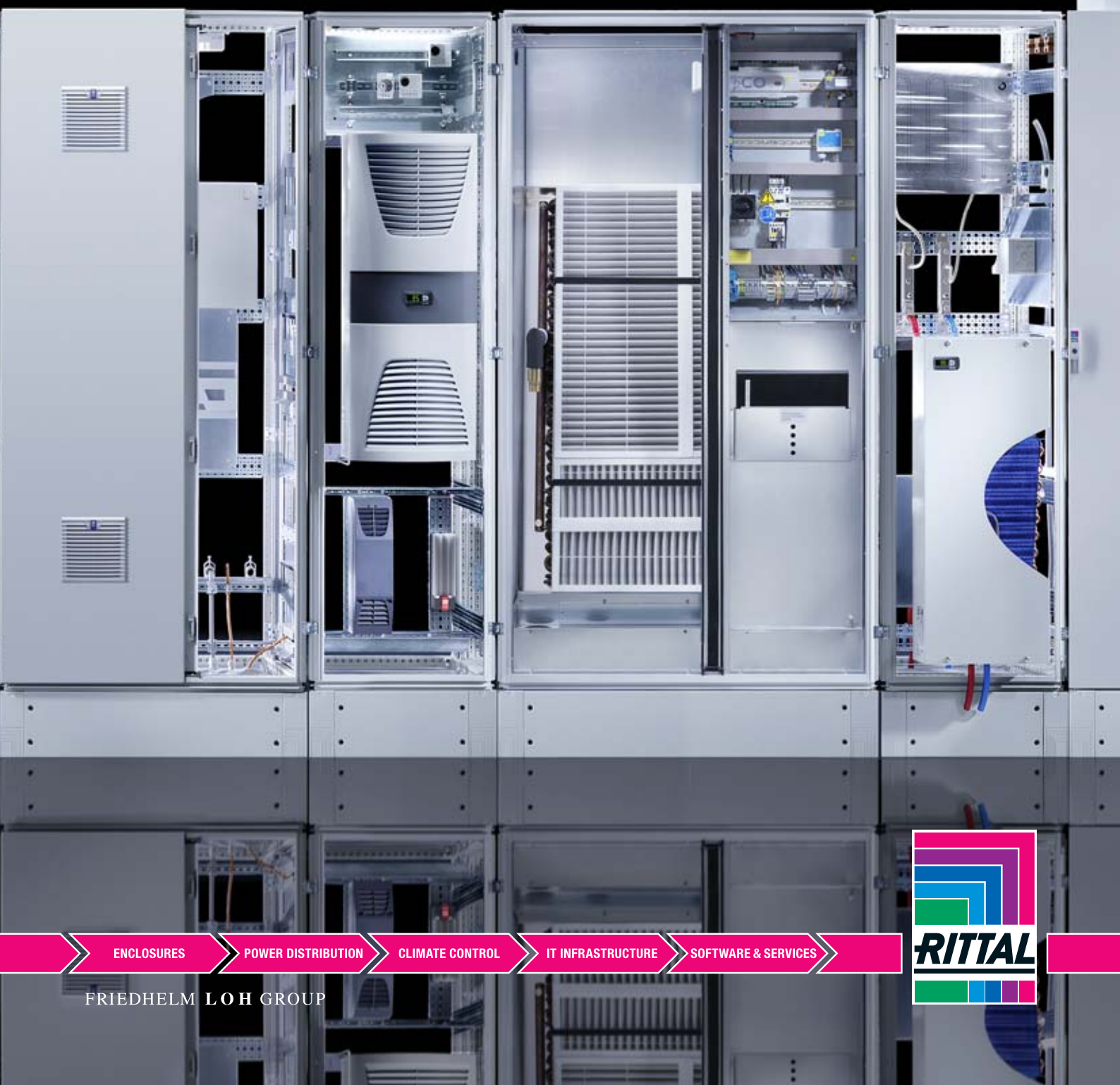


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► Technical System Catalogue Climate Control



ENCLOSURES

POWER DISTRIBUTION

CLIMATE CONTROL

IT INFRASTRUCTURE

SOFTWARE & SERVICES

FRIEDHELM LOH GROUP





Order information Catalogue 33, from page 393

Cooling with ambient air

Even in apparently non-critical ambient conditions, for example when there is an adequate supply of clean, cool air, it is still worthwhile to provide climate control. Here too, the aim is to achieve maximum reliability with exceptional efficiency.

Reliability and efficiency with fan-and-filter units: Temperature-based speed control plus temperature and air flow monitoring.

Reliability and efficiency with air/air heat exchangers: Thanks to separate air circuits (external/internal), dust and contaminants are kept outside the enclosure, while a micro-controller provides temperature-dependent control and monitoring of key parameters.

The benefit to you: Efficient reliability at all times.

Cooling with ambient air

1 TopTherm fan-and-filter units

Fan-and-filter units are ideal for dissipating heat loads cost-effectively.

The prerequisite is that the ambient air must be relatively clean with a temperature below the desired enclosure internal temperature.

EMC variants of the entire range of fan-and-filter units are also available.



2 Rack-mounted fans/tangential fans

Rack-mounted climate control components are fitted directly onto the 482.6 mm (19") mounting level. Positioning directly beneath the electronic components ensures effective cooling, and prevents the formation of hot-spots.



3 Fan systems

Ready-to-use modules, equipped with fans, for effective air throughput and minimal assembly work.



4 Air/air heat exchangers

The requirement for using air/air heat exchangers is that the ambient temperature must be below the required enclosure internal temperature.

Dust and contaminated ambient air are unable to ingress the enclosure, thanks to the two separate air circuits.



TopTherm fan-and-filter units



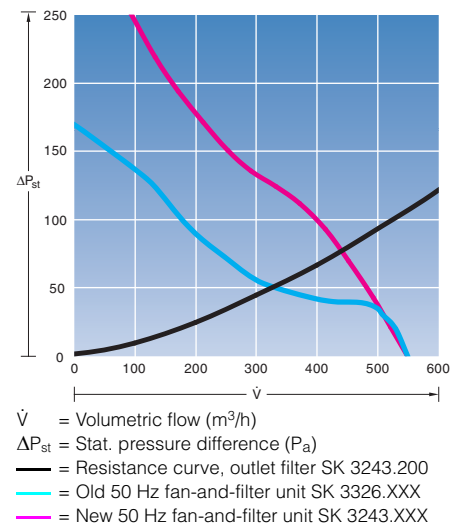
Project planning Page 6 Therm 6.1 software Page 3 Order information Catalogue 33, from page 394

Benefits at a glance:

- Innovative diagonal fan technology for higher, more constant air throughput in the installed state
- Air throughput from 20 m³/h to 900 m³/h
- Fast, toolless assembly for output categories 20 m³/h to 900 m³/h
- IP 54 as standard (up to 700 m³/h)
- Air flow direction may be reversed from supply (default setting) to exhaust
- All fans also available with EMC shielding
- Minimal installation depth

Fan-and-filter units are ideal for dissipating heat loads cost-effectively. The prerequisite is that the ambient air must be relatively clean with a temperature below the desired enclosure internal temperature. The entire range of fan-and-filter units is now also available with EMC shielding and a range of rated operating voltages.

Output comparison old/new



TopTherm fan-and-filter units

Toolless assembly

- Straightforward assembly, maintenance and replacement with no need for tools of any kind
- Simple reversal of the air flow direction by rotating the fan module
- The electrical connection is individually positionable using a screwless spring terminal; no tools required
- Latch on louvred grille for fast filter mat replacement without tools



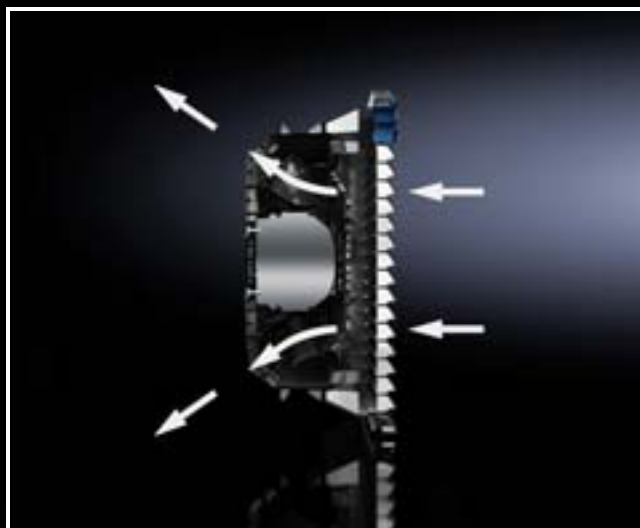
Efficient technology

- Air throughput from 20 to 900 m³/h
- New diagonal fan technology for greater pressure stability and constant air flows in its installed state, even with a contaminated filter mat
- Minimal installation depth
- Flow-optimised air routing
- Extended service life of filter mats and thus longer maintenance intervals



Air routing

- Diagonal fan technology: An intelligent symbiosis of radial and axial fan technology
- Air flow is expelled diagonally from the fan, promoting a more even air distribution in the enclosure



TopTherm fan-and-filter units

Calculation basis for enclosure climate control

In natural convection, heat loss is dissipated to the outside via the enclosure panels. The prerequisite for this is that the ambient temperature must be lower than the temperature inside the enclosure. The maximum temperature increase $(\Delta T)_{\max.}$ which may occur inside an enclosure compared with the ambient air is calculated as follows:

$$(\Delta T)_{\max.} = \frac{\dot{Q}_v}{k \cdot A}$$

Note:

If the heat loss inside the enclosure is not known, this basic formula can be used to calculate actual heat loss, by measuring the ambient temperature T_u and the enclosure internal temperature T_i :

$$\dot{Q}_s = A \cdot k \cdot \Delta T \text{ (watts)}$$

$\dot{Q}_v$ = Heat loss installed in the enclosure [W]

$\dot{Q}_s$ = Heat emitted by the enclosure surface [W]

$\dot{Q}_s > 0$: Radiation ($T_i > T_u$)

$\dot{Q}_s < 0$: Irradiation ($T_i < T_u$)

$\dot{Q}_K$ = Required cooling output of an enclosure cooling unit [W]

$\dot{Q}_H$ = Required thermal output of an enclosure heater [W]

q_w = Specific thermal output of a heat exchanger [W/K]

$\dot{V}$ = Required volumetric air flow of a fan-and-filter unit to maintain the maximum permissible temperature difference between the supply air and the exhaust air [m³/h]

$\Delta T = T_i - T_u$ = Max. permissible temperature difference [K]

A = Effective, heat loss-dissipating enclosure surface area to IEC 890 [m²]

k = Heat transfer coefficient [W/m²K]
for sheet steel $k = 5.5 \text{ W/m}^2\text{K}$

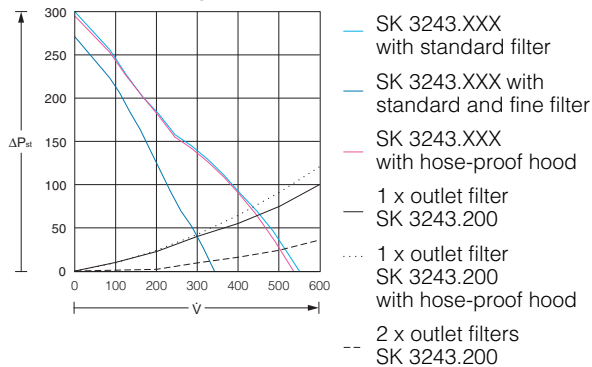
TopTherm fan-and-filter units

Project planning

The following applies when calculating the volumetric air flow:

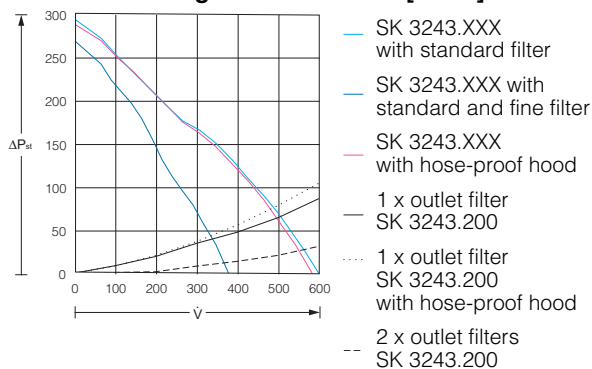
$$\dot{V} = f \cdot \frac{\dot{Q}_V}{\Delta T}$$

Performance diagram SK 3243. . . [50 Hz]



$\dot{V}$ = Volumetric flow (m³/h)
 ΔP_{st} = Stat. pressure difference (Pa)

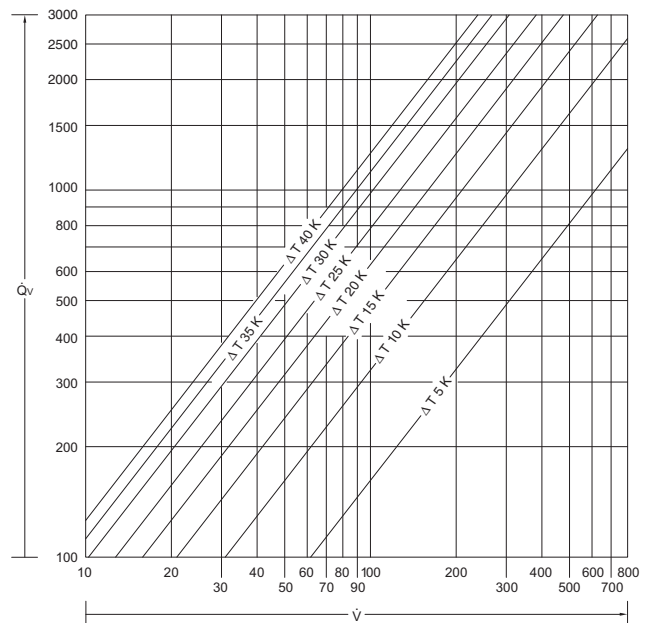
Performance diagram SK 3243. . . [60 Hz]



$\dot{V}$ = Volumetric flow (m³/h)
 ΔP_{st} = Stat. pressure difference (Pa)

Further performance curves may be found on the Internet.

Selection diagram



The styling of the vent louvres in Rittal fan-and-filter units guarantees exemplary stability of the air volumes in relation to pressure loss. The correct fan-and-filter unit has been chosen if the specified heat loss is dissipated whilst complying with the desired maximum enclosure internal temperature.

$f = 3.1 \text{ m}^3 \cdot \text{K/Wh}$ at $h = (0 \text{ to } 100)$
 $f = 3.2 \text{ m}^3 \cdot \text{K/Wh}$ at $h = (100 \text{ to } 250)$
 $f = 3.3 \text{ m}^3 \cdot \text{K/Wh}$ at $h = (250 \text{ to } 500)$
 $f = 3.4 \text{ m}^3 \cdot \text{K/Wh}$ at $h = (500 \text{ to } 750)$
 $f = 3.5 \text{ m}^3 \cdot \text{K/Wh}$ at $h = (750 \text{ to } 1000)$
 f = Compensating factor
 h = Height above sea level [m]

Rack-mounted fans/tangential fans



Therm 6.1 software Page 84 **Order information** Catalogue 33, from page 399

Benefits at a glance:

- Rapid installation on 482.6 mm (19") mounting levels.
- Direct, effective dissipation of heat loss, thanks to positioning beneath the assemblies.
- No externally mounted equipment to disrupt the aesthetic appearance of the enclosure.

All rack-mounted climate control components are fitted directly onto the 482.6 mm (19") mounting level for subracks. Positioning directly beneath the electronic components ensures effective cooling, and prevents the formation of hot-spots.

Rack-mounted fans/ tangential fans

Rack-mounted fans

- The rack-mounted fan slides into the guide frame like a drawer. Connectors on the rear ensure immediate contact.
- Installation options for the guide frame: Directly in the subrack, via two mounting brackets on the 482.6 mm (19") mounting angles.
- Ideal for avoiding hot-spots in fully populated enclosures.
- Also available with speed monitoring of the fans. A reduction in air flow or fan failure being signalled via two floating contacts.



Tangential fans

- 320 m³/h air throughput, 2 U: The high air throughput means that Rittal tangential fans are capable of dissipating large heat losses from the enclosure. The minimal noise generation of 52 dB creates a pleasant working environment.



Fan systems



Project planning Page 13 **Order information** Catalogue 33, from page 401

Benefits at a glance:

- Fast assembly
- Targeted air routing to avoid hot-spots
- Perfect system integration
- Fully wired modules, ready to install

Ready-to-use, wired modules equipped with fans for numerous Rittal enclosure system platforms offer effective air throughput and minimal assembly work.

Choose from:

- Fan roofs
- Fan cross members for server enclosures (door-mounted)
- Internal fan mounting panels, and
- Enclosure internal fans

Fan systems

Fan for integration into the door

Fan cross-member for server enclosures TS 8

Especially for installation in perforated doors. The growing packaging density in data communications and network enclosures make active, direct ventilation of the enclosure indispensable. The door-mounted fans, attached to the rear or front door, support horizontal air routing of the servers.



Fans for integration into the roof

For all enclosures: Roof-mounted fan, passive or active

May be integrated into any enclosure roof area with suitable dimensions for the mounting cut-out.

For TS 8: Fan roof, modular

In exchange for the existing roof plate.
Fan and cable entry are pre-integrated.

For the office sector:

Low noise generation and high performance for sensitive office areas. Unit consisting of TS roof plate and fan.



Air/air heat exchangers



Project planning Page 13 **Therm 6.1 software** Page 85 **Order information** Catalogue 33, from page 408

Benefits at a glance:

- Specific thermal output from 17.5 W/K to 90 W/K
- External and internal circuit may be controlled separately
- Mounting cut-outs and enclosure dimensions identical to TopTherm wall-mounted cooling units
- Suitable for external and internal mounting
- Top design identical to TopTherm wall-mounted cooling units

Important

The temperature difference between the room temperature and enclosure internal temperature will have a decisive effect on the heat loss that may be dissipated.

The requirement for using air/air heat exchangers is that the ambient temperature must be below the required enclosure internal temperature. Dust and any aggressive ambient air is unable to ingress the enclosure, thanks to the two separate air circuits.

Air/air heat exchangers

Safety

■ High protection category

Thanks to the seamlessly sealed heat exchanger module, a protection category of IP 54 to EN 60 529 is achieved.

■ High load capacity

The motors of the fans are equipped with thermal winding protection.

■ Top quality:

Guaranteed protection for your electronics.

All devices in the Rittal TopTherm series are tested in accordance with the internationally recognised approvals (GS, UL).



Intelligent control

- Specific thermal output from 17.5 to 90 W/K.
- With controller and digital temperature display.
- Floating fault signal contact in case of overtemperature.
- System analysis via display.



Platform strategy/installation

■ Identical installation cut-outs

for various output categories.

■ Easily retrofitted

Thanks to the low weight, simple cut-outs and ease of installation of the heat exchangers, they may be easily retrofitted to an existing cabinet or enclosure.

■ Simple maintenance

The heat exchanger module is very easily removed, for effortless cleaning. The cleverly thought-out structure enables fast, economical maintenance.



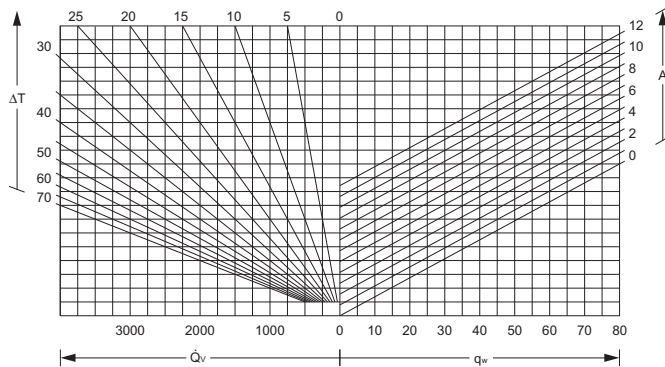
Air/air heat exchangers

Project planning

Calculate the specific thermal output of the heat exchanger:

$$q_w = \frac{\dot{Q}_v - (A \cdot \Delta T \cdot k)}{\Delta T}$$

Selection diagram



- ΔT = Temperature difference (K)
- $\dot{Q}_v$ = Heat loss (W)
- q_w = Specific thermal output (W/K)
- A = Enclosure surface area to IEC 890 (m²)
- k = Heat transfer coefficient (W/m²K)
for sheet steel $k = 5.5 \text{ W/m}^2\text{K}$



Note:

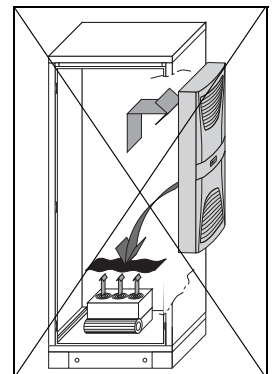
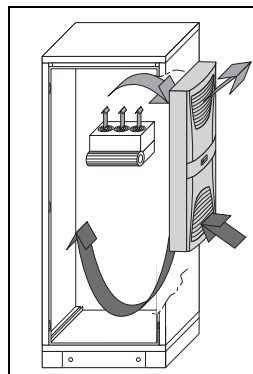
For ambient temperatures that are lower than the desired enclosure internal temperature, the use of air/air heat exchangers may be appropriate, particularly in cases where there are dust, oil and aggressive substances in the ambient air which must not be allowed to ingress the enclosure under any circumstances. A temperature difference of 10 K between the ambient temperature and the enclosure internal temperature is ideal.

Internal circuit – Wall-mounted units

Attention should be paid to installed equipment that is fitted with its own ventilation system, such as blowers and axial fans. If their air flow is directed against the chilled air flow of the heat exchanger, the air may short-circuit, bypassing the component and adequate climate control would no longer be guaranteed.

Note:

Never direct the chilled air flow at active components.



