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Enclosure cooling units with refrigerant R-1234yf

Supplement to the assembly, installation and operating instructions for
devices containing flammable refrigerants to UL 60335-2-40 Annex DD

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1 General

This document is intended to supplement the assembly, installation and operating instructions for the Blue e+/S range with refrigerant R-1234yf and covers the following items:

- Safety instructions
- General guidance on the handling of refrigerants
- Personnel qualification
- Safety checks before commencing work
- Check cooling systems
- Checking the electrical components
- Repairs to intrinsically safe components
- Leak detection with flammable refrigerants
- Removal and evacuation of flammable refrigerants
- Procedure for filling with flammable refrigerants
- Labelling with flammable refrigerants
- Recovery of refrigerant

2 Safety instructions

- The connection regulations of the appropriate power supply company are to be followed. Otherwise, there is risk of injury from electric shock if the connection to the unit is defective or connected incorrectly in any way.
- **Blue e+:** The PE conductor which connects the cover and the chassis must be connected to both connectors in all cases.
- Please observe the maximum permissible weight to be lifted by one person. Use suitable lifting devices, if needed.
- **Blue e+/Blue e+ S/ Blue e+ Outdoor:** During assembly, the cooling unit is at risk of dropping through the mounting cut-out.
- **Blue e+/Blue e+ S/Blue e+ Outdoor:** When assembling the cooling unit, if possible, position it so no accidental contact can occur during operation.
- All ventilation openings of the cooling unit must be freely accessible after assembly and must not be blocked.
- To achieve a secure seal against water ingress from outside, the gasket included in the scope of supply must be fitted to seal the interface between the cooling unit and the enclosure in accordance with these instructions.
- The drill holes on the unit rear (**Blue e+/Blue e+ S/ Blue e+ Outdoor**) or on the underside of the unit (**Blue e+ Roof-mounted**) may be used only for assembling the IoT interface with the screws supplied with this unit. If longer screws are used, there is a risk of undershooting the clearance and creepage distances or electric shock.
- Do not assemble and re-activate the device until it is completely dry.
- Before removing the hood, allow the unit to cool for at least 10 minutes to eliminate the risk of burns from hot surfaces.
- **Blue e+/Blue e+ Outdoor:** At ambient temperatures above 30 °C, the surface temperatures of the cooling unit may exceed the threshold temperatures for 1st and 2nd degree burns with contact times of ≤1 second.
- **Blue e+/Blue e+ Outdoor:** At ambient temperatures below -7 °C, the surface temperatures of the cooling unit may drop below the threshold values for frostbite with contact times of ≤10 seconds.
- **Blue e+:** The cooling unit only stands safely while the hood and chassis are joined to each other. Ensure that the frame, in particular, is secured against tipping before removing the hood.
- **Blue e+ Outdoor:** Stability of the cooling unit is only guaranteed without the mounting frame fitted.
- **Blue e+/Blue e+ S:** Do not strip too much insulation from the connection cable, otherwise the admissible clearance/creepage distances from the terminal point may not be met.
- **Blue e+/Blue e+ S:** Pin 4 on the signal connector should not be used. Otherwise, the admissible clearance/creepage distance between the alarm relay and door contact connections will not be met.
- Always wear the required personal safety equipment when working on this unit.
- Note that refrigerants are odourless.
- The unit must only be cleaned by trained specialists. Deenergise the unit prior to cleaning.
- Never use flammable liquids for cleaning.
- The accumulation of flammable substances inside the unit must be avoided.
- To avoid damaging the pipes or heat exchanger, do not use sharp objects when working on the unit.
- The unit must not be drilled or burnt.
- All persons working on the refrigerant circuit must have a certificate of competence from an industry-accredited body that demonstrates their competence in the safe handling of refrigerants using an accepted industry procedure. The work must be performed in accordance with Rittal specifications.
- If assistance of other persons is required for maintenance and repair work, a person trained in handling flammable refrigerants should supervise the work at all times.
- Do not assemble and re-activate the unit until it is completely dry.
- **Blue e+/Blue e+ S/ Blue e+ Outdoor:** If transporting the unit in an assembled state, always use a suitable supportive structure.
- The products should only be combined and operated with the prescribed Rittal system accessories.
- Only objects approved by Rittal may be used to accelerate the defrosting process.
- When the unit is decommissioned, it must be labelled with the decommissioning date together with a note stating it is filled with flammable refrigerant.

