Rittal CRAC System

Operating and Maintenance Instructions

Rittal CRAC System

FRIEDHELM LOH GROUP

Foreword

Dear Customer,

We would like to thank you for choosing the Rittal CRAC System.

Please take the time to read this documentation carefully.

Please pay particular attention to the safety instructions in the text and to Chapter 2, "Safety Instructions".

This is the prerequisite for:
- Safe assembly of the Rittal CRAC System
- Safe handling
- The most trouble-free operation possible

Please keep the complete documentation readily available so that it is always on hand when needed.

We wish you every success!

Regards,
Rittal GmbH & Co. KG

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We are always happy to answer any technical questions regarding our entire range of products.

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1 Identification

1.1 Manufacturer

Manufacturer:	Rittal GmbH & Co. KG
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1.2 Notes concerning the documentation

1.2.1 Other applicable documents

In conjunction with these operating instructions, the superordinate system documentation (if available) also applies.

Rittal GmbH & Co. KG is not responsible for any damage which may result from failure to comply with these operating and maintenance instructions. This also applies to failure to comply with the valid documentation for accessories used.

1.2.2 CE marking

With the EU declaration of conformity, Rittal GmbH & Co. KG, the manufacturer, certifies that the unit has been manufactured and tested in accordance with the following directives:

- EU EMC Directive 2004/108/EC
- EU Low Voltage Directive 2006/95/EC
- EN 55022
  Information technology equipment – Radio disturbance characteristics
- EN 60335-1
  Safety for household and similar electrical appliances - Part 1: General requirements
- EN 61000 3-2
  Electromagnetic compatibility (EMC)
  Part 3-2: Limits – Limits for harmonic current emissions (equipment input current up to and including 16 A per phase)
- EN 61000 6-2
  Electromagnetic compatibility (EMC)
  Part 6-2: Generic standards – Immunity for industrial environments
- EN 61000 6-3
  Electromagnetic compatibility (EMC)
  Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments

The unit bears the following mark.

CE

1.2.3 Storing the documents

The operating and maintenance instructions as well as all applicable documents are integral components of the product. They must be handed out to those persons who deal with the unit and must always be available and on hand for operating and maintenance personnel.

1.2.4 Legal information concerning the operating instructions

We reserve the right to make changes to the content. The company Rittal GmbH & Co. KG is not responsible for mistakes in this documentation. Liability for indirect damages which occur through the delivery or use of this documentation is excluded to the extent allowable by law.

1.2.5 Copyright

1.2.6 Revision

Rev. 0 from 06.11.2008

1.2.7 Proper use

The CRAC system is a compact air-conditioning unit, and is used for cooling and climate control in server rooms and other IT operating rooms. It is also used for cooling electrical engineering operating rooms using a raised floor system.

The unit is state-of-the-art and built according to recognised safety regulations. Nevertheless, improper use can present a hazard to life and limb of the user or third parties, or result in possible impairment of the system and other property.

The unit should thus only be used properly and in technically sound condition. Any malfunctions which impair safety should be rectified immediately! Follow the operating instructions!

Proper use also includes following the operating instructions and fulfilling the inspection and maintenance conditions.

The following requirements must be met for proper use:

- The air-conditioned or climate-controlled room must be equipped with a raised floor system of sufficient height.
- The raised floor system must have air outlets in the form of cut-outs, air outlet grids or air outlet plates. These must have an approved free cross-section area according to the CRAC system used.
- An inspection area with a minimum depth of 600 mm must be kept free in front of the unit. In order to ensure fan removal, no line systems may be installed within this area.
- Line systems used for connecting the CRAC system must be fed to the side of the unit next to the free space allocated for the fan area according to the diagrams in this document.
- Raised floor supports installed within the specified inspection area must be removable. Technical solutions are readily available for this purpose.
- Cross braces installed between the raised floor supports in front of the unit must be removable.

1.2.8 Precautionary measures

Inappropriate use may result in danger. Inappropriate use may include :

- Improper use
- Improper rectification of malfunctions
- Operation outside the required ambient conditions
- Use of replacement parts which are not authorised by Rittal GmbH & Co. KG

1.3 Product description

1.3.1 Equipment assembly and air treatment functions

The Rittal CRAC system is a one-piece air-circulating climate control enclosure for stand-alone air circulation operation, and is used in server rooms.
Air-circulating climate control systems are used for feeding cooled air to the server room using a raised floor cavity.
The air direction inside the unit feeds the treated air downwards. The return air taken in from the room is filtered and then cooled.
The cooling process is made as the air passes through a heat exchanger installed inside the unit on an incline. Depending on the specific design, either a water/air heat exchanger or a cooling circuit evaporator is installed in the unit.
An optional humidification or heating of the treated air can be made depending on the version supplied.
The treated air is expelled as supply air in the raised floor. The air is conveyed by a fan installed outside of the unit housing, which is mounted in a base in the raised floor.
The fan is installed as a free-running wheel with an integrated EC motor.
Internal deflection and impact losses in the unit are minimised through installation in the raised floor.

1.3.2 Requirements for proper use

In order to guarantee the flow of air, no objects must be placed on the top of the CRAC system.
Due to the air intake, the top is not equipped with a cover. Depending on the design, the top is either open or equipped with a large-scale opening.
The opening must be kept free in order to guarantee uninterrupted air flow.
For this reason, objects which may accidentally fall into the unit must be removed immediately.
In order to guarantee the flow of air, the raised floor must be equipped with a sufficient number of air outlet plates or other approved air outlets.
Closing the raised floor completely or excessively leads to failure of the IT cooling system or an insufficient cooling output.
Depending on the design, the unit must be connected to a cold water system or an outdoor condenser in order to dissipate the heat removed from the air out of the unit.

1.3.3 Terminology

In this documentation, the terms coolant version (DX) and cold water version (CW) are used.

In coolant versions, “DX” stands for “Direct Expansion”. This is the internationally recognised designation for units which use a direct evaporator as a heat exchanger for cooling the flow of air.

In cold water versions, “CW” stands for “Cold Water”. This is the internationally recognised designation for units which use a water/air heat exchanger for cooling the flow of air.
CW versions are also used for mixtures of water and anti-freeze agents.

“Antifrogen N” from Clariant is a popular anti-freeze agent in Europe.

1.3.4 Requirements for correct operation of the CRAC system

Coolant version (DX)

In the coolant version (DX), a coolant circuit is established with R407c coolant. The previously mentioned air cooler is a direct component of this coolant circuit. The coolant version (DX) also contains the compressor (one or more, depending on the size of the unit), electronic expansion valve, oil separator (unit-specific) and other items.
In this way, only a condenser needs to be installed outside of the air-circulating climate control unit in order to guarantee the primary system function (i.e. cooling of the air flow).
The condenser is used to dissipate the heat removed from the air during the cooling process from the cooling circuit. The drive output of the compressor is added to the dissipated thermal output at this point.

Requirement: The condenser must always be installed outdoors or in a location where the dissipated heat can be emitted freely into the surrounding environment.
If heat dissipation is impeded, then this may result in the maximum permissible condensation temperature being exceeded. The pressure of the coolant used is connected to this temperature, and is constantly monitored.
If the permitted condensation pressure is exceeded, then a high-pressure pressostat switches the machine off and air-conditioning is stopped.

Cold water version (CW)

In the cold water version (CW), the unit is fed by an external supply system. This is made either with pumped cold water without added anti-freeze agent or with a brine mixture of water and anti-freeze agent.

Requirement: The unit can only reach the cooling output that it was designed for when the water inlet temperature corresponds to the design requirements. Additionally, the flow rate of the cooling medium must reach the level for which the unit was designed. This is conditional on the availability of the required static pressure for counteracting the pressure loss in the heat exchanger.
The addition of anti-freeze agent reduces the specific cooling output of the heat exchanger.
The cooling output for which the unit was designed can then only be reached when the proportion of anti-freeze agent in the water of the supply medium does not exceed the limits specified in the design requirements.

The system-specific data detailed above can be seen in the data sheet in the appendix.

2 Safety Instructions

The Rittal CRAC system has been developed and produced with due regard to all safety precautions. Nevertheless, the unit still causes a number of unavoidable dangers and risks. The safety instructions provide you with an overview of these dangers and the necessary safety precautions.
In the interest of your safety and the safety of others, please read these safety instructions carefully before assembly and commissioning of the Rittal CRAC system.
Follow the user information found in these instructions and on the unit carefully.

2.1 Symbols in these operating instructions

The following symbols are found in this documentation:

Danger!

This warning symbol is used to indicate great dangers caused by the product which may result in injury and even death if the indicated preventative measures are not followed.

Caution!

This warning symbol is used to indicate procedures which may cause risk of equipment damage or personal injury.

Note:

This instruction symbol indicates information concerning individual procedures, explanations, or tips for simplified approaches.

- This symbol indicates an “Action Point” and shows that you should carry out an operation/procedure.

2.2 Important safety instructions

Danger! Electric shock.

Contact with live electrical parts may be fatal.

Turn off the unit at the main switch before opening the cover plates.

Before switching on, ensure that it is not possible to come into contact with live electrical parts.

Danger! Electric shock.

Some electrical circuits in the unit and the fan electrical supply remain live for some minutes after the power supply is interrupted. Contact with these electrical parts may be fatal.
Wait at least two minutes before carrying out work on or near electrical parts after switching off the unit.

Danger! Electric shock.

Floating contacts may remain live after the power supply is interrupted. Contact with these electrical parts may be fatal.
Only handle floating contacts when you are sure that they are not live.

Danger! Electric shock.

MSR and safety circuits remain live after the main switch has been deactivated. Contact with these electrical parts may be fatal.

Only handle MSR and safety circuits when the system has been disconnected from the power supply.

Danger! Fatal injuries caused by the fan impellor.

Keep persons and objects away from the fan impellor. Do not remove the raised floor until the power supply is disconnected and the impellor is not moving. Shut down the fan as often as possible during maintenance work.

Tie long hair back.

Do not wear loose clothing.

Fans start up automatically following power disruptions.

Danger! Injury caused by raised floor covers springing open.

Excess pressure in the raised floor may lead to the covers springing up when opened.

Only open the raised floor covers when the fan is shut down.

Danger! Risk of contamination with hazardous substances.

Breathing in or coming into contact with the filter dust can be hazardous to health.

Wear a dust mask with a P2 filter insert and protective gloves when removing the filter.

Also wear the additional protective clothing prescribed by the operator when exposing the filter to hazardous substances.

Danger! Risk of contamination with hazardous substances.

Breathing in or coming into contact with contamination caused during normal operation of the unit can be hazardous to health.

Clean the unit at regular intervals.

Danger! Cut wounds, especially through sharp edges on the heat exchanger.

Put on protective gloves before beginning assembly or cleaning work.

Danger! Hand injuries caused by meshing gear wheels on multi-leaf dampers.

Keep hands away from exterior gear wheels.

Danger! Hand injuries caused by retracting multi-leaf dampers.

Keep hands away from the multi-leaf dampers.

Danger! Danger of burns.

Do not touch the heater, compressor, steam humidifier, steam lance and the supply lines during operation and some time afterwards.

Danger! Injury due to falling loads.

Do not stand under suspended loads when transporting the unit with a hoist trolley, a forklift, or a crane.

Danger! Injury due to coolant.

Escaping gas can cause frostbite. Put on protective gloves and goggles before working on the cooling circuit.

Danger! Poisoning by coolant gases produced during heating.

Put on protective gloves and a mask with filter when carrying out welding and soldering work on the cooling circuit. Extinguish any cigarettes immediately if a large-scale leakage occurs. Avoid fires and naked flames.

The coolants used have been rated for their danger to health according to DIN EN 378, and are rated in group L1 (non-flammable). The toxicity readings have been rated as class 6 (relatively harmless) according to the internationally recognised six-level Hodge/Sterner classification.

Caution! Environmental damage caused by escaping coolant.

Do not allow coolant to escape into the environment. When released accidentally, condense the gases with hydrogen and allow the remaining coolant to evaporate.

The operator of the CRAC system is required to observe the accident prevention regulations on handling coolants.

First-aid measures after accidents with anti-freeze agents:

- After inhalation:
  Bring the injured person into the fresh air and keep him or her calm. Consult a doctor. Call for an ambulance with breathing apparatus. When the injured person is not breathing: Start mouth-to-mouth resuscitation.
- After contact with the eyes:
  Do not rub the eyes. Rinse the eyes for at least 15 minutes with lukewarm water, keeping the eyelids spread open. Consult a doctor.
- After contact with the skin:
  Rinse the affected area immediately with lots of water for at least 15 minutes. Consult a doctor.
  Change any wet clothing. Do not pull off any clothing which has become attached to the skin.

Notes for medical staff:

Do not apply adrenaline-ephedrine preparations or catecholamines.

Caution! Environmental damage caused by escaping coolant.

Do not allow coolant to escape into the environment. When released accidentally, condense the gases with hydrogen and allow the remaining coolant to evaporate.

Caution! Risk of damage to the CRAC system.

The vacuum behind the doors and shielding plate may suck objects into the CRAC system.

Only open doors and shielding plates when the fan is shut down.

Caution! Risk of malfunction or damage.

Do not modify the unit. Use only original spare parts.

Caution! Risk of malfunction or damage.

Proper and flawless operation of the CRAC system can only be ensured when it is operated under the intended ambient conditions.

As far as possible, ensure that the ambient conditions for which the unit is designed are complied with (e.g. temperature, humidity, air purity).

Caution! Risk of malfunction or damage.

All media necessary for the control system (e.g. warm water) must be available during the entire operating time of the CRAC system.

The following applies for cooling systems: In accordance with DIN EN 378, the operator is required to create and update a system log. The following entries must be made here:
Details of all repair work, quantity and type (new, reused or recycled) of the coolant, quantity of drained coolant, analysis results for reused coolant, origin of the reused coolant, changes or replacement of system parts, results of all regular routine checks and long shutdown periods.

The following applies for cooling systems: According to the EU regulation 2037/2000 and the German ordinance on ozone-depleting substances (ChemOzonSchichtV), the operator is required to inspect and maintain the unit thoroughly on a regular basis. The unit must also be checked for leaks at least once per year using suitable equipment. Any leakages must be dealt with immediately.

According to the German Water Management Act § 19 (Wasserhaushaltsgesetz), the operator is required to employ a specialist operator for installing, maintaining and cleaning systems if they do not meet the requirements for doing so themselves.
The system operator must monitor the unit for leaks and check the safety equipment on a regular basis. In exceptional cases, the responsible authorities can arrange a monitoring contact between the operator and specialist operator if the system operator lacks expertise in this area.
Additionally, the operator is required to have the system inspected by an approved assessor before commissioning, within two and a half years after the last inspection, before recommissioning a system which has been out of service for over a year and when the system is taken out of service.
The responsible authorities can arrange the provision of an officer for water pollution control.

Applicable waste disposal regulations must be adhered to when disposing of filters.
The operator is responsible for informing personnel and providing protective clothing when exposing the filter to hazardous substances.

2.3 Service and technical staff

The installation, commissioning, maintenance and repair of this unit may only be carried out by qualified mechanical and electro-technical trained personnel, or personnel from Rittal Service. Work on mechanical components carried out with opened doors, viewing panels or covers may only be carried out by electro-technical trained personnel, while work on electrical components may only be carried out by qualified electricians.
Only properly instructed personnel may use the unit while it is in operation.

3 Installation and Commissioning

3.1 Transportation and storage

Caution! Risk of damage to the CRAC system.

When delivering the CRAC system for the first time, only transport and store at temperatures between -10 and +50 °C and at a relative humidity of 80 %. The unit should be transported in suitable packaging and should only be stored in closed rooms (with or without packaging).

- Inform the forwarding agent if the packaging shows signs of damage on delivery that would indicate damage to the contents.

3.2 Notes on waste disposal

3.2.1 Disposing of packaging materials

Note:

The packaging material is comprised of plastic film for protecting the unit, wooden crates for the exterior and wooden pallets. The packaging film, bands and foam lining are made from polyethylene, while the CFC-free protective padding is usually made from polystyrene foam. These packaging materials are made from pure hydrocarbons, and can therefore be recycled. The clamping straps are made from steel; the wooden crates are not chemically pre-treated.

- Dispose of all packaging materials according to the valid regional waste disposal regulations.

3.2.2 Disposing of the CRAC system

- The valid regional waste disposal and waste management regulations must be adhered to when disposing of the CRAC system.

Rittal can also take back CRAC systems and accessories if the cost is paid to deliver them to Rittal. Appropriate waste disposal is guaranteed.

The unit must be cleaned before delivery in this case. The units must be free of pollutants (air freight). The filters must be removed by the system operator. The coolant must be disposed of correctly by the system operator at the place of installation.

Third-party components and machine parts not delivered directly by Rittal are excluded from this return offer.

3.3 Transportation

Danger! Injury due to falling loads.

Do not stand under suspended loads when transporting the unit with a hoist trolley, a forklift, or a crane.

Caution! Risk of damage to the CRAC system.

Protect the unit from heavy impacts.
Do not set the unit down on the housing corners.
Do not submit the housing to sharp loads.
Never lift the unit onto pipes or other equipment.
When transporting with a hoist trolley or forklift, ensure that the hoist is continuous.

Caution! Risk of damage to the CRAC system.

When transporting with a crane, ensure that any supports on the unit are not damaged.
Always keep clamping belts tight.

Note:

The unit is delivered on a pallet in an upright position and is fastened using clamping straps.
The unit must remain on this pallet until it can be transported on an even surface using a device with wheels.

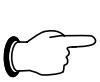
- When setting the unit down on a suitable surface, ensure that it cannot tip over.

Note:

Horizontal transportation

The unit is intended for upright transportation. Proceed with extreme care if horizontal transportation is required, as damage to the housing walls and heat exchanger must be avoided. We recommend prior consultation with Rittal Service.

3.3.1 Unloading the unit from the HGV and transporting using a crane



Note:

The units are delivered with eyebolts for crane transportation, which can be screwed into the sleeves in the frame on the top of the unit.

Unit width	Number of eyebolts
1100 mm	4 pieces
1400 mm	4 pieces
1800 mm	4 pieces
2600 mm	8 pieces

Note:

The permitted load direction must be adhered to when using eyebolts.

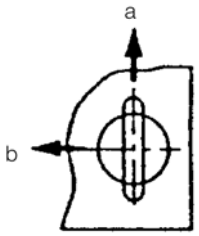


Fig. 1: Top view of eyebolt

- Load direction a: Correct load direction
- Load direction b: Incorrect load direction

Note:

The permitted load must be adhered to when using eyebolts.
This is dependent on the sling angle. The permissible load can be determined according to the following diagram.

Fig. 2: Sling angle

Note:

The eyebolts can be unscrewed, if necessary.

Caution! Risk of damage to the CRAC system.

When transporting on a crane using eyebolts, ensure that any supports on the unit are not damaged.
Use a transportation cross member.
Always keep clamping belts tight.

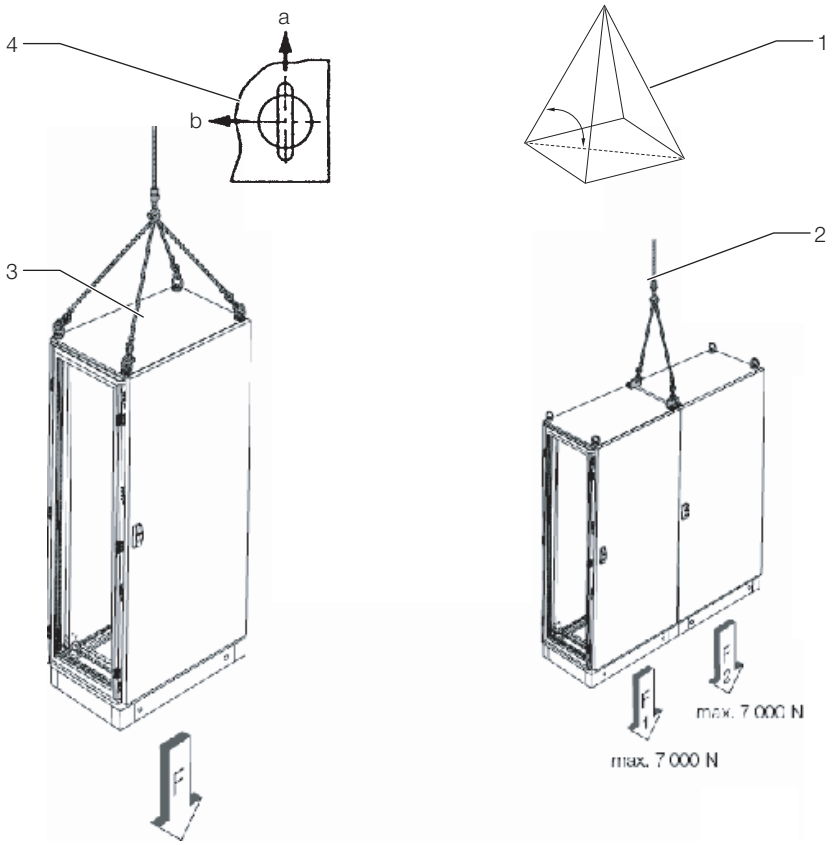


Fig. 3: Crane transportation using eyebolts

1 Sling angle
2 Multiple units
3 Single unit
4 Load direction
a: Correct
b: Incorrect

Individual enclosures (Fig. 3, item 3) are transported safely using the eyebolts included with the delivery. For systematic loads, the following maximum permissible loads apply:

- At a 45° sling angle: 4,800 N
- At a 60° sling angle: 6,400 N
- At a 90° sling angle: 13,600 N

For the combination shown above (Fig. 3, item 2) with angular baying brackets, quick-fit baying clamps and combination angles, the load capacity with a sling angle of 60° is as follows:

- F1 = 7,000 N
- F2 = 7,000 N

3.3.2 Unloading from the HGV by forklift

When unloading the unit using a forklift, the delivered pallet fastened to the unit using clamping straps can be used.