Air/air heat exchangers

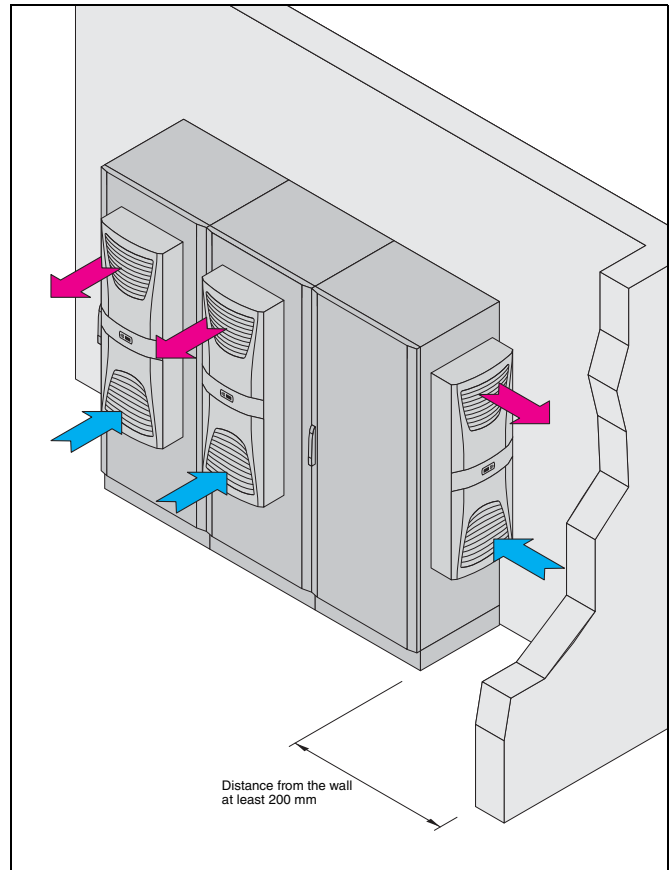
External circuit Flow and siting conditions

Air/air heat exchangers in the external circuit should have a distance of at least 200 mm from a wall and from one another (air inlet and outlet openings).

If this distance cannot be met, air baffle plates should be used.

Siting options

Wall-mounted heat exchangers may be mounted on the rear panel, side panels or door of the enclosure.



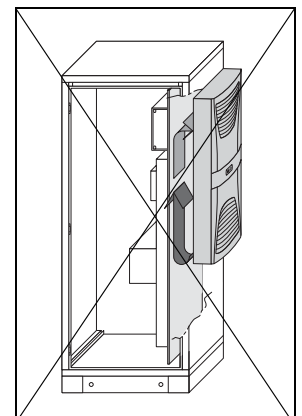
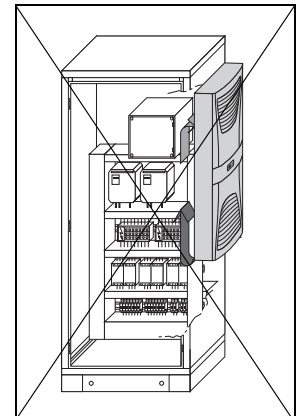
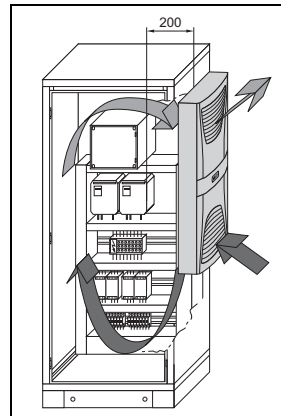
Free air circulation

It is important to ensure “even” air circulation inside the enclosure. Air inlet and outlet openings in the internal circuit must on no account be obstructed by electrical installations. This would prevent air from circulating inside the enclosure. Under such conditions, the capacity of the device would not be adequately utilised. A clearance of > 200 mm must be guaranteed.

Note:

Wall-mounted cooling units should never be fitted directly behind the mounting plate. Active power components are located on the front of the mounting plates. The heat exchanger would then operate in its own air short-circuit.

If it is impossible to install the device any other way, appropriate air baffle plates should be used, and air inlet and outlet openings should be provided in the mounting plate.





Order information Catalogue 33, from page 413

Cooling units

Cooling units keep the temperature of the air inside an enclosure at a constant level, even at below room temperature. Two separate air circuits prevent the ingress of dust or other contaminants into the enclosure.

The new “Blue e” range of energy-saving cooling units from Rittal – with outputs ranging from 500 W to 4000 W – achieve permanent energy savings of up to 45%, compared to conventional cooling units with an identical cooling output.

Generation “Blue e”



1 Thermoelectric coolers

The powerful, lightweight climate control units based on Peltier technology ensure efficient climate control of operating housings and small enclosures.



2 Wall-mounted cooling units

Standard features such as electric condensate evaporation and nano-coating of the condenser coil fins ensure a constant cooling output and easier maintenance. Depending on the space and design requirements, internal mounting, partial internal mounting and external mounting are all possible.



3 Roof-mounted cooling units

Chilled air may be routed to satisfy specific cooling requirements using ducts in conjunction with up to four supply air spigots. In the external circuit, the heated air is expelled to the rear, left and right, and optionally upwards, allowing the enclosure to be sited in a bayed suite or close to the wall.



4 Modular climate control concept

With no mounting cut-outs whatsoever, 48 different combination options with different dimensions, cooling outputs and voltages support a wide range of applications.



Cooling units

Project planning

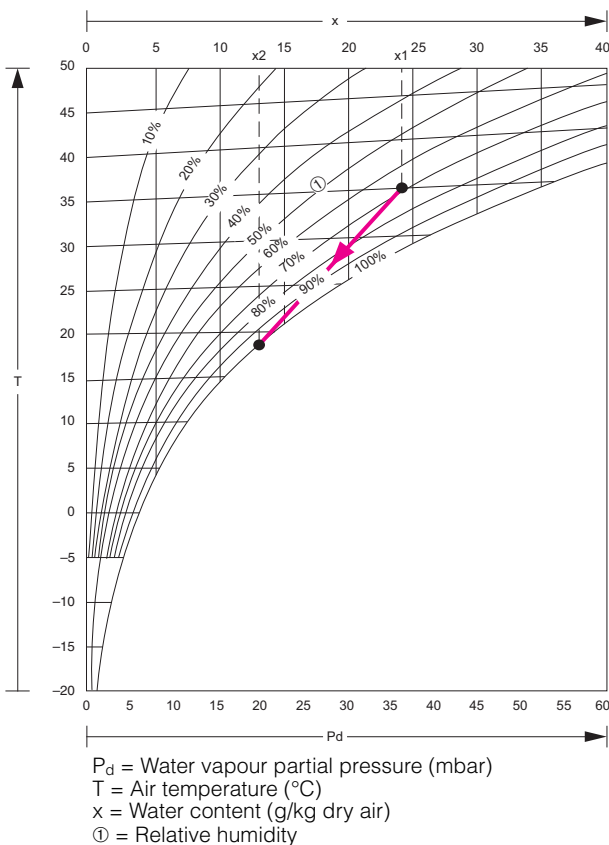
Calculate your required cooling output:

$$\dot{Q}_E = \dot{Q}_V - k \cdot A \cdot \Delta T$$

Condensation and dehumidification of enclosure air when using cooling units

One unavoidable side-effect of using cooling units is the dehumidification of the enclosure's interior air. As it cools down, part of the humidity contained in the air condenses on the evaporator coil. This condensate must be reliably discharged from the enclosure. The amount of condensate occurring depends on relative humidity, the air temperature inside the enclosure and on the evaporator coil, and the air volume present in the enclosure. The Mollier h-x diagram shows the water content of air depending on its temperature and relative air humidity.

Mollier h-x diagram
for calculating the water content of air.



Practical tips

In all situations where optimum operating temperatures are required inside an enclosure, even at high external temperatures, a Rittal enclosure cooling unit can provide the right solution. It is even possible to cool the interior temperature of the enclosure to well below the ambient temperature. The favourable aerodynamic arrangement of the air inlet and outlet openings in the internal and external circuits ensures optimum air circulation inside the enclosure. This sample calculation will show you a quick, time-saving method of selecting a cooling unit.

Example:

A cooling unit with a cooling output of 1500 watts begins operation with a temperature setting of $T_i = 35^\circ\text{C}$. The relative ambient air humidity is 70%. If air at 35°C is passed over the evaporator coil, the surface temperature of the evaporator coil (evaporation temperature of the refrigerant) is approximately 18°C . At the boundary layer adhering to the surface of the evaporator coil, water is deposited at the dew point. The difference $\Delta x = x_1 - x_2$ indicates how much condensation is produced per kg of air with complete dehumidification. The leak-tightness of the enclosure has a decisive effect on the quantity of condensation.

The quantity of condensation is calculated from the following equation:

$$W = V \cdot \rho \cdot \Delta x$$

W = Water quantity in g

V = Volume of the enclosure in m^3

ρ = Density of air kg/m^3

Δx = Difference of water content in g/kg dry air
(from the Mollier h-x diagram)

Enclosure door closed:

Only the enclosure volume is dehumidified.

$$V = W \cdot H \cdot D = 0.6 \text{ m} \cdot 2 \text{ m} \cdot 0.5 \text{ m}$$

$$V = 0.6 \text{ m}^3$$

$$W = V \cdot \rho \cdot \Delta x$$

$$= 0.6 \text{ m}^3 \cdot 1.2 \text{ kg}/\text{m}^3 \cdot 11 \text{ g}/\text{kg}$$

$$W = 7.92 \text{ g} \hat{=} 8 \text{ ml}$$

Poorly sealed cable entries, damaged door seals and the fitting of display media to enclosure surfaces lead to increased rates of leakage in the enclosure. Hence, with a leakage rate of, say, $5 \text{ m}^3/\text{h}$, a continuous condensate volume of up to $80 \text{ ml}/\text{h}$ may occur.

Summary:

Enclosure cooling units should only operate with the door closed.

- Seal the enclosure on all sides.
- Use a door limit switch.
- Use TÜV-tested equipment.
- Only set the enclosure internal temperature as low as is actually needed.

Cooling units

Selection criteria

Enclosure climate control places ever greater demands on integration and adaptation to the local conditions and the existing process control and monitoring system. Rittal offers the right solution to suit every requirement.

When selecting the appropriate cooling unit for your enclosure, please observe the following points:

- What is the installation type to IEC 890? (see page 5, calculation bases)
- What ambient conditions are anticipated (max. ambient temperature and humidity)?
- What is the required maximum internal temperature of the enclosure T_i ?
- What is the heat loss from electronic components inside the enclosure?
- Is there a requirement regarding the protection category to EN 60 529/IEC 529?
- What type of ambient pollution, such as dust, oil and chemicals, are the cooling units exposed to?
- For bayed enclosure suites, the output irradiated from neighbouring units may also need to be taken into account.
- Good ventilation should be ensured at the site of installation (for example, the heat dissipated by the cooling unit may cause a significant rise in the temperature of small rooms).
- Particularly with poor ambient conditions, such as dirt or small, unvented rooms, air/water heat exchangers should be used.

Appropriate use of enclosure cooling units

In order to ensure the proper use of enclosure cooling units, the following points should be observed:

1. The unit must only be installed and opened by authorised, expertly trained personnel.
2. Choose a location for the cooling unit which ensures excellent ventilation. The site must be free from excessive contamination and moisture. For example, the atmosphere must not contain any conductive dusts or corrosive media.
3. The mains connection data (connection voltage and frequency) specified on the rating plate must be observed. In the case of 400 V, 2~ cooling units, we recommend the use of transformer circuit-breakers, and for three-phase units, the use of motor circuit-breakers is advisable.
4. The prescribed electrical protection devices must be connected upstream of the unit. No additional temperature control may be connected upstream of the unit at the supply end. The pre-fuse specified on the rating plate should be provided as line protection. Observe the locally valid regulations when installing.
5. Where a door contact switch is used, a shielded cable should be used in environments with increased levels of electromagnetic interference.
6. The temperature range specified on the rating plate must be observed when operating the cooling unit, both indoors and outdoors.
7. The enclosure must be sealed on all sides (IP 54).
8. The air inlet and outlet openings in the internal circuit of the cooling unit must not be obstructed.
9. The cold air flow should not be pointed directly at electronic components, to prevent the formation of condensation.
10. The unit must only be installed horizontally, in accordance with the prescribed installation position. The maximum permissible deviation from the horizontal is 2°.
11. After disconnecting from the supply voltage, the cooling circuit of the cooling unit must not be switched back on for at least 5 minutes.
12. The customer must not make any modifications to the cooling unit.
13. The heat loss of the components installed in the enclosure must not exceed the specific useful cooling output of the cooling unit.
14. The installation instructions contained in the cooling unit manual must be observed in full.

Cooling units



Application ranges of enclosure cooling units

	Heat loss to be dissipated in kW $\Delta T = 10\text{ K}$		Ambient temperature in °C			Air quality			
	< 1.5	> 1.5	20 – 55	20 – 70	> 70	Dust-free	Dust-laden	Oily	Aggressive

Fan-and-filter units

With filter mat (chopped fibre mat)	■	■	■				■		
--	---	---	---	--	--	--	---	--	--

Air/air heat exchangers

Standard	■		■			■	■		
----------	---	--	---	--	--	---	---	--	--

Cooling unit

Standard version (without filter)	■	■	■			■			
Chemical version	■	■	■						■
With filter mat (Open-celled PU foamed plastic)	■	■	■				■		
With metal filter	■	■	■				■	■	■
With nano-coating of condenser membranes	■	■	■				■	■	■

Air/water heat exchanger

Standard	■	■	■	■	■	■	■	■	■
Stainless steel version	■	■	■	■	■	■	■	■	■

Cooling units

Cool Efficiency “Blue e”

Super-efficient, eco-friendly, cost-cutting – that’s energy efficiency from Rittal. The efficient use of available resources is one of the main aims when developing new cooling systems, particularly in view of the escalating global climate and environmental problems, coupled with ever-rising energy prices. Saving energy, cutting climate control costs, cooling energy-efficiently and protecting the environment – “Blue e”, the energy-saving generation of cooling units from Rittal, already boasts all these achievements. With “Blue e” cooling units, you can make savings of up to 45% – or up to 70% in ideal conditions, as proven by a field test in the automotive industry (see page 27).

Parameters for the sample calculation:

Operation under full load/production phase	70%
Operation under partial load/production	30%
Eco-mode control in idle phase	100%
Production phase per day	8 hours
Idle phase per day	16 hours
Production days per annum	254 days
Idle days per annum	111 days
Electricity price per kWh	0.12 €
Number of units	1

Sample saving calculation

Cooling unit			Energy consumption Production phase	Energy consumption Idle phase	Energy consumption/costs total/p. a.	
Model No. SK	W	Variant	kWh	kWh	kWh	€
3304.500	1000	“Blue e”	878.64	221.35	1099.99	132.00
3304.100	1000	Standard	1240.54	740.08	1980.62	237.67
Saving with “Blue e”			361.90	518.73	880.63	105.68
			29.17%	70.09%	44.46%	

The sample calculation shows the savings achievable per annum with a “Blue e” cooling unit compared with its basic equivalent for single-shift operation over a 5-day week.

Work out for yourself how much energy and money you could save with your choice of “Blue e” cooling unit: The energy savings calculator for “Blue e” cooling units can be found on www.rittal.com under “Climate control”.

Energy savings calculator



Cooling units

External circuit – Flow and siting conditions

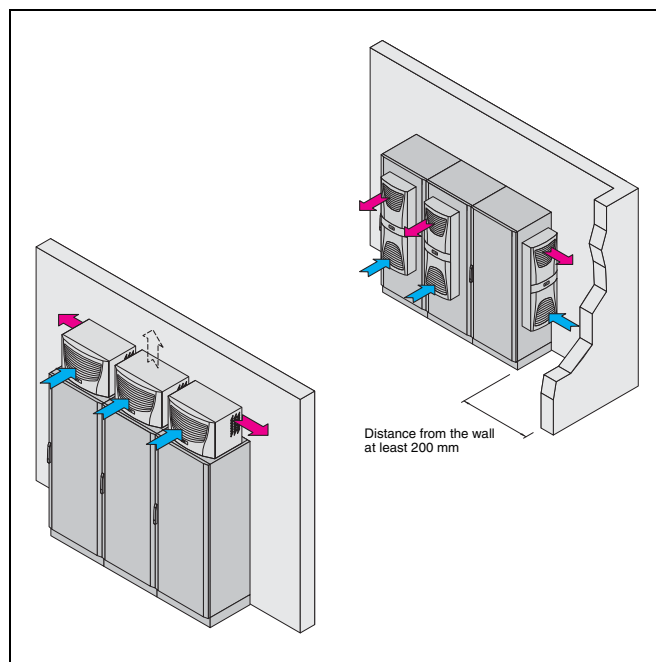
In the outer circuit, enclosure cooling units should be spaced > 200 mm from the wall and/or from each other (air inlet and outlet openings). In order to ensure adequate air circulation, at least one air outlet opening must be kept free. If this clearance cannot be maintained, air baffle plates will need to be used.

Roof-mounted cooling units

A range of installation positions may be considered for roof-mounted cooling units, due, in part, to the routing in the external air circuit. Thanks to this, together with their compact dimensions, roof-mounted cooling units may even be installed in low-height rooms and with bayed enclosure suites. As supplied, the units draw air in at the front and exhaust it via the rear and sides. Exhaust via the top is also available as an option, however, regardless of the type of installation, the units must be free to exhaust air via at least one of these routes.

Wall-mounted cooling units

There are no restrictions to the installation position of wall-mounted cooling units provided that the air intake and exhaust areas at the front are not obscured. Wall-mounted cooling units may be mounted on the rear panel, side panels or door of the enclosure.



Internal circuit – Wall-mounted units Flow conditions

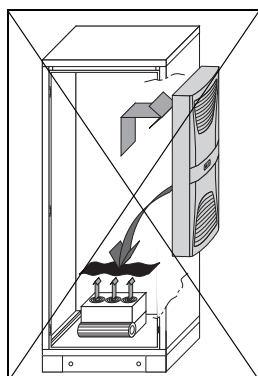
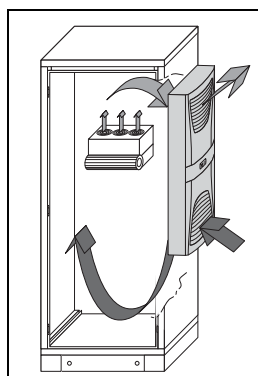
Attention should be paid to installed equipment that is fitted with its own ventilation system, such as blowers and axial fans. If their air flow is directed against the chilled air flow of the cooling unit, the air may short-circuit, bypassing the component. In the worst case, the internal safety systems of the cooling unit would discontinue cooling operation.

Note:

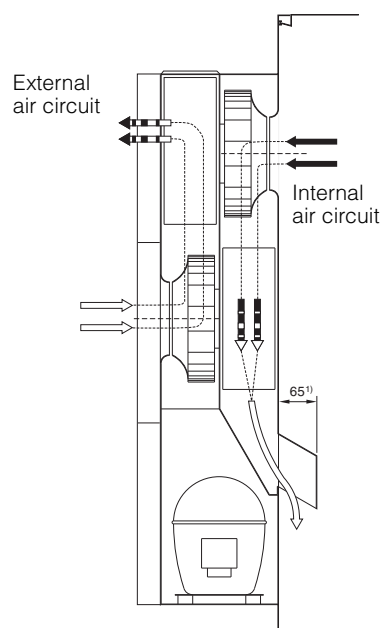
Never direct the chilled air flow at active components.

Accessories:

Air diverter, see Cat. 33, page 475.



Air diverter



¹⁾ 115 mm for SK 3213.330

Cooling units

Free air circulation

It is important to ensure “even” air circulation inside the enclosure. Air inlet and outlet openings in the internal circuit must on no account be obstructed by electrical installations. This would prevent air from circulating inside the enclosure. Under such conditions, the cooling capacity of the device would not be adequately utilised. A clearance of > 200 mm must be guaranteed.

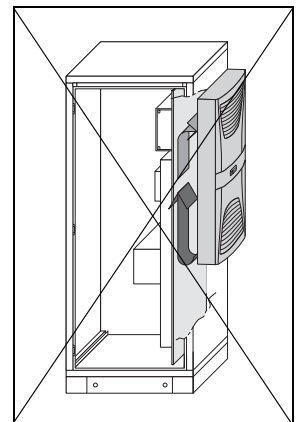
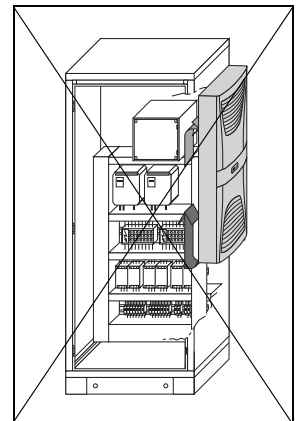
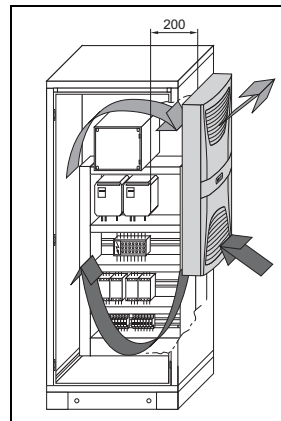
Note:

Wall-mounted cooling units should never be fitted directly behind the mounting plate. Active power components are located on the front of the mounting plates. The cooling unit would then be left to operate in its own air short-circuit.

If it is impossible to install the device any other way, appropriate air baffle plates should be used, and air inlet and outlet openings should be provided in the mounting plate.

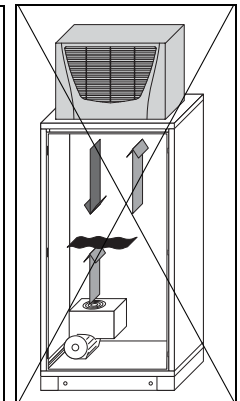
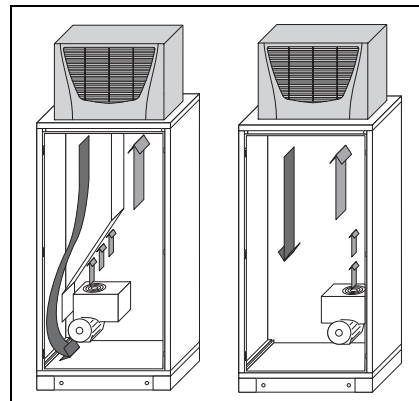
Accessories:

Air diverter, see Cat. 33, page 475.



Internal circuit – Roof-mounted units Flow conditions

When using roof-mounted units, particular attention should be paid to the air flow from blowers built into electronic components (such as frequency converters and other drive units).



Cooling units

Intelligent control

The two controller variants for operational reliability offer a comprehensive range of functions. Essential control electronics are well protected and cooled in the inner circuit.

