Contec concrete core activation (TABS)

System description / application

Uponor Contec

Concrete ceilings can be used for the cooling and/or heating of multi-storey buildings. This future-proof solution from Uponor turns ceilings into thermally active elements with integrated modular water-containing registers.

Uponor Contec utilises the thermal storage capacity of concrete ceilings in large commercial buildings such as office blocks or administrative premises, offering a future-proof and cost-efficient method of room climate control. The Contec modules are installed together with the reinforcing elements in the concrete ceiling. Concrete core activation is an ingenious technology that does not only provide a great indoor climate but also helps protect the environment and save costs. Concrete core activation reduces the air change rate to the basic level necessary for proper room hygiene (1x to 2x convection rate). It is thus possible to install a smaller air-conditioning system.

Thanks to the low capital and operational costs, concrete core activation is also an interesting option for investment project such as office blocks where the initial plans do not include a cooling system.

The efficiency of Uponor Contec is guaranteed by a number of special features, including:

- Factory-assembled modules equipped with Uponor pipes for smooth installation and fast construction progress
- High performance thanks to pipe laying conforming to all relevant standards
- Optimised pipe positioning, with or without patented Uponor mesh hooks
- Uponor PE-Xa pipe with outer protective jacket 20 x 2.3 mm
- Patented system components including ceiling leadthrough elements for pressure testing without damage to the formwork and special pipe fixing panels for modular installation

Your advantages

- High user comfort at low investment and operating costs
- Optimised utilisation of renewable energy sources
- System components are virtually maintenance-free
- No restrictions as regards room design
- Recommended for: new buildings – office blocks and commercial premises
System components / construction

Uponor Contec systems are installed with the following tried and tested system components:

- Uponor Contec module
- Uponor Contec mesh hook
- Uponor Contec ceiling leadthrough element

Components of the Uponor Contec module
The special pipe carrier mesh comes with fully installed sturdy PE-Xa pipes (20 x 2.3 mm). The carrier mesh consists of a special construction with 4 mm cross wires and two 3 mm longitudinal wires. It contains built-in pipe clips that hold the Uponor PE-Xa pipes at the optimum distance to each other. Each Uponor Contec module includes integrated connecting lines for a distribution line or a manifold. The surfaces to be heated or cooled with Uponor Contec are fitted with the matching Contec modules during the planning phase.

To cater for different building types and layouts, Uponor offers modules of various sizes. They come in lengths from 1.35 to 6.30 m, and a standard width of 2.4 m. All lengths are however also available in widths of 2.10, 1.80, 1.50 or 1.20 m. The module range thus includes 60 different types, from compact (1.35 m x 1.20 m) to large-size modules (6.30 m x 2.40 m).

### Uponor Contec modules at a glance

<table>
<thead>
<tr>
<th>Module length L [m]</th>
<th>2.4</th>
<th>2.1</th>
<th>1.8</th>
<th>1.5</th>
<th>1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module width B [m]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6.3</td>
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<td>10.4</td>
<td>9.45</td>
<td>8.1</td>
</tr>
<tr>
<td>4.95</td>
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<td>10.8</td>
<td>9.72</td>
<td>8.51</td>
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<td>4.5</td>
<td>10.8</td>
<td>9.72</td>
<td>8.64</td>
<td>7.56</td>
<td>6.48</td>
</tr>
<tr>
<td>4.05</td>
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<td>8.64</td>
<td>7.56</td>
<td>6.48</td>
<td>5.4</td>
</tr>
<tr>
<td>3.6</td>
<td>8.64</td>
<td>7.56</td>
<td>6.48</td>
<td>5.4</td>
<td>4.32</td>
</tr>
<tr>
<td>3.15</td>
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<td>6.48</td>
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<td>4.32</td>
<td>3.24</td>
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<td>4.86</td>
<td>3.78</td>
<td>2.7</td>
</tr>
<tr>
<td>2.25</td>
<td>5.4</td>
<td>4.86</td>
<td>3.78</td>
<td>2.7</td>
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</tr>
<tr>
<td>1.8</td>
<td>4.86</td>
<td>3.78</td>
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<td>2.16</td>
<td>1.62</td>
</tr>
<tr>
<td>1.35</td>
<td>3.78</td>
<td>2.7</td>
<td>2.16</td>
<td>1.62</td>
<td></td>
</tr>
</tbody>
</table>

**Conversion factors:**
- Weight of Contec module: approx. 2.5 kg/m²
- Number of mesh hooks: approx. 4/m²
- Pipe length on module: approx. 6.7 m²/m²
- Capacity of pipe: approx. 1.3 l/m²

**Note:** Contec modules are available in lengths from 1.35 to 6.30 m (15 cm raster).
Uponor PE-Xa pipes for modular design

The Uponor pipe made in high-pressure cross-linked polyethylene (PE-Xa) produced according to the Engel method was first launched in 1967 and since has been successfully installed in innumerable buildings. The quality of the pipe has remained unrivalled, even considering the latest developments in plastics processing. The product is certified according to all relevant standards.

For investors and users, the following features are the most relevant:

- Flexible even at low temperatures
- Stress crack resistant
- Extremely high impact strength
- Oxygen diffusion tight according to DIN 4726
- Resistant to heat deformation
- Resistant to ageing
- Resistant to chemicals

The extremely high strength of the Uponor PE-Xa pipe is the result of the Engel method that is used in its production, whereby the polyethylene pipe is cross-linked at a pressure of more than 2000 bar at a temperature above the crystallite melting point. At about 250 °C, the material forms a uniform three-dimensional cross-linked structure across the entire pipe cross-section. This means that the entire pipe essentially consists of a single, highly resistant macromolecule. The pipe is then equipped with an oxygen diffusion barrier layer and an outer protective jacket made in cross-linked polyethylene.

