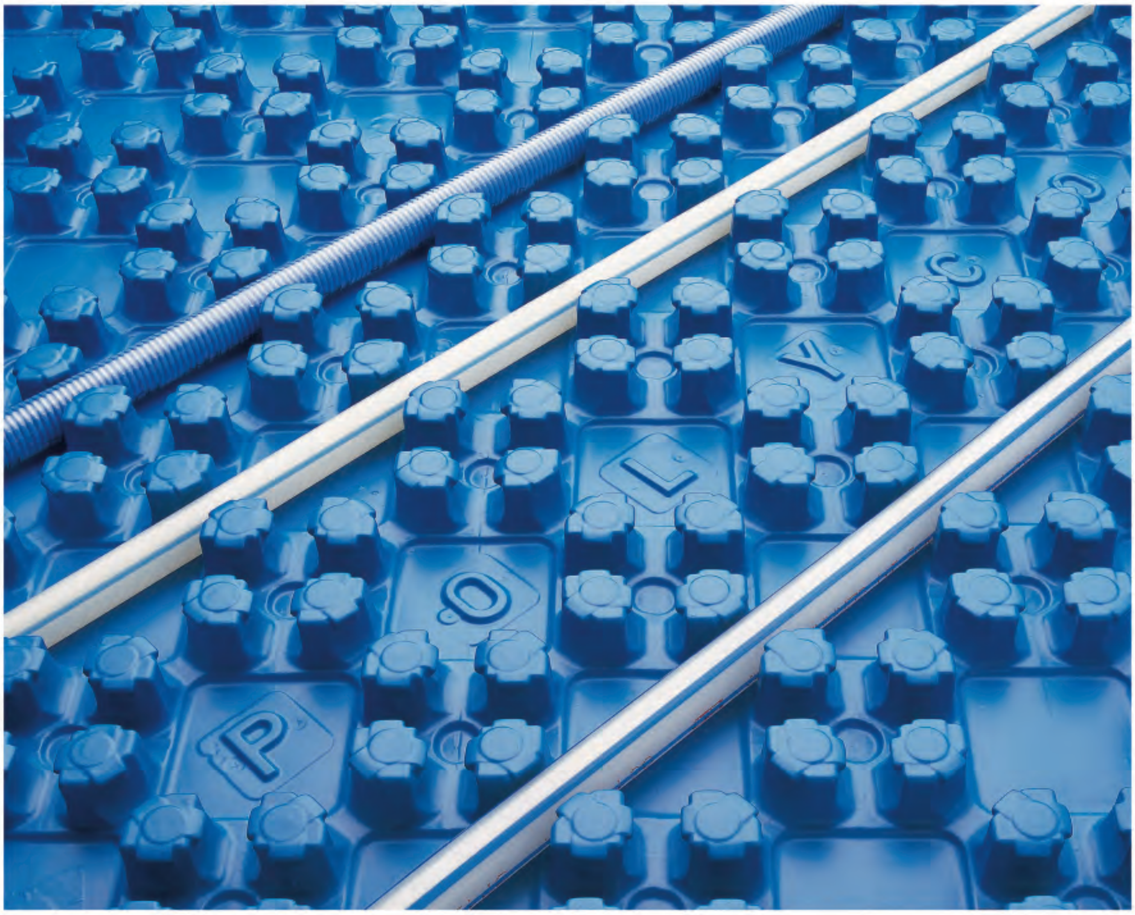
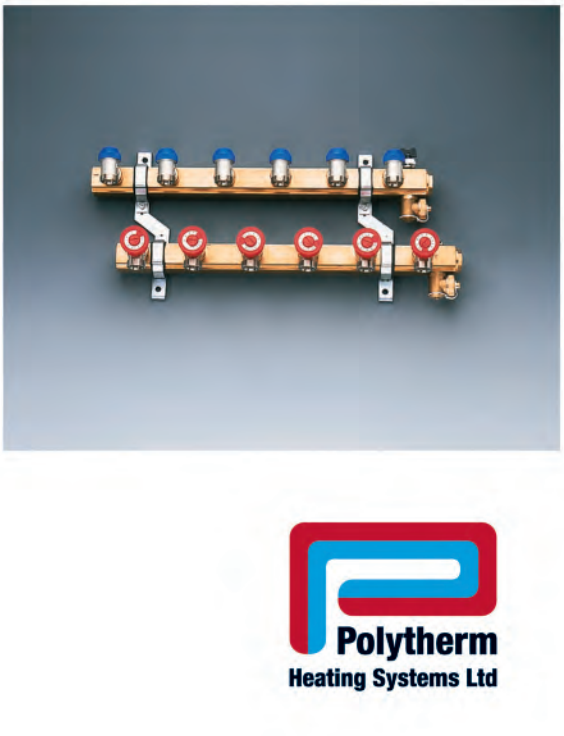
POLYCOMFORT®

THE FIVE-STAR UNDERFLOOR HEATING SYSTEM.

TECHNICAL CATALOGUE

EFFECTIVE FROM 1^{ST} JANUARY 2010





Polytherm
Heating Systems Ltd

Polycomfort is the sum of all our experience.

★★★★★

System panel Polycomfort 30-2 with footfall sound insulation (28 dB).

★★★★★

Quickly installed with virtually no waste.

★★★★★

Polycomfort 11 – the system panel without footfall sound insulation for special-purpose applications, including higher traffic loads.

★★★★★

Excellently suitable for use with cement screed, self-levelling screed and thin-bed screed.

★★★★★

PE-Xc system pipe 14 x 2/16 x 2 mm, cross-linked, oxygen-diffusion proof and flexible.

★★★★★

Environmentally-friendly PS, just one material – easily recyclable.

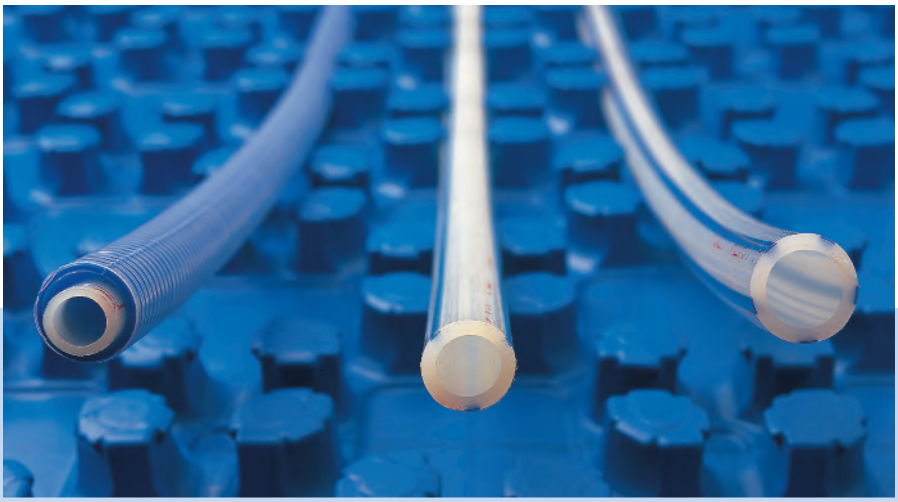
★★★★★

Diagonal installation with no need for extra fixing.

★★★★★

System safety and quality of a tried-and-tested brand-name.

Polytherm® is an area temperature control system with practically universal application – whether for upgrading existing building fabric or for use in new buildings.



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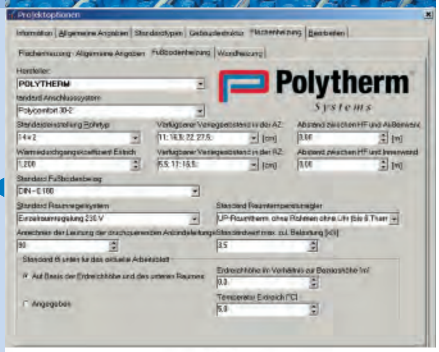
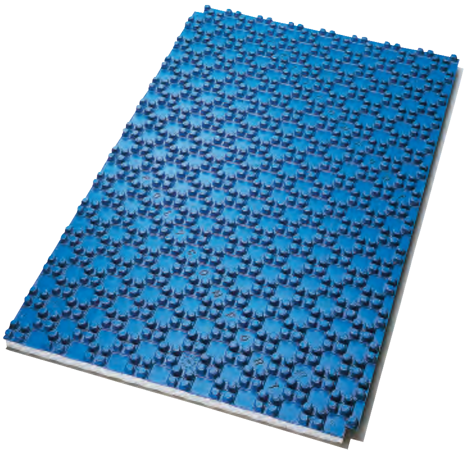


Polycomfort. Just a minimum of system elements required for a 5-star underfloor heating system.



System Panel Polycomfort 30-2.

Meets all the requirements of standard acoustic insulation, thermal insulation, thermal performance and fire protection. It can accommodate both 14 x 2 and 16 x 2 mm pipes and can be optimally adapted to any size and geometry of room. It is installed easily and cleanly using the overlapping press-stud principle.

Polycomfort 11.

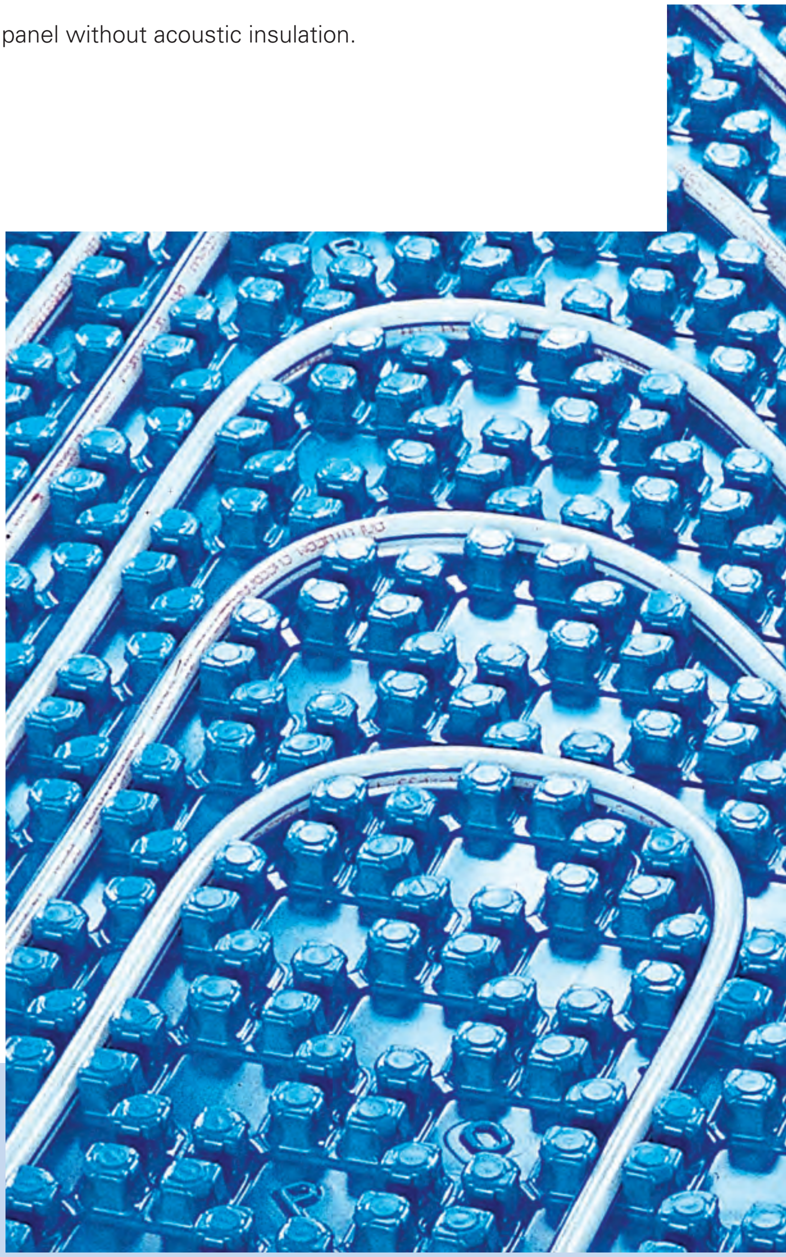
11 mm foam-backed panel without acoustic insulation.

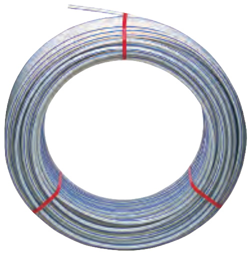
Special edging insulation strips 8.

Despite its inconspicuous appearance, the strip fulfils a vital function in terms of screed as it provides adequate freedom of movement and prevents acoustic and thermal bridges in the connection joints.

Special edging insulation strips 10.

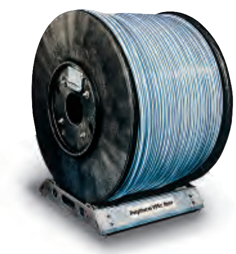
Features an adhesive strip on the film. Ideal for sealing where self-levelling screed is used.





The PE-Xc system pipe 14 x 2/16 x 2 mm.

Cross-linked, oxygen-diffusion proof and extremely flexible. A heating pipe of the very highest quality to meet all installation and heating requirements.



The PE-X plus system pipe with protective jacket.

PE-X plus is the ideal system solution especially for connecting up small areas to existing control circuits with high flow temperatures; for example in bathrooms. Please refer to the special edition of Technik PE-X plus 1/2004.

Good to know!

Polytherm is one of the leading system suppliers for space heating, offering top-quality solutions to ensure perfect installation and superior comfort in any room. To achieve this we are committed to meeting numerous German and European regulations and standards all of which we can document by the corresponding test and quality marks. The minimum standards required by these tests are not stringent enough for Polytherm so we carry out a series of additional measures, both our own and such as are monitored by external authorities in order to guarantee our high quality requirements.

Quality Management at Polytherm has also been certified so together with our highly professional and qualified staff, you can certainly count on us as a reliable partner.

Furthermore, Polytherm can offer any operating company a written ten-year warranty plus a copy of our Professional Indemnity Insurance Policy on request.

System/thermal output DIN EN 1264 — DIN Geprüft • 7F149 • 7F023

RAL Quality mark for combined area heating/cooling systems — RAL GÜTEZEICHEN RAL-GZ 963/1-1

Pipes/connectors DIN 4726 — DIN Geprüft 3 V 265/PE-X

Element 30-2/improved footfall sound insulation DIN 4109 — **28 dB**

Element RAL-monitored — Güteschutz Hartschaum RAL DIN 18164 Teil 2 überwacht

Quality Management — EN ISO 9001:2000 DNV Certified Company

Warranty — **10 years**

Quality is the sum of many excellent properties.
The PE-Xc system pipe 14 x 2/16 x 2 mm.

Flexible handling, frequently severe construction site conditions, permanent physical and chemical stress and last but not least, a desired long service life (projected to more than 50 years) – all these factors have been reduced to one single denominator in the form of a top-class heating pipe.

The Polycomfort system pipe is c-cross-linked.

This necessitates a special production process which converts the high-grade base material (polyethylene) into a special structure using electron radiation; a process referred to in the trade as "spatial networks at the macro-molecular level".

The process gives the material several important characteristics:

> prevention of a severe drop in internal pressure creep strength
> the pipe is insensitive to stress crack formation
> the pipe is more evenly crossed linked than any other chemically crossed linked pipe
> no chemicals are used in PE-Xc process. Therefore there are no implications for sanitary installations

Plus points for easy installation.

> rapid and tension-free installation
> min. bending radius 5 x d
> no pre-heating required, even at min. bending radius
> high-level resistance to tear propagation and abrasion
> oxygen-diffusion proof jacketing

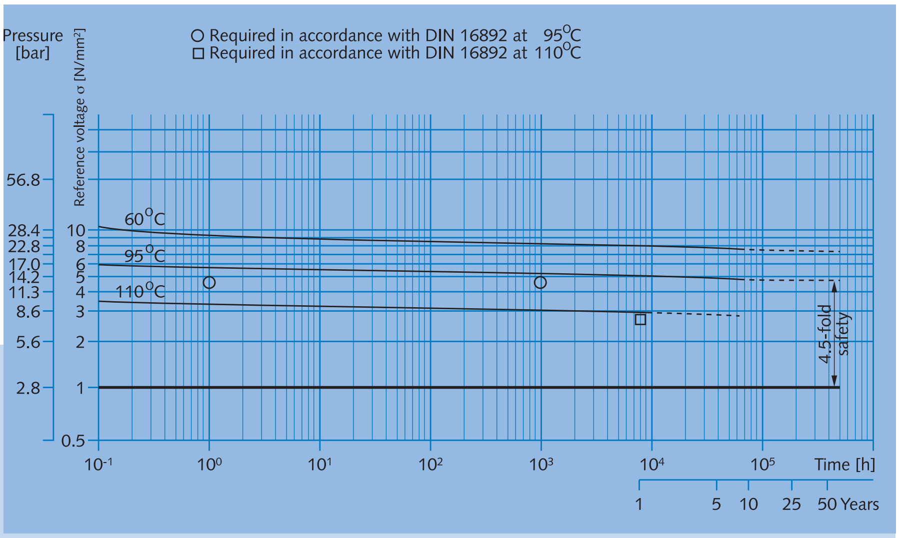
Excellent operational performance.

> high-level operating load capacity: class of application 5; operating pressure up to 10 bar
> excellent stabilising properties against thermal ageing thus preventing damage caused by thermo-oxidative decline in designated operation
> chemical-resistant, corrosion-proof
> negligible pressure loss
> no encrustations
> high-level impact strength

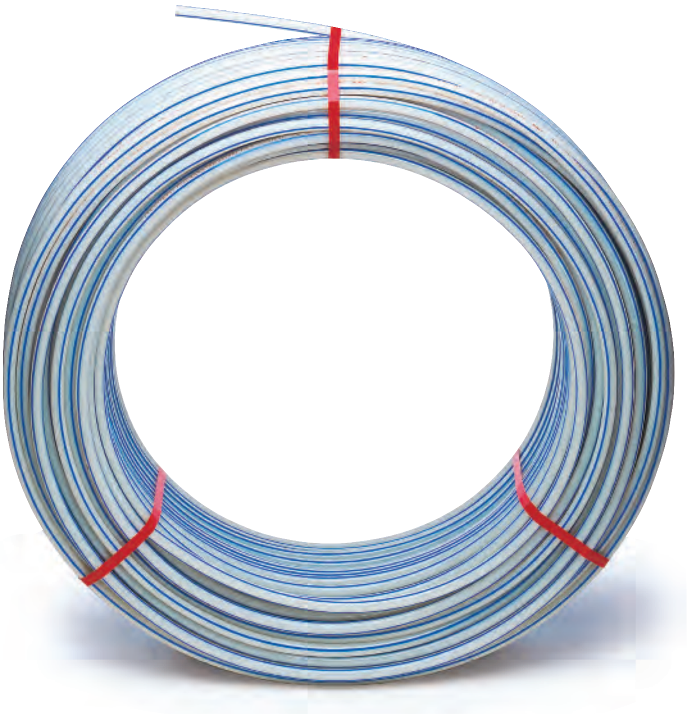
Quality assurance through in-house and external monitoring.

> inspected in accordance with DIN 16892/DIN 4726
> DIN EN ISO 15875-1 to 3 and 5
> Inspection of incoming raw materials
> degree of cross-linking tested in each and every coil
> inspection of resistance to thermo-oxidative ageing
> each coil leak-tested
> constant inspection of dimensional continuity and accuracy in measurements during manufacturing process
> many of these parameters undergo neutral testing carried out by the State Material Inspections Agency in Darmstadt

The Polycomfort system pipe which is monitored by the Material Inspections Agency (MPA) is environmentally-friendly and easily recycled.

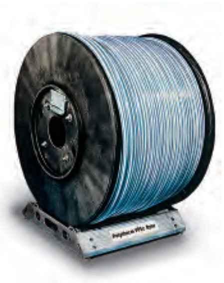


The excellent creep strength is tested batch for batch whereby the pipe sections are subjected to a stress of 95°C at approximately 10 bar over a period of 1000 hours.



14 x 2 mm: 3 blue stripes as trade mark
16 x 2 mm: 5 blue stripes as trade mark

> Also available as a 750/650 m coil for small drums and especially for large construction projects as 3500/3000 mm large-scale drums providing twist-free unwinding with no losses through cuttings and couplings.



The excellent product profile of Polycomfort system pipes.

Degree of cross-linking	≥ 60%	DIN 16892
Density	≈ 0.94 g/cm^3	DIN 16892 DIN 53479
Notch impact strength acc. to Sharpy	No fracture	DIN EN ISO 179-1/2
Breaking strength σ_B	31–33 N/mm^2	DIN EN ISO 6259-1
Elongation at break ε_R	≈ 300%	DIN EN ISO 6259-1
Tensile strength σ_B	33–35 N/mm^2	DIN EN ISO 6259-1
E-module	1600–1700 N/mm^2	DIN 16892 Din EN ISO 527-1
Stress crack strength	No crack	ASTM D 1693
Oxygen imperviousness	≤ 0.1 g/(m^3·d)	DIN 4726
Smallest bending radius	5 · d	DIN 4726

Thermal properties.

Average thermal coefficient of linear expansion	1,5 · 10^{-4}	DIN 16892 / DIN 53479
Thermal conductivity	0.41 W/(m·K)	DIN 16892 / DIN 53479
Crystallite range of melting temperatures	130–133°C	DIN 51004
Thermal ageing	≥ 16 h	DVGW W 544

Part of the standard: combined inspection of pipe and pipe connector.
Heating pipe and pipe connector are two of the most sensitive seals within any system. Polycomfort compression and screwed connections have all been successfully tested to demonstrate that the respective tolerances are optimally adjusted to one another to ensure safe and leak-free connections. The safety of the system has been confirmed by DIN Certco permit 3 V 265/PE-X.

DIN Geprüft
3 V 265/PE-X

Compression connection | Article No. 7233/9320
Screwed connection | Article No. 7232/1043

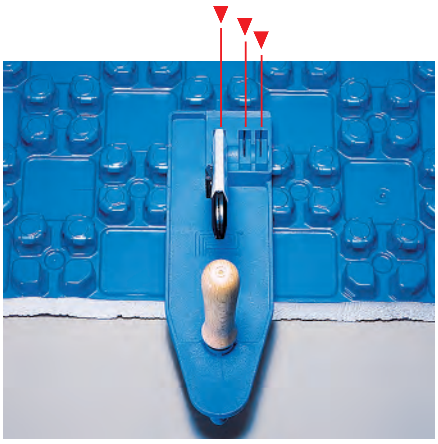
Polycomfort. The subtleties of a system-compatible installation.

Polytherm system panels have long been among the very best on the market when it comes to underfloor heating technology. No wonder then that the Polycomfort system panel also receives praise for its easy installation and superior performance.

Polycomfort system panels, virtually no off-cuts and waste.

This practical cutting tool – the design of which is protected by a patent – is ideal for cutting the panel to size. A specially-designed guide allows a precise cut of three pre-specified lines ▼▼▼ to be made, not only lengthwise but also diagonally. Additional guidance is provided by the studs on the front and the roster structure on the reverse side.

Article No. 7291



Quickly installed by one man alone.

The expansive system panels (approximately 1.25 m²) are installed as usual from left to right. Thanks to the ingenious "cut and overlap" technique there is practically no waste as each cut–off element serves to begin the next row.

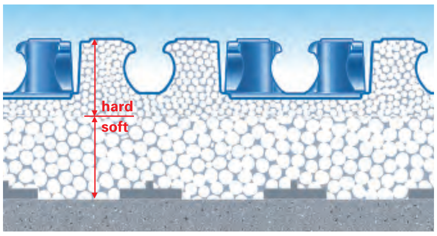
Suitable for two pipe dimensions.

The studded structure of the Polycomfort system elements allows both 14 x 2 mm and 16 x 2 mm PE-Xc system pipes to be accommodated.
The special-purpose PE-X plus pipe is also installed easily and quickly.

Polycomfort 30-2 – meets the highest of demands in functionality.

A cross-sectional view of the system element clearly illustrates the sandwich principle behind the structure. The stud foam is hard on the top to provide improved practical accessibility but soft on the bottom for the footfall sound which together with the studded structure of the deep-drawn foil, result in specific technical data.

Article No. 7200



A thermal conductivity resistance of R_λ = 0.75 m²K/W is prescribed for the thermal insulation of the Polycomfort system element 30-2.
While being classified as a s'20 in terms of rigidity, the Polycomfort 30-2 system element has a standard sound insulation value of 28 dB in accordance with DIN 4109.

The specially-designed pipe-holding studs ensure the system pipe's exact height and placement, thus excluding any horizontal or vertical movement of the system pipe and allowing the pipe to be completely embedded in screed. Seen functionally, that is of considerable importance as the prescribed studded structure ensures an exact transmission of the calculated thermal output.
In terms of flammability in compliance with DIN 4102, the Polycomfort system panel is classified as a B2 building material with normal flammability.

Polycomfort 11 – element panels for special applications.

As an alternative to the Polycomfort system panel 30-2, a panel with just 11 mm back-foam and without footfall sound insulation is available with a thermal conductivity resistance of
R_λ = 0.37 m²K/W.