Note:

When unloading the unit, all four corners must be secured with straps to prevent tipping due to an excessive lateral tilt. The safety straps are attached to the eyebolts.

3.3.3 Transferring the unit into the building and setting down on the mounted fan base

The unit is transported indoors using transport castors with a sufficient load-bearing capacity.

Note:

The unit can only be placed on the installed fan base when the raised floor has been installed around the base beforehand.

Note:

When bringing the unit housing into the appropriate position above the installed fan base, ensure that the fan base plates are not accessible.

Indoor transportation of the unit housing can be made easier by using two hydraulic lifting transporters.

Supply includes:
Two transporters with hydraulic lifting unit and attached lashing strap. 5 metre strap length. Handle for direct control. The load can be moved and set down exactly.

Function:
Slide the loading shovel underneath the transported goods. Tighten the safety straps. Lift the load to the same height on both sides, then move it accordingly.

Technical specifications:
100 mm or 250 mm lifting height.
Contact surface with protective coating. Powder coated, white aluminium (RAL 9006), zinc-plated, passivated.
Heavy-duty wheels with ball bearings, carpet and floor-friendly wheel covers.

Technical specifications		
Load-bearing capacity (per pair)	kg	1800
Width	mm	680
Depth	mm	420
Shovel width	mm	600
Shovel depth	mm	60
Wheel diameter	mm	150

Fig. 4: Hydraulic lifting transporter (Kaiser+Kraft)

Note:

When transporting CRAC systems using a hydraulic lifting transporter, the load transferred by the clamping belts to the door and housing corners must be distributed by inserting an edge protection bracket underneath on each corner.

Specifications: Edge protection bracket made from 12 mm MDF, side length 100 mm, installation length 1,900 mm, contact surface with protective felt coating.

- Adjust the unit housing above the fan base using the lifting transporter or a similar suitable device.

Note:

An instruction label on aligning the housing above the base can be found on the ventilator base.

Note:

The rolled-up fan lines supplied on the fan base must be positioned in the centre of the base to avoid damage caused by the housing edges.

Note:

Transportation of the unit housing to the place of installation can also be made as an optional service by a shipping company authorised by Rittal. The on-site conditions must be checked for suitability by Rittal Service prior to transportation.

3.3.4 Recommendations for positioning CRAC systems in server rooms

The supply of air in the raised floor must be interrupted as little as possible in order to ensure the uniform use of all air outlets. For this reason, CRAC systems should always be positioned so that they are at the front of the rack suites. Cable channels and water-carrying lines in the raised floor should not cross the air supply lengthwise in the rack suites.
In order to allow an easy positioning of the unit housing on the fan base during installation, a distance of around 250 mm should be maintained between the individual units.
The distance from the rear wall of the unit to the structure should be 150 mm, provided the room dimensions allow this.
Further information on positioning CRAC systems and system use with raised floor heights above and below 500 mm can be requested from the IT cooling product management department at Rittal.

3.3.5 Notes on planning energy-efficient system operation

The following design parameters form the basis of energy-efficient operation of the CRAC system:

- Use of a water-based carrier medium as coolant
- Realisation of a maximised return air temperature
- Operation of the server room with a maximised supply temperature
- Planning of the cold water or glycosol network with a maximised inlet temperature
- Use of a surface-optimised free cooling system for recooling the carrier medium without the use of a compressor
- Use of the CRAC system with minimal levels of pressure in the raised floor

Note:

Cable channels and water-carrying lines in the raised floor should not cross the air supply from the CRAC system to the air outlet plates in the raised floor.

Note:

A flow speed below 3 m/s should be aimed for in the air flow between the CRAC system and air outlet plates.

3.4 Scope of delivery

- After unpacking, check whether all parts are present according to the delivery order.
- Check all parts for damages. Report any noticeable damages to the forwarding agent.
- Compare the data on the rating plate of the CRAC system and modules with the delivery order and order documentation.
- Check whether all appropriate documentation and the corresponding operating instructions have been delivered.

3.5 Siting

- Site the unit so that air can be drawn in or blown out without interruptions on all connections.
- Do not position temperature and humidity sensors near machines and units which emit heat or moisture. Do not subject to direct sunlight.
- Ensure that there is sufficient space for maintenance and operation. The free space for maintenance in front of the unit must be at least 900 mm. A space of 600 mm must be available in front of the supporting structure for installing and removing the fan.
- Ensure that the installation room is sufficiently lit.
- Set up and align the fan base before installing the raised floor. Consult the constructor of the raised floor when installing the fan base in an existing raised floor system.

Note:

The unit feet of the fan supporting structure or bottom-mounted box are insulated against vibration and height-adjustable, and are used for **damping structure-borne noise** and compensating for floor irregularities.

3.6 Assembly

3.6.1 Fan supporting structure or bottom-mounted box

- Position the fan supporting structure or bottom-mounted box in the raised floor, adjust the feet to the height of the raised floor plus approx. 5 mm, then align the fan supporting structure horizontally.

Note:

As the adjustable feet are equipped with springs, the height of the fan supporting structure or bottom-mounted box is reduced due to the weight of the CRAC system.

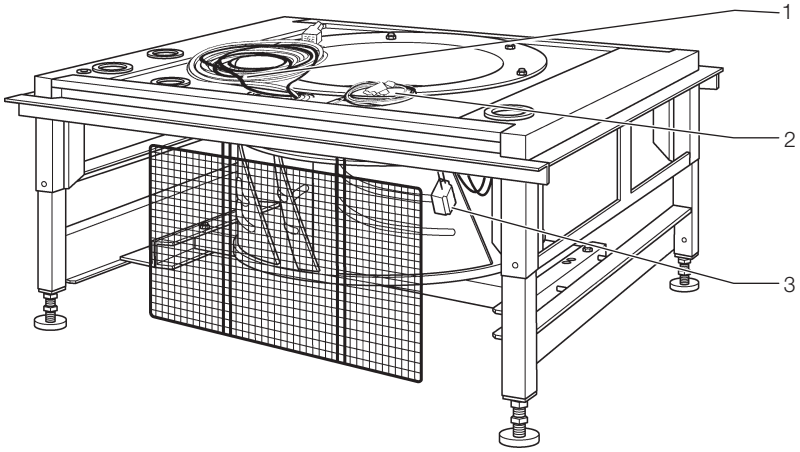


Fig. 5: Fan supporting structure

1 Connection cable, control line and pressure hoses for fan
2 Connections for air supply temperature sensor, humidity limiter (optional) and water sensor (optional)
3 Water sensor (optional)

3.6.2 Unit

- Remove the wooden beams from the bottom of the unit.
- Set the unit onto the fan supporting structure or bottom-mounted box, then align it flush to the front of the base frame.
- Align the unit using the height-adjustable feet of the fan supporting structure or bottom-mounted box.
- Open the front doors.
- Open the shielding plate underneath the electrical unit, then open the small lower cover plate underneath the filter (1 plate in CW version, 2 plates in DX version) using a screwdriver.
- Remove the display connector and open the cover plate of the electrical unit using a screwdriver.

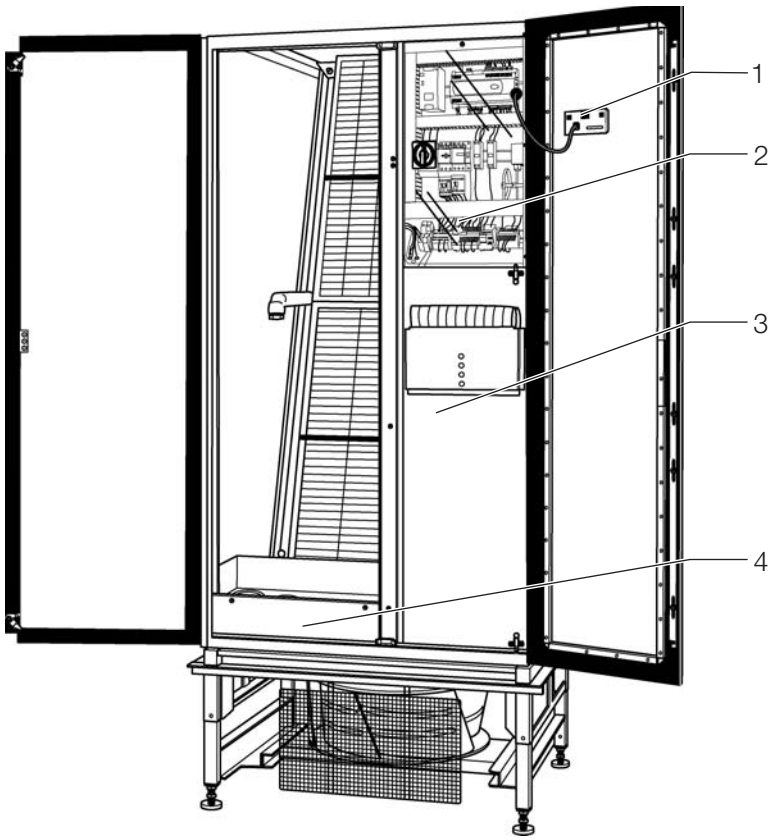


Fig. 6: Covers (CW version in this example)

1 Display connector
2 Electric unit cover plate (transparent)
3 Shielding plate
4 Small cover plate

Note:

The unit must be secured in two places on the fan supporting structure using the pre-installed connection brackets and screws inside the unit.

- Fasten the connection brackets to the left and right inside the unit on the fan supporting structure or bottom-mounted box at the bottom using the screws.

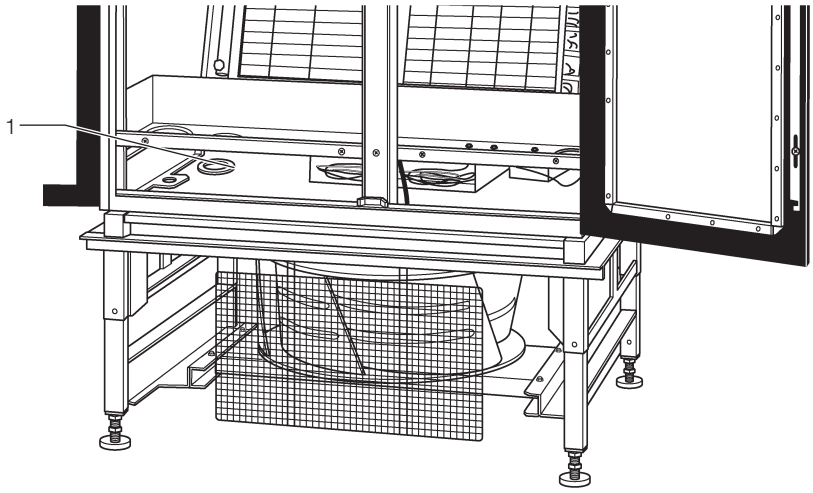


Fig. 7: Connection bracket (CW version in this example)
1 Connection bracket

3.6.3 Fan

- Feed two fan pressure hoses (red and blue) into the electrical unit of each fan from below through the cable glands in the unit behind the centre bar.
- The ends of the pressure hoses must remain open.
- Feed a connection cable and control line into the electrical unit of each fan from below through the cable glands in the unit behind the centre bar, then attach the plug connection according to the wiring plan.
- Attach the rubber membrane to the cable glands.

Note:
The rubber membranes are already threaded onto the connection lines.

3.6.4 Air supply temperature sensor

Note:
The air supply temperature sensor is fastened from below onto the fan supporting structure or bottom-mounted box.

- Feed the connection cable of the air supply temperature sensor to the electrical unit of each fan from below through the cable gland in the unit behind the centre bar, then attach the plug connection according to the wiring plan.
- Attach the rubber membrane to the cable glands.
- At the installation site, position the air supply temperature sensor directly in the air flow of the unit in the raised floor.

3.6.5 Humidity limiter (optional)

Note:

An optional humidity limiter can be installed in units under humidification in order to limit the maximum relative humidity. This is then attached to the fan supporting structure or bottom-mounted box (factory setting).

- Feed the connection cable of the humidity limiter to the electrical unit of each fan from below through the cable gland in the unit behind the centre bar, then attach the plug connection according to the wiring plan.

3.6.6 Water sensor (optional)

Note:

The water sensor is fastened from below onto the fan supporting structure or bottom-mounted box.

- Feed the connection cable of the water sensor to the electrical unit of each fan from below through the cable gland in the unit behind the centre bar, then attach the plug connection according to the wiring plan.
- Install the water sensor in the raised floor at a maximum of 1 metre away from the unit (e.g. on the floor on one of the unit feet).

It is beneficial to install a collecting tray for leaked water in which the complete fan base is set up.

3.6.7 External multi-leaf dampers (optional)

- If not previously attached at the factory, fasten the external multi-leaf dampers with at least four screws according to the overview diagram in the data sheet.
- Install the servo motor, feed the connection cable to the electrical unit and connect it according to the wiring plan.

3.6.8 Air connections (optional)

- Establish the air connections according to the overview diagram in the data sheet.

- The support must not be subject to mechanical loads.

- Establish potential equalisation using the potential equalisation belts and the earthing bolt, through bolt or riveting nut (insert into channel). Do not use screws. Do not use flange connection screws.
- Label as a PE conductor connection.

3.6.9 Dismantling the unit door

Note:

The unit is delivered with attached unit doors. The doors do not need to be dismantled when installing and commissioning the unit in server rooms or air-conditioning strips.

Proceed as follows to dismantle a unit door:

- Remove the sealing bungs from the four door hinges with an appropriate tool (e.g. screwdriver).
- Release and open the unit door.
- Loosen the hinge bolts from the four door hinges by raising them with an appropriate tool (e.g. screwdriver). Pull the bolts out of the hinge bolt holding fixture up to the catch.
- Begin with the lowest door hinge.

Note:

Support the unit door so that it will not fall as the door hinges are loosened. Work with a second person when necessary.

- Remove the unit door.

3.7 Media connections

Note:

Installing the pumped cold water/anti-freeze connections or coolant lines and establishing other media connections may only be carried out by qualified technical specialist personnel.

Depending on the delivered unit type, connections for the following media lines must be established:

- Feed and return lines for pumped cold water/anti-freeze solution, coolant hot gas and coolant liquid lines
- Condensate discharge
- Drinking water connection for humidifier

The connection dimensions of all media lines can be found in the following diagrams for information purposes. A connection drawing of the delivered unit type and size can be found in the appendix.
The connections are labelled clearly with the specified designations.

3.7.1 Connecting the pumped cold water lines/anti-freeze solution lines

Note:

A space of at least 600 mm must be left in front of the fan within the raised floor system. In this way, the fan can be removed from the front of the unit without the need for removing the supply lines.
No lines may cross the specified free space.

- Water-carrying lines must be installed correctly in order to prevent damage caused by leaks.
- Before connecting water-carrying lines to the unit, any stoppers must be removed from the top part of the unit.
- All lines are fed from below from the raised floor space through the appropriate glands in the fan base. The rubber grommets must be left inside the base to prevent air leakages and damage to the lines.
- We recommend making a flexible connection to the incoming line network using high-pressure hoses. The minimum burst pressure of the attached connection hoses must be 60 bar at a media temperature of 20 °C. When adding anti-freeze agents to the medium (e.g. “Antifrogen N” from Clariant), the hose material must be resistant to the additives in the concentration required.
- The control valve attachment in the return must be made using a screw connection to allow the removal of the control valve. This applies especially to rigid piping.

- In the connection line of the inlet, an assembly group comprised of the following components must be installed in the raised floor in the flow direction:
  - Stop valve
  - Dirt trap

- Turbine sensor (optional)
- Stop valve

The optional turbine sensor is required for recording the throughput water quantity.
For further information, see the following line diagram.

- In the connection line of the return, an assembly group comprised of the following components must be installed in the raised floor in the flow direction:
  - Stop valve
  - Extruded regulation valve
  - Stop valve

  The extruded regulation valve is required for calibration of the hydraulic network.
  For further information, see the following line diagram.

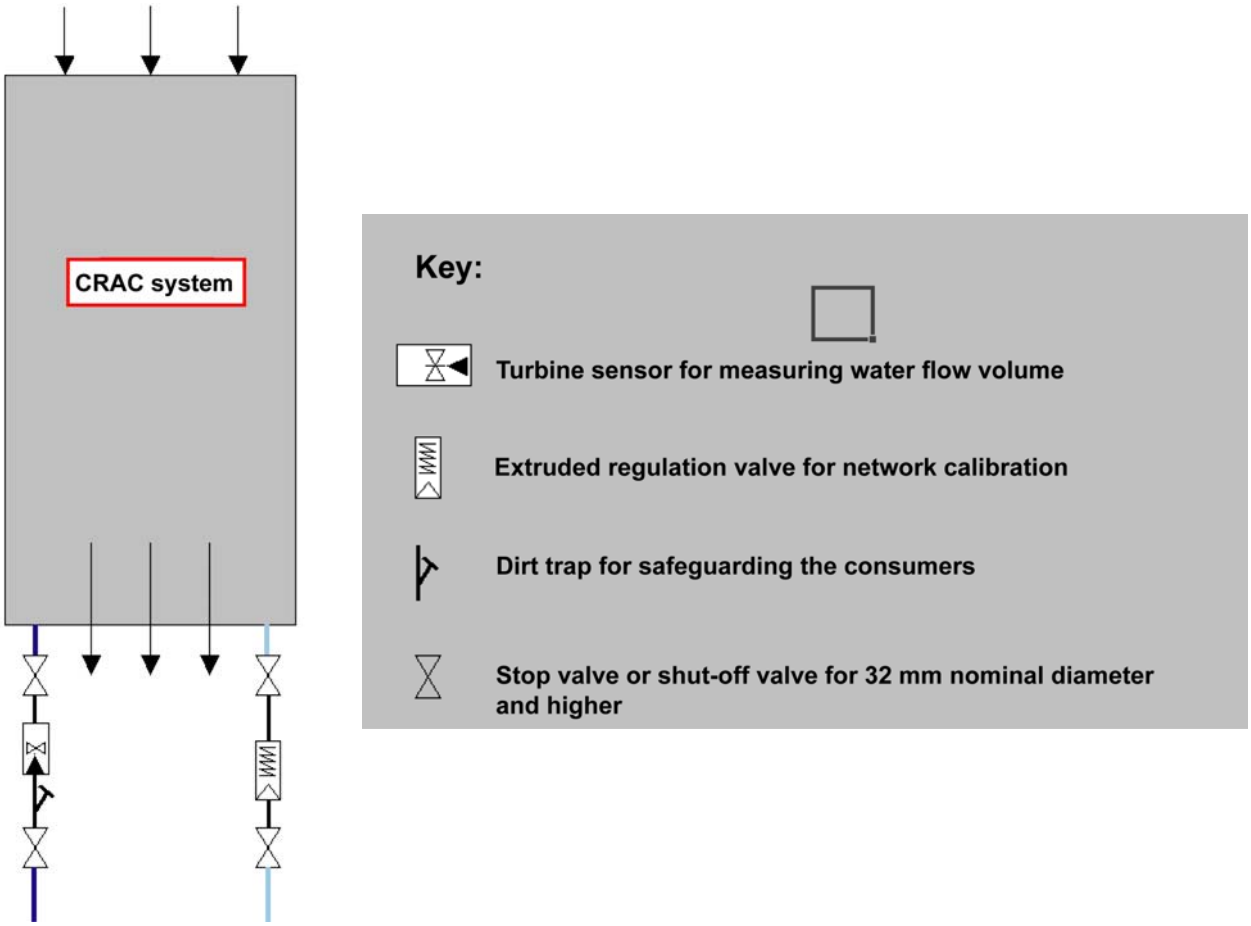


Fig. 8: Line diagram

Notes on water quality

Only water free from suspended matter, rust, large dirt particles and algae should be used as a water-based cooling medium.
The proportion of anti-freeze agent in the cooling medium must be adjusted according to the on-site conditions in order to guarantee the frost protection of the system.
An anti-freeze agent (e.g. “Antifrogen N” from Clariant) can be added up to a maximum concentration of 35 % by volume.
When anti-freeze agent is not added, then a corrosion-protection agent and biocide must be added in order to prevent the corrosion of system parts (e.g. distributors or buffer stores) and restrict the build-up of algae.
“Protectogen” from Clariant is one example of a corrosion-protection agent that can be added here.
The dosage of all additives must be made according to the corresponding manufacturer specifications. Observe the minimum dosage requirements to guarantee the necessary corrosion protection.