Both variants have the following properties:

- Three voltage options: 115 V, 230 V, 400/460 V 3 ~
- Integral start-up delay and door limit switch function
- Icing protection function
- Monitoring of all motors
- Phase monitoring for three-phase units

Basic controller:

- Visualisation of the operating status via LED display:
 - Voltage applied, functions OK
 - Door open
 - Overtemperature
 - High-pressure monitor has switched
- Switching hysteresis: 5 K
- Floating fault signal contact in case of overtemperature
- Setpoint adjustable from outside via potentiometer (setting range 20 – 55 °C)



e-Comfort controller:

- Master/slave function for up to 10 units, i.e. the unit which reaches the setpoint first reports this to the "master unit" which switches all other "slave units" on and off. The unit which activates the door limit switch function reports this to the "master unit", which switches off all "slave units".
- Switching hysteresis: 2 – 10 K; preset to 5 K
- System alarm, individually configurable for 2 floating fault signal contacts
- Visualisation of the current enclosure internal temperature and all system messages on the display
- Storage of all system statuses in the log file
- Optional interface card (SK 3124.200) with RS-232, RS-485, RS-422 and PLC interface for integration into superordinate remote control systems, e.g. with CMC, is also possible



Thermoelectric coolers



Software & Service Page 26 **Order information** Catalogue 33, page 414

Benefits at a glance:

- Cooling and heating output 100 W, with state-of-the-art Peltier technology.
- Low-maintenance thanks to an elementary unit layout.
- High operating ratio (COP >1) thanks to optimum interplay between all components.
- Maximum possible protection for your electronics, floating change-over fault signal contact in case of overtemperature.
- USB interface for unit programming.
- Minimal physical size and mass compared with other systems in this sector.
- Large voltage range from 100 – 230 V (AC) and 24 V (DC).
- Up to 5 units may be connected in parallel.

Rittal rounds out its TopTherm portfolio at the lower output range with the Thermoelectric Cooler. The powerful thermoelectric unit in a light-weight design is the most energy-efficient climate-control solution for command panels and small enclosures, producing energy savings of more than 60% compared with conventional industry systems.

Ideal for precision applications thanks to its low-vibration design.

Heating function included: Automatic changeover between heating and cooling function facilitates precise temperature control to ± 1 K.

Thermoelectric coolers

Assembly

■ Installation

When installed in the enclosure, the unit only protrudes by a few millimetres, and therefore does not interrupt either the aesthetic appearance or freedom of movement on command panels and support arm systems.

■ External mounting

Its low weight also allows it to be externally mounted on simple aluminium rear panels or blanking panels.

■ Flexibility

May be mounted either horizontally or vertically.

■ Ideal for command panels and support arm systems

The Thermoelectric Cooler is distinguished by its low-vibration operation and minimal weight.



Control

- Energy-efficient control with pulse width modulation and innovative soft start function ensures a constant enclosure temperature and a long service life of the Peltier elements and fans.
- The PID control ensures optimum activation of the Peltier elements and fans. The speed and output are adjusted to the ideal operating points via pulse width modulation, and in this way ensure maximum energy efficiency.



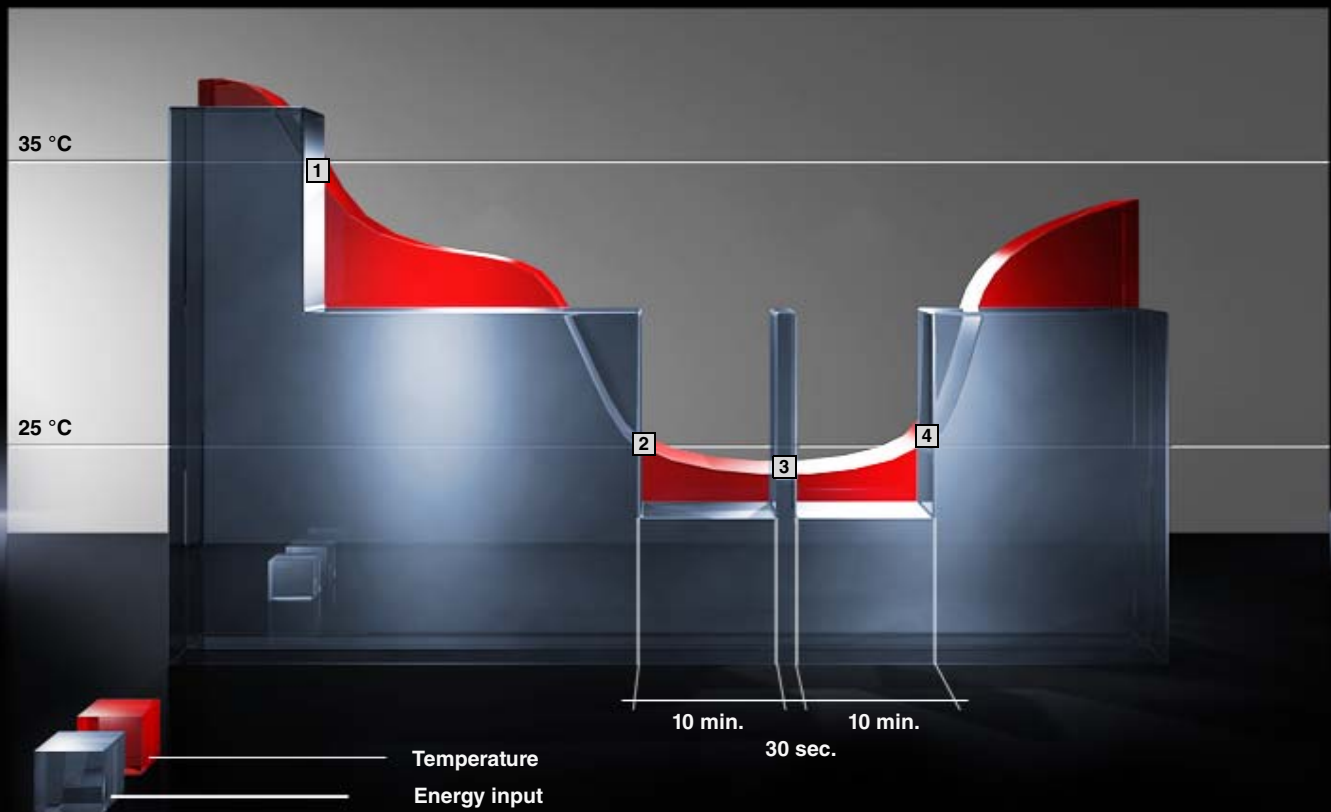
RTC PC software

For units with heating and cooling function

- Parameter setting (including setpoints and alarm values, heating and cooling)
- Master/slave settings
 - Parallel connection of several units for additional cooling output
 - Safety circuit (redundant design)
 - Interconnection of up to 5 units
 - Connection via X3 unit interface
 - Adaptor available as an accessory. Connection via RJ 45 network cable Cat 3 or above (max. 2 m)
- Monitoring (including current temperatures, fan speeds, capacity utilisation of RTC, status display with error messages, operating hours)
- Evaluation (recording of temperature variations, error counters, min./max. temperatures)
- Polling and downloading of software updates (the software is available to the units on CD-ROM, connect using the standard USB cable supplied loose (type A/type B))



“Blue e” cooling units



Cooling units Page 15 Air/water heat exchangers Page 39

Generation “Blue e”

Make permanent energy savings with Rittal cooling units

- Energy-saving cooling units in the output range from 500 W to 4000 W
- In addition to the new controller, the components used (such as fan, compressor, evaporator coil and condenser) have also been optimised in terms of their energy efficiency.
- Savings of **up to 45%** energy consumption with the same cooling output (ideally 70% compared with a conventional Rittal TopTherm Plus cooling unit in field trials)

Eco-mode control

Intelligent, targeted use of energy thanks to the new eco-mode control from Rittal

- 1 Cooling switches off: The interior fan only runs to ensure air circulation inside the enclosure
- 2 The interior fan is switched off.
- 3 The interior fan is switched on for 30 seconds every 10 minutes to briefly blend the air.
- 4 The interior fan is switched back on.

Generation “Blue e”



Up to 70% less energy consumption



The potential for innovations in enclosure cooling units is far from exhausted. There is still significant scope for boosting efficiency, as verified by a pilot application at Daimler AG in Sindelfingen. The automotive manufacturer, one of the world's leading suppliers of premium cars, put the new energy-saving cooling units from Rittal's "Blue e" generation through an exhaustive battery of live tests. The outcome revealed that converting more than 250 cooling units to the new energy-saving technology would save 490 tonnes of CO₂ each year – which translates into six-figure savings in operating costs.

Wall-mounted cooling units



Project planning Page 17 **Therm 6.1 software** Page 85 **Order information** Catalogue 33, from page 415

Benefits at a glance:

- Super-efficient performance and energy consumption
- Wide output range from 300 W to 4000 W
- Controlling and monitoring via Basic or e-Comfort controller
- Three-phase cooling units support multiple voltages as standard
- Electrical condensate evaporation and RiNano coating
- Uniform, output-based, system-wide mounting cut-outs, to coordinate with TopTherm air/air heat exchangers

Please note:

- Air inlet and outlet openings in the internal and external circuit must not be obstructed by electrical installations.

Top design and top performance with a host of assembly benefits. The Rittal platform strategy with system-wide mounting cut-outs to fit cooling units and air/air heat exchangers allows easy adaptation to the required cooling output, even retrospectively.

Generation “Blue e”

Make permanent energy savings with Rittal cooling units.
See page 26.



Wall-mounted cooling units

Flexibility of wall mounting

Practical and stylish

- The mounting cut-out is chosen depending on the mounting variant – either external, internal or partial internal mounting. This makes optimum use of the available space.
- With external mounting, openings are only required for air inlet and outlet.
- The enclosure surface containing the cut-out for partial or full internal mounting is stabilised by the divided internal case construction.
- Special internal or external mounting kits are not required.



Platform strategy

Flexible output

Just 5 mounting cut-outs for 8 different output categories provide investment security and facilitate easy adaptation of the cooling output to the ambient conditions and the installed heat loss.

Rittal platform strategy

TopTherm air/air heat exchangers are also compatible with the mounting cut-outs.



Integral

Electrical condensate evaporation

Condensate arising inside the enclosure or on the evaporator coil of the cooling unit is effectively evaporated. The evaporator device inside the cooling units has a very high evaporation output (several litres per day), thanks to the principle of direct evaporation.

RiNano coating

The standard nano-surface finish on condenser coil fins ensures a more constant cooling output over time and eliminates the need for filter media in many areas.



Wall-mounted cooling units

Condensate evaporation, electrical

Integrated into TopTherm cooling units

Condensate arising inside the enclosure or on the evaporator coil of the cooling unit is effectively evaporated. The integral evaporator device of the cooling units has a very high evaporation output (several litres per day).

This is achieved thanks to the principle of direct evaporation. Important note: The enclosure must be sealed on all sides (minimum IP 54).

Energy-efficient: Activation of the evaporator device is via a separate heater cartridge. "Condensate evaporation" based on the hot gas bypass principle is not effective, due to inadequate evaporation temperatures.

Advantage:

- Safe use: No condensate drips onto the factory floor (no puddles/no risks of slipping/accidents).
- No need to empty the condensate collecting receptacles.
- No time-consuming laying of condensate hoses required.



The Rittal condensate evaporators are active "direct evaporator coils", which actively evaporate the condensate incurred.

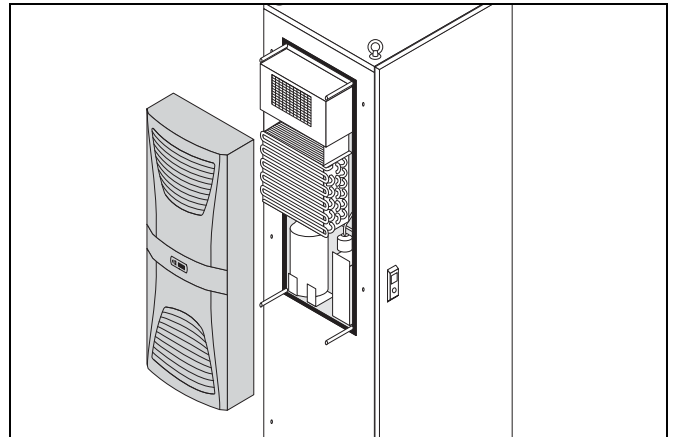
Advantage:

- No collecting vessel required
- No long hosepipes

Note:

For roof and wall-mounted units, either external evaporator units or integral condensate evaporators may be used.

TopTherm cooling units are available with integrated electronic condensate evaporation and external evaporator units for retro-fitting.



Roof-mounted cooling units



Project planning Page 17 **Therm 6.1 software** Page 85 **Order information** Catalogue 33, from page 426

Benefits at a glance:

- Super-efficient performance and energy consumption
- Wide output range from 500 W to 4000 W
- Three-phase cooling units support multiple voltages as standard
- Uniform, output-based, system-wide mounting cut-outs
- Targeted, individual air routing
- Electrical condensate evaporation and RiNano coating

Please note:

- Avoid overloading the roof plate by using stays (with TS 8 system accessories, Catalogue 33, page 649).

Cooling units keep the temperature at a constant level, even below that of the room. Two separate circuits prevent the ingress of dust and other contaminants into the enclosure. Rittal TopTherm roof-mounted cooling units: Top design and top performance with a host of assembly benefits and sophisticated air routing. Superb performance plus cost-cutting design.

Generation “Blue e”

Make permanent energy savings with Rittal cooling units. See page 26.



Flexibility of roof mounting

■ Cut your costs

All three-phase cooling units are suitable for a voltage range of 400/460 V and a frequency range of 50/60 Hz without rewiring. No need for expensive additional transformers.

■ Flexible performance

Just 3 mounting cut-outs for 6 different output categories provide investment security and facilitate easy adaptation of the cooling output to the ambient conditions and the installed heat loss.

■ Rittal platform strategy

TopTherm air/water heat exchangers and roof-mounted fans are also compatible with the mounting cut-outs.



Optimum flow conditions

■ Targeted air routing inside the enclosure

The internal air circulation is targeted and effective: The heated air is extracted centrally. Chilled air is discharged via up to four spigots positioned in the corners of the base plate and may be routed in a controlled manner into the lower enclosure chamber via the optional ducting system. The result is highly effective cooling and the avoidance of air short-circuits. The targeted air circulation inside the enclosure via ducts also prevents the creation of hot-spots.



Integrated

■ Electrical condensate evaporation

Condensate arising inside the enclosure or on the evaporator coil of the cooling unit is effectively evaporated. The evaporator device inside the cooling units has a very high evaporation output (several litres per day). This is achieved thanks to the principle of direct evaporation.

■ RiNano coating

The standard nano-surface finish on condenser coil fins ensures a more constant cooling output over time and eliminates the need for filter media in many areas.



Roof-mounted cooling units

Condensate routing

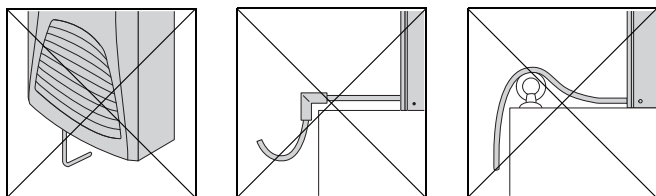
Any condensation which forms on the evaporator coil (with high humidity and low enclosure interior temperatures) is routed to the right and/or downwards out of the device via a drain in the evaporator tray. For this purpose, a piece of hose should be connected to one of the two condensate nozzles (1 or 2). **The drain which is not required should be tightly sealed. The condensate must be able to run off freely. If the condensate is to be drained off over a greater distance, then care must be taken to ensure that the hose is free from kinks** and checked for correct drainage. Units with a Comfort controller are additionally equipped with a condensate alarm.

- 1** Condensate discharge rear
- 2** Condensate discharge right

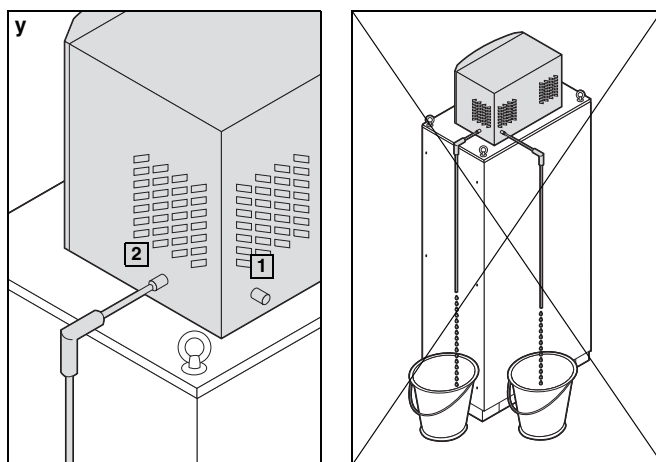
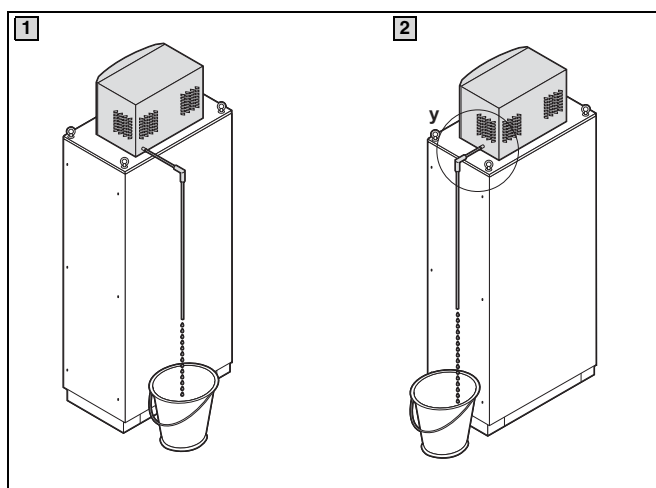
Note:

Condensate discharge (wall-mounted units)

For wall-mounted units, a hose should be connected to the condensate nozzle on the bottom of the unit.



The condensate discharge should be laid with a gradient, taking care to ensure there are no kinks in the pipe!



Climate control checklist

Enclosure commissioning checklist

1. Climate control calculation performed.
2. End client's siting conditions taken into account (temperature, air quality, water quality).
3. The heat loss of the components installed in the enclosure does not exceed the specific cooling output of the cooling unit.
4. Ventilation space above and below the components taken into account as per the manufacturer's requirements.
5. Components are ventilated with cold air as per their position inside the enclosure; in the case of self-ventilated components, the direction of air flow inside the enclosure has been taken into account.
6. Vent grilles of components are free from obstructions, including cables.
7. Cold air flow is not directed straight at active components.
8. The enclosure internal temperature corresponds to the factory setting (+35 °C). In case of setpoint changes, authorisation has been obtained from the electrical planning team.
9. The enclosure is sealed on all sides (minimum IP 54), particularly in the vicinity of the cable entries, to prevent the ingress of ambient air.
10. To avoid increased condensation, door-operated switches have been installed.
11. Safe condensate discharge has been installed as per the user manual. (Units with integral condensate evaporation, external condensate evaporation or condensate collecting bottle; for order information see Catalogue 33, page 484).
12. Depending on the ambient conditions, the correct filter medium should be used; see Catalogue 33, pages 394 – 408.

Modular climate control concept



Project planning Page 17 **Therm 6.1 software** Page 85 **Order information** Catalogue 33, from page 430

Benefits at a glance:

- Modular design – for specific size, cooling output and voltage combinations
- Combination of TS 8 section door and climate control module
- One item number each for the door and climate control module
- Quick delivery
- 8 section doors x 6 climate control modules
= 48 combination options
- Standard RTT version with integral condensate evaporation and RiNano coating
- Intelligent control – Climate control modules supplied with e-Comfort controllers – Control system identical to TopTherm climate control units

Please note:

- A TS 8 base/plinth is required for operation, see Catalogue 33, from page 540.

Less is more! We offer almost limitless application possibilities from just six cooling modules and eight door modules. The best cooling technology, complete and ready for use – without having to make mounting cut-outs. The existing sheet steel doors are easily exchanged for section doors with cooling modules. These can also be exchanged or upgraded while the system is operational.

Generation “Blue e”

Make permanent energy savings with Rittal cooling units.
See page 27.



Modular climate control concept

Modularity

- Create your individual climate control solution from the section door and the climate control module in just a few simple steps.
- Choose from 48 different options with different dimensions, cooling outputs and voltages.



Infinite possibilities

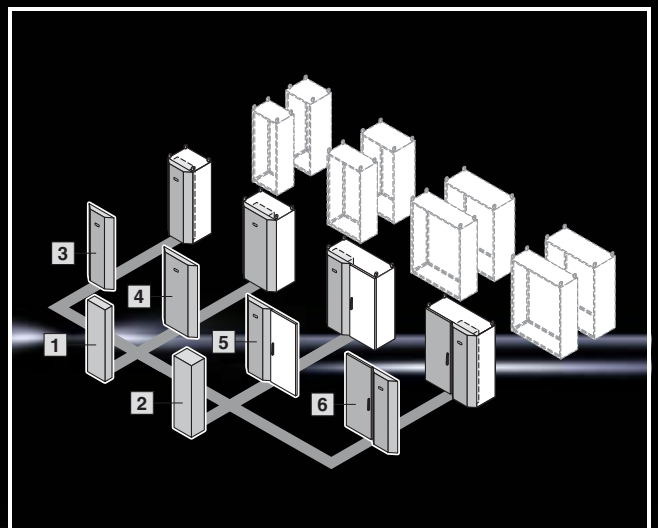
- Seamless baying and perfect integration. Cooling of a bayed enclosure suite is easily achieved, even under awkward room conditions, such as low ceiling heights.
- No mounting cut-outs are required.



Diversity

8 section doors x 6 climate control modules
= 48 combination options

- 1 Cooling module, 1500 W useful cooling output, available with three rated voltage options.
- 2 Cooling module, 2500 W useful cooling output, available with three rated voltage options.
- 3 Section doors for installing cooling modules in 600 mm wide enclosures.
- 4 Section doors for installing cooling modules in 800 mm wide enclosures.
- 5 Section doors for installing cooling modules in 1200 mm wide enclosures; cooling module fitted on the left.
- 6 Section doors for installing cooling modules in 1200 mm wide enclosures; cooling module fitted on the right, including lockable door on the left.





Order information Catalogue 33, from page 433

Liquid cooling

Whenever a higher enclosure protection category is needed due to hot, dust-laden (e.g. metal dust) or oily ambient conditions, Rittal liquid cooling concepts come into their own. Precise temperature control of machine and process cooling is another of their strengths. For cooling spindles and the like,

Rittal chillers provide volumetric flows and cooling medium temperatures at precisely the required level. Rittal system climate control: the key to a high level of dimensional accuracy, consistently perfect workpieces, and stable production conditions.

Liquid cooling

1 Air/water heat exchanger

Liquid cooling classics

The temperature of the air inside the enclosure interior may also be cooled to a level below that of the external air by using air/water heat exchangers in conjunction with a central re-cooling system. Dust is unable to penetrate the enclosure. The waste heat from the enclosure does not raise the temperature of the ambient air, provided the cold water supply system is remotely located.