Excellent temperature resistance and flexibility

The PE-Xa pipe produced with the Engel method can be used within a temperature range from -70 °C to +95 °C. Even during the winter months when the temperature at the building site drops below zero, there is no need to delay installation, and no special preparation such as pre-heating the pipe is necessary.

Durability:

The Uponor PE-Xa pipe has a service life in line with that of the building (DIN 16892 version 7/2000). The durability curves obtained in long-term internal pressure tests indicate a service life of 100 years for the Uponor PE-Xa pipe. In contrast to the kinked durability curves of non-cross-linked plastic pipes, the curves of Uponor PE-Xa pipes are linear. Assuming operating temperature and pressures that are typical for concrete core activation systems, the Uponor PE-Xa pipe of size 20 x 2.3 mm offers a minimum safety factor of 6.7 even after 100 years. This means that even 100 years from now, the pipe can be safely pressurised with nearly 20 bar at a temperature of 30 °C.

To prevent damage to the pipes during installation in the concrete ceiling, it is important to choose the right material for the task. For concrete core activation, it is important that a very sturdy pipe is used that can withstand the rough conditions on a building site. The high-pressure cross-linked PE-Xa pipe manufactured with the Engel method has been successfully installed in concrete for many decades and is widely used in industrial radiant heating systems. By opting for the PE-Xa pipe, proprietors make a prudent investment that will last the lifetime of the building.
Memory effect

If the Uponor PE-Xa pipe is kinked, minute PE crystals in the material prevent it from returning to its initial shape, which would normally be the case with three-dimensionally cross-linked materials. These crystals are however dissolved at temperatures above 133 °C, and the pipe changes from white opaque to transparent. In other words, the memory effect of the cross-linked polymer now comes to the fore so that the pipe resumes its initial shape. At this point, the pipe has again the same physical and chemical properties as during production. After cooling, the kinked section has completely disappeared and the PE-Xa base pipe is as good as new.

We therefore guarantee the quality of any pipe section that has repaired itself in this manner.

Press-fitting technique

Press-fitting is a method that guarantees permanent connections and perfect safety. It could not be easier: Simply push the stainless steel ferrule onto the pipe and insert the press-fitting. Then press-fit the connection with the battery-powered press head or mains-powered pressing machine. It takes only about 10 seconds to make a connection. The Uponor PE-Xa pipe produced with the Engel method is designed for tight press-fittings. The three lock grooves ensure that the pipe material is compressed across the entire length of the compression body, forming a perfect seal. Press-fittings are thus as tight and safe as any pipe connection can be.

Your advantage – properties of Uponor PE-Xa pipes

- Safety factor S > 6 after 100 years according to DIN 16892
- Excellent mechanical strength (great resistance to notching)
- High stress crack resistance and impact strength at cold temperatures make the product particularly suitable for use on building sites during winter months
- Oxygen-tight according to DIN 4726 (no need for heat exchangers)
- Oxygen diffusion barrier protected against mechanical impact by additional outer protective layer
- Kinks disappear with heating
Uponor Contec mesh hook

The specially designed hook ensures fixture of the module in the statically neutral zone of the ceiling and prevents the module from floating on the poured-in concrete. Each Contec module is secured with four mesh hooks per m² at the desired height.

Calculation of the pipe position at the centre of the ceiling

\[
H = \left( \frac{D_{\text{Ro}}}{2} + \frac{D_{\text{Ro}}}{2} + 7 \right) - s_u
\]

\[
D_{\text{Ro}} = \frac{1}{2} \text{ ceiling thickness}
\]

\[
D_{\text{Ro}} = \text{ pipe diameter, e.g. } 20 \text{ mm}
\]

\[
H = \text{ mesh hook length}
\]

\[
s_u = \text{ concrete layer above top reinforcement, e.g. } 40 \text{ mm}
\]

Example:

- Ceiling thickness = 190 mm
- Pipe diameter = 20 mm
- Concrete layer = 40 mm
- H = 72 mm
- Chosen mesh hook length: H = 70 mm

\[
H = \left( \frac{190}{2} + \frac{20}{2} + 7 \right) - 40
\]

To cater for various ceiling thicknesses, the mesh hooks are available in a range of lengths from 70 mm to 780 mm.
Uponor Contec ceiling leadthrough element

The patented ceiling leadthrough element from Uponor allows you to lead the cooling or heating pipes from the concrete ceilings into the room below without causing damage to the formwork. This advantage is a prerequisite for rented formwork, which is the mostly widely used solution today. The heating or cooling circuits can be pressure-tested at any time, i.e. before, during or after concreting.

The leadthrough elements offer however a second huge advantage: With this method, you can pull connecting lines of any lengths from the ceiling for direct, adapter-free connection to other lines, including manifold collection lines.