3.7.2 Connecting coolant lines to an external condenser (coolant condenser) (optional)

Note:

A space of at least 600 mm must be left in front of the fan within the raised floor system. In this way, the fan can be removed from the front of the unit without the need for removing the supply lines.
No lines may cross the specified free space.

- Before connecting coolant lines to the unit, any stoppers must be removed from the top part of the unit.
- Both lines are fed from below from the raised floor space through the appropriate glands in the fan base. The rubber grommets must be left inside the base to prevent air leakages and damage to the lines.

Note:

In order for the complete system (CRAC system and outdoor condenser) to function correctly when using coolants as a cooling medium, the coolant line system must be adjusted according to on-site conditions.
A reliable return of lubricating oil contained in the coolant for compressor lubrication is important for system functionality, as is the return of coolant from the condenser after shutdown periods in winter.
The following points are basic information for implementation by qualified specialist personnel.

- When hot gas lines are fed horizontally, ensure that no hollow areas are present where an uncontrollable build-up of oil can occur.
- Always install horizontal hot gas lines connected to the condenser with an inclination towards the condenser.
- When the condenser is installed above the CRAC system (typically when a condenser is mounted on the roof), then oil transfer pumps must be installed at distances of 3 metres in the vertical hot gas line.
- When the condenser is installed below the CRAC system (typically when a condenser is mounted outdoors), then a coolant collector must be installed in the liquid line. The volume of the collector must be adjusted according to the on-site conditions.

- When a horizontal hot gas line of more than 20 metres is used, then the CRAC system must be equipped with an oil separator. This restricts the lubrication oil and feeds it back to the compressor on the extraction side via the shortest route.

Note:

The retrofitting of an oil separator or coolant collector in CRAC systems may only be carried out by Rittal Service International or a specialist firm on their behalf.

3.7.3 Connecting the condensate discharge connectors and humidifier discharge connectors (humidifier = optional)

Note:

The special siphon with anti-kickback attachment (supplied loose) must be used to prevent condensate from being drawn back into the unit due to underpressure or pressure variations (e.g. when the unit is switched on).

Note:

In the direction of flow, the connection line of the humidifier discharge connector may only be combined with the connection line of the condensate discharge connector after the ball siphon. A 45° junction must be used at the junction point.

Note:

A space of at least 600 mm must be left in front of the fan within the raised floor system. In this way, the fan can be removed from the front of the unit without the need for removing the supply lines.
No lines may cross the specified free space.

- Both lines are fed from below from the raised floor space through the appropriate glands in the fan base. The rubber grommets must be left inside the base to prevent air leakages and damage to the lines.
- The connection is made using standard HT piping. Humidifier discharge connectors and condensate discharge connectors have a nominal diameter of 40 mm on all unit sizes.
- The supplied ball siphon must be installed as a siphon trap in the condensate discharge connector. The preferred installation point is directly underneath the piping gland through the fan base. The siphon must be kept accessible for maintenance purposes.
- In the direction of flow, the connection lines of the humidifier discharge connector and condensate discharge connector must be merged into a combined discharge line after the siphon. A 45° junction must be used at the junction point.
- No condensate pump is installed in the CRAC system. Therefore, the combined discharge line must lead downwards to a drainage point in the building, or the storage tank must be equipped with an external condensate transfer pump.
- Drainage into the wastewater system of the building must be made without counterpressure when a condensate transfer pump is not used.

3.7.4 Attaching the humidifier feed water connection (humidifier = optional)

Note:

The humidifier used is a steam humidifier which is supplied with drinking water from the mains water network. Depending on the water hardness and the concentration of minerals in the water, the steam cylinder of the humidifier is automatically rinsed with drinking water to reduce the remaining concentration in the cylinder. The water used for rinsing exits the humidifier through the humidifier discharge connector.

Note:

A space of at least 600 mm must be left in front of the fan within the raised floor system. In this way, the fan can be removed from the front of the unit without the need for removing the supply lines.
No lines may cross the specified free space.

- The feed line is fed from below from the raised floor space through the appropriate gland in the fan base. The rubber grommet must be left inside the base to prevent air leakages and damage to the lines.
- Connection lines must be produced from materials suitable for drinking water (e.g. PP plastic, copper or stainless steel).
- A shut-off valve should be installed in the connection line inside the raised floor so that maintenance work can be carried out on the humidifier. This recommendation applies especially when using multiple CRAC systems.
- It must be possible to shut off the drinking water supply outside the air-conditioned room in order to interrupt the water supply in the event of leakage in the piping system.
- Depending on the on-site connection requirements and building characteristics, a pipe disconnector must be installed in the drinking water supply line. This disconnector shuts off the supply automatically without auxiliary power in the event of a loss of line pressure in the drinking water system.

3.8 Electrical connection

Note:

Electrical connections may only be made by qualified, electro-technical trained personnel.

Note:

The electrical unit is responsible for all electrical functions in the CRAC system. It is classified as a separate unit in the basic CRAC system module. All electrical equipment is wired and individually fused ex-works according to VDE guidelines. Operating, error and warning messages can be forwarded to superordinate control systems.

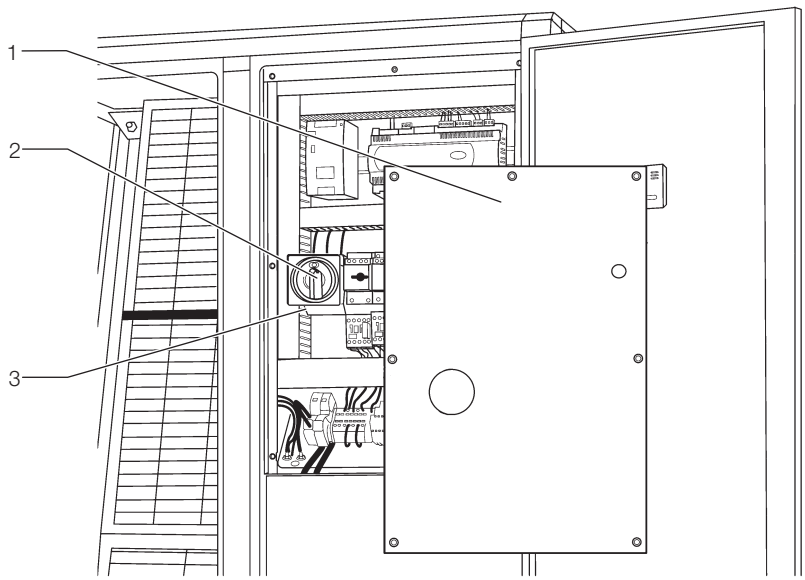


Fig. 9: Electrical unit

1 Electrical unit cover plate
2 Main switch
3 Network input terminals

Note:

Electrical connections are made according to the valid circuit diagrams and terminal diagrams for the supplied unit.
The circuit diagrams for connecting to a supply network can be found for all available unit types and sizes in the following diagrams for information purposes.

Carry out the following tasks when connecting the CRAC system to the power supply, external consumers (e.g. condensers) or field devices used for notification and control:

- Remove the display connector and open the cover plate of the electrical unit using a screwdriver.
- Connect the external consumer to the circuit-breaker.
- Connect the external control lines according to the circuit diagram.
- Lay the external control lines onto the clamping strip and the sensors onto the control unit.
- Connect the unit to the network using the network input terminals (see diagram – clockwise rotary field). See the technical specifications for the electrical connection values.

Note: Handling the spring clips.

- Insert the screwdriver into the square activation opening up to the stop.
- Insert the wires into the round opening.
- Remove the screwdriver. The conductor is now clamped securely.

Danger! Electric shock.

Contact with live electrical parts may be fatal.

Only qualified electro-technical personnel may open the electrical unit and carry out work on it.

