



THERMALLY ACTIVATED BUILDING STRUCTURES

Technical manual



This technical information Area Heating/Cooling System
Concrete Core Tempering is valid from January 2013.



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1 INFORMATION AND SAFETY INSTRUCTIONS

Notes on this Technical Information

Applicability

This technical information applies to [COUNTRY](#).

Other Applicable Technical Information

- Underfloor heating/cooling
- System principles, pipe and joints

Navigation

At the start of this Technical Information you will find a detailed table of contents with the hierarchical headings and the corresponding page numbers.

Pictograms and Logos



Safety instructions



Legal information



Important information which must be noted



Information on the internet



The advantages to you



Currentness of the Technical Information

For your own safety and for the correct application of our products please check at regular intervals whether a newer version of your technical information is available.

The issue date of your technical information is always printed on the bottom left-hand side of the cover page.

You can obtain the current technical information from your REHAU sales office, specialist wholesaler or you can download it from the internet at: www.rehau.com or www.rehau.com/downloads

Safety instructions and operating instructions

- For your own safety and the safety of other people, please read through all safety instructions and operating instructions carefully and completely prior to commencing assembly.
- Keep the operating instructions safe and have them available.
- If you have not understood the safety instructions or the individual assembly guidelines or find them unclear, please contact your REHAU sales office.
- **Non-compliance with the safety instructions may lead to damage to property and personal injury**

Use in line with the specification

The REHAU systems may only be designed, installed and operated as described in this technical information. Any other use is not in accordance with the specification and is therefore not permitted.



Observe all applicable national and international regulations relating to laying, installation, safety and the prevention of accidents when installing pipe systems as well as the instructions in this technical information. Areas of application that are not included in this technical information (special applications) require consultation with our technical applications department. Contact your REHAU sales office.



Personnel requirements

- Our systems must only be assembled by authorised and trained persons
- Work on electrical installations or pipework components should only be carried out by trained and authorised persons.

General precautions

- Keep your workplace tidy and free of obstructions.
- Make sure there is sufficient light in your workplace.
- Keep children, pets and unauthorised persons away from tools and the assembly areas. This applies particularly in the case of renovation work in an occupied area.
- Only use the components intended for the particular REHAU pipe system. The use of components from other systems or the use of tools that are not from the relevant REHAU installation system can result in accidents or other risks.
- Avoid handling open fires in your working environment.

Working clothing

- Wear protective goggles, suitable working clothing, safety shoes, a hard hat and a hairnet if you have long hair.
- Do not wear loosely fitting clothes or jewellery; they may get caught in moving parts
- Wear a hard hat when carrying out assembly work at head height or above your head.

During assembly

- Always read and follow the operating instructions for the REHAU assembly tool used.
- The REHAU pipe shears have sharp blades. Store and handle them in such a way that there is no risk of injury from the pipe shears.
- When cutting the pipes to length, keep a safe distance between the hand holding the pipe and the cutting tool.
- Never put your hand in the tool's cutting zone or on moving parts during the cutting process.
- Following the expansion process, the expanded pipe shrinks back to its original shape (memory effect). Do not insert any foreign objects into the expanded pipe end during this stage.
- Never put your hand in the tool's compression zone or on moving parts during the compression process.
- Until the connection is established following the compression process, the fitting can fall out of the pipe. Risk of injury!
- During maintenance or retooling work and when changing the assembly area, always unplug the tool and prevent it from being switched on accidentally.

2 REHAU CONCRETE CORE TEMPERING

2.1 Introduction



2.1.1 General Information

Great demands are placed on modern buildings in terms of thermal comfort for the user, energy-saving and environmentally friendly operation as well as low investment and operating costs for the building manager. Concrete core tempering (CCT) can help meet these requirements to a large extent.

Concrete core tempering applies the principle of using the thermal storage mass of building components for constant heating/cooling. The thermal energy absorbed by the building component in the case of cooling is dissipated via integrated pipes. In the case of heating, the pipes heat up the building component, which can release the heat to the room again via the surface. Thanks to the high insulating standard of the building shell and the large-area energy exchange in CCT primarily due to radiation, only slightly higher or lower surface temperatures are required compared to the room temperature. At the same time, the ventilation technology can be reduced to peak loads and hygienic change of air. The lower air speeds as a result of this and tempering through thermal radiation result in a room air conditions, which are healthy and comfortable for the human body.

The use of CCT systems guarantees efficient heating and cooling. The low temperature level close to room temperature and the low fluctuations of the flow temperatures contribute to the economic operation and to saving CO₂. The use of CCT systems ensures potential savings by means of covering the base load via the even temperature level in the flow, the smaller dimensions of the ventilation equipment, the fast assembly already into the shell and the use of renewable energy sources.



- Low operating costs
- Low investment costs
- Use of renewable energies possible
- Suitable for the Green Building Standards e.g LEED
- Low temperature level in terms of energy
- Low surface temperatures
- Very comfortable room air conditions
- No signs of draught
- No sick building syndrome

The thermal activation of solid building components is similar to the thermal storage capacity of walls in historical buildings such as churches and castles. Arranging the pipe layers in the centre, in the neutral fibre of the ceiling, creates a large levelling compound around the base load to cover heating and cooling and to minimise severe temperature fluctuations.

The development of CCT to the fast response CCT (sCCT) near the surface enables a higher and faster adjustment of the performance. Flexible office concepts are possible by taking into consideration the mounting strips for dry-lined walls.

2.1.2 Fire Resistance – REI 90 in accordance with DIN EN 13501

In the event of a fire, the passive fire protection has to ensure that persons and objects are protected. Load-bearing building components such as ceilings must remain load-bearing for a certain period to allow rescue services to rescue people and carry out fire-fighting work safely.

The applicable fire protection requirements of buildings are governed in the relevant Regional Building Codes. The requirement on load-bearing and reinforcing building components for buildings, whose FF of the last storey is ≤ 60 m with REI 90 is generally stipulated in accordance with DIN EN 13501 in the Model Building Code.

2.1.3 Fire Resistance – REI 120 in accordance with DIN EN 13501

The requirement on the fire resistance duration of load-bearing and reinforcing building components changes from the FF of the last storey above 60 m.

A fire resistance duration of REI 120 in accordance with DIN EN 13501 can be requested for the fire protection concept raised for the relevant building proposal regardless of the height of the building.

2.1.4 Special Buildings: High-rise Buildings, Office Buildings, Administration Buildings, Airports

“Building structures and rooms of a special type and use” are defined as special buildings in the Model Building Code (MBO), which include, amongst others, high-rise buildings, office and administration buildings and airports. In addition to the regulations in the MBO and the Regional Building Code (LBO), individual fire protection concepts can be raised for special buildings, in which the requirements are expanded and, amongst other things, the building fire protection is regulated in more detail.

2.1.5 Exposed Concrete

The design of office rooms and workplaces also includes the room planning carried out by architects and interior designers in addition to ergonomics. In order to design concrete surfaces and to fully utilise the thermal capacity, concrete surfaces can be designed as exposed building components or be painted.

In CCT, the surface quality of the ceilings depends on the spacers for the bottom reinforcement and the quality of the shuttering. If sCCT modules are used, surfaces in exposed concrete quality can be achieved using the integrated spacers with poured concrete feet.

2.2 System Variants

2.2.1 REHAU sCCT – Concrete Core Tempering near the Surface



Fig. 2-1 REHAU sCCT



The use of REHAU sCCT in line with specifications is the assembly of pre-fabricated modules underneath the lower reinforcement layer within solid reinforced concrete ceilings at least 200 mm height.

System Properties

- Pre-fabricated sCCT modules
- Double meander
- Installation distance VA 7.5 or VA 15
- Integrated spacers for installation underneath the lower reinforcement layer
- Integrated spacers for the lower reinforcement layer
- Fire resistance class REI 120 in accordance with DIN EN 13501
- Fire resistance class F 120 in accordance with DIN 4102-2
- Spacers made of poured concrete or alternatively from polymer



- F 120 certified by a general Building Inspectorate inspection certificate
- Exposed concrete quality with spacers made of poured concrete
- Module with integrated spacers for the lower reinforcement
- Spacers with a low overall height
- Variable, project-related module
- Fast response CCT system
- Double meander for an even surface temperature
- Fast assembly
- High cooling capacity up to 90 W/m² is possible

System Components

- sCCT module
- RAUTHERM S pipe
- Compression sleeve
- Coupler
- Compressed air coupler
- Dummy plug
- CCT connection box
- Protective sleeve
- Protective tape
- CCT connecting box

Pipe Dimension

- RAUTHERM S 14 x 1.5 mm

2.2.2 CCT Module

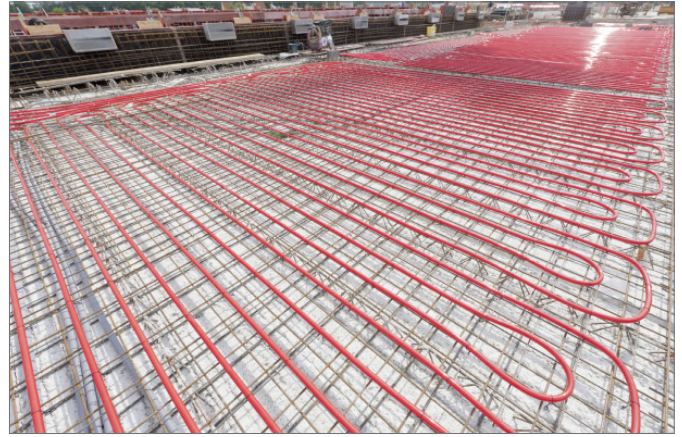


Fig. 2-2 REHAU CCT module



The use of REHAU CCT modules in line with specifications is the assembly of pre-fabricated modules between the lower and upper reinforcement layer of solid reinforced concrete ceilings.

