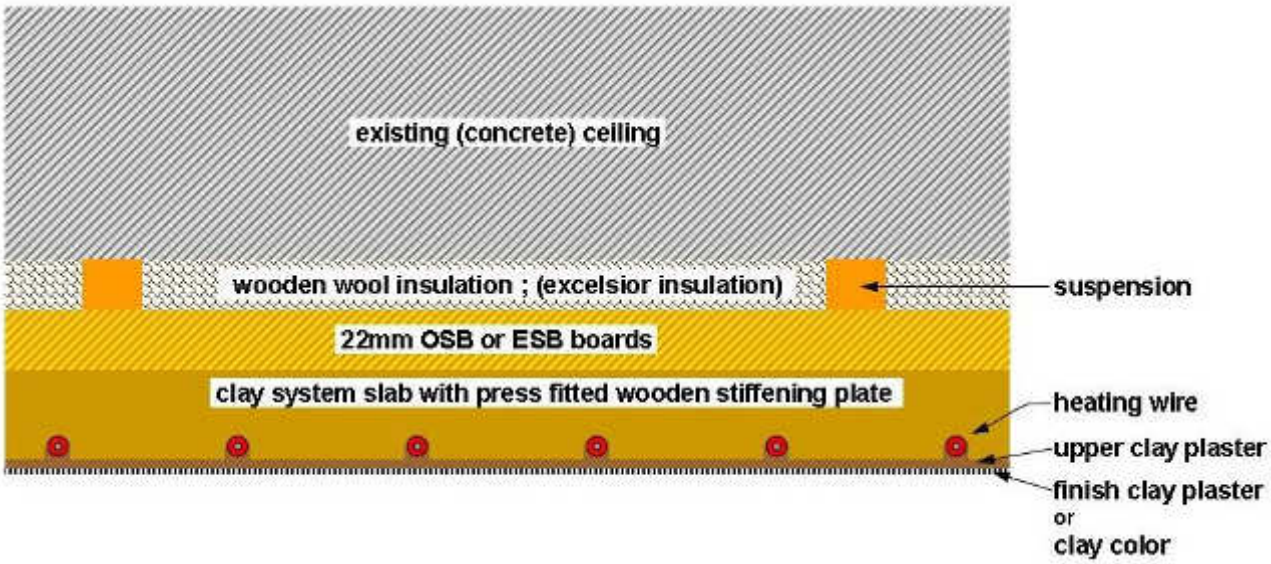
The thermal transfer resistance downwards amounts to less than half of the total resistance upwards (transfer and volume resistance). Therefore approximately 2/3 of the heat goes directly into the room and 1/3 into the clay layer of the ArgillaTherm system construction panel. Thencea large proportion of the heat returns from there, due to the resistance in the storey above it being so much greater than the resistance back into the clay panel.

Fixing methods / system design

Method 1: direct attachment to the ceiling / thickness 52mm



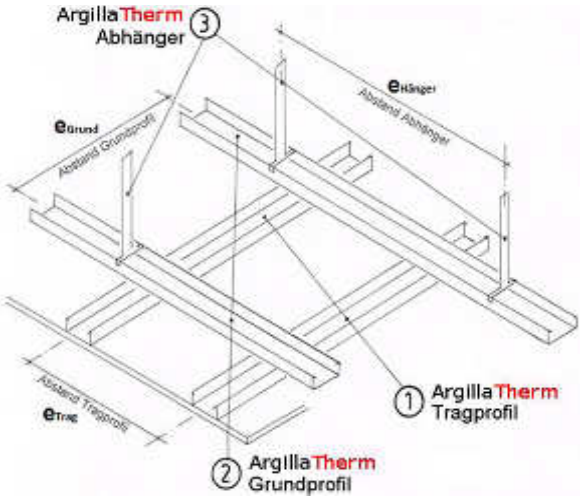
Method 2: attachment by suspension and cavity insolation (e.g. top floor ceiling)
thickness 52mm plus. suspension height

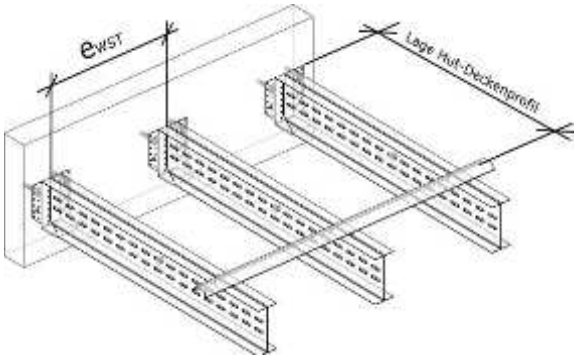


Method 3: approved metal ceiling suspension in light-weight construction mode

a) by Nonius-jointers for attachment to ceiling
b) cantilever for attachment to ceiling for considerable reduction of impact-sound

Request our free layout tool for this.





Fields of application

The electrical low-temperature panel heating system TOSKANA on a clay dry-construction basis is ideal for use on a commercial scale, as well as on private new buildings (calculatable up to KfW40plus-standard) and is also extremly suited for partial or full renovations of well insulated existing buildings with a maximum annual energy demand of 60KWh/m².

Perfect conditions are given for the conversion of nighttime storage heaters, since the existing infrastructure, such as conductors to electric meters, can be used for this.

In Germany the average annual consumption costs for nighttime storage heaters amount to 25 – 35€/m².

Due to the low-temperature heating technology and the use of clay these costs can be reduced to almost half of the amount!

Requirements for the application in new buildings

Design requirements according to EnEV 2016.

facility	threshold	KfW 55 Standard	KfW 40 Standard	KfW 40plus Standard
controlled room venting with heat recovery	necessary	necessary	necessary	necessary
Electrical flow heater	necessary	necessary	necessary	necessary
Solar power system	necessary	necessary	necessary	necessary
Energy storage battery	not necessary	Not necessary	Not necessary	necessary

Asset costs, consumption and maintenance

Although compared to gas the energy source electricity costs about 3-times more per kWh, it is not decisive in terms of the total costs (consumption and maintenance). As the consumption in a new building is so low nowadays that often it is less than 1/3 of the total costs.

The crucial advantages of the electrical ceiling heating system TOSKANA are the low asset costs, the high energy savings as per page 5 and the completely maintenance-free operation of the heating system.

For a cost comparison see following table (page 10).

Sample calculation acquisition and consumption

Energy prices: gas = 6 Cent/KWh, pellet = 5 Cent/KWh, electricity = 19 Cent/KWh

New single-family house150m², KfW55	Combiboiler with underfloor heating	Heat pump with underfloor heating	Pellet boiler with underfloor heating	Ceiling heating Toskana by Argilla Therm®
Price for heating system	15.000€	24.000€	25.000€	4.500€
Therefrom non-durable (25a)	5.000€	14.000€	15.000€	0€
Therefrom durable (75a)	10.000€	10.000€	10.000€	4.500€
Costs for heating room/buffer storage	2.500€	2.500€	7.500€	0€
Costs for fuel storage room	0€	0€	9.000€	0€
Costs for gas connection	2.5000€	0€	0€	0€
Costs for chimney and roof exit	2.5000€	0€	2.5000€	0€
Additional costs for tacker system and incorporation of distribution boxes	2..000€	2..000€	2..000€	0€
Costs for plaster, wallpaper etc.	4.500€	4.500€	4.500€	0€
Costs for clay system construction ceiling	0€	0€	0€	15.000€
Total investment	29.000€	33.000€	50.500€	19.500€
Annual amortisation costs for non-durable components	200€	560€	600€	0€
Annual amortisation costs for durable components	133€	133€	133€	60€
Annual additional costs (service, operation, maintenance)	180€	270€	360€	0€
Annual energy costs	360€	376€	300€	770€
Total annual costs	873€	1.340€	1.393€	830€

Electrical resistor cable

The in according to DIN IEC 60800 (ed.3):2009-07, VDE-approved resistor heating cable consists of a red heating cable (available in 5 different length, 12m, 36m, 60m, 119m and 179m) and a 4m long connector cable (posistor). The seamless transition from connector to heating cable is entirely waterproof and ideal for the laying in the ceiling heating system TOSKANA.

The heating cable consists of a solid heat conductor with insulation cover, a solid copper return conductor with insulation cover and a solid copper Fl-protective conductor. An aluminium coating with external insulation completes the heating cable.

Bild vom nahtlosen Übergang; Anschluss- zum Heizkabel

Electromagnetic/electrical fields

The supply- and return conductors in the ArgillaTherm® heating cable are located very tightly together and are perfused by electricity flowing in the opposite direction. The magnetic fields of the two conductors (twin-conductor-technique) through their contrary alignment they revoke each other. This design guarantees electromagnetic fields of virtually zero (0-0,2 micro tesla). In addition to that all conductors are insulated and protected entirely by an aluminium coating with external insulation. The aluminium coating

functions similarto a Faraday cage, meaning electric fields are shielded completely. Important: The protective conductor has to be grounded!