Principle

The connecting line extending from the module side is thread through the ceiling leadthrough element, which is nailed to the formwork. Special red tabs in the ceiling leadthrough element enable the installer to determine the direction of the pipe leadthrough, which is necessary for the later removal of the connecting line. The protective pipe at this side of the element prevents concrete from entering the pipe system. On the other side, the connecting line remains enclosed in a protective pipe and protrudes above the upper edge of the concrete layer, so that this end of the line remains flexible and can be pulled back into the floor when necessary.
Uponor pipe bending guide / conduit
If the modules or the cooling/heating circuits are to be connected to a manifold/collection line installed in a double floor, the Uponor protective pipe is the ideal solution for the installation of the connecting line upwards out of the bare concrete floor. This protects the Uponor PE-Xa pipe where it exits the concrete. As the protective pipe is flexible, the connecting line can be attached in a horizontal position even in a very confined space.

Options for manifold installation: directly on the floor structure

If the modules or the cooling/heating circuits are to be connected to a manifold located above the activated floor, use the Uponor pipe bending guide to deflect the pipe by 90°.

Options for manifold installation: Uponor manifold installed on wall
**Floor constructions / utilisation values**

The performance of a radiant heating/cooling system is determined by the coefficient of heat transfer at the ceiling or on the floor, the maximum and minimum permissible surface temperatures and the size of the system surface.

The cooling function determines the size of the water mass flows. To achieve high performance at water temperatures that are close to room temperature, the water volume is determined based on a small spread between the supply and the return (2 to 5 K).

The required water mass flow is based on the maximum performance (40 – 60 W/m²) and the spread. The maximum cooling/heating circuit length is then calculated on the basis of the maximum permissible pressure drop.

Floor constructions without insulation or air layer are ideal for concrete core activation with highest possible efficiency. The following structures are most suitable for the installation of the system:

Concrete floors equipped only with floor covering, and floors with a bonded screed. Both floor constructions are widely used in buildings where maximum heating/cooling performance is the key objective.

Impact noise insulation reduces the heating/cooling output through the floor. As most of the output is emitted through the ceiling, such constructions are however still suitable for the installation of Uponor ceiling systems.

Concrete floors equipped only with floor covering, and floors with a bonded screed. Both floor constructions are widely used in buildings where maximum heating/cooling performance is the key objective.

Another very popular construction for office buildings are raised floors. As regards the heating/cooling performance, they are comparable with double floors. As these floors are covered with screed (instead of system panels), builders must provide access openings in the floor.

Fully suspended ceilings are normally not suitable for combination with concrete core activation, as the suspended structure prevents effective performance of the system. There are however a number of special cases where such combinations must be useful, for example in order to dissipate the heat created by lighting devices from the suspended ceiling.
Utilisation values of a concrete floor without insulation

The calculation (finite element method) using a software program for two-dimensional thermal transfer illustrates the temperature distribution in a solid building component.

### Cooling application

<table>
<thead>
<tr>
<th>Supply temperature</th>
<th>Return temperature</th>
<th>Room temperature</th>
<th>Rel. humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 °C</td>
<td>20 °C</td>
<td>26 °C</td>
<td>50 %</td>
</tr>
</tbody>
</table>

**Calculation parameters**

- Supply temperature: 16 °C
- Return temperature: 20 °C
- Room temperature: 26 °C
- Rel. humidity: 50%

#### Cooling performance

- Utilisation through floor: $q_{fb} \approx 20 \text{ W/m}^2$
- Utilisation through ceiling: $q_{bc} \approx 37 \text{ W/m}^2$
- Total utilisation: $q_{ge} \approx 57 \text{ W/m}^2$

### Heating application

<table>
<thead>
<tr>
<th>Supply temperature</th>
<th>Room temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 °C</td>
<td>20 °C</td>
</tr>
</tbody>
</table>

**Calculation parameters**

- Supply temperature: 28 °C
- Room temperature: 20 °C

#### Heating performance

- Utilisation through floor: $q_{fh} \approx 18 \text{ W/m}^2$
- Utilisation through ceiling: $q_{bh} \approx 22 \text{ W/m}^2$
- Total utilisation: $q_{gh} \approx 40 \text{ W/m}^2$
Utilisation of concrete floor with impact noise insulation

### Cooling application

**Utilisation through floor**  \( q_{fb} = \text{approx. } 8 \text{ W/m}^2 \)

**Utilisation through ceiling**  \( q_{ce} = \text{approx. } 40 \text{ W/m}^2 \)

**Total utilisation**  \( q_{Ge} = \text{approx. } 48 \text{ W/m}^2 \)

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### Heating application

**Utilisation through floor**  \( q_{fb} = \text{approx. } 6 \text{ W/m}^2 \)

**Utilisation through ceiling**  \( q_{ce} = \text{approx. } 23 \text{ W/m}^2 \)

**Total utilisation**  \( q_{Ge} = \text{approx. } 29 \text{ W/m}^2 \)
Utilisation values of concrete floor with double floor construction

<table>
<thead>
<tr>
<th>Material</th>
<th>R value (m²K/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpet</td>
<td>0.015</td>
</tr>
<tr>
<td>Panel</td>
<td>0.020</td>
</tr>
<tr>
<td>Air</td>
<td>0.150</td>
</tr>
<tr>
<td>Concrete</td>
<td>0.250</td>
</tr>
</tbody>
</table>

**Cooling application**

- Supply temperature: 16 °C
- Return temperature: 20 °C
- Room temperature: 26 °C
- Rel. humidity: 50%

Utilisation through floor: \( q_{fb} = \text{approx. 8 W/m}^2 \)
Utilisation through ceiling: \( q_{ce} = \text{approx. 40 W/m}^2 \)
Total utilisation: \( q_{ge} = \text{approx. 48 W/m}^2 \)