System Properties

- Pre-fabricated modules
- Double meander / single meander .
- Installation distance VA 15



- Fast assembly
- Variable, project-related module
- Double meander for an even surface temperature
- High cooling capacity up to 70 W/m² is possible

System Components

- CCT module
- RAUTHERM S pipe
- Compression sleeve
- Coupler
- Compressed air coupler
- Dummy plug
- CCT connection box
- Protective sleeve
- Protective tape
- CCT connecting box

Pipe Dimension

- RAUTHERM S 17 x 2.0 mm
- RAUTHERM S 20 x 2.0 mm

2.2.3 CCT on Site



Fig. 2-3 REHAU CCT installed on site



The use of the CCT on site in line with specifications is the assembly of RAUTHERM S pipes on construction site pipe grids between the lower and upper reinforcement layer of solid reinforced concrete ceilings.

System Properties

- RAUTHERM S pipe
- Single meander / double meander
- Installation distance VA 15



- Flexible adaptation to the building shape
- Variable CCT circuit lengths
- Double meander for an even surface temperature
- High cooling capacity up to 70 W/m² is possible

System Components

- RAUTHERM S pipe
- CCT grid ties/cable ties
- Compression sleeve
- Coupler
- Compressed air coupler
- Dummy plug
- CCT connection box
- Protective sleeve
- Protective tape
- CCT connecting box

Pipe Dimension

- RAUTHERM S 17 x 2.0 mm
- RAUTHERM S 20 x 2.0 mm

2.2.4 CCT and sCCT in Finished and Semi-finished Goods



Fig. 2-4 REHAU CCT in semi-precast part



The use of the CCT and sCCT in line with specifications in pre-fabricated and semi-precast parts is the integration of pre-fabricated modules in the plant for solid reinforced concrete ceilings.

System Properties

- CCT modules and sCCT modules integrated in the concrete pre-fabricated/ semi-precast part
- Single meander / double meander
- Installation distance VA 15 or VA 7.5 for sCCT



- Fast assembly thanks to pre-fabrication in plant
- Low expenditure for shuttering
- High surface quality of a concrete pre-fabricated part
- Variable, project-related module size
- Double meander for an even surface temperature
- High cooling capacity up to 90 W/m² is possible

System Components

- RAUTHERM S pipe
- CCT grid ties/cable ties
- Compression sleeve
- Coupler
- Compressed air coupler
- Dummy plug
- CCT connection box
- Protective sleeve
- Protective tape
- CCT connecting box

Pipe Dimensions

- RAUTHERM S 14 x 1.5 mm
- RAUTHERM S 17 x 2.0 mm
- RAUTHERM S 20 x 2.0 mm

2.3.1 Planning Principles

Building taboo zones, which must not be activated, are to be taken into account generally for the thermal activation of concrete components during the planning stage. Taboo zones for the installation of CCT and sCCT are for example specified by the structural engineer based on the reinforcement density in the support area.

For CCT near the surface, mounting strips are to be allowed for when assembling dry-lined walls.

If the requirements of the CCT change when they are used, additional components can be integrated subsequently by installing CCT connecting boxes during the construction stage. Ceiling sails can be connected to REHAU cooling ceilings for example by means of a CCT connecting box, which provides additional cooling/heating capacity.



When using concrete core tempering near the surface, assembly areas for partition walls and dry-lined walls have to be allowed for due to the installation underneath the lower reinforcement layer for flexible office concepts.



The effective use of concrete core tempering is enhanced by the following building peripheral conditions:

- Even load profile in the event of heating and cooling
- Heat transfer coefficient window U_{window} : 1.0 to 1.3 W/m²K
- Transmission factor sun protection $b_{\text{sun protection}}$: 0.15 to 0.20
- Standard heating load $\Phi_{\text{HL DIN EN 12831}}$: approx. 40 to 50 W/m²
- Cooling load $Q_{\text{K VDI 2078}}$: up to approx 60 W/m²
- No suspended, closed ceilings in activated zones
- Flexible room temperatures are possible during extremely hot days
- For equipment variants with supporting air conditioning units up to approx. +27 °C
- For equipment variants with window ventilation up to approx. +29 °C
- Homogeneous user structure / uniform usage

2.3.1.1 Constructional Requirements

A balanced and even load profile progression in the event of heating and cooling promotes the effective use of concrete core tempering. The internal loads can be considered constant during normal operation of an office building. The load fluctuations are caused by meteorological influences. These adverse effects can be reduced significantly by optimising the building shell in terms of:

- Windows
- Sun protection
- Transmission heat protection

A significant contribution towards reducing the transmission heat requirement and therefore the smoothing of the load progression is achieved by the high proportion of glazing in office buildings with heat transfer coefficients of window areas between 1.0 – 1.3 W/m²K.

The adverse effect of the sun's rays on a room in summer can be reduced by up to 85 % thanks to sun protection devices fitted to the outside with an average transmission factor b of 0.15 to 0.20. The metal blinds on the outside with an opening angle of 45° have a b -factor of 0.15. This shielding effect cannot be achieved with sun protection devices on the inside e.g. fabric blinds.

A heat requirement of office and administration buildings of approx. 40 W/m² and 50 W/m² is supposed to be achieved by improving the transmission heat protection of outside components. A profit contribution to the heat requirement of up to 75 % can be achieved depending on the ceiling design and use of CCT or sCCT.

Conventionally used office buildings have cooling loads of approx. 60 W/m². Up to 80 % of the cooling loads can be covered depending on the ceiling design by using CCT. Cooling loads exceeding 60 W/m² can be covered by using sCCT and peak loads can be compensated.

Concrete core tempering achieves optimum storage effects with bare ceiling thicknesses of 25 cm to 30 cm



It is not allowed to install suspended, closed ceilings in the area of activated, bare ceilings. The installation of open, suspended louvered ceilings has to be thoroughly checked in individual cases.

Acoustic measures in open plan offices are recommended. Sound-absorbing, suspended ceilings are not permitted in activated zones. It is to be checked in particular for open plan offices and halls whether measures to optimise the room acoustics are required.

2.3.1.2 Constructional Requirements sCCT

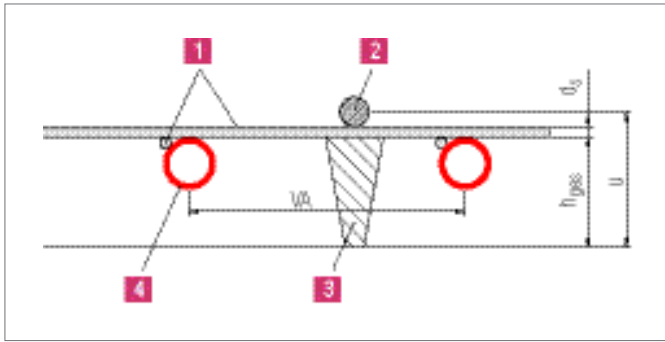


Fig. 2-5 Detail sCCT module with lower reinforcement

- 1 Pipe grid
 - 2 Lower reinforcement
 - 3 Spacers
 - 4 RAUTHERM S 14 x 1.5 mm
- d_s Diameter pipe grid
 h_{ges} Height overall
 u Distance axis reinforcement to surface ceiling
 VA Pipe spacing



Classification of fire resistance is tested with fire from the lower surface. Construction of the floor on top of the ceiling has to be done according DIN 4102-2.



Distance of axis reinforcement to surface ceiling must be $u \geq 37$ mm. In areas of the slab where no sCCT is installed there must be $u \geq 37$ mm too.