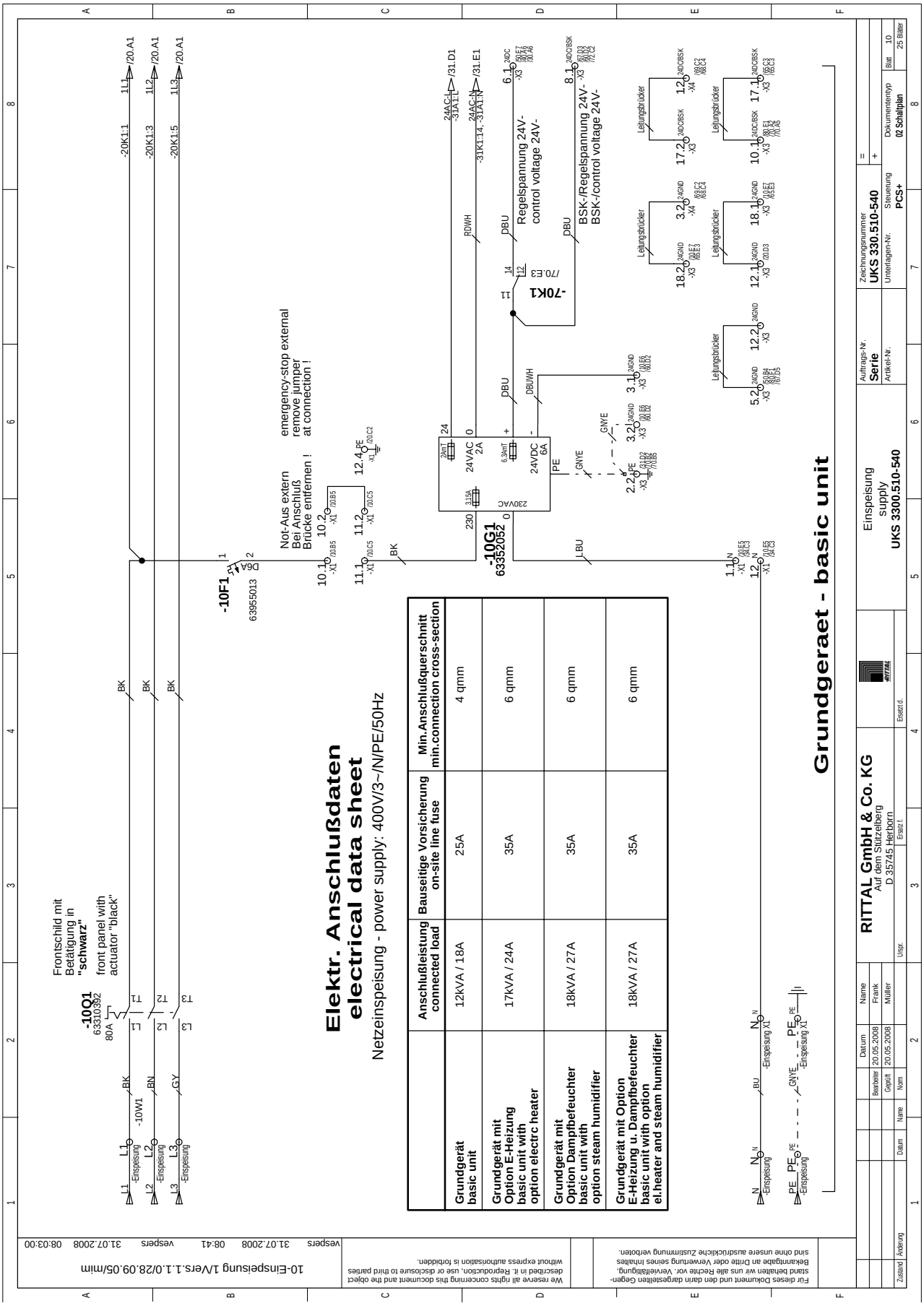


Fig. 10: Electrical connection ratings for CRAC 330.510-540

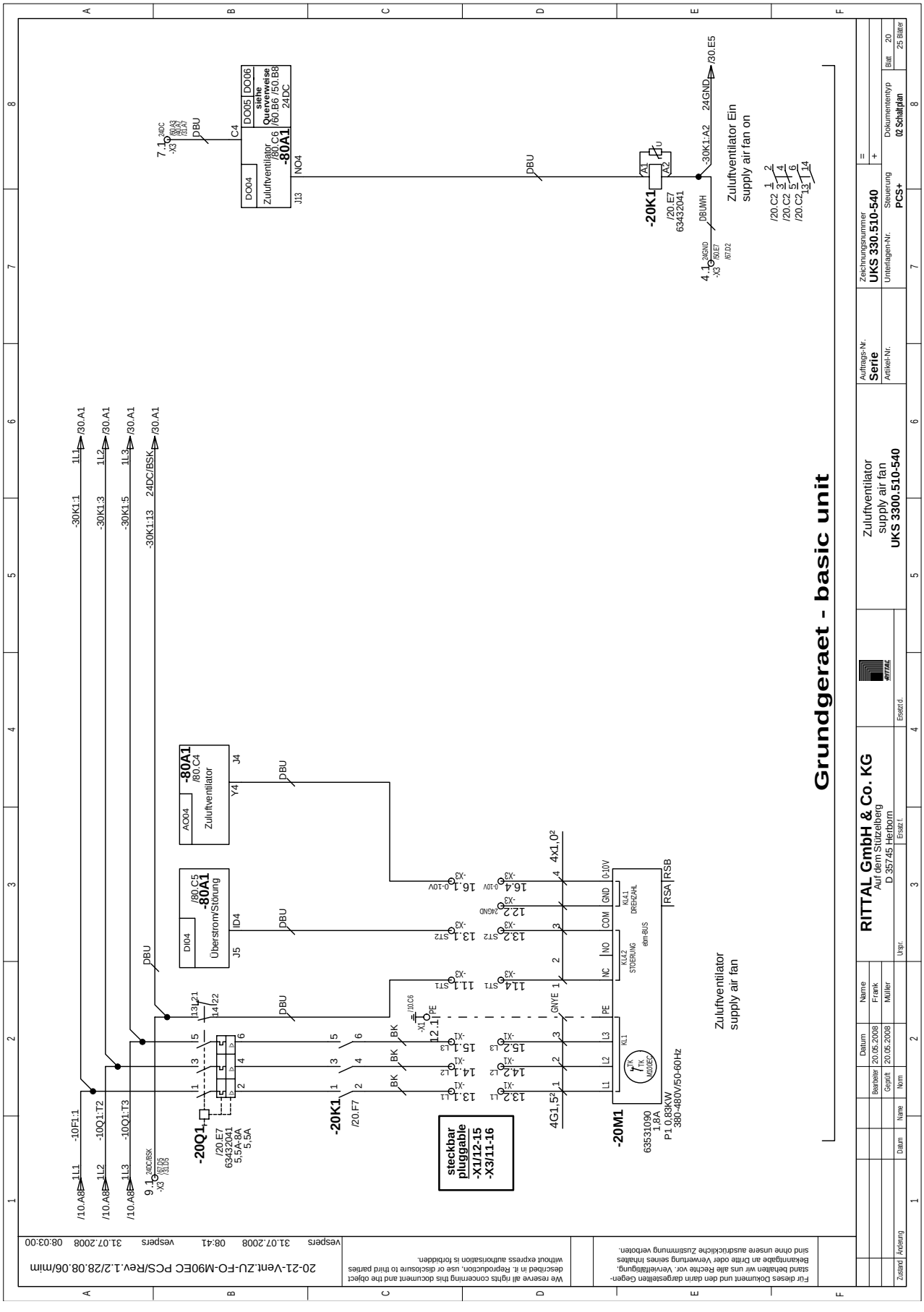


Fig. 11: Floating contacts for CRAC 330.510-540

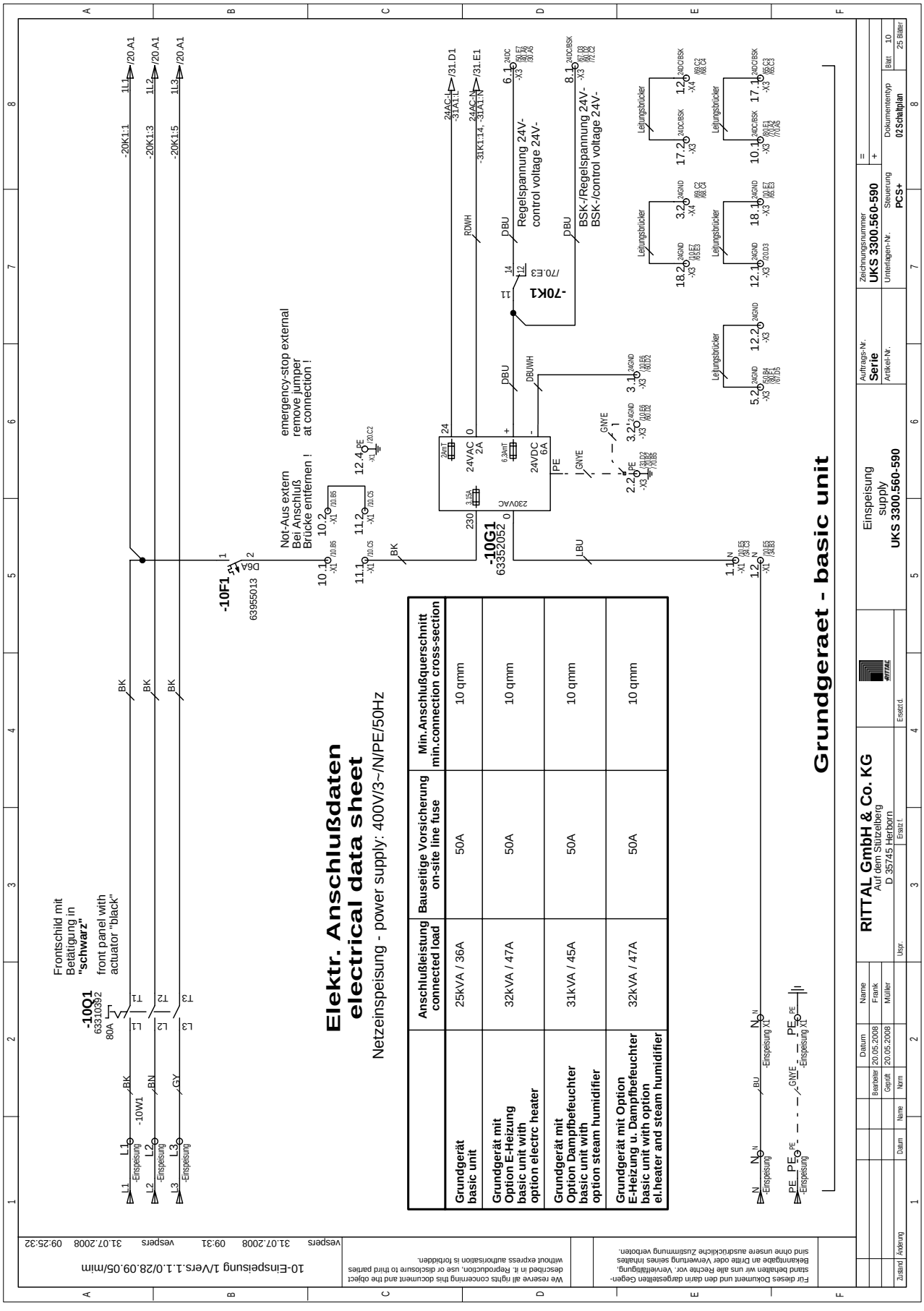


Fig. 12: Electrical connection ratings for CRAC 3300.560-590

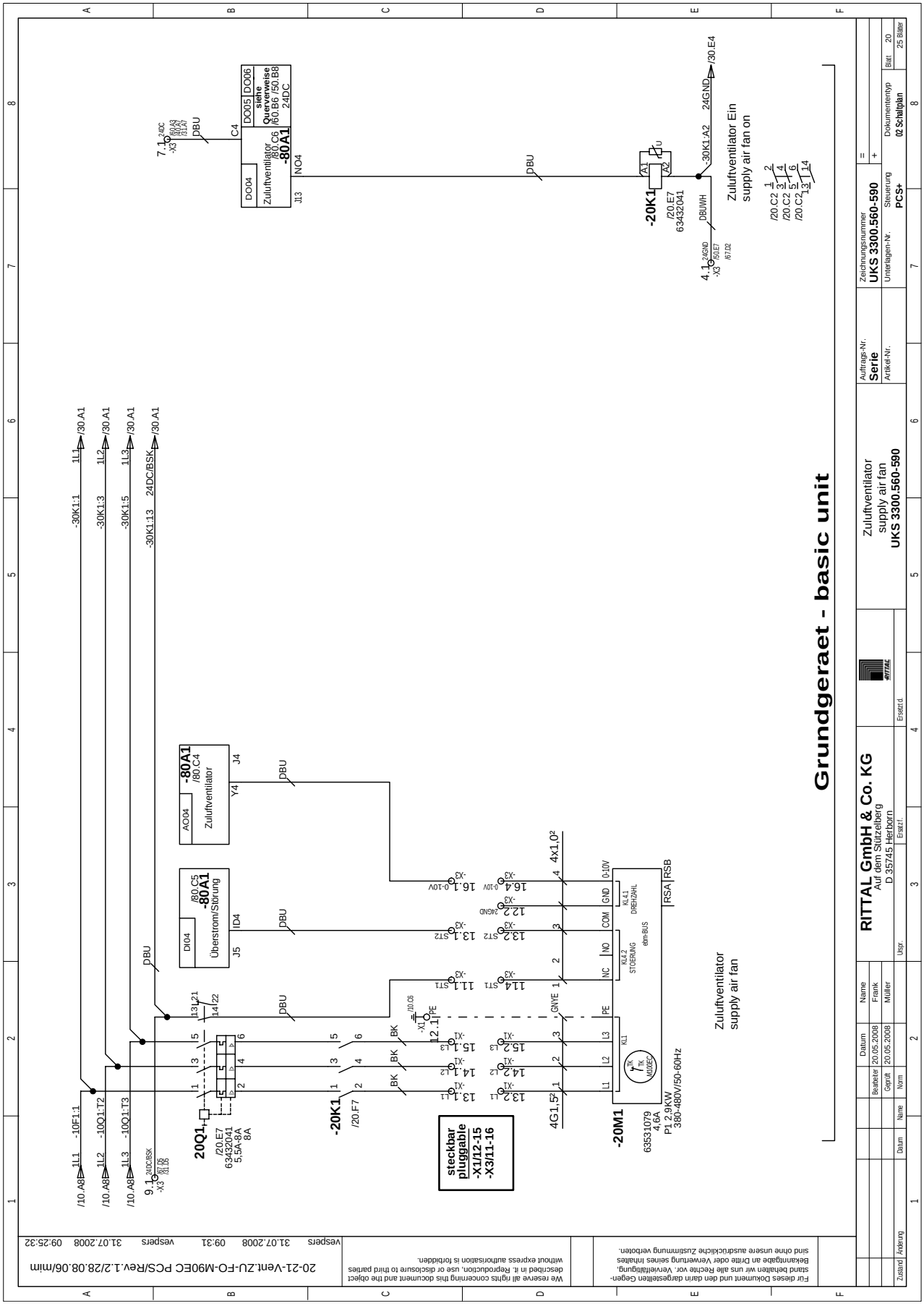
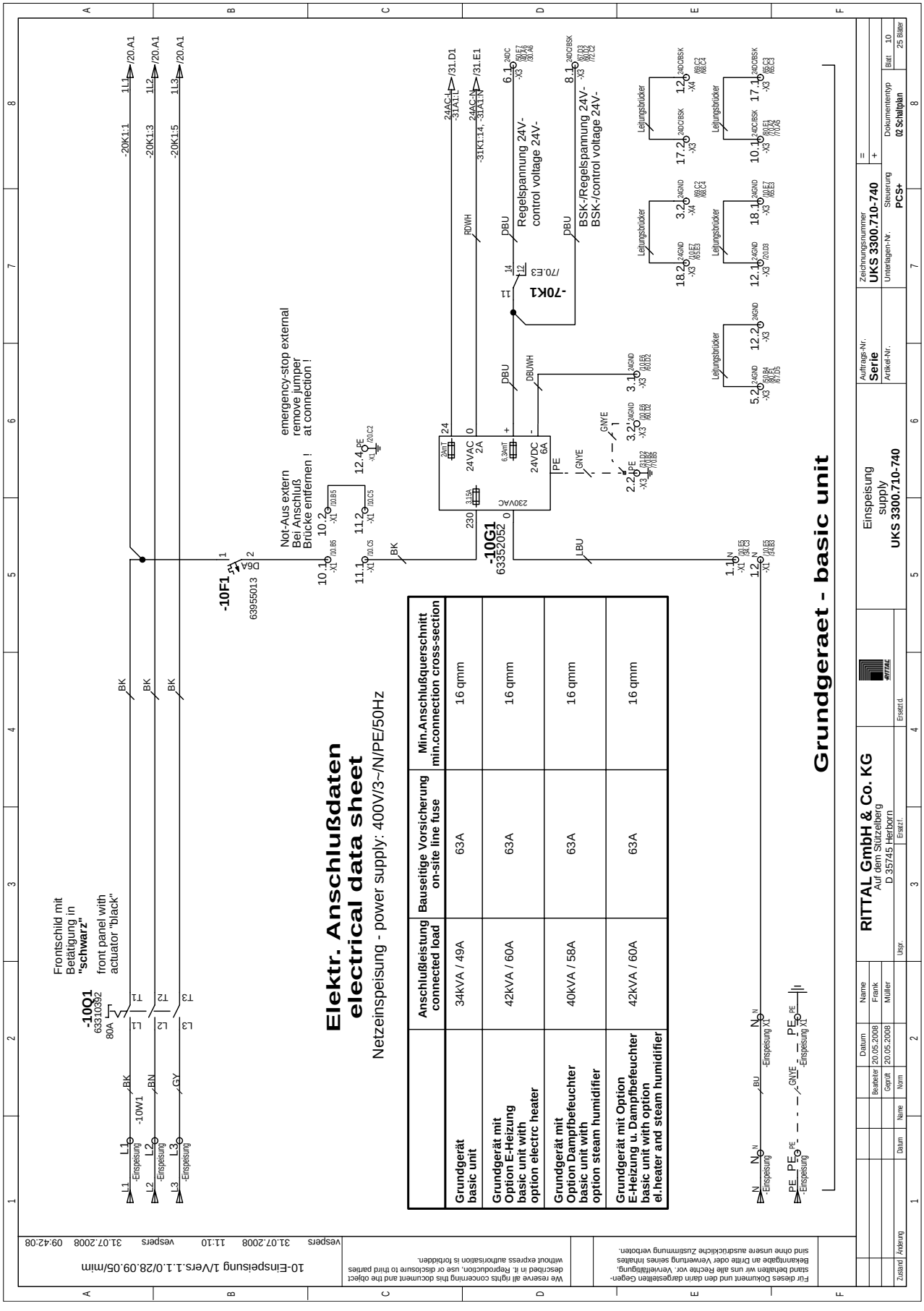


Fig. 13: Floating contacts for CRAC 3300.560-590



	Anschlußleistung connected load	Bauseitige Vorsicherung on-site line fuse	Min.Anschlußquerschnitt min.connection cross-section
Grundgerät basic unit	34kVA / 49A	63A	16 qmm
Grundgerät mit Option E-Heizung basic unit with option electrc heater	42kVA / 60A	63A	16 qmm
Grundgerät mit Option Dampfbefeuchter basic unit with option steam humidifier	40kVA / 58A	63A	16 qmm
Grundgerät mit Option E-Heizung u. Dampfbefeuchter basic unit with option el.heater and steam humidifier	42kVA / 60A	63A	16 qmm

Fig. 14: Electrical connection ratings for CRAC 3300.710-740

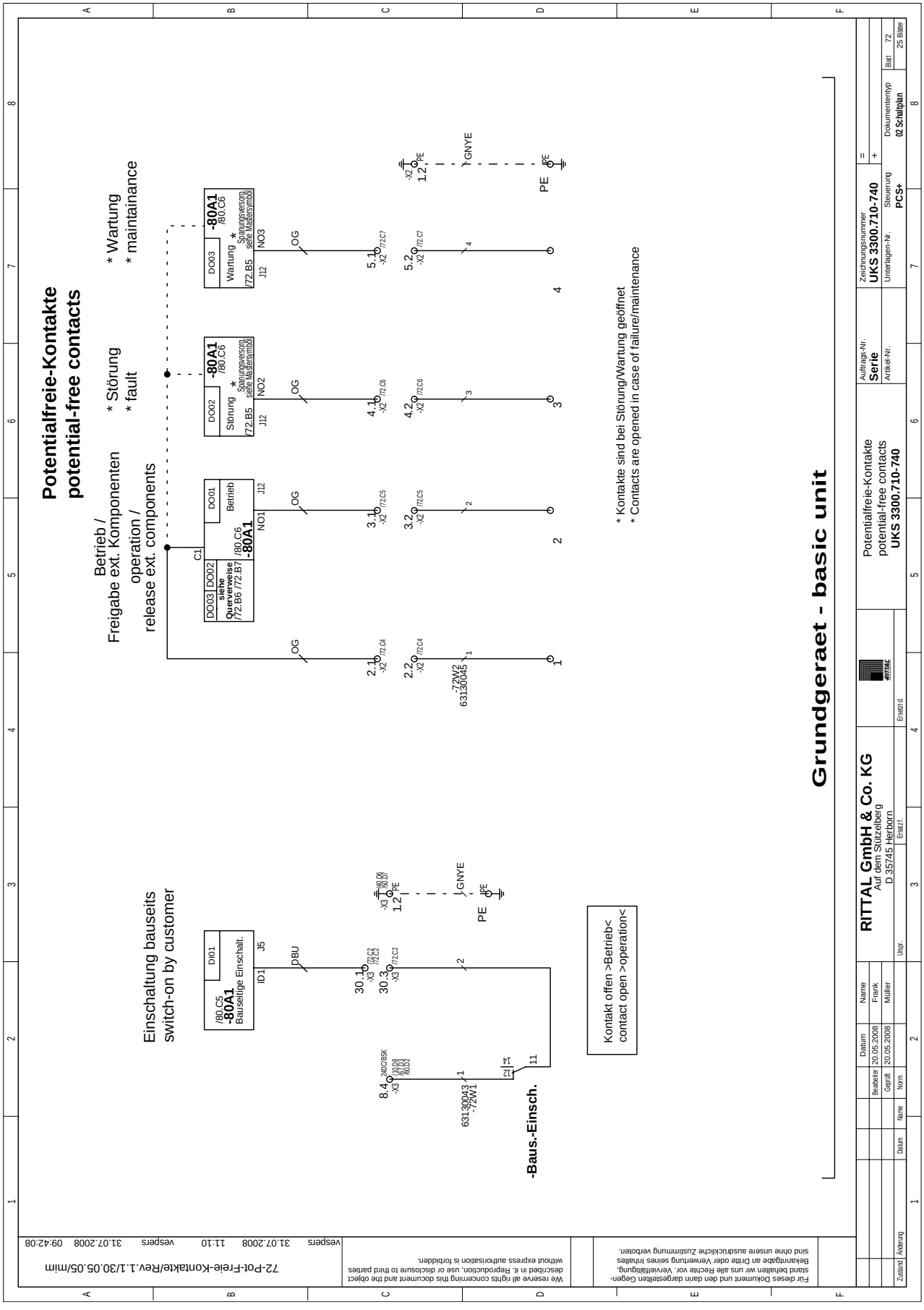


Fig. 15: Floating contacts for CRAC 3300.710-740

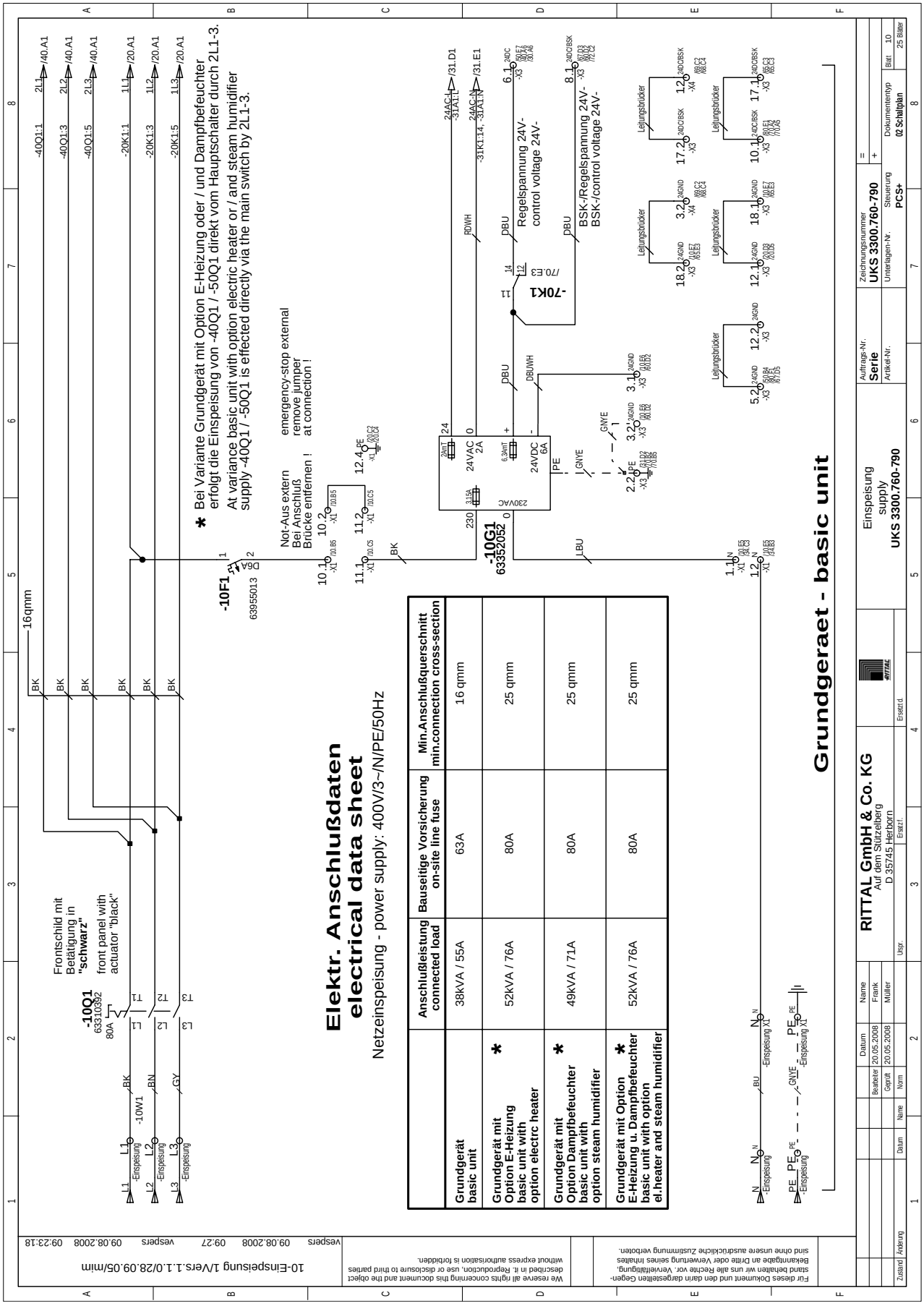


Fig. 16: Electrical connection ratings for CRAC 3300.760-790

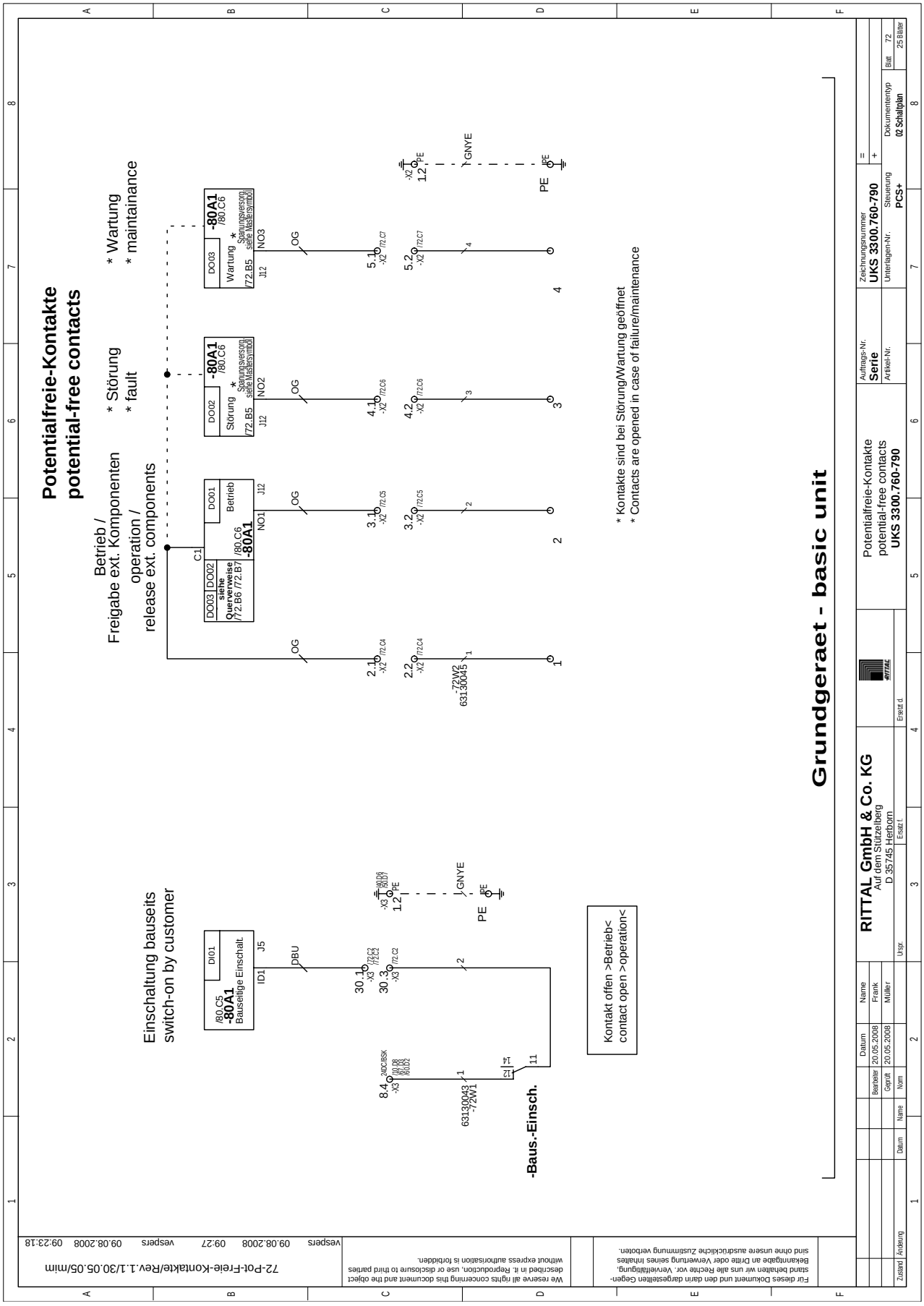
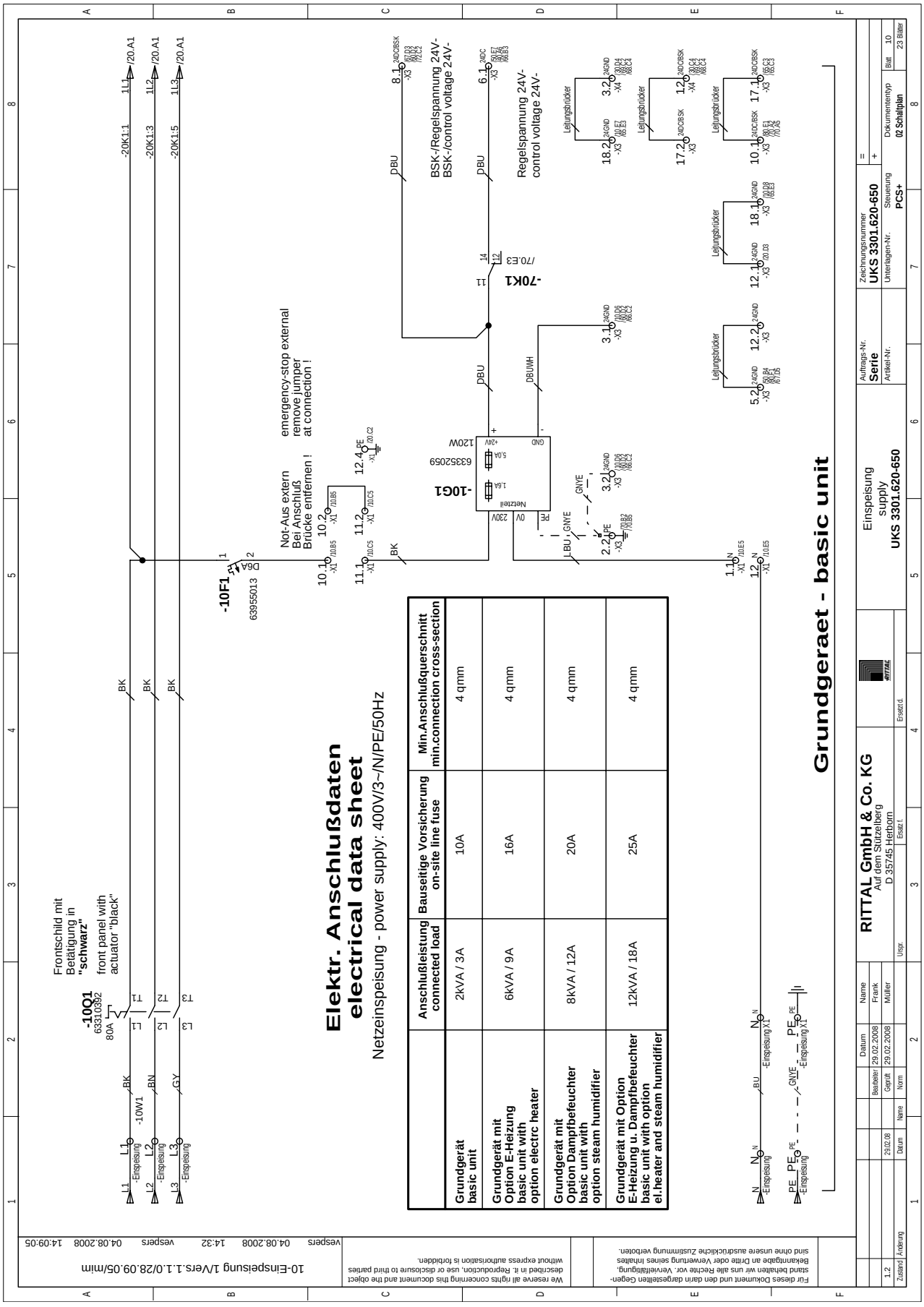


