

Operating manual

IMPRINT

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This manual is in English and the original version is in German.

Version: 10/2025

Translation of the original German operating instructions

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1 Information on the operating instructions

This operating manual contains information and instructions for the safe and proper operation as well as for maintenance of the Semitrailer Cooling Unit S.CU, incl. the ePTO ready option for S.CU types d80 and dc90.

The operating instructions are intended for the driver and the vehicle owner. The operating instructions should increase the reliability as well as service life of the device, should avoid dangers and downtimes and, where applicable, the loss of warranty claims. The operating instructions must be read and understood in all cases.

The vehicle details left, right, front and rear always apply in the driving direction.

1.1 Operating instructions validity

The operating manual applies only for the following transport refrigeration units:

- Semitrailer Cooling Unit S.CU dc90
- Semitrailer Cooling Unit S.CU d80
- Semitrailer Cooling Unit S.CU e80

The Semitrailer Cooling Units will be referred to as “S.CU” in the following, deviations will be mentioned explicitly.

1.2 Product identification and name plates

Name plates have been fitted on the following main components for the purpose of product identification:

- S.CU
- Compressor
- Diesel engine

1.2.1 Semitrailer Cooling Unit (S.CU) name plate

The name plate is attached on the bottom right of the S.CU frame and contains the following information:

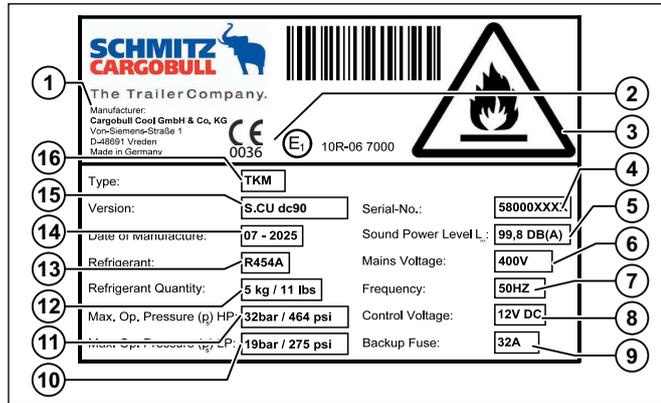


Figure 1: Name plate for S.CU refrigerant R454A (example)

- | | | | |
|---|---|----|----------------------|
| 1 | Manufacturer | 9 | Pre-fuse |
| 2 | CE marking | 10 | Max. pressure LP |
| 3 | Flame symbol for highly flammable materials | 11 | Max. pressure HP |
| 4 | Identification number | 12 | Refrigerant quantity |
| 5 | Sound power level | 13 | Refrigerant |
| 6 | Mains voltage | 14 | Year of construction |
| 7 | Frequency | 15 | Version |
| 8 | Control voltage | 16 | Model |

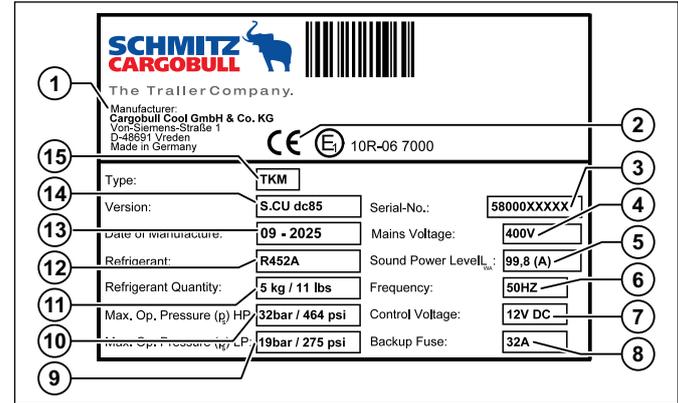


Figure 2: Name plate for S.CU refrigerant R452A (example)

- | | | | |
|---|-----------------------|----|----------------------|
| 1 | Manufacturer | 9 | Max. pressure LP |
| 2 | CE marking | 10 | Max. pressure HP |
| 3 | Identification number | 11 | Refrigerant quantity |
| 4 | Mains voltage | 12 | Refrigerant |
| 5 | Sound power level | 13 | Year of construction |
| 6 | Frequency | 14 | Version |
| 7 | Control voltage | 15 | Model |
| 8 | Pre-fuse | | |

1.2.2 Compressor name plate

The name plate is attached on the housing of the piston or scroll compressor and contains the following information:

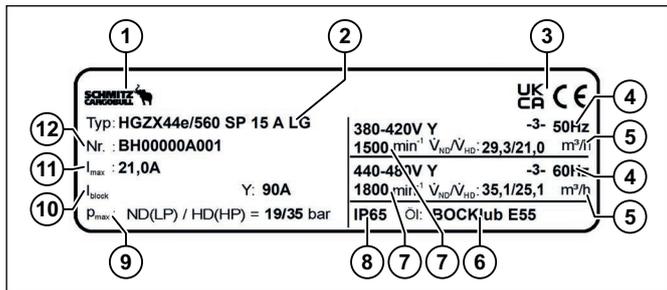


Figure 3: Name plate for compressor S.CU dc90 (example)

- 1 Manufacturer
- 2 Model designation
- 3 UKCA/CE label
- 4 Voltage supply
- 5 Piston displacement flow
- 6 Oil type filled ex-factory
- 7 Speed
- 8 Protection class
- 9 Vacuum side standstill pressure / high pressure side operating pressure
- 10 Fuse
- 11 Power consumption
- 12 Machine number