Certificate F 120 by a general Building Inspectorate inspection certificate No. P-3159/334/12-MPA BS can be downloaded at www.rehau.com

2.3.1.3 Building Technology

When using CCT, areas with uniform load progression can be consolidated into regulation zones by taking into account the system inertia. It is possible to distinguish between a Northern and Southern zone for example. The development of the CCT to sCCT also enables higher performances on the ceiling surface apart from a quicker regulation. The demands for heating and cooling on the air conditioning unit are further reduced due to this. In the event of heating, it can be prevented that the room temperature overshoots significantly by choosing suitable flow temperature levels.



The CCT systems are to be fitted with dew point monitoring systems of the relevant ambient air state in order to prevent the failure of dew water on activated building components in the event of cooling.



The CCT flow temperature has to be at least 1 K above the relevant dew point temperature of the room air condition.

2.3.1.4 Module: Active Area – Connection Line

The RAUTHERM S pipe is attached in the plant. The pipes are fabricated with REHAU CCT grid ties on concrete reinforced grids for CCT modules and for sCCT modules on pipe grids.

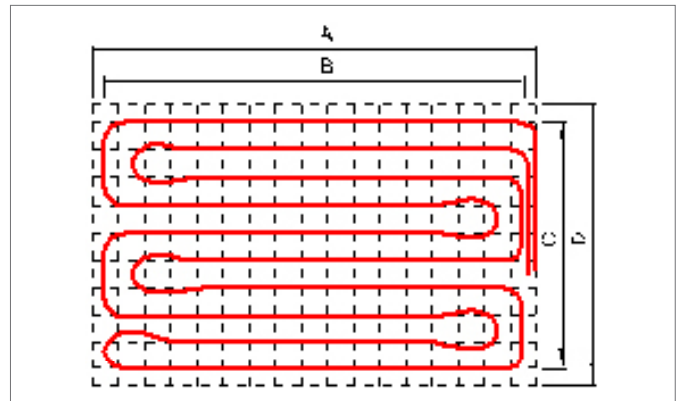


Fig. 2-6 Installation dimensions, example connection line right

- A Module length: thermally active length in m
 - B Module length fitted with pipes A-VA in m
 - C Module width fitted with pipes: D-VA in m
 - D Module width: thermally active width in m
- Thermally active module area: $A \times D$ in m^2

sCCT

Every module is supplied with two connection lines measuring 1 m in length each for flow and return.

The connection lines are fixed to the module during transit.

Installation spacing 75 mm / VA 7.5

Installation spacing 150 mm / VA 15

Spacer for the lower reinforcement layer: height 34 mm

Width D [m]	0.75	0.90	1.05	1.20	1.35	1.50
Installation spacing VA	7.5	7.5	7.5	7.5	7.5	7.5
Length A [m]	Active area [m ²]					
0.90	0.68	0.81	0.95	1.08	1.22	1.35
1.05	0.79	0.95	1.10	1.26	1.42	1.58
1.20	0.90	1.08	1.26	1.44	1.62	1.80
1.35	1.01	1.22	1.42	1.62	1.82	2.03
1.50	1.13	1.35	1.58	1.80	2.03	2.25
1.65	1.24	1.49	1.73	1.98	2.23	2.48
1.80	1.35	1.62	1.89	2.16	2.43	2.70
1.95	1.46	1.76	2.05	2.34	2.63	2.93
2.10	1.58	1.89	2.21	2.52	2.84	3.15
2.25	1.69	2.03	2.36	2.70	3.04	3.38
2.40	1.80	2.16	2.52	2.88	3.24	3.60
2.55	1.91	2.30	2.68	3.06	3.44	3.83
2.70	2.03	2.43	2.84	3.24	3.65	4.05
2.85	2.14	2.57	2.99	3.42	3.85	4.28
3.00	2.25	2.70	3.15	3.60	4.05	4.50
3.15	2.36	2.84	3.31	3.78	4.25	4.73
3.30	2.48	2.97	3.47	3.96	4.46	4.95
3.45	2.59	3.11	3.62	4.14	4.66	5.18
3.60	2.70	3.24	3.78	4.32	4.86	5.40
3.75	2.81	3.38	3.94	4.50	5.06	5.63
3.90	2.93	3.51	4.10	4.68	5.27	5.85
4.05	3.04	3.65	4.25	4.86	5.47	6.08
4.20	3.15	3.78	4.41	5.04	5.67	6.30
4.35	3.26	3.92	4.57	5.22	5.87	6.53
4.50	3.38	4.05	4.73	5.40	6.08	6.75
4.65	3.49	4.19	4.88	5.58	6.28	6.98
4.80	3.60	4.32	5.04	5.76	6.48	7.20
4.95	3.71	4.46	5.20	5.94	6.68	7.43
5.10	3.83	4.59	5.36	6.12	6.89	7.65
5.25	3.94	4.73	5.51	6.30	7.09	7.88
5.40	4.05	4.86	5.67	6.48	7.29	8.10
5.55	4.16	5.00	5.83	6.66	7.49	8.33
5.70	4.28	5.13	5.99	6.84	7.70	8.55

The dimensions refer to the thermally active area

CCT

Every module is supplied with two connection lines left measuring 2 m in length each for flow and return.

The connection lines are fixed to the module during transit.

Installation spacing 150 mm / VA 15

Width D [m]	0.90	1.2	1.50	1.80	2.10	2.40
Length A [m]	Active area [m ²]					
1.50	1.35	1.80	2.25	2.70	3.15	3.60
1.65	1.49	1.98	2.48	2.97	3.47	3.96
1.80	1.62	2.16	2.70	3.24	3.78	4.32
1.95	1.76	2.34	2.93	3.51	4.10	4.68
2.10	1.89	2.52	3.15	3.78	4.41	5.04
2.25	2.03	2.70	3.38	4.05	4.73	5.40
2.40	2.16	2.88	3.60	4.32	5.04	5.76
2.55	2.30	3.06	3.83	4.59	5.36	6.12
2.70	2.43	3.24	4.05	4.86	5.67	6.48
2.85	2.57	3.42	4.28	5.13	5.99	6.84
3.00	2.70	3.60	4.50	5.40	6.30	7.20
3.15	2.84	3.78	4.73	5.67	6.62	7.56
3.30	2.97	3.96	4.95	5.94	6.93	7.92
3.45	3.11	4.14	5.18	6.21	7.25	8.28
3.60	3.24	4.32	5.40	6.48	7.56	8.64
3.75	3.38	4.50	5.63	6.75	7.88	9.00
3.90	3.51	4.68	5.85	7.02	8.19	9.36
4.05	3.65	4.86	6.08	7.29	8.51	9.72
4.20	3.78	5.04	6.30	7.56	8.82	10.08
4.35	3.92	5.22	6.53	7.83	9.14	10.44
4.50	4.05	5.40	6.75	8.10	9.45	10.80
4.65	4.19	5.58	6.98	8.37	9.77	11.16
4.80	4.32	5.76	7.20	8.64	10.08	11.52
4.95	4.46	5.94	7.43	8.91	10.40	11.88
5.10	4.59	6.12	7.65	9.18	10.71	12.24
5.25	4.73	6.30	7.88	9.45	11.03	12.60
5.40	4.86	6.48	8.10	9.72	11.34	12.96
5.55	5.00	6.66	8.33	9.99	11.66	13.32
5.70	5.13	6.84	8.55	10.26	11.97	13.68
5.85	5.27	7.02	8.78	10.53	12.29	14.04
6.00	5.40	7.20	9.00	10.80	12.60	14.40
6.15	5.54	7.38	9.23	11.07	12.92	14.76
6.30	5.67	7.56	9.45	11.34	13.23	15.12

The dimensions refer to the thermally active area

2.3.1.5 Installation Method Double Meander / Single Meander

The pipe installation method double meander has a more even temperature profile across the entire module area compared to the single meander. In particular for large-surface modules, this leads to a more homogeneous temperature distribution in the building component and to more even temperatures on the building component surfaces.

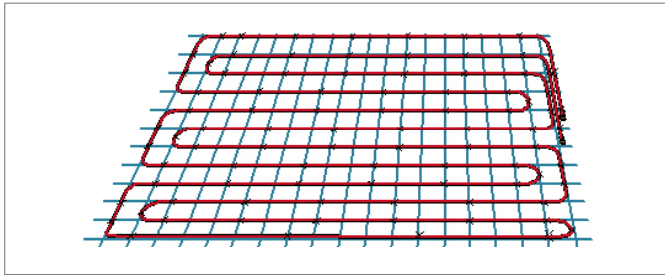


Fig. 2-7 REHAU CCT module DM

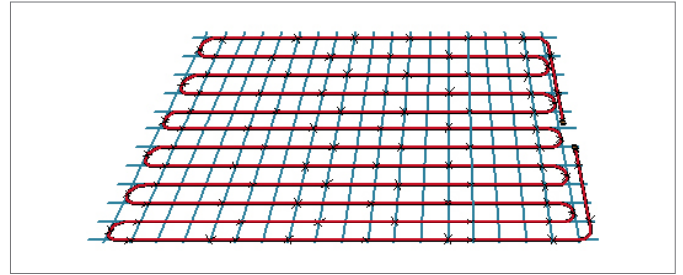


Fig. 2-8 REHAU CCT module EM

2.3.1.6 Hydraulic Connection Variants



The hydraulic balancing of CCT circuits and the entire pipe network is required for each connection variant.