- For extremely hot and dusty ambient conditions
- To dissipate high heat loads without putting thermal pressure on the ambient air



2 Cold Plate

Direct cooling of power electronics inside the enclosure

Liquid-cooled partial mounting plate with copper or stainless steel pipes press-fitted onto the rear, integrated into closed recooling systems or into the existing water infrastructure. With the pitch of Rittal partial mounting plates, installation into the TS 8 top enclosure system is child's play using system accessories with a 25 mm pitch pattern. At the same time, however, a 4-point attachment facility permits direct mounting on the mounting plate or any other surface.

- Using liquid-cooled mounting plates (Cold Plate)
- No impairment to the protection category
- With efficient frequency converter cooling



3 Chillers for water

Energy-efficient cooling of liquid cooling media

Chiller systems are a centralised, efficient means of providing cooling either directly or via complementary equipment using a fluid medium, typically a mixture of water and glycol. For example, all cooling requirements on a system or machine, whether they are for the process or control equipment, may be satisfied using a single scheme. The spatial separation of the cooling supply and the process to be cooled may be achieved using a chiller.

- A high level of temperature accuracy
- Powerful performance
- Individual system solutions



Air/water heat exchanger



Project planning Page 43 **Therm 6.1 software** Page 85 **Order information** Catalogue 33, from page 434

Benefits at a glance:

- Useful cooling output from 300 W to 7000 W
- Suitable for use even under extreme conditions and ambient temperatures of up to +70 °C
- Also available with all water-carrying parts made from stainless steel
- High protection category. Thanks to the sealed design, a protection category of IP 55 to EN 60 529 is achieved.

Please note:

Air/water heat exchangers should always be used in conjunction with recooling systems or an existing cooling water circuit.

The temperature of the air inside the enclosure may also be cooled to a level below that of the external air, if required, using cooled water from a central recooling system. The ingress of dust from outside into the cooled enclosure is prevented. The waste heat from the enclosure does not raise the temperature of the ambient air, provided the heat exchanger and cold water supply system are located remote to one another.

Air/water heat exchangers may even be used in particularly extreme ambient temperatures from +1 °C to +70 °C.

Even extreme levels of contamination in the ambient air, e.g. with dust and oil, do not affect functionality. High heat losses are dissipated in the most confined spaces without emitting them directly to the ambient air. High cooling performances are achieved, thanks to the large surface area of the heat exchanger unit and the powerful fan technology.

Air/water heat exchanger

Variants

■ Roof mounting

Especially for bayed enclosures, where wall-mounted devices would obstruct the door.

■ Wall mounting

For mounting on the wall or any sufficiently large vertical surface.

More effective cooling thanks to selective air routing
An important feature of TopTherm roof-mounted units:
The air cooled by the heat exchanger is routed precisely to the relevant assembly via the air duct system, see Catalogue 33, page 473.

The result:

Exceptionally efficient and cost-effective cooling!

Another cost benefit:

The air duct system is also compatible with roof-mounted cooling units.



Flexibility

Versatile water connection options

Safe connection technology thanks to a certified system:

- The new threaded adaptors for quick fastening allow easy connection to fixed or flexible piping; see Catalogue 33, page 486.
- Flex-hose and connector/coupling are included as standard with the supply – G3/8" internal or external threads are also optionally available.



Functional reliability

Enhanced functional reliability and longevity

Corrosion can be prevented, as the heat exchangers are also available with all water-carrying parts in stainless steel (V4A 1.4571).

Wide output range

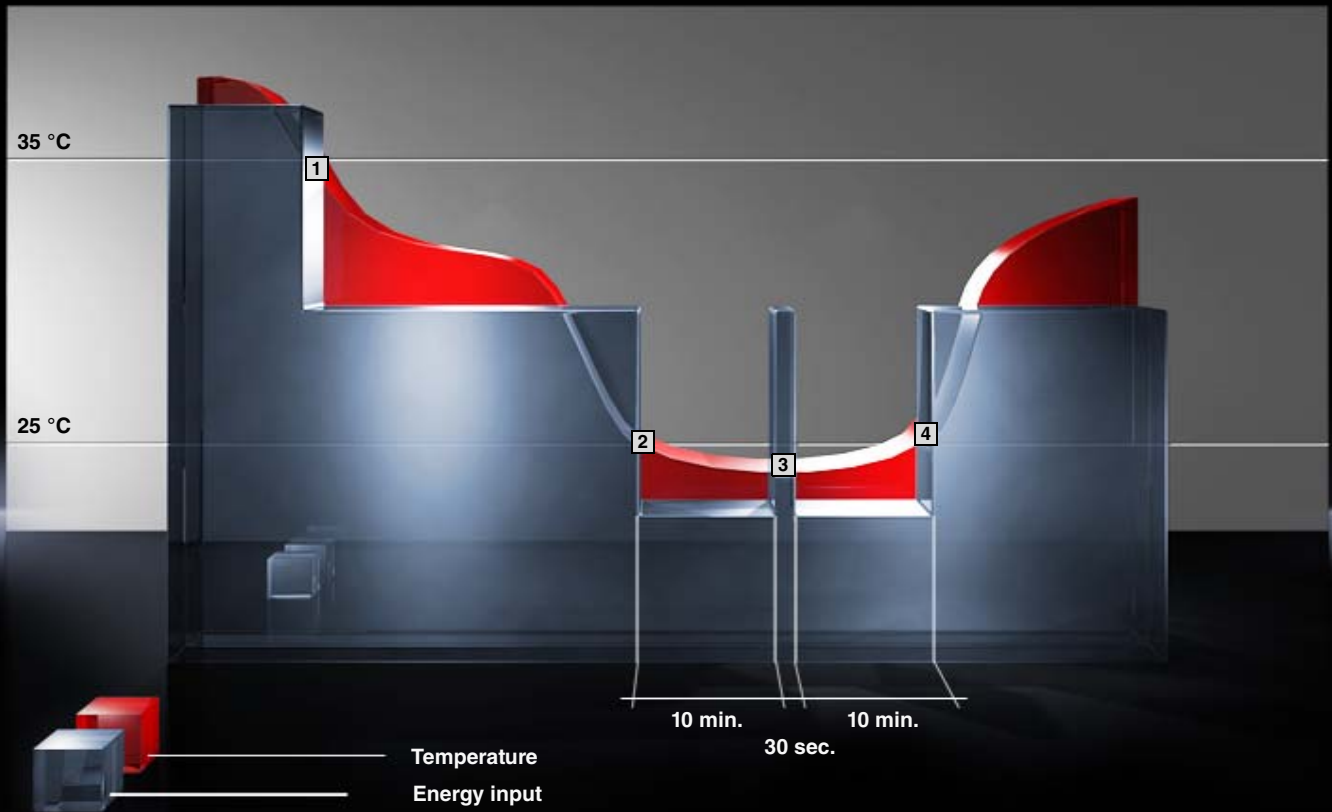
- From 300 W to 7000 W useful cooling capacity for every application
- Simple assembly with roof-mounted and wall-mounted cooling units

Available immediately in 230 V

All outputs are also available in 115 and 400 V in our standard special range.



Air/water heat exchanger



Cooling units Page 15 Air/air heat exchangers Page 11

Effective and efficient

- Easier assembly:
Assembled in less than 2 minutes
- Extensive choice of water connection options
- All units with Comfort control become efficient energy-saving variants with eco-mode control.
- Temperature display comes as standard even with the Basic version

Eco-mode control

**Intelligent, targeted use of energy
thanks to the new eco-mode control from Rittal**

- 1** Cooling switches off: The interior fan only runs to ensure air circulation inside the enclosure.
- 2** The interior fan is switched off.
- 3** The interior fan is switched on for 30 seconds every 10 minutes to briefly blend the air.
- 4** The interior fan is switched back on.

Air/water heat exchanger

Cost cutting

Cost reduction through variable cooling outputs and technology in conjunction with simple installation

- Fast mounting and installation thanks to a system platform with identical mounting cut-outs for cooling units, air/air and air/water heat exchangers.
- Roof plates with the same prepared mounting cut-outs as for roof-mounted cooling units from our range of accessories.
- Clear benefits in terms of investment, installation and operating costs.
- Heat exchangers in output categories from 500 W to 5000 W are effortlessly fitted in less than 2 minutes by simply locating into position. The pre-fitted mounting hooks and the addition of just 2 screws hold them in place.



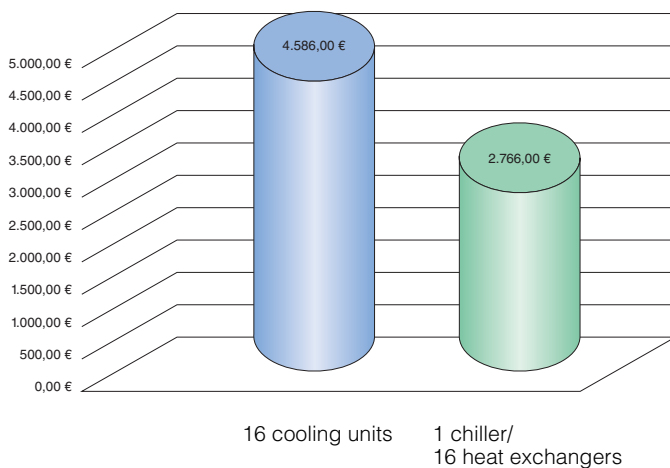
Comparative calculation of energy costs

Here, we compare the energy costs of cooling a bayed enclosure suite (heat loss 25 kW).
Cooling units versus air/water heat exchangers combined with chillers.

	Qty.	Power consumption kW per unit	Price kWh Euro	Energy costs Euro
Cooling unit for wall-mounting	8	1.02	0.12	2,923.20
Cooling unit for wall-mounting	8	0.58	0.12	1,663.20
Total		12.74		4,586.40

	Qty.	Power consumption kW per unit	Price kWh Euro	Energy costs Euro
Air/water heat exchanger	8	0.06	0.12	175.39
Air/water heat exchanger	8	0.16	0.12	463.68
Chiller in a TS 8 enclosure	1	5.91	0.12	2,126.88
Total		7.68		2,765.95

Difference
€ 1,820.45 =
approx. 40%



Air/water heat exchanger

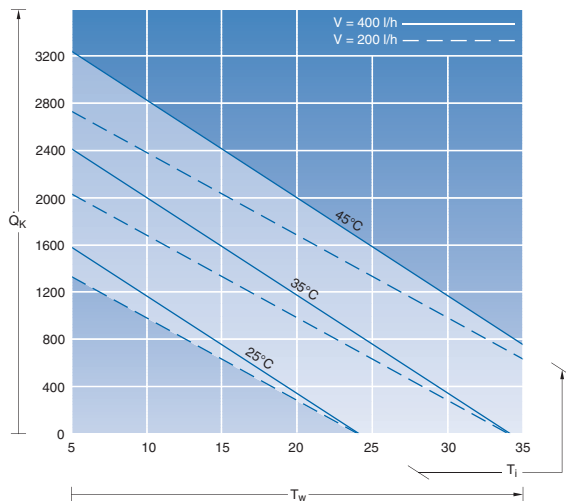
Project planning

Calculate your required cooling output:

e. g. Performance diagram Air/water heat exchanger 1000 W

50 Hz

SK 3373.100, .110, .140, .500, .510, .540



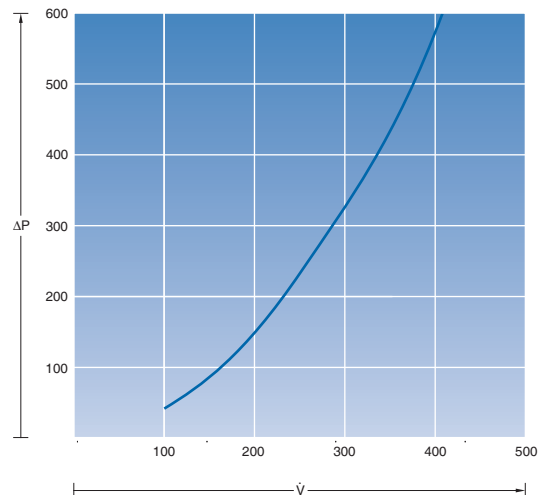
T_w = Water inlet temperature (°C)

$\dot{Q}_K$ = Useful cooling output (W)

T_i = Enclosure internal temperature (°C)

Water resistance performance diagram

SK 3373.100, .110, .140, .500, .510, .540



$\dot{V}$ = Volumetric flow (l/h)

ΔP = Water resistance (mbar)

Notes on water quality

For safe operation of the equipment, it is essential to observe the VGB guidelines on cooling water (VGB-R 455 P).

The cooling water should have a low level of hardness, particularly calcium hardness. In particular, for recooling within the plant, the calcium hardness should not be too high. On the other hand, the water should not be so soft that it attacks the materials. When recooling the cooling water, the salt content should not be allowed to increase excessively due to the evaporation of large quantities of water, since electrical conductivity increases as the concentration of dissolved substances rises, and the water thereby becomes more corrosive. For this reason, not only is it always necessary to add a corresponding quantity of fresh water, but also to remove part of the enriched water.

Water with high gypsum content is unsuitable for cooling purposes because it has a tendency to form boiler scale that is particularly difficult to remove. Furthermore, cooling water should be free from iron and manganese, because otherwise deposits may occur which settle in the pipes and block them. At best, organic substances should only be present in small quantities, because otherwise sludge deposits and microbiological contamination may occur.

	Material of the water-carrying parts	
	CuAl	V4A ¹⁾
Hydrological data		
pH value	7 – 8.5	6 – 9
Calcium hardness	> 3 < 8° dH	1 – 12° dH
Free carbonic acid	8 – 15 mg/dm ³	1 – 100 mg/dm ³
Accompanying carbonic acid	8 – 15 mg/dm ³	Zero
Aggressive carbonic acid	0 mg/dm ³	0 – 400 mg/dm ³
Sulphides	Zero	Zero
Oxygen	< 10 mg/dm ³	< 10 mg/dm ³
Chloride ions	< 50 mg/dm ³	< 200 mg/dm ³
Sulphate ions	< 250 mg/dm ³	< 500 mg/dm ³
Nitrates and nitrites	< 10 mg/dm ³	< 100 mg/dm ³
COD	< 7 mg/dm ³	< 40 mg/dm ³
Ammonia	< 5 mg/dm ³	< 20 mg/dm ³
Iron	< 0.2 mg/dm ³	Free
Manganese	< 0.2 mg/dm ³	Free
Conductivity	< 2200 µS/cm	< 4000 µS/cm
Evaporation residue	< 500 mg/dm ³	< 200 mg/dm ³
Potassium permanganate consumption	< 25 mg/dm ³	< 40 mg/dm ³
	< 3 mg/dm ³	
Suspended matter	> 3 < 15 mg/dm ³ partial flow purification recommended	
	> 15 mg/dm ³ continuous purification recommended	

¹⁾ The complete absence of corrosion under experimental conditions suggests that solutions with a significantly higher salt content and greater corrosion potential (such as seawater) may still be tolerated.

Air/water heat exchanger

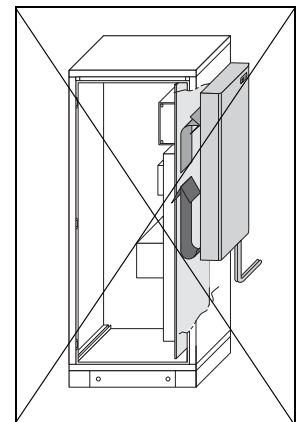
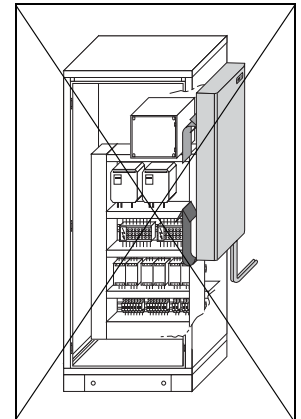
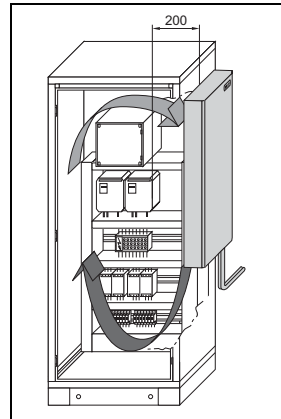
Free air circulation

It is important to ensure “even” air circulation inside the enclosure. Air inlet and outlet openings in the internal circuit must on no account be obstructed by electrical installations. This would prevent air from circulating inside the enclosure. Under such conditions, the cooling capacity of the device would not be adequately utilised. A clearance of > 200 mm must be guaranteed.

Note:

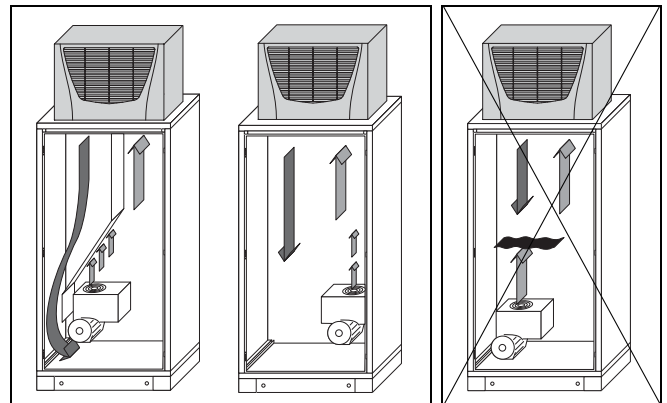
Wall-mounted cooling units should never be fitted directly behind the mounting plate. Active power components are located on the front of the mounting plates. The heat exchanger would then operate in its own air short-circuit.

If it is impossible to install the device any other way, appropriate air baffle plates should be used, and air inlet and outlet openings should be provided in the mounting plate.



Internal circuit – Roof-mounted units Flow conditions

When using roof-mounted units, particular attention should be paid to the air flow from blowers built into electronic components such as frequency converters and other drive units.

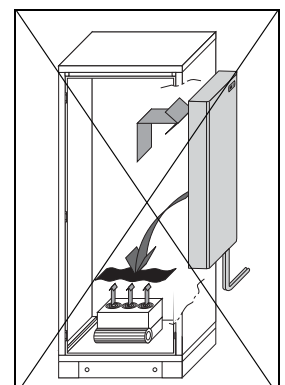
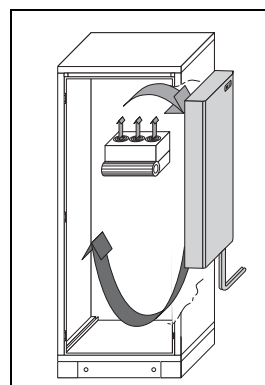


Internal circuit – Wall-mounted units Flow conditions

When installing self-ventilating components and electronic parts, please observe the following: Blowers and axial fans whose air flow is in the opposite direction to the cold air flow from the heat exchangers may cause a short-circuit and prevent adequate climate control.

Note:

Never direct the chilled air flow at active components.



Air/water heat exchanger

Condensate routing (roof-mounted units)

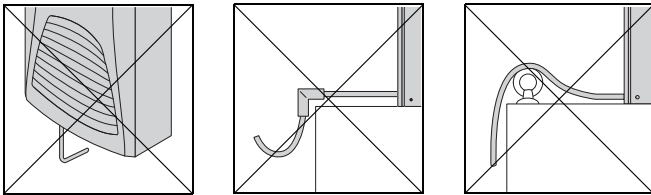
Any condensation which forms on the evaporator coil (with high humidity and low enclosure interior temperatures) is routed to the right and/or downwards out of the device via a drain in the evaporator tray. For this purpose, a piece of hose should be connected to one of the two condensate nozzles (1 or 2). **The drain which is not required should be tightly sealed. The condensate must be able to run off freely. If the condensate is to be drained off over a greater distance, then care must be taken to ensure that the hose is free from kinks** and checked for correct drainage. Units with an e-Comfort controller are additionally equipped with a condensate alarm.

- 1** Condensate discharge rear
- 2** Condensate discharge right

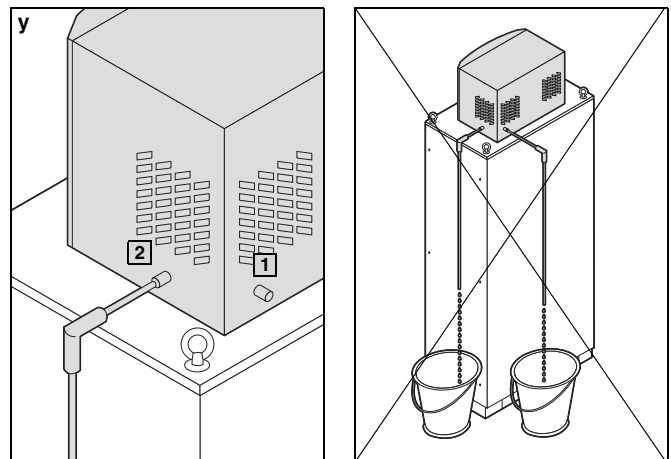
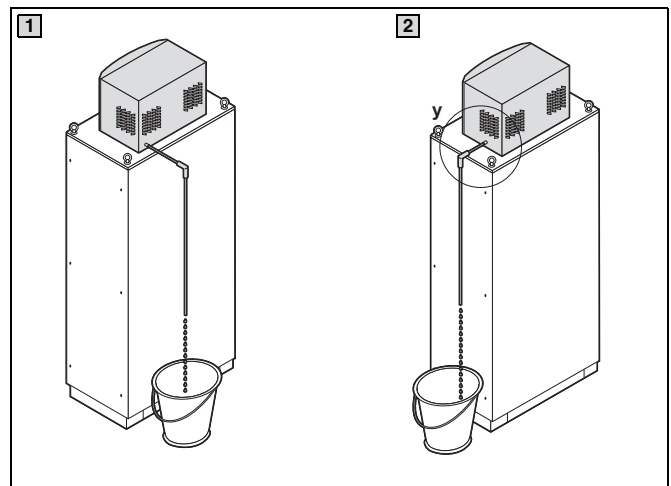
Note:

Condensate discharge (wall-mounted units)

For wall-mounted units, a hose should be connected to the condensate nozzle on the bottom of the unit.



The condensate drain pipe should be laid with a gradient, taking care to ensure there are no kinks in the pipe!



Air/water heat exchanger

Intelligent control

The two controller variants for operational reliability offer a comprehensive range of functions. Essential control electronics are well protected and cooled in the inner circuit.