Fig. 17: Floating contacts for CRAC 3300.760-790



	Anschlußleistung connected load	Bauseitige Vorsicherung on-site line fuse	Min.Anschlußquerschnitt min.connection cross-section
Grundgerät basic unit	2kVA / 3A	10A	4 qmm
Grundgerät mit Option E-Heizung basic unit with option electrc heater	6kVA / 9A	16A	4 qmm
Grundgerät mit Option Dampfbefeuchter basic unit with option steam humidifier	8kVA / 12A	20A	4 qmm
Grundgerät mit Option E-Heizung u. Dampfbefeuchter basic unit with option el.heater and steam humidifier	12kVA / 18A	25A	4 qmm

Fig. 18: Electrical connection ratings for CRAC 3301.620-650

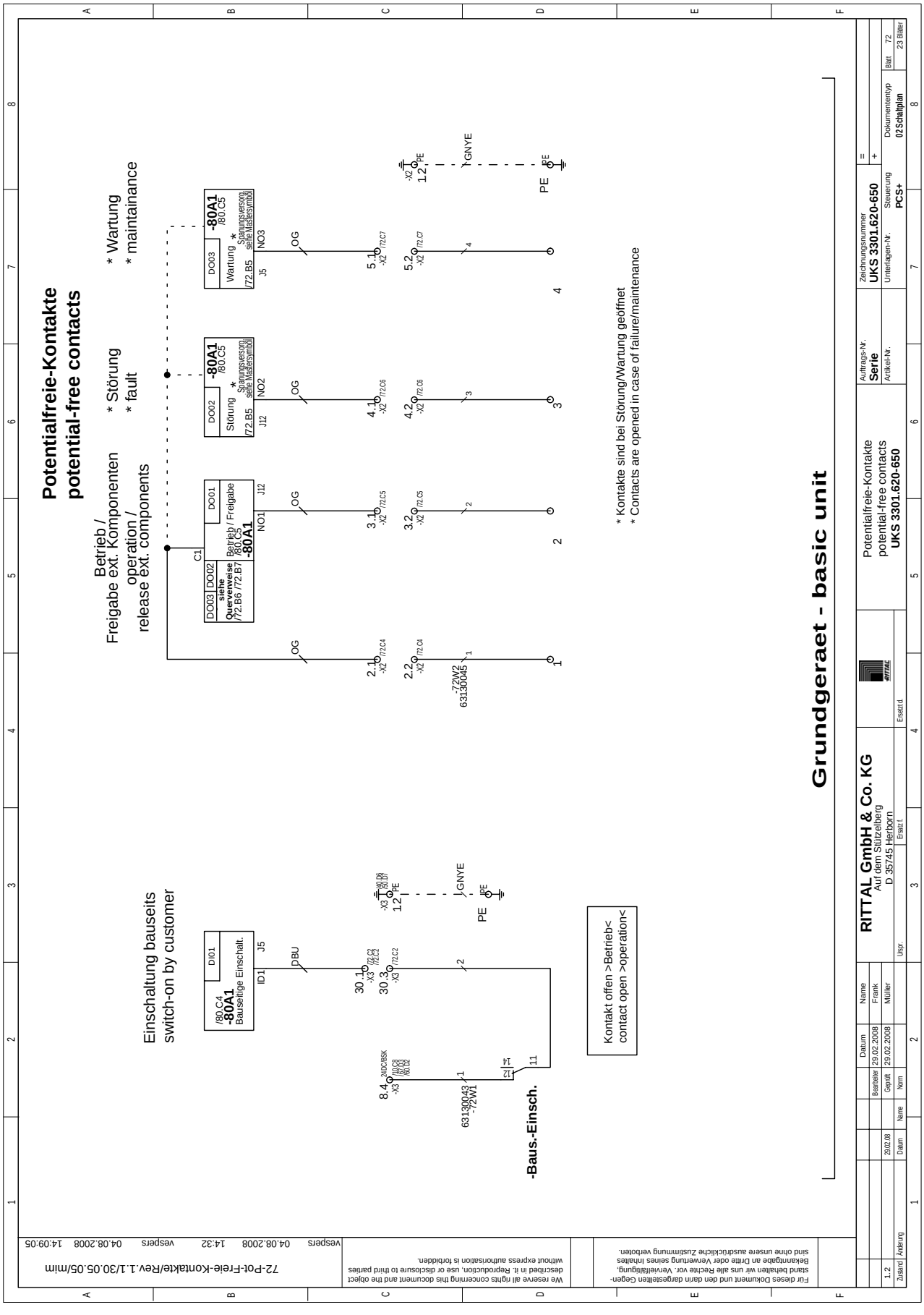


Fig. 19: Floating contacts for CRAC 3301.620-650

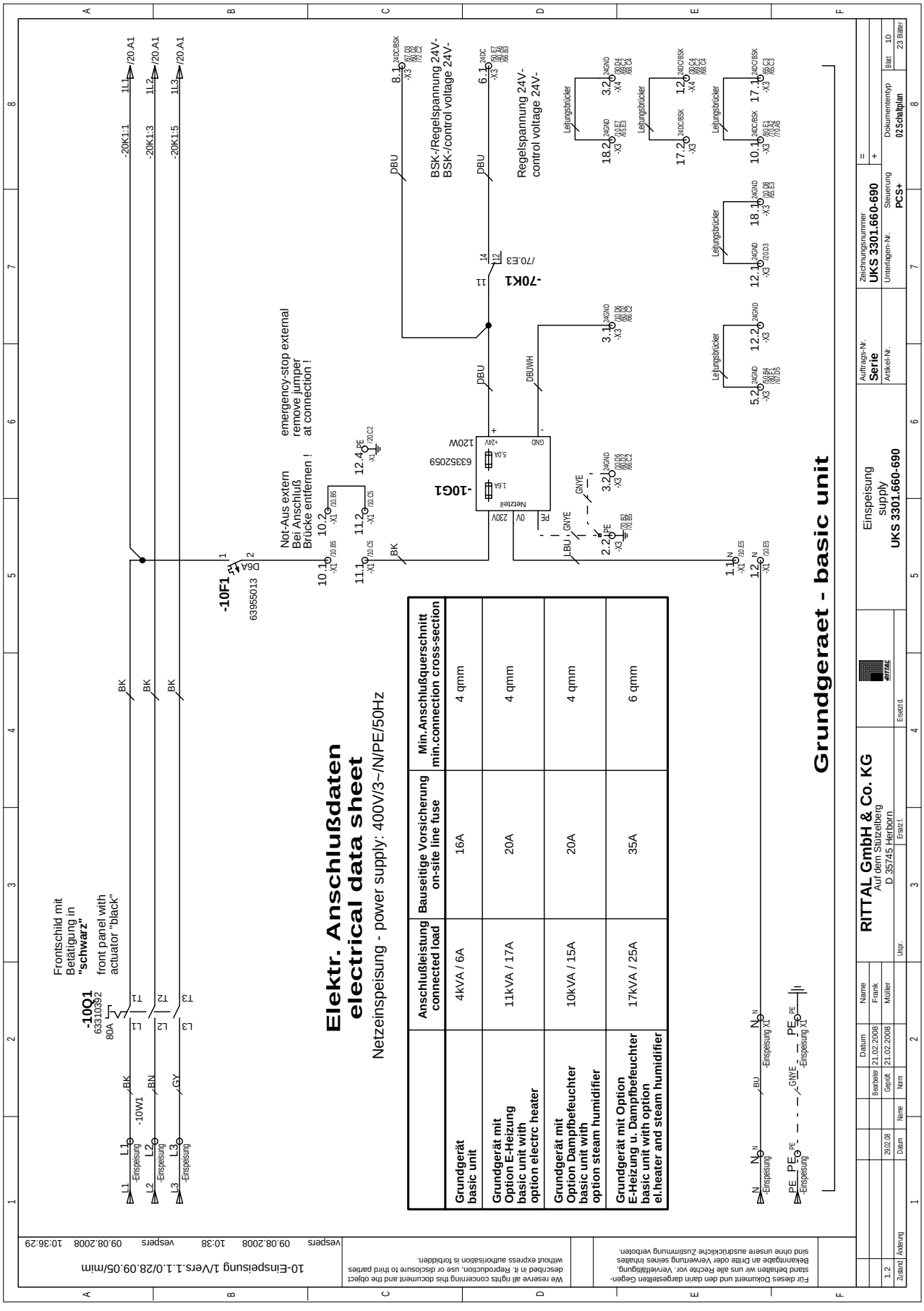


Fig. 20: Electrical connection ratings for CRAC 3301.660-690

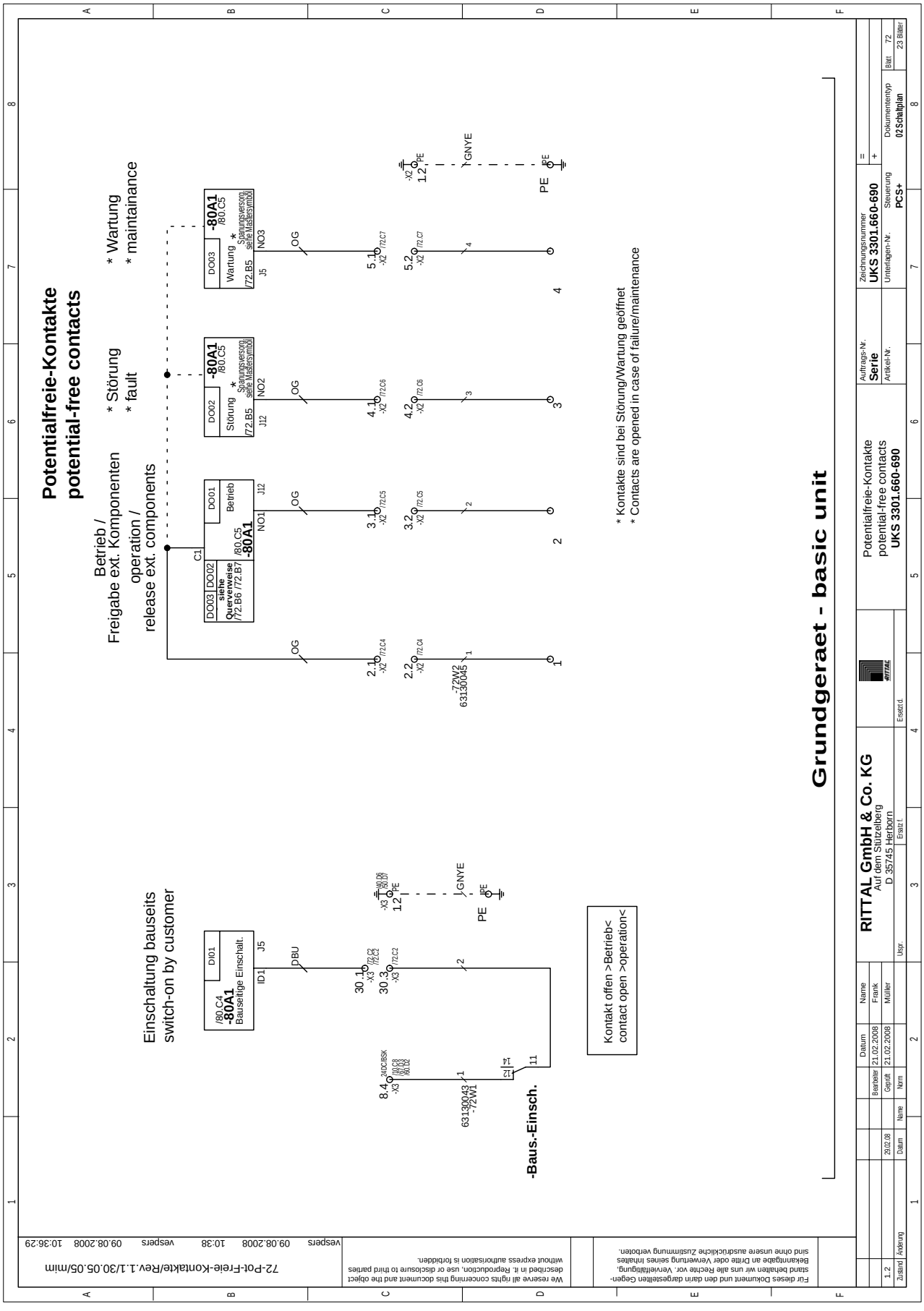
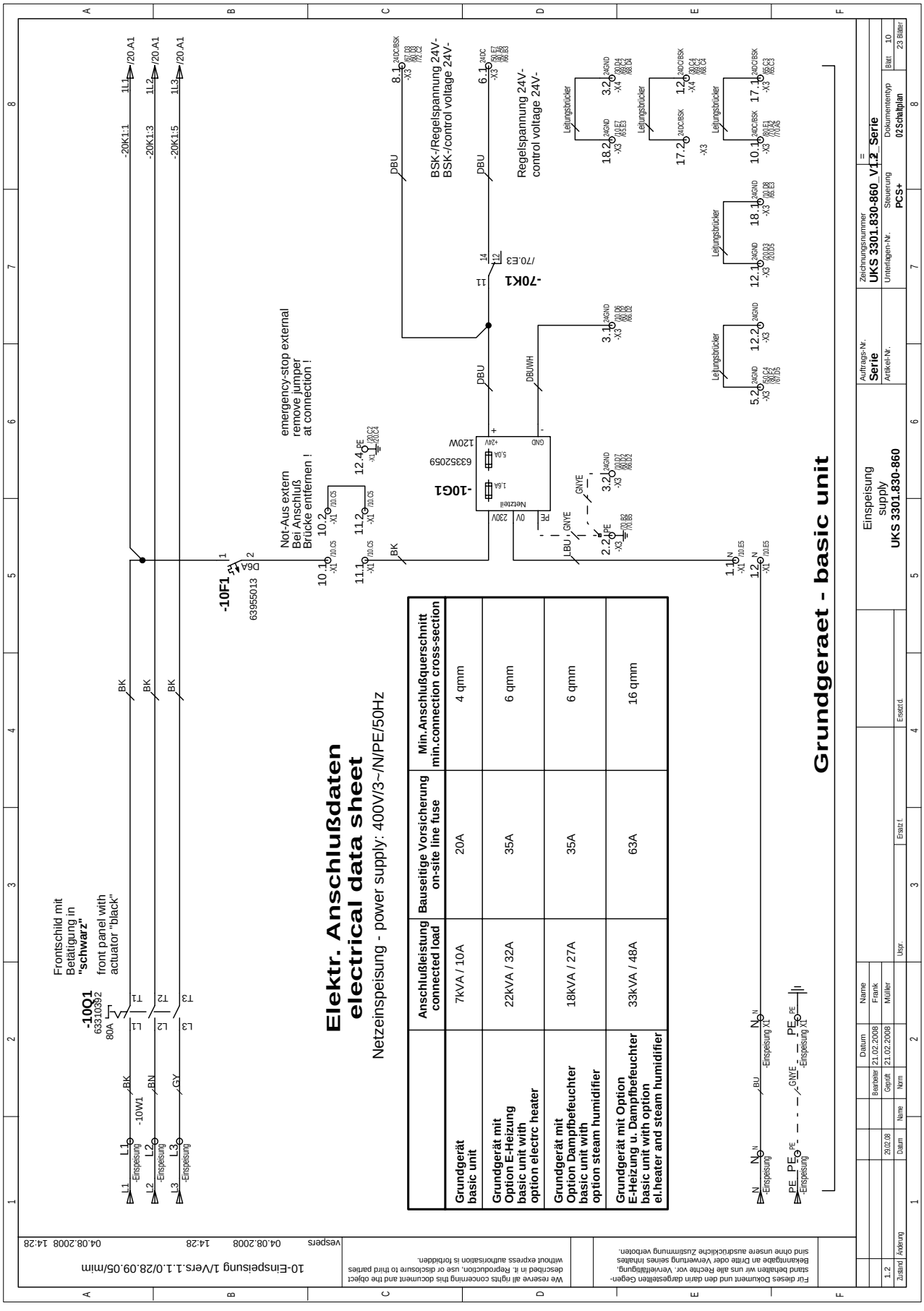


Fig. 21: Floating contacts for CRAC 3301.660-690



	Anschlußleistung connected load	Bauseitige Vorsicherung on-site line fuse	Min.Anschlußquerschnitt min.connection cross-section
Grundgerät basic unit	7kVA / 10A	20A	4 qmm
Grundgerät mit Option E-Heizung basic unit with option electrc heater	22kVA / 32A	35A	6 qmm
Grundgerät mit Option Dampfbefeuchter basic unit with option steam humidifier	18kVA / 27A	35A	6 qmm
Grundgerät mit Option E-Heizung u. Dampfbefeuchter basic unit with option el.heater and steam humidifier	33kVA / 48A	63A	16 qmm