Manifold Connection

The connection of the CCT circuit to the pipe network can be established using a CCT manifold in the same manner as with the REHAU underfloor heating and cooling system.

Ball valves and balancing valves are recommended for shutting off and adjusting.

The following has to be borne in mind during the design stage:

- Max. pressure loss of 300 mbar per CCT circuit
- CCT circuits of virtually the same size

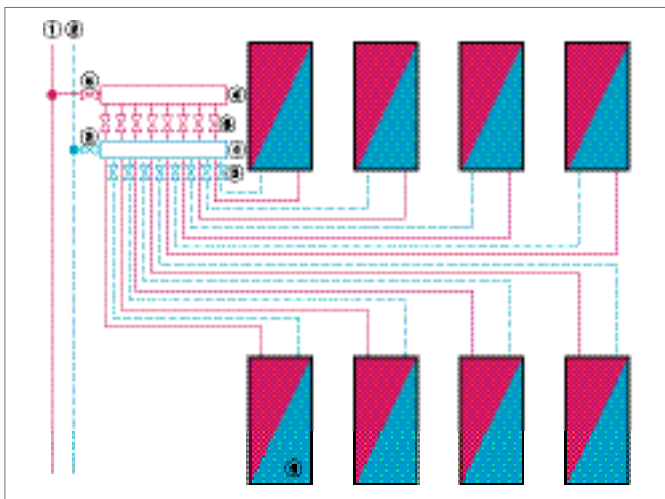


Fig. 2-9 Schematic illustration of manifold connection

- 1 Flow
- 2 Return
- 3 Balancing and shut-off valve
- 4 Compression sleeve manifold
- 5 Shut-off valve
- 6 CCT circuit

Two-line System Using the Tichelmann Principle

Each CCT circuit is connected directly to the manifold lines with a two-line system. Ball valves and balancing valves are recommended for shutting off, emptying and adjusting.

A virtually uniform pressure loss is achieved by installing the manifold lines with the Tichelmann principle.

The following has to be borne in mind during the design stage:

- Max. pressure loss of 300 mbar per CCT circuit
- CCT circuits of virtually the same size

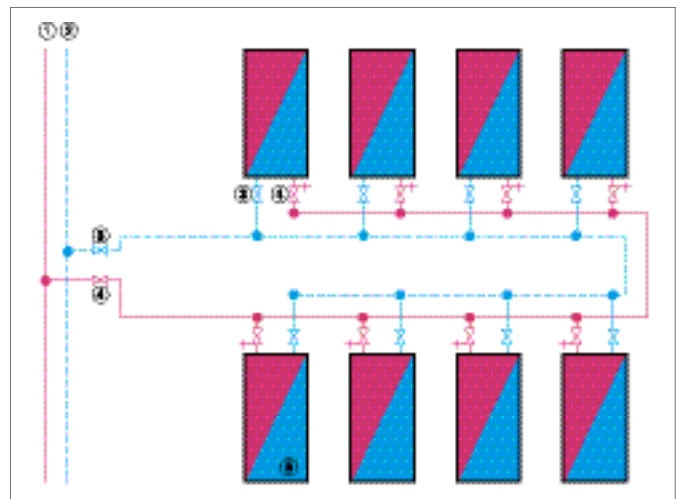
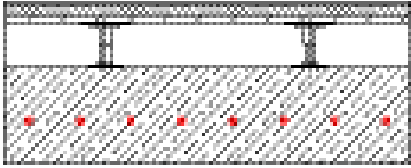
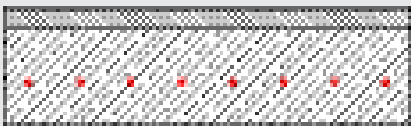
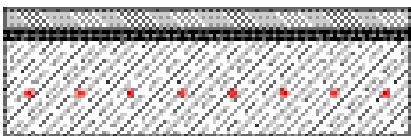
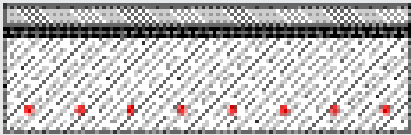
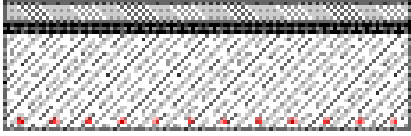









Fig. 2-10 Schematic illustration of a two-line system

- 1 Flow
- 2 Return
- 3 Balancing and shut-off valve
- 4 Shut-off valve
- 5 CCT circuit

2.3.2 Heating/Cooling Performance

Ceiling design	Design [mm]	Cooling				Heating
		Room temperature [°C]	26	26	26	20
		Flow temperature [°C]	16	16	16	15
		Return temperature [°C]	20	19	18	17
CCT with cavity floor						
RAUTHERM S 20 x 2.0 VA 15						
Pipe cover 130 mm						
	10 Carpet	Performance (active area)				
	35 Screed	Floor	[W/m²]	9	9	10
	20 Wooden board	Average T on surface	[°C]	24.8	24.7	24.6
	130 Floor cavity	Ceiling	[W/m²]	39	42	44
	280 Reinforced concrete ceiling	Average T on surface	[°C]	22.4	22.2	22.0
		Total	[W/m²]	48	51	54
CCT with composite screed						
RAUTHERM S 20 x 2.0 VA 15						
Pipe cover 130 mm						
	10 Carpet	Performance (active area)				
	60 Screed	Floor	[W/m²]	18	19	20
	280 Reinforced concrete ceiling	Average T on surface	[°C]	23.4	23.3	23.1
		Ceiling	[W/m²]	38	40	43
		Average T on surface	[°C]	22.6	22.4	22.1
		Total	[W/m²]	56	59	63
CCT with INI and screed						
RAUTHERM S 20 x 2.0 VA 15						
Pipe cover 130 mm						
	10 Carpet	Performance (active area)				
	60 Screed	Floor	[W/m²]	6	6	7
	30 Impact noise insulation	Average T on surface	[°C]	25.2	25.1	25.0
	280 Reinforced concrete ceiling	Ceiling	[W/m²]	40	42	45
		Average T on surface	[°C]	22.4	22.2	21.9
		Total	[W/m²]	46	48	52
CCT on the lower reinforcement layer with INI and screed						
RAUTHERM S 20 x 2.0 VA 15						
Pipe cover 55 mm						
	10 Carpet	Performance (active area)				
	60 Screed	Floor	[W/m²]	6	6	6
	30 Impact noise insulation	Average T on surface	[°C]	25.2	25.2	25.1
	280 Reinforced concrete ceiling	Ceiling	[W/m²]	50	53	56
		Average T on surface	[°C]	21.5	21.2	20.9
		Total	[W/m²]	56	59	62
sCCT with INI and screed						
RAUTHERM S 14 x 1.5 VA 7.5						
Pipe cover 17 mm						
	10 Carpet	Performance (active area)				
	60 Screed	Floor	[W/m²]	6	7	7
	30 Impact noise insulation	Average T on surface	[°C]	25.1	25.1	25.0
	280 Reinforced concrete ceiling	Ceiling	[W/m²]	67	71	76
		Average T on surface	[°C]	19.9	19.5	19.1
		Total	[W/m²]	73	78	83

Tab. 2-1 Average static performance in W/m² (active area)

	Carpet	$R = 0.08$
	Screed	$\lambda = 1.2 \text{ W/(mK)}$ to EN 15377
	Wooden board	$R = 0.13$
	Floor cavity	
	Impact noise insulation	$R = 0.040$
	Reinforced concrete ceiling	$\lambda = 1.9 \text{ W/(mK)}$ to EN 15377
	RAUTHERM S pipe	

- Thermal resistance of the air layer in the false floor in accordance with EN 15377
- Thermal resistance on the surface in accordance with EN 15377
- At flow temperature +16 °C:
rel. room humidity 50 %, 26 °C room temperature
- At flow temperature +15 °C:
rel. room humidity 45 %, 26 °C room temperature

2.3.3 Assembly



You can find a detailed CCT assembly instruction, which has to be complied with, as well as the pressure test reports in the internet as a download at www.rehau.com/downloads



Our systems must only be assembled by authorised and trained expert staff.

2.3.3.1 General Assembly Information for CCT and sCCT



Taboo zones must not be occupied with CCT or sCCT as per the installation plan.