Article No. 7201

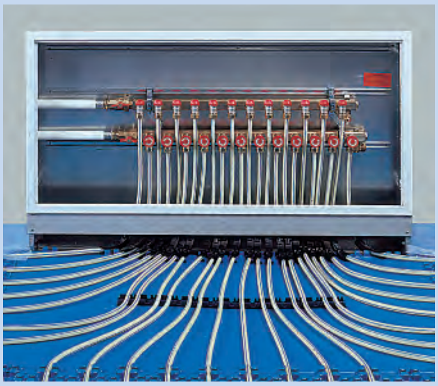
Polycomfort supplemental set. Easier incorporation into heating loop manifolds, improved pipe guidance through doorways!

For these two "problem zones", Polytherm has developed ideal supplementary products for the system.

The manifold element.

For example, if more than eight heating loops are to be connected up to a manifold from one side, there will be 16 pipe guides fighting for space. The Polycomfort manifold element provides room and, using a manifold bar which can be positioned as required, resulting in a tidy arrangement at fixed intervals.

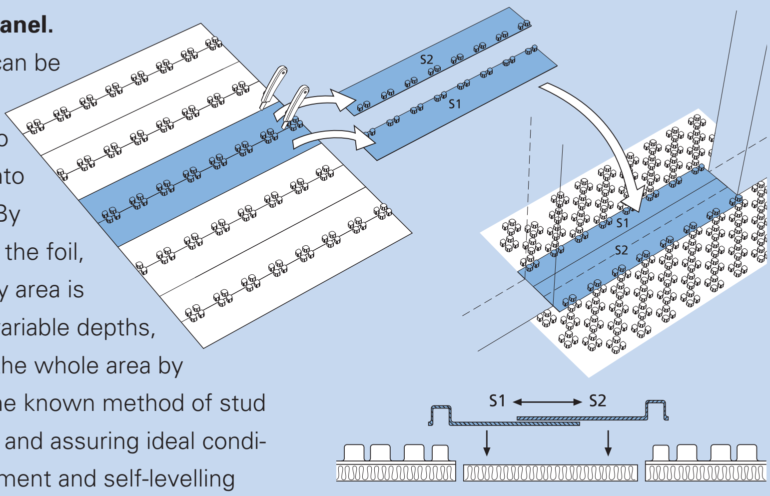
The studded structure all over the panel ensures a safe connection to the Polycomfort system panel. At the same time, overlapping using the press-stud principle ensures the necessary sealing for self-levelling screed and cement screed.

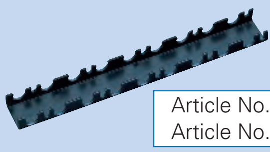


The door panel.

This panel can be easily cut into strips to fit exactly into doorways. By overlapping the foil, the doorway area is bridged at variable depths, sealing off the whole area by means of the known method of stud overlapping and assuring ideal conditions for cement and self-levelling screeds.

Loose **insulation** is supplied to be installed under the manifold element or door strips beforehand.





Article No. 7225
Article No. 7226

Supplemental set 30-2

2.5 m^2	manifold panel foil
2.5 m^2	door panel foil
5 m^2	30-2 mm thermal and footfall sound insulation
s'	20 MN/m^3
	WLG 040

Article No. 7202

Supplemental set 11

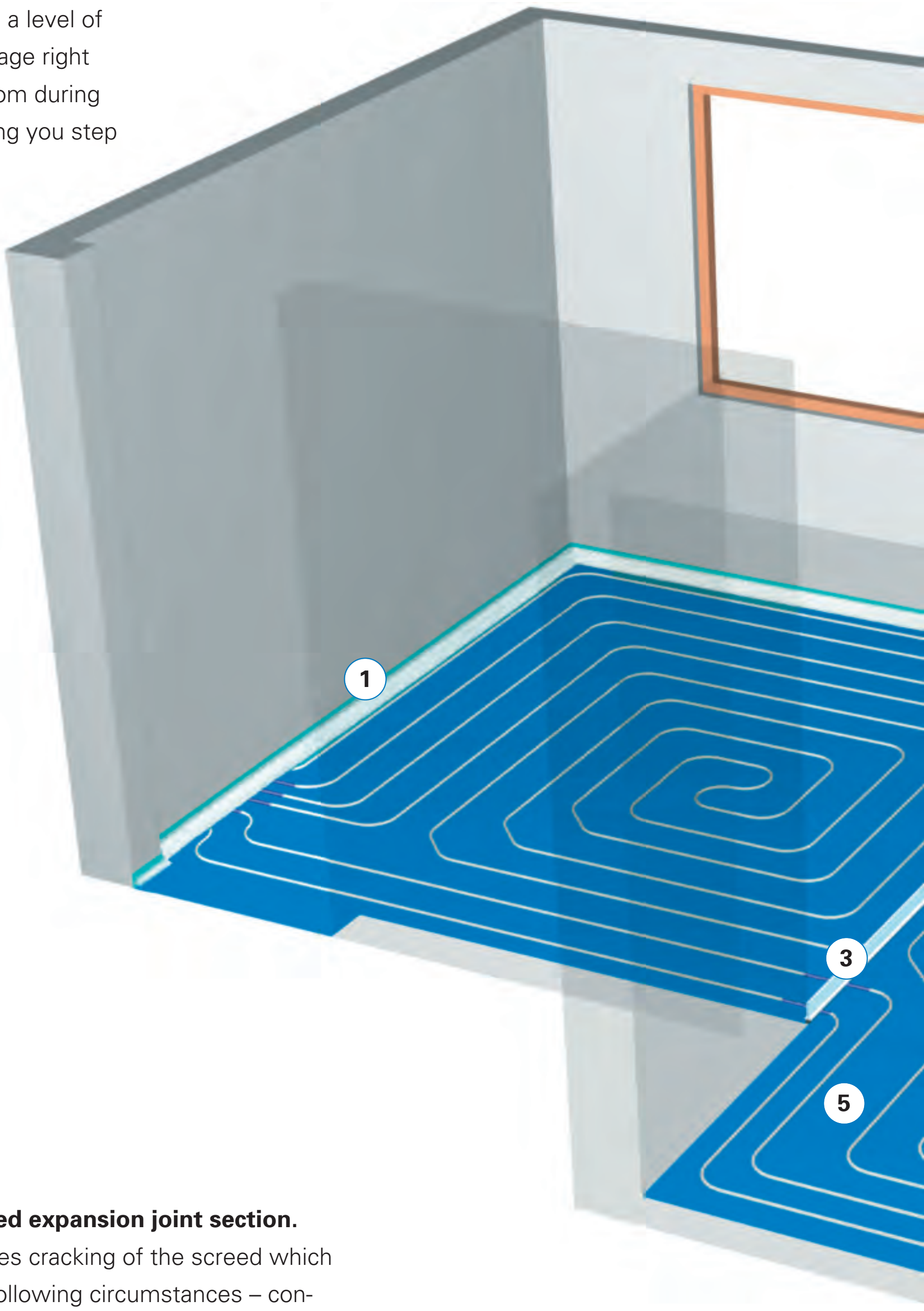
2.5 m^2	manifold panel foil
2.5 m^2	door panel foil
5 m^2	11 mm thermal insulation
s'	30 MN/m^3
	WLG 035

Article No. 7203

Manifold bar for the Polycomfort supplemental set with 32.5 mm roster, self-adhesive.

Polycomfort. Components of a perfect system solution.

Polycomfort is a floor heating system incorporating a level of comfort which sets standards from the planning stage right through to the smallest nooks and crannies of a room during installation. All details are ideally integrated providing you step by step with a perfect system solution.



1

Special edging insulation strips fulfil two important functions. Prevent acoustic bridges around the border joints whilst providing sufficient freedom of movement (at least 5 mm) in compliance with standard specifications and the manufacturer's specifications for self-levelling screed. Polytherm supplies the special edging insulation strips in two versions.

Special edging insulation strip 8
for cement screed, 8 mm thick

Article No. 1077

Special edging insulation strip 10 for self-levelling screed, 10 mm thick, additionally features foil with an adhesive strip to provide improved sealing of border joints.

Article No. 7220

2

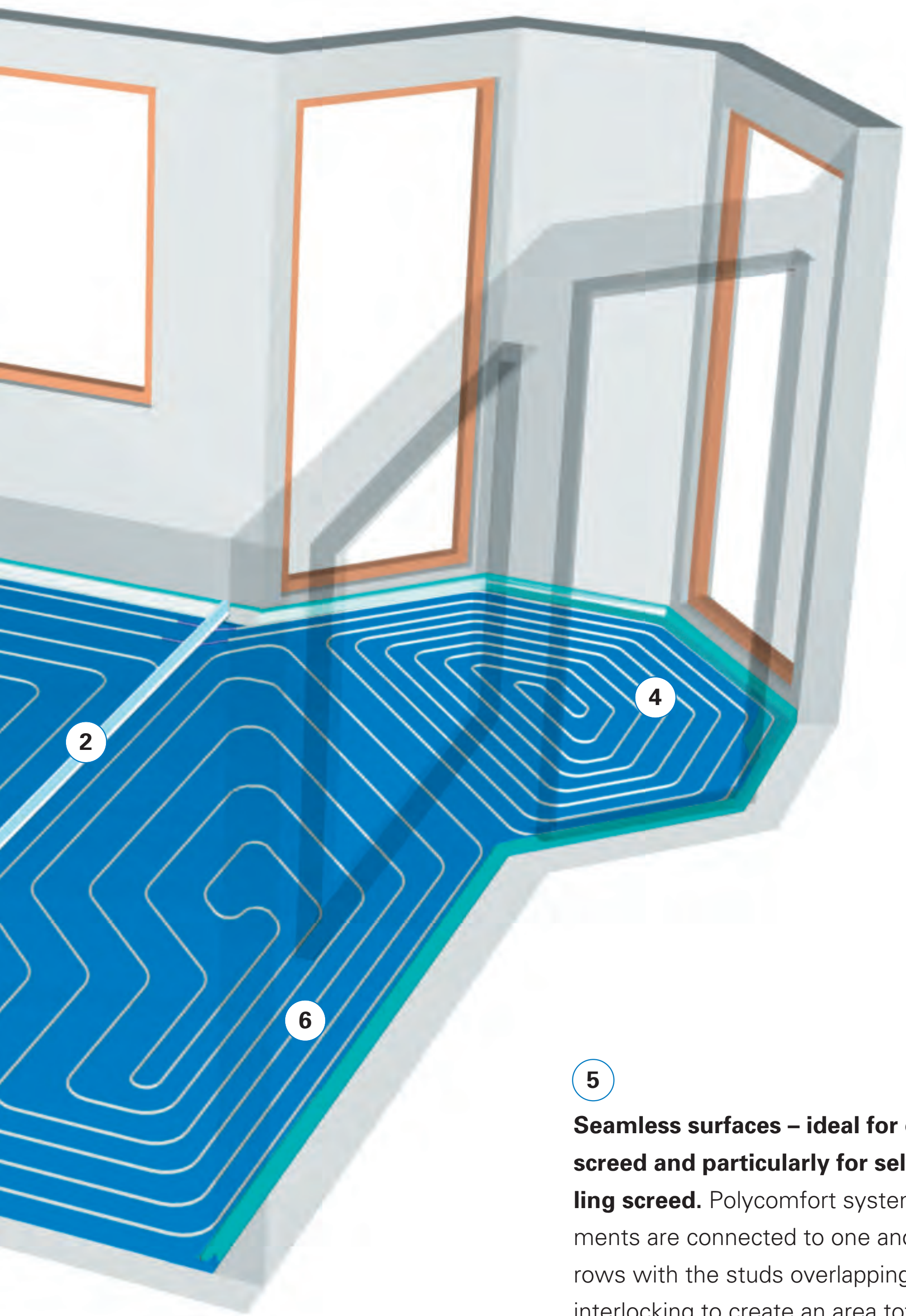
Rounded expansion joint section.
Alleviates cracking of the screed which in the following circumstances – construction joints, areas exceeding 40 m^2, side lengths in excess of 8 m, inconsistent geometries and doorways – must be taken into consideration during the planning stage. The rounded section reliably separates the areas of screed at stud level.

Article No. 7222

3

Expansion joint pipe protection.
Heating pipes which cross an expansion joint must be protected with a flexible pipe.

Article No. 7221 | Article No. 1050



5

Seamless surfaces – ideal for cement screed and particularly for self-levelling screed. Polycomfort system elements are connected to one another in rows with the studs overlapping and interlocking to create an area totally seam-free. The benefit of this is that the required degree of sealing – especially where self-levelling screed is used – is ensured and acoustic and thermal bridges are avoided (DIN 18560).

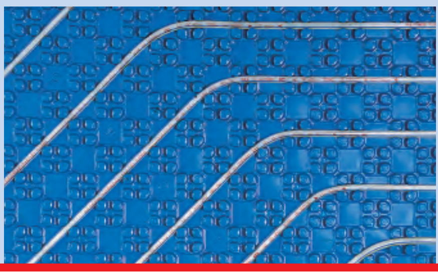
6

Layout exactly according to plan. The studs on the system elements allow pipes to be installed at a fixed height and intervals with 6 rectangular pipe intervals (RA 5.5 – 11 —16.5 – 22 – 27.5 – 33 cm) and 4 diagonal pipe intervals (RA 7.5 – 15 – 22.5 – 30 cm).

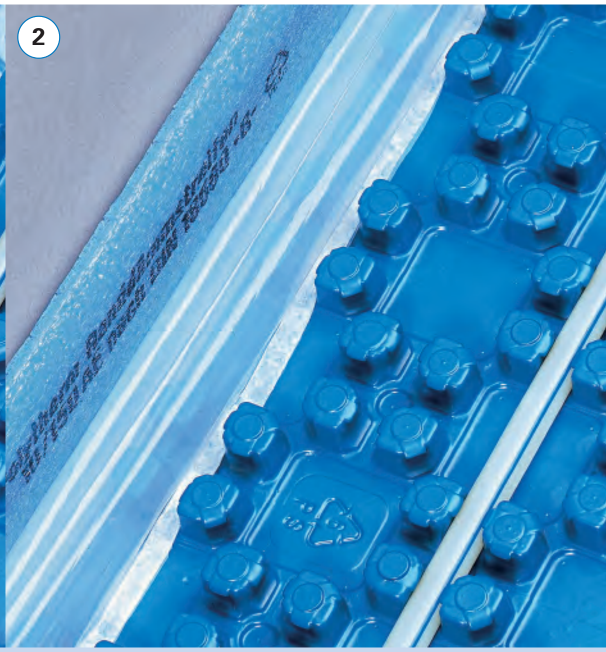
System pipes for installation:
14 x 2 mm, 16 x 2 mm,
PE-X plus (10.5 x 1.25/16 mm)

4

Diagonal layout without extra fixing. The Polycomfort system element and the PE-Xc system pipe can be adapted to any room – whatever its geometry.



Practical tips and suggestions for laying screed surfaces.



A system-compatible installation begins with setting up the special edging insulation strips to the floor or an additional thermal insulation. If cement screed is to be used, choose special edging insulation strips 8. Place, fix, and lay the foil lightly on the system panel – and finished!

1 Article No. 1077

If self-levelling screed is to be used, place special edging insulation strips 10 which have an additional adhesive strip on the foil. The foil is pressed into the first row of studs and then stuck to the system panel.

2 Article No. 7220

The foil is welded low so that there are no cavities in the edge joints area thus ensuring a perfect sealing of the joints.

Polycomfort is excellently suited for layouts using self-levelling screed. Please ensure that the self-levelling screed is first poured into the edge areas from the outside inward.

3

The most important aspects about self-levelling screed. Self-levelling screed, referred to in the trade as calcium sulphate self-levelling screed, is produced in accordance with DIN 18560, Part 1 and further processed on site **without any special additives.** What makes it special is that the heating process proper can begin as a rule after one week.

Polycomfort and cement screed. When using cement screed, it is necessary to add a special ingredient to provide improved flexural tension and to promote higher compression strength and sealing effect.
Polytherm Estrotherm H allows normal heating in accordance with standard specifications to begin after 21 days.

Article No. 1012

If **Polytherm Temporex** is used as an alternative addition to cement screed, normal heating can begin after just 10 days! Standards specifications regarding final strength and shrinkage are satisfied.

Article No. 1115

Polycomfort with thin-bed screed. Where superstructure height is low, a very special cement screed can be used.
Adding **Polytherm Estro-Special,** assures an improved quality of cement screed to allow pipe covering of just 30 mm. Standard specifications are met and quality control is ensured through special tests.

Article No. 7021

Easy measuring of screed moisture.
The Polytherm scope of supplies includes a measuring station set comprising 4 rods and a printed head plate. At least 3 measuring stations are designed for every 200 m^2 or per apartment, the ideal location being a terminal loop in the centre of the heating circuit, for example.

Article No. 1117

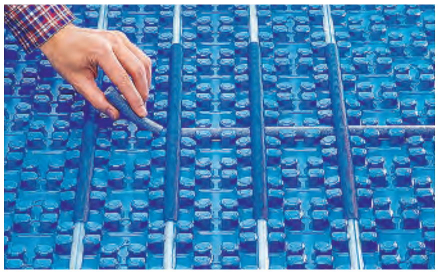
Expansion joints and pipe protection.
It is essential to remember that expansion joints may only be crossed by connection tubes. Protect the pipes with a protection pipe slit lengthwise to ensure a tension-free layout.

Pipe protection

Article No. 7221
Article No. 1050

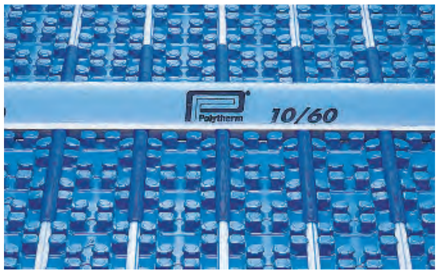
Rounded section

Article No. 7224



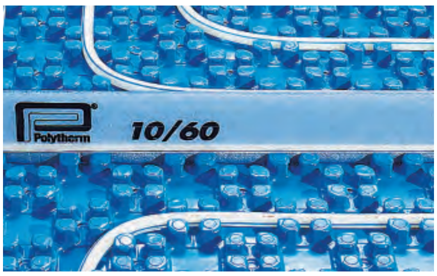
Expansion joint section

Article No. 7222



Safety through commissioning heating.
Beginning with a flow temperature of 25°C over a period of three days, after which the installation is heated up for 4 days at the maximum calculated flow temperature. Please record and confirm compliance with these specifications in the start-up protocol.
Remember to wait the required period of time for the screed to set first.

Expansion joint sections to prevent damage.
Prior to placing heating screed, the heating circuit and the screed area must be coordinated and a plan drawn up to show the location of expansion joints. Polytherm offers exactly the right solution for a professionally executed expansion joint whereby the rounded section is pressed between the studs of the system element followed by positioning the expansion joint section with the self-adhesive base. The dimensional stability is a guarantee for exact and straight joint control.

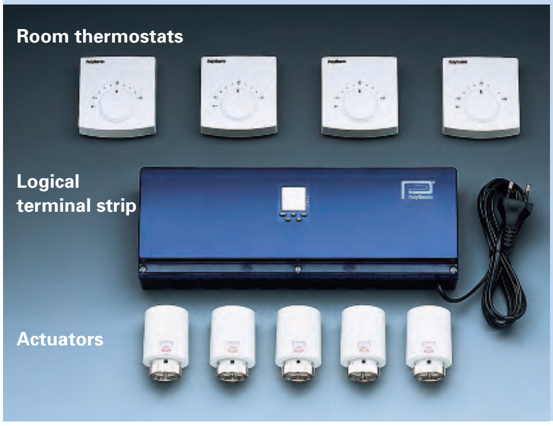


Polytherm control engineering. Individual planning – sensitive control.

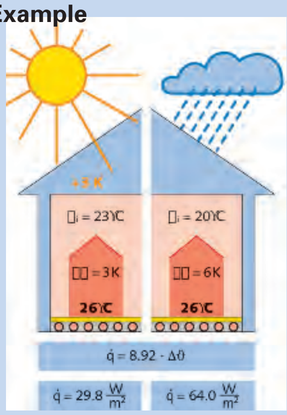
Individual room control

Self-regulating effect in area heating.

Heating systems with a low heating surface temperature display a physical effect which makes the heating system practically self-regulating. If the temperature of the air in a room with a floor heating system of 23°C increases, for example, from 20°C to 21°C due to sunshine, then the heat emission is reduced by one third. Vice versa, should the temperature of the air in the room drop, this will result in an increase of the heat emission. The self-regulating effect of floor heating does not depend on any technical control equipment and forms the basis of a comfortable and pleasant room temperature.



Example



Polytherm individual room control (230 V or 24 V).

Individual room temperature control further improves the self-regulating effect of area heating in order to save energy and to provide an individual room climate. Each room can be heated or cooled as required. Room thermostats allow for influential factors such as sunshine, electrical devices, lighting or body heat.

Information!

According to §12 (2) of the energy saving regulation (EnEV) the heating facility has to be provided with an "autonomously acting facility for the roomwise temperature control" (individual room control).

Room thermostat (230 V or 24 V).

Room thermostats serve to regulate individual room temperatures. Switch on the actuators on the heating circuit via the logical terminal strips and temperature can be reduced via an external signal, for example, a timer. Well-designed room thermostats are also available as a UP (flush-mounting) version for installation into switch programmes which have been provided by the customer.

Room thermostat

Wireless control.

Wireless control is ideal for subsequent installation as it is not necessary to prise open walls or install electrical leads to the thermostats. The basic unit to receive the wireless signals from four or eight wireless thermostats FT converts the thermostat signals into control signals for the Polytherm actuator TS 230. The temperature can be reduced manually either at the thermostat or via the basic wireless unit with timer.

Wireless basic unit

Actuator (230 V or 24 V).

Polytherm actuators are designed for optimal use with Polytherm heating manifolds. They are supplied as NC, under protection class IP 54 and are therefore suitable for overhead installations.

Logical terminal strips LK 6/ LK 8 (230 V or 24 V).

Logical terminal strips make easy work of assembling and wiring control components. Logical terminal strips are equipped with a digital, two-channel seven-day timer. For example, the two channels allow living room and bedroom to be regulated independently from one another.

Logical terminal strip timer

Flow temperature control stations

Fixed set point control station FRS (max. 8 kW).

The low-temperature fixed set point control station FRS maintains a constant flow temperature in heating systems. It is used for de-centralised control of area heating systems and is installed directly upstream of the manifold in the apartment/storey. As for reasons of comfort and building physics, surface temperatures in living areas may not exceed 29°C, in marginal areas and wall-heating 35°C, the flow temperature for floor heating must be maintained at a correspondingly low figure. Flow temperature can be easily pre-set at the control station infinitely variable from approximately 27 to 42°C. In case of failure, the integrated safety temperature limiter switches off the circulation pump thus preventing the floor from over-heating. FRS components are optimally coordinated and designated for use in the Polytherm manifold cabinets VSS-U and VSS-A and heating loop manifold HKV 1".

Fixed set point control station FRS

Manifold control station VRS 7/10/15 (max. 15 kW).

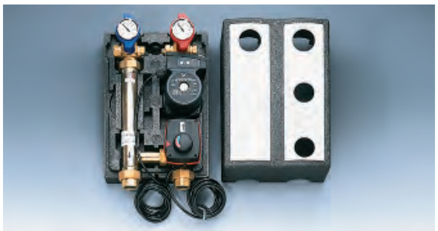
The control station VRS is used for simple decentralised control of area heating and is installed directly upstream of the manifold in the apartment/storey. It provides variable control of the flow temperature by means of a mixer unit depending on the outside temperature. If the device technically allows, the mixer unit can be triggered by regulating the boiler, a procedure requiring a VRS with actuator. If boiler control is not an option for triggering an area heating mixer circuit, the VRS is combined with the area heating controller ECL 100. The VRS is exactly coordinated for use with the Polytherm manifold cabinet VSS-U and VSS-A and the heating loop manifold HKV 1".

VRS with actuator

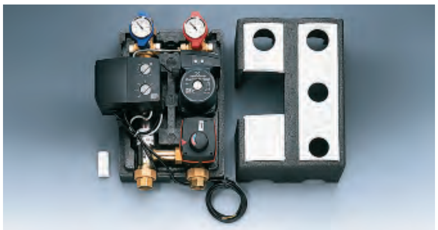
VRS with area heating controller ECL 100 (without timer)

Compact mixer station KMS 10/15/25 (max. 25 kW).

The control station KMS is used for centralised control of buildings or sections of buildings. It provides variable control of the flow temperature by means of a mixer unit which reacts to outside temperature. If the device technically allows, the mixer unit can be triggered by regulating the boiler, a procedure requiring a KMS with actuator. If boiler control is not an option for triggering an area heating mixer circuit, the KMS is combined with the area heating controller ECL 100.



KMS with actuator



KMS with area heating controller ECL 100 (without timer)

Room mixer station RMS 15/2.

The room mixer station RMS 15/2 is used for decentralised control of floor or wall heating systems up to max. 30 m^2. Standard connections are made to two heating loops of more or less the same length. Return flow temperature is controlled by setting a return flow temperature limiter. The device is usually installed in a Polytherm mini-cabinet Art. No. 3254 or on to a plastered surface.

Polytherm control engineering. Individual planning – sensitive control.

Flow temperature control stations

Area heating controller ECL 100.

The area heating controller ECL 100 is used to trigger the compact mixer station KMS or the manifold control station VRS controlling flow temperature in accordance with weather conditions and the type of area heating. Subsequent installation of a single-channel analogue timer or a remote-control device ECA 61 allows the temperature to be reduced during the night.

ECL 100

Multi-function controller MFR 300.