Both variants have the following properties:

- Three voltage options: 115 V, 230 V, 400/460 V, 3 ~
- Integral start-up delay and door limit switch function
- Icing protection function
- Monitoring of all motors
- Phase monitoring for three-phase units

Basic controller:

- Visualisation of the operating status via LED display:
 - Voltage applied, functions OK
 - Door open
 - Overtemperature
 - High-pressure monitor has switched
- Switching hysteresis: 5 K
- Floating fault signal contact in case of overtemperature
- Setpoint adjustable from outside via potentiometer (setting range 20 – 55 °C)



e-Comfort controller:

- Master/slave function for up to 10 units, i.e. the unit which reaches the setpoint first reports this to the “master unit” which switches all other “slave units” on and off. The unit which activates the door limit switch function reports this to the “master unit”, which switches off all “slave units”.
- Switching hysteresis: 2 – 10 K; preset to 5 K
- System alarm, individually configurable for 2 floating fault signal contacts
- Visualisation of the current enclosure internal temperature and all system messages on the display
- Storage of all system statuses in the log file
- Optional interface card (SK 3124.200) with RS-232, RS-485, RS-422 and PLC interface for integration into superordinate remote control systems, e.g. with CMC, is also possible



Cold Plate



Order information Catalogue 33, page 444

Benefits at a glance:

- High surface quality ($R_a = 1.2 \mu\text{m}$) to reduce thermal resistance
- No vibrations from compressors and fans
- Ideal for precision machine tools
- No noise generation
- No top-mounted parts on the enclosure
- Enclosure may be installed in the machine base and in niches
- The protection category of the enclosure is preserved
- Mounting surface on both sides may be used as a contact surface for heat dissipation
- Space-saving configuration of electronic components in the enclosure

Please note:

- Two standard versions with water-carrying parts made of copper or stainless steel are available from stock
- Manufacturer or customer-specific Cold Plates may be supplied on a project-related basis on request.

Power electronic components can be cooled particularly effectively using the liquid cooled DCP mounting plate. Heat losses are cleverly dissipated from the enclosure or housing without compromising the high enclosure protection category in any way. Liquid cooling is silent, as well as being many times more efficient than heat loss dissipation via air. The horizontal positioning of the water pipes ensures even heat dissipation and allows easy emptying.

Copper piping: For standard applications with air/water heat exchangers and recooling systems with the cooling medium water + glycol (e. g. inhibitor Antifrogen N 20 – 30 vol. %).
Stainless steel piping: Material 1.4301 e.g. for open cooling circuits and for use in the food industry.

The Rittal DCP Cold Plate has received type-tested certification from the TÜV inspection authority and is approved for pressures up to 10 bar.



Cold Plate

Assembly

- Height and depth-variable mounting positions are offered by the system punchings of the TS 8 profiles in conjunction with punched section with mounting flange 17 x 73 mm (for the outer mounting level).
- Medium connections on the sides provide a larger plate capacity, and allow easier draining.

Attachment directly in the T-slot

Direct and fast mounting using sliding nuts for components with suitable dimensions. Direct earthing or equipotential bonding points may be provided on the Cold Plate.

Attachment with variable clamping system

Supports fast mechanical installation without the need for drilling, independently of the original attachment points on the component. For use with a wide range of models and makes.

Attachment with retainers

Frequency converters with dimensions marginally smaller than the T-slot spacing can be secured with special retainers.

Attachment with tapped holes

Power electronics may be attached on both sides of the entire surface using tapped holes (except where the copper pipelines are laid, as shown on the drawing).



Chillers for water



Project planning Page 51 **Therm 6.1 software** Page 85 **Order information** Catalogue 33, from page 446

Benefits at a glance:

- Cooling output from 1 kW to 40 kW
- One system for enclosure cooling
- Integration into bayed enclosure suites
- Individual project planning
- Commissioning and servicing
- Comprehensive pipeline calculation
- Global service network

Applications:

- Enclosure cooling
- Cooling of liquid media
- Process and machine cooling
- Spindle cooling
- IT server cooling

Chiller systems are a centralised and efficient means of providing cooling either directly or via complementary equipment using a fluid medium, typically a mixture of water and glycol, and may be used to dissipate particularly high heat loads.

For example, all cooling requirements on a system or machine, whether they are for the process or the control equipment, may be satisfied using a single scheme. The spatial separation of the cooling supply and the process to be cooled may be achieved using a chiller which may supply several pieces of equipment simultaneously, and is particularly effective in terms of cooling output.

Chillers for water

Floor-standing and roof-mounted version

TopTherm output range 1 kW – 6 kW

TopTherm chillers in a floor-standing enclosure are used to facilitate the precise temperature control of water mixed with an additive. The water system, which is configured as an open system, has an integral buffer tank into which warm water returns before being cooled again to the pre-set temperature. The modular configuration allows the microcontroller display to be mounted on the front or rear of the chiller, to suit the view point of the operator.



Wall-mounted

TopTherm output range 1 kW – 4 kW

TopTherm chillers, for mounting on the external walls of enclosures, offer centralised cooling whilst occupying minimal space. This, in conjunction with their optimum cooling output, opens up new opportunities for integration into machine and enclosure housings without the need for additional floor area.



Modular design

TopTherm output range 8 kW – 40 kW

- Water and cooling modules and an electronic module built into a TS 8 enclosure system.
- Choose from seven different cooling outputs.



Chillers for water

Project planning

Chillers may be used in all situations where a high cooling load is required, e.g. in process and machine cooling, in media cooling or when dissipating heat loss from enclosures via air/water heat exchangers.

Our project engineers will be happy to help you design a chiller for your specific application area. An overview of the planning data required for this purpose can also be found on the Internet at www.rittal.com.

The cooling output is calculated from the heat loss of the components to be cooled. This can be calculated using volumetric flow and temperature difference.

$$\dot{Q}_0 = \dot{V} \cdot c \cdot \Delta T$$

$\dot{Q}_0$ = Cooling output kW
 $\dot{V}$ = Volume flow [l/min]
 ΔT = Temperature difference [K]
 c = Specific thermal capacity [kJ/kg · K]

Rifrost Indoor = 3.914/Outdoor = 3.66



Design of chillers

The Therm software takes care of the time-consuming calculation of the required cooling output, allowing you to design the optimum chiller.

Further tips on the calculation aid may be found on page 87 or at www.rittal.com.



Chillers – General instructions

Assembly and commissioning

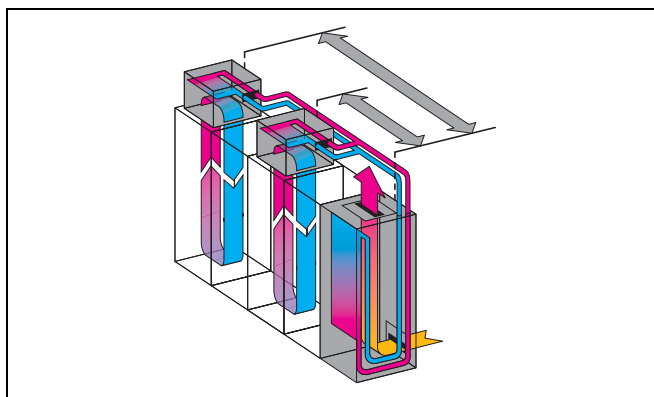
When siting the chillers, the following points should be observed:

- Connection of an inlet and outlet duct requires the manufacturer's prior consent.
 - Performance loss (air-cooled chillers)
- Never site the chiller in the vicinity of a heater.
 - Performance loss.
- The chiller may only be sited on flat, solid surfaces. The maximum permissible deviation from the vertical is 2°.
- Connect the equipment to the chiller using insulated pipe or hose connections.
- If the equipment is positioned higher than the chiller, install a non-return valve in the upstream inlet and a magnetic valve in the return to prevent the tank from overflowing.
- With chillers that are intended for covered outdoor siting, the minimum external temperature should be taken from the technical specifications.
- In the case of chillers (for water) at temperatures below 0 °C, a water/glycol mixture should be added in the prescribed ratio.
- If it is possible to shut off the equipment cycle, a bypass must be provided in order to protect the pump.
- Under no circumstances must the circulation pump be allowed to run dry.
 - Damage to the pump.

Distance from equipment

Site the chiller close to the equipment it is supplying in order to avoid long pipe runs which may lead to a reduction in cooling output due to unsuitable ambient conditions. When selecting the installation site, care should be taken to ensure easy access at all times; this will make maintenance of the system easier.

You should also ensure adequate ventilation of the room where the chiller is sited. If there is inadequate ventilation, the temperature of the room will increase as a result of waste heat, leading to impaired performance of the chillers.



Cooling media

Chillers are suitable for cooling water or a water/glycol mixture. When filling the systems for the first time, water from the existing supply line is generally suitable, although care should be taken to ensure a consistent water quality.

However, as satisfactory results are only rarely achieved without water treatment, additives should always be added to the cooling water, irrespective of the installation site. As well as protecting against frost, these also serve to impair bacterial growth and achieve optimum corrosion protection.

Pre-mixed additive is available from Rittal in the mix ratios

- 1:2 for outdoor siting
- 1:4 for indoor siting, both types are available in 10 l, 25 l and 200 l containers



Chiller for water – TopTherm

Floor-standing and roof-mounted



Therm 6.1 software Page 85 **Order information** Catalogue 33, from page 446 – 451

Benefits at a glance:

- Innovative control concept with microcontroller control
- Energy efficiency with eco-mode control using an integral real-time clock
- Fixed and differential-value-based temperature control
- With RiNano coating (on all heat exchanger membranes) and bifrequency design of all components as standard
- Integral flow monitor to protect the pump from running dry
- Filter mat monitoring for a high level of operational reliability
- 2 floating fault alarm relays, freely programmable
- Communication to superordinate control unit
- No additional floor space with external enclosure and machine mounting

The TopTherm chiller series, which have a cooling output range of 1 kW to 6 kW, are ideally used to supply air/water heat exchangers or Cold Plates for enclosure climate control. The space-saving compact design turns the TopTherm chiller into the perfect cooling solution for plant and machinery production, and is ideal for the supply of cold water. High Mean Time Between Failures (MTBF) is ensured thanks to the integral RiNano coating provided as standard.

Integral monitoring systems such as pump monitoring, filter mat monitoring and connection to superordinate control units ensure that the unit meets the maximum requirements in terms of reliability and availability.

Chillers for water – Floor-standing and roof-mounted

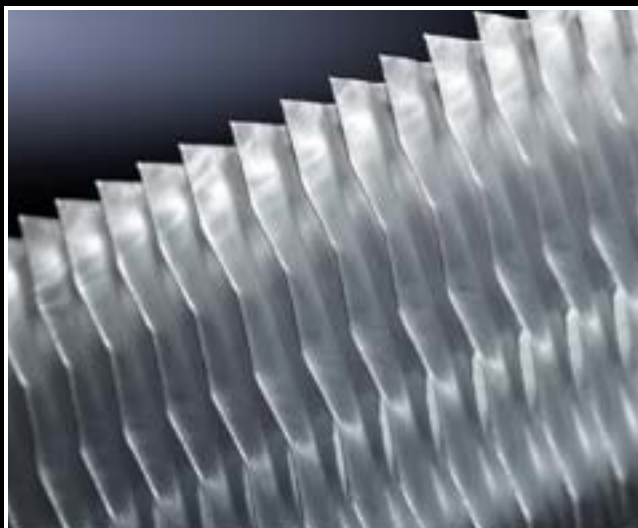
Compact design

- Cut your costs
- Preassembled, space-saving standard dimensions for enclosure assembly, ideally suited to all common enclosures
- Compact layout of the cooling components on a base plate which functions as a collecting tray



High Mean Time Between Failures (MTBF)

- RiNano coating as standard (on all heat exchanger membranes)
- Interactive, service-friendly filter mat monitoring for added reliability
- Precise temperature control, based on microprocessor technology
- Microcontroller box is easily replaceable



International

- Bifrequency version as standard
- Supports multiple voltages without rewiring
- Approvals for the world's leading markets: GS, TÜV, UL listed



Chillers for water – TopTherm wall-mounted



Therm 6.1 software Page 85 **Order information** Catalogue 33, from page 448

Benefits at a glance:

- Modular layout for enclosure assembly, partial assembly and full installation
- Integral flow monitor to protect the pump from running dry
- No additional floor space with external enclosure and machine mounting
- System messages are displayed centrally

The TopTherm chiller series, which have a cooling output range of 1 kW to 4 kW, are ideally used to supply air/water heat exchangers or Cold Plates for enclosure climate control. The space-saving compact design turns the TopTherm chiller into the perfect cooling solution for plant and machinery production, and is ideal for the supply of cold water. High Mean Time Between Failures (MTBF) is ensured thanks to the integral RiNano coating provided as standard.

Integral monitoring systems such as pump monitoring, filter mat monitoring and connection to superordinate control units ensure that the unit meets the maximum requirements in terms of reliability and availability.

Chillers for water – Wall-mounted

Flexible external mounting

- Three external mounting options provide flexibility – the same unit may be mounted fully internally, partially internally or externally.
- The available space is optimised



Ease of installation and commissioning

- Special internal or external mounting kits are not required: Quick-release couplings including the mating components, reduce the time taken for commissioning
- External access to both the water connections and the electric control unit



Integrated as standard

- Fill level display
- Filter mat monitoring
- Pump for the movement of the fluid cooling medium



Chillers for water – Modular design



Therm 6.1 software Page 85 **Order information** Catalogue 33, page 449

Benefits at a glance:

Premanufactured standard modules

- Shorter delivery times (modular design)
- Integration into TS 8 system
- Global 24-hour service availability and reduced number of spare parts

High standard specification

- High reliability thanks to the supply of an automatic water bypass valve and flow switch as standard
- More efficient refrigerant R410A

Greater flexibility

- Output range: 8 kW – 40 kW
- Small footprint thanks to vertical design
- One version for two frequencies providing international compatibility

Chillers have proved ideal for powerful, targeted climate control in industry. The new TopTherm chiller from Rittal is a particular highlight since the modular chiller covers eight cooling outputs ranging from 8 kW to 40 kW with five sizes. This translates into savings across the board, since rather than customised production, the new TopTherm chiller is a standardised climate control solution with a full performance range available off the shelf.

Well thought-out: TopTherm chillers based on the TS 8 enclosure integrate the electrical controller as well as the water and cooling module, and spare parts management is reduced to a bare minimum.

Chillers for water – Modular design

Control module

- One version for two frequencies 400 V/50 Hz, 460 V/60 Hz
- Temperature control using fixed or differential values, switchable



Chiller module

- Various air inlet options enable the chiller to be specifically tailored to cater for any site restrictions. Air inlet may be from the rear (size 8, 12 and 16 kW), or optionally from the left or right.
- Refrigerant R410A
- Modules with different outputs may be easily exchanged



Water module

- Water bypass valve supplied as standard
- Flow switch supplied as standard
- Modules with different outputs may be easily exchanged



Enclosure suites

- Two modules can be bayed together to double the cooling capacity
- Integration into existing enclosure suites is possible.



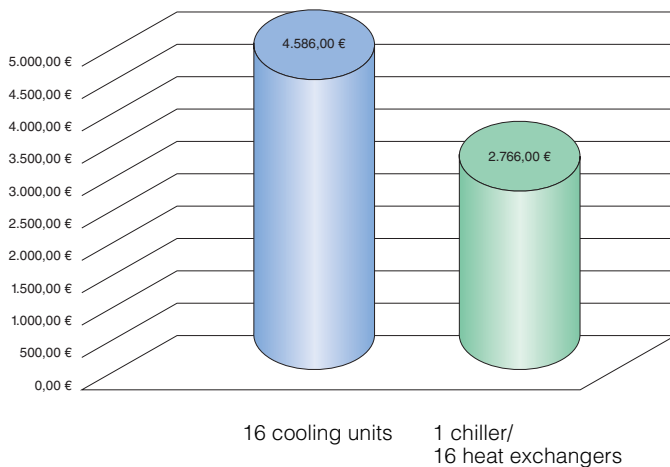
Chiller for water – Modular design

Comparative calculation of energy costs

Here, we compare the energy costs of cooling a bayed enclosure suite (heat loss 25 kW).
Cooling units versus air/water heat exchangers combined with chillers.

	Qty.	Power consumption kW per unit	Price kWh Euro	Energy costs Euro
Cooling unit for wall-mounting	8	1.02	0.12	2,923.20
Cooling unit for wall-mounting	8	0.58	0.12	1,663.20
Total		12.74		4,586.40

	Qty.	Power consumption kW per unit	Price kWh Euro	Energy costs Euro
Air/water heat exchanger	8	0.06	0.12	175.39
Air/water heat exchanger	8	0.16	0.12	463.68
Chiller in a TS 8 enclosure	1	5.91	0.12	2,126.88
Total		7.68		2,765.95



Difference
€ 1,820.45 =
approx. 40%

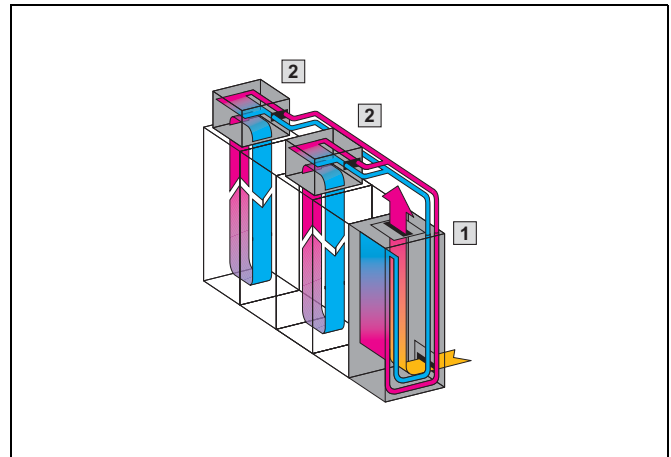
Chillers – General remarks on installation

Unit with enclosures

Chillers may be connected directly to a bayed enclosure suite, providing effective, centralised cooling of all cases and enclosures on a machine or plant.

Chillers in the TS 8 Top enclosure system are easily integrated into existing enclosure combinations. The chillers for wall and roof mounting in output categories, with cooling outputs up to 6 kW are ideally suited for applications in confined areas, due to their space-saving, compact design.

- 1 Chiller
- 2 Air/water heat exchanger, roof-mounted

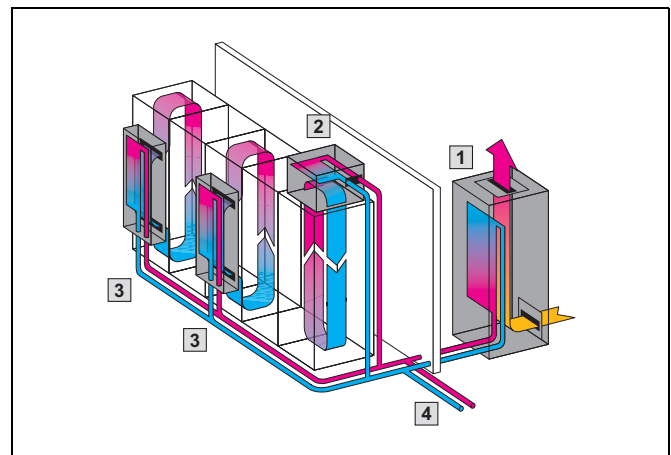


Spatial separation

High heat loads may be dissipated from awkward and confined spaces, thanks to the option of positioning the chiller remote to the enclosures and machine. In all cases, as well as enclosure cooling, cooling water may also be produced for process and machine cooling or for cooling liquid media.

Chillers, with their robust design, are the ideal stand-alone solution, and provide optimum accessibility for servicing purposes.

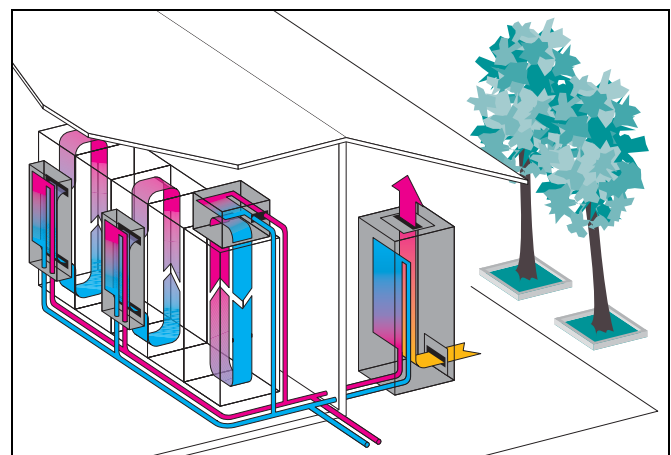
- 1 Chiller
- 2 Air/water heat exchanger, roof-mounted
- 3 Air/water heat exchanger, wall-mounted
- 4 Other cooling options, e.g. machine cooling



Outdoor siting

To avoid putting additional thermal pressure on the factory air due to the internal dissipation of heat created during a process, chillers suitable for outdoor siting may be supplied (for ambient temperatures up to -20°C).

In such cases, a rain canopy should be provided to protect the chiller from extreme weather. The water circuit must be filled with 34% anti-freeze agent Antifrogen N (or equivalent) to 66% water by volume, or with Rifrost 1:2.





Order information Catalogue 33, from page 456

Aisle containment

In server rooms that have not been designed as data centres, the permanent mixing of cooled and heated air often leads to cooling deficits. Hot-spots make the IT equipment's work more difficult.

In order to ensure efficient cooling in this type of environment, Rittal has developed three aisle containment options, two of them containing the cold aisle, and one of them enclosing the hot aisle.

Benefits at a glance:

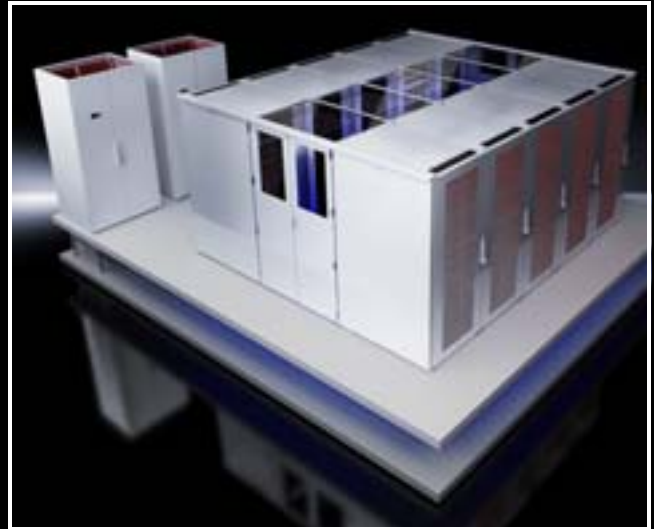
- Intake air (cold) and waste air (hot) are unable to mix
- It is possible to operate at higher temperature levels throughout the entire system
- The CRAC units run at maximum efficiency, thanks to the greater temperature difference between the cold and hot air
- Modular, scalable and upgradable
- Simple arrangement
- An inexpensive solution for the optimum cooling of existing data centres

Aisle containment

Cold aisle with raised floor

The CRAC system routes the cooled air to the cold aisle via perforated raised base plates.