Fig. 22: Electrical connection ratings for CRAC 3301.830-860

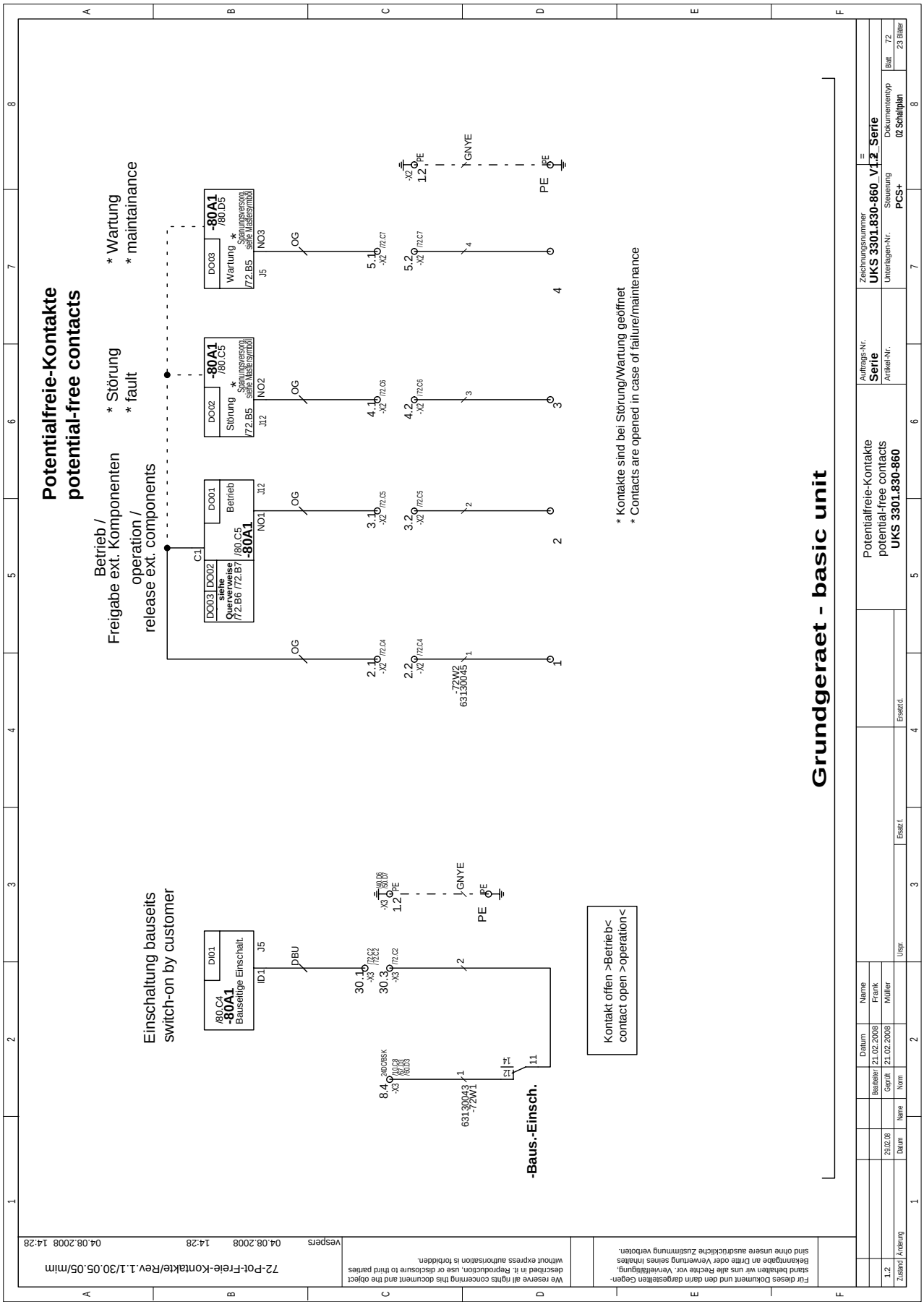


Fig. 23: Floating contacts for CRAC 3301.830-860

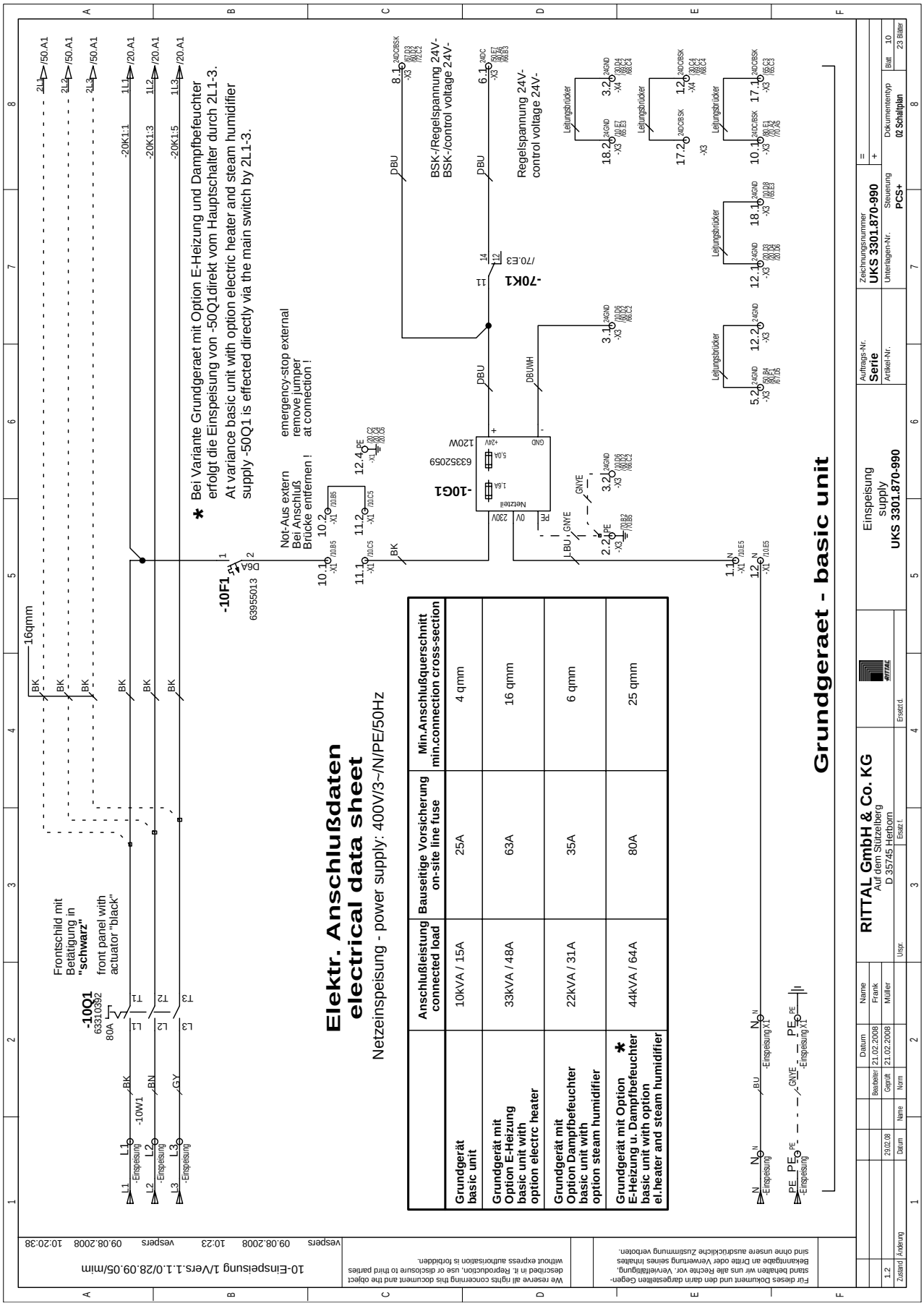


Fig. 24: Electrical connection ratings for CRAC 3301.870-990

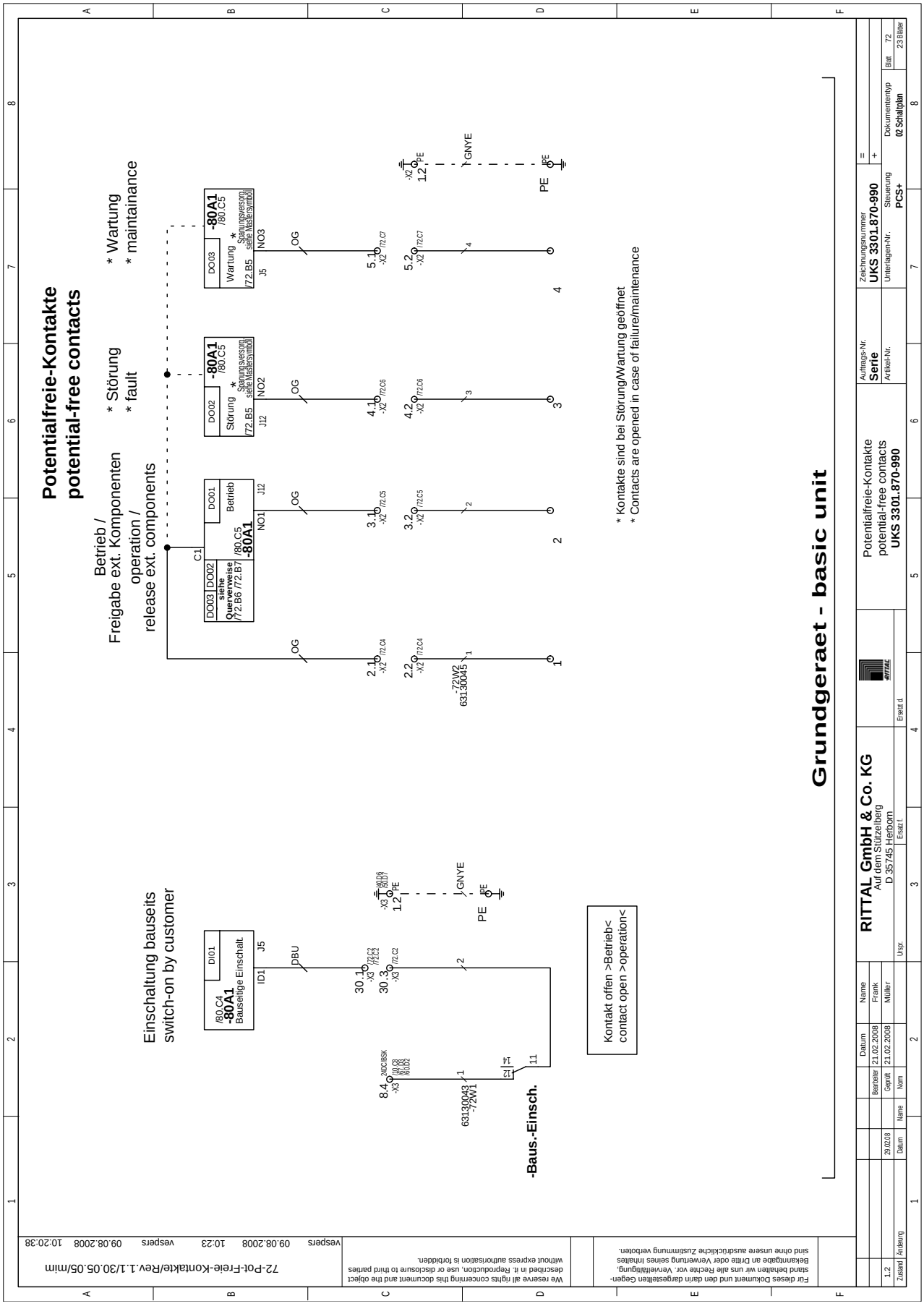


Fig. 25: Floating contacts for CRAC 3301.870-990

3.9 Commissioning

Note:

Observe Chapter 2, "Safety Instructions".

Note:

Commissioning of CRAC systems may only be carried out by Rittal Service International employees or a specialist firm on their behalf.
Work on mechanical components carried out with opened doors and viewing panels on the electrical unit may only be carried out by electro-technical trained personnel, while work on electro-technical components may only be carried out by qualified electricians.

Note:

The following table is intended for qualified specialists or Rittal Service as a checklist for commissioning. Depending on the unit equipment, not all points may be relevant. In this case, tick **"n/a"** for not applicable.

Component	To be checked	Check method	n/a	OK	Comments
Ensure that the unit is ready for operation.					
Fan unit	Are the fastening screws of the fan unit(s) tightened in the base frame?	Visual check / tensile check			
Filters	Correct filter type used?	Visual check of the filter cassette rating plate			
	Filter inserted correctly?	Visual check of air direction specification on filter cassette			
Coolant version (DX): Line system to external condenser	Piping system evacuated?	Visual check of vacuum meter			
	Coolant in system?	Visual check of inspection glass			
Compressors on cooling module	Rotalock valves tight?	Tighten using a torque wrench			1"-14 UNF: 100 Nm 1 ¼"-12 UNF: 110 Nm 1 ¾"-12 UNF: 180 Nm 2 ¼"-12 UNF: 200 Nm
Coolant version (DX) and cold water version (CW): Heat exchanger	In good condition?	Visual check of lamina and soldering points			

Component	To be checked	Check method	n/a	OK	Comments
Cold water version (CW): Line system	Supply of cold water present? All valves open in inlet and return?	Functional check			
	Control valve functions correctly?	Functional check (open/close)			
	Air bled from pumped cold water heat exchanger?	Test by opening the bleed valve			
	Water supply line without leaks?	Visual check			
Steam humidifier (optional)	Ensure quality of drinking water	Customer verification			
	Water supply line without leaks and thoroughly rinsed?	Visual check			
	Check electrical operating conditions	Compare the wiring with the circuit diagram			
	Humidifier output set correctly?	Check jumper and potentiometer settings according to circuit diagram			
	Blowdown: Drainage pipes without leaks / correct, unhindered drainage?	Blow down manually using water-filled cylinders			
Condensate transfer pump (optional)	Voltage supply present?	Main switch ON: Check terminals according to circuit diagram			
	Pressure hose laid correctly?	Visual check			
	Functionality	Fill condensate tray with water			
Multi-leaf dampers (optional)	Damper axles fixed in the servo motors? Damper axles move freely?	Visual check, manual check, move axles back and forth			
Housing	All contamination caused by installation removed?	Visual check (inside and outside)			
	Air inlet and outlet unrestricted?	Visual check			
	Front doors closed?	Visual check			
Supply and disposal lines	Area in front of unit for fan removal kept clear?	Visual check			
	Water-carrying lines: Stop valves and other valves opened?	Manual check			
	Required water quality available?	Manual check			
	Condensate piping without leaks?	Fill condensate tray with water, visual check			

Component	To be checked	Check method	n/a	OK	Comments
Electrical module	All cables in spring clips secure?	Check individually			
	Terminal connections made according to the plan (if not wired ex-works)?	Compare the terminal connections with the circuit diagram			
	All fuses OK?	Visual check			
	Voltage supply present?	Main switch ON: Is the control display activated?			
	Correct polarity (clockwise rotary field)?	Check using a rotary field measuring device			
Controllers	All setpoints set on controllers?	Compare the set parameters with the project planning documentation			
	Pressure sensor for monitoring filter contamination and volumetric flow set to the correct value?	Compare the value set on the pressure sensor with the project planning documentation			
Checks while the unit is running:					
Fan	Power consumption of the fan motor in the permissible range?	Measure and log the power consumption, then compare the measured data with the project planning documentation and motor data			
	Correct rotational direction of the fan impellor?	Visual check during run-out, compare with direction of arrow			
	Fan impellor correctly attached and balanced? Engine bearings move freely?	Vibrations / noise during operation			

Component	To be checked	Check method	n/a	OK	Comments
Cooling system in coolant version (DX)	Filling of coolant	Check compressor operation and for bubbles in the inspection glass			
	Setting values of condenser control and safety equipment (pressure switches)	Measure the set condenser pressure and compare with the setpoints in the project planning; set the pressure switches			
	Overheating	Measure the evaporator pressure. Determine the evaporation temperature from the vapour pressure table for R407c; measure the temperature at the compressor inlet			
	Humidity	Check the humidity indicator in the inspection glass on the flow side behind the filter dryer			
	Resistance on filter dryer	Check for bubbles on the discharge side of the filter dryer; measure the pressure difference on the filter dryer			
Cooling system in cold water version (CW): Supply and disposal lines	Cooling output present?	Measure the inlet temperature of the cooling medium and supply temperature, then compare this to the project planning data			
Steam humidifier (optional)	Locks released (e.g. safety hygrostat)?	Check functionality by changing the humidity setpoint			
Multi-leaf dampers	All servo motors working properly?	Check functionality by switching the unit on and off			
Volumetric air flow	Volumetric flow settings correct?	Make differential pressure measurements for the set operating point on the inlet nozzle; read the air quantities from the fan diagrams and compare them to the project planning data			

Component	To be checked	Check method	n/a	OK	Comments
Monitoring functions	Motor circuit breaker responds?	Set the trigger value temporarily under the measured power consumption at the highest operating point			
	Volumetric flow monitoring system on the pressure sensor responds?	Remove the air hose on the pressure sensor			
	Filter pressure monitoring system works properly?	Measure the filter resistance and set the switching value of the pressure sensor below the current resistance			
	Safety thermostat on the electric heater > 65 °C	Using a hot-air gun, heat the thermostat to above the switching value and check the switch function; Disconnect one of the poles on the clamping strip and check whether the heater turns off			

Tab. 1: Commissioning checklist

4 Operation

Note:

Permanent operation of the CRAC system does not require repeated operator intervention.
The unit maintains a constant room temperature automatically.
In the event of faults, the unit emits a fault alarm automatically.
In the event of serious malfunctions, the unit switches itself off automatically and also emits a fault alarm. The forwarding of the fault alarm depends on the connection to the surrounding on-site equipment.
If a reserve unit is available according to the project planning, then this is switched on automatically in the event of a fault.
When operating according to the energy efficiency guidelines recommended by Rittal, the reserve systems also operate permanently in normal operation. When a unit breaks down, the volumetric air flow setpoints of the operational units are automatically increased without user intervention. This maintains the total planned quantity of conditioned air despite the failure of a unit.
The previous operating method must be planned and parameterised by Rittal Service International during commissioning.
The reserve operation of several units requires the installation of a bus line between the Rittal CRAC systems used in a room.

Note:

This documentation is also included with the delivery of a separate set of operating instructions for the “Rittal pcs+” controller. These operating instructions are available on the network as a separate document.
For example, the Rittal pcs+ operating instructions can be used when changing temperature setpoints.

Note:

Opening the unit doors as described below should only be made when the unit has to be disconnected as a matter of urgency.
If the unit is operating as part of a reserve combination, then switching off the unit is interpreted as a fault.
If all units used for cooling IT rooms (or more than one unit when several units are used) should be switched off, then this **must be agreed upon beforehand** with the IT hardware operator.

4.1 Opening the front doors

Note:

Opening the front door containing the controller display is necessary for accessing the main unit switch.
Opening the front doors during operation is essentially possible without coming into contact with rotating parts.
However, the unit should be switched off on the controller display before opening the doors. For more information, see the separate operating instructions of the “Rittal pcs+” controller.

The transparent cover plate used for covering the electrical unit inside the system does not need to be removed for maintenance purposes. Please observe the following safety instructions.

Danger! Electric shock.

Contact with live electrical parts may be fatal.

Turn off the unit at the main switch before opening the cover plates.

Before switching on, ensure that it is not possible to come into contact with live electrical parts.

Only trained electro-technical personnel and electricians may open the cover plates.

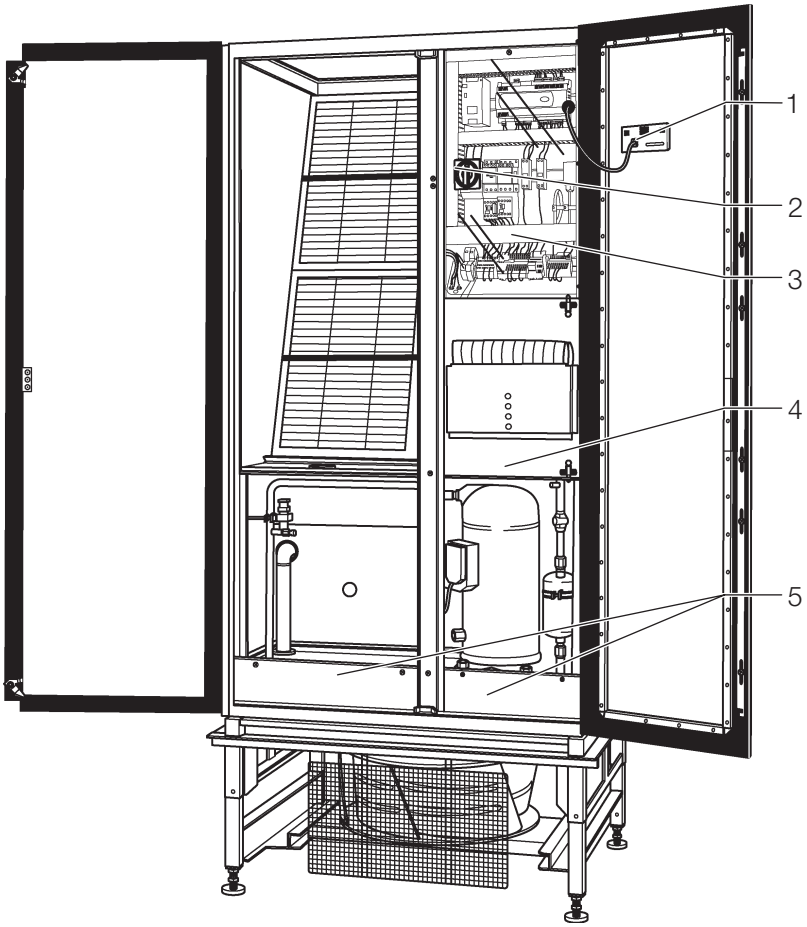


Fig. 26: Covers (DX version in this example)

1 Display connector
2 Main switch
3 Electric unit cover plate (transparent)
4 Shielding plate
5 Small cover plates

4.2 Switching the unit on and off

Note:

The unit is disconnected from the power supply by pressing the main switch.