**Heating application**

- Supply temperature: 28 °C
- Room temperature: 20 °C

Utilisation through floor: \( q_{fh} = \text{approx. 6 W/m}^2 \)
Utilisation through ceiling: \( q_{ce} = \text{approx. 23 W/m}^2 \)
Total utilisation: \( q_{ge} = \text{approx. 29 W/m}^2 \)
Reduction of performance by acoustic insulation, other insulation and hollow spaces

Floor construction
As the above calculations clearly show, the installation of a double floor greatly reduces the performance of the system through the floor. This is of particular concern where systems must cover a great heating load. In such cases, proprietors should reconsider the necessity of a double floor. Even conventional impact noise insulation prevents effective heat transfer through the floor. Where it is not possible to do away with noise impact insulation, choose a material that offers adequate noise reduction and good thermal permeability.

Ceiling substructure
From a heating point of view, enclosed suspended ceilings are normally not suitable for combination with concrete core activation, as thermal convection is significantly limited or delayed. This also applies to wall-to-wall plastered acoustic ceilings.

The free area in a sealed suspended ceiling acts like an insulating layer, obstructing heat transfer through the concrete floor.

Important planning note:
- Consult an acoustic engineer in the planning phase.
Planning notes for building construction

Uponor Contec can be installed in virtually any concrete floor/wall construction

In-situ concrete floor
In-situ concrete floors are currently the preferred floor type in office buildings. The Contec system components, modules, mesh hooks and ceiling leadthrough elements have therefore been specifically designed for this type of construction. To find out more about the patented mesh hook element method from Uponor, and its advantages, see chapter “Installation procedure for in-situ concrete floors”.

The Uponor Contec modules are installed at the centre of the floor, using mesh hooks.

In-situ concrete casting

Uponor Contec mesh hook
Uponor Contec module (PE-Xa pipe 20 x 2.3 mm – special pipe fixing panel)

Spacer for upper reinforcement layer

Uponor Contec, mesh hook element method
**Filigree slab floor**
The Uponor Contec modules are also suitable for installation in filigree slab floors as they allow for fast installation. In this case, the mesh carriers, which normally serve as spacers for the upper reinforcement layer, are shortened so that they can carry the medium reinforcement layer and the Contec modules.

**Pre-cast concrete floors**
The installation of modules in pre-cast concrete structures is a widely used method. The modular design enables the concrete element manufacturer to supply the pre-cast parts with fully integrated concrete core activation on time to the site.
Permanent formwork ceilings
With the assistance of Uponor, the Contec system has been successfully integrated into a number of special floor constructions, such as sheet steel trapezoid ceilings (permanent formwork construction).

Special ceiling constructions
In the historic docks of Hamburg, a number of old warehouses have been converted into modern office buildings. In some of these buildings, concrete core activation has been successfully integrated into the old building structure using a tailor-made construction method. As the rooms were rather low, there was no space available for air channels.
Wall installation
Apart from installation in concrete floors, which are often the only part of the building with thermal storage capacity, especially in glass facade constructions, Uponor Contec modules for concrete core activation can also be integrated into solid walls. Combined with concrete core activated floors, such solutions significantly increase the heating/cooling performance in the building. In addition, this has the welcome effect that wet shells dry much quicker with heating.

Note:
For the installation of pipe registers in external walls, observe the regulations of EnEV 2009 for thermal insulation.
Planning notes for floor constructions with integrated Uponor Contec modules

Uponor PE-Xa pipes manufactured with the Engel method that are fully integrated into the concrete floor do not in any way weaken the floor structure. At point loads, the lines of force actually bypass the pipe.

There is no need for any special measures in connection with the thermal elongation of the Uponor pipe, as it is self-compensating.

As regards the thermal elongation of the concrete floor, constructions with concrete core activation show temperature fluctuations that are actually smaller than those in floors without concrete core activation. As the floor temperature is kept uniform throughout the structure thanks to operating temperatures that are closed to the room temperature, the maximum temperature inside the floor is normally not higher than that in floors without concrete core activation.

Under certain circumstances, the structural engineer might request that there are no pipes close to supports or in end sections of walls. It is therefore important to consult the structural engineer in time to take into account such requirements in the further planning process.

The patented Uponor mesh hook method (patent no. DE/3906729) is the preferred technology for the proper positioning of the prefabricated Contec modules in the concrete floor. This approach allows for precise vertical adjustment of the Contec module layer within the concrete floor structure.

Near structural supports, crossing steel rods might not leave enough space for the Uponor Contec components. We therefore recommend keeping the area within a 60 cm radius around support points free of pipes.

On-site adjustment of modules to cater for pipe-free areas should be avoided. If certain sections of the floor (for example around supports) are to be left free of pipes, choose shorter modules (guide value $r \approx 0.2 – 1.0$ m).

The lines of force within the concrete run around the pipes, similar to a bridge construction.
In smaller buildings or constructions with a complicated floor plan, the Uponor Contec heating/cooling circuits are supplied through manifolds. In this case, the connecting lines of the modules are extended by means of Uponor press fittings and run inside the concrete to a central manifold station. Such systems offer the advantage that circuits can be shut down individually. The required hydraulic balancing is simply done at the manifold. Please note that such solutions require manual installation of the connecting lines on site and are thus more costly.