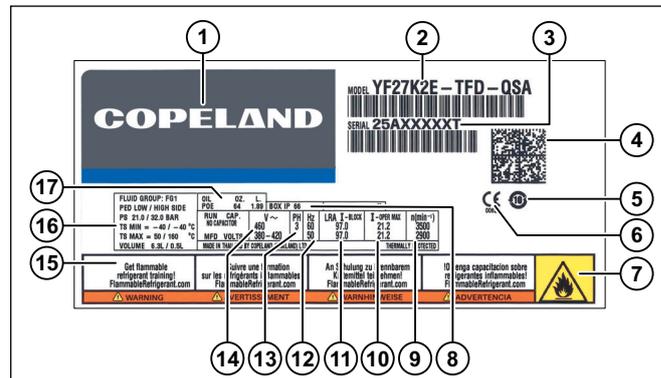


Figure 4: Compressor name plate S.CU d80 and S.CU e80 (example)

- 1 Manufacturer
- 2 Model number
- 3 Serial number
- 4 QR code
- 5 RoHS label
- 6 CE label
- 7 Flame symbol for highly flammable refrigerant
- 8 Water protection class
- 9 Speed
- 10 Permissible operating current
- 11 Start-up current
- 12 Mains frequency
- 13 Number of phases
- 14 Required voltage supply
- 15 Warning: "Get flammable refrigerant training!"
- 16 Oil quantity (litres) / oil type / oil quantity (liquid ounces)
- 17 Permissible operating pressures/temperatures

1.2.3 Diesel engine serial number

A serial number is fixed to the diesel engine in order to be able to identify it. The plate with the serial number of the diesel engine is located above the fuel injection pump on the right side of the cylinder block.

1.3 Symbols used

Text with different markings and symbols are used in the operating instructions.

These are explained in the following.



The warning symbol shown on the left is used in the warning instructions and is categorised with regard to the severity of the risk.

Observe the instructions and explanations in the Safety chapter.

⇒ *"Danger grading of warning instructions" on page 11*



Additional information and instructions

[1] Numbered handling steps

► Symbol for an instruction or required action

▷ Results of a handling

■ Symbol for a list

1. Numbered list

⇒ *"Cross-reference to a chapter or further contents"*

1.4 Figures used

Figures are used in the operating instructions for the better representation and explanation, in some cases with parts removed or shown simplified. This serves for a better understanding.

► Observe the following:

- A disassembly is not always necessary for the respective description.
- No different equipment versions are displayed in the figures as long as this is not described.
- The corresponding text described for the figures always applies.

1.5 Relevant documents

The relevant documents are classified into three categories. All instruction manuals must be observed.

1. The following documents are included with this operating manual:
 - Declaration of Conformity
 - Circuit diagram for the transport refrigeration unit in the control box
2. The following documents are available in digital form via the Service portal:

⇒ *Service portal: www.cargobull-serviceportal.de*

 - Safety data sheets for the refrigerants
 - High-voltage circuit diagram for ePTO
 - Connector and pin assignment for ePTO connector
3. Additional manuals from other manufacturers:
 - Operating manual for ePTO vehicle
 - Operating manual for the general vehicle
 - Safety data sheets for other operating materials

1.6 Storing documents

- ▶ Store this manual as well as all applicable documents in a safe manner so that they are available at all times.
- ▶ Hand over the complete documents to the next driver or owner.

1.7 Guarantee and liability

Basically, the “General terms of sales and delivery” of Schmitz Cargobull AG apply. Guarantee and liability claims for personal injuries and damaged equipment will be rejected if the claim can be traced back to one or more of the following causes:

- Non-intended use, (⇒ *see “2 For your safety” p. 11*)
- Non-observance of the instructions, notices and prohibitions of the operating instructions,
- Unauthorised changes made to the structure of the Semitrailer Cooling Unit S.CU,
- Incorrect monitoring of wearing parts,
- Service work carried out incorrectly and not on time,
- Improper storage of the ePTO connection cable,
- Improper handling of the ePTO connector and the connection socket when not in use,
- Non-observance of the requirements for the ePTO interface.
(⇒ *see “11.6 Requirements for the ePTO interface” p. 107*)

2 For your safety

These operating instructions include instructions for your safety.

The basic safety instructions include instructions that basically apply to the safe use or the adherence with the safe condition of the S.CU.

The action-related warning instructions warn you against residual risks and are in front of a danger action step.

- ▶ Follow all of the instructions in order to prevent personal injury and damage to the environment or property.

2.1 Representation and layout of the warning instructions

The action-related warning instructions have the following layout:

SIGNAL WORD

Type and source of danger!

Explanation for the type and source of danger.

- ▶ Measures for averting the danger.

2.2 Danger grading of warning instructions

The warning instructions are graded with regard to the severity of their danger. The danger gradings with corresponding signal words and warning symbols are explained in the following.

DANGER

Immediate mortal danger or severe injuries.

WARNING

Possible mortal danger or severe injuries.

CAUTION

Possible slight injuries.

CAUTION

Damage to the device or in the surroundings.



Tips or additional information.

2.3 Intended use

The Schmitz Cargobull Semitrailer Cooling Unit S.CU of type dc90, type d80 or type e80 is a complete (ready for use) machine according to the Machinery Directive 2006/42/EC and is completely assembled on thermally insulated transport containers (e.g., trailers, railway carriages, swap bodies and semitrailers). It is used to heat or cool transport goods (e.g., foodstuffs).