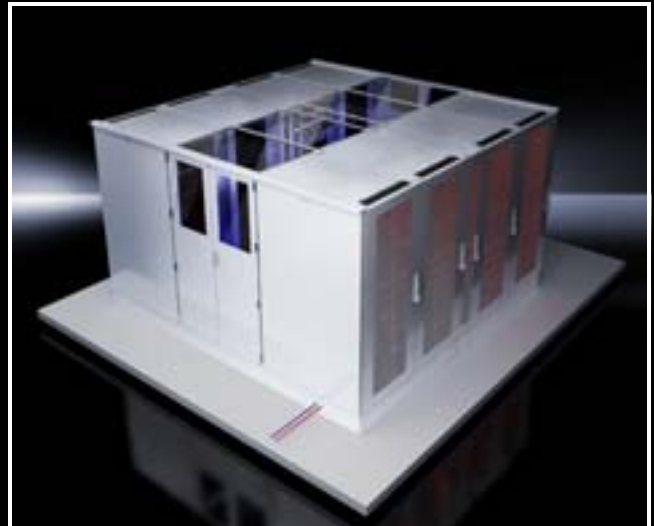
- Use of inexpensive standard CRAC cooling units sited outside of the server area
- Even with low room heights, the raised floor height is maximised for cooling air supply without flow losses
- Undisturbed and uniform distribution of cooling air in the cold aisle guarantees high efficiency
- Favourable working conditions in the cold aisle thanks to low temperature, air flow and noise factors
- Hardware racks not connected to the enclosure do not impair the cooling efficiency of the cold aisle



Cold aisle without raised floor

The LCP Inline routes the cooled air directly to the cold aisle at the front.

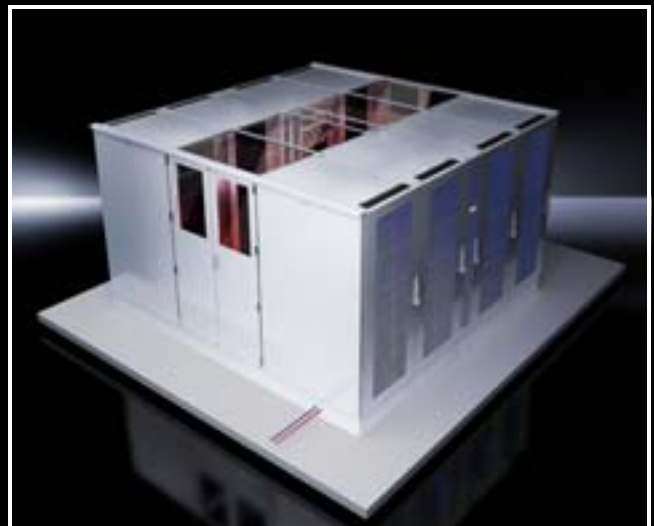
- Direct connection of the liquid cooling packages to an external cold water supply
- Simple laying of pipework in the rack base/plinth
- Homogeneous distribution of cooling air in the cold aisle guarantees a high level of efficiency
- Favourable working conditions in the cold aisle thanks to low temperature, air flow and noise factors
- Hardware racks not connected to the containment system do not impair cooling efficiency via the cold aisle
- Server rooms with lower heights may be effectively cooled



Hot aisle without raised floor

The LCP Inline extracts the hot air directly from point where it is created, optimising the performance of the cooling units and significantly increasing the overall efficiency of the system.

- Simple assembly using existing Rittal aisle containment components
- Direct connection of the Liquid Cooling Packages (TopTherm LCP Inline CW and DX) to an external cold water supply
- Simple laying of pipework in the base/plinth
- Suitable for use with high heat losses
- Room-neutral dissipation of the heat loss



CRAC system



Order information Catalogue 33, from page 456

Benefits at a glance:

- Hot air is drawn in from above, and cold air is expelled downwards into the raised floor
- Four output categories with a cooling output of 23 to 118 kW – medium: cold water (CW)
- Four output categories with a cooling output of 18 to 54 kW – medium: refrigerant (DX)
- The CRAC DX cools using external air via an external condenser unit
- Optimum energy and space efficiency thanks to intelligent design features, such as the slanted heat exchanger and base-integrated fan
- The basic variant of the units includes the base unit and the fan supporting structure for integration into the raised floor, as well as the automatic controller with graphic display, 2-way valve and integral filters
- Integration into RiZone

Room cooling with the Rittal CRAC system is an innovative technology for professional IT climate control. The emphasis here is on constant temperatures and precisely adjusted humidity.

CRAC systems dissipate waste heat from the IT equipment according to requirements, so that the entire system operates at optimum energy and cost efficiency.

CRAC system

Rittal CRAC DX system

- The refrigerant-cooled CRAC DX system operates in conjunction with an external condenser unit that utilises external air for cooling. This combination is used primarily in small locations with a low cooling output.
- The CRAC DX system operates on the principle of direct evaporation, and is fitted as standard with the innovative Energy Save Control (ESC): At reduced external temperatures, the power consumption of the compressors is reduced while at the same time, their cooling output rises, so that redundant compressors may be switched off.



Rittal CRAC CW system

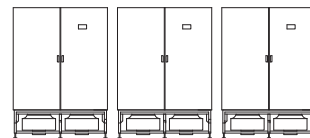
- The water-cooled CRAC CW system may be used in conjunction with a Rittal IT chiller, so that the operating costs of the system may be reduced still further with optimum use of the external temperatures.
- The CRAC CW system is designed for IT rooms with a high thermal load, and may be combined with various mechanical cooling systems such as chillers or free coolers. Thanks to the underfloor fan arrangement, the enclosure is able to accommodate a filter and heat exchanger with increased surface areas.



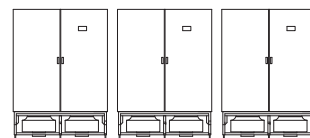
Energy saving through redundancy

- More space for larger heat exchangers and filters
- High cooling output with minimal space requirement and small footprint
- Low power consumption in year-round operation
- Very high energy-saving figures
- Low maintenance costs

**Energy saving through redundancy operation:
3.3 kW at 44000 m³/h air volume**

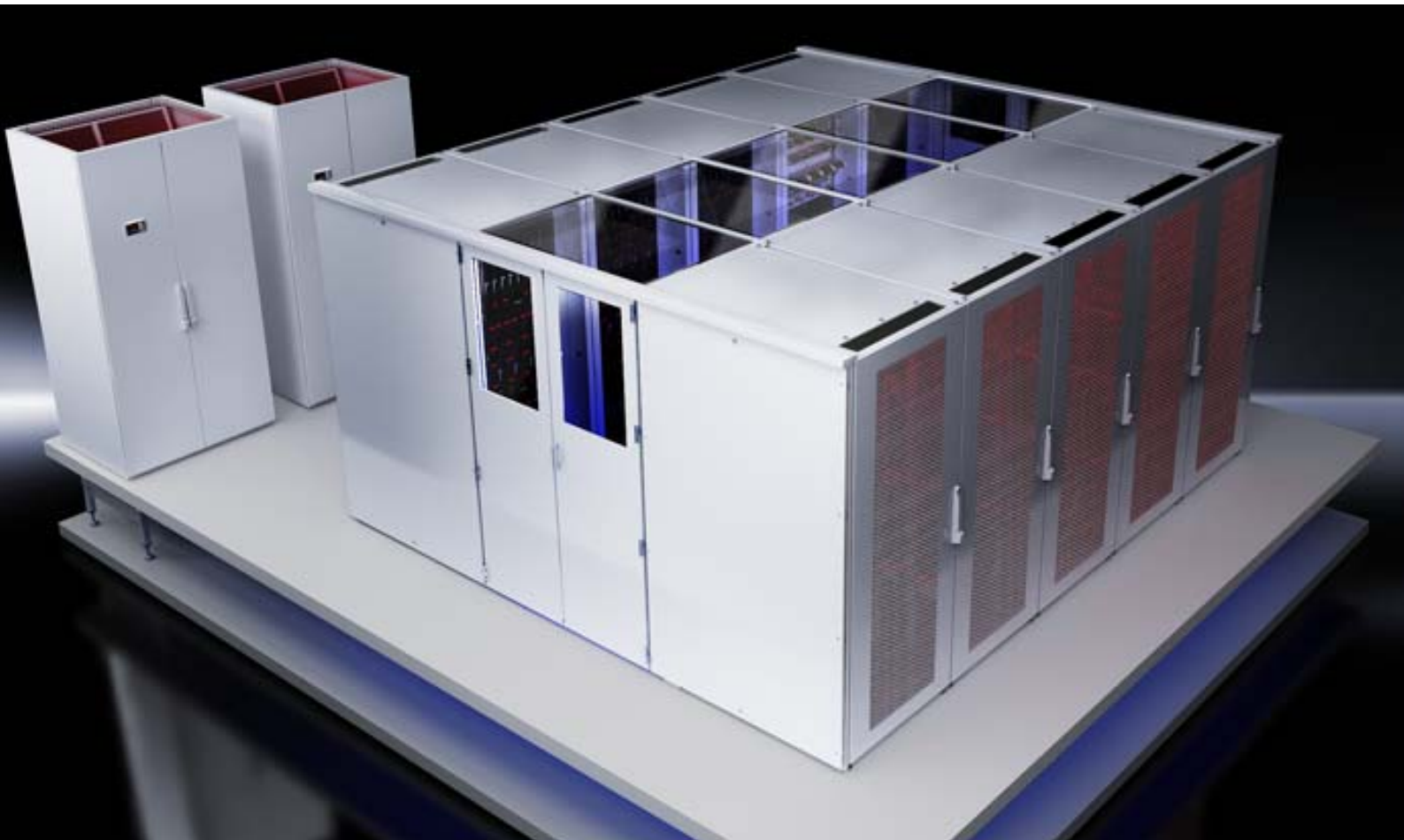


2 fan units
at full load,
1 fan unit standby:
2 x 3 kW = 6 kW



3 fan units
at partial load:
3 x 0.9 kW = 2.7 kW

CRAC CW system with cold aisle containment



Order information Catalogue 33, page 460

By using Rittal cold aisle containment in conjunction with the Rittal CRAC system, you can optimise climate control of the room in terms of energy efficiency and cooling output.

- High energy efficiency
- Increased cooling output per server rack
- Easily retro-fitted to existing systems
- Protection of your existing infrastructure
- The Mean Time Between Failures (MTBF) of existing systems can be significantly extended

Instead of flooding the room with cold air, this Rittal concept routes the cold air directly to the equipment via the cold aisle. Cold air is directed across the whole height of the enclosure, ensuring that there are no hot-spots, and the hot air is exhausted out of the system. Due to the cold aisle being contained, there is no chance of the hot exhaust air mixing with the cold inlet air, leading to an increase in system efficiency.

The outstanding energy efficiency of the Rittal cold aisle concept has a simple explanation:

1. The intake air (cold) and waste air (hot) cannot mix.
2. The system may be operated at a significantly higher temperature level.
3. Thanks to the increased temperature difference between the intake air and waste air, the cooling performance and efficiency of the climate control units are optimised.

Sample calculation

Step 1: Raise the water inlet temperature

Q_{total} (Q_{sens.})	80 kW (80 kW) – 79.9 kW (79.9 kW)
T_{air; hot} (rel. humidity)	26 °C (45%) – 31 °C (32%)
T_{air; cold} (rel. humidity)	15 °C (89%) – 19.8 °C (62.2%)
T_{water; inlet}	10 °C – 15 °C
T_{water; return}	15 °C – 20 °C
P_{electr. for cold water}	190 MWh/a – 139 MWh/a

The temperature in the cold aisle is precisely definable and identical throughout, thanks to optimised temperature distribution.

- Increasing the air intake temperature also increases the waste air temperature.
- Increasing the air intake temperature improves the performance of free cooling.

Possible energy saving in the production of chilled water: up to 26%.

–26%

Step 2: Reduce the volumetric air flow

Q_{total} (Q_{sens.})	79.9 kW (79.9 kW) – 88.4 kW (88.4 kW)
T_{air; hot} (rel. humidity)	31 °C (32%) – 36 °C (25%)
T_{air; cold} (rel. humidity)	19.8 °C (62.2%) – 19.7 °C (64.6%)
V_{air} (ext. press.)	22000 m³/h (80 Pa) – 17000 m³/h (20 Pa)
P_{electr. for CRAC fan}	3.6 kW – 1.5 kW

For a constant air volume flow rate, the cooling output improves with airside temperature difference.

- By reducing the volumetric air flow, the return waste air temperature is increased,

Possible energy saving in the operation of the fans: up to 60%.

–60%

Step 3: Reduce the throughput

Q_{total} (Q_{sens.})	88.4 kW (88.4 kW) – 80 kW (80 kW)
T_{air; hot} (rel. humidity)	36 °C (25%) – 36 °C (25%)
T_{air; cold} (rel. humidity)	19.7 °C (64.6%) – 21.3 °C (54.2%)
T_{water; inlet}	15 °C – 15 °C
T_{water; return}	20.6 °C – 23.5 °C
V_{water} (P_{electr.})	13.6 m³/h (3 kW) – 8.1 m³/h (2.3 kW)
P_{electr. for cold water}	143 MWh/a – 125 MWh/a

The speed of the pump may be reduced because a smaller amount of cooling water is required to provide the same cooling output if the return water temperature is increased.

Possible energy saving in the operation of the pump: up to 14%.

Potential saving in the production of chilled water: up to 17%.

–17%

Summary

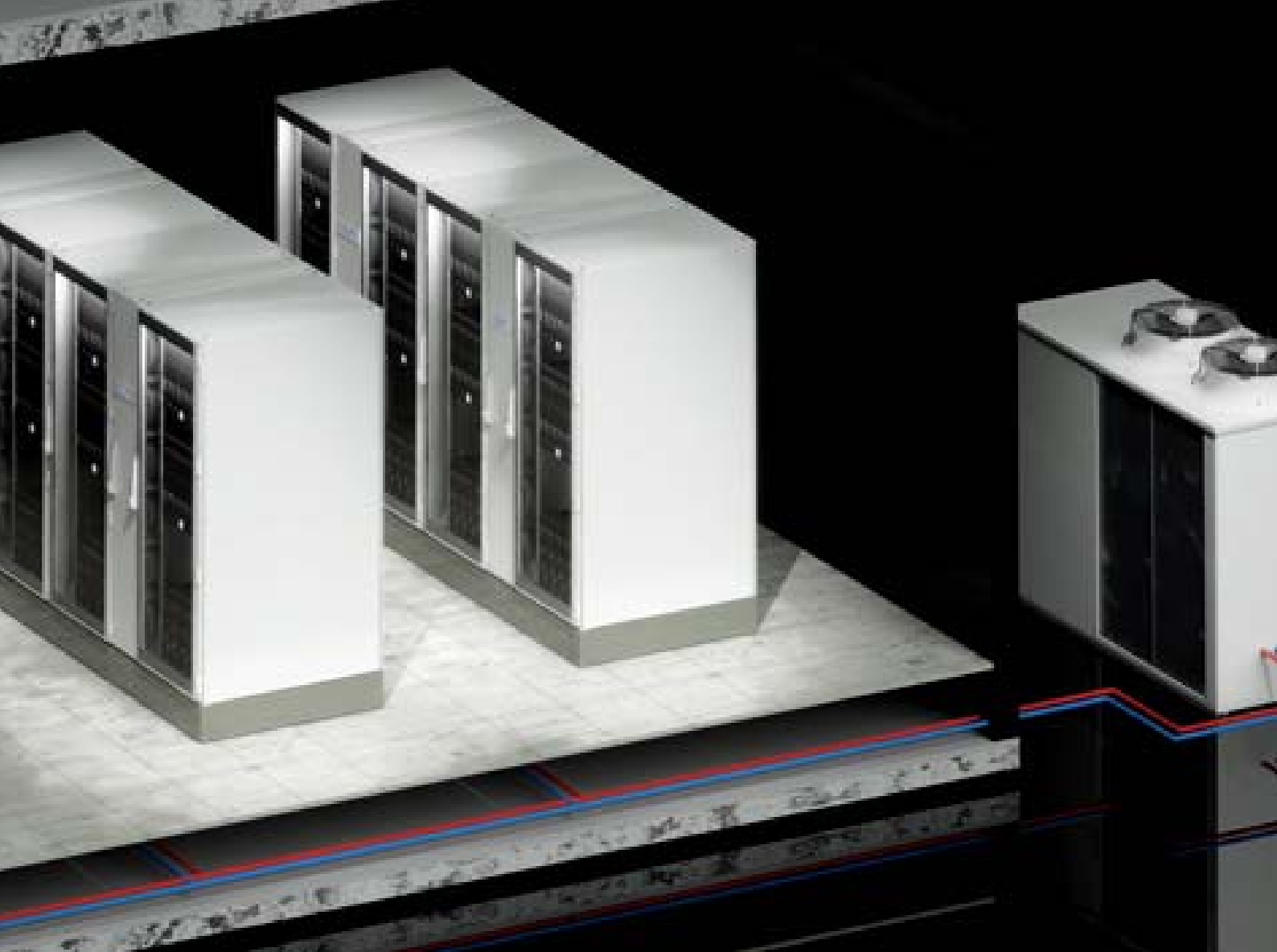
Q_{total} (Q_{sens.})	80 kW (80 kW) – 80 kW (80 kW)
T_{air; hot} (rel. humidity)	26 °C (45%) – 36 °C (25%)
T_{air; cold} (rel. humidity)	15 °C (89%) – 21.3 °C (54.2%)
V_{air} (ext. press.)	22000 m³/h (80 Pa) – 17000 m³/h (20 Pa)
T_{water; inlet}	10 °C – 15 °C
T_{water; return}	15 °C – 23.5 °C
V_{water} (P_{electr.})	13.8 m³/h (3 kW) – 8.09 m³/h (2.3 kW)
P_{electr. for CRAC fan}	3.6 kW – 1.5 kW
P_{electr. for cold water}	190 MWh/a – 125 MWh/a
P_{electr. Total}	248 MWh/a – 158 MWh/a

Energy saving:

- Fans: 19 MWh/a
- Pumps: 6 MWh/a
- Cold water production: 65 MWh/a
- Overall: 90 MWh/a

Cost saving with Rittal aisle containment: up to 36%.

–36%



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Liquid Cooling Package

Data centres support corporate process with ever-growing output. The packing density in computer systems is increasing, and processor capacity is growing.

This leads to a continuous growth in heat development. You can keep temperatures at a constant level with the highly efficient Rittal Liquid Cooling Packages. With optimised operating costs, our LCPs precisely and effortlessly dissipate heat losses of up to 60 kW per enclosure.

Rittal bayed suite climate control is extremely powerful and the ideal solution for extremely high cooling demands, particularly when the cooling of server racks cannot be achieved via the room climate control. Alternatively, bayed suite cooling can be used to support the existing climate control system in the room or for transforming existing structures into server rooms. A raised floor is not necessary for the operation of suite cooling.

Liquid Cooling Package

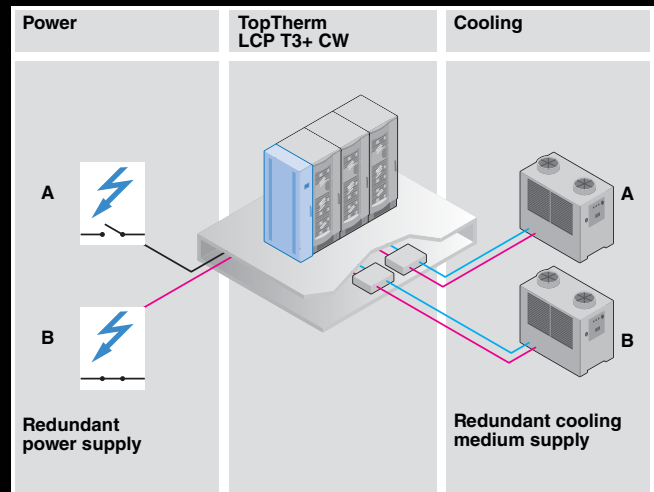
Rack climate control

- Cooling output from 10 kW to 60 kW
- Energy saving with high water inlet temperatures (more free cooling)
- Minimisation of operating costs with efficient EC fan technology
- Spatial separation of cooling and server rack
- Integral condensate and leakage management
- Highly developed control concept including online connection
- Optional cooling of one or two server racks
- Simple emulation of redundancies
- Assembly- and service-friendly
- Integration into RiZone (data centre management software)
- Cooling output scalable through the number of fan modules



Redundancy with TopTherm LCP T3+ CW

- Redundant heat exchanger concept with two active water circuits (A/B medium supply)
- Redundant power infeed (A/B power supply) with automatic changeover in case of an emergency
- Fully redundant cooling output of 25 kW
- Redundant fan configuration
- Integrated controller with own web server for network and BMS interfaces
- Auto-load balancing function
- Auto-recovery function
- Energy saving with high water inlet temperatures (more free cooling)
- Minimisation of operating costs with efficient EC fan technology
- Integration into RiZone



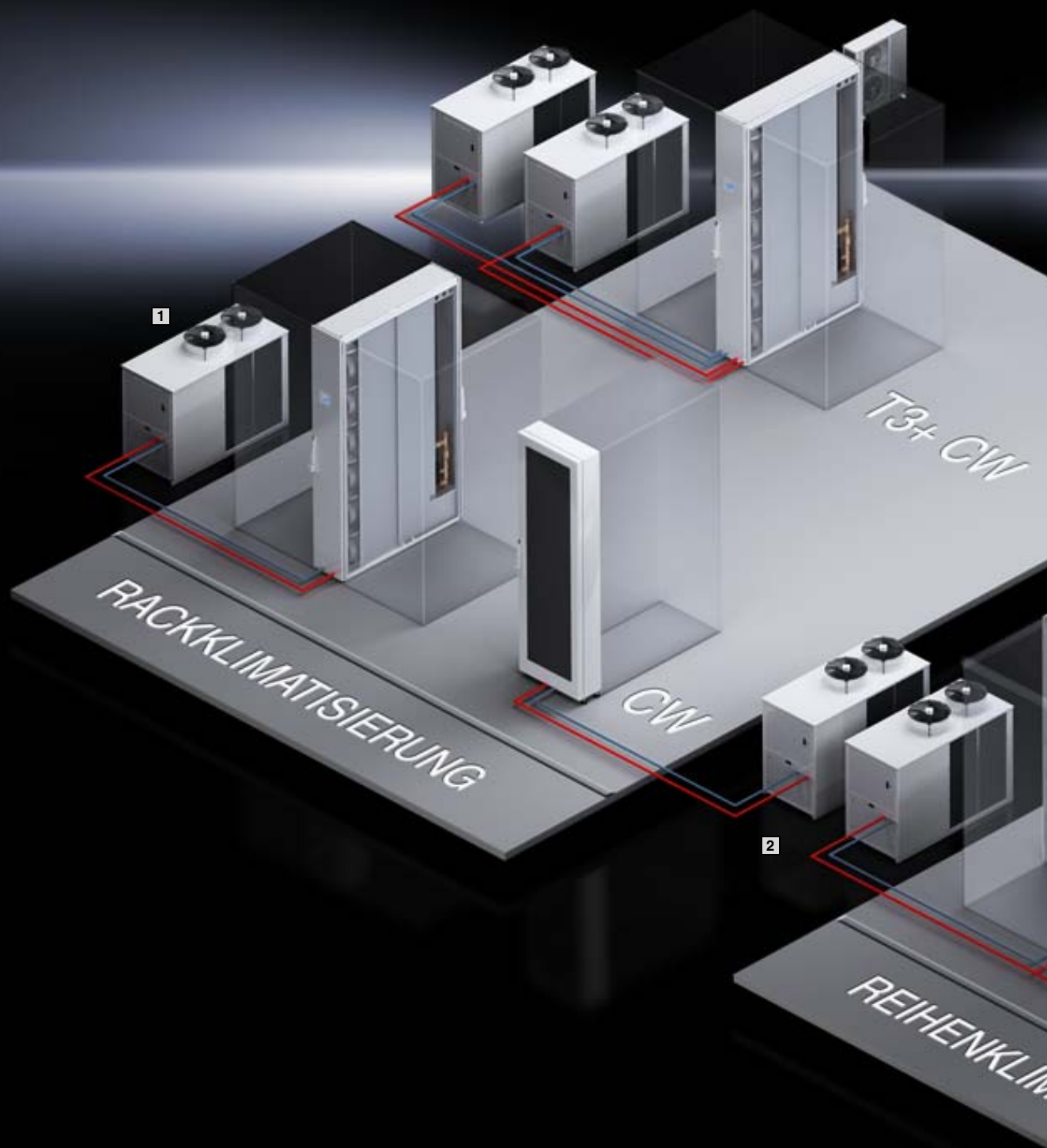
Bayed climate control

The unit is designed for siting within a bayed enclosure suite. The hot air is drawn in from the room or hot aisle at the rear of the device and expelled at the front into the room or cold aisle after cooling.