- **Blue e+:** Never lift the unit by the pipes, but rather only by the housing, handle or lifting eyebolt.
- **Blue e+:** If the cooling unit is partially integrated in a side panel, to minimise the risk of damage to the piping, it should be assembled outside the enclosure. The side panel, including the cooling unit, can then be assembled on the enclosure.
- **Blue e+ Roof-mounted:** It is not permitted to operate the unit without a pleated filter. Only use original accessories (3285.700).
- **Blue e+ Roof-mounted:** A shift in the centre of gravity may cause the integration solution to tip over, especially when it is being lifted before anything has been fitted to it or when removing the cooling module.
- **Blue e+ Roof-mounted:** Instructions for the VX25 enclosure are supplied along with the VX25 Blue e+ integration solution. They include further safety-related details about the enclosure, such as a warning about the risk of crushing when removing the mounting plate.
- **Blue e+ Roof-mounted:** Ensure prior to startup that the condensate management system is installed as described. Regularly check the solution is working properly during maintenance of the end application.
- The unit may only be shipped as a package.
- Keep the unit aligned with the markings on the packaging throughout transport.



Sticker on the packaging: Flammable, warning of flammable materials



Sticker near the rating plate: Low flammability (A2L), warning of flammable materials

3 General guidance on the handling of refrigerants

Basic information on the safe handling, installation, maintenance and disposal of refrigerants, particularly for devices with flammable refrigerants.

3.1 Maximum volume of refrigerant

Observe the maximum admissible volume of refrigerant (m_{max}). This must not be exceeded. This information can be taken from the technical documentation or the rating plate.

3.2 Handling information

The assembly, installation and operating instructions combined with this supplement set out clear guidelines on:

- Handling the refrigerant
- Installing the device
- Cleaning and maintenance, and
- Disposal of the refrigerant and components.

3.3 Maintenance instructions

Maintenance must only be carried out in accordance with the manufacturer's instructions. Unauthorised or unqualified interventions may pose a safety threat and could invalidate warranty claims.

3.4 Personnel qualification

Maintenance, service and repair work must only be carried out by qualified personnel. Safety-relevant work on the device (such as opening the cooling circuit) may only be carried out by trained personnel qualified in the handling of cooling systems and refrigerants. These individuals must be authorised to work on climate control and cooling systems in the relevant country.

4 Safety checks before commencing work

Before commencing work on a refrigerant system, particularly those that use flammable refrigerants, it is essential to conduct a careful safety check. The aim is to identify potential hazards early on and take suitable precautions. On-site working practices must be monitored and structured to minimise the risk of gas collection and the associated explosion risks or health hazards.

4.1 General working environment

Instruction: All maintenance staff and individuals who enter the work area must be instructed in the type of work to be carried out.

Minimise confined spaces: Working in confined or poorly ventilated spaces is to be avoided wherever possible.

4.2 Check for refrigerants

Detection before and during work: The work area should be checked for the presence of refrigerant using a suitable detector.

Suitable equipment: The leak detector used must be suitable for all refrigerants used, particularly A2L and A3 refrigerants (e.g. spark-free, sealed and intrinsically safe).

Hazard awareness: Technicians must be well-informed about potentially toxic or flammable atmospheres.

4.3 Ensure there is a fire extinguisher available

Availability during high-temperature work: When carrying out high-temperature work on cooling systems or related components, a suitable fire extinguisher must be close at hand.

Recommended types: Powder or CO₂ extinguishers should be positioned in the immediate vicinity of the working area.

Check cooling systems

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4.4 Avoid ignition sources

No naked flames: When working on exposed pipe-work, never use ignition sources that could pose a risk of fire or explosion.

Smoking ban: Smoking and other ignition sources are prohibited in the work area.

Hazard analysis: Before starting work, check the area for flammable materials and ignition risks.

Signage: "No smoking" signs should be clearly displayed for the duration of works.