System components

System component	Article - number	image
ArgillaTherm® clay system construction panel TOSKANA E11.8 mit pressed-in glass fibre scrim, size: 375 x 375 x 25mm	ESBP000001	
ArgillaTherm®clay compensation plate, bulk density approx 620Kg/m³, 750 x 750 x 25mm	ZLBP757525	
ArgillaTherm® clay upper plaster no.1-2 acc. DIN 18947, 25Kg bag as dryware for 2m² ceiling area	ZLOP120025	
ArgillaTherm® clay paint no. 3-1 sprayable and brushable ready-mix, 10l for 35m² ceiling area, pure white	ZLFA310010	
Wood-wool edge insulation strip, size 50 x 10mm, 10m per roll	ZRDS501000	
Glass fibre scrim, MW 7 x 7mm, 105g/m², 100cm wide, 100m per roll	ZGSGG77000	
Stainless-steel load distributor-for fixing of clay system construction panels, 5 x 50mm, 100 off per box	ZLTE055100	
Stainless-steel – collated flat countersunk head screw T-Star Plus T20 with partial thread 5 x 45mm, 200 off per box	ZETS054500	

Heating technology

item	Article no.	image
ArgillaTherm® electronic ceiling temperature regulator AT-3D, 10-40°C incl. 4m remote sensor	ZAT3DR000	
ArgillaTherm® electrical resistor cable 230V, 12,07m heating conductor á 12 Watt/m, 150Watt, 4m connector cable	EHK001207	
ArgillaTherm® electrical resistor cable 230V, 35,97m heating conductor á 12 Watt/m, 450 Watt, 4m connector cable	EHK003597	
ArgillaTherm® electrical resistor cable 230V, 59,87m heating conductor á 12 Watt/m, 750 Watt, 4m connector cable	EHK005987	
ArgillaTherm® electrical resistor cable 230V, 119,37m heating conductor á 12 Watt/m, 1.432 Watt, 4m connector cable	EHK011937	
ArgillaTherm® electrical resistor cable 230V, 179,37m heating conductor á 12 Watt/m, 2.152 Watt, 4m connector cable	EHK017937	

Technical planning and basics

Regarding design and construction of the AgrillaTherm ceiling heating system all formal regulations and standards are to be taken into account.

DIN EN 12831	Calculation procedure of standard heating load
DIN IEC 60800	Requirements for electrical heating resistor cables
DIN EN 60730	Automatic electrical regulation-and control devices
DIN 18947	Requirements for clay plasters for plastering of walls and ceilings
DVL TM 06	Technical leaflet for thin-layer clay -coating of walls and ceilings
DVL TM 07	Technical leaflet requirements, fields of application, performance characteristics and test procedures for indoors fabricated clay construction plates

The works of participating trades during the construction process are to be coordinated accordingly.

Development: Energy consultants/architects/designers

Executing trades: electricians/drywall constructors/construction company

Design of ceiling heating

At a standard room height, the ceiling temperature should be limited to 29°C for reasons of comfort. This corresponds to a desired room temperature of 20°C with a thermal output of 60W/m^2.

The room thermostat is to be adjusted accordingly.

Lower thermal outputs are achieved either by a reduction of the system temperatures or by a reduced area occupied by system construction panels (areas are occupied by clay compensation plates instead). In case higher thermal outputs are necessary for example at reconstructions of old buildings, this can be achieved by higher surface or radiated temperatures, too. The temperature asymmetry to be expected might reduce the feeling of comfort and should be checked for each individual case, but usually is not a problem at high ceilings in old buildings.

Ceiling temperature in °C	Room temperature in °C	Heating load In Watt/m²
40,0	20	120
37,5	20	105
35,0	20	90
32,5	20	75
30,0	20	60
27,5	20	45
25,0	20	30
22,5	20	15

The ceiling cover with clay system panels by ArgillaTherm® should be applied on the entire surface only for higher heating loads. For heating loads of less than 50 W/m² the use of clay system compensatiion plates is recommended for financial reasons.

The length of the resistor cable goes by the required heating demand, to reach mentioned ceiling temperatures. The heating load is determined according to DIN EN 12831.

Overdimensioning is impossible!

Due to the heat generation taking place decentralized, in the electrical low-temperature ceiling heating system Toskana by ArgillaTherm® (100% of the electricity is transformed into thermal energy), overdimensioning does not lead to any energy losses! It merely reduces the heating-up phase.

Calculation of heating cable length

The electrical resistor cable has a heating capacity of 12 W per meter. Since it does not have a hydraulic system compared to water-based heaters (amount of water, which flow rates, what pressure) the design is fairly simple.

„heating load divided by 12“ = heating cable length

example: 600 Watt heating load ÷ 12 = 50 m heating cable length
≙ heating cable article -no. EHK005987 with 59,87m heating load and 750 Watt heating capacity

The individual heating cables can be combined with one another, in any manner according to the following table and connected to one room thermostat. The maximum capacity per room thermostat should not exceed 3.200 W.

Advice: to reduce heating-up phases, the heating cable should be oversized by 20 to 30%.
Energy losses do not occur by doing this!

Forms of delivery heating cable

Heating capacity in W	length heating conductor in m*	Article number
150	12,07	EHK001207
450	35,97	EHK003597
750	59,87	EHK005987
1432	119,37	EHK011937
2152	179,37	EHK017937

* all cables are ready-made with a 4m long connector cablet (seamless transition)

Maximum occupancy per m² clay system panel TOSKANA: 11,8 m ≙ approx. 140 W/m² heating capacity when there is no limitation of surface temperature

Statics

Ceiling loads are calculated and designed according to DIN 1055. This requires a load capacity of 1,5 or 2,0kN/m² for present time apartment buildings. Regarding older buildings with timber ceilings the load capacity usually amounts to 1,5kN/m². 1kN corresponds to about 100kg.

Weight of clay system construction panel	39,70 KG/m²
Weight of clay compensation plate	15,50 KG/m²
Weight of fixings, cable and plaster	17,00 KG/m²
Weight of fixings, cable , clay plaster and 22mm OSB/ESB-plate	30,20 KG/m²

example: ceiling 20m² occupied by 50% clay system construction panels and 50% compensation plates

==> 10m² x 69,90kg (39,70kg + 30,20kg) und 10 x 45,70kg (15,50kg + 30,20kg) = 1.156 kg

==> 57,80kg/m² average weight

The maximum weight amounts to 69,9 kg/m² (at entire occupancy by clay system construction panels).

Self-cooling effect of clay

Clay has an enormous sorption capacity, meaning the absorption of water from air inside the room or masonry, transporting it and emitting it back into the room with drying out air. The clay system construction panels by ArgillaTherm and clay plaster located above them can absorb up to 70g/m² of water (e.g on a sultry summer day) in just 12 hours. For instance in a 25m² office, should these be emitted again during the day, a cooling capacity of 1kWh is archieved by natural evaporation. This value corresponds to a cooling capacity of 3-4 W/m².

Room acoustics

In nurseries, schools, administrative objects, etc. the requirements as specified in standard DIN 18041 (acoustics quality and reverberation time, respectively, in rooms) must be met. For this reason a clay paint with a high portion of marble powder (grain size<1mm) is applied. Hereby an average sound absorption coefficient of 0,2 is achieved, meaning a significant reduction of room acoustics. In case of higher requirements sound absorber plates instead of the clay compensation plates are used. The demarcation is carried out by auminium angle profiles.

Material calculation

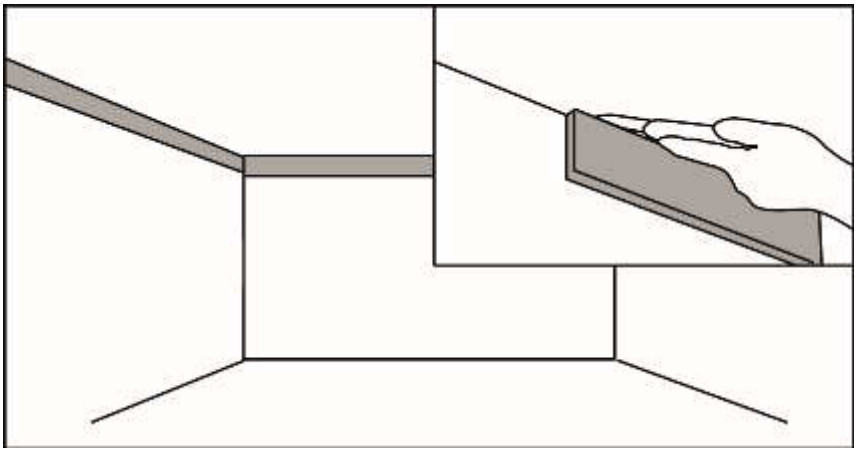
requirements: room size: 20m², heating capacity: 400 Watt ≙ 20 Watt/m² (KfW55-Standard)