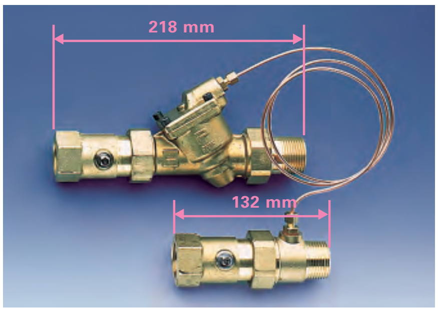
The multi-function controller MFR is used for easy control of area heating and cooling systems and of buildings incorporating thermally-activated building components. The area heating-compatible, micro-processor controlled mixer or valve control allows an optimal heat-up process depending on the outside temperature and the building. The MFR 300 allows automatic change-over from heating to cooling operations whereby switch-over valves and energy supplier are triggered directly. Control during heating and cooling operations follows a special-purpose programme card "Heating/Cooling" which, in addition to providing optimum heat-up, takes over the control of cooling operations depending on the dew point temperature in a reference area.

MFR 300

Accessories

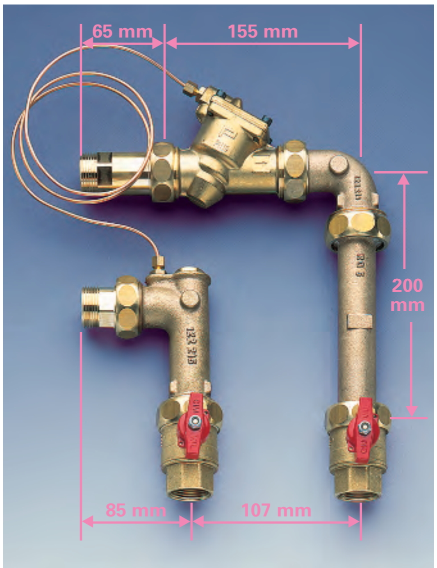
Differential pressure control set PDD-250.

The PDD is a proportional controller which requires no auxiliary energy. It generates hydraulically-independent, downstream manifold units, with the added benefit that the manifolds need no longer be aligned to one another. Its selected valve authority within the overall pipe network guarantees optimum operating conditions whatever the load. For reason of the standard required hydraulic alignment, the PDD is installed upstream of each heating loop manifold – and that makes sense, especially in large-scale projects.



Combi-set WDKS 25.

If a heat meter is to be installed in addition to a differential pressure controller, the universal set WDKS 25 is an excellent choice as it can be custom-fitted upstream of the heating loop manifolds.



Heat meter connection set.

If in a heating system covering several residential sections, the amount of heat is be recorded upstream of each manifold, the heat meter connection set will prove to be useful as it allows the installation of heat meters with a construction length of 110 or 130 mm.

The WZ retrofit set accessory is required for fitting the heat meter.

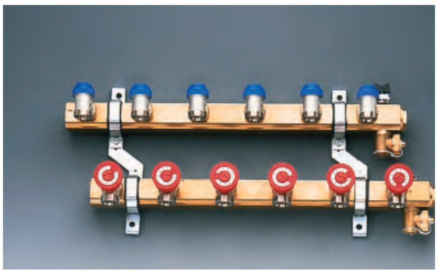
Manifolds/manifold cabinets

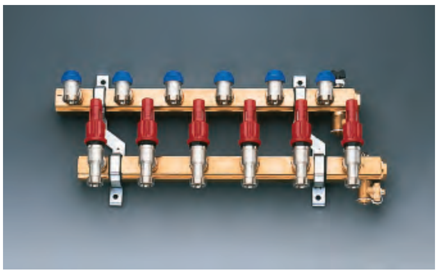
System-compatible heating loop connections – heat distribution tailored to meet any demand.

In Polytherm system solutions all the components of the heating loop manifold from valves to accessories are designed for coordinated use with one another. The task of the heating loop manifold is to provide the individual heating loops with the calculated thermal output. By pre-setting the heating loop valves, the through flow of each heating loop is limited to the specified value.

Heating loop manifold sets are available in 1" and $1^{1}/_{4}$" dimensions, with and without integrated flow meters.

Heating loop manifolds including flow meters additionally display the volume of the flow for each heating loop. This has the advantage of allowing the valve to be pre-set even for a calculated flow if the unit design should deviate from the theoretical calculation. The heating loop manifold sets 1" and $1^{1}/_{4}$" are ready for assembly and comprise mounting brackets, plugs and two filling and draining ball valves for self-sealing assembly. The $1^{1}/_{4}$" heating loop manifold comes with two upstream ball valves.





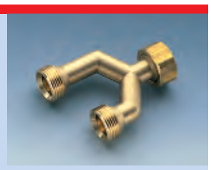
Accessories.

Duo-submanifolds allow the connection of two heating loops of the same length to a manifold outlet. They are available in the dimensions 10.5 x 1.25 and max. 14 x 2.

Zone valves can be connected upstream of the manifolds and used to control several heating loops using an electric actuator for 230 V or 24 V (function “normally closed”).

Ball valves act as shut-off devices upstream of the heating loop manifold. They are also available as alternative shut-off devices with a thermometer.

Duo-submanifold 10.5



Duo-submanifold 14

Zone valve

Zone valve angled

Ball valve set

Ball valve set 1" with thermometer

Manifold cabinets.

Manifold cabinets for flush-mounting and surface-mounting are made of galvanized, 1 mm steel sheet with a removable front frame. The frame and lockable door are painted white (RAL 9010).
The flush-mounted manifold cabinets are 115 to 165 mm deep and can be height-adjusted from 780 to 880 mm.

The surface-mounted manifold cabinet is designed for use with the Polytherm control station. Depth = 150 mm, height = 700 mm.

VSS-U/A – 560	(width 560 mm)
VSS-U/A – 700	(width 700 mm)
VSS-U/A – 1000	(width 1000 mm)
VSS-U/A – 1300	(width 1300 mm)

To ignore the environment is to ignore future consequences!

Environmental responsibility has long been a firm part of Polytherm's business policies. Environmentally-directed corporate management begins with making employees aware of the environment by promoting their understanding of important economic and ecological interactions, encouraging them to consider these in their daily work and to act as a mediator in conveying the concept of environmental care to others.

High in our priorities is the provision of environmentally-compatible products.
As one of the leading system providers concerned with specific problem solutions, Polytherm has an immense interest in providing their professional partners with ecologically-safe products.
For example, our tried-and-tested PE-X pipes. Made of polyethylene, a plastic derived from a totally natural raw material – crude oil. Or our CFC-free system elements made of just one PS material.

The best disposal method is targeted recycling.
A lot has happened in the recent past. Close cooperation between associations and industry has resulted in a comprehensive system for companies involved in products for the heating, cooling and sanitary business to recycle material residues and used products.
INTERSEROH guarantees that all material is reintroduced into the raw material cycle and the remainder is disposed off as safely for the environment as possible.
Our service hotlines are therefore certainly of interest for the processing trade as you can find out here for example where the nearest disposal station is. Often it will be quite close to your construction site.
Looking after the environment is a goal well worthwhile. Achieving and tackling the job together brings us a great deal nearer to it.

Major efforts against the flood of packaging material.
Basically, the disposal of product and transport packaging is taken care of through our membership in the INTERSEROH. However, Polytherm would like to make you aware of a further issue – and that is, avoidance of packaging waste. The Polytherm pump-mixer-block is a paradigm. It is wrapped in protective packaging which simultaneously serves as thermal insulation. Not to forget the re-usable large-scale drums which require no packaging material at all.

INTERSEROH®
RECYCLING

Zertifiziert nach
DIN EN ISO 9001
INTERSEROH®
RECYCLING SYSTEM
SANITÄR
HEIZUNG
KLIMA

www.interseroh.de

Advantages of a Polytherm Underfloor Heating System.

Hot water floor heating can be called the heating system with the ideal temperature profile. A **constant temperature profile** over the room geometry and room height is the logical consequence of even thermal distribution with low surface temperatures. The diagram below shows different levels of temperature in different types of heating systems.

Together with an even temperature distribution over the room, there is an **optimum feeling of well-being** which a hot water floor heating system, in contrast to a conventionally heated room, provides when the temperature of the room is just 2°C lower.

This means a higher level of comfort, lower room air temperatures and even reduced energy costs.

Depending on the user habits, a hot water floor heating system has the advantage of allowing **6 to 12% energy savings** because of the lower temperature of the heating medium and ambient air.

Optimal use can be made of modern condensing-appliance technology and alternative energies such as solar energy, heat pumps etc.

Important facts for builders.

No matter if it is an old building, a new building, whether the floor is to be covered in parquet, carpeting, marble or tiles – Polytherm systems can be installed anywhere.

And as far as the price is concerned, Polytherm floor heating systems can compete any time against conventional radiators when taking all the cost-saving advantages into consideration.

The task of space heating is to warm a room and thus a building i.e. to heat up the air in a room to a comfortable temperature. In a low-energy house, a very low water temperature is usually sufficient so that on some days, the residents have the impression that “the floor heating isn’t on at all”. How wrong they are! The floor simply feels colder but the heating system is saving energy. If the residents want a constantly warm floor, then this must be taken into special consideration already during the planning stage.

Important for deciding on a system for a low-energy house.

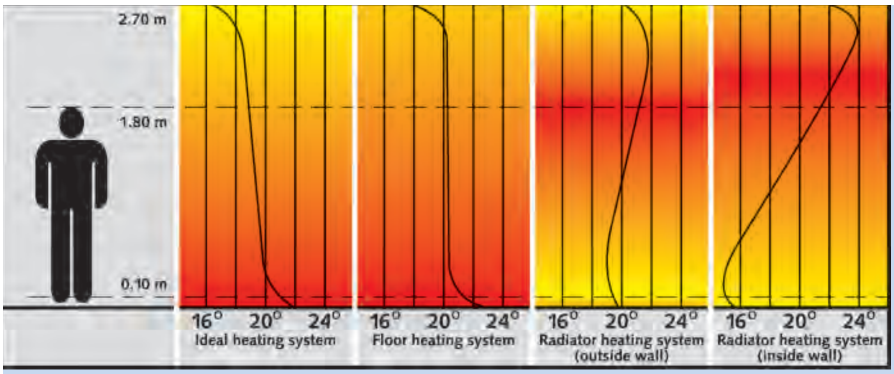
The constructional concept for a low-energy house offers the best conditions for using Polytherm floor heating. The low energy requirements are met by the system and in combination with a modern heat generator e.g. an energy-saving, environmentally-friendly condensing boiler or heat pump, both economical and ecological aims can be achieved by Polytherm floor heating.

In addition to heating and energy benefits, the health aspects of a floor heating system are also of major interest.

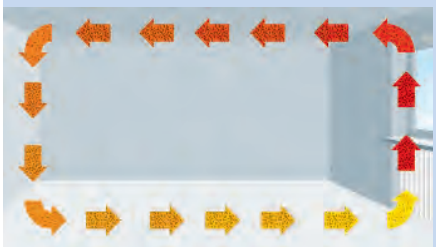
The low surface temperature of the floor prevents dust from being swirled around and upwards, something which is all too familiar where conventional heating systems are used. People suffering from allergies will particularly welcome this beneficial effect.

What’s more, floor heating systems remove moisture from the floor i.e. a dry floor is conceivably the worst possible place for all those things which can trigger off an allergy, such as household dust mites, fungus spores, germs.

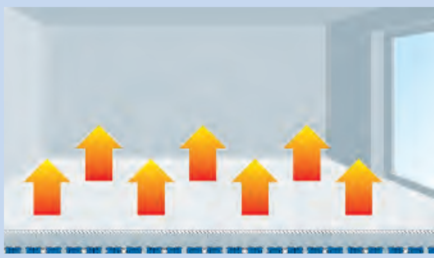
A healthy climate, increased healthy living conditions in the home – that’s certainly worth a Polytherm floor heating system.



Raising the dust …



… but not where there is floor heating



Basics for the project planning, assistance for preliminary costings.

Standards and legal requirements.
Specific parameters in the form of European and German standards have been defined for use when project planning a hot water floor heating system. They include system performance, calculations, the installation of thermal and footfall sound insulation and screed engineering.
Besides these standards, there are EnEV legal guidelines provided by the federal states and the federal government which must also be taken into consideration.
Polytherm documents, including planning software, point out these standards and the legal requirements to allow proper operation of the whole of the heating unit on an economical basis.
The Energy Performance Certificate together with the heat requirements to be calculated in accordance with DIN EN 12831 are deemed to be the basis of any project planning for a hot water floor heating system.
The area heating output is limited by the maximum permissible surface temperatures defined in DIN EN 1264.

Recreational areas: $\vartheta_{Fb., max.} \leq 29°C$
Marginal zones (1 m deep): $\vartheta_{Fb., max.} \leq 35°C$
Bathrooms/shower rooms: $\vartheta_{Fb., max.} \leq \vartheta_i + 9\ K$

These physical limits are seldom reached in today's energy-saving method of building. As a rule, a floor heating is sufficient to provide an average surface temperature of 22 to 24°C throughout the heating period.

Example 14 x 2:	
Room temperature	20°C
Heated area of floor	16 m^2
Heat flux density	55 W/m^2
Carpeting, 7 mm	$R_{\lambda,B} = 0.1 \frac{m^2\,K}{W}$
Selected flow temperature	40°C
Max. surface temperature	25.5°C
Recommended pipe spacing	RA 16.5
Max. area to be heated	12.2 m^2
16 m^2 are to be installed, that means	2 heating loops

Preliminary costings
Polycomfort 14 x 2

Heat flux density [Watt/m^2]			
Average floor surface temperature		ϑ_i = 20°C	
		ϑ_i = 24°C	
Flow temperature 35°C	Room temperature 20°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
Flow temperature 40°C	Room temperature 20°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
Flow temperature 45°C	Room temperature 20 °C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
Flow temperature 50°C	Room temperature 20°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles

(lengthwise installation RA 55 / 110 / 165 / 220 / 330)

35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	
				Recreational area						←			→					Marginal area						
24			25		26			27			29			30			31		32			33	°C	
					Bathrooms etc.																			
26			29		30			31			33												°C	
33.0	27.5	27.5	27.5	22.0	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5										recommended RA
26.4	23.6	17.2	16.6	12.1	12.9	9.7	10.2	8.2	6.1	3.8	5.7	4.5	3.2	1.7										max. m²
27.5	22.0	16.5	16.5	11.0	11.0	11.0	5.5	5.5																recommended RA
21.6	18.4	15.9	11.0	10.3	6.9	2.9	4.6	2.2																max. m²
22.0	16.5	16.5	11.0	5.5	5.5																			recommended RA
17.6	13.9	6.8	5.9	5.3	1.2																			max. m²
16.5	11.0	5.5																						recommended RA
13.4	9.2	6.2																						max. m²
	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5																recommended RA
	16.4	12.0	11.0	8.2	5.3	1.7	4.3	2.5																max. m²
	33.0	27.5	27.5	22.0	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5	5.5			recommended RA
	36.0	32.6	27.1	25.2	21.4	17.8	17.7	15.2	12.9	12.9	11.3	9.7	8.2	6.6	5.0	3.2	5.7	4.8	3.8	2.8	1.7			max. m²
33.0	27.5	27.5	22.0	16.5	16.5	16.5	16.5	11.0	11.0	11.0	5.5	5.5	5.5											recommended RA
36.5	31.2	24.0	21.8	19.7	15.9	12.2	8.4	9.5	6.9	4.0	5.7	4.1	2.2											max. m²
33.0	27.5	22.0	22.0	16.5	16.5	11.0	11.0	5.5	5.5															recommended RA
28.7	23.5	19.8	13.0	12.2	6.8	7.2	2.6	4.4	1.2															max. m²
27.5	22.0	16.5	16.5	11.0	5.5	5.5																		recommended RA
25.5	19.7	15.7	8.7	7.5	6.2	2.2																		max. m²
				16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5									recommended RA
				18.4	15.2	12.3	12.1	10.1	8.2	6.2	4.2	5.9	4.8	3.6	2.3									max. m²
			33.0	33.0	27.5	27.5	22.0	22.0	22.0	16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	5.5	5.5	recommended RA
			36.0	30.1	29.2	25.0	24.4	21.4	18.5	18.8	16.7	14.8	12.9	13.2	11.9	10.7	9.4	8.2	6.9	5.6	4.3	6.4	5.7	max. m²
		33.0	33.0	27.5	22.0	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5						recommended RA
		34.5	26.9	25.4	24.0	19.8	15.7	15.9	15.9	10.0	11.0	9.0	6.9	4.7	6.3	5.1	3.7	2.2						max. m²
	33.0	27.5	27.5	22.0	22.0	16.5	16.5	16.5	11.0	11.0	5.5	5.5	5.5											recommended RA
	35.8	30.8	23.5	21.2	15.7	15.3	11.2	6.8	8.0	4.7	5.9	3.9	1.2											max. m²
33.0	33.0	27.5	22.0	16.5	16.5	11.0	11.0	5.5	5.5															recommended RA
39.9	28.5	23.3	19.7	17.0	11.6	10.6	6.4	6.2	3.2															max. m²
							16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5	5.5		recommended RA
							19.5	17.0	14.7	12.4	12.7	11.1	9.7	8.2	6.7	5.1	3.4	5.8	5.0	4.1	3.2	2.2		max. m²
					33.0	33.0	27.5	27.5	22.0	22.0	22.0	22.0	16.5	16.5	16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	recommended RA
					36.0	31.1	30.7	27.1	26.6	23.9	21.4	19.0	19.5	17.7	16.1	14.4	12.9	11.3	12.4	11.3	10.2	9.2	8.2	max. m²
			33.0	33.0	33.0	27.5	22.0	22.0	22.0	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5	recommended RA
			39.9	33.2	26.9	26.3	25.4	21.8	18.4	15.0	15.9	13.4	11.0	12.0	10.3	8.6	6.9	5.1	2.9	5.7	4.6	3.5	2.2	max. m²
			33.0	27.5	27.5	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5	5.5							recommended RA
			32.6	29.6	23.5	22.1	17.6	17.3	13.9	10.5	11.0	8.5	5.9	2.6	5.3	3.5	1.2							max. m²
		33.0	27.5	27.5	22.0	22.0	16.5	16.5	11.0	5.5	5.5	5.5												recommended RA
		34.1	29.3	21.8	19.7	13.8	13.4	8.7	9.2	5.6	6.2	3.7												max. m²
											16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	recommended RA
											18.1	16.2	14.3	12.5	13.0	11.8	10.6	9.4	8.2	7.0	5.8	4.5	3.0	max. m²

Quick calculation of preliminary costings for 20°C and 24°C room air temperature.

Basics of the Table.

- heating loop pressure loss: 200 mbar
- temperature below that of the room to be calculated: 20°C
- length of heating loop: max. 120 m
- 14 x 2/16 x 2 mm PE-Xc system pipe
- 45 mm screed pipe covering

Heat flux density "q" and floor covering must be known.

It is only possible to calculate preliminary costings for a previously defined flow temperature (35, 40, 45 or 50°C). If the flow temperature has been selected, the corresponding temperature block applies to the whole of the object.
Surface temperatures for the corresponding heat flux density must be checked.
Now, using the respective heat flux density "q" for a room – from the upper beams down to the floor covering of the selected flow temperature block – the recommended Polytherm pipe spacing (RA) with the maximum heating loop area including lines can now be read off from the table. Two heating loops with the respective pipe spacing must be taken into the calculations for heating loops/rooms with a larger area than the maximum heating loop area given in each case there. A pipe spacing of not more than 11 cm is specified for bathrooms.

Note!
The preliminary costing cannot be seen as a substitute for a detailed rating.

Preliminary costings
Polycomfort 16 x 2

Heat flux density [Watt/m²]			
Average floor surface temperature		ϑ_i = 20°C	
		ϑ_i = 24°C	
Flow temperature 35°C	Room temperature 20°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
Flow temperature 40°C	Room temperature 20°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
Flow temperature 45°C	Room temperature 20 °C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
Flow temperature 50°C	Room temperature 20°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles
		$R_{\lambda,B} = 0.05 \frac{m^2K}{W}$	10 mm E-parquet
		$R_{\lambda,B} = 0.10 \frac{m^2K}{W}$	7 mm carpeting
		$R_{\lambda,B} = 0.15 \frac{m^2K}{W}$	
	24°C	$R_{\lambda,B} = 0.01 \frac{m^2K}{W}$	5 mm tiles

Example 16 x 2:	
Room temperature	20°C
Heated area of floor	16 m^2
Heat flux density	60 W/m^2
Carpeting, 7 mm	$R_{\lambda,B} = 0.1 \frac{m^2\,K}{W}$
Selected flow temperature	40°C
Max. surface temperature	26°C
Recommended pipe spacing	RA 16.5
Max. area to be heated	10.4 m^2
16 m^2 are to be installed, that means	2 heating loops

(lengthwise installation RA 55 / 110 / 165 / 220 / 330)

35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	
					Recreational area					←					→				**Marginal area**					
24			25		26			27			29			30			31		32			33	°C	
						Bathrooms etc.																		
26			29		30			31			33												°C	
33.0	33.0	27.5	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5											recommended RA
37.9	26.2	25.0	24.0	18.0	18.4	14.2	14.2	11.8	9.1	6.1	2.5	6.3	4.5											max. m²
33.0	27.5	22.0	16.5	16.5	11.0	11.0	5.5	5.5																recommended RA
23.0	19.1	17.4	16.2	9.4	10.4	5.3	6.8	3.6																max. m²
	22.0	16.5	11.0	5.5	5.5																			recommended RA
	13.1	10.4	9.0	7.6	2.4																			max. m²
	16.5	11.0																						recommended RA
	5.5	2.0																						max. m²
		16.5	16.5	11.0	11.0	11.0	5.5	5.5																recommended RA
		17.2	11.6	11.8	8.0	3.7	6.1	3.7																max. m²
			33.0	27.5	27.5	22.0	22.0	22.0	16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5			recommended RA
			32.0	31.4	25.0	25.5	21.0	16.5	18.4	15.3	12.2	8.9	11.8	9.8	7.6	5.3	2.5	6.6	5.4	4.1	2.6			max. m²
	33.0	33.0	27.5	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	5.5	5.5											recommended RA
	38.9	27.0	25.2	24.1	17.4	17.8	12.9	7.5	10.4	6.7	1.8	6.0	3.6											max. m²
	33.0	27.5	22.0	16.5	16.5	11.0	11.0	5.5	5.5															recommended RA
	26.4	21.8	19.5	17.6	10.4	10.7	5.0	6.4	2.4															max. m²
	27.5	22.0	16.5	11.0	11.0	5.5																		recommended RA
	21.5	16.4	13.0	11.0	2.0	3.3																		max. m²
						16.5	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5								recommended RA
						17.6	13.7	9.7	11.8	9.2	6.5	3.3	6.7	5.1	3.4	1.0								max. m²
					33.0	33.0	27.5	27.5	22.0	22.0	22.0	22.0	16.5	16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	11.0	recommended RA
					35.5	28.5	30.1	25.0	26.5	22.8	19.2	15.6	18.4	15.9	13.4	10.9	8.2	11.8	10.2	8.5	6.8	4.9	2.5	max. m²
			33.0	33.0	27.5	27.5	22.0	22.0	16.5	16.5	16.5	11.0	11.0	11.0	11.0	5.5	5.5	5.5						recommended RA
			38.8	29.3	28.8	21.6	22.8	17.4	18.8	14.9	10.8	13.1	10.4	7.5	4.1	7.4	5.6	3.6						max. m²
		33.0	33.0	27.5	22.0	22.0	16.5	16.5	11.0	11.0	11.0	5.5	5.5											recommended RA
		38.4	26.4	24.2	23.1	15.7	16.2	10.4	11.8	7.5	1.6	5.7	2.4											max. m²
		33.0	27.5	22.0	16.5	16.5	11.0	11.0	5.5															recommended RA
		25.5	21.5	18.9	16.8	8.8	9.5	2.0	4.6															max. m²
										16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	5.5	5.5	recommended RA
										17.8	14.8	11.9	8.7	11.8	9.9	7.8	5.7	3.2	7.0	5.8	4.5	3.2	1.5	max. m²
							33.0	33.0	33.0	27.5	27.5	22.0	22.0	22.0	22.0	22.0	16.5	16.5	16.5	16.5	16.5	11.0	11.0	recommended RA
							37.9	32.0	26.2	29.2	25.0	20.8	24.0	21.0	18.0	15.0	18.4	16.3	14.2	12.2	10.0	13.2	11.8	max. m²
					33.0	33.0	27.5	27.5	22.0	22.0	22.0	16.5	16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	5.5	5.5	5.5	recommended RA
					38.9	30.9	31.2	25.2	26.4	21.9	17.4	19.4	16.2	12.9	9.4	12.6	10.4	8.0	5.3	1.8	6.8	5.3	3.6	max. m²
				33.0	33.0	27.5	22.0	22.0	22.0	16.5	16.5	11.0	11.0	11.0	5.5	5.5	5.5							recommended RA
				36.4	26.4	25.8	25.5	19.5	13.1	15.3	10.4	12.4	9.0	5.0	7.6	5.2	2.4							max. m²
			33.0	27.5	27.5	22.0	22.0	16.5	16.5	11.0	11.0	5.5												recommended RA
			35.5	31.5	21.5	20.5	12.0	13.0	5.5	8.5	2.0	5.3												max. m²
															16.5	16.5	16.5	11.0	11.0	11.0	11.0	11.0	11.0	recommended RA
															15.5	13.1	10.7	8.1	11.8	10.2	8.6	7.0	5.2	max. m²

Guidelines on the dimensioning of a Polytherm heating area in accordance with DIN EN 1264, Part 3.