5 Check cooling systems

To ensure the safe, reliable operation of cooling systems, particularly those that use flammable refrigerants, please observe the following checks when carrying out maintenance and repairs:

5.1 Replacement of electrical components

If it becomes necessary to replace electrical components, it is important to ensure that they:

- are suitable for the intended purpose, and
- comply with the manufacturer's technical specifications.

Only components that meet the safety and compatibility requirements may be used.

5.2 Compliance with manufacturer guidelines

All maintenance and servicing work must only be conducted in accordance with the manufacturer's instructions.

In case of deviations or uncertainties, please consult the Rittal Customer Service team before continuing with the work.

6 Checking the electrical components

Maintenance and repairs to electrical components in cooling systems, particularly those with flammable refrigerants, should be carried out with particular care and must comply with all relevant safety guidelines.

6.1 Safety checks and component inspections

Before commencing repair and maintenance work on electrical components, it is essential to carry out safety checks and an inspection of the affected components. Only components that are fully functional and suitable for the intended purpose may be used.

6.2 Handling of safety-relevant errors

If an error occurs that could threaten operational safety, the system should be disconnected from the power supply until the error has been rectified in full.

If immediate rectification is not possible but continued operation is essential, a temporary solution may be used on a provisional basis only.

This measure must be notified to the plant operator in writing to ensure that all parties are duly informed.

6.3 Initial inspection prior to commissioning

Before recommissioning the system, the following safety checks must be carried out:

- No live electrical components or cables must be exposed.
- The earth connection must be continuous and fully functional.

7 Repairs to intrinsically safe components

When working on intrinsically safe components in cooling systems – particularly in environments with flammable refrigerants – special safety precautions must be observed to maintain safety and prevent ignition risks.

7.1 Electrical load

No permanent inductive or capacitive loads may be connected to the circuit without first ensuring that the admissible voltages and currents for that device are not exceeded.

7.2 Working with a live system

If the device is in a flammable atmosphere, only intrinsically safe components may be maintained or checked while the system is live.

The test equipment used must be designed for the correct output category.

7.3 Replacing components

Defective components may only be replaced with spare parts specified by Rittal.

The use of unauthorised parts could cause leaked refrigerant to ignite and pose a significant safety threat.

7.4 Checking the cabling

The electrical cabling must be laid and protected in such a way that it cannot be damaged by wear and tear, corrosion, excessive pressure, vibrations, sharp edges or other environmental influences.

7.5 Consider ageing and vibrations

When carrying out an inspection, please also check for possible signs of ageing and the effects of permanent vibrations from components such as compressors or fans.

8 Leak detection with flammable refrigerants

When working with flammable refrigerants, particular caution is advised. The following instructions MUST be observed in order to ensure safe, professional leak location:

8.1 Ban all ignition sources

Using potential ignition sources to detect leaks is strictly prohibited. In particular, halogen lamps and other detectors with a naked flame must not be used.

8.2 Use of electronic leak detection equipment

Electronic leak detection equipment is admissible in principle, but

- must be suitable for the refrigerant used,
- must not be an ignition source, and
- must be calibrated to the refrigerant.

The device should be set to a maximum of 25% of the lower flammable limit (LFL) of the refrigerant in question.

8.3 Use of leak detection liquids

Leak detection liquids are suitable for most refrigerants. However, detergents containing chlorine should not be used, as these could react with the refrigerant and cause corrosion of copper pipework.

8.4 What to do if you suspect a leak

If you suspect a leak:

- Immediately remove or extinguish any naked flames.
- Secure the affected area and ventilate as necessary.

8.5 Essential repairs

If a repair e.g. with hard soldering becomes necessary, the refrigerant must

- be completely removed from the system or
- be isolated in a section of the system that is remote from the leak using suitable barrier measures.

9 Removal and evacuation of flammable refrigerants

When working on the refrigerant cycle – whether to carry out repairs or for some other reason – special safety measures must be observed, particularly when handling flammable refrigerants. The following procedure will ensure that the work is carried out safely and professionally:

9.1 General notes

Follow the usual procedures when opening the refrigerant circuit, but exercise particular caution with flammable refrigerants, because flammability poses an additional risk.

9.2 Safe removal

The following steps are mandatory and must be observed:

- Remove the refrigerant completely.
- Flush out the circuit with an inert gas (such as oxygen-free nitrogen).
- Evacuate the system.
- Flush again with inert gas.
- Open the circuit by cutting or hard soldering.