Wood-wool edge insulation strip (50x10mm)	18-20m
22mm ESB-Plus P5 oder OSB plate with tongue and groove as substructure	20 m²
Clay system construction panel for laying of electrical resistor cable	7 m²
Clay compensation plate for covering of areas without heating cable	13 m²
Stainless-steel – load distributor 5 x 50 mm and stainless-steel - screw 5 x 45mm	300 off
ArgillaTherm® resistor heating cable with 59,87m heating cable, 750 Watt heating capacity	1 off
ArgillaTherm clay plasternor.1-2 acc. DIN 18947, 25kg dry bagware	10 bags
Glass fibre scrim, MW 7 x 7mm, 105g/m², 100cm wide	22 m²
ArgillaTherm® electronic ceiling temperature regulator AT-3D incl. 4m remote sensor	1 off
ArgillaTherm® clay paint no. 3-1 sprayable and brushable ready-mix	1 bucket

Assembly instructions TOSKANA system

Electrical low-temperature ceiling heating system on clay construction basis

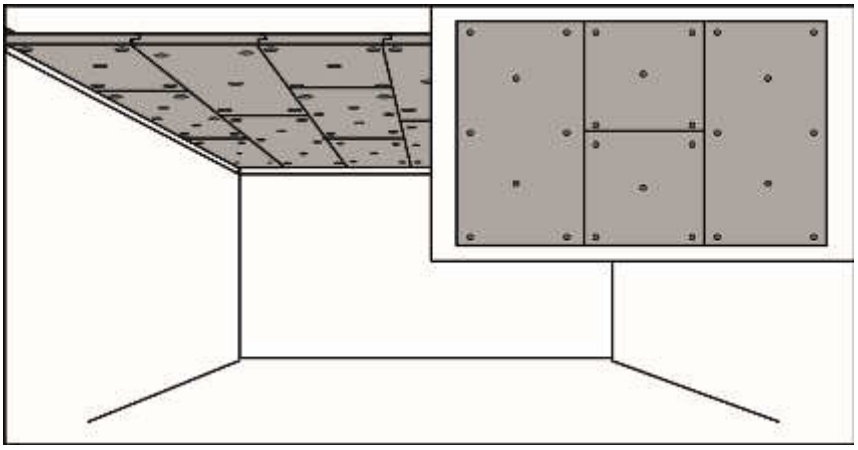
For montage to ceiling or inclinations



Circumferentially install insulation strips for outer edges 50x10mm round the room

The use of wood-fibre material is recommended

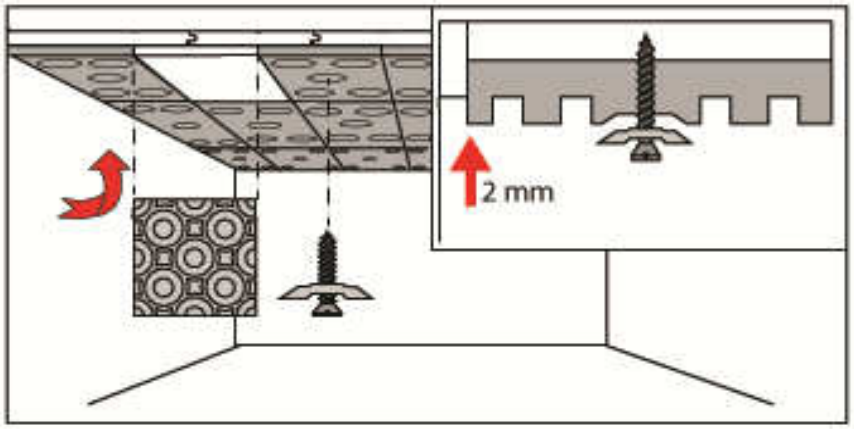
Execution: construction company/ drywall constructors



Mount ESB-Plus P5 22mm chipboards with Fischer frame plugs SXR 8x80T or SXR 8x100T directly to ceiling (ceiling approval by multiple mounting) or mount with a suspension.

Always handle chipboards with a **tongue and groove** connection. Suitable as a substructure for ceiling heaters; SD-value (ESB-Plus):0,88m

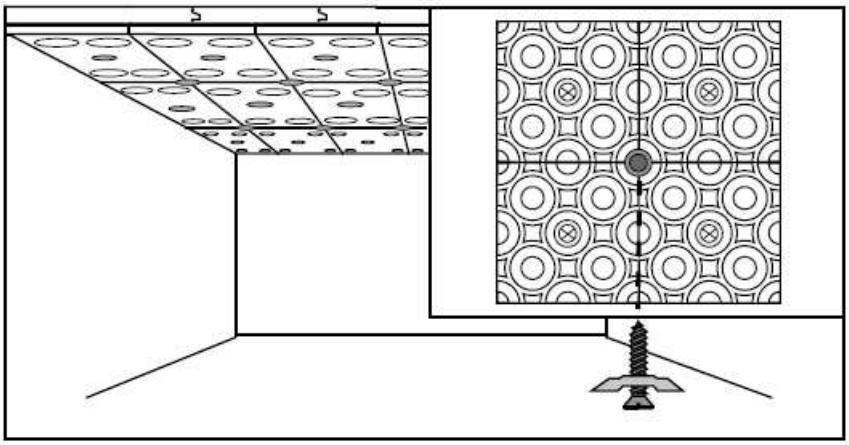
Execution: construction company/ drywall constructors



Attach clay construction panels, with the aid of suitable stainless-steel screws with a coarse thread, using ArgillaTherm® stainless-steel load-distributors.

Lay panels onto crossjoint and fasten only centrally with a screw.

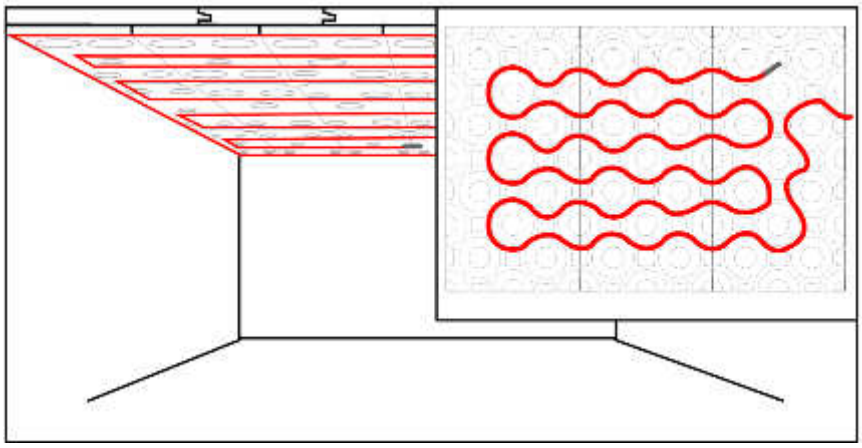
Execution: construction company/ drywall constructors



Screw together at intersection points after full cover of ceiling.

Urgently note: Edges of clay structural panels should not be layed directly over the edges of the chipboards.

Execution: construction company/ drywall constructors

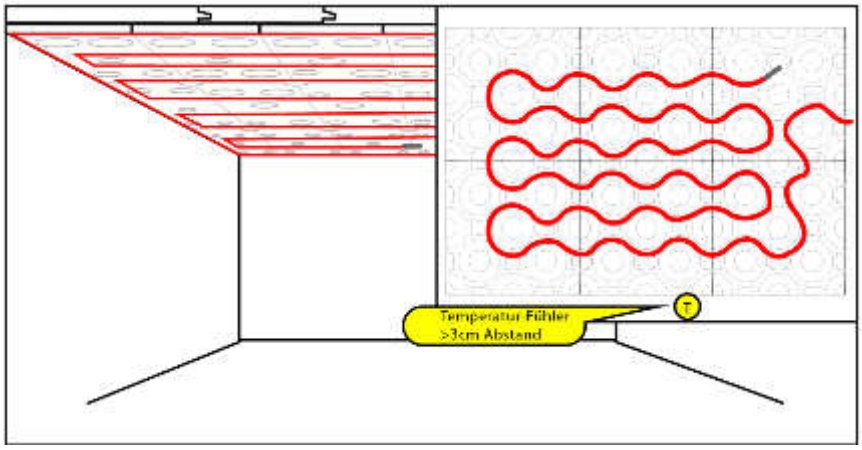


Installation of the ArgillaTherm® resistor cable into the grooves of the clay panels with use of a cable testing device (Recomendation; Warmup Watchdog), starting at the transition of PTC- to NTC thermistors (Labeled with red and blue arrows).

Do not occupy the outer circumferential groove; as it serves as a safety-discharge lane!