1. Position, heating loop number

2. Room number

3. Type of room

4. Standard interior temperature

5. Temperature of rooms below

6. Area of floor to be heated; i.e. the overall floor area which is available per room for area dimensioning. Generally speaking, the installation should cover the whole room to avoid the occurrence of any tension between cold and warm areas in the screed.
If more than 30% of a room with floor heating is to be taken up by furniture, the respective reduction in output should be taken into consideration. Approximately 15% of the room area should be deducted for the calculation.
If desired, the floor area beneath the bath and the shower in a bathroom need not be taken into consideration.

7. The designed heat output is determined by the standard heat requirements in accordance with DIN EN 12831, **less heat loss to rooms below the heated area (adjusted heat requirements).**

$$\dot{Q}_H = (1+X)\,\dot{Q}_N$$

As a rule, this designed addition for hot water floor heating systems is X = 0, in so far as no heat pump has been installed.

8. The design heat flux density is the heat flux required to cover the design heat output of a floor-heated room.

9. Floor covering/thermal resistance of the surface flooring to be used in the room. Standard floor coverings with R_λ = 0.1 m²K/W are assumed when designing floor heating systems for recreational rooms. This is to ensure that any later changes to the floor covering do not impact the heat emission from the floor heating too much. Employing higher values for $R_{\lambda,B}$ up to a maximum of 0.15 m²K/W must be agreed separately. The value $R_{\lambda,B}$ = 0 is assumed for bathrooms.

10. Area sectioning/type and number of heating loops.
In accordance with heating screed standards, floor heating loops must be aligned to the size of screed areas. It is important to plan a sensible sectioning of heating loops from the very beginning of the planning to accommodate the geometry of the room.
The desired number and types of heating loops are to be entered (recreational area = A/marginal areas = R). The number of heating loops must be checked after calculation and corrected if necessary.

11. Heating loop area in the recreational or marginal areas according to the above area sectioning.

12. Heat flux density of the recreational zone and marginal zone according to the above area sectioning and desired heat output.

13. Regulation of the average floor surface temperature.

$$\vartheta_{F,m} = \vartheta_i + \sqrt[1.1]{\dot{q}_{A/R}/8.92}$$

The basis of which is the basic characteristic curve.

If the permissible surface temperature of
29°C for recreational zones,
35°C for marginal zones and
33°C (ϑ_i + 9 K) for bathrooms and similar areas is exceeded, lines 12 and 13 are deleted and replaced by the desired max. surface temperature. This results in a corrected heat flux density of

$$\dot{q}_{A/R} = 8.92\,(\vartheta_{F,m} - \vartheta_i)^{1.1}$$

and a corresponding additional thermal output of

$$\dot{Q}_{Zus.} = \dot{Q}_{H,A/R} - (\dot{q}_{A/R} \cdot A_{A/R})$$

14. Design flow temperature.
The applicable design flow temperature for the whole object is determined for the room with the highest design heat flux density (excluding bathrooms) whereby a standard floor covering with $R_{\lambda,B}$ = 0.1 m²K/W and a spread of σ = 5 K is fixed (drawing on marginal heat flux density – marginal zones 3 K).

The designed heat medium overtemperature $\Delta\vartheta_{H,Ausl.}$ for max. heat flux density may be taken from the Polytherm performance diagrams. A piping distribution for the system and thus a design heat flux are selected for the heating loop with $q_{max.}$ which must be below the limiting curve. The flow temperature for the whole system may then be calculated in accordance with the following formula:

$$\vartheta_{V,Ausl.} = (\Delta\vartheta_{H,Ausl.} + \vartheta_i) + \frac{\sigma}{2}$$

15. Max. permissible flow temperature, i.e. the max. surface temperature $\Delta\vartheta_{F,max.}$ – corresponding to the σ/2 higher overtemperature of the heating medium – in contrast to the centre of the room may be exceeded. The max. permissible flow temperature is then:

$$\Delta\vartheta_{V,Ausl.} \leq \Delta\vartheta_{H,Ausl.} + \frac{\sigma}{2}$$

when $(\sigma/\Delta\vartheta_H) \leq 0.5$

If the ratio $\sigma/\Delta\vartheta_H > 0.5$ respectively $\Delta\vartheta_H < 10$ K, then:

$$\Delta\vartheta_{V,Ausl.} = \Delta\vartheta_{H,Ausl.} + \frac{\sigma}{2} + \frac{\sigma^2}{12\,\Delta\vartheta_{H,Ausl.}}$$

16. Polytherm pipe spacing. The pipe spacing can be entered into the Polytherm performance diagrams for individual floor coverings and thermal resistance only when taking into consideration the limiting curves and max. heat medium over-temperature $\Delta\vartheta_H$
The floors of recreational areas and similar rooms which are to be covered with ceramic tiles should not use pipe spacing RA 27.5 and 33. Bathrooms, toilets and marginal zones should use pipe spacing RA 5.5/11 as far as possible. If area heating is used in a bathroom only for the purpose of temperature, RA 11/16.5 can be incorporated into the planning.

17. The heating medium overtemperature can be taken from the Polytherm performance diagrams according to the pipe spacing.

18. The spread of heating loops in each case depends on the max. permissible flow temperature (line 15) and is calculated as follows:

$$\sigma = (\Delta\vartheta_{V,Ausl.} - \Delta\vartheta_H) \cdot 2$$

when $(\sigma/\Delta\vartheta_H) \leq 0.5$

If the ratio $\sigma/\Delta\vartheta_H > 0.5$ respectively the heating medium over-temperature $\Delta\vartheta_H < 10$ K, then:

$$\sigma = 3 \cdot \Delta\vartheta_H \left[\sqrt{1 + \frac{4(\Delta\vartheta_{V,Ausl.} - \Delta\vartheta_H)}{3 \cdot \Delta\vartheta_H}} - 1\right]$$

19. Heat flux density downward for four standard situations: the downward heat flux density referring to the existing heat flux density of the heating loops can be read off directly from the Polytherm output diagrams. The basis of such standard cases is the following table and the standard temperature differences between the room to be heated and the rooms below it.

Minimum diathermic resistance of thermal insulation:

No.	Thermal insulation	$R_{\lambda,Dä,min}$ [m² K/W]
I	above rooms in similar use	0.75
II	above rooms not in similar use (e.g. residential rooms above rooms used for business purposes)	1.25
III	above unheated rooms (e.g. cellars) also outside air and ground	in acc. with EnEV

The condition $R_{\lambda,Dä}$ = 0.75 is automatically fulfilled in connection with the Polycomfort system element 30-2. If thermal insulation or temperature differences are planned which deviate from the standard values, the heat flux density downward is to be determined using the following formula:

$$\dot{q}_u = \dot{q}_{A/R} \cdot \left(\frac{R_o}{R_u} + \frac{\vartheta_i - \vartheta_u}{\dot{q}_{A/R} \cdot R_u}\right)$$

20. The total heat output of the heating loop is a product of the floor surface and the sum of heat flux density upward and downward.

$$\dot{Q}_F = A_{A/R} \cdot (\dot{q}_{A/R} + \dot{q}_u)$$

21. Design heating medium flow for a heating loop (specific thermal capacity of water c = 1.163 Wh/kg K)

$$\dot{m}_H = \frac{\dot{Q}_F}{\sigma \cdot 1.163}$$

22.–24. In accordance with the following Table, the consecutive meters of Polytherm PE-Xc system pipe for the heating loop for the individual Polytherm pipe spacings are to be entered and added together. These are the **theoretical lengths of pipe to be installed.**

Pipe spacing RA	Cons. m/m² **theoretical** Pressure loss calculation	Cons. m/m² **used in practice** Material take-off
5.5	18.2	17.6
11	9.1	8.8
16.5	6.1	5.9
22	4.5	4.4
27.5	3.6	3.5
33	3	2.9

25. The pressure loss in the heating loop including lines (pipe only) can be read off in the Polytherm pressure loss diagram for the corresponding heating medium flow. The pressure loss taken here for 1 m of system pipe is then multiplied with the length of the heating loop including lines.

26. The pressure loss for the

$$\Delta p_R = R \cdot l_{pipe}$$

fully open Polytherm heating loop valve (flow and reflux) can be taken from the Polytherm pressure loss diagram, the **common pressure loss** is read off **for the appropriate heating medium flow on the blue-coloured curve.**

27. The total pressure loss for the heating loop consists of:

$$\Delta p_{ges} = \Delta p_R + \Delta p_v$$

The highest loss of pressure in the object is entered at the top of the summarized heating area under Δp_{max}.

28. The difference in pressure losses of individual heating loops to Δp_{max} for the Polytherm valve pre-setting is to be reduced.

29. The Polytherm valve pre-setting can be taken from the Polytherm valve diagram. The respective heating medium flow and the pressure loss to be reduced gives the pre-setting value for the Polytherm heating loop pre-set valve.

Example: Polycomfort 14 x 2

Construction project ____________ Project No. ________ Sheet ________ Date ____________

$\Sigma\dot{Q}_F$ **3806** W Clerk ____________

Δp_{max} **166** mbar $\Sigma\dot{m}_H$ **526** l/h No. of heating loops **7** Manifold ____________

$\vartheta_{V, Ausl.}$ **44** °C $\Sigma\dot{m}_H$ ______ l/h No. of heating loops ____ Manifold ____________

1 Position, heating loop number		1	2a	2b	3	4	5	6	7
2 Number of room		1	1	1	1	2	3	4	5
3 Type of room		Living				Kitchen	Corridor	Toilet	Guest
4 ϑ_i Standard interior temperature	°C	20	20	20	20	20	20	20	20
5 ϑ_u Temperature of rooms below	°C	6	6	6	6	6	6	6	6
6 A_F Floor area to be heated	m²	24.0				8.1	9.3	3.8	14.3
7 $\dot{Q}_H$ Designed thermal output	W	1287				553	568	399	660
8 $\dot{q}_{Ausl.}$ Design heat flux density	W/m²	53.6				68.3	61.1	105	46.1
9 Floor covering/thermal resistance	m² K/W	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.1
10 Area sectioning/number and yape of heating loops		R/1	A/1	R/1	A/1	A/1	A/1	A/1	A/1
11 $A_{A/R}$ Heating loop area (recreational or marginal zones)	m²	4.2	4.6	3.6	11.6	8.1	9.3	3.8	14.3
12 $\dot{q}_{A/R}$ Heat flux density/recreational zone/marginal zone	W/m²	73	49	66	45	69	61	105	46
13 $\vartheta_{F,m}$ Average surface temperature	°C	26.8	24.7	26.2	24.4	26.4	25.7	29.4	24.4
Exceeding permissible surface temperatures! – $\vartheta_{F,m}$ – selected	°C							27.0	
– $\dot{q}_{A/R}$ – corrected	W/m²							75.9	
– $\dot{Q}_{Zus.}$ – additional output	W							110.7	
14 $\vartheta_{V, Ausl.}$ Design flow temperature	°C	44							
15 $\Delta\vartheta_{V, Ausl.}$ Max. permissible flow over-temperature	K	24							
16 RA Polytherm pipe spacing	cm	11	22	11	22	16.5	22	11	16.5
17 $\Delta\vartheta_H$ Heating medium over-temperature	K	20.4	17.3	18.5	15.9	21.6	21.6	21.6	14.4
18 σ Heating loop spread	K	7	13	11	16	5	5	5	20
19 $\dot{q}_u$ Heat flux density downward	W/m²	9.6	8.3	9.2	8.0	9.4	9.0	12.9	2.7
20 $\dot{Q}_F$ Total thermal output heating loop	W	316	264	271	615	635	651	448	696
21 $\dot{m}_H$ Design heating medium flow	l/h	39	32	39	76	109	112	77	75
22 Cons. m PE-Xc system pipe/heating loop	m	38	21	33	52	49	42	35	87
23 Cons. m PE-Xc system pipe/lines	m	12	8		0	10	1	8	0
24 Σ Cons. m heating loop and lines	m	50	62		52	59	43	43	87
25 Δp_R Pressure loss heating loop incl. lines	mbar	24	80		75	162	119	52	126
26 Δp_V Pressure loss Polytherm flow/reflux valve	mbar	0.5	1.7		1.9	3.6	3.8	1.9	4.1
27 $\Delta p_{ges.}$ Total pressure loss	mbar	25	82		77	166	123	54	130
28 $\Delta p_{pre\text{-}set}$ (reduce)	mbar	141	84		89	0	43	112	36
29 Polytherm valve pre-setting		2	3		3	10	5	3	4

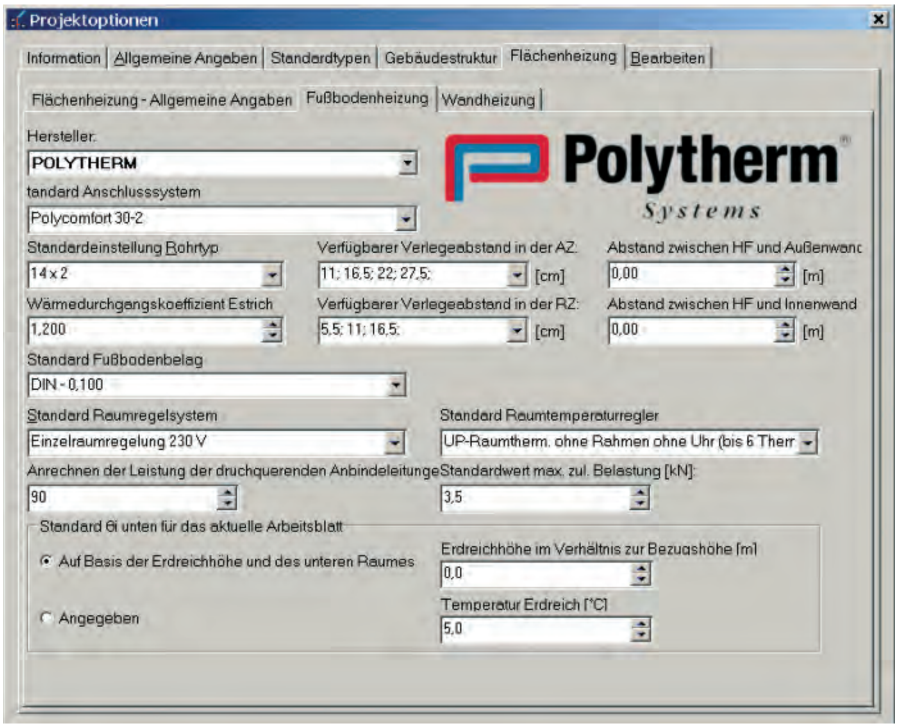
Quick and safe planning

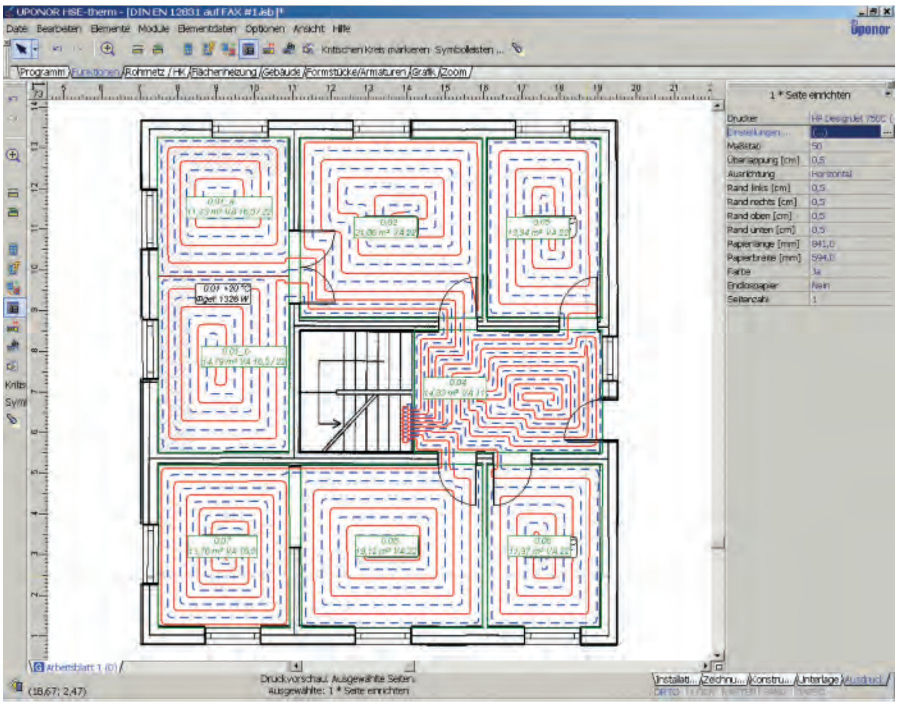
Planning, costing, identifying.

- > Polytherm uses an independent CAE programme, independent of AutoCAD®.
- > Interpretation of room geometries from DWG and DXF files. For example, the building is measured automatically for the heating load calculation.
- > Optimisation of FBH dimensioning according to operational and investment costs.
- > Automatic generation of a diagram from the ground plan drawing (processing of storey installation).
- > Export of data e.g. Microsoft® Office® and into GAEB and UGS formats.
- > Export of drawings into DWG and DXF formats.
- > Detailed bill of quantities including all transitions to threads or flange connections.

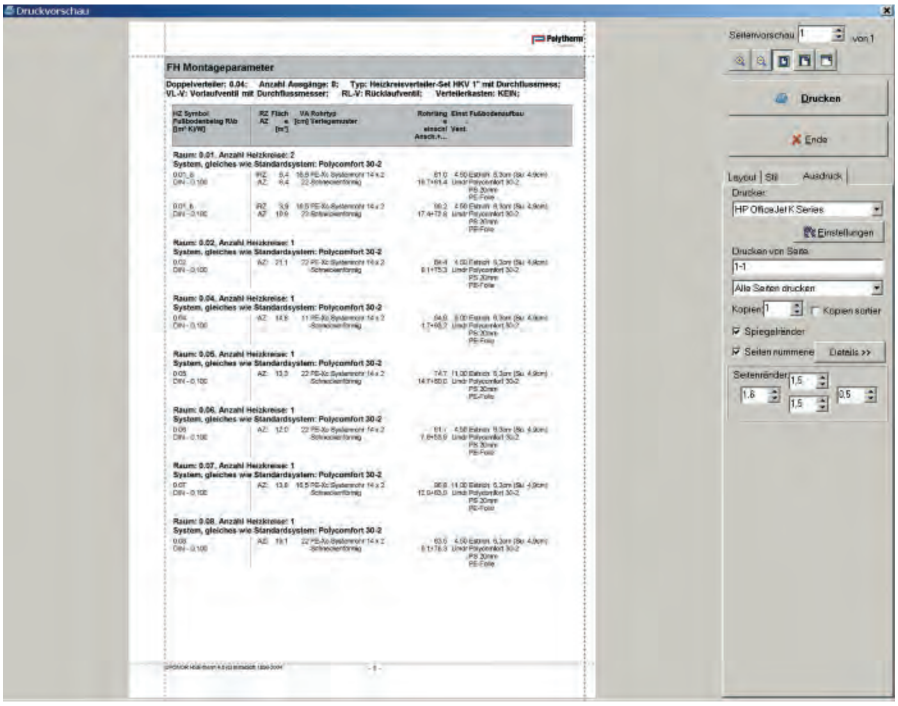
System requirements:

- > Pentium or compatible processor
- > Min. 32 Mbyte memory
- > Colour display with resolution min. 1024 x 768 Pixel
- > CD-ROM drive
- > Microsoft® Windows 98/NT4SP6/2000/ME/XP
- > Internet Explorer 7.0
- > Acrobat Reader 6.0

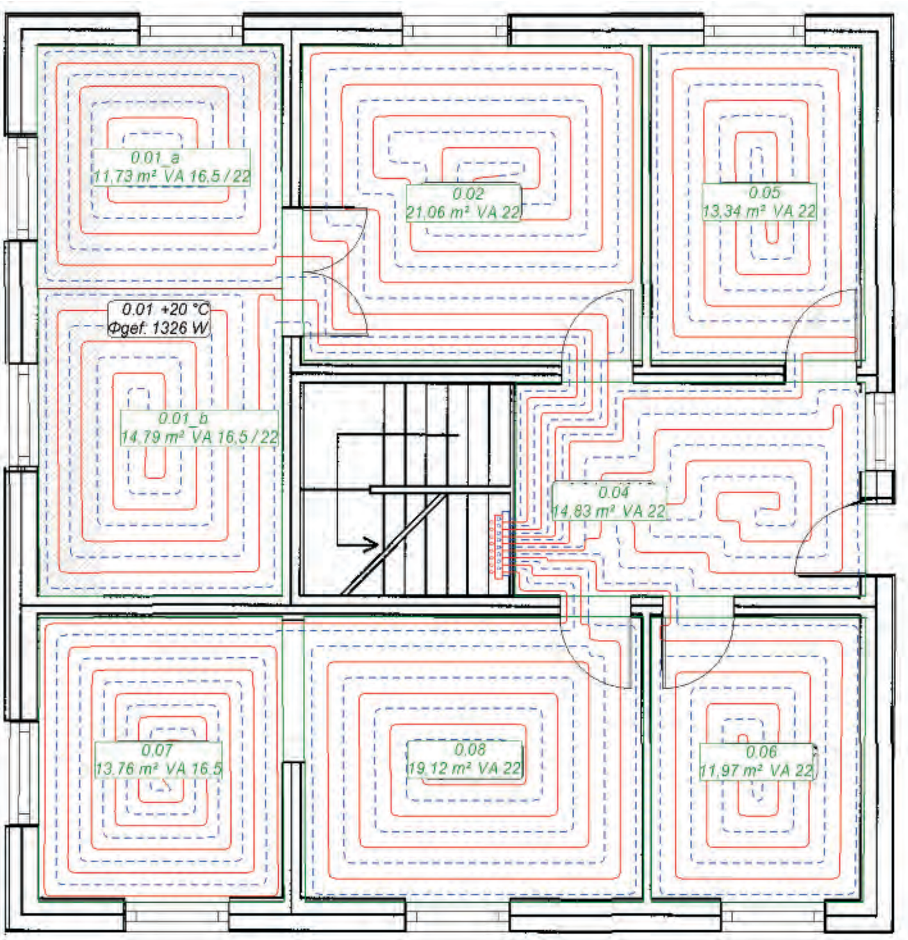




Important for on-site work: planning overview of the heating loops. Here, the company carrying out the installation work will find e.g. information on individual set-ups for the manifolds.



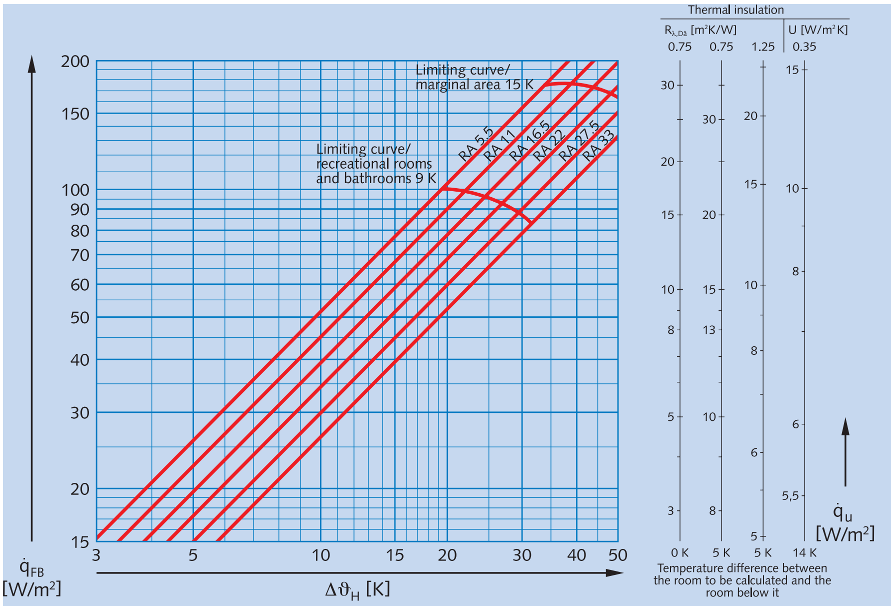
If the planning is to be documented both in tabular and graphic form, the benefits of HSE will very soon become clear.
For example, the heating loops can be presented as a diagram or as a detailed visual version using the independent CAE programme and direct data connection in order to calculate floor heating in accordance with DIN EN 1264.



Note!
The heating loop manifold should be placed in the centre of the house/storey. order The two-sided heating loop connection thus avoids pipe bundling resulting in unregulated outputs.