9.3 Recover the refrigerant

The removed refrigerant should be collected in suitable containers that are approved for use with that particular type of refrigerant.

9.4 Special requirements for particular refrigerants

Equipment containing flammable refrigerants (with the exception of A2L refrigerants) must be flushed with oxygen-free nitrogen in order to ensure a safe working environment.

This process may be repeated multiple times until there is no refrigerant left in the system.

9.5 Safety measures for evacuation

- Compressed air and oxygen must not be used for flushing as they constitute a fire / explosion risk.
- During the final flush-out with oxygen-free nitrogen, the system should be vented to atmospheric pressure to ensure safe working.
- The vacuum pump outlet must not be anywhere near an ignition source. It is important to ensure adequate ventilation of the workspace.

10 Procedure for filling with flammable refrigerants

When filling cooling systems with flammable refrigerants, additional safety measures above and beyond the usual procedures must be taken into account. The following points are mandatory and must be observed to ensure safe, standard-compliant filling:

10.1 Avoid mixing

It is important to prevent any mixing of different refrigerants.

- Filling hoses and lines should be kept as short as possible to minimise the volume of refrigerant remaining in the system.

10.2 Earthing the system

Before filling, the cooling system must be properly earthed to avoid electrostatic discharges and associated ignition risks.

10.3 Labelling the system

Once the filling process is complete, the system should be suitably labelled, if this has not been done already.

10.4 Avoid overfilling

Exercise particular caution to avoid overfilling the system. Overfilling can interrupt operations and pose a safety risk.

10.5 Check the pressure before filling

Before refilling, the system should be pressure-tested with a suitable inert gas (such as oxygen-free nitrogen) to exclude leaks.

10.6 Leak testing after filling

Once the filling process is complete but before commissioning, a leak test should be carried out. Additionally, one final leak test is required before leaving the site to ensure that the system is airtight.

11 Labelling with flammable refrigerants

Clear, intelligible labelling of equipment is a key aspect of the safe handling of refrigerants, particularly in the case of flammable refrigerants. The following requirements should be observed with regard to labelling:

11.1 Labelling after decommissioning

Decommissioned equipment that has been drained of refrigerant must be labelled with a sticker to this effect.

- The sticker should show the date of decommissioning and the signature of the responsible individual.

11.2 Labelling of flammable refrigerants

Equipment containing flammable refrigerants must be clearly labelled.

- The label should clearly indicate that the device contains flammable refrigerant.

This labelling helps to ensure the safety of service personnel, end users and disposal companies and is therefore mandatory.

12 Recovery of refrigerant

The safe recovery of refrigerant is an essential part of maintenance work and the decommissioning of cooling systems. This is particularly applicable to flammable refrigerants, which require special precautions.

12.1 General requirements

When removing refrigerant from a system, care must be taken to ensure that all refrigerant is safely and completely removed. This is the state of the art and is intended to protect human beings and the environment.

12.2 Recovery equipment requirements

The recovery equipment used must be in perfect condition and be suitable for recovering the refrigerants used, including any flammable refrigerants.

- Operating instructions for the equipment must be available on site.
- Calibrated scales to weigh the refrigerant volume must be available and in full working order.
- Hoses must be equipped with leak-proof quick-release couplings and in good condition.
- Before use, it is important to check that the equipment has been properly maintained and is in good working order. Electrical components must be sealed to prevent ignition in the event of refrigerant escaping.
- In case of doubt, please consult the manufacturer.

12.3 Handling recovered refrigerant

The recovered refrigerant should be collected in approved containers and returned to the refrigerant supplier.

Disposal should be properly documented (e.g. waste manifest).

Refrigerants must not be mixed, either in the recovery equipment or in containers.

12.4 Handling compressors and oils

When removing compressors or compressor oils, care must be taken to ensure that they are sufficiently evacuated so that no flammable refrigerant remains in the lubricant.

They must be evacuated before returning the compressor to the supplier.

Only electric heating of the compressor housing may be used to accelerate the process.

Oil must be drained off under safe conditions.

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

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09.2025/D-0000-00004677-00-EN

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