- Cooling output 60 kW
- Cooling of several server racks
- Energy saving with high water inlet temperatures (more free cooling)
- Minimisation of operating costs with efficient EC fan technology
- Spatial separation of cooling and server rack
- Integral condensate and leakage management
- Highly developed control concept including online connection
- Assembly- and service-friendly
- Optional front cover to reduce the air outlet speed and for superior air distribution
- Increased performance and efficiency in conjunction with Rittal aisle containment
- Integration into RiZone
- Cooling output scalable through the number of fan modules

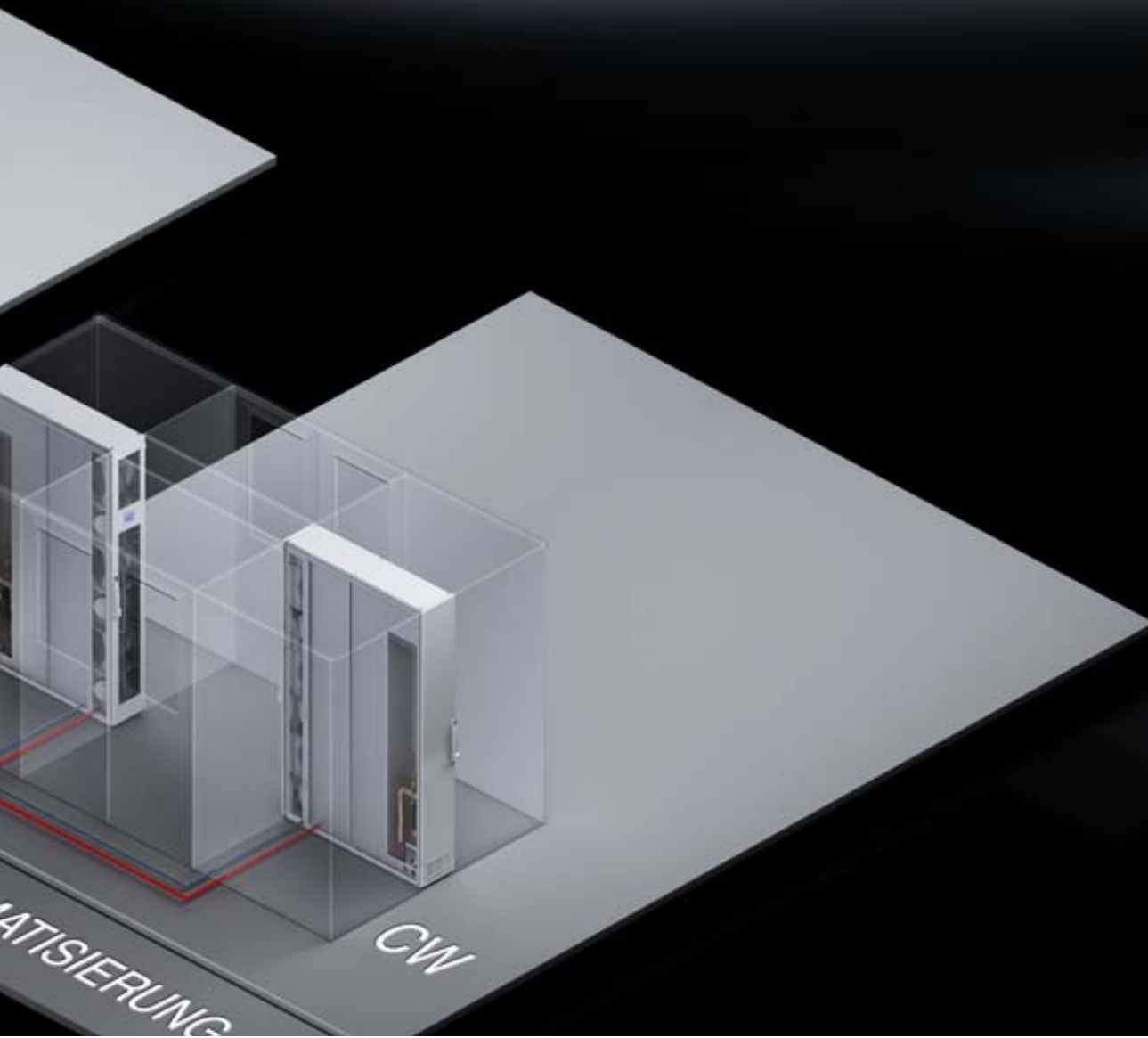


Liquid Cooling Package



Climate control of your data centre is becoming ever more important in terms of availability and energy costs. The Rittal Liquid Cooling concepts ensure precise, problem-free heat loss dissipation of up to 60 kW per rack.

Liquid Cooling Package



- 1 Rack climate control CW via chiller
- 2 Bayed climate control CW via chiller

CW = Chilled Water

Liquid Cooling Package



Rack climate control

The LCP for rack climate control is designed for siting within a bayed enclosure suite. The cold air is expelled sideways on the front of the servers, and warm air is drawn back in at the rear. The LCP for rack climate control is ideal for maximum cooling performance and maximum fail-safeness, thanks to redundancy of all key components.		A large-scale high-capacity air/water heat exchanger, designed as the rear door of the server enclosure, ensures that heated waste air from the servers is cooled down to server intake air level. This is achieved extremely energy-efficiently, because no electrical power is required for fans. High inlet temperatures above the dew point improve energy efficiency still further.	
Technology CW = Chilled Water T3+ = for Tier 3	CW	T3+ CW	CW
Output kW	10, 20, 30, 40, 50, 60	25	20
Cooling medium	Water	Water	Water
Auto-load balancing	–	■	–
Auto-recovery	–	■	–

Liquid Cooling Package



Bayed climate control

The LCP for bayed climate control is designed for siting within a bayed enclosure suite. The hot air is drawn in from the room or hot aisle at the rear of the device and expelled at the front into the cold aisle after cooling. The LCP for inline bayed climate control achieves maximum performance and efficiency in conjunction with Rittal cold aisle containment.

Technology CW = Chilled Water	CW Set forward variant	CW Flush variant
Output kW	10, 20, 30, 40, 50, 60	30
Cooling medium	Water	Water
Auto-load balancing	–	–
Auto-recovery	–	–

Chillers for IT cooling



Order information Catalogue 33, from page 454

Benefits at a glance:

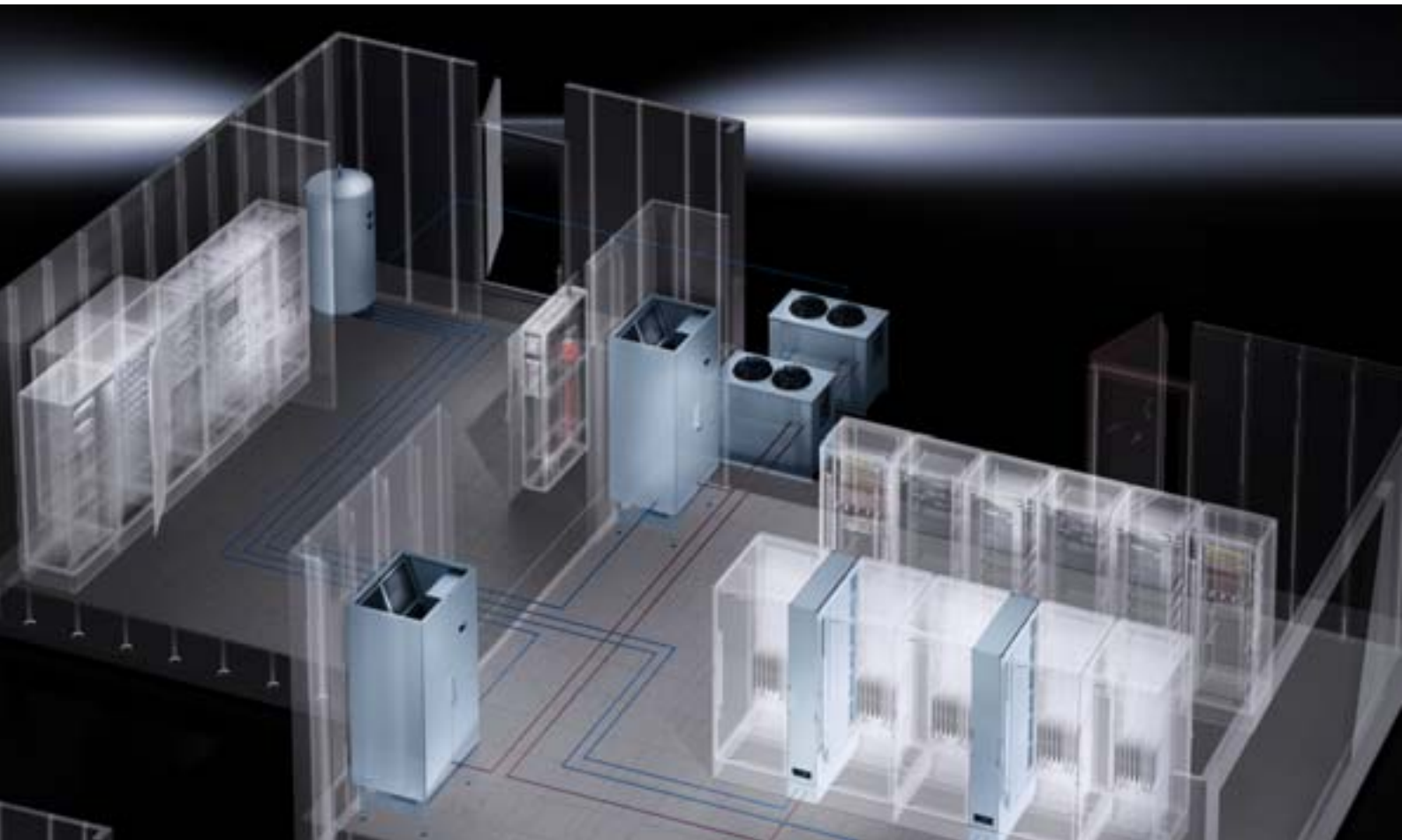
- Redundant pumps, speed-regulated
- Redundant scroll compressor
- Intelligent control concept
- Interfaces: SNMP, BACnet
- Integral or separate free coolers (optional)
- Integral automatic bypass valve
- Flow monitor
- Minimisation of operating costs thanks to high water inlet temperatures for LCP and CRAC operation
- High COP (coefficient of performance)
- Integration into RiZone

The Rittal IT chiller in conjunction with free cooling supplies media for exceptionally energy- and cost-efficient IT cooling. The system is specially designed for cooling critical IT applications via Liquid Cooling Packages (LCP), air/water heat exchangers or CRAC systems. In this atmospherically sealed system, redundant, speed-regulated pumps, compressors, emergency cooling or buffer stores ensure optimum operational reliability and fail-safeness. Alongside

optional heat recovery from the system, the connection to the Rittal free cooling recooling systems ensures exceptionally energy-efficient operation. Free cooling uses cold ambient air for cooling, reduces operating costs by up to 80%, extends the service life of components, and increases operational reliability.

If the free cooling performance is insufficient, the IT chiller will cut in.

Piping systems

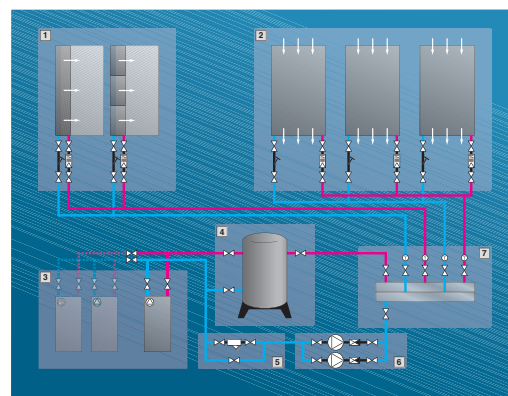


Benefits at a glance:

- Pipeline systems are part of a turnkey solution for the targeted cooling of IT operating environments
- Media network for the connection of coolers (IT chillers) and cooling equipment (liquid cooling package and CRAC systems)
- Free scalability of chiller and equipment output via hydraulic separation of the producer and equipment sides
- Use of a hydraulic separating filter with dual function as a buffer store
- Maximum energy efficiency thanks to the use of polypropylene piping with low pipe friction losses
- Systems are suitable for the use of cold water and water/antifreeze mixtures (glycol)
- Media pumping redundancy by fitting every chiller with its own primary pump and via the use of redundant main pumps on the equipment side

Efficient cooling solutions rely on an excellent infrastructure. The Rittal piping system provides the link between the equipment and the refrigeration system. An optimum design and targeted media supply ensure efficient operation of all cooling components. This also includes safety-relevant options such as redundant pumps, emergency cooling or buffer stores.

- | | |
|--|---|
| 1 Direct cooling systems (e.g. LCP) | 5 Dirt collector station with maintenance bypass |
| 2 CRAC systems | 6 Main pump (redundant) |
| 3 IT chiller | 7 Compact distributor with lockable outlets |
| 4 Buffer store | |



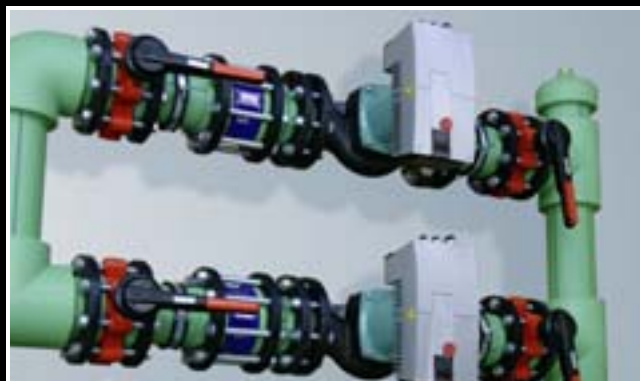
Piping systems

Speed-controlled pump

Speed-controlled pumps are used to convey the coolant. The pumped volume may be varied by using state-of-the-art EC motors.

Your practical benefit:

Lower energy consumption thanks to “cold water on demand”. Only the volume of water that is actually needed for cooling is moved through the system.



Standard hydraulic layout

The standard hydraulic layout includes the use of a hydraulic separating filter. Different volumes of water on the producer side and equipment side for process cooling do not adversely affect the function of the cooling systems.

Your practical benefit:

Less energy consumption via the use of free cooling heat exchangers including redundancy. Chiller pumps may be activated and deactivated as required.



Use of compact distributors

Use of compact distributors to distribute the cooling medium among different pieces of equipment.

Your practical benefit:

Redundancies in the supply lines to the equipment may be designed as required. For example, a layout can be designed to facilitate the automatic shut-off of sub-sections in the event of pipe leaks.



Innovative pipework

The innovative polypropylene piping is distinguished by minimal pipe friction resistance.

Your practical benefit:

Less energy consumption for conveying the cooling medium, thanks to lower flow resistance. The material is corrosion-resistant and may be machined without residues.





Order information Catalogue 33, from page 203 – 209

CS Outdoor climate control

Benefits at a glance:

- The IP 55 protection category of the enclosures is retained
- Hermetically separate air circuits – Contaminated ambient air is unable to ingress the enclosure
- Backup-compatible 48 V DC air/air heat exchangers
- Integral heater in many units

Please note:

- CS Outdoor cooling units and CS Outdoor heat exchangers are manufactured to order
- CS Outdoor cooling units and CS Outdoor heat exchangers are supplied as fully integrated units on the CS Outdoor enclosure. Mounting on other Rittal enclosures is only possible by arrangement.

The Rittal Outdoor range offers everything you need to protect your electronic equipment, from weather-tested enclosure solutions, to a variety of climate control components, through to complete security management systems. Cooling units, heat exchangers, fans and heaters especially designed for outdoor use ensure constant interior temperatures. A protection category of IP 55 is retained for the system as a whole when using Outdoor heat exchangers and cooling units. Rittal has conducted in-depth studies and accumulated wide-ranging expertise in the calculation and design of climate control units for outdoor siting.

Rittal offers a free calculation service for determining the required output of climate control units in outdoor applications. The broad range of products and materials offers maximum protection for your equipment, tested to international provisions and standards such as IEC, ETSI, Bellcore, NEMA and UL. With this wide variety of materials, Rittal is able to achieve the level of corrosion protection required for a specific location.

Flexibility

Climate control modules of various cooling outputs, may be positioned on the door, rear panel, side panel or roof of the modular enclosure.

The climate control modules provide flexibility of installation with three mounting positions, full internal, partial internal or external and the choice of between cooling via the front or rear door of the CS Toptec.

Suitable for use within a temperature range from -33°C to $+55^{\circ}\text{C}$ (cooling units) or $+65^{\circ}\text{C}$ (heat exchangers). Many units feature an integral heater.



Standardised installation

The full 25 mm double wall takes care of heat exchange and minimises the influence of sunlight, featuring an active climate control concept with fixed cut-out sizes and a mounting frame for depth-variable positioning of the climate control unit. Depending on the local conditions at the installation site, either a heat exchanger or a cooling unit may be used.



Quality

Maximum cathodic edge protection is achieved by the choice of materials. Additional zinc phosphating significantly enhances the protective effect of galvanising. The subsequent high-quality powder coating offers additional protection and allows individual colouring.

Optimum rust-proofing at a moderate cost – Analyses by neutral laboratories underscore our high quality standards.



CS Outdoor climate control



Order information Catalogue 33, page 468

Air/air heat exchangers and cooling units for CS Toptec

Benefits at a glance:

- With sealing frame for universal attachment in 3 positions: internal, partial internal and external
- Air/air heat exchangers, specific thermal output 85 W/K and 105 W/K
- Cooling units, useful cooling output 1000 W – 1750 W

At many locations worldwide, a temperature range of more than 50 K (e.g. minimum temperature -15°C and maximum temperature $+40^{\circ}\text{C}$) has been measured in outdoor installations. When using equipment suitable for outdoor use, which operates correctly at interior temperatures of up to $+55^{\circ}\text{C}$, an air/air heat exchanger may be used for climate control purposes. The air/air heat exchanger has hermetically separated air circuits and uses the ambient air to cool the raised interior temperature at the heat exchanger module. With a correctly designed heat exchanger, this climate control

concept is capable of limiting temperatures inside the enclosure which are 10 K higher than the ambient temperature. The application range of the installed components is crucial when selecting the right climate control unit. If equipment intended for indoor applications is used outdoors at an ambient temperature of up to approximately $+35^{\circ}\text{C}$, a compressor cooling unit must be used. Only cooling units can achieve temperatures in the enclosure interior which are lower than the ambient temperature.



Order information Catalogue 33, page 469

Air/air heat exchangers and cooling units for CS modular enclosures

Benefits at a glance:

- Air/air heat exchangers for roof mounting, spec. thermal output 30 W/K
- Cooling units for roof mounting, useful cooling output 720 W – 1020 W
- Cooling units for wall mounting, useful cooling output 750 W – 1050 W
- Cooling units for partial internal mounting, useful cooling output 1250 W – 1600 W

Protection of the installed equipment is of central importance in many locations, particularly outdoor enclosures which may be sited in public spaces, need to be cleverly designed to protect against unauthorised access. Depending on the enclosure platform, the specified design principles are incorporated into the standard enclosure.

Some basic design principles:

- No externally visible or accessible screws. If screws are unavoidable, special screw heads are used.

- Minimal gap between doors and side panels, no leverage points.
- Modified closure and lock concepts, e.g. 3-point lock or better.

The basic design of the enclosures also plays a major role with regard to additional heating from sunlight: While single-walled enclosures can heat up to extreme levels, the chimney effect resulting from a twin-walled design reduces the influence of sunlight.



Project planning Page 82 **Order information** Catalogue 33, page 471

Enclosure heaters

Enclosure heaters are used to prevent the formation of condensation inside the enclosure and maintain a constant minimum operating temperature (e.g. when the system is switched off overnight).