The transportation of goods that are to be stored above or below the permissible temperature specifications is not correct.

- ▶ Operate the Semitrailer Cooling Unit S.CU only in a technically flawless condition.
- ▶ Operate the Semitrailer Cooling Unit S.CU only with prescribed diesel fuel or electric power.
- ▶ Have defects that impair safety immediately repaired by an authorised specialist workshop.
- ▶ Operate the Semitrailer Cooling Unit S.CU in compliance with the national standards and regulations.

2.4 Declaration of Conformity

The Semitrailer Cooling Unit S.CU dc90, S.CU d80 and S.CU e80 comply with Machinery Directive 2006/42/EC and EMC Directive 2014/30/EC for the electromagnetic compatibility and Directive 2014/68/EU for pressure equipment.

The Declaration of Conformity is supplied separately.



Konformitätserklärung / Conformity declaration

Wir als Hersteller der Transportkältemaschine erklären, dass nachfolgend bezeichnete Maschine der Richtlinie 2014/68/EU nach dem Konformitätsbewertungsverfahren Modul A2 und den unten angeführten Verordnungen und Normen entspricht.

We, the manufacturer of the transport refrigeration machine, declare that the machine described below complies with Directive 2014/68/EU in accordance with the conformity assessment procedure Module A2 and the regulations and standards listed below.

| | |
|--|--|
| Hersteller/ Manufacturer | Cargobull Cool GmbH & Co. KG Von-Siemens-Straße 1 48691 Vreden |
| Bevollmächtigter für Dokumentation/ Authorised Person for Documents | Rolf Tenbrock |
| Maschinentyp / Machine type Version/ version | TKM S.CU dxx |
| Seriennummer / Serial No. | 58000xxxx |
| Baujahr / Year of manufacture | xx.xx.202x |
| Kältemittel/ Refrigerant | R454A |
| Richtlinien / Directives | Datum / Date |
| 2006/42/EG | 2006-05 |
| 2014/30/EG | 2014-02 |
| Regelungen / Regulations | Datum / Date |
| ECE-R10 (Rev.6) | 2022-10 |
| Normen / Standards | Datum / Date |
| DIN EN 378-2 | 2018-04 |
| EN 61000-6-2 | 2011 |
| EN 61000-6-4 | 2018 |
| DIN EN 61851-21-1 | 2018-04 |
| DIN EN 60204-1 | 2019-06 |
| Notifizierte Stelle gemäß 2014/68/EU Notified Body according 2014/68/EU | TÜV SÜD Industrie Service GmbH Ridlerstr. 65, 80339 München Kennnummer: 0036 |
| Zertifikats-Nr. / Certificate- No. | xxx |
| Beschreibung | Description |
| Baugruppe Kältemaschine: Kategorie II, Modul A2 | Module Refrigerant Unit: Category II, Module A2 |
| Flüssigkeitsamplifier nach Kategorie II | Liquid Receiver acc. Category II |
| Hochdruckwächter nach Kategorie IV | High Pressure Limiter acc. Category IV |
| Scrollverdichter nach Kategorie II | Scroll Compressor acc. Category II |


 Vreden, 2025-08-26
 Geschäftsführer / Managing Director

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 Nachfolgersitz: 50, der Gesellschaft Vreden, Amtsgericht Coesfeld HRB 212
 Komplementär: Cargobull Cool Verwaltungs GmbH HRB 13739, Steuer-Nr.: 3112061/2017
 Geschäftsführer: Dr. Norbert Facke, Michael Tremermann

Figure 5: Declaration of Conformity (example)

2.5 Personnel qualification

In the operating instructions, a difference is made between:

- the operating company,
- driving personnel and
- specialist personnel.

The operating company must ensure that the driving personnel and the specialist personnel are sufficiently instructed in the operation, required measures in event of malfunctions and all necessary safety instructions.

- ▶ A written report must be completed for the instructing of the personnel.
- ▶ Confirm instruction by entering it in the service book.
- ▶ Send the confirmation from the operator to the manufacturer.
 - ▷ This confirmation is a requirement for any warranty claims.

The operating company, the driving personnel and the specialist personnel must have read and understood the operating instructions.

2.5.1 Operating company

The operating company is responsible for the correct operation of the refrigerated vehicle and the S.CU.

The operating company must:

- have reached the legal minimum age,
- instruct the specialist personnel in using the S.CU and
- make sure that the refrigerated vehicle including the S.CU are tested and maintained by an authorised specialist workshop at regular intervals.

2.5.2 Driving personnel

The driving personnel is always the vehicle operator and, where applicable, the co-driver.

The driving personnel is responsible for the correct operation of the refrigerated vehicle with S.CU and must:

- have read and understood the operating instructions,
- have reached the legal minimum age.

Only specialised personnel that have been instructed verbally and workplace-related once before commencing with their employment, and thereafter, at least once a year should be assigned to operating the S.CU.

In particular, training and instruction must cover the following points:

- operation
- measures to be taken in event of malfunction or accident and
- the particular hazards when operating refrigerant units.

2.5.3 Specialist personnel

The specialist personnel of a workshop are authorised to carry out the maintenance tasks (servicing and maintenance).

Authorised specialist personnel must have the following listed qualifications.

In order to be able to carry out work on a refrigerant circuit, the specialist personnel must have a certificate of education in the form of a technical expert certificate according to Ordinance (EU) 2024/2215 or higher.