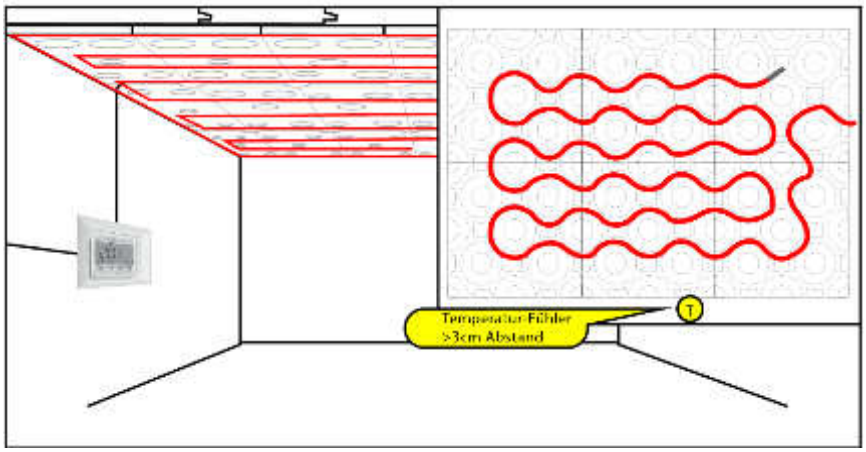
Protective conductor must be grounded!

Execution: electrician/construction company



Place the white sensor head **3cm** apart from closest heating cable! Distance to wall of at least 10cm.

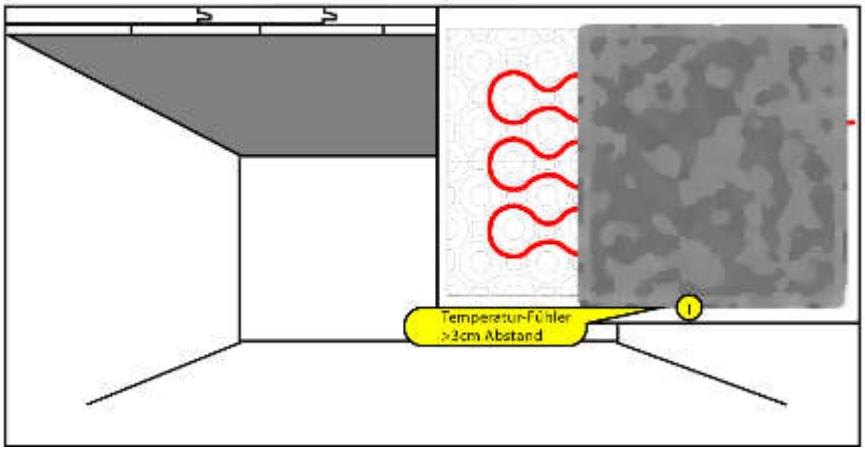
Execution: electrician/constuction company



Mounting of the ArgillaTherm® room thermostat. Connection of ceiling sensor and resistor cable and connection to power grid.

Since the indoor air temperature plays a minor role, the thermostat can be installed anywhere around the room or outside of it!

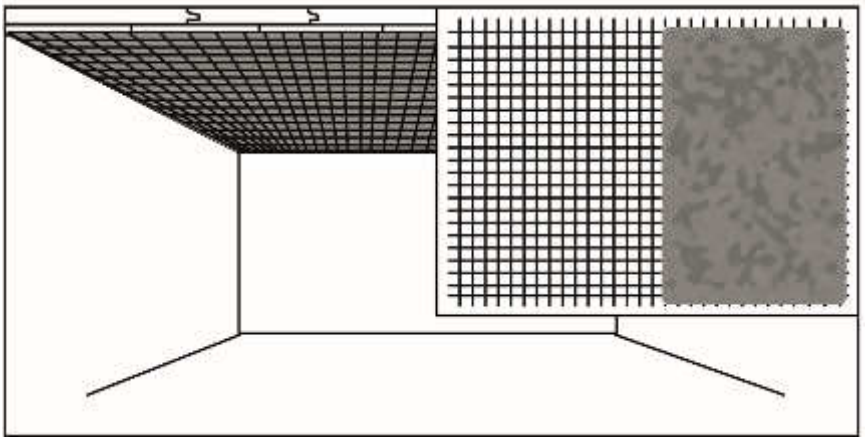
Execution: electrician



Sufficiently wet clay panels!

Forceful refilling of grooves of clay construction panels with the ArgillaTherm® finish plaster Nr.1-2 allow it to harden slightly.

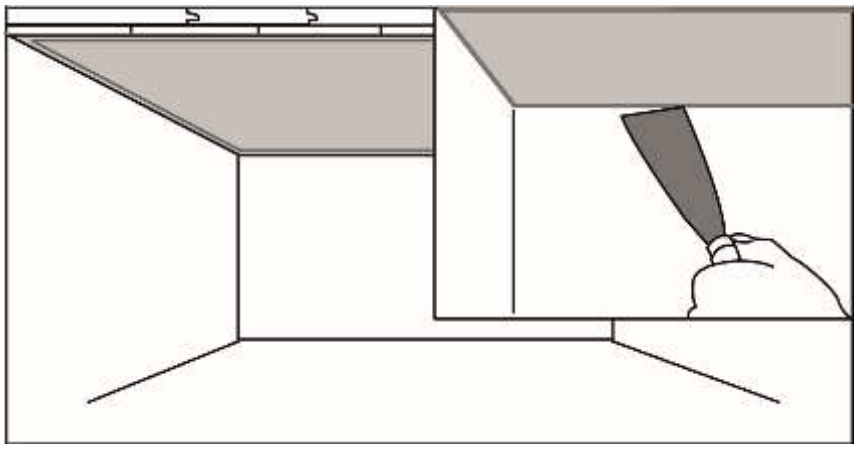
Execution: construction company/ drywall constructors



Apply a 3-5mm compensation layer with the same clay finish plaster, incorporate reinforcement fabric sufficiently overlapping and allow to harden slightly

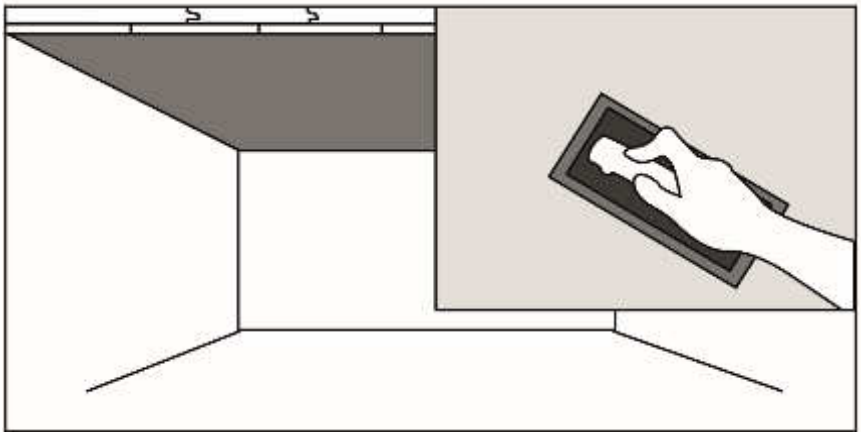
Subsequently apply a **2-3mm top layer** and even it out.

Execution: construction company/ drywall constructors



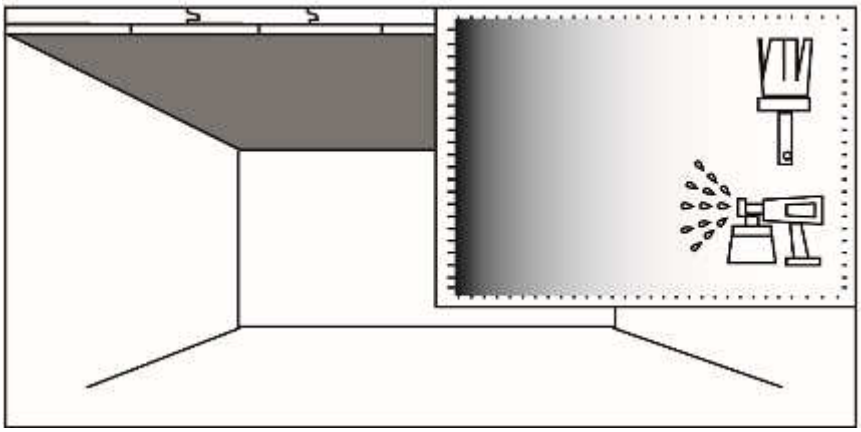
Create a circumferential wall connection joint around the edges of the room by making cuts with a trowel directly after.

Execution: construction company/ drywall constructors



After drying off, even out the surface with a sponge board or a special felting machine in the surface quality Q2.

Execution: construction company/ drywall constructors



Application of the clay paint by 2-layered brushing or spraying.

For a uniform appearance, the application of the clay paint with a mixture, should be completed on the entire surface, on a single working day.