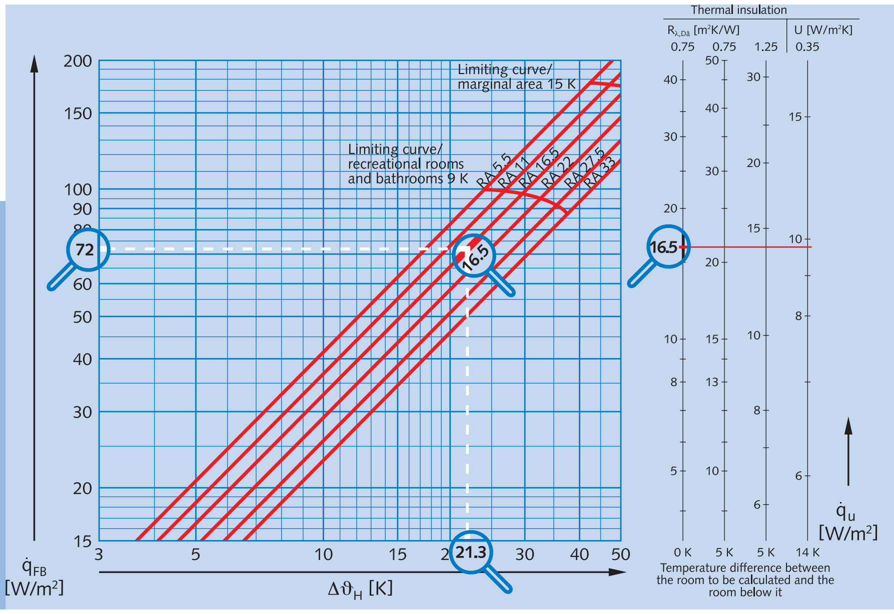
Polycomfort performance diagrams 14 x 2 mm in accordance with DIN EN 1264, Part 2.

$R_{\lambda,B}$ = 0.05 m²K/W
e.g.: 10 mm parquet floor with
45 mm screed pipe covering



$R_{\lambda,B}$ = 0.1 m²K/W
e.g.: 7 mm carpeting with
45 mm screed pipe covering

Example:
A required special-purpose heat density of **72 W/m²** combined with a pipe spacing of **RA 16.5** have a heating medium over-temperature ($\Delta\vartheta_H$) of **21.3 K** as a result. This means a special heat flux density ($\dot{q}_u$) downward of **16.5 W/m²** for a ceiling with thermal insulation where R = 0.75 m²K/W.

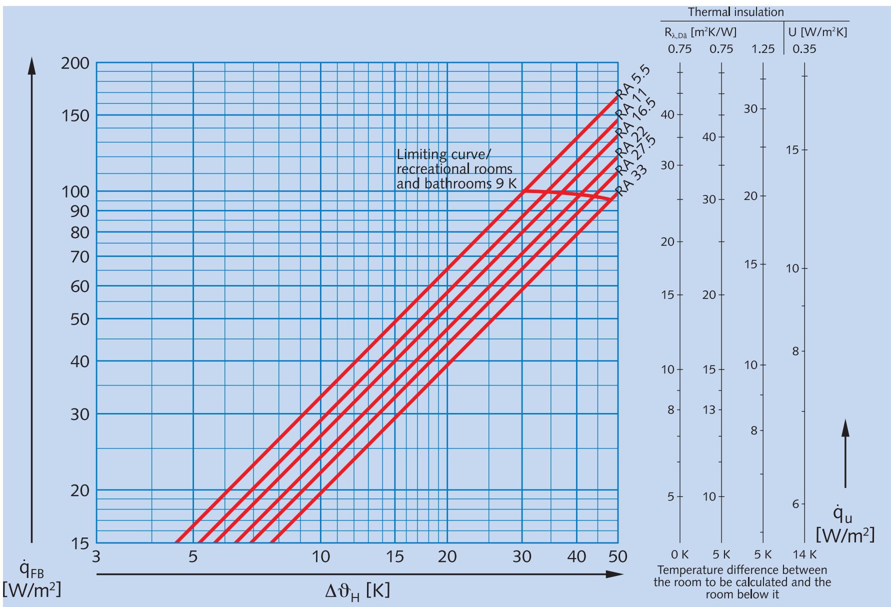


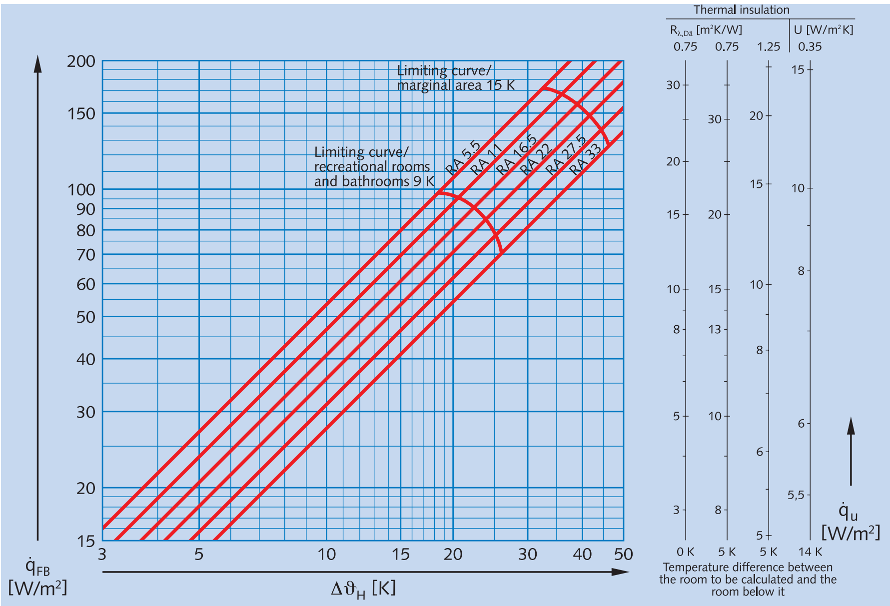
$R_{\lambda,B}$ = 0.15 m²K/W
(max. floor surface resistance)
e.g.: 10.5 mm carpeting with
45 mm screed pipe covering

DIN Geprüft
7F023

Standard heat flux density and standard heating medium over-temperature in accordance with DIN EN 1264, Part 2 for 45 mm pipe covering.

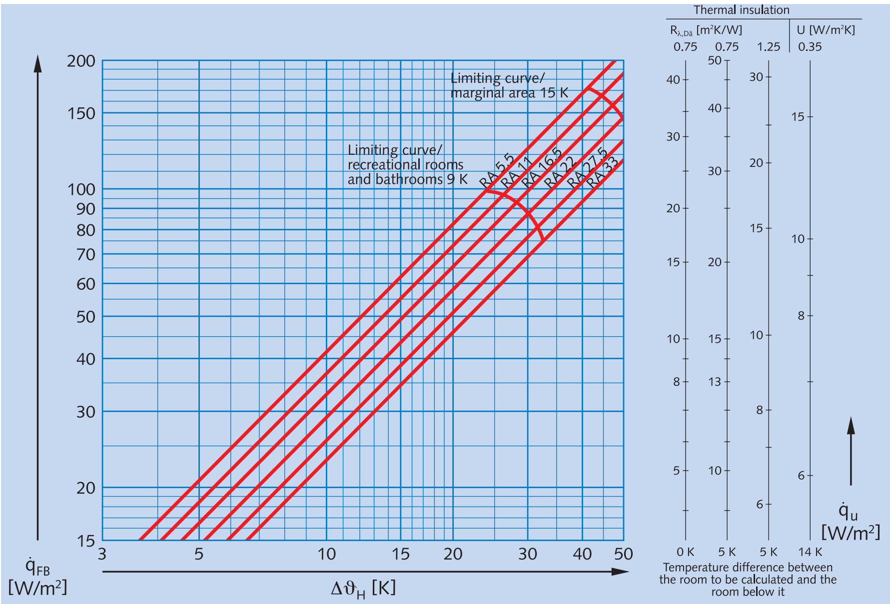
	q_N [W/m²]	$\Delta\vartheta_N$ [K]
RA 5.5	100.0	13.9
RA 11	98.0	16.3
RA 16.5	95.5	18.7
RA 22	90.5	20.9
RA 27.5	84.2	22.7
RA 33	76.0	24.0





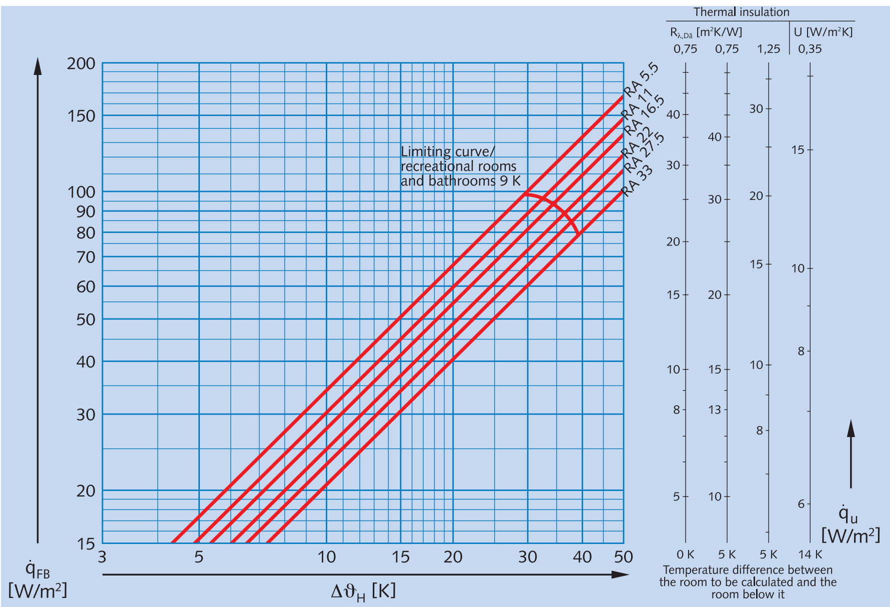
$R_{\lambda,B}$ = 0.05 m²K/W

e.g.: 10 mm parquet floor with 35 mm screed pipe covering



$R_{\lambda,B}$ = 0.1 m²K/W

e.g.: 7 mm carpeting with 35 mm screed pipe covering



$R_{\lambda,B}$ = 0.15 m²K/W (max. floor surface resistance)

e.g.: 10.5 mm carpeting with 35 mm screed pipe covering

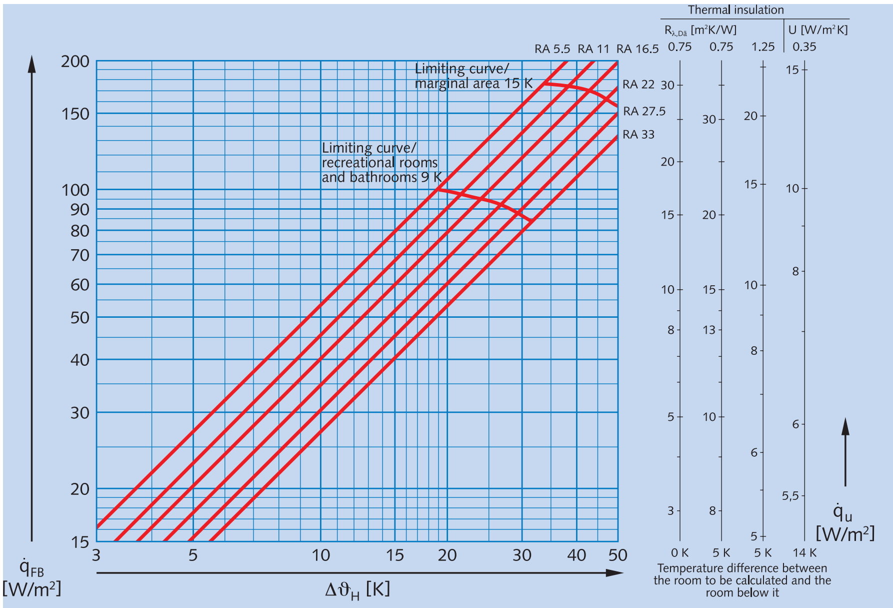
7F023

Standard heat flux density and standard heating medium over-temperature in accordance with DIN EN 1264, Part 2 for 35 mm pipe covering.

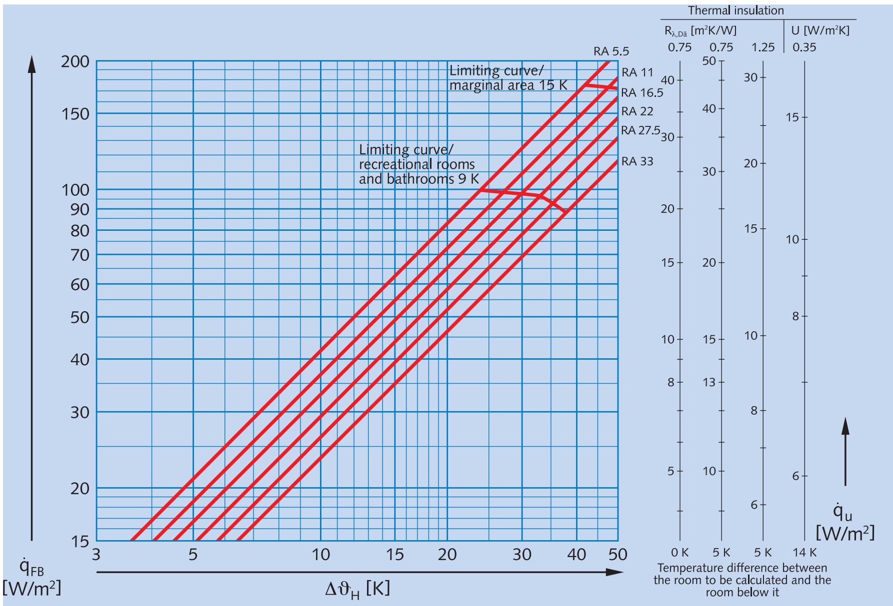
	q_N [W/m²]	$\Delta\vartheta_N$ [K]
RA 5.5	97.9	12.8
RA 11	93.6	14.7
RA 16.5	88.1	16.5
RA 22	81.0	17.9
RA 27.5	72.9	19.0
RA 33	64.8	19.8

Polycomfort performance diagrams 16 x 2 mm in accordance with DIN EN 1264, Part 2.

$R_{\lambda,B}$ = 0.05 m²K/W
e.g.: 10 mm parquet floor with
45 mm screed pipe covering



$R_{\lambda,B}$ = 0.1 m²K/W
e.g.: 7 mm carpeting with
45 mm screed pipe covering

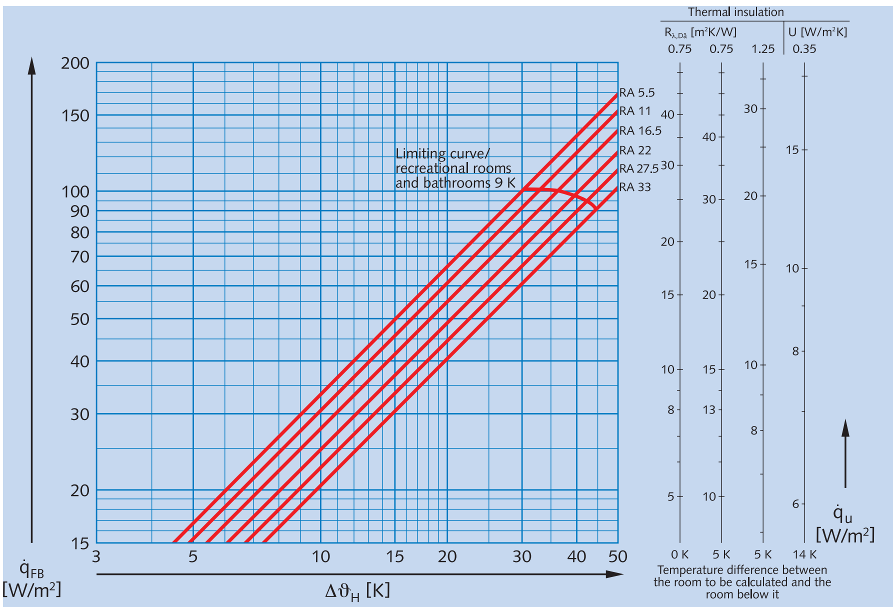


$R_{\lambda,B}$ = 0.15 m²K/W
(max. floor surface resistance)
e.g.: 10.5 mm carpeting with
45 mm screed pipe covering

DIN Geprüft
7F149

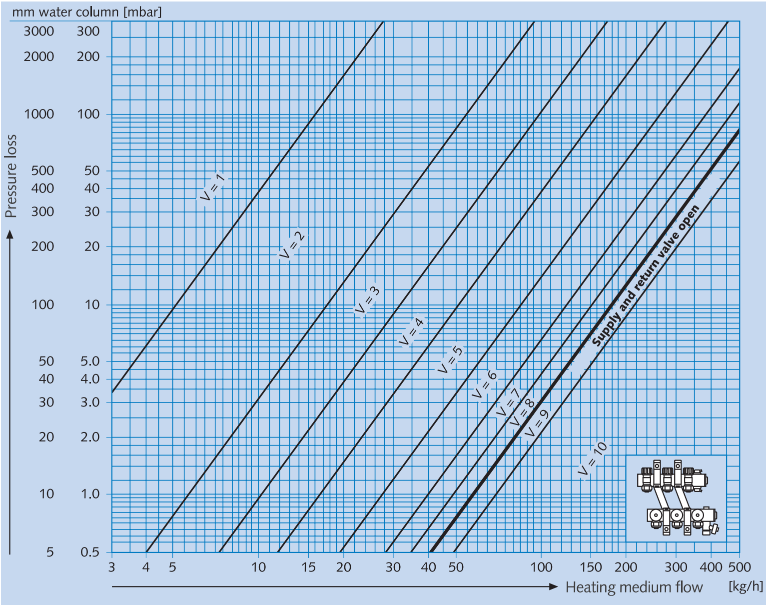
Standard heat flux density and standard heating medium over-temperature in accordance with DIN EN 1264, Part 2 for 45 mm pipe covering.

	q_N [W/m²]	$\Delta\vartheta_N$ [K]
RA 5.5	100.0	13.8
RA 11	97.9	16.0
RA 16.5	95.3	18.3
RA 22	90.1	20.3
RA 27.5	83.7	22.0
RA 33	75.3	23.1

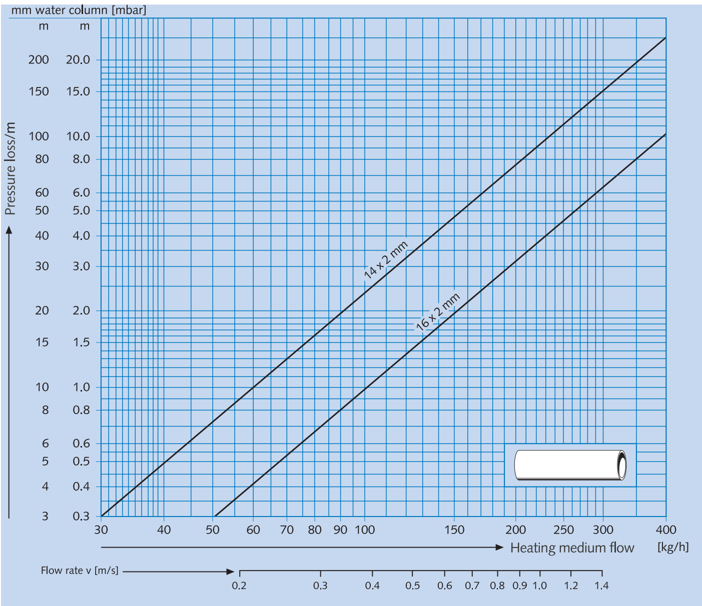


Pressure loss diagrams.

Pressure loss
Heating loop manifold with standard angled valve

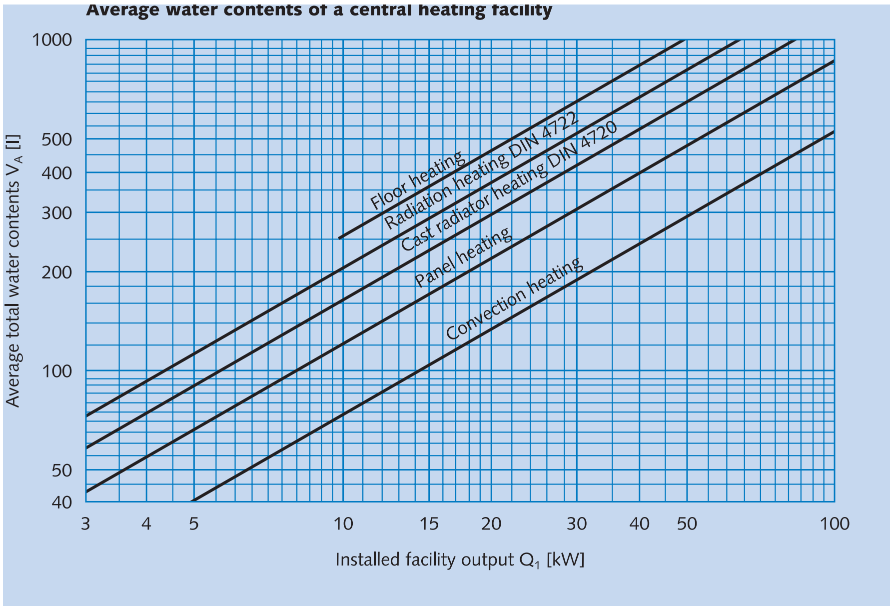


Pressure loss
PE-Xc system pipe



Sizing of expansion vessel.

Expansion vessels (MAG) according to DIN EN 12828 Part 2 are essential parts of safety installations in closed heating systems serving to absorb changes in water volumes due to fluctuations in temperature.
If a heat exchanger or mixers are used to separate systems, e.g. when refurbishing an old building, two expansion tanks are required, in each case, primary and secondary sided.
If expansion tanks are operated at too low or incorrect design pre-pressure, this may lead to failures and even damage to the facility, it is therefore essential that the MAGs are sized exactly. Please also refer to the technical documentation provided by the manufacturer of your choice! It is further recommended that the functionality of the MAG is checked each year!



Calculation of MAG
(in accordance with DIN 4807)

Necessary facility key data

V_{System}	Water contents of heating facility
V_{Rohr}	**0.079 m³/m** for 14 x 2 mm pipe
l_{Rohr}	Pipe length **[m]**
V_{WE}	Water volume of heat generator **[dm³]**
V_e	Expansion volume of the facility **[dm³]**
V_{WR}	Water trap MAG **[dm³]**
V_0	Useful volume MAG **[dm³]**
$V_{exp,\,min}$	Nominal volume MAG **[dm³]**
ϑ_E	Fill-in temperature in the facility **[°C]** as a rule 10°C
ϑ_V	Design flow temperature of the facility **[°C]**
ϑ_R	Design reflux temperature of the facility **[°C]**
$\vartheta_{v,max}$	Max. set-point temperature of heat generator **[°C]**
e	Water expansion depending on highest set-point temperature of the heat generator and fill-in temperature of 10°C **[%]**
n_R	Water expansion depending on highest set-point reflux temperature and fill-in temperature of 10°C **[%]**
p_{St}	Static pressure in the facility **[bar]**
p_0	Minimum pre-pressure of MAG **[bar]**
p_D	Evaporation pressure **[bar]** (ignore for temperatures < 100°C)
p_s	Initial pressure in the facility **[bar]**
$p_{a,\,min}$	Filling pressure in the facility **[bar]**
p_e	Final pressure in the facility **[bar]**
p_{sv}	Safety valve response pressure **[bar]**

Example of calculation

Fill-in temperature of the facility	ϑ_E	**10°C**
Design flow temperature	ϑ_V	**45°C**
Design reflux temperature	ϑ_R	**35°C**
Max. set-point temperature (highest set point of heat generator)	$\vartheta_{v,max}$	**60°C**
Static pressure (≈ 5 m water column)	p_{St}	**0.5 bar**

1. Calculation of facility volume V_a
(Boiler with 12 kW floor heating)
V_{System} **= 300 dm³** (acc. to diagram)
$V_{System} = V_{pipe} \cdot l_{pipe} + V_{WE}$

2. Calculation of expansion volume V_e

ϑ_V [°C]	30	40	50	60	70	80	90
n [%]	0.66	0.93	1.29	1.71	2.22	2.51	3.47

n_R **= 0.5%** (for designed reflux temperature of 40°C)
I = 1.71% (at max. set-point temperature of the boiler regulator)
$V_e = V_{System} \cdot e/100 = 300\ dm^3 \cdot 1.71/100 = 5.1\ dm^3$

3. Calculation of pressure
> MAG pre-pressure p_0 (static height = 5 m)
$p_0 = p_{St} + p_D + 0.2\ bar = 0.5\ bar + 0.2\ bar = 0.7\ bar$ (recommended is 0.2 bar)
Recommendation – set $p_0 \geq P_{St} + P_D$

> Safety valve response pressure p_{sv}
$p_{sv} \geq p_0 + 2.0\ bar$ **for** $p_{sv} \geq 5\ bar$
$p_{sv} = 1.0\ bar + 2.0\ bar = 3.0\ bar \Rightarrow 3.0\ bar$

> Final pressure p_e
$p_e = p_{sv} - 0.5\ bar\ (p_{sv} \leq 5\ bar)$
$= 3.0\ bar - 0.5\ bar = 2.5\ bar$

4. Tank calculation
> Water trap V_{WR}
(for $V_{exp,\,min} > 15\ dm^3$ with $V_{WR} \geq 3\ dm^3$)
$V_{WR} = 0.005 \cdot V_a = 0.005 \cdot 300\ dm^3 = 1.5\ dm^3$
(for $V_n \leq 15\ dm^3$)
$V_{WR} = 0.2 \cdot V_{exp,\,min}$
> Useful volume (bubble volume) V_0
$V_{0,min} \geq V_e + V_{WR} \geq 5.1\ dm^3 + 1.5\ dm^3 \geq 6.6\ dm^3$
> Nominal volume $V_{exp,\,min}$
$$V_{exp,\,min} = (V_e + V_{WR}) \cdot \frac{p_e + 1}{p_e - p_0}$$
$$= (5.1 + 1.5) \cdot \frac{2.5 + 1}{2.5 - 1} = 15.4\ dm^3$$
The next largest size of tank should be selected e.g. $V_0 = 25\ dm^3$
Controle: $V_0 > V_{0,min}$
25 dm³ ≥ 6.6 dm³ o.k.!
> Initial pressure/filling pressure calculation p_a

In order to ensure a sufficient quantity of water in the tank, filling pressure should be 0.25 to 0.3 bar higher than the tank pressure.