In order to carry out troubleshooting, maintenance work or servicing on the network and generator power circuits, Schmitz Cargobull AG specifies the following qualifications:

- In Germany: “Specialist electrician for determined activities (German – EFKffT) on transport refrigeration units”. Comment: A “Person instructed in electrical engineering” (EUP) is not sufficient as qualification.
- According to the national standards and regulations, work may only be performed on mains and generator power circuits by specialist electricians.
- In other European countries, a qualified person in electrical engineering is necessary.

Documentation is required for assembly work on the S.CU.

- ▶ Observe the national standards, specifications and regulations.
- ▶ Maintenance and servicing work may only be carried out by specialist personnel in service workshops authorised by the manufacturer.
- The specialist personnel must have experts knowledge in the fields for diesel engines, electrical system and cooling technology. System-specific training courses are carried out at and confirmed by the manufacturer.

2.6 Danger zones

In normal operation, all moving parts are protected against accidents by covers.

During the check before commissioning, daily checks and maintenance work, there is a possibility that dangerous components can be accessed.

- ▶ For this purpose, maintain sufficient distance from open components when the refrigerating unit is switched on.
- ▶ Observe possible hazards in the basic safety instructions.
⇒ see “2.9 General safety instructions“ p. 16

2.7 Protective equipment

The S.CU is secured against unauthorised access by lockable doors.

- ▶ Always keep the doors on the S.CU closed.

2.8 Information, warning and prohibition signs

The warning instructions and prohibitions of this operating manual are also attached to the S.CU as signs. The hazards and measures are described in detail in front of the respective instructions and in the following chapter.

⇒ see “2.9 General safety instructions“ p. 16

| Sign | Explanation |
|---|---|
|  | Warning of automatic start-up |
|  | Warning of risk of crushing by belt drive |
|  | Warning of sharp-edged fan wheel |
|  | Warning of magnetic field |
|  | Warning of electric voltage |
|  | Warning of hot surface |
|  | Warning of flammable refrigerant |

| Sign | Explanation |
|---|--|
|  | Disconnect before maintenance or repairs |
|  | Disconnect the power cable |
|  | Disconnect the battery |
|  | Spraying with water is prohibited |
|  | No open flames; fire, open ignition source and smoking prohibited |
|  | Drilling forbidden |

- ▶ Observe and follow all of the signs.
- ▶ Keep signs clean and legible.
- ▶ Do not clean the signs with solvents, petrol or other aggressive chemicals.
- ▶ Do not remove, paint over or cover signs.
- ▶ Replace illegible or missing signs immediately.

2.9 General safety instructions

The generally existing dangers and residual risks with corresponding measures in handling the S.CU are listed in the following.

Danger from remote start

Depending on the setting in the controller, the S.CU is equipped with a remote start and can start at any time and without prior warning. There is a risk of crushing of hands and fingers with irreparable injuries.

- ▶ After opening the doors or for maintenance work, switch the main switch to the 0 position.
- ▶ Observe the information sign on the outside of the S.CU.

Danger from automatic start

The S.CU is equipped with an automatic start / stop system and when in start / stop operating mode, it can start at any time without prior warning. There is a risk of crushing of hands and fingers with irreparable injuries.

- ▶ After opening the doors or for maintenance work, switch the main switch to the 0 position.

Danger of asphyxiation from exhaust gases during diesel operation in enclosed spaces

The S.CU produces toxic exhaust gases during diesel operation. If operated in enclosed spaces, these exhaust gases cannot escape. There is a risk of death due to suffocation.

- ▶ In diesel mode, only operate the S.CU outdoors.
- ▶ Only operate S.CU indoors on diesel if an exhaust extraction system for diesel exhaust gases is available and turned on.
- ▶ When using the 2-way communication in closed spaces, operate the S.CU only in "Electric mode" if an exhaust extraction system for diesel exhaust gases is not available or not turned on.

Risk of crushing from drive belts for the water pump

The water pump of the diesel engine is driven by a V-ribbed belt. Hands may be crushed between the drive belts and pulley.

- ▶ Do not reach between the drive belts and pulley.

Danger from sharp edged fan wheels

Several components are equipped with fan wheels. Rotating parts are installed in the fan. Working without covers can lead to severe injuries.

- ▶ Do not reach into the fan.
- ▶ After opening the doors or for maintenance work, switch the main switch to the 0 position.
- ▶ Before performing maintenance tasks on rotating and moving parts, disconnect the battery.
- ▶ For maintenance tasks, make sure that the fan cannot start running.
- ▶ Put S.CU into operation only with properly installed covers.

Risk of burns and scalding

The surfaces of separate components and lines may be very hot. Contact can cause burns or scalds on the skin.

- ▶ Do not touch hot surfaces such as the diesel engine, exhaust system, pipes, cooler and cooling elements.
- ▶ Never open components of the cooling device or the engine cooling.

Risks from electric shocks

The generator produces high voltage of up to 690 V. Touching live parts can lead to electric shocks with severe injuries or even death.

- ▶ When working on electric components, switch the voltage supply off immediately.
- ▶ Have work on the electrical system performed only by specialist electricians.
- ▶ Never touch electric components with wet or moist parts of your body.
- ▶ Do not pull on electric cables.
- ▶ Before performing maintenance work on the electrical system (especially the generator), make sure that the S.CU is switched off and that the lamp of the ON/OFF button on the control unit has gone out.
- ▶ Prior to performing maintenance work on the electrical system, always disconnect the negative terminal of the battery.

Danger from an exploding battery

The unit is equipped with a lead accumulator that, in normal cases, releases small amounts of combustible hydrogen gas. An exploding battery can lead to severe injuries. Incorrect connection of the bridging cable can cause explosions with severe injuries.