Execution: construction company/ drywall constructor end customer

System requirements

- ✓ Constructional prerequisites and general trades are to be taken into account or considered accordingly.
- ✓ For a ceiling suspension: It is necessary to ensure a sufficient static or load capacity.
- ✓ For direct attachment to ceiling: The mansonry requirements according to DIN 18560 (DE) are to be complied by. Surfaces are not allowed to have any considerable unevenness. Basis of this, are values according to DIN 18202 (DE).
- ✓ For direct montage to ceiling: use Fischer long-shaft dowels SXR 8×80 T or SXR 8×100 with a safety screw, ETA-admission for concrete and masonry.

- ✓ For mounting and securing of clay system construction panels, depending on the ceiling construction, sufficient fastening products with load capacity distributors by ArgillaTherm® need to be used. Designated depressions in the clay construction panels are to be utilized for this (do not drill outside of them).
- ✓ Objects that need to be fastened to the ArgillaTherm clay surface heating-system, such as lights or smoke detectors should be screwed on only and are not allowed to be nailed on. The precise location of heating elements and electrical cables is be determined previously.
- ✓ Drillings on the ArgillaTherm clay ceiling heating system are to be performed without percussion. Hammer blows, percussion drills, hammer drills and impact wrenches should not be used here as well as for wood panel ceilings to prevent a potential development of cracks caused by this.

System warranty

For a professional montage by ArgillaTherm® certified specialized trades, consideration and compliance by system requirements and use of listed products according to assembly instructions, the company ArgillaTherm GmbH provides a

warranty for the clay surface-heating system TOSKANA of 5 years.

For detachments and cracks that exceed a normal level or don’t originate from known shrinkage or settlement cracks.

Exclusions

The warranty by ArgillaTherm generally excludes all deficiencies of the clay surface heating system that

- are based on building movements, due to building settlements or forces of nature
- are caused by drilling into heating materials or sensors required for control and their electrical cables.
- were caused by vibrations of tools such as hammer blows, percussion drills, hammer drills and impact wrenches of which the use is explicitly prohibited.

Pos.	Performance/description	Images
	Electrical module-based 230V low-temperature panel heating system on clay- dry construction basis Designed for the ideal and energy efficient heating of a room and the achievement of a physiologically perfect interior climate according to DIN ISO 7730, for ceilings and sloping roofs. Minimum structural height: 52mm including wooden substructure Operating weight: up to max. 70 Kg/m² including wooden substructure **System design:** **1.Substructure** Consisting of 22mm ESB-Plus P5 or OSB3 chipboards, to be handled via tongue and grove connection. The substructure can be attached directly to the ceiling or sloping roof using suitable fixing materials such as Fischer frame-plugs SXR 8x80T or SXR 8x100T or nail anchors 6x30/50, attached to suitable wooden support laths (70/50mm) or bolted to a statically sufficient metal substructure using Nonius ceiling suspensions or self-supporting metal carriers. The adjoining wall surfaces are to be decoupled using suitable edge insulation strips, preferably wood fiber material. Operating weight: up to max. 14 Kg/m² **2. Clay-construction panels** Heating surface cladding with pre-manufactured clay- system-heating and compensation panels. Proportional percentages of the system- heating panels result from heating load requirements of the respective rooms. Panels are to be layed onto cross joints and fastened with stainless-steel load distributors and stainless-steel screws. - Clay- system heating panels according to DVL TM 07 MHK I (type A) consisting of sorption capable, capillary active and highly condensed clay- dry construction panels with press-fitted glass fiber mesh and pre-manufactured single sided groove-shaped form for installation of system- coordinated heating cables Panel thickness: approx. 25mm Max. cable length: 11,8m/m² Construction material class: A1 Flexural strength: > 3 N/mm² Sorption grade: WS III according to DIN 18947 Thermal conductivity: > 1 W/mK Water vapour diffusion resistance: < μ = 10 Operating weight: up to max. 40 Kg/m² - Lehm-Systemausgleichsplatten gem. DVL TM 07 MHK I (Typ A) mit beidseitigem Glasfaser-Gittergewebe und hohem Anteil an Fasermaterialien aus Hanf oder vergleichbaren Naturprodukten. Leichtbauplatten zur Auskleidung der heizkabelfreien Flächen. Panel thickness: zirka 25mm Bulk density: < 900 Kg/m² Construction material class: A2 Flexural strength: > 2 N/mm² Sorption grade: WS III gemäß DIN 18947 Thermal conductivity: < 0,3 W/mK Water vapour diffusion resistance: < μ = 10 Operating weight: up to max. 17 Kg/m²	   

3.Resistor cable

Pre-manufactured electrical resistor cable in accordance to IEC 60800 (ed.3):2009-07, consisting of:

- solid heating conductor with insulation cover
- solid copper return conductor with insulation cover
- solid copper Fl-protective conductor and
- aluminum coating with exterior insulation

Seamless and completely water-proof transition to the 4m long connection cable (PTC thermistor). Free from electromagnetic fields due to closely spaced flow- and return conductors with opposite electrical power flow directions (twin-conductor system).

Additional aluminum coating with resilient heat resistant and hardly flammable synthetic material for shielding magnetic fields.

For use in combination with the suitable thermostat according to. DIN 60730, protection grade II with related ceiling sensor.

Heating cable diameter: 5mm

Heating output: ~ 12Watt/m

Max. temperature: 40°C (capacity crash protection according to EN 50559)

4.Clay- upper plaster with plaster reinforcement material

Clay- upper plaster according to DIN 18947, Dry ready-mix for single-layered application with 7mm of plaster reinforcement material inlay.

Plaster coating thickness: min. 5mm / max. 8mm

Grain size: < 2mm

Fiber components: Miscanthus up to 10mm

Construction material grade: A1

Strength category: SII

Adhesive strength: > 0,15 N/mm²

Flexural strength: > 1 N/mm²

Sorption grade: WS III

Thermal conductivity: > 1 W/mK

Water vapour diffusion resistance: < μ = 10

Operating weight: up to max. 15 Kg/m²

5.Clay color

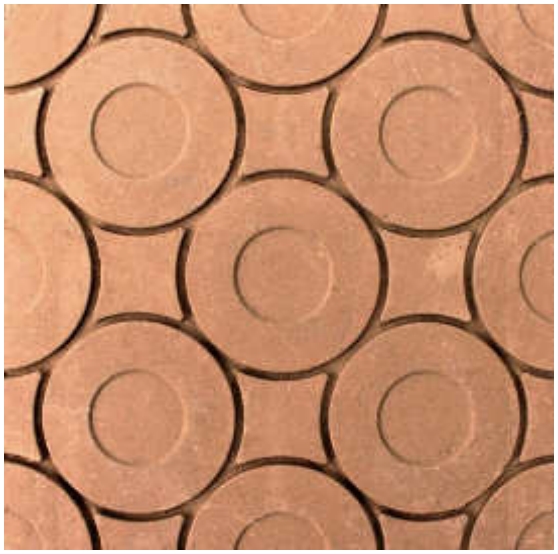
Spray- and paintable ready-mix according to DVL TM 06 for the creation of a colored clay surface and significant reduction of acoustic noise (αs=0,2) through the use of marble powder (grain size < 1mm).

Pos.	Leistung/Beschreibung	Bilder
	Thermostat Programmierbarer Thermostat inklusive Fernfühler zur Regelung der System- bzw. Abstrahltemperaturen. Mit beleuchtetem Display, automatischer Sommer-Winterzeitumschaltung, Optimum-Start-Funktion, abnehmbarem Bedienteil, Urlaubsfunktion mit Datumseingabe, Energieverbrauchsanzeigen und verschiedenen Bedienersprachen. Heizungsunterbrechung nach Norm EN 50559 einstellbar. Installation durch einen Elektrofachmann. Spannungsversorgung: 230 V AC 50 HZ (207…253 V) Wählbarer Temperaturbereich: 10 °C bis 40 °C; in 0,5 °C Schritten Anzeige Temperaturbereich: 0,1 °C Schritte Ausgang: Relaisschließer, potenzialgebunden Schaltstrom: 10 mA... 16(4) A *; 230 V~ Ausgangssignal: PWM oder 2-Punkt (Ein/Aus) PWM-Zykluszeit: einstellbar Hysterese: einstellbar (bei 2-Punkt) Minimale Schaltzeit: 10 Minuten Leistungsaufnahme: ~ 1,2 W Ganggenauigkeit: < 4 Min / Jahr Gangreserve: ~ 10 Jahre Fernfühler: AT-F100-1 Länge 4 m, verlängerbar bis 50 m Umgebungstemperatur: Betrieb 0 °C bis 40 °C (ohne Betauung) Lagerung: -20 °C bis 70 °C (ohne Betauung) Stoßspannung für Bemessung: 4 kV EMV-Störaussendungsprüfung: 230 V Spannung, 0,1 A Strom Schutzart: IP 30 Schutzklasse: II (siehe „Installation“) Softwareklasse: A Verschmutzungsgrad: 2 °C für Kugeldruckprüfung: 75 ± 2 °C Energieklasse nach EU 811/2013, 812/2013, 813/2013, 814/2013: IV = 2% Maße: Bedienteil 50 x 50 mm Blendrahmen 80,5 x 80,5 mm Einbautiefe 42 mm Auftragsstärke 17,5 mm Fühlerkopf 20 mm x Ø 9 mm Bei Aufputzmontage: Gira AP-Gehäuse 1f.rws-g 006103 Die Positionierung und der Einbau des Fernfühlers erfolgt gemäß den Vorgaben des Systemherstellers!	