Rittal TopTherm heaters, with self-regulating PTC technology, ensure constant heat distribution with outputs in the range; of 10 W – 150 W, for those not fitted with a fan and 250 W – 800 W for fan assisted variants. For heaters with fans, a minimum safety clearance of 300 mm at the top must be observed, and the equivalent figure for heaters without fans is 100 mm. In each case the thermal safety clearance to the sides of 60 mm, and 100 mm at the bottom is required.

Fast assembly system:

- Quick terminal connection for power supply
- Terminal suitable for parallel connection of an additional heater
- Minimal wiring work

Superior efficiency:

- Energy-saving self-regulating PTC technology
- Superior thermal output with an identical construction size
- Constant distribution of heat

Greater flexibility:

- Output range: 10 – 800 W
- Attachment on a 35 mm top hat rail or mounting plate

Enclosure heaters

Fast assembly

- Snap-fastening onto 35 mm support rails EN 50 022
- Direct screw-fastening onto the mounting plate
- Quick terminal connection for power supply (spring terminal)
- No need for any other terminals
- No wiring required



Energy-efficient design

- PTC technology for constant heat distribution
- Computational Fluid Dynamics (CFD)-assisted design for superior heating performance with an identical construction size



Output range

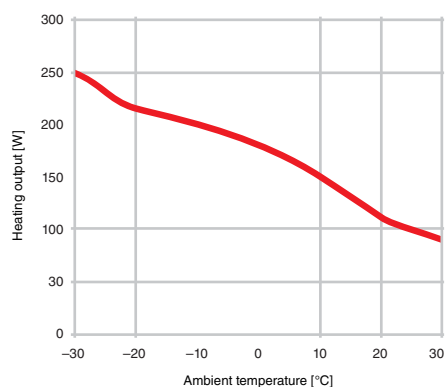
- Without fan 10 W, 20 W, 30 W, 50 W, 75 W, 100 W, 150 W
- With fan 250 W, 400 W, 800 W
- Voltage ranges
 - 110 V – 240 V, 50/60 Hz
 - 115 V, 50/60 Hz
 - 230 V, 50/60 Hz



Self-regulating PTC technology

Energy-efficient PTC technology and an optimised design using computational fluid dynamics (CFD) permit improved heating outputs from units of the same size compared to the previous product versions.

Heating performance diagram for a PTC heater



Enclosure heaters

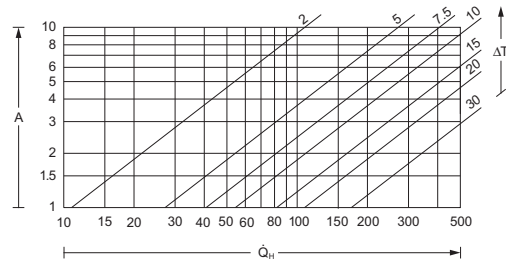
Project planning

Enclosure heaters

The required thermal output is calculated from:

$$\dot{Q}_H = A \cdot \Delta T \cdot k$$

Heating performance diagram



$\dot{Q}_H$ = Thermal output (W)

A = Enclosure surface area to IEC 890 (m²)

ΔT = Temperature difference (K)

Based on:

Interior siting, static air,
heat transfer coefficient $k = 5.5 \text{ W/m}^2 \text{ K}$

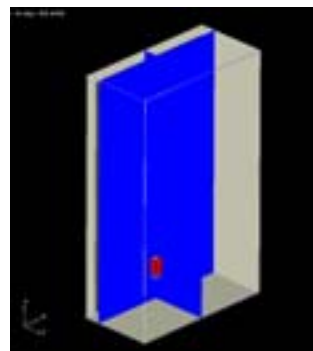
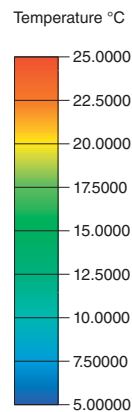
For exterior siting (moving air):

Double the determined thermal output

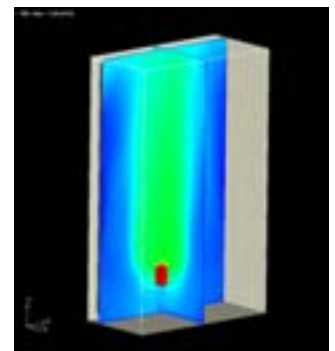
Even temperature distribution

Via a CFD analysis, even temperature distribution in the (empty) enclosure is observed when using a 400 W enclosure heater following a heating period of approx. 30 minutes.

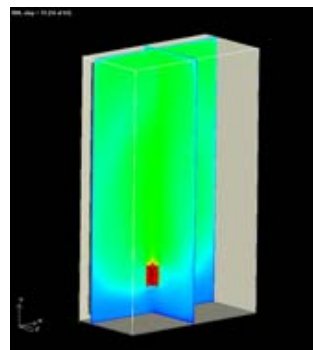
According to the CFD analysis, positioning of the enclosure heater in the base area of the enclosure is essential for even temperature control of the enclosure, since those areas located beneath the heater are only minimally warmed.



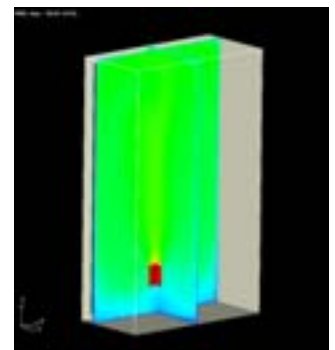
Start



After 5 minutes



After 15 minutes



After 30 minutes

Protection categories

Sealing of the enclosure

To ensure fault-free cooling operation, the enclosure should be sealed. A minimum protection category of IP 54 should be ensured. The IP classification to IEC 60 529 describes resistance to the ingress of solid or liquid substances. The first digit in the IP designation refers to solid objects (dust), and the second to water.

Protection against foreign objects			Moisture protection		
	Description	Explanation		Description	Explanation
IP 1X	Protected against solid foreign objects with a diameter of 50 mm and greater	The object probe (a sphere 50 mm in diameter) must not penetrate fully ¹⁾ .	IP X1	Protected against vertically falling water drops	Vertically falling drops shall have no harmful effects.
IP 2X	Protected against solid foreign objects with a diameter of 12.5 mm and greater	The object probe (a sphere 12.5 mm in diameter) must not penetrate fully ¹⁾ . The articulated test finger may penetrate up to its length of 80 mm, but adequate distance must be adhered to.	IP X2	Protected against vertically falling water drops when the enclosure is tilted up to 15°.	Vertically falling drops must not have any harmful effects when the enclosure is tilted up to 15° on either side of the vertical.
IP 3X	Protected against solid foreign objects with a diameter of 2.5 mm and greater	The object probe (a sphere 2.5 mm in diameter) must not penetrate fully ¹⁾ .	IP X3	Protected against spraying water	Water sprayed at an angle of up to 60° on either side of the vertical shall have no harmful effects.
IP 4X	Protected against solid foreign objects with a diameter of 1 mm and greater	The object probe (a sphere 1.0 mm in diameter) must not penetrate fully ¹⁾ .	IP X4	Protected against splashing water	Water splashed on the enclosure from any direction shall have no harmful effects.
IP 5X	Dust-protected	The ingress of dust is not fully prevented, but dust may not enter to such an extent as to impair satisfactory operation of the device or safety.	IP X5	Protected against water jets	Water directed at the enclosure from any direction in a jet shall have no harmful effects.
IP 6X	Dust-tight	No ingress of dust at a partial vacuum of 20 mbar inside the enclosure.	IP X6	Protected against powerful water jets	Water directed at the enclosure from every direction in a powerful jet shall have no harmful effects.
			IP X7	Protected against the effects of temporary immersion in water	Water must not ingress to such an extent as to cause harmful effects when the enclosure is immersed in water under standardised pressure and time conditions.
			9K	Water during high-pressure/steam-jet cleaning ²⁾	Water directed at the enclosure from every direction under greatly increased pressure must not have any adverse effects.

¹⁾ The full diameter of the object probe must not pass through an opening of the enclosure.

²⁾ Code number 9K to DIN EN 40 050, part 9.

¹⁾ The full diameter of the object probe must not pass through an opening of the enclosure.

²⁾ Code number 9K to DIN EN 40 050, part 9.



Order information Catalogue 33, from page 473

Climate control accessories

Benefits at a glance:

- Complete system solutions
- Perfectly coordinated components

Finding the perfect climate control solution is now even easier with the right system accessories that adapt the climate control components perfectly to your requirements. From parameter setting to targeted air routing and precise control of the equipment, Rittal has the right solution for all of your needs.

Climate control accessories

Air routing

Air duct and air deflector systems for targeted air routing and deflection in all areas of the enclosure.



Software

For planning and calculation of precision, efficient climate control solutions as well as tools for diagnosis, maintenance and long-term data logging.



Monitoring

Interlinking of cooling units and air/water heat exchangers in master/slave mode.
Control including climate alarm warning in the enclosure with the CMC III monitoring system.



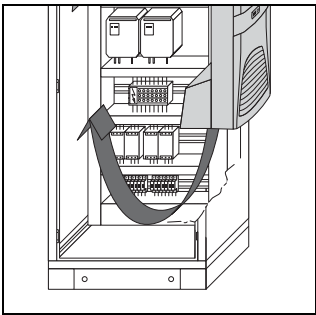
Air routing

Air diverter systems

For wall-mounted units

Used in conjunction with climate control side panels and TopTherm wall-mounted cooling units for targeted air routing of the cold air in a downward direction. Particularly well-suited for densely-packed electrical components in the lower section of the enclosure.

See Cat. 33, page 475.



Air duct system

For TopTherm roof-mounted cooling systems

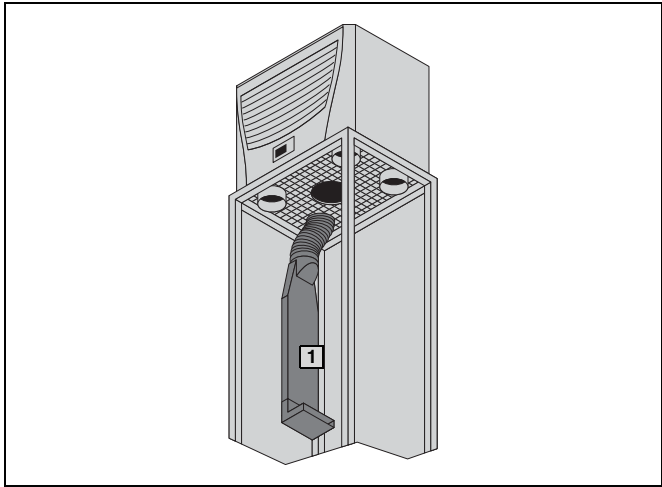
It is possible to route the cold air directly to specific areas of the enclosure using the air duct system. The risk of "short circuits" in the air circulation due to self-ventilated installed devices is therefore eliminated.

Note:

- Never direct the cold air flow straight at active components.
- Route the air duct system directly downwards with no bends.
- Cold air must be able to escape unobstructed at the end of the duct.
- Additional deflections will reduce the useful cooling output.
- When using the ducting system, the performance of the cooling unit may be reduced, depending on the respective application.

The air duct system should not be extended.

CAUTION Risk of icing!



Accessories:

- 1** Air duct system for roof-mounted units, see Cat. 33, page 473/474.

Stoppers

For TopTherm roof-mounted cooling systems

For sealing cold air outlets that are not required in cooling units and air/water heat exchangers.

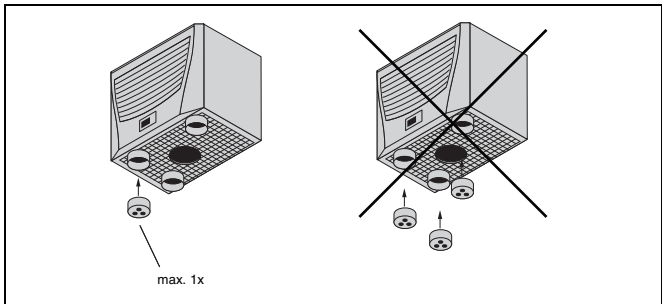
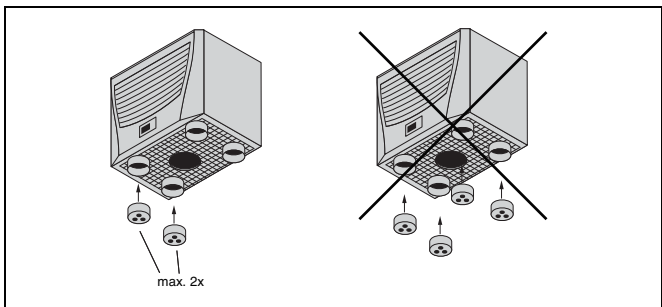
Note:

At least two outlet openings must always remain open!

Please note that if two or three openings are closed, the cooling output may be reduced by 20% and 30% respectively!

For units	Max. no. of stoppers per unit	Packs of	Model No. SK
SK 3359.../SK 3382....	1	2	3286.780
SK 3209.../SK 3210.../ SK 3273.../SK 3383.../ SK 3384.../SK 3385....	2	2	3286.880
SK 3386.../SK 3387....	1	2	3286.980

See Cat. 33, page 474.



Software

Therm 6.1 software

Precision, efficient climate control

Rittal Therm undertakes the time consuming calculation of the required cooling or heating power and selects the matching products.

Benefits:

- Fast and thorough determination of the required climate control measures
- Determining the correct climate control measures leads to cost savings
- Easy calculation of the required actual cooling output, as well as any upgrades or enhancements to the switchgear
- Detailed documentation is supplied with the calculation

Note:

Your free 30-day trial version may be downloaded at www.rittal.com



RiDiag II

For the diagnosis of cooling units in the Comfort series

RiDiag II is a diagnostic, maintenance and long-term data logging program for our Comfort range of cooling units. Every diagnosis check can be saved to serve as documentation of the operating response. All setting parameters such as enclosure internal temperature, sensitivity of filter mat monitoring etc. may be edited and saved via RiDiag II.

Benefits:

The following data may be retrieved after connecting to a PC:

- Error messages that have arisen and their frequency and timing
- Maximum ambient temperature that has occurred
- Minimum enclosure interior temperature that has occurred
- Duty cycle and capacity utilisation of cooling unit

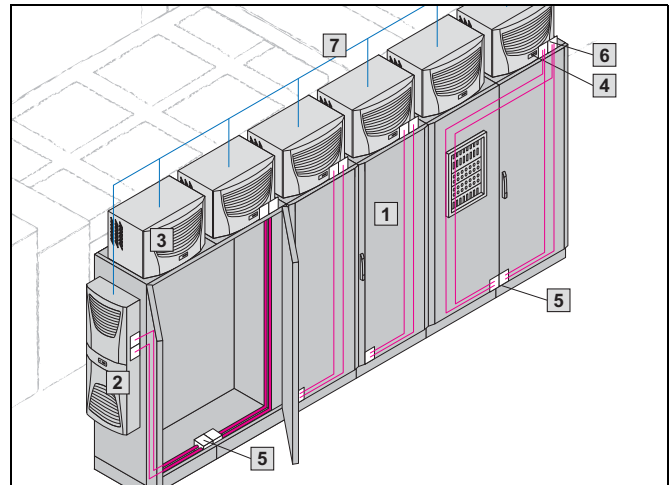


Monitoring

Master/slave operation

In open bayed enclosure systems that are not separate from one another, cooling units and air/water heat exchangers with Comfort control should always be used as they may be placed in master/slave mode via bus cable, part number SK 3124.100:

- Simultaneous activation and deactivation of the devices
- Parallel fault and door limit switch function
- Even temperature distribution across all sections of the enclosure



- | | |
|----------------------|--|
| 1 Control cabinets | 5 Door limit switch |
| 2 Wall-mounted unit | 6 Connection terminals 1 and 2 of the cooling unit |
| 3 Roof-mounted unit | 7 Master/slave unit |
| 4 Comfort controller | |

Master/slave operation

The interface board (part number SK 3214.200, see Catalogue 33, page 477) is an extension for TopTherm cooling units and air/water heat exchangers with Comfort control. It may be used to monitor a master/slave application of up to 10 cooling units. Control is achieved via standardised interfaces RS-232 (DB9) or RS-485, a PLC interface. RS-422 (RJ 45 jack) is the connection to the Rittal CMC III. Remote monitoring via TCP-IP, graphical interfaces for operation, evaluation and control, documentation, and connection to additional sensors for access control facilitates monitoring.

- The extension card is built into a 1 U plastic housing. A voltage supply of 24 V DC is needed. This can be supplied from the CMC III via long-range power pack or externally via a Kycon connector.

Further information may be found in our assembly and operating instructions, at www.rittal.com → **Products** → **Product search** → **SK 3124.200**.

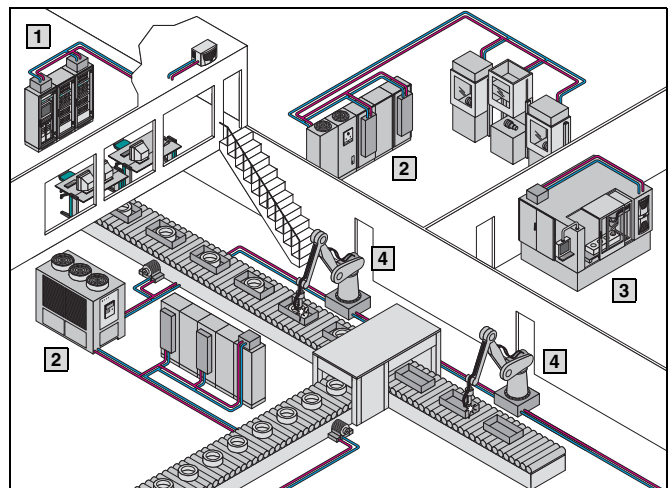
Warnings and alarms from the interface board

- | | |
|---|--|
| ■ Interior temperature too high | ■ Sensor failure, ambient temperature |
| ■ Icing | ■ Sensor failure, icing sensor |
| ■ High-pressure sensor | ■ Sensor failure, condensate level |
| ■ Leakage | ■ Sensor failure, internal temperature |
| ■ Condenser/fan defect | ■ Phase missing or incorrect |
| ■ Evaporator coil/fan defect | ■ EEPROM defect |
| ■ Compressor defect | |
| ■ Sensor failure, condenser temperature | |

Monitoring

Application example: Master/slave operation and interface board

- 1 Control point/server room
- 2 Recooling system
- 3 Machining centre
- 4 Welding robot



Connection example: Master/slave operation with bus cable and interface board

- 1 Serial interface board,
Model No.: SK 3124.200
- 2 Serial interface cable
- 3 Master/slave bus cable,
Model No.: SK 3124.100

RTT = Rittal TopTherm cooling unit/
Air/water heat exchanger

X1 = Supply connection/door limit switch/alarms

X2 = Master/slave connection SUB-D 9-pole

X3 = Serial interface SUB-D 9-pole

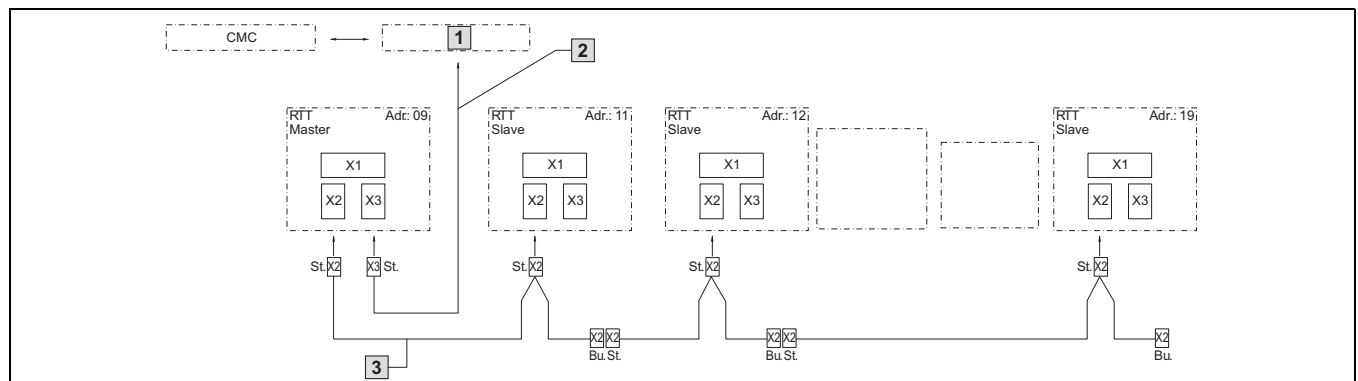
St. = SUB-D connector 9-pole

Bu. = SUB-D jack 9-pole

Adr. = Address

Description:

The address of the master depends on the number of attached slave units (09 = master with 9 slave units). The address of a slave unit always begins with a 1. The 2nd digit represents the actual address. Up to a maximum of 9 slave units may be operated with one master unit, whereby any unit may be a master. The maximum overall length of all connected units is 50 m. Single-phase and 3-phase units may be connected.



Monitoring

Enclosure monitoring system CMC III

The CMC III monitoring system controls the climate inside the enclosure. The user specifies limits for his equipment inside the enclosure. These are fully automatically monitored by the CMC III system. If a limit is exceeded, the CMC III can report this to the service team via e-mail or SMS. Counteractive action may also be initiated automatically.

The system may also be connected to the customer network (via OPC/SNMP) to generate messages or values directly in the control room system (SCADA/BMS/NMS).

The basic unit contains the principal sensors and may be extended via the integral CAN bus.

The CMC III system is plug & play-ready, sensors are detected automatically, and the Web user interface is easy to use even with no programming knowledge.

The power supply is 24 V DC with a redundant design.

The system may also be supplied via the integral Power over Ethernet (PoE).

The benefits of this system lie in its high level of reliability with automatic, direct initiation of counteractive action. Ever more complex applications are monitored by ever fewer personnel. Staff may therefore rely on automated solutions to assist them in their duties and responsibilities.

Applications:

- Temperature monitoring
- Humidity monitoring
- Filter mat/fan monitoring via air flow sensor, analog (m/s) with limits or speed control.
- Cold aisle housing/raised floor monitoring via differential pressure sensor, analog (Pa) with limits.
- Air control/regulation
- Heating control/regulation
- CMC III switches climate control unit off automatically when the enclosure door is open
- CMC III reports malfunctions in the event of a defective climate control unit
- CMC III opens the enclosure doors automatically in the event of a failure in the climate control system and uses the ambient air
- CMC III switches off the system in the event of overheating or shuts down a server in a controlled manner

Note:

For further information see Catalogue 33, page 768 – 777.



CAN bus

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