- ▶ Do not place any metallic objects on the battery.
- ▶ Avoid smoking, handling open flames or flying sparks on the battery and when charging.
- ▶ Use a voltmeter or acid tester to check the charge state of the battery.
- ▶ Do not charge the battery if it is frozen.
- ▶ Do not disconnect the charger cable from the battery before the charge process is finished.
- ▶ Keep the battery clean.
- ▶ Use the S.CU only with the recommended cables, fittings and correctly installed cover of the battery box.

Danger from strong magnetic fields and high voltage

During operation, the generator / electric motor produces a strong magnetic fields and high voltage. When the generator / electric motor is stopped, a portion of the magnetic field remains. There is mortal danger for persons with pacemakers due to magnetic radiation and due to electric shock.

- ▶ Keep persons with a cardiac pacemaker away from the S.CU during operation.
- ▶ Never take apart the generator and compressor.

Danger from battery acid

There can be battery acid on the surfaces of batteries. Battery acid is corrosive and causes severe burns on the skin and serious eye damage. Irreversible damage is possible in cases of longer contact or higher concentrations.

- ▶ When working on the battery, always wear protective clothing, protective goggles and gloves.
- ▶ After touching the battery, always wash your hands thoroughly with water.

After eye contact:

- ▶ Immediately flush the eye with open eyelid under running water for at least 15 minutes.
- ▶ Promptly consult an eye specialist or emergency physician.

Property damage from electrostatic discharge

Several electronic components are very sensitive to electrostatic discharge. In certain cases, human bodies can generate sufficiently high static voltage in order to cause damage. Incorrect earthing leads to uncontrolled current paths. Uncontrolled current paths can lead to damage to the main bearing, the surfaces of the crankshaft journal and from components from aluminium. Diesel engines with insufficient earthing connections can be damaged by electrostatic discharge.

- ▶ Check regularly to see if electrical cables are loose or damaged.
- ▶ Have damaged cables repaired by a specialist electrician.
- ▶ Before commissioning the diesel engine, clean and tighten all of the electrical cables.
- ▶ Check that the electrical system of the diesel engine is properly connected to earth on a regular basis.
- ▶ Check that all earthing connections have a tight fit and are free of corrosion on a regular basis.
- ▶ Check that the battery cover or the terminal caps are present on the battery and that they are properly fastened on a regular basis.

⇒ see "8.3.1 Replacing the battery" p. 88

Property damage of the control system

The electric control with display and membrane keyboard comprise sensitive components that could be damaged quickly. Incorrect use of voltmeters, connecting wires, continuity testers, etc. can damage the control.

- ▶ In event of malfunctions of the electrical system or the controller, switch off the S.CU immediately.
- ▶ Do not repair the controller and its display independently.
- ▶ In event of a defective controller, contact the Schmitz Cargobull Service department immediately.

2.10 Limits of use/anti-freeze

Unfavourable conditions of use can cause damage to the S.CU due to corrosion, chemical and physical reactions.

- ▶ Observe the following requirements.
 - The S.CU is designed for safe operation at outside temperatures from -30 °C to +43 °C.
- ▶ At temperatures below 0 °C, take measures for frost protection.

⇒ see "5.6 Operating at low ambient temperatures" p. 43

2.11 Handling refrigerants

Depending on the type, refrigerant R452A or R454A is used. Refrigerant is a liquefied gas under pressure. When used correctly, there should not be any health risk or damage to the environment.

- ▶ Observe the information on the name plate for the utilised refrigerant.

⇒ see "1.2.1 Semitrailer Cooling Unit (S.CU) name plate" p. 7

- ▶ Only use the prescribed refrigerant.
- ▶ Do not mix different refrigerants.
- ▶ When handling refrigerants, observe the safety information on the respective safety data sheets.

In normal operation, there is no particular risk from the refrigerant used as it is located in a closed circuit.

Fundamentally applicable instructions for handling refrigerants

- ▶ Only specialist personnel may carry out work on the refrigerant circuit.
- ▶ Always wear chemical-resistant protective gloves when working with refrigerants.
- ▶ Wear chemical-resistant protective goggles to protect your eyes.
- ▶ Avoid inhaling vapour concentrations.
- ▶ Ensure suitable ventilation or wear a suitable self-contained breathing apparatus.

- ▶ Avoid eating and drinking when handling refrigerants.
- ▶ After handling refrigerants, before breaks and after finishing work, wash your hands thoroughly.
- ▶ Protect refrigerant circuit components and lines from mechanical damage, direct solar radiation and temperatures above 50 °C.
- ▶ Avoid open flames and hot surfaces, as they can produce corrosive and toxic decomposition products.
- ▶ Only use non-sparking tools for maintenance work.
- ▶ Avoid contact with the fluid as there is a risk of freezing.
- ▶ Avoid eye and skin contact with the fluid.
- ▶ Avoid releasing refrigerants into the environment.
- ▶ During maintenance work, dispose of the refrigerant and used refrigerant oil correctly.

⇒ see "9.3 Final decommissioning/disposal" p. 95

The following applies after breathing in refrigerant:

- ▶ Take the person to where there is fresh air, keep warm, allow to rest. Initiate the breathing of oxygen if required.
- ▶ In event of respiratory arrest or irregular respiration, initiate artificial respiration.
- ▶ In event of cardiac arrest, apply a cardiac massage and seek medical assistance immediately.