- Cover the compression sleeve connections with protective tape in the concrete as per DIN 18560.
- The assembly plans refer to the reference axes/points of the building
- Installations using CCT and sCCT can be carried out at the following installation temperatures:
 - Module installation:
 - 10 °C to +45 °C
 - Establishing connections using REHAU compression sleeve jointing:
 - 10 °C to +45 °C



- Immediately prior to commencing concreting, the installed modules must be subjected to a visual inspection.
- If deformed reinforcement irons or other ceiling mounting parts press onto the lower shuttering level, this is to be rectified.
- The orientation of the spaces is to be checked when carrying out the visual inspection. Defective spacers must be replaced and twisted spacers straightened.



- Module distances for assembly areas are to be observed as per installation plan.
- The bottom reinforcement layer is to be placed onto the modules with integrated spacers in such a way that the reinforcement load is transferred via the spacers onto the lower shuttering level.
- If individual reinforcing bars are used, they have to be tied together to form a mesh so the loads can be properly distributed onto the spacers.

2.3.3.2 General Assembly Process

CCT Module and CCT in FT

Steps	CCT module	CCT in FT
1. Shuttering	Assemble mounting parts such as e.g. connection box, CCT extension box	
2. Installation	Installation of the lower reinforcement	
	Installation of the modules with spacers to assembly plan with subsequent pressure test	
	Install connection line and lead into connection box	
3. Concrete	Visual acceptance	
	Installation of the upper reinforcement	
	Monitor concreting process	
	After removal of the ceiling shuttering, carry out the second pressure test	

sCCT Module



Certificate F 120 by a general Building Inspectorate inspection certificate No. P-3159/334/12-MPA BS can be downloaded at www.rehau.com

Steps	sCCT module
1. Shuttering	Assemble mounting parts such as e.g. connection box, CCT extension box
2. Installation	Installation of the modules with spacers with subsequent pressure test, fixing the modules at the surface
	Check the position of the modules. Visual acceptance
	Installation of the lower reinforcement layer
3. Concrete	- Lead the connection lines along the lower shuttering level of the module
	- Insert the connection lines into the connection box
	Visual acceptance
	Installation of the upper reinforcement
	Monitor concreting process
	After removal of the ceiling shuttering, carry out the second pressure test



On-site assembly of the REHAU CCT is carried out in the same manner as the installation of an industrial panel heating system. See technical information "Underfloor heating/cooling".



Module modification on site are not allowed.

2.3.4 System Components

Twisting Tool



Fig. 2-11 Twisting tool

The twisting tool made from metal with a plastic coating is used for the correct and rapid twisting of the CCT grid ties. It is used during the course of the fastening work for REHAU CCT modules and during the concrete core tempering system installed on site.

Material	Steel
Length	310 mm
Twisting tool Ø	30 mm
Colour	Black

CCT Grid Ties

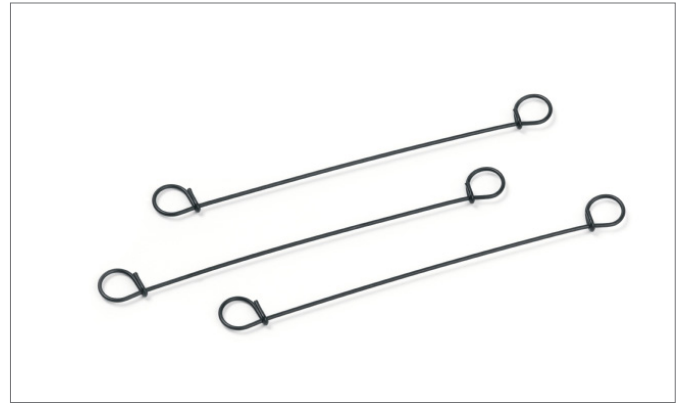


Fig. 2-13 CCT grid ties

The CCT grid tie consists of a wire coated with plastic. It is used for attaching the REHAU CCT module to the reinforcement and for fixing it to the CCT spacers.

It can also be used with the REHAU concrete core tempering system installed on site.

Material	Wire coated in plastic
Wire Ø	1.4 mm
Length	140 mm
Colour	Black

CCT Connection Box



Fig. 2-12 CCT connection box

The CCT connection box made of impact-resistant polyethylene is used to lead the connection lines of the REHAU CCT module out of the concrete ceiling. It can be used as a single connection box and also as multiple connection boxes with formed connectors.

Material	PE
Length	400 mm
Width	50 mm
Height	60 mm
Pipe Ø	17 x 2.0 / 20 x 2.0

CCT connection box open on both sides on request

CCT Extension Box

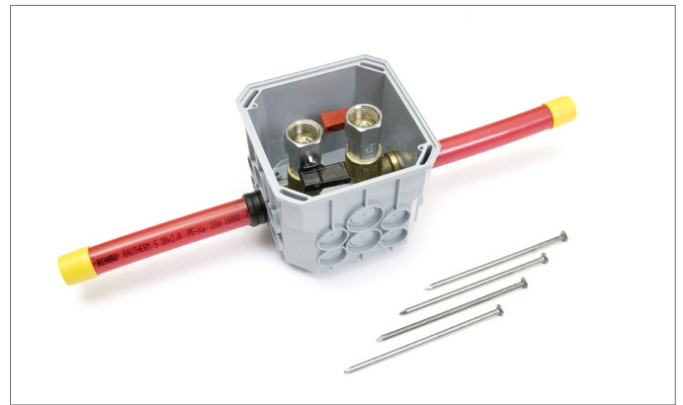


Fig. 2-14 CCT extension box

The extension box including a matching socket lid is used to subsequently connect additional cooling/heating elements freely suspended from the ceiling or circulating air cooling units to cover peak loads.

Material	Halogen-free, polymer
Length	115 mm
Width	115 mm
Height	90 mm
Colour housing	Grey
Colour socket lid	White

Cable Ties

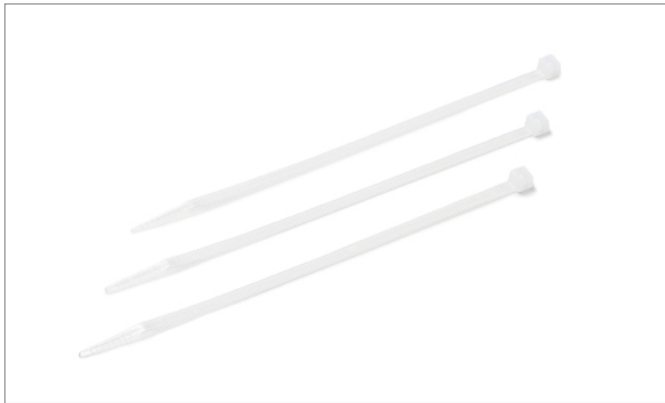


Fig. 2-15 Cable ties

The polyamide cable tie is used for attaching the REHAU CCT module to the reinforcement and for fixing it to the CCT spacers. It can also be used with the REHAU concrete core tempering system installed on site.

Material	PA
Length	178 mm
Width	4.8 mm
Colour	Natural

Protective Sleeve



Fig. 2-17 Protective sleeve

The protective sleeve made of polyethylene is used in the area of expansion joints. It can also be used for leading connection lines through the concrete ceiling on the top side of the ceiling.

Material	PE
Internal Ø	19/23/29 mm
Outer Ø	24/29/34 mm
Colour	Black

CCT Protective Tape

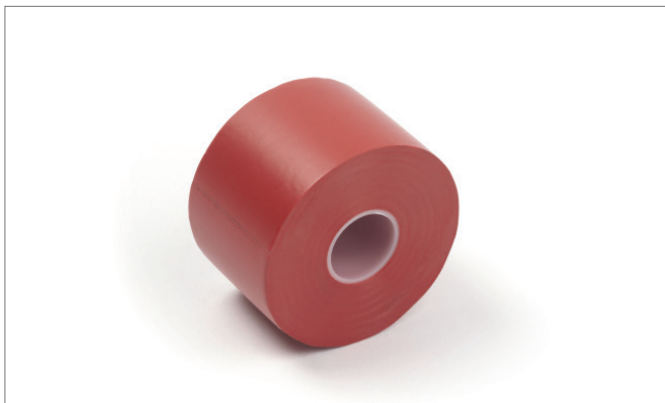


Fig. 2-16 Protective tape

The protective tape made of soft polyvinyl chloride is used to protect the REHAU compression sleeve joint from direct contact with concrete according in accordance with DIN 18560.



Each compression sleeve joint has to be coated with REHAU protective tape in the concrete as per DIN 18560.