In many buildings, the Uponor Contec heating/cooling circuits are supplied through Tichelmann distribution/collection pipes. In two-storey buildings, these are often installed in a suspended ceiling structure or might be laid in suspended channels in the ceiling, which also includes noise insulation and light fittings. Alternatively, they are fully embedded in concrete.
It is recommended to keep a distance of 20 – 50 cm from the façade with modules, depending on the actual building plan.

Certain areas along the façade might need to be kept free of pipes.

For the planning of Uponor Contec systems in floors, Uponor will assist you with a proposed installation layout, based on the actual floor plans.

In principle, you should always opt for the largest possible modules. It is therefore important to determine first whether standard modules (width 2.40 m) can be used.

Alternatively, you can of course also include modules of 2.10 m, 1.80 m, 1.50 m or 1.20 m in width. In any case, it is advisable to opt for as few different module types as possible, as this facilitates the logistics at the building site.

Depending on the size, you can link several modules to form a single heating/cooling circuit, up to a maximum pressure drop of approx. 300 mbar. This is best done with Uponor press fittings.

For the detailed planning of the system, Uponor offers planners access to the Contec module library, where all available Uponor Contec modules are stored. These can then be included in the CAD floor plans.

In buildings with non-rectangular floor plans, you might consider installing modules with an overlap rather than opting for special modules.

Areas that are not suitable for Contec modules can be equipped with manually laid pipes.

For complex geometries, it might be useful to combine modules with manually laid pipe sections.
Delivery, crane transport and installation

The key advantage of the modular design of the Contec system is the easy and fast installation of the element in the course of the floor construction. The Contec modules are installed together with the reinforcing elements in the concrete floor. For this purpose, prefabricated modules equipped with pipes are simply placed on top of the first reinforcement layer.

Delivery

Depending on the size and type, the Contec modules are supplied to the building site in upright or horizontal packs on non-returnable transport devices. The module packs are unloaded by crane and stored on site until installation. During storage, they must be protected against impact and the elements.

Uponor system solutions for heating and cooling > ceiling cooling/heating > Contec

Module design

After the top reinforcement layer has been installed, the modules are secured to these elements with special mesh hooks. The patented Uponor mesh hook method allows for the precise installation of the pipe registers in the neutral zone at the centre of the concrete floor.

For prolonged storage on the construction site (> 30 days), ensure that the modules are not exposed to direct sunlight (UV radiation).
Crane transport of Contec module pack

The instructions below must be strictly adhered to in order to prevent injury to persons and damage to property.

Module pack with upright Contec modules
The module pack consists of a non-returnable transport device to which the Contec modules are secured. Each transport device can hold up to 35 modules. Dimensions of the empty transport device: L/W/H approx. 3.50 m/1.20 m/2.00 m. The maximum weight of a transport device with 35 modules of size 6.30 m x 2.40 m is approx. 1400 kg.

For crane transport, position the module packs on a firm and level ground. Attach the module pack with the straps provided to the crane hook. Lift the module pack by crane to the respective installation level and place it on a level surface with the necessary load bearing capacity. Remove the transport straps. The individual Contec modules can now be removed from the transport device.

Module pack with lying Contec modules
Contec modules with Q 131 steel mesh reinforcement are transported and stored in horizontal stacks on non-returnable pallets. The rules for handling and crane transport are the same as for upright module packs. Again, do not change the attachment of the lifting straps as the load might otherwise become dislodged when lifted.

Important!
- Always place the module packs on firm and level ground. Observe the necessary load capacity.
- Do not change the attachment of the straps to the transport device (seen from the top: threaded through the third loop of the smallest module).
- Do not attach any lifting tackle to the non-returnable transport device.
- Do not attach more than one module pack at the time to the crane hook.
- Never stand under lifted module packs.
- When removing Contec modules from upright module packs, take one module from one side and the next module from the other side to prevent the pack from toppling over.
Installation steps for in-situ cast concrete floors

Thanks to the modular design of the system, installation is made easy and much faster. There is thus normally no need to plan for extra time in the floor construction schedule.

The individual steps of the installation procedure are as follows:

1. Erection of the floor formwork by the building contractor.
2. Nailing of the ceiling leadthrough elements to the formwork, according to the installation plan of the heating engineer.
3. Installation of the lower reinforcement and the necessary spacers by the building contractor.
4. Lifting of the Uponor module transport device by crane to the floor for installation.
5. The heating installers remove the individual modules from the transport device to install and align them according to the installation plan on the lower reinforcement structure. Each module is labelled with its dimensions and a position number.
6. Where required, two or more modules are connected to each other with press fittings to form combined cooling/heating circuits. Press fittings are also used to extend the connecting lines. The open ends of the connecting pipes are fitted with a protective pipe and pushed through the ceiling leadthrough elements.

Caution:
Cater for crane access!
7 The concreting contractor installs the spacers for the upper reinforcement, positions the reinforcement elements and secures them.

8 Using the Uponor mesh hooks, the modules are pulled up and attached to the upper reinforcement structure.

9 The modules are secured in the neutral zone by bending the mesh hooks (to prevent floating). The modules are secured with four mesh hooks per m² in the floor.

10 To pressure test the circuits according to the pressure testing instructions, the pipe ends protruding upwards from the ceiling leadthrough elements must be equipped with pressure test fittings, consisting of Uponor adapter fittings, pressure gauges and drain valves.