The following applies after contact with skin:

- ▶ Thaw the affected area using water.
- ▶ Carefully remove contaminated soaked clothing as the clothing may stick to skin in event of frozen burns.
- ▶ After contact with skin, wash-off immediately with warm water.
- ▶ If the skin is irritated or blisters form, seek medical attention.

The following applies after contact with eyes:

- ▶ With your eyelids spread open, rinse thoroughly with plenty of clean water or eyewash solution for at least 10 minutes.
- ▶ Seek medical assistance at an ophthalmologist immediately.

The following applies after swallowing refrigerant:

- ▶ In case the person affected is conscious, rinse out their mouth with water and give them a glass of water to drink.
- ⇒ Seek medical assistance immediately.

Explosion and fire hazard due to refrigerant

Refrigerant R452A or R454A differ in terms of their flammability.

- R452A: Safety class A1, not flammable
- R454A: Safety class A2L, highly flammable

When using refrigerant R454A, observe the following protective measures against explosions and fire:

- ▶ Avoid ignition sources (heat, hot surfaces, sparks, smoking and open flames).
- ▶ Avoid electrostatic charging.
- ▶ Only use electric devices with recognised explosion protection.
- ▶ Use only in an area that is equipped with explosion-proof ventilation.
- ▶ Ensure ventilation to avoid the formation of flammable vapour concentrations.
- ▶ In case of leaks, use a fan to ensure air circulation, particularly in lower areas.
- ▶ Extinguish fires only from a safe distance.

Risk of asphyxiation due to leaking refrigerant

If refrigerant should escape in greater quantities in the event of a leak and the refrigerant collects in poorly ventilated rooms or in a pit, it can displace oxygen. In the event of oxygen displacement, refrigerant can be inhaled and impair your ability to escape. This results in lethal danger due to asphyxiation.

Both refrigerants can be recognised by their specific odour.

- R452A: faint odour of ether
- R454A: faint to strong odour of solvent
- ▶ Observe the fundamentally applicable instructions for refrigerants.
- ⇒ see “*Fundamentally applicable instructions for handling refrigerants*“ p. 20
- ▶ Do not work in tight spaces where gas has accumulated.
- ▶ Ensure ventilation.

Risk of frostbite due to skin contact with refrigerants

Touching or skin contact with the liquid or cold gas can cause frostbite or freezer burns.

- ▶ Observe the fundamentally applicable instructions for refrigerants.
- ⇒ see “*Fundamentally applicable instructions for handling refrigerants*“ p. 20

Measures after a leak on the refrigeration unit

If a leak occurs on the refrigeration unit, e.g., following an accident, observe the following measures.

- ▶ Observe the fundamentally applicable instructions for refrigerants.
- ⇒ see “*Fundamentally applicable instructions for handling refrigerants*“ p. 20.

2.12 Dealing with operating resources

The following are operating resources:

- diesel,
- engine oil,
- lubricants,
- refrigerant and
- coolant for cooling the engine.

Under certain circumstances, the operating materials can cause injuries or environmental damage. For this purpose, the operating company must inform the driving and specialist personnel about the safe use of substances that could pose a risk to health and the environment.

- ▶ Observe the national standards, specifications and regulations.

Fluids under pressure

Fluid escaping from a leak is under pressure and can penetrate body tissue. Fluids penetrating your skin can lead to severe or, under certain circumstances, even to mortal injuries.

- ▶ Wear protective clothing and protective goggles during maintenance work.
- ▶ Have wounds treated by a doctor if fluids have penetrated your skin.

The diesel engine is equipped with a cooling water circuit. Under normal operating conditions the coolant in the diesel engine and cooler is under pressure and is very hot. Contact with coolant can lead to severe burns.

- ▶ Never open the seal or other components of the cooling system during normal operation.
- ▶ During maintenance work, the seal of the cooling system must only be opened very slowly to allow the pressure to be equalised without fluid escaping.

Hot oil

Hot oil can lead to burns.

- ▶ Avoid skin contact with hot oil.
- ▶ Wear protective clothing and protective goggles during maintenance work.

Flammable operating materials

Fuels, oils or lubricants and refrigerants can ignite on hot surfaces.

- ▶ Keep the surfaces of the S.CU clean.
- ▶ Have identified defects or leakages repaired in an authorised specialist workshop.

Potential environmental risks from operating materials

The operating materials can endanger the environment. Fluid escaping from a leak must not seep into the ground. There is a risk of contaminating the ground water.

- ▶ Avoid smoking, handling open flames or flying sparks.
- ▶ Always use a suitable collecting vessel when checking for leaks.
- ▶ Make sure that no fluids escape when carrying out maintenance work on the diesel engine.
- ▶ Always use a suitable container for collecting the fluids.
- ▶ Keep the container available before opening a housing or taking apart a component containing fluids.
- ▶ Dispose of operating materials collected according to the country-specific legal regulations for the disposal of fluids.

Property damage caused by incorrect operating materials

Incorrect operating materials can result in power loss or damage to the S.CU, among other things.

- ▶ Only use approved operating materials.
- ⇒ see "11.4 Operating materials" p. 100

2.13 What has to be observed in case of emergency?

To avoid further damage in event of an accident, initiate the appropriate measures under the circumstances:

- ▶ Properly secure the accident site.
- ▶ Provide first aid, if necessary.
- ▶ Use an eyewash bottle in case of eye injuries.
- ▶ Extinguish small fires using a fire extinguisher.
- ▶ Call the fire brigade and describe the situation briefly and objectively.
(Detailed information will be specifically requested.)
- ▶ Inform the operator.