Material	Soft PVC
Tape width	50 mm
Tape length	33 m
Colour	Red

Compression Sleeve



Fig. 2-18 Compression sleeve

The galvanized brass compression sleeve is compressed on the fitting support liner with the RAUTHERM S pipe when joining the compression sleeves. This results in a permanently leak-tight connection in accordance with DIN 18380 (VOB).

Material	Galvanized brass
Pipe Ø	14 x 1.5 / 17 x 2.0 / 20 x 2.0
Length	20 mm

Coupler



Fig. 2-19 Coupler

The coupler is used to connect pipe ends of the concrete core tempering installed on site. In conjunction with the REHAU compression sleeve, a permanently leak-tight connection in accordance with DIN 18380 (VOB) can be achieved.

Material	Galvanised brass
Pipe Ø	14 x 1.5 / 17 x 2.0 / 20 x 2.0
Length	53 mm

Dummy Plug



Fig. 2-21 Dummy plug

The dummy plug is used to seal the pipe ends and is fitted to the RAUTHERM S pipes using compression sleeve connection.

Material	Messing
Pipe Ø	14 x 1.5 / 17 x 2.0 / 20 x 2.0

Compressed Air Pipe Cap



Fig. 2-20 Compressed air pipe cap

The compressed air pipe cap is used for pressure tests at the construction site and is fitted in the plant to the RAUTHERM S pipes using a compression sleeve connection. If concrete core tempering is carried out on site, it is fitted on the construction site.

Material	Brass
Pipe Ø	14 x 1.5 / 17 x 2.0 / 20 x 2.0
Length	59/58 mm

Compressed Air Plug-in Nipple



Fig. 2-22 Compressed air plug-in nipple

The compressed air plug-in nipple is used with the manometer during the pressure test at the construction site. The pressure tests are to be performed prior to concreting and after accepting the lower shuttering level at the construction site.

Material	Brass
Length	33 mm
Connection	Rp 1/4"

Manometer



Fig. 2-23 Manometer

The manometer is used with the compressed air plug-in nipple during the pressure test at the construction site. The pressure tests are to be performed prior to concreting and after accepting the lower shuttering level at the construction site.

Material	Steel
Length	40 mm
Connection	R ¼"

REHAU Industrial Manifold

The manifold and collecting tank made of brass pipe with ventilation valve and system filling/draining cock Each heating circuit can be shut off with a ball valve on the flow pipe and a fine regulation valve (for hydraulic balancing of each heating circuit) on the return pipe. Fitted onto robust, galvanised, sound-insulated consoles. See technical information "Underfloor heating/cooling system non-residential buildings"

REHAU CCT Transport Frame

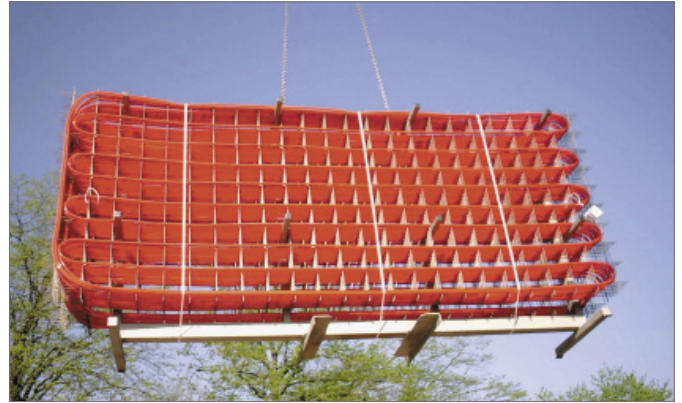


Fig. 2-24 REHAU CCT transport frame

REHAU CCT modules are transported directly to the construction site on REHAU transport frames. They are hung up and secured in multiple layers on the support arms. The transport frames are suitable to be transported on a crane on the construction site and are equipped with a forklift attachment. On completion of the unloading process, the REHAU transport frames are collected and returned together.

The REHAU transport frames meet the highest possible safety standards and comply with the EC Machine Directive 89/392/EEC, appendix II A, the EC Machine Directive 93/44/ECC taking into account DIN 15018, sections 1 and 2. In addition to this, they are subject to an annual inspection.

Technical Data

Length	4.0 m
Width	1.0 m
Height	2.2 m
Material	Painted steel
Weight	235 kg



CAUTION

REHAU CCT transport frames may only be transported with the load secured.

3 INSPECTION SHEETS

Pressure Test Principles 20

REHAU Concrete Core Tempering Pressure Test Report / 1st Pressure Test with the Test Medium Water 22

REHAU Concrete Core Tempering Pressure Test Report / 2nd Pressure Test with the Test Medium Water 23

REHAU Concrete Core Tempering Pressure Test Report / 1st Pressure Test with the Test Medium Air or Inert Gas 24

REHAU Concrete Core Tempering Pressure Test Report / 2nd Pressure Test with the Test Medium Air or Inert Gas 26

3.1 Pressure Test Principles



Successful conducting and documenting of a pressure test is the prerequisite for any claims in line with the REHAU warranty or assumption of liability agreement with the Central Plumbing, Heating and Air-Conditioning Association (ZVSHK Germany).

According to DIN 1264 and VOB DIN 18380 a pressure test must be carried out on the finished but not yet covered pipes prior to commissioning. Statements regarding the leak-tightness of the system based on the test pressure progression (constant, decreasing, increasing) can only be made conditionally.

- The leak-tightness of the system can only be checked with a visual inspection on uncovered pipes.
- Minor leaks can only be located with a visual inspection (water leak or leak detector) at high pressures.

Dividing the pipe system into smaller inspection sections increases the accuracy of the test.

3.2 Leak Tests of Underfloor Heating/Cooling Installations with Water

3.2.1 Preparing for a pressure test with water

1. The pipes must be accessible and must not be covered.
2. Remove safety and counting equipment if necessary and replace with pipe parts or pipe end stops.
3. Fill pipes from the lowest point of the system, excluding any air, with filtered drinking water to VDI 2035.
4. Rinse and deaerate the pipes until it can be determined that water emerges without air.
5. A pressure tester with an accuracy of 100 hPa (0.1 bar) is to be used for the pressure test.
6. Connect the pressure tester at the lowest point to the underfloor heating / cooling installation.
7. Carefully close all ball valves/valves.



The pressure test can be heavily influenced by temperature changes in the pipe system e.g. a temperature change of 10 K can cause a pressure change of 0.5 to 1 bar.

A pressure fluctuation can arise during the pressure test due to the pipe material properties (e.g. pipe expansion due to increasing pressurisation).

The test pressure as well as the pressure progression arising during the test do not allow for sufficient conclusions to be drawn regarding the leak-tightness of the system. Therefore, the entire underfloor heating /cooling installation has to be checked for leak-tightness by means of a visual inspection as stipulated in standards.

8. Make sure that the temperature remains as constant as possible during the pressure test.
9. Prepare pressure inspection report (see chapter 3.5, page 21) and make a note of the system data.

3.2.2 Completion of the Pressure Test with Water

After completion of the pressure test:

1. The company carrying out the test and client must confirm the pressure test in the pressure test record.
2. Remove the pressure tester.
3. Following the pressure test, rinse the underfloor heating/cooling pipes thoroughly (see chapter 3.4, page 21).
4. Re-attach the removed safety and counting equipment.

3.3 Leak Tests of Underfloor Heating/Cooling Installations with Oil-free Compressed Air/Inert Gas

Important information regarding the test with oil-free compressed air or inert gas:

- Minor leaks can only be detected with leak detectors at high test pressures (load test) and corresponding visual inspection.
- Temperature fluctuations can have an adverse effect on the test result (pressure drop or increase).
- Oil-free compressed air or inert gas are compressed gases. The pipe volume therefore has a major impact on the pressure result displayed. A large pipe volume minimises the detection of minor leaks with pressure drops.



Leak detectors

Only use leak detectors (e.g. foaming agents) with a valid DVGW certificate.