4.2.1 Switching on the CRAC system

- Switch on the main switch (“I” setting).
- Switch on the CRAC system using the controller.

4.2.2 Switching off the CRAC system

- Switch off the CRAC system using the controller.
- After the fan has come to a stop, switch off the main switch (“0” setting).

5 Maintenance

Note:

Observe Chapter 2, "Safety Instructions".

Note:

Maintenance of the CRAC system may only be carried out by qualified mechanical and electro-technical trained personnel, or by Rittal Service. Work on mechanical components carried out with opened doors, viewing panels and covers may only be carried out by electro-technical trained personnel, while work on electrical components may only be carried out by qualified electricians.

For details on the maintenance of unit components, see also Chapter 7, "Unit Components". Observe the separate instructions when using external components.

5.1 Monthly maintenance

Monthly maintenance tasks primarily deal with checks that prevent errors by detecting wear to the unit in good time.
The following maintenance tasks can therefore be carried out by the customer's maintenance personnel.

Assembly / component	Maintenance task	Carried out by ...	
		1)	2)
Humidifier	Check for contamination and correct functionality. Check correct operation.	x	x
Fan	Check smoothness of fan operation	x	
	Check motor bearing for noises	x	
Cooling circuit	Check smoothness of compressor operation	x	
	Check pipes for traces of oil (leaks)	x	
Heat exchanger	Check pumped cold water heat exchanger for contamination on the lamella	x	
Condensate transfer pump	Check filter, container and float-actuator switch for contamination	x	
Condensate discharge	Unscrew the ball non-return siphon and check for contamination	x	
1) Maintenance specialists 2) Rittal Service			

Tab. 1: Monthly maintenance

5.2 Six-monthly maintenance

Six-monthly maintenance tasks deal primarily with work that is only to be made by trained specialists from Rittal Service or their authorised agents. The customer's maintenance staff may only carry out tasks listed in the left-hand column.

All maintenance tasks must be documented.

Assembly / component	Maintenance task	Carried out by ...	
		1)	2)
Fan	Check the motor circuit-breaker combination		x
Air filter	Check level of contamination and replace, if necessary	x	x
	Check filter and filter support for leaks	x	x
	Check filter monitoring	x	x
Cooling circuit	Measure temperature of the pressure line		x
	Measure temperature of the extraction line; visual check of collar		x
	Measure overheating, undercooling and evaporation/condensation temperature		x
	Check high-pressure and low-pressure switch		x
	Check pressure control of the condenser fan		x
	Check coolant for bubbles in the inspection glass under full load		x
	Examine coolant-carrying parts for traces of oil		x
	Examine coolant-carrying parts for leaks		x
Multi-leaf dampers	Check that axles are fixed in the servo motors and check for smooth axle movement. Control direction correct?		x
Supply and disposal lines	Check all flexible connections for leaks		x
	Clean all condensate discharges, including the siphon	x	x
	Check functionality of all condensate discharges, including the siphon	x	x
	Clean all trays	x	x
	Check and clean dirt trap		x
Electric heater	Safety thermostat on the electric heater: Check functionality		x
Electric unit/ control unit/ controller	Check all fuses	x	x
	Check functionality of guards and relays	x	x
	Check connection clamps and signal lights	x	x
	Set limits OK?	x	x
	Determine actual temperature and humidity values and compare with setpoints		x
Housing	Clean inside of unit	x	
1) Maintenance specialists 2) Rittal Service			

Tab. 2: Six-monthly maintenance

5.3 Annual maintenance

Annual maintenance tasks deal only with work made by trained specialists from Rittal Service or their authorised agents. The customer's maintenance staff should not carry out these tasks.

All maintenance tasks must be documented.

Assembly / component	Maintenance task	Carried out by ...	
		1)	2)
Humidifier	Clean inlet and drainage valves, drainage channel and internal parts; check drainage lines including the siphon, plus all hoses and electrical lines.		x
	Check for contamination and correct functionality. If necessary, replace the cylinder and reset the maintenance display.		x
	Check functionality and calcification of steam lance and condensate discharge.		x
Fan	Clean fan impellor		x
	Check power consumption of the drive motor		x
Cooling circuit	Measure power consumption of the compressor at the maximum permissible operating pressure		x
	Check filter dryer for icing and replace, if necessary		x
	Check functionality of expansion valve and injection		x
1) Maintenance specialists 2) Rittal Service			

Tab. 3: Annual maintenance

5.4 Irregular maintenance tasks

The service life of the filter inserts is especially dependent on the contamination of the air within the controlled room, irrespective of the recurrent maintenance tasks. The level of contamination is influenced by different factors, such as:

- The filtration quality of air supplied by a third-party system
- The operation of a server room with overpressure or uniform pressure compared to the surrounding environment
- The dust released from the clothing of IT personnel
- The amount of personnel occupying the room

The differential pressure of the filter inserts increases when they are subjected to dust.
This pressure difference on the filter is monitored and a maintenance signal is emitted by the microprocessor controller when the limit is exceeded.
The CRAC system filter inserts should be replaced as soon as possible when this signal occurs.

These maintenance tasks can be made independently by the customer's maintenance staff. The measures described below must be carried out for this purpose.

Danger! Electric shock.

Contact with live electrical parts may be fatal.

Turn off the unit at the main switch before opening the cover plate of the electrical unit.

Before switching on, ensure that it is not possible to come into contact with live electrical parts.

Danger! Electric shock.

Some electrical circuits in the unit and the fan electrical supply remain live for some minutes after the power supply is interrupted. Contact with these electrical parts may be fatal.
Wait at least two minutes before carrying out work on or near electrical parts after switching off the unit.

Danger! Electric shock.

Floating contacts may remain live after the power supply is interrupted. Contact with these electrical parts may be fatal.
Only handle floating contacts when you are sure that they are not live.

Danger! Electric shock.

MSR and safety circuits remain live after the main switch has been deactivated. Contact with these electrical parts may be fatal.

Only handle MSR and safety circuits when the system has been disconnected from the power supply.

Danger! Fatal injuries caused by the fan impellor.

Keep persons and objects away from the fan impellor. Do not remove the raised floor until the power supply is disconnected and the impellor is not moving. Shut down the fan as often as possible during maintenance work.

Tie long hair back.

Do not wear loose clothing.

Fans start up automatically following power disruptions.

Danger! Injury caused by raised floor covers springing open.

Excess pressure in the raised floor may lead to the covers springing up when opened.

Only open the raised floor covers when the fan is shut down.

Danger! Risk of contamination with hazardous substances.

Breathing in or coming into contact with the filter dust can be hazardous to health.

Wear a dust mask with a P2 filter insert and protective gloves when removing the filter.

Also wear the additional protective clothing prescribed by the operator when exposing the filter to hazardous substances.

Danger! Risk of contamination with hazardous substances.

Breathing in or coming into contact with contamination caused during normal operation of the unit can be hazardous to health.

Clean the unit at regular intervals.

Danger! Cut wounds, especially due to sharp edges on the heat exchanger.

Put on protective gloves before beginning assembly or cleaning work.

Danger! Hand injuries caused by meshing gear wheels on multi-leaf dampers.

Keep hands away from exterior gear wheels.

Danger! Hand injuries caused by retracting multi-leaf dampers.

Keep hands away from the multi-leaf dampers.

Danger! Danger of burns.

Do not touch the heater, steam humidifier (and lance) and the supply lines during operation and some time after operation.

Caution! Risk of malfunction or damage.

Do not modify the unit. Use only original spare parts.

Note:

Observe all regional water regulations when disposing of cleaning water.

5.4.1 Removing the cover plates inside the unit

Danger! Electric shock.

Contact with live electrical parts may be fatal.

Turn off the unit at the main switch before opening the cover plates.

Before switching on, ensure that it is not possible to come into contact with live electrical parts.

Only trained electro-technical personnel and electricians may open the cover plates.

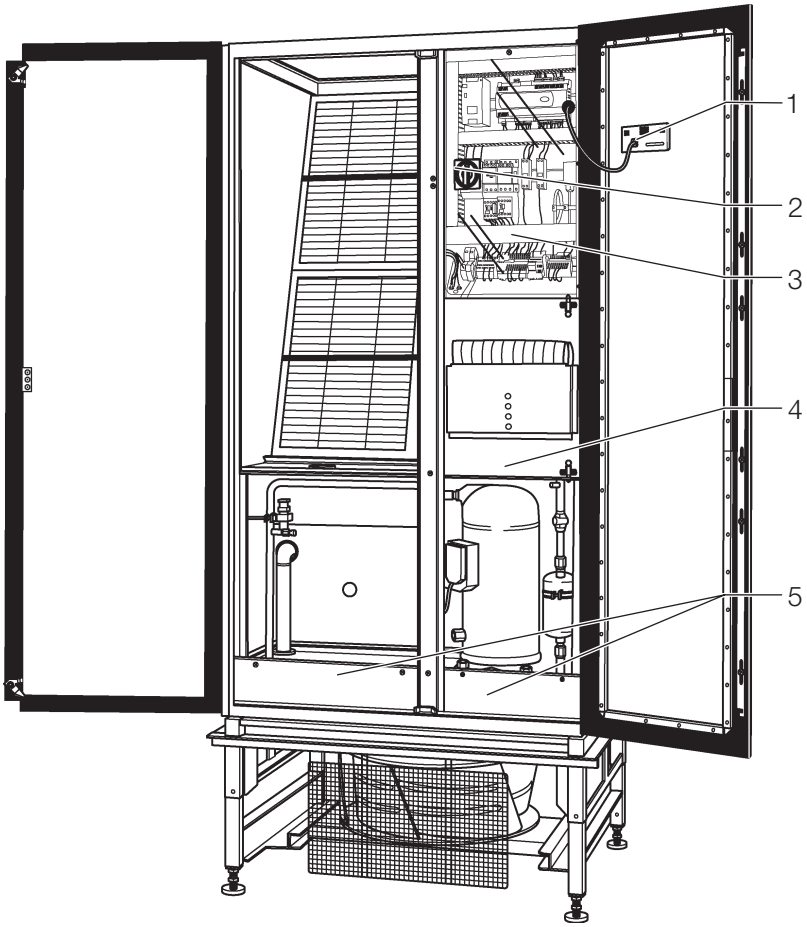


Fig. 27: Covers (DX version in this example)

1 Display connector
2 Main switch
3 Electric unit cover plate (transparent)
4 Shielding plate
5 Small cover plates

Note:

Only remove the cover plates inside the unit when necessary according to the descriptions of the maintenance tasks.
Otherwise, the individual plates must be left in their installation positions.

The following steps must be carried out when removing the cover plates:

- Remove the shielding plate under the electrical unit (Fig. 27, item 4):
- To do this, push the bar on the shielding plate under the electrical unit inwards, then remove the shielding plate.
- Remove the cover plates under the heat exchanger (Fig. 27, item 5): CW units have one cover plate, while DX units have two cover plates underneath the heat exchanger.
- To remove the plates, open the locks with a screwdriver.
- Remove the cover plate on the electrical unit (Fig. 27, item 3): The display connector (Fig. 27, item 1) must be removed first.
- Loosen the mounting screws on the electrical unit with a screwdriver, then pull the cable of the display and connector through the recess in the cover plate.

Reassembly is made in reverse order to the process detailed above.

5.4.2 Filter replacement

Note:

Depending on the size of the unit, the CRAC system is equipped with one or more filter inserts.

Note:

Replacement of the filter inserts is either made according to the maintenance plan or when the filter monitoring system emits a fault message due to a pressure difference.

Note:

The transparent cover plate of the electrical unit is not removed when the filter inserts are replaced.

Note:

The filter inserts are pressed against the heat exchanger by the air flow and kept in place by a frame plate. The rubber clamps are used additionally for locking the inserts into the correct position, which prevents the air flow from avoiding the filter.

Note:

Filter inserts cannot be regenerated by washing or cleaning with compressed air. Only original, packed replacement filter cassettes may be used.

The following tasks must be carried out when replacing the filter insert:

- Switch off the unit on the controller display on the front of the unit (see also the separate Rittal pcs+ operating instructions).
- Switch off the unit additionally on the main unit switch.
- Remove the shielding plate under the electrical unit (see also the safety instructions and process description in Chapter 5.4.1, "Removing the cover plates inside the unit").
- Remove the rubber clamps by detaching the metal side hooks from the holes in the heat exchanger frame.
- Remove the filter inserts.
- Make a visual check of the heat exchanger membrane for contamination. Clean with a suitable vacuum cleaner, if required.
- Insert the new filter inserts.
- Bring the rubber clamps back into their original position and attach the metal hooks to the side holes.
- Reattach the cover plate.
- Switch the main unit switch back on.

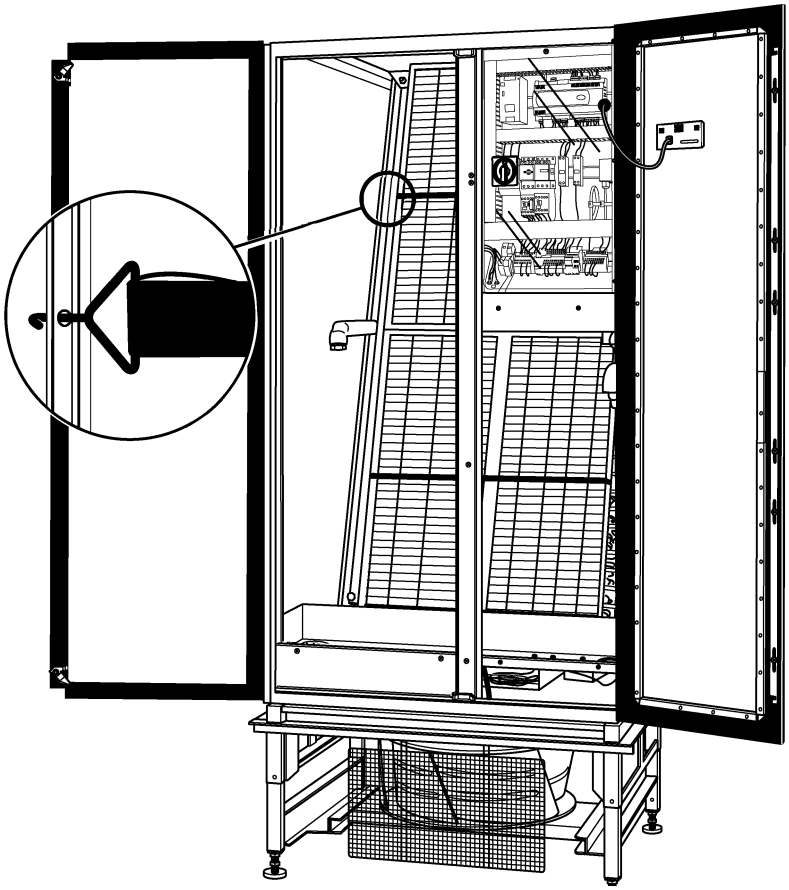


Fig. 28: Filter attachment with rubber clamps (CW version in this example)

6 Troubleshooting and Decommissioning

Note:

Observe Chapter 2, "Safety Instructions".

Note:

Troubleshooting and decommissioning of the CRAC system may only be carried out by qualified mechanical and electro-technical trained personnel, or by Rittal Service. Work on mechanical components carried out with opened doors, viewing panels and covers may only be carried out by electro-technical trained personnel, while work on electrical components may only be carried out by qualified electricians.

6.1 Troubleshooting

Assembly / component	Malfunction	Cause	Solution	Implementation by ...	
				1)	2)
Fan	No air flow/ to little air	Fan not moving	Check position of the main switch	x	
			Check the system controller (external release)		x
			Check the motor protection and switch back on, if necessary	x	
			Check the power supply on all three motor phases		x
			Measure the power consumption		x
			Check the motor winding. Replace the motor in the event of phase-to-phase faults or earth faults.		x
			Check the motor protection device (thermal contact)		x
			Check the controller		x
			Check the air flow monitoring		x
			Check the setting values on the pressure sensor	x	
	Motor power consumption too high	Too much air flow	Set the air flow		x
		Wrong direction of motor rotation	Phase change on mains connection	x	
		External pressure in raised floor too high	Check the pressure		x
Cooler area	Discharge of water	Condensate discharge blocked	Clean the tray and drain Check the ball siphon	x	
		Heat exchanger or pipes are leaking	Check for damages and tightness of screw connections		x
	No cooling output	Valve does not open	Check the controller (setpoint)	x	
			Check the valve position	x	
		No cold water	Check the generation of cold water	x	
		Air in the exchanger	Bleed the exchanger	x	
Compressor/ compressor controller	Compressor is not running	Thermostat not switched to cooling	Set the thermostat correctly	x	
		Motor-circuit breaker has been triggered	Check the settings and measure the motor winding, if necessary	x	
		High-pressure switch has been switched off	Reset the pressure switch and replace, if defective		x
			Check the condenser for contamination and clean, if necessary		x
		To little coolant, low-pressure switch does not switch	Check the correct activation	x	
			See cooling circuit		x
		Control lines of the contactor interrupted	Check the screws, terminals and cables	x	
		Contactor coil burnt out	Replace the coil	x	

Assembly / component	Malfunction	Cause	Solution	Implementation by ...	
				1)	2)
Cooling circuit	Constant excessive bubbling of coolant in the inspection glass	Too little coolant	Check all connections for leaks and tighten rotalock valves with a torque wrench, if necessary: 1"-14 UNF: 100 Nm 1 ¼"-12 UNF: 110 Nm 1 ¾"-12 UNF: 180 Nm 2 ¼"-12 UNF: 200 Nm		x
			Check coolant quantity and refill, if necessary		x
	Filter dryer iced up	Nozzle needle in injection valve is stuck	Replace the injection valve		x
		Filter dryer exhausted	Replace the filter dryer		x
Humidifier	Insufficient humidification	Fault on humidifier	See table in Chapter 7, "Unit Components"		x
		Humidity controller set incorrectly	Reset	x	
		Fault on cooler	Request a Rittal service technician		x
Heater	No heating (electric heater)	Miniature circuit-breaker has been triggered	Check and switch on, when necessary	x	
		No power supply on heater coils	Check the controller	x	
			Check the overtemperature protection device	x	
		Heating rod defective (power supply on heating coils present)	Replace the heating rods		x
		Temperature limiter has been triggered	Rectify the cause of the trigger (e.g. power failure, insufficient air quantity, fan failure, cover not fully open, volumetric flow fluctuations) and reset the temperature limiter		x
1) Maintenance specialists 2) Rittal Service					

Tab. 1: Troubleshooting

6.2 Decommissioning

6.2.1 Temporary decommissioning

Coolant version (DX)

- Tighten the caps and screw connections on the injection valves and compressors.
- If the cooling system has been disconnected, close the manual shut-off valve behind the condenser and extract to 1.5 bar. Disconnect the connection cables and seal both ends tightly with sealing bungs.

Cold water version (CW)

- Drain the water from the system. Rinse the heat exchanger with Antifrogen N or another suitable anti-freeze agent at a concentration of 25 %. The agent must be set up for an ambient temperature of -20 °C.

Humidifier and condensate system

- Remove water from the steam cylinder, humidifier supply line, blowdown line, condensate tray and ball non-return valve.

Electrical system

- Disconnect all connection cables in the electrical unit.
- Remove and store the sensor.

6.2.2 Permanent decommissioning

Coolant version (DX)

- Extract the coolant from the entire system and dispose of correctly.
- Drain the compressor oil and dispose of correctly.
- Drain the water from the entire system.

Cold water version (CW)

- Remove the water from the system.

Humidifier and condensate system

- Remove water from the steam cylinder, humidifier supply line, blowdown line, condensate tray and ball non-return valve.

Electrical system

- Disconnect all connection cables in the electrical unit.
- Remove the sensor.

- Dispose of the unit correctly.

Note:

See also the instructions in Chapter 2, "Safety Instructions".

7 Unit Components

This chapter describes the technical properties of the most important components on the CRAC system. It also contains detailed information on the necessary steps for the commissioning, maintenance and repair of important unit components.

Note:

Observe Chapter 2, "Safety Instructions".