3 Machine overview

3.1 Design

3.1.1 Main assemblies

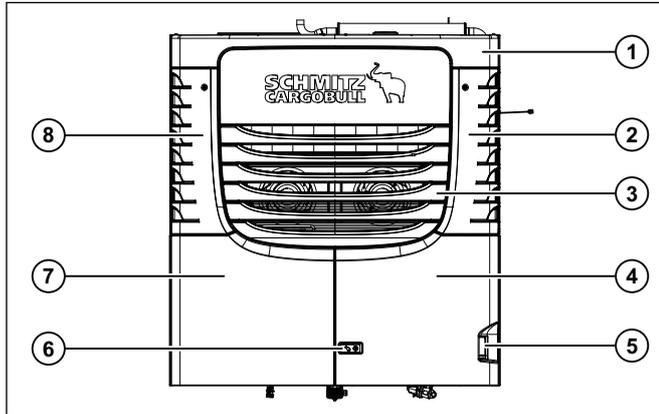


Figure 6: View from outside

- | | |
|-------------------------|--------------------------|
| 1 Head piece | 5 Control unit |
| 2 Side panel, left side | 6 Lock |
| 3 Cooler sign | 7 Door, right side |
| 4 Door, left side | 8 Side panel, right side |

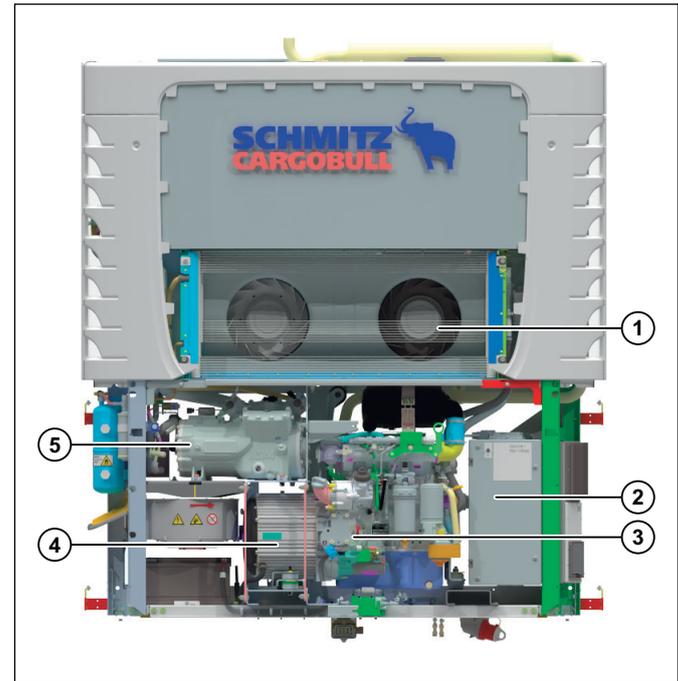


Figure 7: View with the doors open (S.CU dc90)

- | | |
|------------------------------|----------------------------------|
| 1 Cold section/hot section | 4 Three-phase generator |
| 2 Switch box with controller | 5 Compressor with electric motor |
| 3 Diesel engine | |

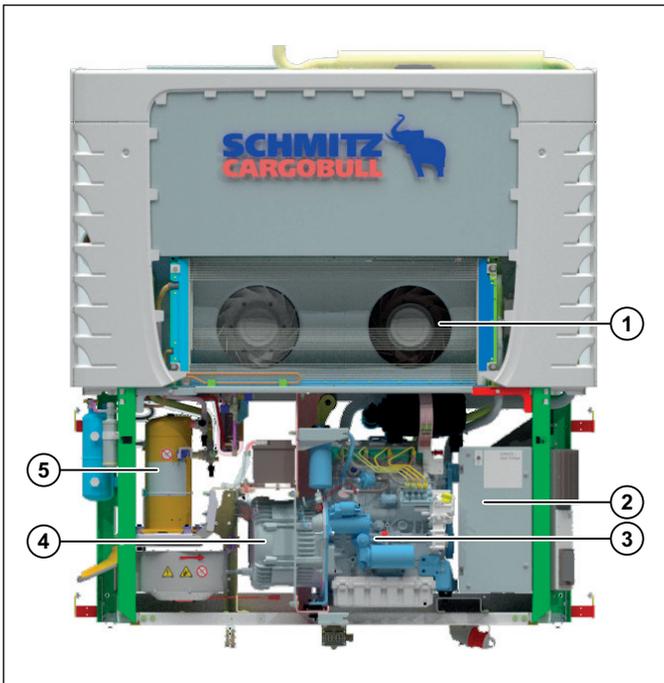


Figure 8: View with the doors open (S.CU d80)

- 1 Cold section/hot section
- 2 Switch box with controller
- 3 Diesel engine
- 4 Three-phase generator
- 5 Compressor with electric motor