3.3.1 Preparing for a Pressure Test with Oil-free Compressed Air/Inert Gas

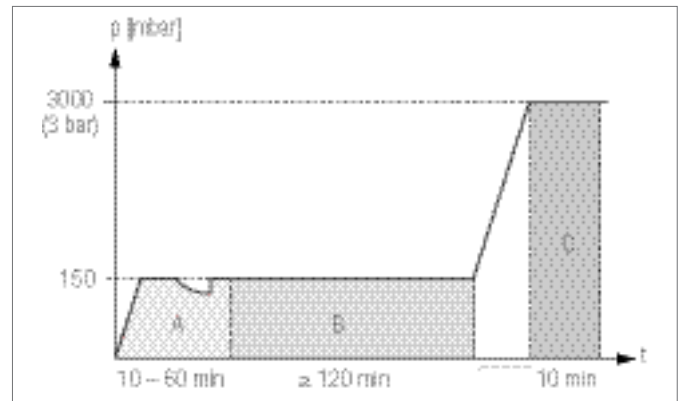


Fig. 3-1 Pressure test diagram for pressure tests with oil-free compressed air/ inert gas

A Preconditioning time, see Tab. 3-1

B Leak test

C Load test

Pipe volume	Preconditioning time ¹⁾	Test time ¹⁾
< 100 l	10 min	120 min
≥ 100 < 200 l	30 min	140 min
≥ 200 l	60 min	+ 20 min each 100 l

¹⁾ Reference values, depending on pipe volume

Tab. 3-1 Pipe volume, preconditioning time and test time

1. The pipes must be accessible and must not be covered.
2. Remove safety and counting equipment if necessary and replace with pipe parts or pipe end stops.
3. A sufficiently large number of bleeder valves to safely discharge the compressed air are to be installed at suitable locations.
4. Install a manometer with an accuracy of reading of 1 hPa (1 bar).
5. Carefully close all ball valves/valves.



The test pressure as well as the pressure progression arising during the test do not allow for sufficient conclusions to be drawn regarding the leak-tightness of the system. Therefore, the entire underfloor heating /cooling installation has to be checked for leak-tightness by means of a leak detector and visual inspection as stipulated in standards.

6. Make sure that the temperature remains as constant as possible during the pressure test.
7. Prepare the pressure test record sheet (see chapter 3.5) and make a note of the system data.

3.3.2 Leak Test

1. Select preconditioning time and test duration as per Tab. 3-1, page 20.
2. Slowly increase the pressure to 150 mbar in the underfloor heating / cooling installation.
3. If required, increase the test pressure again after the preconditioning time.
4. Start the leak test after the preconditioning time.
5. Take a reading of the test pressure and make a note if it in conjunction with the test duration in the pressure test report.
6. Make a note of the test pressure in the pressure test report after the inspection time.
7. Verify the leak-tightness of the entire underfloor heating/cooling installation, particularly the connecting points, by means of a visual inspection with a leak detector.

In the event that the test pressure has dropped:

- Carry out a thorough visual inspection of the pipes, extraction and connecting points with a leak detector again.
- Rectify the reason for the pressure drop and repeat leak test (steps 1 - 5).

8. Make a note in the pressure test report if no leaks were detected.

3.3.3 Load Test

1. Slowly increase the pressure to 3 mbar in the underfloor heating /cooling installation.
2. Restore the test pressure of 3 bar, if required, after the pressure has stabilised.
3. Take a reading of the test pressure and make a note of it in the pressure test report.
4. Take a reading of the test pressure and make a note of it after 10 minutes.
5. Verify the leak-tightness of the entire underfloor heating/cooling installation, particularly the connecting points, by means of a visual inspection with leak detectors.

In the event that a leak was discovered during the visual inspection:

- Remove leak and repeat the entire leak and load test.

6. Make a note of the visual inspection in the pressure test report if no leaks were detected.
7. Discharge the compressed air after completion of the load test without posing a risk.

3.3.4 Completion of the Pressure Test with Oil-free Compressed Air/ Inert Gas

After completion of the pressure test:

1. The company carrying out the test and client must confirm the pressure test in the pressure test record.
2. Remove the pressure tester.
3. Re-attach the removed safety and counting equipment.

3.4 Rinsing the Underfloor Heating/Cooling Installation

To remove any contamination from the storage and building phase, all pipes have to be rinsed for several minutes in a specified order and quantity as per the stipulations of the DIN EN 14336 AND VDI 2035 sheet 2 "Prevention of damage in water heating installations".

Draining the underfloor heating/cooling installation following a pressure test with water is to be avoided as per VDI 2035, sheet 2.

It is not recommended to only temporarily use water/anti-freeze agent and subsequent filling with additional water without anti-freeze agent according to the VDI 2035 sheet 2.

It is therefore mandatory to avoid a risk of freezing during and following the pressure test by means of suitable measures.

3.5 Pressure Test Report: REHAU Underfloor Heating/Cooling System



You can download a template of the pressure test report from the internet at the URL www.rehau.com

REHAU Concrete Core Tempering Pressure Test Report
1st Pressure Test with the Test Medium Water

Visual acceptance and pressure test report of the REHAU concrete core tempering for REHAU CCT modules, REHAU sCCT modules and REHAU concrete core tempering installed on site prior to concreting

Building:	Building owner:
Street/house number:	Postcode/town:
Client represented by:	Contractor represented by:
Ambient temperature:	Water temperature:
Max. operating pressure:	

1. Visual Acceptance

The check of the CCT modules/sCCT modules/CCT circuits listed in this table includes the following criteria:

- 1.) Fixing and positioning of the forms based on valid assembly plans
- 2.) Module or pipe installation based on valid assembly plans
- 3.) Fixing and installation of connection lines as well fully inserting them into the connection box
- 4.) No visible damage on the CCT modules/sCCT modules/CCT circuits
- 5.) sCCT: Aligning the spacers

2. Pressure Test

The pressure tests refers to the CCT modules/sCCT modules/CCT circuits listed in the table.

- a. Visual inspection of all connections to ascertain that they have been established correctly.
- b. Close ball valve/valve on manifold.
- b. Fill heating circuits **individually one after another** with filtered water to VDI 2035, rinse and deaerate the system completely.
- d. Apply test pressure: not less than 4 bar and not exceeding 6 bar.
- e. Re-apply pressure after 2 hours, as a pressure drop is possible due to the expansion of the pipes.
- f. Inspection time 3 hours.
- g. Pressure test has been passed, if no water leaks from any point in the pipe and the test pressure has not dropped by more than 0.1 bar per hour.

Note:

- The CCT modules/sCCT modules/CCT circuit has to be pressurised during the entire concreting process to be able to detect leaks.
- It must be possible to rule out a risk of freezing during and after the pressure test!

Module No.	Building component	Storey	Module type	Length [m]	Width [m]	Installation position CCT module/sCCT module/CCT circuit	Verified pressure [bar]	Comments

3. Confirmation

The visual acceptance and leak test has been carried out to specifications and in line with the inspection sheet.

Place:	Date:
Company carrying out CCT:	
TGA site supervision/client:	

REHAU Concrete Core Tempering Pressure Test Report
2nd Pressure Test with the Test Medium Water

Visual acceptance and pressure test report of the REHAU concrete core tempering for REHAU CCT modules, REHAU sCCT modules and REHAU concrete core tempering installed on site prior to concreting

Building:	Building owner:
Street/house number:	Postcode/town:
Client represented by:	Contractor represented by:
Ambient temperature:	Water temperature:
Max. operating pressure:	

1. Visual Acceptance

The check of the CCT modules/sCCT modules/CCT circuits listed in this table includes the following criteria:

- 1.) Condition of connection lines
- 2.) Condition of compressed air pipe caps

2. Pressure Test

The pressure tests refers to the CCT modules/sCCT modules/CCT circuits listed in the table.

- a) Checking the test pressure applied during the 1st pressure test.
- b) Leak-tightness is achieved if no test medium has emerged from any point in the pipe and the 1st pressure test has not dropped by more than 0.3 bar.
- c) If the test pressure dropped by more than 0.3 bar, the 1st pressure test is to be repeated.

Note: It must be possible to rule out a risk of freezing during and after the pressure test!

Module No.	Building component	Storey	Module type	Length [m]	Width [m]	Installation position CCT module/sCCT module/CCT circuit	Verified pressure [bar]	Comments

3. Confirmation

The visual acceptance and leak test has been carried out to specifications and in line with the inspection sheet.

Place:	Date:
Company carrying out CCT:	
TGA site supervision/client:	

Inspection Sheets

REHAU Concrete Core Tempering Pressure Test Report

1st Pressure Test with the Test Medium Air or Inert Gas, Test based on the ZVSHK Advisory Sheet

Page 1/2

Visual acceptance and pressure test report of the REHAU concrete core tempering for REHAU CCT modules, REHAU sCCT modules and REHAU concrete core tempering installed on site prior to concreting

Building:	Building owner:
Street/house number:	Postcode/town:
Client represented by:	Contractor represented by:
Ambient temperature:	Test medium temperature:
Max. operating pressure:	

1. Visual Acceptance

The check of the CCT modules/sCCT modules/CCT circuits listed in this table includes the following criteria:

- 1.) Fixing and positioning of the forms based on valid assembly plans
- 2.) Module or pipe installation based on valid assembly plans
- 3.) Fixing and installation of connection lines as well fully inserting them into the connection box
- 4.) No visible damage on the CCT modules/sCCT modules/CCT circuits
- 5.) sCCT: Aligning the spacers

2. Pressure Test

The pressure tests refers to the CCT modules/sCCT modules/CCT circuits listed in the table

- Visual inspection of all connections to ascertain that they have been established correctly, ball valve/valve closed on manifold

Test medium Oil-free compressed air Nitrogen
 Carbon dioxide _____

- 2.1 Test pressure _____ mbar (150 mbar = 150 hPa)
 2.2 Pipe volume _____ l
 2.3 Preconditioning time _____ min
 2.4 Current pressure _____ mbar (150 mbar = 150 hPa)
 2.5 Test time _____ min
 2.6 Current pressure _____ mbar (150 mbar = 150 hPa)

- The entire concrete core tempering, in particular in connecting points, have been checked for leak-tightness by means of a visual inspection with a leak detector and no leaks were discovered.