Note:

The installation, commissioning and maintenance of the CRAC system may only be carried out by qualified mechanical and electro-technical trained personnel, or by Rittal Service. Work on mechanical components carried out with opened doors and viewing panels may only be carried out by electro-technical trained personnel, while work on electrical components may only be carried out by qualified electricians.

7.1 Fan and fan activation

Danger! Fatal injuries caused by the fan impellor.

Keep persons and objects away from the fan impellor. Do not remove the raised floor until the power supply is disconnected and the impellor is not moving. Shut down the fan as often as possible during maintenance work.

Tie long hair back.

Do not wear loose clothing.

Fans start up automatically following power disruptions.

Danger! Electric shock.

Some electrical circuits in the unit and the fan electrical supply remain live for some minutes after the power supply is interrupted. Contact with these electrical parts may be fatal.
Wait at least two minutes before carrying out work on or near electrical parts after switching off the unit.

7.1.1 Properties

- High-performance radial fan without spiral housing; air extraction from one side with stable volumetric pressure flow characteristics; statically and dynamically balanced; balance class G 2.5 according to DIN ISO 1940, part 1.
- Driven by three-phase EC motor with insulation class F according to DIN EN 60034-1; thermal contact motor protection.
- Attached in a supporting structure on a rack-mounted module which can be removed by pulling it forwards.
- Adjustment of the volumetric flow is made by a commutation unit which is addressed by the controller.

Air flow monitoring

Note:

The pressure sensor has an analogue signal output, meaning the air flow is monitored by measuring the pressure difference. A fault message is triggered when the limit pre-configured in the software is reached. A signal output to an external control unit and a remote query via modem are possible.

7.1.2 Commissioning

Checking and adjusting the volumetric flow

Note:

To determine the volumetric flow, the inlet nozzle pressure is measured against the extraction pressure on the fan.

Requirement:
All covers must be open.

- Switch off the unit using the controller and main switch.
- Remove the display connector and open the cover plate on the electric unit.
- Follow the path of the pressure measuring hose from the fan to the electric unit.
- Connect the hoses of the pressure measuring device to the free ends of the pressure measuring hoses.
- Switch the unit back on.
- Read and note down the pressure difference.
- Determine the volumetric flow according to the curve in Chapter 7.1.4. When several fans are used, multiply this figure by the number of fans. When the setpoints deviate from the measured values, then the fan speed can be changed by making entries on the controller. Further information on changing the fan speed setpoints can be found in the separate operating instructions for the CRAC system controller (Rittal pcs+).
- Remove the pressure measuring device hoses, close the electrical unit and reattach the display connector.

7.1.3 Inspection, maintenance and repairs

- Make a visual check of the fan; check the smoothness of the wheel movement.

Note:

The directly operated, free-running wheel is maintenance-free.

In the event of a defective fan impellor, motor or retainer, the complete fan unit must be replaced by Rittal Service.

7.1.4 Curves for adjusting the volumetric flow:

M100 EC fan (63531079)

The M100 EC fan is installed in all CRAC system unit sizes, with the exception of item numbers SK3301.620 to SK3301.650 (CW version) and item numbers SK3300.510 to SK3300.540 (DX version).

Identifying the unit type using unit-specific characteristics:

Cold water version (CW): Units with item numbers SK3301.620 to SK3301.650 are 1,100 mm wide and 650 mm deep.

Direct evaporator version (DX): Units with item numbers SK3300.510 to SK3300.540 are only equipped with a coolant compressor.

Unit identification according to the housing dimensions is not possible, as different unit sizes all have identical housing dimensions.

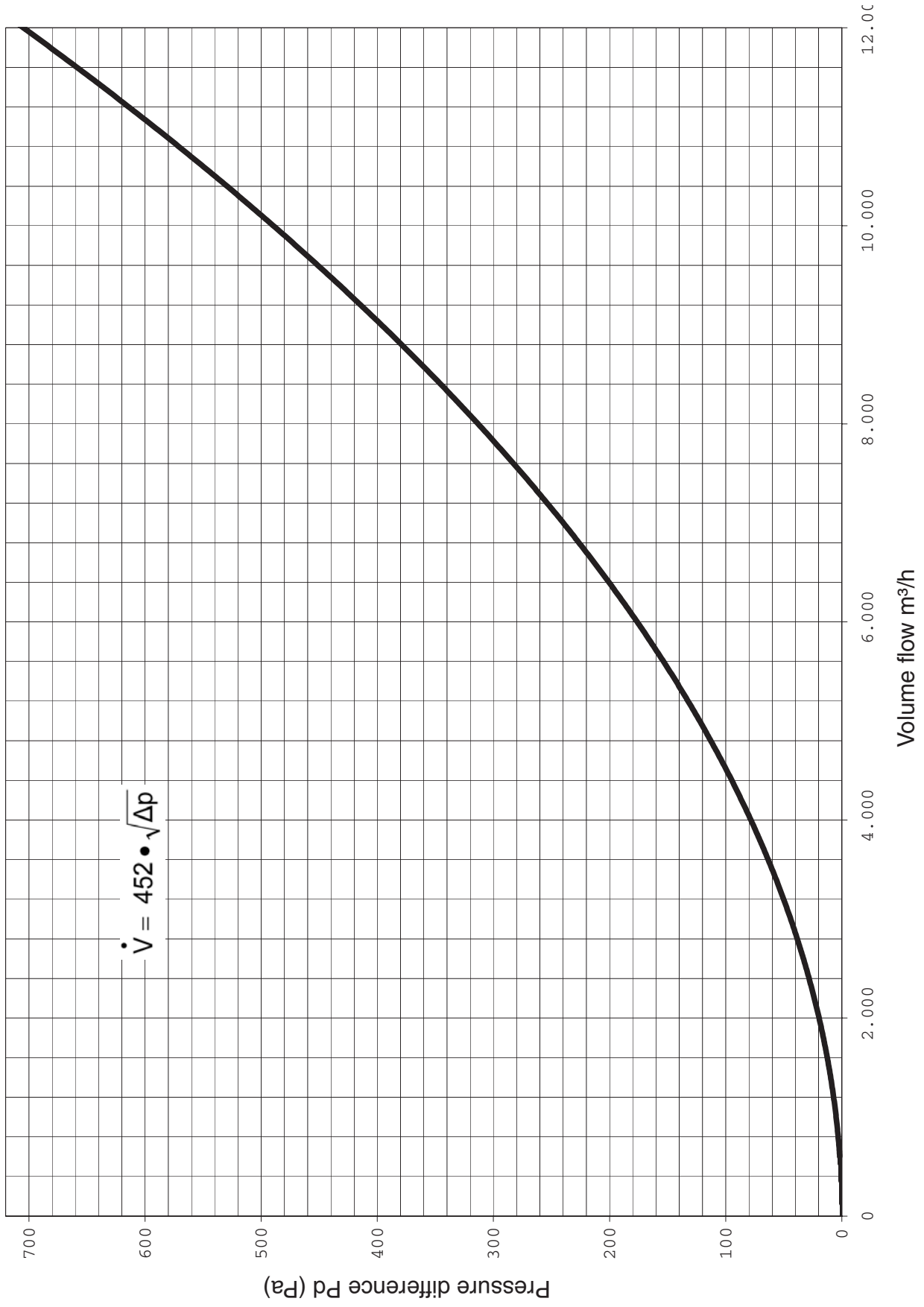


Fig. 29: Volumetric flow curve for M100 fan

M60 EC fan (63531090)

The M60 EC fan is only installed in units with item numbers SK3301.620 to SK3301.650 (CW version) and item numbers SK3300.510 to SK3300.540 (DX version).

Identifying the unit type using unit-specific characteristics:

Cold water version (CW): Units with item numbers SK3301.620 to SK3301.650 are 1,100 mm wide and 650 mm deep.

Direct evaporator version (DX): Units with item numbers SK3300.510 to SK3300.540 are only equipped with a coolant compressor.

Unit identification according to the housing dimensions is not possible, as different unit sizes all have identical housing dimensions.

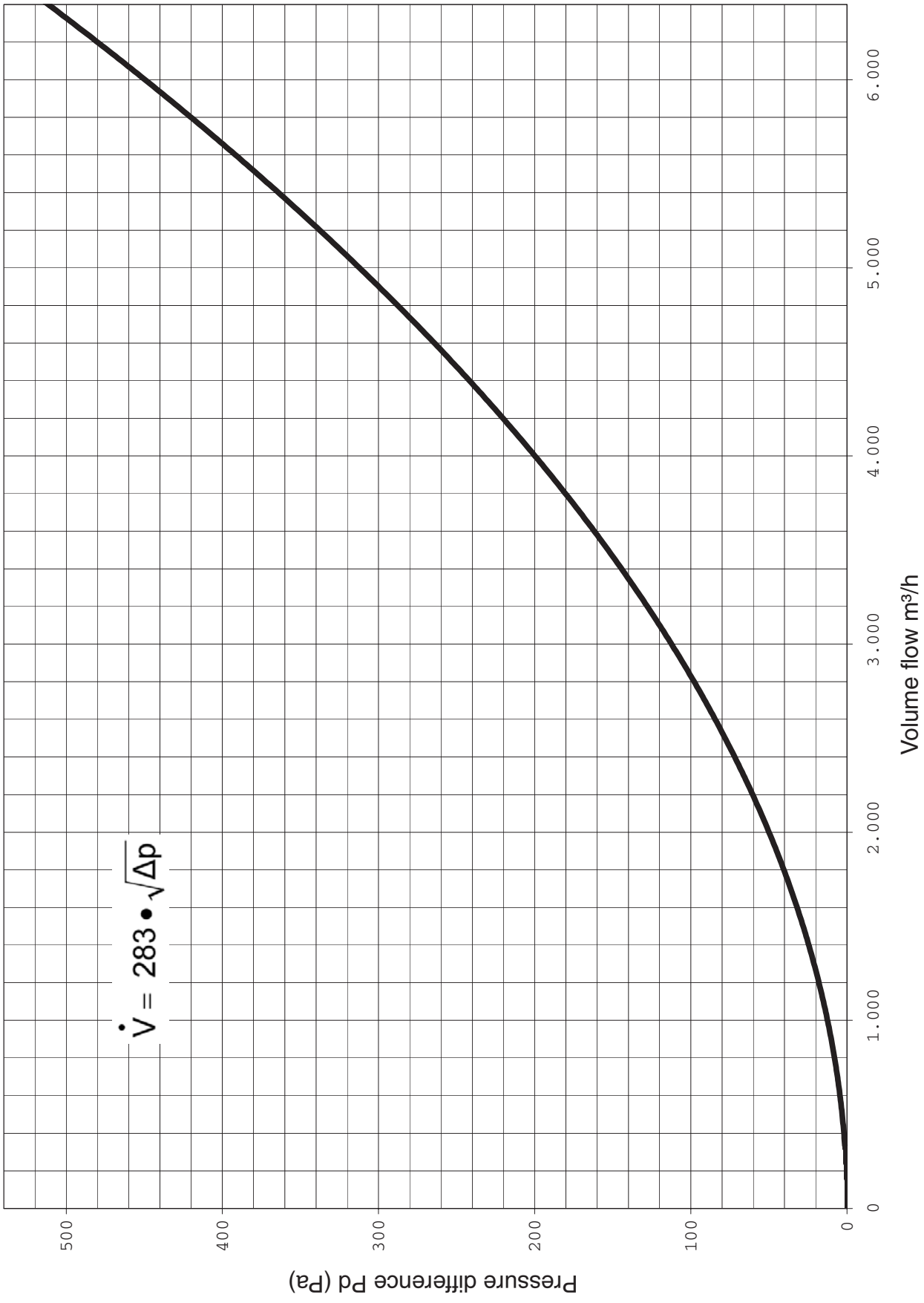


Fig. 30: Volumetric flow curve for M60 fan

7.2 Filter monitoring and filters

7.2.1 Filter monitoring using pressure sensors

Properties

- Monitoring the level of filter contamination using a pressure sensor with an analogue signal output.

Note:

The current pressure loss can be queried using the controller display. A prompt for filter replacement is emitted when the final set pressure loss value is reached. Further information on changing the limit values for filter pressure loss can be found in the separate operating instructions for the CRAC system controller (Rittal pcs+).
A fault signal is shown on the controller display when the filter limit value is reached. Fault signals do not lead to an automatic deactivation of the CRAC system.

A transfer of the filter message to an external building service management system can be made using an optional interface card for the controller.

7.2.2 Filters

Properties

- Cassette filters made from fibreglass membrane.

Note:

The filter class used and end pressure loss for filter contamination can be found on the filter rating plate on the inside of the unit door. Filter inserts of quality class G4 are delivered as standard. Filter inserts of quality class F5 or F7 can also be inserted in the unit according to customer requirements (optional).

Filter replacement

Danger! Risk of contamination with hazardous substances.

Breathing in or coming into contact with the filter dust can be hazardous to health.

Wear a dust mask with a P2 filter insert and protective gloves when removing the filter.

Also wear the additional protective clothing prescribed by the operator when exposing the filter to hazardous substances.

- Switch off the unit using the controller and main switch.
- Open the doors and shielding plate.
- Remove the rubber clamping hooks above the filters from the heat exchanger frame.
- Remove the filter.
- Insert the new filter correctly (pay attention to the directional arrow).
- Secure the filter: Reattach the rubber tension hooks in the heat exchanger frame.
- Attach the shielding plate and switch the unit back on.

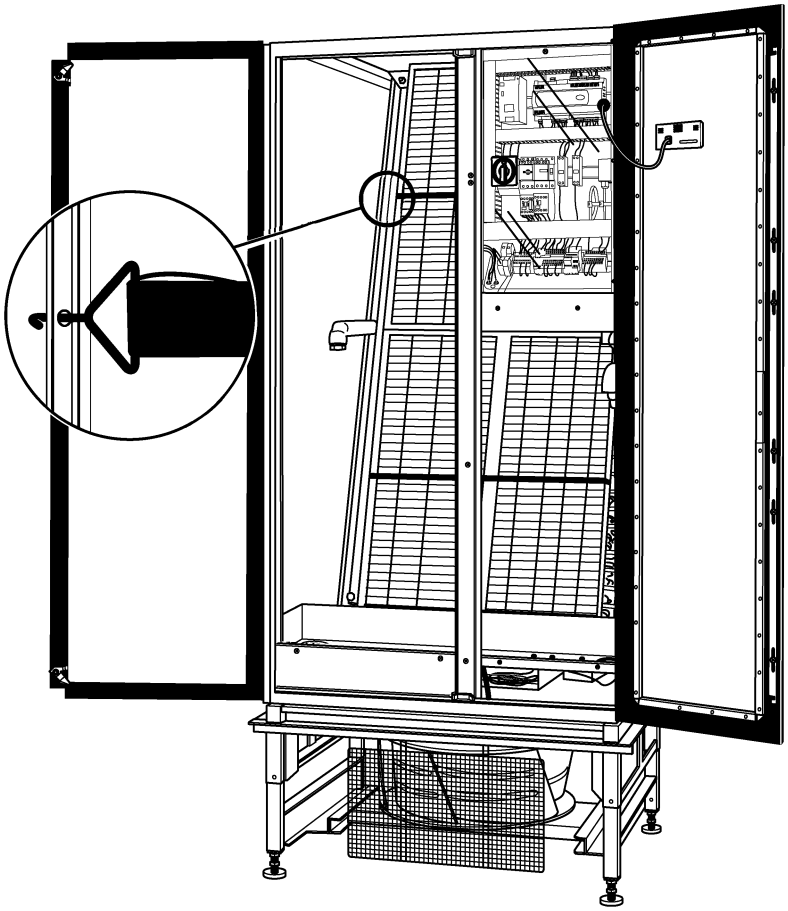


Fig. 31: Filter attachment with rubber clamps (CW version in this example)

7.3 Cooling system

7.3.1 Direct evaporation (DX)

Properties

- Membrane heat exchanger on extraction side as direct evaporator for air cooling and dehumidification.
- Venturi distributor for multiple injection and distribution pipe for gas extraction.
- Stainless steel or aluminium condensate tray for collecting and discharging condensed water during dehumidification. Condensate line fed out of the unit housing without counterpressure.

Note:

The following product specifications for the condenser only apply when a condenser is delivered as an optional accessory as part of a customer order.

- Air-cooled high-pressure axial condenser for outdoor siting (unrestricted air intake and discharge). Membrane heat exchanger, axial fan with constant speed control in corrosion-proof design. Control made using integrated speed control (phase angle control); released by CRAC system; separate main switch for repair work.

Notes on commissioning

Please ensure the following:

Air-cooled condenser:
- Power supply is connected
- Rotational direction of the fans is correct
- Air intake is unrestricted

Cooling circuit:
- Sufficient coolant in the circuit (bubbles in inspection glass)
- Power supply is connected
- Rotational direction of the compressor is correct

Notes on inspection, maintenance and repairs

- Check the system at regular intervals for contamination, damage, corrosion and wear.

7.3.2 Cold water version (CW)

- Membrane heat exchanger as cold water cooler for air cooling and dehumidification.
- Supply and drainage of pumped cold water for constant regulation of cooling output using a three-way or two-way valve.
- Various water temperatures available for inlets and outlets on the heat exchanger; see technical specification for design.
- Aluminium condensate tray for collecting and discharging condensed water during dehumidification. Condensate line fed out of the unit housing without counterpressure.

Notes on commissioning

Please ensure the following:

- Medium is connected
- All valves are opened in inlet and return
- Air bled from heat exchanger and pipelines
- Control valve works correctly

Notes on inspection, maintenance and repairs

- Check the system at regular intervals for contamination, damage, corrosion and wear.

7.4 Humidifier (optional)

7.4.1 Steam humidifier

Properties

The internal steam humidifier is a non-pressurised steam generator for direct humidification of the air supply. It operates with an electrode heating system, and is designed for use with normal drinking water. It is comprised of a console with an attached steam cylinder, connected steam lance and electronic ECCM control unit.

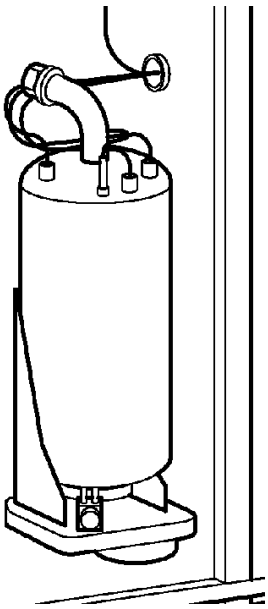


Fig. 32: Internal steam humidifier

Notes on commissioning

- Open the water supply line.

Note:

When the CRAC system is switched on, the electric system on the humidifier is put into operation and makes a system test where all LEDs on the ECCM control unit light up consecutively. The heating circuit is switched on as soon as humidification is required. The inlet valve opens and the cylinder is filled with water. The green LED lights up as soon as the submerged electrodes heat the water. Steam is produced after approximately 5 to 10 minutes.

Note:

The **low conductivity** of soft water can result in the maximum steam output not being reached in the first hours of operation. A sufficient level of conductivity is usually reached automatically through the evaporation process. Please consult Rittal Service regarding a special steam cylinder in the event of on-site water conductivity below < 300 mS/cm.

Notes on decommissioning

- Close the water supply line.
- Press the blowdown/information key briefly and wait 5 to 10 minutes until the steam cylinder is empty.
- Set the circuit-breaker of the steam humidifier to “0” in the electrical unit. This disconnects the steam cylinder from the power supply.

Notes on inspection, maintenance and repairs

The steam generator is maintenance-free. In the event of a fault message, Rittal Service must carry out measures to correct the fault.
A fault signal is shown on the controller display when the steam cylinder intended service life has been reached. Fault signals do not lead to an automatic deactivation of the CRAC system.

7.5 Heating (optional) Electric heater

Properties

- Electric air heater, installed on the air flow side as a reheater behind the air cooler with safeguards against overheating of the supply air through the use of a temperature limiter.

Notes on commissioning

- Check all three phases for correct values and secure connection.
- Check the safety chain.

Notes on inspection, maintenance and repairs

- Check the system at regular intervals for contamination, damage, corrosion and wear.

Resetting the electric heater

Note:

The temperature limiter is integrated in the safety thermostat. The limiter switches the electric heater off when the maximum temperature is exceeded. The limiter must be reset manually after the cause of the overheating has been solved.

- Switch off the unit using the controller and main switch.
- Open the machine part door and shielding plate.
- Open the unit doors and remove the lower shielding plate above the raised floor.
- Press the reset button.
- Reattach the protective cap, close the shielding plate and machine part door and switch the unit back on.