The initial pressure p_a is usually set the same as the filling pressure p_F as the filling temperature of 10°C almost always represents the lowest temperature in the system.

$p_{a,min} \geq p_0 + 0.3\ bar$ otherwise calculations must be made for a larger nominal volume!

$p_{a,min} \geq p_0 + 0.3\ bar \geq 1.0\ bar + 0.3\ bar \geq 1.3\ bar$

$$p_e = \frac{p_e + 1}{1 + \frac{V_e\ (p_e + 1) \cdot (n - n_R)}{V_{exp,\,min} \cdot (p_0 + 1) \cdot 2n}} - 1\ bar$$

$$= \frac{2.5 + 1}{1 + \frac{5.1 \cdot (2 + 1) \cdot (1.74 - 0.5)}{32.7 \cdot (1 + 1) \cdot (2 \cdot 1.71)}} - 1\ bar$$

$p_a = 2.04\ bar$

$p_a \approx$ **bar** over-pressure

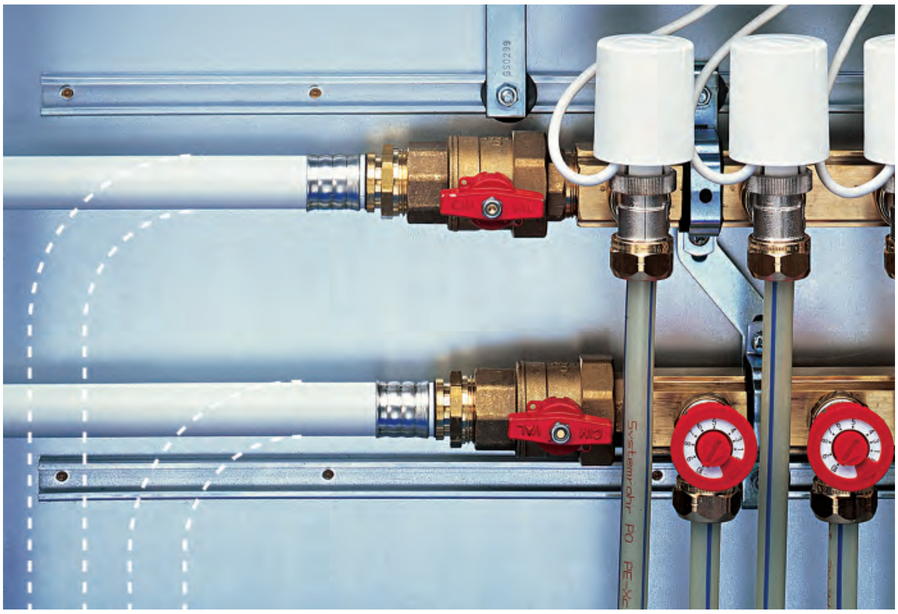
$p_a > p_{a,min}$ **o.k.!**

$$p_{a\ min} \geq \frac{V_{exp,\,min} \cdot (p_0 + 1)}{V_{exp,\,min} - V_{WR}} - 1$$

$$p_{a\ min} \geq \frac{15.4 \cdot (1.0 + 1)}{5.4 - 1.5} - 1 = 1.22\ bar$$

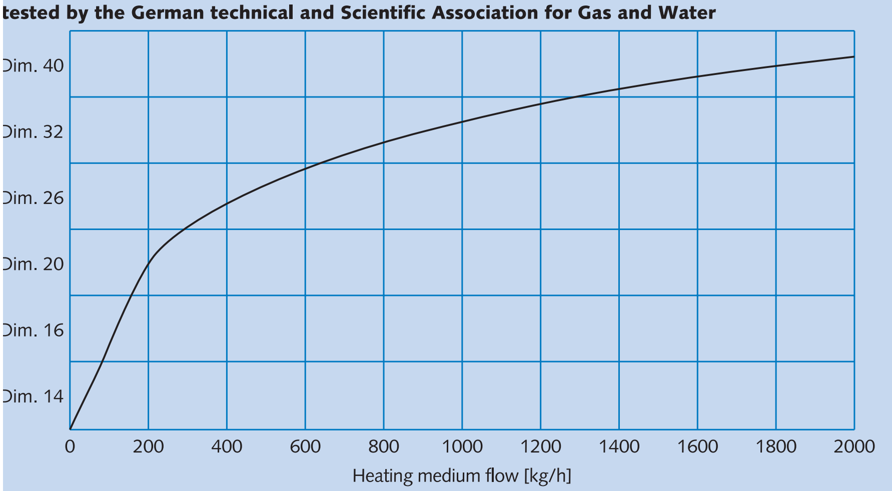
From boiler to manifold – system-compatible connections with Presstite ML Pipe.

It makes no difference if the heat generator is to stand as is customary in the garage, or in the house or even in the attic, Presstite ML sanitary and heating systems can be recommended for lines and connections.
The ML composite pipe ideally combines the properties of a plastic and a metal pipe; it is dimensionally stable, corrosion-free, allows "round-the-bend" installations or can be used as rising pipe. The carefully aligned programme of fittings combined with safe Polytherm compression method allows cost-efficient, and what is more important, safe installations to be carried out.



Assistance in dimensioning.
Dimensioning the lines to individual Polytherm heating loop manifolds is made in exactly the same way as for piping work in conventional units.
The flow rates for all sections of the lines are determined and a suitable pipe diameter is selected, keeping in mind the permissible flow velocities.
We recommend not exceeding a max. velocity of approximately v = 0.4 to 0.8 m/s.
The values for flow rates are taken from the heating area lists. The relevant volumes of water are added together for sections of the lines which are supplied via several manifolds.
The calculation for the pipe network can be made using either the usual forms or an appropriate software.
For a rapid dimensioning, please use the diagram where a specified flow rate shows a suitable pipe diameter.

Presstite ML composite pipe, tested by the German technical and Scientific Association for Gas and Water



Diameters determined in this way result in R-values of ≤ 2 mbar/m (≤ 20 mm water column/m); flow velocities are in the range of 0.35 m/s to 0.85 m/s.

Note: The lines must be insulated in accordance with EnEV.

Presstite ML composite pipe.

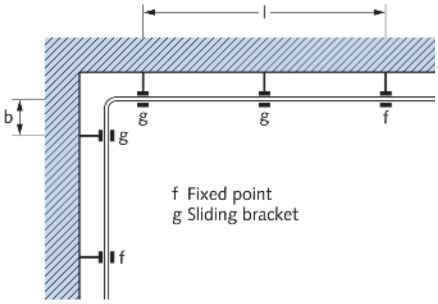
The pipe combines the properties of both a metal and a plastic pipe: dimensional stability, corrosion-free and safe to transport potable water. It is a high-quality PE-Xc basis pipe featuring a special aluminium coating and a low-wear PE-X protective jacket. The pipe is approved for use by the German Technical and Scientific Association for Gas and Water.
Max. operating pressure: 10 bar
Max. operating temperature: 95°C
For short periods 110°C
Smallest bending radius 1.5 d for dim. 16

Coils · Sanitary/heating	Article No.
Dim. 16 (16 x 2.0 mm) 100 m/coil	920100002
Dim. 20 (20 x 2.0 mm) 100 m/coil	920100003
Dim. 26 (26 x 3.0 mm) 50 m/coil	920100004
Dim. 32 (32 x 3.0 mm) 50 m/coil	920100005

Cut-to-length · Sanitary/heating	Article No.
Dim. 32 (32 x 3.0 mm) 5 m/length	920200005
Dim. 40 (40 x 3.5 mm) 5 m/length	920200006
Dim. 50 (50 x 4.0 mm) 5 m/length	920200007
Dim. 63 (63 x 4.5 mm) 5 m/length	920200008

Changes in length of open pipe installations.

As a rule, thermal length changes are regulated by a suitable line guide (bent angle in the direction of the change) or by compensating for expansion (in the form of expansion loops and compensators). The selection and arrangement of pipe fixtures (sliding brackets and fixed points) depend on installation conditions. A change in direction inevitably leads to a pipe being installed with a bent leg as to compensate the length likewise a rectangular connection with a correct arrangement of sliding and fixed points.



Determination of the length of the bent leg.

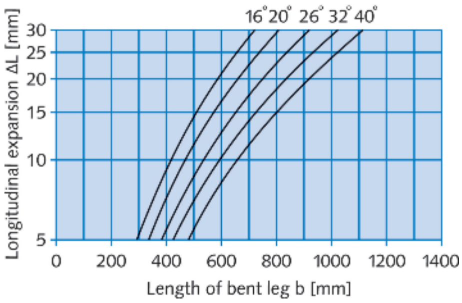
The change in length and the pipe outside diameter affect the length of the bent leg.

Calculation of bent leg.

The minimum leg length can be determined using the diagram or the following formula.

$$b = k \cdot (d \cdot \Delta L)^{0.5}$$

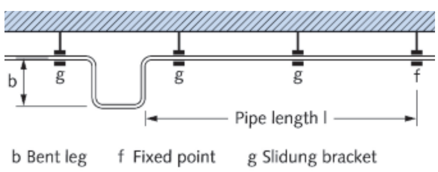
b = Length of bent leg in mm
d = Outside diameter in mm
ΔL = Longitudinal expansion in mm (refer to diagram below)
k = Material-dependent constant (for MT pipes = 33)



Expansion loop.

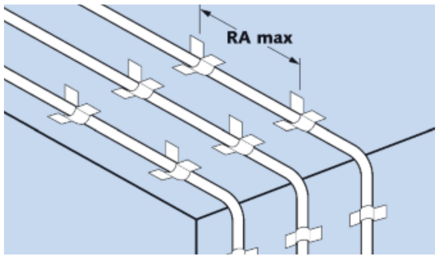
Example of calculation:

Wanted:	length of bent leg	
Given:	longitudinal ecpansion ΔL	= 10 mm
	pipe outside diameter d	= 26 mm
Solution:	b	= 530 mm



Fixing method/spacing.

Maximum pipe bracket spacing for Polyfix MT composite pipes:



DN	Dim.	RA (cm)
12	16	100
15	20	125
20	26	150
26	32	200
32	40	200
40	50	200
50	63	200

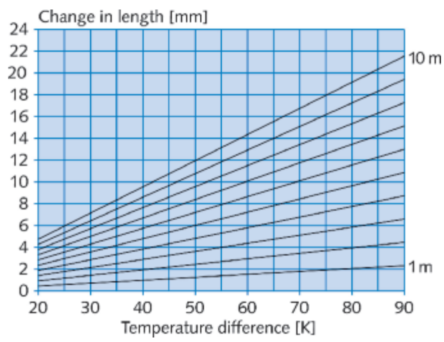
Thermal change in length in MT pipes.

The thermal change in length to be expected during operation can be taken from the diagram below or calculated using the following formula:

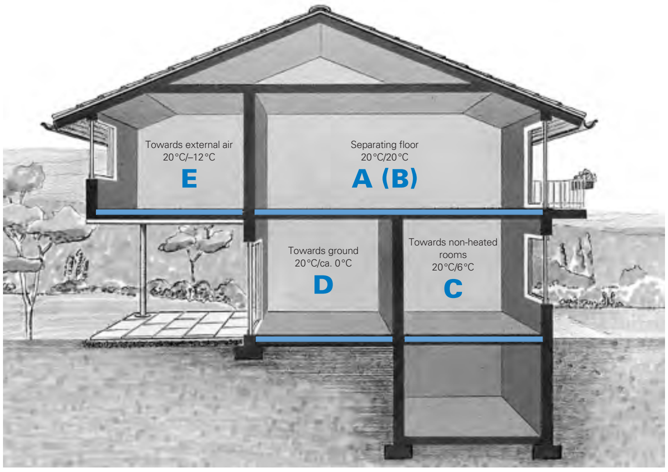
$$\Delta L = \alpha \cdot L \cdot \Delta\vartheta$$

α = Expansion coefficient in mm/mK
L = Pipe length in m
Δϑ = Temperature difference installation and max. operating temperature in K
ΔL = Longitudinal expansion in mm

The thermal expansion coefficient for an MT PE-X pipe is
α = 0.024 mm/mK



Underfloor standard constructions for new residential buildings in compliance with DIN EN 1264 and EnEV 2/02.



A, B

The European standard (DIN EN 1264-4).
Requirement $R_\lambda \geq 0.75$ m²K/W refers exclusively to the insulation layer in the separating floors of rooms used for similar purposes.
Rooms which are heated at intervals, e.g. business premises, require heat insulation with a heat conductivity resistance of $R_\lambda \geq 1.25$ m²K/W beneath the heating level.

Minimum heat conductivity resistance of insulation layers beneath underfloor heating systems (DIN EN 1264-4)

			R_λ [m²K/W]
A	Heated rooms below		0.75
B, C, D	Unheated rooms, rooms below heated at intervals, or direct on the ground (ground water > 5 m)*		1.25
E	Outside air	Design temperature ≥ 0°C	1.25
		Design temperature < 0°C; ≥ –5°C	1.50
		Design temperature < –5°C; ≥ –15°C	2.00

*If the ground water level is < 5 m, set a higher R-value.

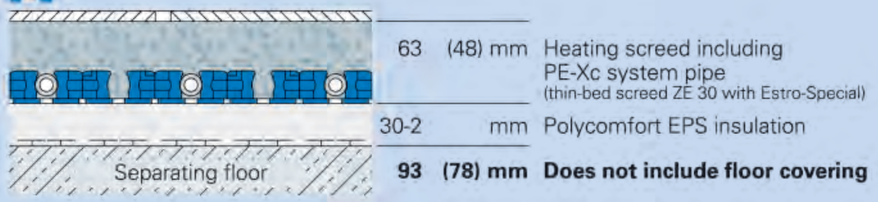
C, D, E

EnEV = German decree on Energy Saving.
The main objective of the German decree is to limit annual primary energy requirements in accordance with §3, Section 1 on the basis of the surface to volume ratio with particular focus on specific transmission heat loss from the outside walls of the building. The specific transmission value for area heating is no longer fixed. Paragraph 6 of the EnEV requires a minimum thermal protection "according to recognised rules of engineering".
In accordance with the EnEV, Appendix 1 the annual primary energy requirements and additional transmission heat loss from area heating to the outside atmosphere, ground and unheated rooms is to be determined in compliance with DIN 4108-6. There are numerous EDP programmes to help solve this problem. According to the specifications given by the DIBt (the German Institute for Construction Engineering) no individual verification is required when using an insulation layer of $R_\lambda = 2.0$ m²K/W (e.g. 8 cm WLG 040). If calculated verification is provided, the heat insulation regulations under the European standard DIN EN 1264-4 at least must be adhered to. Ask the builders or the architect for the energy requirements verification in order to check on which heat transmission coefficient your offer planning will be based. In the case of possibly existing "higher heat insulation requirements" made by the builder, Polytherm planning documents will provide further descriptions of floor superstructures with increased requirements.

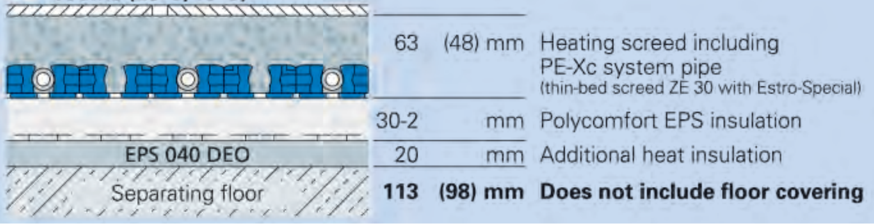
Superstructures for residential buildings.
Higher traffic loads from up to 5 kN/m² can be accommodated using adapted load distribution layers. The construction details for traffic load in residential buildings and offices are designed for loads of ≤ 2 kN/m².
Polytherm supplies two additional components for use with cement screed; **Estrotherm H** with which standard heating screeds can be designed with a pipe coverage of 45 mm in accordance with standards.
Estro-Special allows a thin-bed screed with reduced pipe coverage of only 30 mm to be made. The screed standard allows this, if a test certificate for the thin-bed screed can be shown.
Sealing in compliance with state-of-the-art methods or in accordance with DIN 18195/DIN 18336 is to be considered in the case of ground moisture and/or ground water.
The issue of to what extent protective measures against residual moisture in the concrete floor are required is to be clarified with the site engineer.

Floor superstructures for new residential buildings Polycomfort 30-2.

A Separating floors (20°C/20°C)



B Separating floors over commercially-used rooms (20°C/15°C)



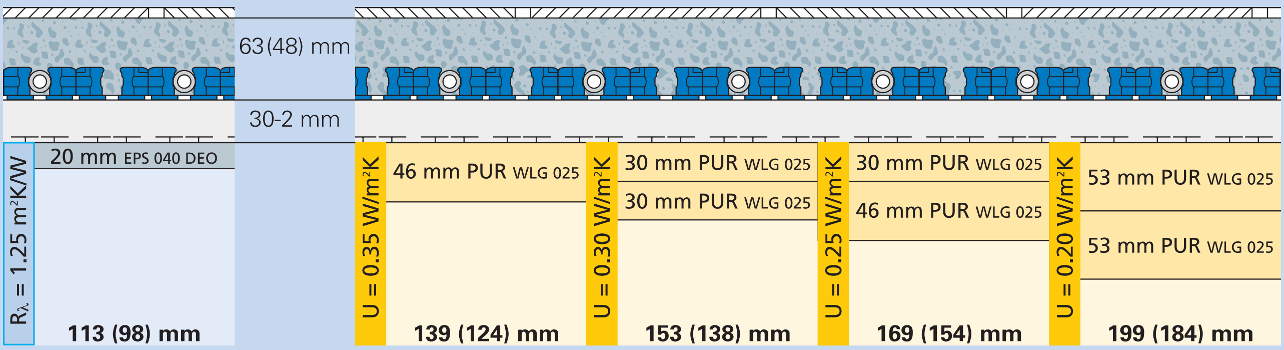
Standard screed
With 63 mm nominal screed thickness (45 mm pipe coverage) with the addition of Estrotherm H.

Thin-bed screed
With 48 mm nominal screed thickness (30 mm pipe coverage) with addition of Estro-Special.
Construction dimensions are given in brackets.

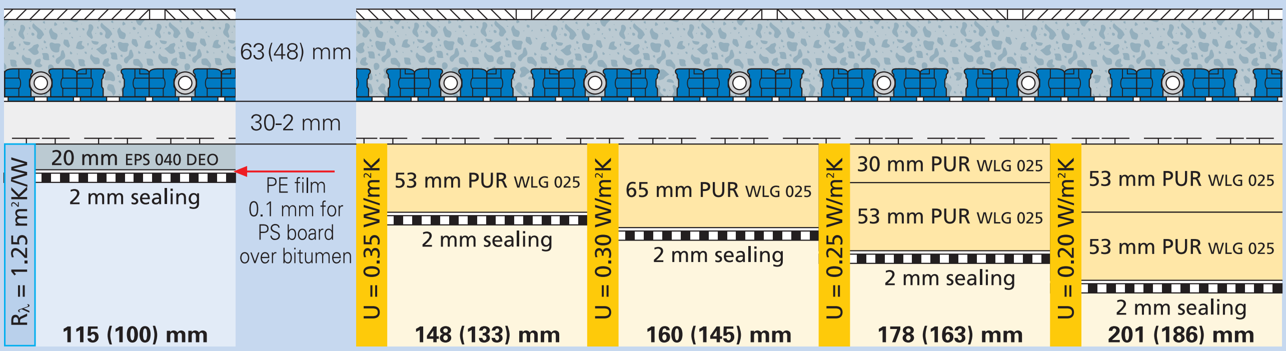
Minimum requirements
in accordance with DIN EN 1264-4

Further construction examples
As far as **increased requirements** are made for the U-value for the outside walls of the building regarding the architect's specifications for constructional heat protection.

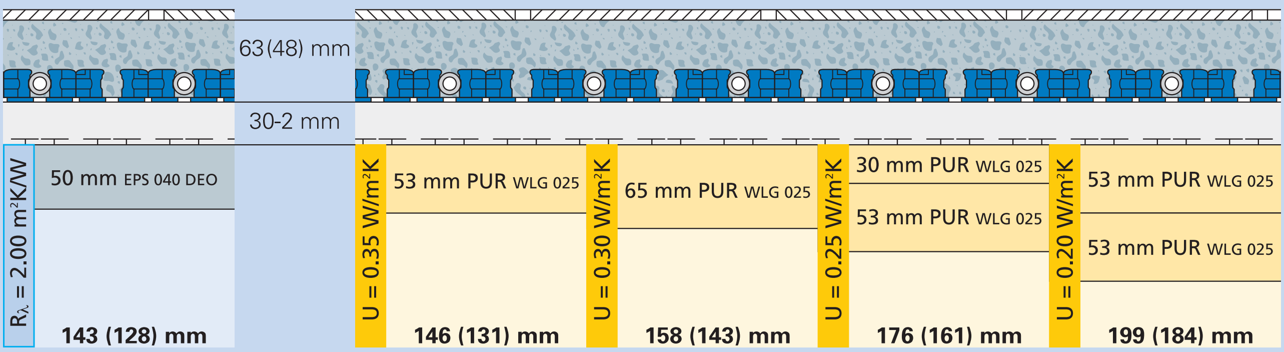
C Basement floor against unheated rooms



D Foundation/ground (depth of ground water > 5 m)



E Floor to outside air



Polycomfort 11.

Polytherm Systems

A Separating floors (20°C/20°C)

63	(48) mm	Heating screed including PE-Xc system pipe (thin-bed screed ZE 30 with Estro-Special)
11	mm	Polycomfort EPS insulation
20-2	mm	Sound insulation (EPS 040 DES sg)
		Separating floor
94	**(79) mm**	**Does not include floor covering**

B Separating floors over commercially-used rooms (20°C/15°C)

63	(48) mm	Heating screed including PE-Xc system pipe (thin-bed screed ZE 30 with Estro-Special)
11	mm	Polycomfort EPS insulation
40-2	mm	Sound insulation (EPS 040 DES sg)
		Separating floor
114	**(99) mm**	**Does not include floor covering**

Standard screed
With 63 mm nominal screed thickness (45 mm pipe coverage) with the addition of Estrotherm H.

Thin-bed screed
With 48 mm nominal screed thickness (30 mm pipe coverage) with addition of Estro-Special.
Construction dimensions are given in brackets.

Minimum requirements
in accordance with DIN EN 1264-4

Further construction examples
As far as **increased requirements** are made for the U-value for the outside walls of the building regarding the architect's specifications for constructional heat protection.

C Basement floor against unheated rooms (with footfall sound insulation)

Common layers: 63 (48) mm heating screed; 11 mm Polycomfort EPS insulation.

R_λ = 1.25 m²K/W	U = 0.35 W/m²K	U = 0.30 W/m²K	U = 0.25 W/m²K	U = 0.20 W/m²K
40-2 mm EPS 040 DES sg	20-2 mm EPS 040 DES sg	20-2 mm EPS 040 DES sg	20-2 mm EPS 040 DES sg	20-2 mm EPS 040 DES sg
	46 mm PUR WLG 025	30 mm PUR WLG 025	40 mm PUR WLG 025	46 mm PUR WLG 025
		30 mm PUR WLG 025	40 mm PUR WLG 025	53 mm PUR WLG 025
114 (99) mm	**140 (125) mm**	**154 (139) mm**	**174 (159) mm**	**193 (178) mm**

D Foundation/ground (depth of ground water > 5 m)

Common layers: 63 (48) mm heating screed; 11 mm Polycomfort EPS insulation. PE film 0.1 mm for PS board over bitumen.