Pipe volume	Preconditioning time ¹⁾	Test time ¹⁾
< 100 l	10 min	120 min
≥ 100 < 200 l	30 min	140 min
≥ 200 l	60 min	+ 20 min each 100 l

¹⁾ Reference values, depending on pipe volume

Dim. RAUTHERM S	Content [l/m]
10.1	0.049
14	0.095
16	0.113
17	0.113
20	0.201
25	0.327
32	0.539

Determining the pipe volume

3. Main Test

- 3.1 Test pressure _____ bar (3 bar)
 3.2 Current pressure after 10 min _____ bar

- The entire concrete core tempering, in particular in connecting points, have been checked for leak-tightness by means of a visual inspection with a leak detector and no leaks were discovered

Note: The CCT modules/sCCT modules/CCT circuits have to be pressurised during the entire concreting process in order to detect leaks.

Table module numbers and confirmation see page 2 of the pressure test report

REHAU Concrete Core Tempering Pressure Test Report

1st Pressure Test with the Test Medium Air or Inert Gas, Test based on the ZVSHK Advisory Sheet

Module No.	Building component	Storey	Module type	Length [m]	Width [m]	Installation position CCT module/sCCT module/CCT circuit	Verified pressure [bar]	Comments

Inspection Sheets

4. Confirmation

The visual acceptance and leak test has been carried out to specifications and in line with the inspection sheet.

Place: _____ Date: _____

Company carrying out CCT: _____

TGA site supervision/client: _____

REHAU Concrete Core Tempering Pressure Test Report

2nd Pressure Test with the Test Medium Air or Inert Gas, Test based on the ZVSHK Advisory Sheet

Visual acceptance and pressure test report of the REHAU concrete core tempering for REHAU CCT modules, REHAU sCCT modules and REHAU concrete core tempering installed on site prior to concreting

Building:	Building owner:
Street/house number:	Postcode/town:
Client represented by:	Contractor represented by:
Ambient temperature:	Test medium temperature:
Max. operating pressure:	

1. Visual Acceptance

The check of the CCT modules/sCCT modules/CCT circuits listed in this table includes the following criteria:

- 1.) Condition of connection lines
- 2.) Condition of compressed air pipe caps

2. Pressure Test

The pressure tests refers to the CCT modules/sCCT modules/CCT circuits listed in the table

- a) Checking the test pressure applied during the 1st pressure test.
- b) If the test pressure dropped the 1st pressure test is to be repeated.

Module No.	Building component	Storey	Module type	Length [m]	Width [m]	Installation position CCT module/sCCT module/CCT circuit	Verified pressure [bar]	Comments

3. Confirmation

The visual acceptance and leak test has been carried out to specifications and in line with the inspection sheet.

Place:	Date:
Company carrying out CCT:	
TGA site supervision/client:	

4 STANDARDS, REGULATIONS AND GUIDELINES



Observe all applicable national and international regulations relating to laying, installation, safety and the prevention of accidents when installing pipe systems as well as the instructions in this technical information.

Also adhere to the applicable laws, standards, guidelines, regulations (e.g. DIN, EN, ISO, DVGW, TRGI, VDE and VDI) as well as the regulations on the protection of the environment, the regulations of the Employer's Liability Insurance Associations and regulations of the public utilities companies.

Areas of application not covered in this technical information (special applications) require consultation with our technical applications department. Please contact your REHAU sales office for more detailed advice.

The planning and assembly instructions relate directly to the corresponding REHAU product. Extracts of generally applicable standards or regulations are referred to.

Please ensure that the guidelines, standards and regulations are the valid issue in each case.

More specific standards, regulations and directives relating to the planning, installation and operation of drinking water and heating systems or systems for building services must also be observed and do not form part of this technical information.

The technical information refers to the standards, regulations and guidelines (the current status is always valid):

DIN 1045
Concrete, reinforced and prestressed concrete structures

DIN 1055
Actions on structures

DIN 15018
Cranes

DIN 16892
Cross-linked high-density polyethylene (PE-X) pipes - General quality requirements, testing

DIN 16893
Cross-linked high-density polyethylene (PE-X) pipes - Dimensions

DIN 18195
Construction sealing

DIN 18202
Tolerances in building constructions

DIN 18350
VOB construction contract procedures - Part C:
General technical specifications in construction contracts (ATV) - plastering and rendering

DIN 18380
VOB construction contract procedures - Part C:
General technical specifications in construction contracts (ATV) - Installation of central heating systems and hot water supply systems

DIN 18560
Screeds in construction.

DIN 4102
Fire behaviour of building materials and elements

DIN 4108
Thermal protection and energy economy in buildings

DIN 4109
Sound insulation in buildings

DIN 4726
Warm water surface heating systems and radiator connecting systems -
Plastics piping systems and multilayer piping systems

DIN 49019
Electrical installation pipes and accessories

DIN 50916-2
Testing of copper alloys; stress corrosion cracking test using ammonia;
testing of components

DIN 50930-6 Corrosion of metals - Corrosion of metallic materials under corrosion load by water inside of tubes, tanks and apparatus - Part 6: Influence of the composition of drinking water	DIN V 4108-6 Thermal protection and energy economy in buildings
DIN EN 10226 Pipe threads where pressure tight joints are made on the threads	DIN VDE 0100 (summary) Electrical installations of buildings Erection of high voltage installations Erection of low voltage installations
DIN EN 12502-1 Protection of metallic materials against corrosion - Guidance on the assessment of corrosion likelihood in water distribution and storage systems	DIN VDE 0100-701 Low-voltage electrical installations - Part 7-701: Requirements for special installations or locations - Locations containing a bath or shower
DIN EN 1264 Water based surface embedded heating and cooling systems	EnEV Energy Saving Ordinance
DIN EN 12828 Heating systems in buildings - Design for water-based heating systems	European directive for machines (89/392/EEC) including amendments
DIN EN 12831 Heating systems in buildings	ISO 228 Pipe threads where pressure tight joints are made on the threads
DIN EN 12831 Supplement 1 Heating systems in buildings - Method for calculation of the design heat load	ISO 7-1 Pipe threads where pressure tight joints are made on the threads
DIN EN 13163 Thermal insulation products for buildings	LBO Regional building code of the states of the Federal Republic of Germany
DIN EN 13163 to DIN EN 13171 Thermal insulation products for buildings	MBO Model building code for the states of the Federal Republic of Germany
DIN EN 13501 Fire classification of construction products and building elements	MLAR Model wiring guideline
DIN EN 14240 Ventilation for buildings - Chilled ceilings	Muster-Feu-VO Specimen firing installations order
DIN EN 14336 Heating systems in buildings	VDI 2035 Prevention of damage in water heating installations
DIN EN 15377 Heating systems in buildings	VDI 2078 Cooling load calculation of air-conditioned buildings
DIN EN 1990 Eurocode: Basis of structural design	VDI 4100 Noise control in dwellings
DIN EN 1991-1 Eurocode 1: Actions on structures	VOB Contracting rules for awarding public work
DIN EN 1992-1 Eurocode 2: Actions on structures	ZVSHK advisory sheets Central Plumbing, Heating and Air-Conditioning Association (ZVSHK / GED)
DIN EN 60529 Degrees of protection provided by enclosures	
DIN EN ISO 15875 Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X)	
DIN EN ISO 6509 Corrosion of metals and alloys - Determination of dezincification resistance of brass alloys	
DIN EN ISO 7730 Ergonomics of the thermal environment	

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Our verbal and written advice with regard to usage is based on years of experience and standardised assumptions and is provided to the best of our knowledge. The intended use of REHAU products is described comprehensively in the technical product information. The latest version can be viewed at www.rehau.com/ti. We have no control over the application, use or processing of the products. Responsibility for these activities therefore remains entirely with the respective user/processor. Where claims for liability nonetheless arise, they shall be governed exclusively according to our terms and conditions, available at www.rehau.com/conditions, insofar as nothing else has been agreed upon with REHAU in writing. This shall also apply for all warranty claims, with the warranty applying to the consistent quality of our products in accordance with our specifications. Subject to technical changes.

Your REHAU sales office is happy to assist you:

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