Clay dry construction panel acc. to. DVL TM 07 (type A), system TOSKANA

Dry construction panel as mounting aid for electrical resistor cable.

For assembly to ceiling.



properties

clay dry construction panel with pressed-in grooved structure for laying of electrical resistor cable of system TOSKANA. With pressed-in glassfibre-grid. For installation to ceiling, onto wooden substucture. Asa base for ArgillaTherm clay-upper plaster No. 1-2.

composition

wooden grid, sands, clays, hemp fibres, glassfibre grid

Key figures

measurements	375 x 375 x 25 mm
Size accuracy	± 0,5 mm
weight panel / m²	5,58 kg / 39,70 kg
max. cable capacity per m²	11,8 m
Compressive strength	minimum 2,5 N / mm²
Tensile strength in bending	minimum 4,5 N/mm²
Bulk density	1.745 kg/m³
Steam diffusion resistance	mind. μ = 5/10
Reaction to fire classification	A 1
Thermal conductivity of clay	1,05 W/mK
Thermal conductivity of wood material	0,14 W/mK
abrasion	≤ 0,7
Steam sorption grade	WS III
Desiccation shrinkage degree	≤ 2 %

Forms of delivery

packages	content	Reach in system	Article number
1 palette à 180 panels	180 pieces	25,315 m²	ESBP000181

Measurements including palette approx.120 x 80 x 95 cm (length x width x height) with edge protection and cardboard cover. Weight incl. palette approx. 1.034 kg.

Storage

The material is indefinitely storable at dry storage.

Application

Clay dry-construction panel for creation of clay-dry- plaster, as mounting aid for ArgillaTherm electrical resistor cable and as subsurface for ArgillaTherm clay-upper plaster No. 1-2. Create a sufficiently viable and even surface, e.g. out of laths 2 x 4 and 2,2cm ESB-panels. Install Toskana panels to it gaplessly, while fastening it at the center of very panel and where the cross joint is formed. Subsequently lay electrical resistor cable and cover with ArgillaTherm clay-upper plaster No. 1-2. The panels can be cut using an angle grinder or a circular saw bench (recommended saw blade: ODESSÖ DP HKS 250x2,4/1), holes can be drilled with a diamond studded drill bit.

For more accurate processing directions please refer to the TOSKANA system instruction manual.

Subsurface

The subsurface must be sufficiently viable and even. Generally use ESB-Plus or OSB panels, which are to be handled by tongue and groove connection, as a substructure.

For construction parts that are not in direct contact with outdoor air there is usually no need for thermal insulation. In case of doubt please refer to our technical experts.

System components

ArgillaTherm electrical resistor cable

Electrical resistor cable for fabrication as a heating tool in system TOSKANA.

ArgillaTherm clay-upper plaster No. 1-2

Maschinengängige Lehmputz- Fertigmischung gem. DIN 18947.

ArgillaTherm clay-finish plaster No. 2-2

Ready-mix for manufacture of white clay thin-layer coating according to DVL TM 06.

Thermostat according to DIN EN 60730, fire classification II, for finery and flush mounting. Unterputzmontage.

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Clay,dry construction plate according to LP (type A) - TM 07 – MHK I – 0,6 - 25

Clay dry construction plate for paneling and sheathing

For montage to ceiling, wall or slant

Properties

Lehm-dry construction plate with double-sided glass fibre -mesh for laying on compensation areas (areas without heating medium) at systems RIVIERA and TOSKANA. Suitable for panelingof stands or sheathing of wooden areas or masonries forexample,or. Can be fixed to walls, ceilings or slants. As dry-plastering plate for ArgillaTherm clayupper plaster no. 1-2.

Composition

clay, sands, hamp fibres, hamp flakes, glass fibre mesh 12mm.

Characteristics

dimension	750 x 750 x 25 mm
Dimensioning tolerance	MHK I (± 1,0 mm)
weight plate / m²	8,70 kg / 15,50 kg
Bulk density	Bulk density class 0,7 (620 kg/m³)
Surface reinforcement	12mm glass fibre-mesh (both-sided)
Biegezugfestigkeit longitudinal/transverse	3,65 / 2,15 N/mm²
Surface strength	0,11 N/mm²
Water vapor diffusion resistancy	mind. μ = 5/10
Thermal conductivity	0,17 W/mK
Specific heat storage capacity	1,5 kJ/kgK
Fire classification	A 2
Water vapor absorption class	WS III

Forms of delivery

package	Range of coverage	Article no.
1 palette à 60 plates 750 x 750mm 60 plates 750 x 375mm	50,62 m²	ZLBP757525

Dimensions incl. palette approx. 120 x 80 x 170 cm (L x W x H) with edge protection and cardboard cover.
weight incl. palette approx. 815 kg.

Storage

Unlimited at dry storage.

Application

The clay compensation plate can be used in the complete interior works field at walls, ceilings and slants as compensation plate (on areas without heating medium) in conjunction with the heating systems RIVIERA and TOSKANA.

Handling

Machining of the plates

Cutting of plates by means of all popular woodworking and stoneworking machines, such as jigsaw, circular saw and holesaw. Attention: increased dust appearance! Pay attention to the appropriate health and safety rules!

Alternatively plates can be broken across an edge. For that purpose one-sided cut the scrim by means of a cutting knife, break the plate and then cut the scrim at the other side. Finish the broken edges by means of a rasp or mason's plane, if necessary.

Montage

At montage to continous wooden plates the butt joints should not be above the butt joints of the carrier board.

For fixing use stainless-steel load distributors- Art.-No55100 and suitable stainless-steel-screws.

System products

ArgillaTherm clay upper plaster no. 1-2

Machine usable clay plaster ready-mix acc. DIN 18947.

ArgillaTherm clay paint no. 3-1

Sprayable and brushable clay paint as ready-mix.

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Electrical resistor cable system TOSKANA

Electrical resistor cable for the TOSKANA system

following IEC 60800 (ed.3):2009-07

Properties

Electrical resistor cable for fabrication as heating tool in the ArgillaTherm®
System panel TOSKANA.

Insulation

Fluoroplastic

Key figures (values in brackets are required according to DIN)

Nominal voltage	230 Volt
Demand	12 W/m
Cold applied conduit connection	4 m
Minimum installation temperature	5 °C
Smallest bend	29,4 mm
Resistance tolerance	- 5 % / +10 %
Approval	following IEC 60800 (ed.3):2009-07
Cold warm transition	Seamless, without shrink-fit technology
Cable diameter	5,0 mm

Forms of delivery

Heating load in W	Length of heating conductor in m*	Area in m² (at complete occupancy)	Article number
150	12,07	1,02	EHK001207
450	35,97	3,05	EHK003597
750	59,87	5,07	EHK005987
1432	119,37	10,12	EHK011937
2152	179,37	15,20	EHK017937

* all cables are pre-assembled with a 4 m long connection cable pre-assembled (seamless transition)

Bild vom nahtlosen Übergang; Anschluss- zum Heizkabel

The seamless transition of connection and heating cable is waterproof and ideal for installation into the TOSKANA ceiling heating system. The heating cable is made up of a solid heating conductor with an insulation cover, a solid return copper conductor with an insulation cover and a copper current-operated circuit breaker. An aluminum coat with outer insulation forms the completion of the heating cable.

Storage

The material is indefinitely storable at dry storage.

Occupancy

The specified area is related to the closest-possible occupancy at system TOSKANA. In practice the occupancy is based on the calculated length of the heating cable and the actual conditions.

Lower heating loads are represented either by a reduced ceiling surface temperature or a reduced number of clay system panels at constant surface temperatures (areas are paneled by clay compensation plates).

Application

Electrical resistor cable for laying into the ArgillaTherm system panel TOSKANA. Connect testing device (e.g. Warmup Watchdog). Conduct a wavelike installation of the cable, starting at the transition of the connector to the heating cable (labeled with red and blue arrows). Belay the circumferential groove last, because it serves as a safety lead-out track. In conclusion cover with the ArgillaTherm finish plaster.

The VDE / EN-requirements (60335-2-96-2002) demand a 5,00 mm cover of the heating pipes. Comply with an approximate 30cm spare space, for lamps, required areas for smoke detectors or other attachments.