11 Before and during the concreting work, all circuits must be kept pressurised (water or air). Regularly check the pressure in the system. The pressure test must be documented. Before commissioning the system, perform a leakage test of the pipe registers with operating medium according to VOB DIN 18380, whereby the test pressure must be at least 1.3 times the operating pressure.

12 After the concrete has cured, or after removal of the formwork and disconnection of the pressure testing fittings, you can pull the connecting lines downwards from the ceiling leadthrough elements. The red tabs at the openings of the ceiling leadthrough elements indicate the direction of the pipe installation.

13 The heating installer thus knows from which side he must pull down the connecting lines.

Important planning notes:
- Water-filled pipelines must be protected against frost.

From the above installation procedure, it becomes clear that proper coordination between the various subcontractors is very important. The implementation of the concrete core activation must be coordinated between the heating engineer and the reinforced concrete installer.

Important planning notes:
The floor structure must be equipped with spacers that are supported on the formwork, as it is otherwise not possible to suspend the modules correctly in the neutral zone of the construction.
Concrete core activation with Uponor Contec modules in filigree slab floors

The advantages of the modular Contec system can also be used in filigree slab floors, as has been shown in numerous constructions projects.

1. The intermediate reinforcement layer can for example be implemented with Q131 steel mesh reinforcement.

2. The heating installer can then take the modules from the Uponor transport device at the respective floor level and position them on this reinforcement structure.

Important planning notes:
In the planning phase, the filigree slab floors must be designed for the subsequent installation of the Contec modules. The mesh carriers of the floor elements that normally serve as supports for the upper reinforcement must be shortened so that the modules can be positioned at intermediate reinforcement level. The filigree slab elements must thus be prepared accordingly by the manufacturer.
3 As the Contec modules are placed in their final position at the centre of the floor structure, it is not necessary, to suspend them with the patented mesh hooks, as is the case with in-situ cast floor constructions. The elements need however to be secured to prevent shifting.

4 There is no need for ceiling leadthrough elements in filigree slab floors, as any pipe leadthroughs to the floor below can be easily implemented by drilling through the filigree slabs. The connecting lines are then equipped with protective pipes and extended into the room below.

5 The concreting contractor installs the spacers for the upper reinforcement, positions the reinforcement elements and secures them.

6 Before any concreting work is carried out, pressurise all heating/cooling circuits and perform a pressure test.
Contec TS thermal socket

System description / application

Uponor Contec TS extends the concrete core activation system by providing a thermal socket that allows for the connection of additional, external cooling/heating or peak load elements that can be freely suspended from the ceiling.

To connect the thermal socket outside the concrete ceiling, you need an adapter plug (accessory available from Uponor). The Uponor Contec TS socket is mounted directly on the ceiling formwork and is then embedded in concrete together with the distribution lines. The system features an automatic shut-off device so that the socket can be commissioned with the adapter at any time without the need to drain the lines.

Highlights

- Optional provision of additional thermal energy
- Flexibility for subsequent change of room use/planning
- Postponed commissioning without the need to drain the system

Recommended for:
Add-on to Uponor Contec, where there might be increased need for cooling in certain sections of the building.

Optional cooling/heating capacity approx. 200 kg/h or 850 W/unit at 4 K systems spread
Pressure loss calculation

Pressure loss: thermal socket

Normally, the lengths of circuits for concrete core activation are chosen based on a pressure drop of max. 350 mbar. To have sufficient reserve for pressure drops occurring in connecting lines for thermal sockets and the connected radiant ceiling panels, the volumetric flow rate should be between 0.15 and 0.16 m³/h to prevent a pressure drop inside the socket of more than approx. 150 mbar.

Example: Thermal socket with GK radiant ceiling panel

<table>
<thead>
<tr>
<th>System</th>
<th>GK radiant ceiling panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface of ceiling panel</td>
<td>2100 mm x 2400 mm</td>
</tr>
<tr>
<td>Number of ceiling panels</td>
<td>2</td>
</tr>
<tr>
<td>Output rate</td>
<td>60 W/m²</td>
</tr>
<tr>
<td>Temperature spread</td>
<td>3 Kelvin</td>
</tr>
<tr>
<td>Total output rate</td>
<td>2 x (2.1 x 2.4) m² x 60 W/m² = 604.8 W</td>
</tr>
<tr>
<td>Volumetric flow</td>
<td>604.8 W</td>
</tr>
<tr>
<td></td>
<td>1.163 Wh/kgK x 3K = 173 l/h</td>
</tr>
<tr>
<td>Pressure drop in panel (example)</td>
<td>21 mbar according to manufacturer specifications</td>
</tr>
<tr>
<td>Pressure drop in socket</td>
<td>187 mbar (at kvs = 0.4 m³/h)</td>
</tr>
</tbody>
</table>

Pressure drop in connecting line

<table>
<thead>
<tr>
<th>Length</th>
<th>50 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure drop</td>
<td>1.9 mbar/m</td>
</tr>
<tr>
<td>Total pressure drop</td>
<td>95 mbar</td>
</tr>
</tbody>
</table>

Total pressure drop

<table>
<thead>
<tr>
<th>Connecting line</th>
<th>95 mbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal socket</td>
<td>187 mbar</td>
</tr>
<tr>
<td>Radiant panel</td>
<td>21 mbar</td>
</tr>
<tr>
<td>Total</td>
<td>303 mbar</td>
</tr>
</tbody>
</table>
Thermal sockets can be connected to the system in several different ways. If only minimal additional output is required and the sockets can be operated together with the concrete core activation, they are connected to the same supply line as the concrete core activation. Usually, the required additional output is however greater, or the socket is to be operated at times when concrete core activation is not in use. In this case, the sockets should be equipped with at least a separate supply line and shared return line (three-pipe system). Alternatively, the sockets can be operated through a completely separate circuit (four-pipe system).