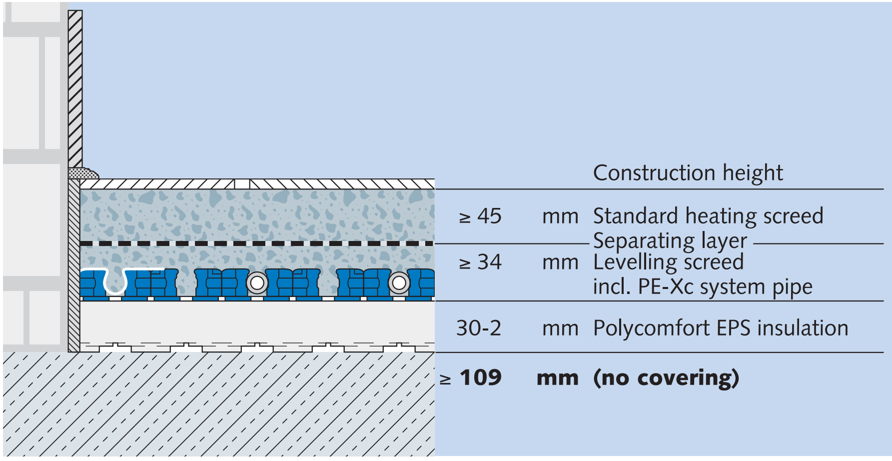
R_λ = 1.25 m²K/W	U = 0.35 W/m²K	U = 0.30 W/m²K	U = 0.25 W/m²K	U = 0.20 W/m²K
40 mm EPS 040 DEO	65 mm PUR WLG 025	30 mm PUR WLG 025	46 mm PUR WLG 025	53 mm PUR WLG 025
2 mm sealing	2 mm sealing	46 mm PUR WLG 025	46 mm PUR WLG 025	65 mm PUR WLG 025
		2 mm sealing	2 mm sealing	2 mm sealing
116 (101) mm	**141 (126) mm**	**152 (137) mm**	**168 (153) mm**	**194 (179) mm**

E Floor to outside air

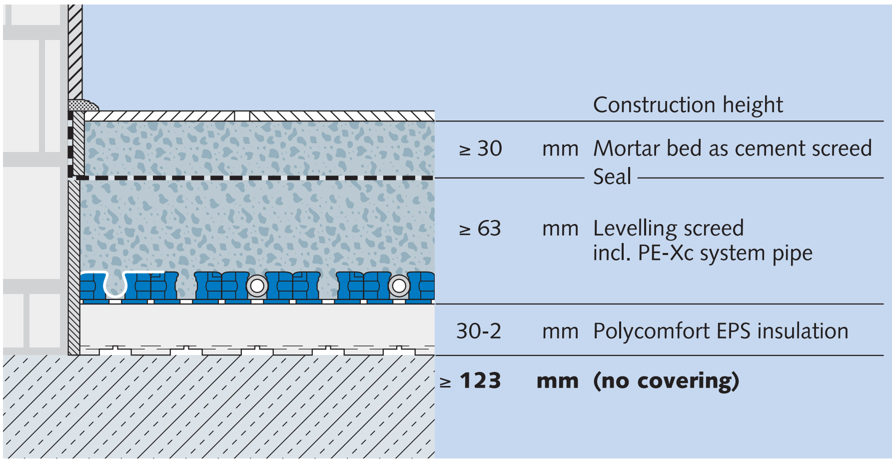
Common layers: 63 (48) mm heating screed; 11 mm Polycomfort EPS insulation.

R_λ = 2.00 m²K/W	U = 0.35 W/m²K	U = 0.30 W/m²K	U = 0.25 W/m²K	U = 0.20 W/m²K
40 mm PUR WLG 025	65 mm PUR WLG 025	30 mm PUR WLG 025	46 mm PUR WLG 025	53 mm PUR WLG 025
		46 mm PUR WLG 025	46 mm PUR WLG 025	65 mm PUR WLG 025
114 (99) mm	**139 (124) mm**	**150 (135) mm**	**166 (151) mm**	**192 (177) mm**

Polycomfort. Superstructure for special-purpose constructions. Floor with heating screed in accordance with DIN 18560/DIN 18353.



Special-purpose construction with levelling screed.
(Type of construction C in accordance with DIN 18560) to protect heating area during progression of construction work. The levelling screed must be placed at least as F4 (ZE 20) as it tends to cracking and has no load-distributing function.



Special purpose construction with anti-surface water sealing.
In so-called wet rooms such as bathrooms or shower rooms, surface water and surges of water are to be expected. A thick layer of paint or an adhesive sealant placed above the load distribution layer will prevent the building work from moisture.

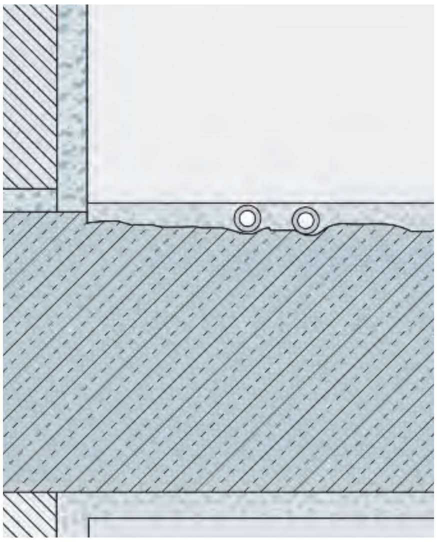
Should the surface of the self-levelling screed be inclined, the load-bearing foundation should be likewise in order that the screed may be applied in the same thickness.

Construction pre-requisites.

General/construction level.
The respective applicable standards, laws, decrees and guidelines are to be observed. Preliminary work on the upstream section are to be inspected and, if necessary, any concerns reported in writing prior to commencement of further required work. Plastering work must be completed, wall plaster must be applied up to the unplastered concrete ceiling. Windows and doors must have been installed. Construction requirements in accordance with DIN 18560, Part 2, Section 4 must be taken into consideration. This includes, e.g. the alignment of heating screed for the heating loops and screed fields during the planning stage. Any expansion joints in a load-bearing subfloor must not be crossed by heating pipes.

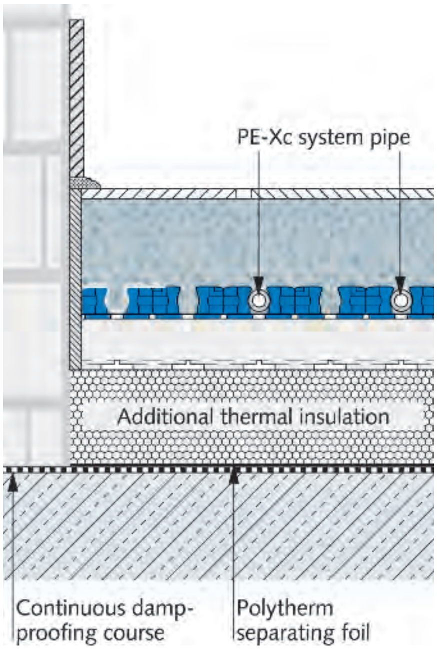
Height reference.
The height reference point in each storey must be inspected to ensure the construction height overall has been maintained.

Load-bearing bases.
The load–bearing subfloor must be sufficiently dry and even to support floating heat screed and there must be no punctual bumps, pipes or similar items which could lead to sound bridges and/or oscillations in the screed layer. The tolerances of the elevation and incline of the load-bearing subfloor must comply with DIN 18202 "Dimensional Tolerance in Structural Engineering". Any installation lines to be placed on the load-bearing subfloor must be fixed and an even surface must be created once more in order to accommodate an insulation



layer – **at least however footfall sound insulation** – with the required construction height as part of the planning. Filling material may be used in order to level off the surface if evidence of its serviceability has been provided by the manufacturer. **When placing a levelling layer the manufacturer's instructions regarding installation readiness (residual moisture), information regarding priming and/or floating to the unfinished floor and additional weight load must be observed.**

Damp-proofing of areas bordering on the ground.
Damp-proofing measures in compliance with **DIN 18195 "Damp-proofing"** must be determined to deal with ground moisture and rising damp prior to the installation of hot water floor heating including heating screed. It is recommended that the installation work be carried out only by a specialised professional company. Prior to installing the polystyrene heat and footfall sound insulation layer, it is essential to place a border of Polytherm PE foil to the damp-proofing bitumen.



Residual moisture in the concrete floor.
Shorter building times usually mean that concrete floors still contain a considerable quantity of residual moisture. The planners must clarify whether a diffusion-proof film should be placed underneath the whole of the area heating structure in order to prevent any later defects or deficiencies in the structure.

Floor heating components/working.
Thermal insulation, edging insulation strips, footfall sound insulation, system element.

Thermal insulation/additional insulation layers.
In compliance with standards DIN EN 1264, DIN 4108 and the Energy Conservation Act, the planner shall determine the degree and thickness of insulation required. Should additional insulation layers be required these are to be installed offset to one another beneath the Polycomfort system elements in a tight join leaving no gaps. Only such products may be used which have been tested and certified in compliance with DIN EN 13162–13171.
Additional installation panels purchased by the owner must have a minimum volumetric weight of 20 kg/m^3 (PS 20 SE)). Maximum compactability of the overall insulation layer including the Polycomfort system element 30-2 may not exceed 5 mm at a perpendicular working load of ≤ 2 kN/m^2 to comply with DIN 18560, Part 2. Polycomfort system element 30-2 has a compactability of 2 mm.

> Please refer to thermal insulation regulations on pages 36–38.

Edging insulation strips.
DIN 18560 for screed requires that edging insulation strips display freedom of movement of 5 mm which generally can be met by edging insulation strips 7 to 8 mm thick.
Data sheets for calcium sulphate self-levelling screed point out that edging insulation strips 10 mm thick should be used where self-levelling screed is placed.

Polytherm supplies these in two variants:

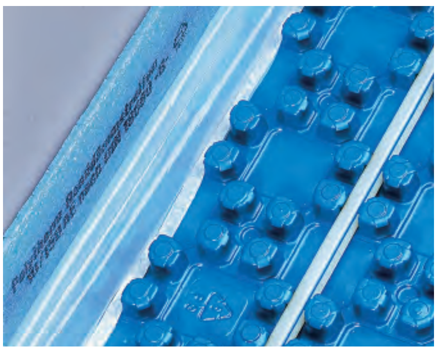
Special edging insulation strips 8 for use with cement screed.
> PE foam
> 8 mm thick
> 150 mm high
> Freedom of movement 5 mm
> Slit diagonal and lengthwise
> Foil

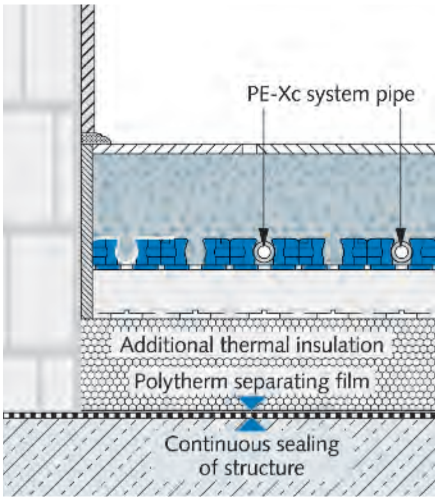
Special edging insulation strips 10 for use with calcium sulphate self-levelling screed.
> PE foam
> 10 mm thick
> 150 mm high
> Freedom of movement 7–8 mm
> Slit diagonal and lengthwise
> Foil plus adhesive strip

Prior to installation of area heating, determine whether cement screed or calcium sulphate self-levelling screed is to be used!
In addition to absorbing thermal expansion in the load-distributing layer, the proper placing of edging insulation strips enhances footfall sound insulation properties of the floating thermal screed and also prevents cold/heat bridges to adjoining structures.

The following is to be observed when carrying out installation:

1 The edging insulation strips must be placed prior to laying the sound insulation layer in cases where there are multi-layer insulations.
2 It is essential that the strips are placed continuously without gaps to all the surrounding walls and fixtures such as door frames or columns. Any gaps in the strips would lead to acoustic bridges or in the worst scenario, to the formation of cracks in the screed with the floor covering.
3 To seal the edge joints, the foil of the edging strip is placed on, or if necessary, stuck onto, the Polycomfort system element (refer to photo).
4 Do not cut off any excess pieces of the edging insulation strips until the jointing work has been completed or after the floor covering has been laid (special benefit in accordance with VOB [Construction Contract Procedures], Part C, DIN 18299).





Sealing self-levelling screed.
When using self-levelling screed, the joints must be executed with particular care.
And this is where the advantages of the special edging insulation strips 10 plus adhesive strip come into their own. To achieve a better joint, the foil is pressed into the first row of studs and firmly stuck to the system element.

Footfall sound insulation.

Footfall sound insulation measures are to be planned in accordance with DIN 4109 "Sound Insulation in Structural Engineering". Minimum requirements are $L'_{n,w,R}$ = 53 dB.

Refer to Supplementary Sheet 2 of DIN 4109 for proposals regarding increased sound insulation the implementation of which is to be agreed between the building owner and the designer. The area of the separating floors and floating screed influence increased sound insulation therefore the works and any necessary constructional measures must be finely coordinated already during the planning stage.

The Polycomfort system element 30-2 provides an improved level of footfall insulation of 28 dB and the standard construction method using floating heating screed meets the minimum requirements of DIN 4109. The expected standard footfall sound level $L'_{n,w,R}$ is to be checked for each building according to the following basis for computation:

$$L'_{n,w,R} = L_{n,e,eq,R} - L_{w,R} + 2 \text{ dB}$$

$L_{n,w,R}$ (TSM_R)	evaluated standard sound level (footfall sound insulation level) for the whole of the floor structure
$L_{n,e,eq,R}$ ($TSM_{eq,R}$)	equivalent evaluated standard footfall level (equivalent footfall sound insulation level) of the solid floor excluding floor covering
$L_{w,R}$ (VM_R)	improved footfall sound insulation level of floor covering
2 dB	rated level (safety margin)

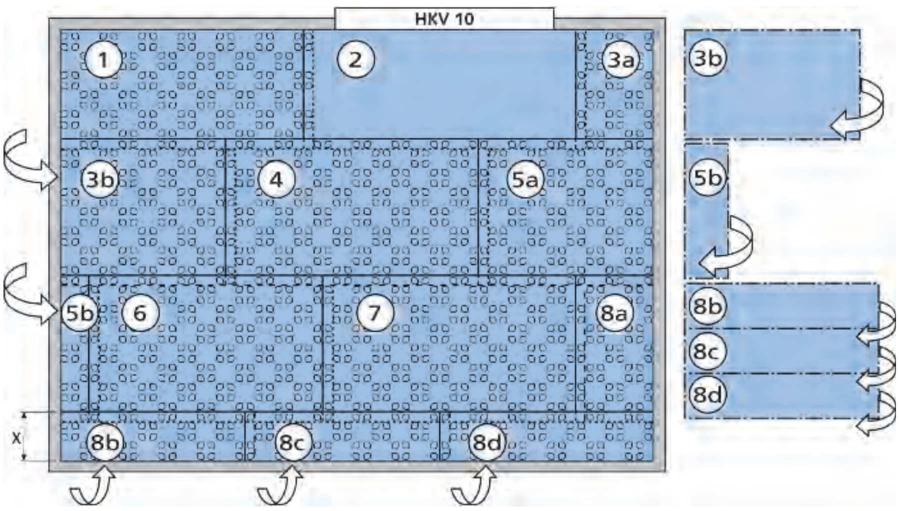
The compressability of all installed footfall sound insulation layers may not exceed 5 mm (≤ 2 kN/m²) or 3 mm (≤ 4 kN/m²).

If thermal insulation and footfall sound insulation are placed together as one layer, the insulation layer with the lowest compressability should be pleased as the top layer. This does not apply to footfall sound insulating heating panel systems. Only one footfall sound insulation layer is to be placed.

Areal combination of footfall sound insulation.

In public buildings and residential blocks it is essential to ensure that an expansion joint is made in doorways to external areas/flats to prevent sound being carried by the floating thermal insulation layer.

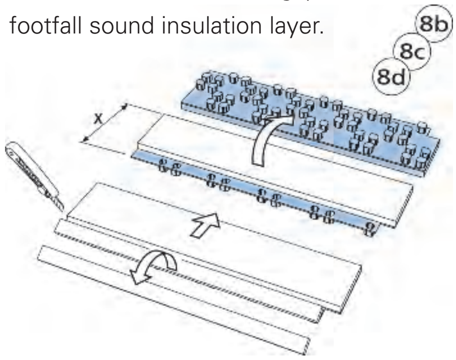
Polycomfort system element.



Technical data

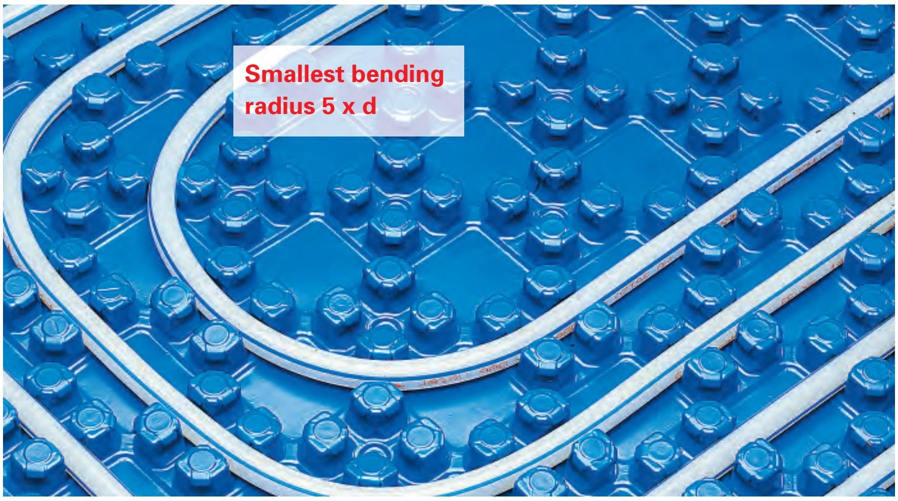
Type: Polycomfort 30-2	
EPS 040 DES sg	
Dimensions: 1447 x 900 mm	
Board thickness: 48 mm	
Footfall sound insulation improvement	28 dB
Thermal conductivity	R_λ = 0.75 m²K/W
Type: Polycomfort 11	
EPS 035 DEO (200 kPA)	
Dimensions: 1447 x 900 mm	
Board thickness: 29 mm	
Footfall sound insulation improvement	none
Thermal conductivity	R_λ = 0.37 m²K/W
Construction material classification	B2
Foil covering	≥ 0.5 mm
CFC-free PS	
(foam and foil)	
Pipe spacing	rectangular RA 5.5 cm
	diagonal RA 7.5 cm
±2 mm manufacturing tolerance	

Polycomfort system elements are to be installed in accordance with the Polytherm installation instructions. Overlapping the covering foil provides a closed footfall sound insulation layer over the whole area and following pipe installation, presents a suitable surface for placing cement screed or self-levelling screed. A well-conceived cutting and overlapping technique results in just 1 to 2% waste. The whole area must be covered without joints and cavities. Any interfaces resulting from the object design must be sealed off prior to laying the screed. In accordance with DIN 18560, there must be no gaps in the footfall sound insulation layer.



Floor heating components/installation.
PE-Xc system pipe 14 x 2/16 x 2 mm.

Technical data	
Dimensions	14 x 2; 16 x 2 mm
Oxygen diffusion proof jacket, highly flexible	
Resistant to stress cracking	
Stabilised against thermal ageing	
Minimum bending radius	5 x d
Maximum operating pressure	10 bar
Application classification	5
Maximum operating temperature	90°C
Quality is RAL-monitored by the manufacturer	
Tested in accordance with DIN 4726 3V265 PE-Xc	

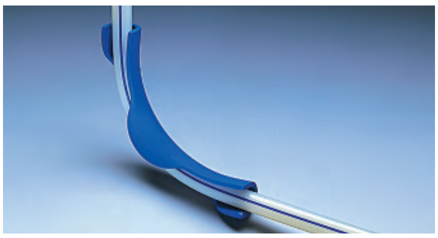


Pipe fixtures.
DIN EN 1264 for hot water floor heating systems stipulates that pipes and their fixtures must be safe in both horizontal and vertical positions. Vertical deviation of the pipe must not exceed in any place 5 mm either prior to or following installation of the screed. Horizontal deviation in the prescribed pipe spacing in the heating loop must not exceed 10 mm at the point of fixture. These requirements do not apply to elbows and direction changes.

The standard further states that spacing between pipe fixture points may not exceed 50 cm.
The Polycomfort system meets the requirements of this standard in both rectangular and diagonal pipe installations with exact height and spacing fixture without any additional measures.
The pipes must be installed more than 50 mm away from vertical structures and 20 mm from chimneys or open fireplaces or brickwork shafts.

Heating loop arrangements/expansion joints.
The system pipe is to be installed according to the assembly instructions and the specifications in the plan. The arrangement of heating loops regarding any required expansion joints must be coordinated between the screed-laying company and the planners. Heating loop lines may only cross expansion joints, but not joints in the building structure itself. System pipes crossing an expansion joint must be provided with a flexible protective pipe 0.3 m in length.

Manifold connection.
The PE-Xc system pipe and the Polytherm heating loop manifold must always be connected via a guide pipe bend so that the pipe may be led out of the screed tension-free. **Care must be taken that pre-setting the floor heating loop valve after flushing the whole heating unit is done in accordance with the computerised planning.** Article No. 1054



Straight couplings.
Polytherm straight couplings have been tested in connection with Pipe DIN 4726 and are an integrated part of our guarantee. Positioning is to be identified in the plan. The straight coupling must be protected with foil.

Screw coupling	Article No. 14-7232 Article No. 16-1043
Compression connector	Article No. 14-7233 Article No. 16-9320

Leak test.
The heating loops must be tested for leaks using water pressure of at least 1.3 times the max. permissible operating pressure.
> Polytherm recommends for testing pressure: 6 bar.

Leak tightness of the system must be ensured prior to and during the placement of the screed. Leak tightness and testing pressure are to be recorded in a test protocol.
> Please refer to Polytherm start-up protocol.

It is essential to ensure that all screw connections are retightened.

Frost protection.
Suitable measures are to be taken if there is a danger of frost e.g. the use of anti-freeze or heating the building.
In as far as no anti-freeze is further required for the designed operation of the heating unit, the anti-freeze agent is to be discharged and the unit flushed at least three times using fresh water for each flushing process.

If the anti-freeze remains in the unit, its concentration is to be checked each year. **Too little anti-freeze generally leads to increased corrosion** (offer a maintenance contract).

Assessment of required quantity of anti-freeze: The Polytherm PE-Xc system pipe 14 x 2 mm handles 0.079 l/m (16 x 2 mm: 0.113 l/m).

Pipe spacing	Pipe required m/m²	Water content l/m² 14 x 2	Water content l/m² 16 x 2
RA 5.5	17.6	1.38	1.99
RA 11	8.8	0.69	0.99
RA 16.5	5.9	0.46	0.67
RA 22	4.4	0.34	0.50
RA 27.5	3.5	0.27	0.40
RA 33	2.9	0.23	0.33

Polytherm Anti-freeze PFS

pH-value	8.5 ± 0.2
Density	1.118 g/cm³ ± 0.005 g/cm³ at 20°C
Freezing point	–14°C

For further material data, please refer to data sheet "Physical data".

Anti-freeze protection at various application concentrations

Addition	Polytherm PFS	Density	Frost protection
Vol. %	Weight %	g/m³ at 20°C	up to
20	22.5	1.028	– 10°C
25	30.0	1.037	– 14°C
30	33.5	1.043	– 18°C
35	39.0	1.048	– 22°C*
40	44.5	1.056	– 27°C*
45	50.0	1.062	– 33°C*
50	55.5	1.067	– 40°C*

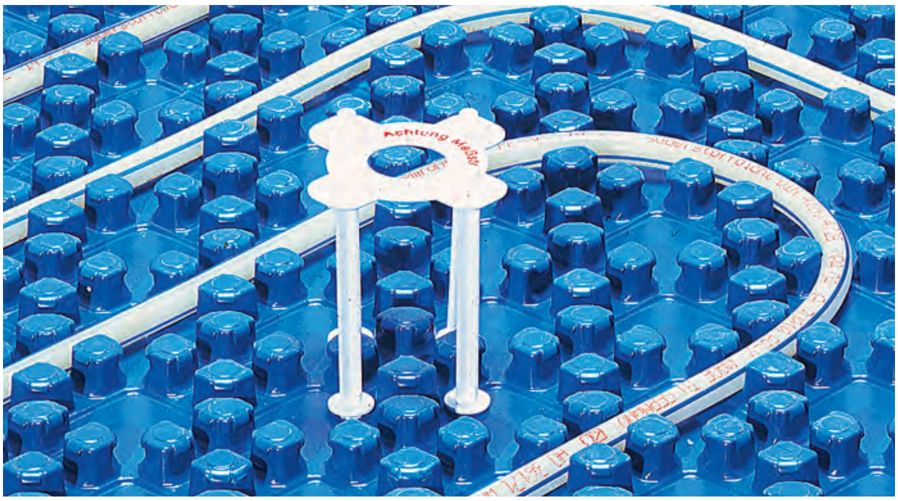
*No explosive effect when falling below temperature.

Measuring points for measuring moisture content.
Suitable points are to be identified for measuring the moisture content in the heated area. Independent of the actual required number of measurements to be taken, at least 3 points per 200 m² or per residence must be identified. The

Polytherm measuring point set easily allows a **pipe-free position** (e.g. in the terminal loop) to be identified.

Article No. 1117

Please also refer to the information given in "Interface coordination in heated floor constructions" on Page 48.



Heating screed/load-distribution layer.

General.
The Polycomfort system can be installed in cement screed and self-levelling screed.

Structural requirements.
Pre-requisites for installation of a heating screed are the completion of interior plastering work, plus draught-free windows and outer doors, in accordance with DIN EN 1264, Part 4. This protects the screed from drying out too early and reduces the tendency to shrinkage cracks.

Inspection of completed hot water floor heating installation.
The specialised screed-laying company is obliged to ensure that the installation has been properly carried out and is free of damage. Any defects or damage occurring in the meantime are to be reported to the construction supervisor.

Important inspection criteria:
1 Edging insulation strips.
The Polytherm edging insulation strips comply with DIN 18560 and must enclose all rising structures such as walls, pillars, stair thresholds. The strips must not be cut off until after the upper floor covering, including jointing has been laid.

2 Polycomfort system elements.
The system elements must be properly laid overlapping over the whole area in accordance with the assembly instructions. Any joints where panels do not overlap, e.g in doorways, must be sealed using Polytherm adhesive strips.