Electromagnetic fields

Supply and return conductors lie closely together and are passed through by a current, running in opposite directions in the heating cable by ArgillaTherm®. The magnetic fields of both conductors (twin sheet technology) are oppositely aligned in this order neutralizing each other. This design guarantees electromagnetic fields of practically zero (0-0,2 Mikrotesla).

Additionally, all conductors are insulated and repeatedly entirely protected by an aluminium coating with outer insulation. The aluminium coat acts like a faraday cage, meaning electric fields are completely.
Important: **The protective conductor must be grounded!**

System products

ArgillaTherm clay-dry construction panel system TOSKANA acc. to DVL TM 07 (Typ A)

Dry construction panel as mounting aid for electrical resistor cable.

ArgillaTherm clay-upper plaster No. 1-2

Machinable clay plaster ready-mix acc. to. DIN 18947.

ArgillaTherm clay-finish plaster No. 2-2

Ready-mix for creation of white thin layer coating acc. To DVL TM 06.

ArgillaTherm clay-paint No. 3-1

Spray and brushable clay paint as ready-mix.

Thermostat AT-3D

Thermostat acc. DIN EN 60730, protection class II, for finery or flush mounting.

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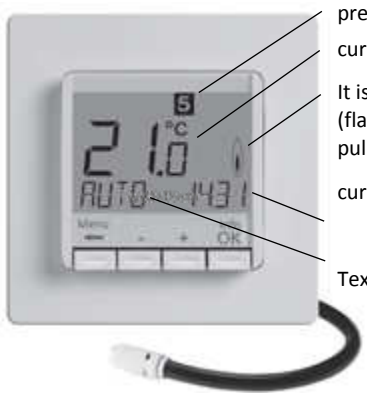
Thermostat AT-3D

According to DIN EN 60730, protection grade II

For finery and flush mounting for heating/cooling



Properties

The VDE-certified, programmable thermostat AT-3D by ArgillaTherm® is perfectly suited for the regulation of the low-temperature- ceiling/wall heating system TOSKANA and RIVIERA. Indoor temperature only plays a minor role, since heat transfer takes place through an almost 100% proportion of thermal waves (radiant heat). The temperature is regulated depending on the ceiling temperature, measured by the remote sensor. Thus, possible external influences like draft cannot have a negative effect on the regulation behaviour. The regulator can be positioned all around the room or even outside of it.

- ✓ Single-lined text display for simplified usage
- ✓ Background lighting
- ✓ Real time clock (setting of year, month, day, time)
- ✓ Automatic summer/wintertime changeover
- ✓ Max. 9 switching times per day (various per day)
- ✓ Pre-set and adjustable time programmes
- ✓ Optimal-start (temperature is achieved at set time)
- ✓ Switch-off function, press V button for 10 sec.
- ✓ Vacation function with date (vacation from…to)
- ✓ Short term timer (party) for temporary change of temperature
- ✓ Energy consumption display of the last 2 days, -week, -month, -year
- ✓ Energy costs adjustable per hour
- ✓ Antifreeze
- ✓ Temperature adjustment range terminable
- ✓ Safeguard for unauthorized parties
- ✓ Operating language adjustable
- ✓ Temperature readable as number
- ✓ Configurable heating break according to EN 50559 standard

Key figures (according to DIN required values in brackets)

Power supply	230 V AC 50 HZ (207…253 V)
Selectable temperature range	10 °C to 40 °C; in 0,5 °C steps
Display temperature range	0,1 °C steps
Output	relay change-over, non-floating
Switching current	10 mA... 16(4) A *; 230 V~
Output signal	PWM or 2-point (on/off)
PWM-cycle period	adjustable
Hysteresis	adjustable (for 2 points)
Minimal switching times	10 minutes
Power consumption	~ 1,2 W
Rate precision	< 4 min / year
Power reserve	~ 10 years
Remote sensor	AT-F100-1, length 4 m, extendable to 50 m
Ambient temperature	operation 0 °C to 40 °C (without condensation)
Storage	-20 °C to 70 °C (without condensation)
Impulse voltage for calculation	4 kV
EMV-emisson interferance testing	230 V voltage, 0,1 A power
Protection type	IP 30
Protection grade	II
Software grade	A
Pollution grade	2
°C for ball pressure testing	75 ± 2 °C
Energy grade*	IV = 2%
Measurements	Control panel 50 x 50 mm Blind frame 80,5 x 80,5 mm Installation depth 42 mm Coating thickness 17,5 mm Remote sensor head 20 mm x Ø 8 mm

* with electricity > 14 A, N-Do not drag power cable over the regulator, jam seperatly instead.

** acc. to EU 811/2013, 812/2013, 813/2013, 814/2013

Forms of delivery

Package/ 1 piece	Content	Article number
11,5 x 10 x 6,5 cm weight: 280g	1 piece thermostat 1 piece privacy shade 2 piece screws 15 x 2 mm 1 piece remote sensor, 4m long 1 piece instruction manual	ZAT3DR000

Assembly

The device is to be opened by an electrician only and installed according to the circuit diagram or instruction manual in the case cover. Herefore all safety regulations must be complied by. To meet protection grade II requirements, according installation measures must be undertaken.
For use in the TOSKANA system: To avoid electric fields, the protective conductor of the electrical resistor cable must be grounded!
Installation only to non-conductive (synthetic-) flush-mounted boxes!
For solid and flexible conductors, cross section 1 to 2,5 mm².
For surface installation; use Gira case GIR AP-case1f.rws-g 006103.

Remote sensor

Install remote sensor (Caution voltage! Extendable with twin-core cable for 230 V to approx. 50 m) so that it touches on the ceiling temperature correctly. Avoid narrow parallel guidances with power cables, in the cable duct for instance. Dismantling of cables max. 8mm.

Placement in the RIVIERA system: White sensor head 2 cm apart from closest return pipe.

Placement in the TOSKANA system: White sensor head 3 cm apart from closest heating cable.

Example TOSKANA system

Resistance table remote sensor

Temperature	Resistance
10°C	66,8 kΩ
20°C	41,3 kΩ
25°C	33,0 kΩ
30°C	26,3 kΩ
40°C	17,0 kΩ
50°C	11,3 kΩ

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No. 1-2

clay-upper plaster

according to DIN 18947 – LPM 02 f – S II – 1,8

Characteristics

clay upper plaster is a machinable ready-mix according to DIN 18947.

Composition

Construction clay, sand 0-2mm, Mmscanthus fibres 0-10mm

(DIN required data in brackets)

Plaster application thickness	5 mm / 15 mm (min./max.)
Particle size group oversize grain	0/1, < 2 mm
Gross density class	1,8
Drying shrinkage rate	2,2 % (≤ 3 %)
Strength class	SII
Compressive strength	3,2 N/mm² (≥ 3,0)
Bending tensile strength	1,1 N/mm² (≥ 1,0)
Adhesive strength	0,20 N/mm² (≥ 0,15)
Steam diffusion resistance	μ < 8
Reaction to fire classification	A 1
Thermal conductivity	1,30 W/mK
Abrasion	0,6 g (≤ 0,7)
Fibres	Miscanthus up to 10 mm
Steam sorption grade	WS III

Forms of delivery

package	content	System reach	Article no.
1 bag à 25 kg	25 kg	2 m²	ZLOP120025
40 bags à 25 kg on euro pallet	1000 kg	80 m²	ZLOP121000

Storage

Material is indefinitely storable at dry storage.

Yield

25 kg clay-upper plaster amount to approximately 16 l render mortar.

For use on ArgillaTherm claysystem panels according to instructions this amount is sufficient to approx.2 m².

Addition of water

Auf 25 kg Lehm-Oberputz ca. 4-6 l Wasser bei Anwendung auf ArgillaTherm Lehm-Systembauplatten.

Die angegebene Wasserzugabe ist vom Verarbeiter an den Untergrund, die Verarbeitungsart und die Auftragsstärke anzupassen und muss bei Überkopfanwendung eher trockner eingestellt werden.

Application

Ein- oder mehrlagiger Putz für den Innenbereich für Hand- oder Maschinenauftrag auf ArgillaTherm Lehm-Systembauplatten, Lehm-Unterputz, allen Mauerwerksarten und anderen Massivbaustoffen. Kleine Mengen können mit dem Motorquirl oder von Hand angerührt werden, bei Maschineneinsatz unter Zugabe von Wasser mit allen handelsüblichen Freifall- und Zwangsmischern oder geschlossenen Putzmaschinensystemen (z. B. G4 u. G5).

Mischzeiten

Motorized mixer	5 minute
Gravity mixer	10 minutes
Compulsory mixer	5 minutes

An extension of these mixing times make the plaster smoother and enhance ist adhesion.