**Two-pipe system**

In two-pipe systems, the thermal sockets and Contec modules share a supply and return line. This is a cost-efficient solution, as it requires less material and labour. This type of circuit is however only suitable for buildings where the sockets and the modules are to be operated at the same time and with the same system temperature.

**Three-pipe system**

In three-pipe systems, the thermal sockets and the Contec modules are supplied with cooling/heating energy through separate supply lines but share a return line. This type of system is particularly suitable for installations where the socket and the heating/cooling registers are to be operated at different times. The components remain however hydraulically linked.

**Four-pipe system**

In four-pipe systems, the circuits for the thermal socket and the Contec modules are fully separated from each other. This system is the most expensive, as it requires more material and additional labour. It has however the advantage that the thermal socket and the Contec modules can be regulated and operated independently from each other.
Example of installation: Combination of Contec and Contec TS for operation at different times (three-pipe system)

The instructions below serve as a quick guide for the installation of Uponor Contec TS. Please always observe the installation instructions shipped with the product, which can also be downloaded at www.uponor.com

1. Positioning of the thermal socket on the formwork and fixture of the socket with the supplied standard or screw nails.
2. Installation of the lower reinforcement layer (to be provided by building contractor).
3. Fixture of the distribution and collection lines for Contec and Contec TS on the lower reinforcement.
5. Laying of Contec module panels.
7. Installation of the upper reinforcement layer (to be provided by building contractor).
8. Lifting of Contec module panels for positioning in the neutral zone, using mesh hooks.
9. Pressure testing of piping system. System must remain pressurised during concreting work.
System description / application

Contec ON

Concrete core activation is a technology that utilizes the mass of the building as an active thermal storage system. The thermal inertia of the mass levels out temperature fluctuations during the day and thus helps ensure a constant comfortable room climate. For fast response to load changes and/or greater demands for cooling/heating, we recommend installing a system with pipe registers installed close to the surface, such as the Uponor Contec ON solution.

System with fast response to cover peak loads

The Uponor Contec ON pipe fixing panel made in plastic guarantees that the pipes are installed exactly at the intended level, a few millimetres below the surface of the ceiling. The panel also acts as a spacer for the positioning of the lower reinforcement layer. In buildings with a concrete core activation system that provides effective thermal storage, it is often useful to provide a complementary fast-acting system to deal with peak loads that also allows for temperature regulation in individual rooms. Uponor Contec ON is again the ideal solution to achieve this.

Highlights

- Increase of capacity and fast adjustment to changes in use
- Caters for peak loads/compensation of fluctuations in load
- Improved microclimate at workplaces near windows
- Replaces secondary radiators / cooling and heating with a single system
- Individual room temperature control adjustable by room user

Recommended for:
New buildings: office blocks and commercial premises

Uponor Contec ON – standard and high-performance versions

Uponor Contec ON is available in the standard version (pipe spacing 170 mm) designed mainly for installation across the entire ceiling. In addition, we offer a high-performance version (pipe spacing 85 mm) intended for areas around the edges of a room where a high output rate is to be achieved across a small surface.

The perfect match – Uponor Contec and Uponor Contec ON

As the Uponor Contec ON standard version is designed to respond with a certain delay, it requires that there be sufficient energy available for cooling or heating during the actual peak demand time. The system is suitable for operation with renewable sources of energy. The cost-efficient utilization of natural cooling sources is one of the key advantages of concrete core activation technology. Thanks to the storage capacity of such systems, it is possible to use the energy stored overnight during the daytime when the building is in use. The combination of Uponor Contec operated during the night with Uponor Contec ON to cover peak loads, is a highly effective solution for just-in-time climate control during the daytime.

National Technical Approval for use in concrete ceilings of fire safety classes F 30 – F 120
Laboratory tested load capacity according to DIN 1045-1

Contec ON standard version installed close to the ceiling surface on the formwork
Planning and dimensioning

Cooling with Contec ON

As the Contec ON system is installed closer to the surface, it provides higher cooling output than the Contec active storage system at the same system temperature. It also allows for lower system temperatures, as the temperature at the ceiling can relatively quickly increase as the humidity in the room rises. It is however not advisable to lower the surface temperature at any point in the ceiling to below 18 °C. From our experience, the supply/return temperatures should be around 15/17 °C. Dew point monitoring and regulation is a must with Contec ON. The necessary components are described in chapter "Distribution and control equipment". Please also note that not only the ceiling but also the supply and distribution components of the system must be dew point monitored. Alternatively, insulate the components in a diffusion-tight material to prevent condensation.

Heating with Contec ON

To achieve a comfortable room temperature with ceiling heating systems, the permissible radiant temperature asymmetry (ISO EN 7730) must not be exceeded. As a consequence, the ceiling temperature that is permissible from the thermo-physiological point of view for a room height of 2.5 m should not be higher than 27 to 28 °C with a full-service installation. For the Contec ON standard system, this translates into a hot water temperature of maximum 32/28 °C (FL/RL) and a heat flow density of about 40 W/m².