3 Polytherm PE-Xc system pipe.
The screed-laying company can ensure the hot water floor heating system has been hydraulically tested on the basis of the prescribed leak test inspection protocol. The heating loops must be left under pressure when heating screed is laid so that any damage may be noted immediately.
Damage from the use of kneeling pads must be avoided.

Working load (traffic load) standardisation.
The thickness, strength and hardness of heating screed must correspond to the selected construction method and the required working load prescribed by DIN 18560. The nominal thickness over the heating elements (pipe covering) in the Polycomfort system is 45 mm in accordance with Structural type A for cement screed. This standard refers to working loads of up to 2 kN/m^2 as floating heating screed constructions in residential buildings. In buildings with a higher traffic load (e.g. churches) other classes of strength and hardness are required as prescribed in Tables 2 to 4 in DIN 18560/II.

> **Any reduction required for structural reasons can be effected using Polydynamic or a thin-bed screed with just 30 mm pipe coverage. Reduction of up to 30 mm for a working load of up to 2 kN/m^2 is allowed by the DIN if suitability has been evidenced by a testing certificate.**

The standard allows in general a reduction in the nominal thickness to 40 mm (≤ 2 kN/m^2) in calcium sulphate self-levelling screeds. Conventional mastic asphalt screeds may not be used in combination with a Polytherm hot water floor heating system.

Reinforcements.
In principle, it is not necessary to reinforce screed and heating screeds on insulation layers (DIN 18560, Part 2, Item 5.3.2) as the formation of cracks caused by the reinforcement cannot be prevented. Should there be any fracturing and thus damage to the screed, this can often be attributed to improper execution of edging or expansion joints.
In such cases, reinforcement could prevent cracks from spreading or a slip in height. If reinforcement is to be used, it should be placed in the centre third of the heating screed and interrupted around expansion joints.

Working load	Individual load	C	Nominal thickness CAF-F4	Nominal thickness CT-F4
≤ 2 kN/m^2	—	≤ 5 mm	40 + d	45 + d
≤ 3 kN/m^2	≤ 2 kN	≤ 5 mm	50 + d	65 + d
≤ 4 kN/m^2	≤ 3 kN	≤ 3 mm	60 + d	70 + d
≤ 5 kN/m^2	≤ 4 kN	≤ 3 mm	65 + d	75 + d

CT-F4 (ZE 20) = Cement screed in accordance with hardness class F4
CAF-F4 (AE 20) = Calcium sulphate self-levelling screed in accordance with hardness class F4
C = Max. permissible compressability of insulation layers
d = Pipe diameter/stud height

Expansion joints.

When planning heating screeds, coordinate heating loops and screed areas. Furthermore, calarify who is to carry out the setting up of suitable expansion joint strips for expansion joints with the jacketing of the heating pipes.

Expansion joints are to be planned in accordance with the following DIN 1264 criteria and are not dependent on floor covering.

1 **Structural joints** are to be accommodated as expansion joints in the heating screed and may not be traversed by heating pipes. Connecting lines which must cross expansion joints must be protected in a suitable fashion, e.g. with pipe sleeves.
2 Areas larger than approx. **40 m²** are to be split up with expansion joints.
3 Likewise, where side lengths exceed **8 m**, the size of the screed fields should be as compact as possible and length-width ratio should not exceed 2:1.
4 Where **areas jut out strongly**, the expansion joint should commence from an incoming corner so that rectangular or square screed fields can be formed (please refer to drawing).
5 In **doorways**.

Note!
In public buildings and residential blocks it is essential to ensure that an expansion joint is made in doorways to external areas/flats to prevent sound being carried by the floating thermal insulation layer.

A dummy joint (cut by a trowel) is not an expansion joint. If however, one is made, then only to a maximum of one third of the screed thickness. After the screed has set, it must be closed as a force-fit e.g. using an artificial epoxy resin which means it need not be accommodated congruently as e.g. an expansion joint in the floor covering. **When determining spacing for joints and screed fields the type of bonding agent , the specified floor covering and stress e.g. through temperature, must be taken into consideration.**

A plan must be drawn up showing the joints, the type and arrangement of joints. A plan of the arrangement of the joints is drawn up by the construction planner and presented to the executing company as part of the specification of services.

The heating process causes a thermal longitudinal expansion in floating load-distribution layers. The thermal expansion coefficient for screeds is approx. 0.012 mm/mK. The overall longitudinal change (ΔL) is calculated on the basis of:

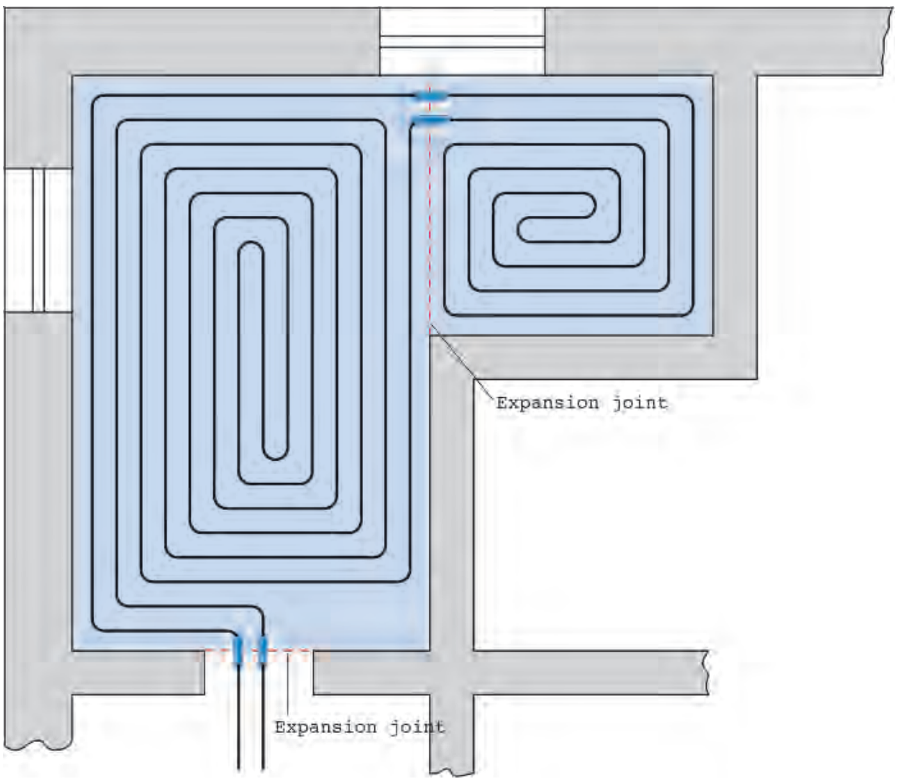
$$\Delta L = \alpha \cdot \Delta\vartheta \cdot L$$

L = Length of room/field
$\Delta\vartheta$ = Difference in temperature
α = Thermal expansion coefficient

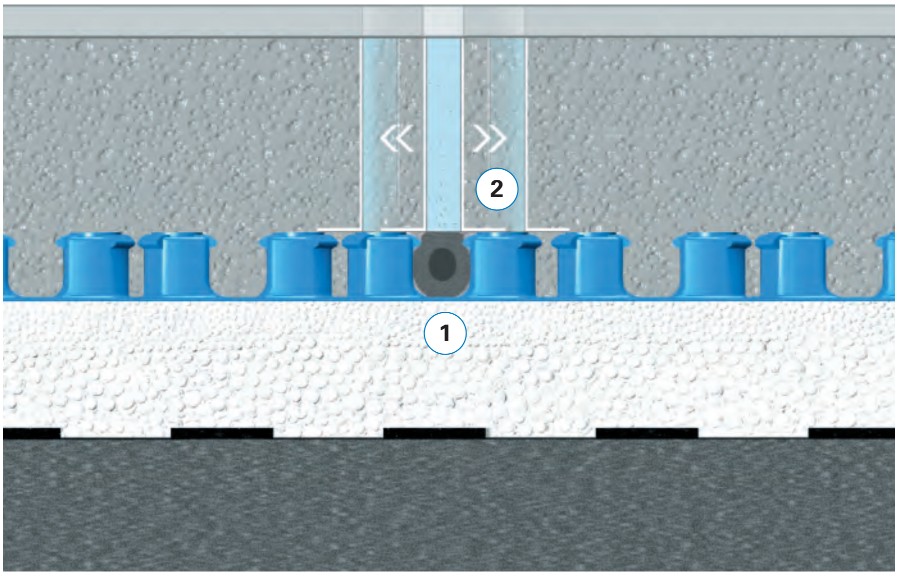
Example

$\Delta L = 8\ m \cdot 20\ K \cdot 0.012\ mm/mK$
$= 1.92\ mm$

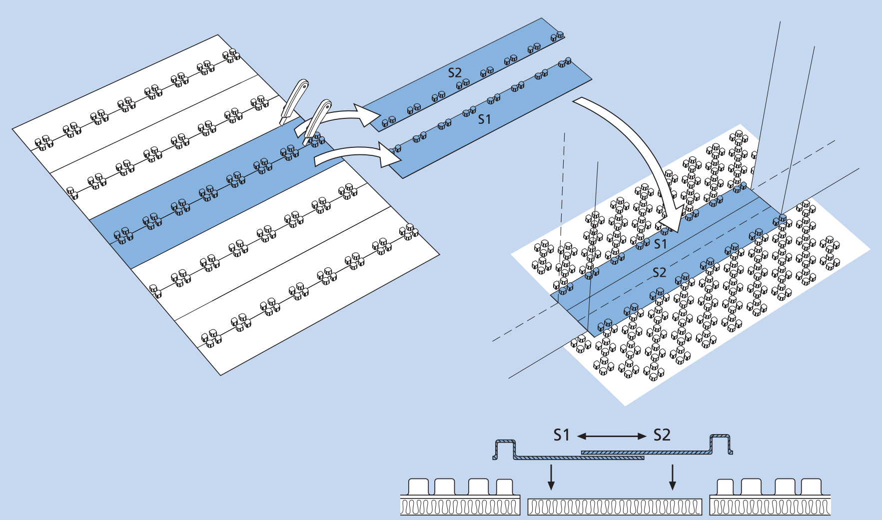
The longitudinal expansion in larger expanses of calcium sulphate self-levelling screed is (even) larger therefore the arrangement of expansion joints must follow the instructions of the manufacturer or data sheets.



Expansion joints – design.
Expansion joints should be made from the upper edge of the insulation to the upper edge of the finished floor covering without offset and if necessary safeguarded against a slip in height. If the expansion joint of the heating screed is not accommodated all over in the floor covering, the floor covering is pre-destined to crack where the expansion joint has been made in the screed.
Polytherm has solved this problem using a rounded section (1) and a self-adhesive expansion joint section (2)



System pipe crossing an expansion joint.
Expansion joints in heating screed should only be crossed by connecting lines at one level. **For this purpose, it is essential to coordinate heating loops with the fields of screed.** The connecting lines crossing an expansion joint should be provided with flexible protective pipes of about 0.3 m in length.



Design of expansion joints in doorways.
Polytherm Polycomfort supplementary set provides a door element which can be easily cut into strips and installed. The door strips bridge the area around the doorway as the foil overlaps at variable depths, efficiently sealing off the total area using the known stud overlapping principle for self-levelling and cement screeds.

Installation.

The screed is to be made in accordance with DIN 18560, Part 1. Screed mortar and screed masses must be identified by means of a CE code in accordance with DIN EN 13813. In the production of the screed, use only additives which with DIN EN 196, Part 1 do not increase the volume of air pores in the mortar by more than 5%. The respective processing instructions must be observed. As a load-distributing panel must be made for every floating screed, special attention should be paid to proper compaction. **Heating pipes must be totally embedded in screed mortar.** Depending on the working load, observe the corresponding specifications given in DIN 18560, Part 2 excerpts of which can be found in the table opposite.

Reference values for heating screed – thickness for differing traffic loads up to 5 kN/m²

Polycomfort system

with special-purpose cement screed additives

Working load (kN/m²)	Individual load (kN)	Category/use in acc. DIN 1055, Sheet 3 (Excerpt/example)	Max. compressability insulation layers	Screed quality CT F4 – With cement screed additives "Estrotherm H" "Temporex": Min. screed nominal thickness (mm)	Screed quality CT F4: Min. heating pipe coverage (mm)	Screed quality CT ≥ F5 – "Estro-Special": Min. screed nominal thickness (mm)	Screed quality CT ≥ F5: Min. heating pipe coverage (mm)
2	–	Category "A" Residential and recreational rooms	5 mm	Polycomfort 30-2 or 11 mm: 63 *0.14 or 0.15 kg/m²	**45**	48 *1.1 kg/m²	**30**
3	2	Category "B" Offices, workplaces, public corridors	5 mm (3 mm F6–7)	Polycomfort 30-2 or 11 mm: 83 *0.15 or 0.17 kg/m²	**65**	58 *1.35 kg/m²	**40**
4	3	Category "C" Rooms, assembly rooms and areas serving as public assembly areas	3 mm	Polycomfort 30-2 or 11 mm: 88 *0.16 or 0.18 kg/m²	**70**	63 *1.45 kg/m²	**45**
5	4	Category "D" Sales rooms	3 mm	Polycomfort 30-2 or 11 mm: 93 *0.17 or 0.2 kg/m²	**75**	68 *1.6 kg/m²	**50**
≥ 5 ≤ 10		Category "E" Production halls and workshops, stables, storerooms and entrances, areas accommodating considerable crowds	0 mm	**"Not reasonable!"**		Polycomfort 11 mm: 80 with industrial additives	**65**

N.B. *Additives

1 Assumed structural loads must be specified by stress analyst and evidenced.

2 The nominal thickness of the heating screed depends on the type of use and the strength classification of the screed

Cement screed with Polytherm "Estrotherm H".

Technical data (2 kN/m²)	
Quantity used 63 mm	approx. 0.14 kg/m²
Accessibility after	3 days
Setting phase	21 days
Functional heating	3 days at 25°C 4 days at e.g. 45°C

No other screed additives must be added. It is essential to observe instructions for use.

Polytherm screed additive "Estrotherm H" can be added to cement heating screeds and levelling screeds made in accordance with DIN 18560.

In addition to a higher bending tension strength and compression strength, the addition of Polytherm screed additive to the mixing water makes the mortar more workable and allows an ever desirable reduction in mixing water with the same consistency of mortar.

Cement screed with Polytherm "Temporex".

Technical data (2 kN/m²)	
Quantity used 63 mm	approx. 0.15 kg/m²
Accessibility after	2 days
Setting phase	10 days
Functional heating	3 days at 25°C 4 days at e.g. 45°C

No other screed additives must be added. It is essential to observe instructions for use.

Using the cement screed additive "Temporex" results in a 10-day shorter drying out period compared with the usual 21 days with a residual moisture of 3%. Compression strength, bending tension strength and deflection correspond to a ZE 20 in accordance with DIN 18560. Faster drying out period also means that the final strength and final shrinkage rate are reached more quickly. "Temporex" can be used in cement heating screeds and levelling screeds.

Thin-bed cement screed with Polytherm "Estro-Special".

Technical data (2 kN/m²)	
Quantity used 48 mm	approx. 1.1 kg/m²
Accessibility after	3 days
Setting phase	21 days
Functional heating	3 days at 25°C 4 days at e.g. 45°C

No other screed additives must be added. It is essential to observe instructions for use.

Using screed additive "Estro-Special" can reduce pipe coverage to 30 mm in accordance with DIN 18560, Part 2. Stress values were evidenced in compliance with standard specifications so that the addition of 1.3 kg/m² provides a sufficient load-distribution layer for 2 kN/m².

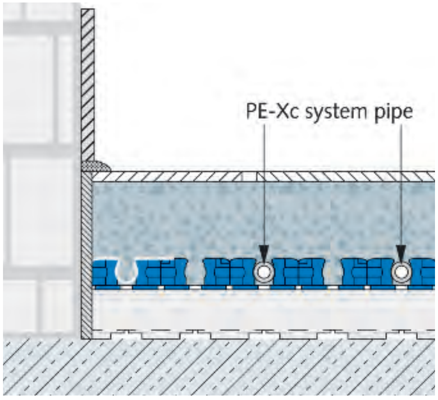
Placing cement screed.

In order to recognise immediately any damage occurring to the heating pipe, the screed-laying company should observe that the test pressure of the heating pipe is maintained until screed works have been completed.

Calcium sulphate self-levelling screed.

The Polycomfort system is excellently suited for use with calcium sulphate self-levelling screed, whereby it is essential to follow the instructions for installation.

The 10 mm special edging insulation strips with adhesive strips on the overlapping foil are designed for use with self-levelling screed and allow quick and easy sealing of the edge joints.



Calcium sulphate self-levelling screed must be produced in compliance with DIN 18560, Part 2 and placed according to the manufacturer's instructions.

No Polytherm or other additives must be added.

It is essential to consult the manufacturer on the following points:

> **Screed nominal thickness**
DIN 18560 stipulates a pipe coverage of 40 mm for a working load of 2 kN/m^2.

> **Setting and drying times, plus heat-up regulations**
DIN 18560 allows normal heating to commence after 7 days for calcium sulphate self-levelling screeds.

> **Expansion joints**
Data sheets require an arrangement of expansion joints for calcium sulphate self-levelling screeds.

> **Max. temperature load**
In some cases, the temperature of 50°C must not be exceeded.

> **Processing of calcium sulphate self-levelling screed to safeguard and prevent footfall bridges**
The marginal areas of calcium sulphate self-levelling screed must be of a somewhat more viscous consistency.

Functional heating of screed/protocol.

Heating screeds must be generally heated up prior to the installation of floor covering.

This initial functional heating is made no earlier than 21 days for cement screeds and at the earliest 7 days for calcium sulphate self-levelling screed according to the manufacturer's instructions.

Normal heating commences with a flow temperature of 25°C and is maintained for 3 days. Then the max. calculated flow temperature is set and maintained for a further 4 days. Any deviations in standards or screed manufacturer's specifications must be agreed at an early stage.

As with unheated screeds, it is the task of the company laying the floor covering to ensure the floor is ready for covering during the course of the tests they carry out under VOB, Part C, DIN 18365 "Floor covering tasks", Item 3.1.1 prior to commencing work.

All inter-structural work has been compiled in the journal **"Interface coordination for heated floor constructions"** which is available from the Bundesverband Flächenheizungen e.V.,

Start-up protocol for Polytherm hot water floor heating systems in compliance with DIN EN 1264, Part 4.

Customer	
Building/real estate	
Construction phase/part/storey/flat	
Unit part	

Polytherm system

- ☐ Polycomfort ☐ Polydynamic ☐ Polydynamic light
- ☐ Polyseco ☐ Polyjet ☐ Special-purpose systems

1 Leak test

The heating loop is tested for leaks immediately prior to placing the screed, a water pressure test being used to ensure the loop is leakproof. The operating pressure is then set and maintained. Test pressure is 1.3 times the max. permissible operating pressure, at least 1 bar over-pressure.

Max. permissible operating pressure	bar
Test pressure	bar
Durating of load	h

The system has been shown to be leak-proof; no deformation was observed on any structure.
Note: Pre-set the Polytherm heating loop valves after the system has been flushed!

2 Functional heating for calcium sulphate screed and cement screed

Proper functioning of a floor heating construction is tested by means of a functional heating process.

> In the case of cement screed at the earliest 21 days after screed work has been completed.
> Where cement screed additive Temporex has been used, at the earliest after 10 days.
> In the case of calcium sulphate screeds at the earliest after 7 days (or according to the manufacturer's instructions).

Type of screed, make ☐ Cement screed ☐ Calcium sulphate screed ☐ ______

Bonding agent used ☐ Estrotherm H ☐ Estro-Special ☐ Temporex ☐ ______

Screed work completed ____________________ Date

Begin functional heating ____________________ Date

A constant flow temperature of 25°C to be maintained for 3 days.

Setting to max. flow temperature of _____°C Date

Max. flow temperature to be maintained for 4 days (refer to manufacturer's instructions).

End of functional heating ____________________ Date

N.B. Functional heating does not ensure that the screed has reached the required moisture content to allow floor covering to be placed.

Functional heating was interrupted ☐ no ☐ yes from ______ to ______

The rooms were aired draught-free and all windows/outer doors were closed after the floor heating had been switched off.
The heated floor area has been cleared of building materials and other coverings/weights.
The site was released for further building activities at an outside temperature of _____°C.

☐ The unit was out of operation.

☐ The floor was heated with a flow temperature of _____°C.

Confirmed (Date/stamp/signature)

Floor coverings.

Designs/what type of floor covering may be used?

The types of floor coverings described here can be used with Polycomfort floor heating systems under the following conditions:

- The manufacturer of the floor covering has released the covering for use by means of an appropriate identification
- Max. thermal conductivity is $R_{\lambda,B} < 0.15\ m^2W/K$
- The manufacturer's working instructions are observed, if necessary likewise those of the manufacturer of the adhesive
- Inspection that preliminary work has been correctly carried out
- Following successful inspection that the floor is ready for covering/residual moisture
- Observation of the respective standard regulations
  DIN 18352 Tiles and panel work
  DIN 18356 Parquet work
  DIN 18365 Floor covering work
  DIN 18353/18560 Screed work/screed in the building industry

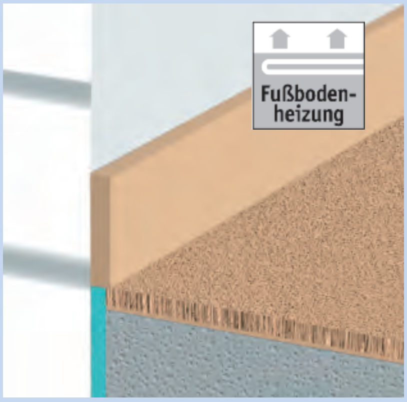
The screed must always be heated up prior to placing floor covering.

Prior to placing floor covering, the heating is switched off or the flow temperature is reduced so that the surface of the screed is not more than 15 to 18°C. Only those materials designated by the manufacturer as being "suitable for floor heating systems" are to be used as bases, fillers and adhesives. Such materials must also be resistant to thermal ageing and be able to withstand a permanent temperature load of 50°C.

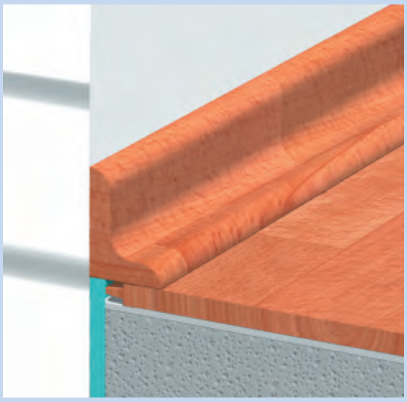
Removal of rests of edging insulation strip.

At this point, we would like once more to point out that for all types of installation, the remains of the edging insulation strips must not be removed until completion of jointing work in order to prevent any jointing mortar from entering the joint and forming a permanent connection. The remaining edging and expansion joints of the floor covering may only be sealed using a permanently elastic material. Excess mortar must be removed.

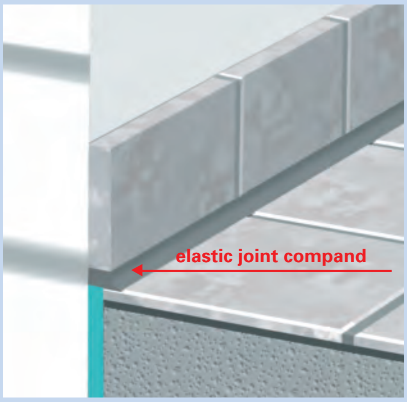
Textile and elastic coverings (carpet/PVC)



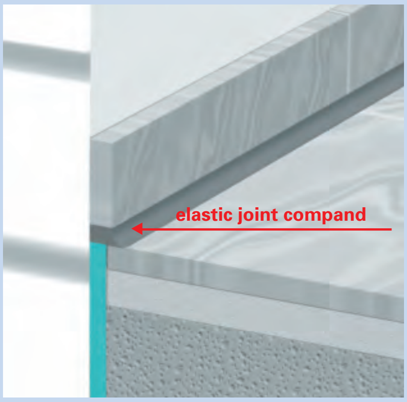
Parquet flooring/ laminate coverings



Ceramic tiles and panels (glued in thinbed)



Marble/natural stone/concrete block



Inspection of readiness to accommodate floor coverings.
Following the professional operation of the functional heating process, there is still no certainty that the screed has reached a sufficient level of moisture to allow a floor covering to be laid. An installer of upper floor covering shall inspect this prior to work beginning as per VOB, Part C, DIN 18365 "Floor covering operations", item 3.1.1.
The professional source **"Interface coordination in heated floor constructions"** provides information of preparatory measures to be taken when installing upper floor coverings, CM measurements and heating of screed up to readiness to accommodate floor coverings including certain requirements made regarding max. moisture content.
> Please refer to the Table opposite.
The flooring specialist (FS) is responsible for these works.

Maximum moisture content in screed in %, determined by means of CM measuring device

	Upper floring cover		Cement screed designed	Calcium sulphate screed designed
FS 1	Elastic floorings		1.8%	0.3%
FS 1	Textile floorings	Vapour-proof	1.8%	0.3%
FS 1	Textile floorings	Vapour-permeable	3.0%	1.0%
FS 2	Parquet		1.8%	0.3%
FS 3	Laminate		1.8%	0.3%
FS 4	Ceramic tiles and natural stone/cement stone	Thick-bed	3.0%	–
FS 4	Ceramic tiles and natural stone/cement stone	Thin-bed	2.0%	0.3%

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