Plaster subsurface

Subsurfaces must be solid, clean and free of film forming release agents and sufficiently rough and dry, since clay plaster only sticks mechanically. Older clay subsurface,such as the ArgillaTherm clay system construction panels must be watered previously, for other surfaces previous watering is only needed in case of an extension oft he processing times. Do not wet sand lime bricks!

Application

Forcefully apply a 3-5mm layer to a previously wet surface of the Argilla Therm clay system construction panels with a trowel and smoother and thereby level the grooves, let it dry. Insert a suitable reinforcement fabric (7mm mesh) sufficiently overlapping and even out the pushed through clay mass with a 2-3mm und trocknen lassen. Mit Zahnkelle etwa 5mm Putzüberdeckung mit ausreichend überlappenden 7mm Armierungsgewebe herstellen. Urgently note: the overlapping of the mesh should not be directly over edges of system panels, at least 10cm apart!

After drying prepare the surface using a sponge float or a special felting machineto prepare for application of ArgillaTherm clay paint No.3-1.

Open time

If covered up the mixed clay upper plaster stays ready for use for a few days. Water can be added at any time to achieve the desired consistency.

System products

ArgillaTherm clay-dry construction panel system TOSKANA acc. DVL TM 07 (Typ A)

Dry construction panel as mounting aid for the electrical resistor cable.

ArgillaTherm electrical resistor cable

Electrical resistor cablefor fabrication as heating tool in the sToskana system.

ArgillaTherm clay-finish plaster No. 2-2

Ready-mix for creation of a white thin layer coating acc. to DVL TM 06.

ArgillaTherm clay paint No. 3-1

Spray und brushable clay paint as ready-mix.

Thermostat AT-3D

Thermostat according to DIN EN 60730, fire classification II, for flush and finery mounting.

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Working conditions for construction and application areas of our products are very various. In our technical data sheets, we can only provide basic processing guidelines. These comply with our current state of knowledge. Planners and processors are obligated to examine suitability and potential applications for the intended use. For application scenarios that are not expressly mentioned in our data sheets, planners and processors are obligated to refer to the ArgillaTherm® application technology. If the processor uses the product beyond the area of application in the instruction manual, without previous consultation of the ArgillaTherm® application technology, they are completely liable for the potential resulting damages. All herein contained descriptions, sketches, photographies, data, conditions, weights etc. can be changed without prior notice and do not represent contractual agreements of the of the products characteristics.

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No. 2-2

Clay finish plaster

White clay thin layer coating according to DIN 18947 – LPM 02 f – S II – 1,8

Characteristics

Clay finish plaster is a machinable ready-mix and meets all DIN 18947 requirements.

Composition

Construction clay, sand 0-2mm, marble powder, cellulose

Key figures (following DIN required data in brackets)

Plaster application thickness	5 mm / 15 mm (min./max.)
Particle size group, oversize grain size	0/2, < 3 mm
Gross density class	1,8
Drying shrinkage rate	0,82 % (≤ 1 %)
Strength class	SII
Compressive strength	2,7 N/mm² (≥ 1,5)
Bending tensile strength	1,0 N/mm² (≥ 0,7)
Adhesive strength	0,22 N/mm² (≥ 0,1)
Steam diffusion resistance	μ < 8
Fire classification	A 1
Thermal conductivity	1,40 W/mK
Steam sorption grade	WS III

Forms of delivery

Containers	Content	System reach	Article number
25 kg per bag	25 kg	6-7 m²	ZFIP220025
40 25 kg bags per euro pallet	1000 kg	240-280 m²	ZFIP221000

Storage

Material is indefinitely storable at dry storage.

Yield

25 kg clay final plaster amount to 16 l render mortar.

For use on the ArgillaTherm clay system panels according to instructions this amount is sufficient for approx. 2 m².

Addition of water

Add approx. 4 l of water to 25 kg clay final-plaster for use on the ArgillaTherm clay system panels. The given amount of water is to be adjusted to surface, processing type and application intensity by the processor and should be rather dry for overhead application.

Application

Single- or multiple layered plaster, for indoor areas, for manual and machinery application to the ArgillaTherm clay system construction panels, clay flush mounting, all types of masonry and other solid construction materials. Smaller amounts can be mixed per hand or with a motorized mixer, for use of machines under addition of water with all customary free fall- and compulsory mixers or closed plastering machine systems (e.g. G4 and G5).

Mixing duration

Motorized mixer	5 minutes
Drum mixer	10 minutes
Compulsory mixer	5 minutes

An extension of the mixing duration makes the plaster smoother and enhances its adhesion.

Plaster surface

Surfaces must be solid, clean and free of film forming release agents and sufficiently rough and dry, since clay plaster only sticks mechanically. Older clay surfaces like the ArgillaTherm clay system construction panels must be watered well previously, for other surfaces previous watering is only needed in case of an extension of the processing times. Do not wet sand lime bricks.

Plaster application

Apply plaster evenly using a stainless steel smoother. Smoothen the surface and and rub it through using a sponge float as soon as the finish plaster has dried leather-hard. For a finer structure the surface can be rewet and rubed through using a clean sponge float. For an even appearance Argilla Therm finish plaster should be applied with one mix for the complete surface within one working day.

Open time

IMixed clay finish plaster should be applied within 3days. Water can be added at any time to achieve the desired consistency.

System products

ArgillaTherm clay dry construction board TOSKANA system

Dry construction board as mounting aid for the electrical resistor cable.

ArgillaTherm elecrical resistor cable

Electrical resistor cable for fabrication as heating tool in the Toskana system.

ArgillaTherm clay upper plaster No. 2-2

Ready-mix for preparation of a white thin layer coating according to DVL TM 06.

ArgillaTherm clay paint No. 3-2

spray and brushable able clay paint.

Thermostat AT-3D

Thermostat according to DIN EN 60730, protection grade II, for flush and finery mounting.

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Standard assembly times of the ArgillaTherm clay system ceiling

Ground	minutes/m²
montage of ESBplus/ OSB-panel onto concrete ceiling by means of frame or nail plugs	20
montage of ESBplus/OSB-panels onto wood construction	15

System TOSKANA	minutes/m²
assembly of clay system panel onto OSB/ ESB incl. insulation strip	15
laying of electrical resistance cable (configuration 6 running metres per m²)	7
application of clay finish plaster incorporating reinforcement fabric, finely grated, surface Q2, ready for application	40
Application of 2 layers of clay paint onto clay finish plaster	8

Specified figures refer to normal sized, rectangular rooms of approximately 20 m², are based on our up-to-date technical experiences and make up for rough calculation. Actual figures can significantly vary according to actual structural conditions.

System products

System products	Art.-No.	UVP Without VAT. Per unit	Images
ArgillaTherm clay system panel TOSKANA E11.8 with press fitted glass-silk mesh, measurements: 375 x 375 x 25mm	ESBP000001	55,50€/m²	
ArgillaTherm clay system compensation plate, bulk density approx. 620Kg/m³, 750 x 750 x 25mm	ZLBP757525	27,50€/m²	
ArgillaTherm clay finish plaster No.1-2 according to DIN 18947, dry ware for 2m² ceiling surface, 25KG bagged goods	ZLOP120025	9,95€/bag	
ArgillaTherm® clay-color No. 3-1 spray- and paintable ready-mix for 35m² ceiling surface, pure white	ZLFA310010	49,50€/bucket	
Wood fiber edge insulation strips, , size 50 x 10mm, roll with 10m	ZRDS501000	7,95€/roll	
Glass silk mesh, MW 7 x 7mm, 105g/m², 100cm wide, roll with 100m	ZGSGG77000	89,50€/roll	
Stainless-steel load distributors for mounting of the clay system panels, 5 x 50mm, 100 pieces per box	ZLTE055100	19,50€/box	
Stainless-steel countersunk multi head screws T-Star Plus T20 with partial thread 5 x 45mm, 200 pieces per box	ZETS054500	22,50€/box	

Heating technology

Heating technology	Art.-No.	UVP Without VAT. per unit	Images
ArgillaTherm® electronic ceiling- temperature-regulator AT-3D including 4m remote sensor, VDE-approval	ZAT3DR000	89,50€/pcs.	
ArgillaTherm® electronic resistor cable.230V 12,07m heating conductor á 12 watt/m, 150watt, 4m connection line	EHK001207	72,95€/pcs.	
ArgillaTherm® electronic resistor cable 230V 35,97m heating conductor á 12 watt/m, 450 watt, 4m connection line	EHK003597	135,95€/pcs.	
ArgillaTherm® electronic resistor cable 230V 59,87m heating conductor á 12 watt/m, 750 watt, 4m connection line	EHK005987	197,95€/pcs.	
ArgillaTherm® electronic resistor cable 230V 119,37m heating conductor á 12 watt/m, 1.432 watt, 4m connection line	EHK011937	249,95€/pcs.	
ArgillaTherm® electronic resistor cable 230V 179,37m heating conductor á 12 watt/m, 2.152 watt, 4m connection line	EHK017937	369,95€/pcs.