Near windows or outside walls, it is possible to increase the ceiling temperature and output rates somewhat, as the cold window surfaces are close to the heated area around the edge of the ceiling, having a positive effect on the radiation temperature. Furthermore, the workplace guidelines stipulate that workplaces should not be positioned directly at windows but at a distance of approx. 1 m away from them. Normally, Contec ON high-performance modules are the preferred option for installation near the outside walls of the building. At supply temperature of 34 to 36 °C, it is thus possible to achieve heat flow densities of between 60 and 70 W/m² without any problems.

Performance diagram

The performance diagram below shows the cooling or hot water temperatures required for the actual cooling or heating load. The performance data applies to concrete ceilings without plaster. For plastered ceilings, the output is reduced by 15 to 30 %, depending on the plaster type and composition. Please note that acoustic plaster products can reduce the performance by more than 50 %, depending on the thickness of the layer.

The calculated performance figures refer to Contec ON embedded in concrete with a coefficient of thermal conductivity of $\lambda = 2.1 \text{ W/mK}$

![Performance diagram](image-url)
**Field sizes and pressure loss**

The calculated performance figures are valid for the following boundary conditions (according to DIN 2078):

- **Room temperature**
  - Room temperature in summer / cooling operation \( t_i = 26 \, ^\circ\text{C} \)
  - Room temperature in winter / heating operation \( t_i = 20 \, ^\circ\text{C} \)

**Ceiling and floor construction**

- Nominal thickness of concrete \( s_B = 20 \, \text{cm} \), coefficient of thermal conductivity \( \lambda = 2.1 \, \text{W/mK} \)
- Nominal thickness of PS thermal insulation \( s_WD = 30 \, \text{mm} \), coefficient of thermal conductivity \( \lambda = 0.026 \, \text{W/mK} \)
- Nominal screed thickness \( s_E = 45 \, \text{mm} \), coefficient of thermal conductivity \( \lambda = 1.6 \, \text{W/mK} \)

When designing a system, always assess both the cooling and the heating performance. The smaller area value must then be taken into account for the largest possible circuit.

<table>
<thead>
<tr>
<th>System temperatures supply / return (^\circ\text{C})</th>
<th>Contec ON standard Max. area ([\text{m}^2])</th>
<th>Pressure drop ([\text{mbar})]</th>
<th>Contec ON high-performance Max. area ([\text{m}^2])</th>
<th>Pressure drop ([\text{mbar})]</th>
</tr>
</thead>
<tbody>
<tr>
<td>16/20</td>
<td>49</td>
<td>13</td>
<td>320</td>
<td>63</td>
</tr>
<tr>
<td>16/19</td>
<td>52</td>
<td>10</td>
<td>300</td>
<td>67</td>
</tr>
<tr>
<td>16/18</td>
<td>55</td>
<td>8</td>
<td>345</td>
<td>71</td>
</tr>
<tr>
<td>15/17</td>
<td>61</td>
<td>7</td>
<td>273</td>
<td>79</td>
</tr>
<tr>
<td>28/24</td>
<td>25</td>
<td>20</td>
<td>328</td>
<td>30</td>
</tr>
<tr>
<td>30/26</td>
<td>33</td>
<td>17</td>
<td>338</td>
<td>39</td>
</tr>
<tr>
<td>32/28</td>
<td>41</td>
<td>15</td>
<td>342</td>
<td>49</td>
</tr>
<tr>
<td>34/30</td>
<td>49</td>
<td>13</td>
<td>312</td>
<td>59</td>
</tr>
<tr>
<td>36/32</td>
<td>58</td>
<td>12</td>
<td>345</td>
<td>69</td>
</tr>
</tbody>
</table>
Installation instructions

Contec ON – installation on construction site

The prefabricated pipe fixing panels are laid directly onto the ceiling formwork. Contec ON thus provides a support frame for the lower reinforcement layer, which can be simply placed on the panels. The modules can then be connected to the distribution/collection lines. For installation in fair-faced concrete ceilings, Contec ON is available with fibre cement feet. The modules can be complemented with thermal sockets (Uponor Contec TS) embedded in the concrete for the connection of radiant ceiling cooling panels. After the Uponor Contec components have been put in place, a second reinforcement layer is installed, if required, and the floor is cast in in-situ concrete. During this process, the Contec ON pipes must remain pressurised so that any damage can be quickly detected.

Contec ON in semi-finished concrete element constructions

Semi-finished concrete elements for use in filigree floors and walls can be factory-fitted with Uponor Contec ON modules. This approach allows for extremely fast and easy installation within a fraction of the time required for conventional on-site connection and concrete casting.

Prefabrication at the concrete plant

At the concrete casting plant, the individual modules are placed on the lower component formwork, with the connecting lines for the heating circuits protruding upwards from the mould. In addition to the modules, it is possible to pre-install and embed thermal sockets (Uponor Contec TS) for the connection of radiant ceiling cooling panels. After the Uponor Contec components have been put in place, a second reinforcement layer is installed, if required, and the element is cast in precasting concrete. During this process, the Contec ON pipes must remain pressurised so that any damage can be quickly detected.

On-site assembly

The modules are positioned according to the plans and connected by means of Uponor press fittings to form cooling/heating circuits. The groups of connected modules are then linked above or below the ceiling to the cooling/heating network. The supply lines of the modules and the thermal sockets including all adapters and fittings are embedded in in-situ concrete. Before the concrete can be cast, the Contec ON system must be pressure-tested and kept pressurised while the concreting work is carried out.