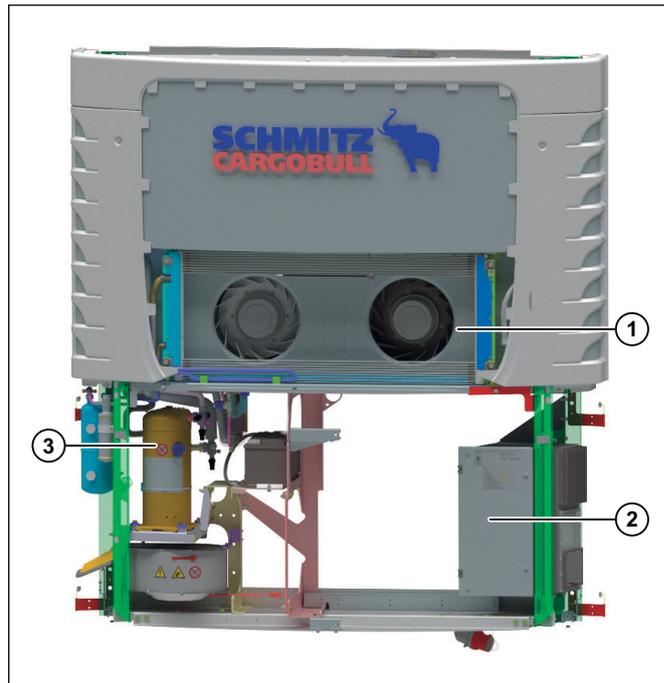
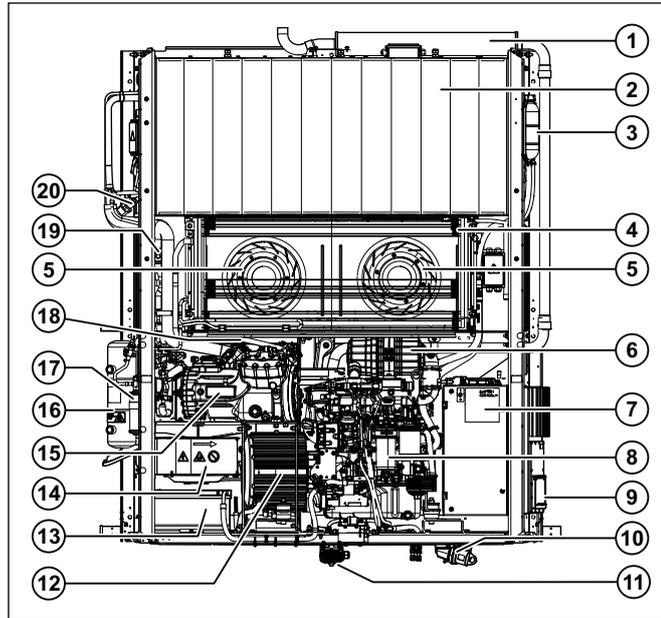


Figure 9: View with the doors open (S.CU e80)

- 1 Cold section/hot section
- 2 Switch box with controller
- 3 Compressor with electric motor

3.1.2 Assemblies



- 1 Silencer
- 2 Cold section (evaporator with an electrical heating device and fans)
- 3 Coolant compensating reservoir
- 4 Hot section (cooler/condenser)
- 5 Condenser fan
- 6 Air filter
- 7 Switch box
- 8 Hatz diesel engine
- 9 Control unit with control panel
- 10 32 A CEE socket mains connection
- 11 ePTO interface (socket)
- 12 Three-phase generator
- 13 Battery
- 14 Machine room fans
- 15 Compressor with electric motor
- 16 Fluid accumulator
- 17 Dryer
- 18 Economizer assembly
- 19 Solenoid valve (MV1)
- 20 Suction pressure modulation valve (SMV)

Figure 10: View of the assemblies without covers from the front
(S.CU dc90)

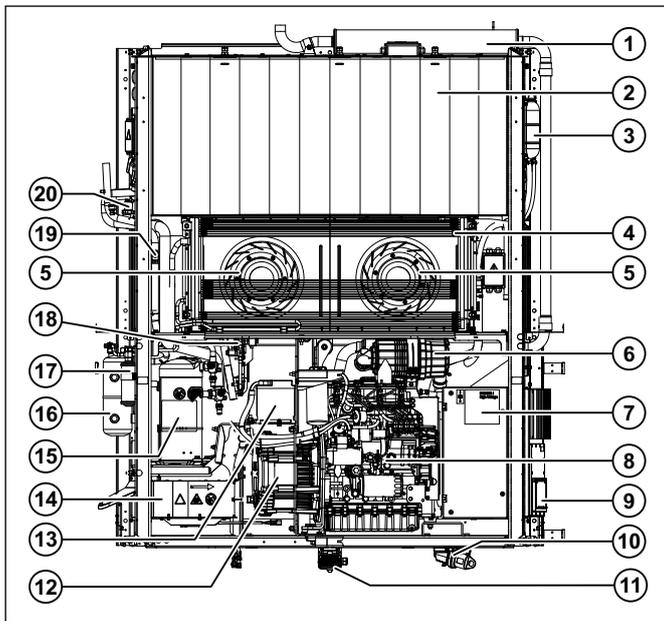


Figure 11: View of the assemblies without covers from the front
(S.CU d80 and S.CU e80)

- 1 Silencer (S.CU d80 only)
- 2 Cold section (evaporator with an electrical heating device and fans)
- 3 Coolant compensating reservoir (S.CU d80 only)
- 4 Hot section (cooler/condenser)
- 5 Condenser fan
- 6 Air filter (S.CU d80 only)
- 7 Control box
- 8 Perkins diesel engine (S.CU d80 only)
- 9 Control unit with control panel
- 10 32 A CEE socket mains connection
- 11 ePTO interface (socket)
- 12 Three-phase generator (S.CU d80 only)
- 13 Battery
- 14 Machine room fans
- 15 Compressor with electric motor
- 16 Fluid accumulator
- 17 Dryer
- 18 Economizer assembly
- 19 Solenoid valve (MV1)
- 20 Suction pressure modulation valve (SMV)

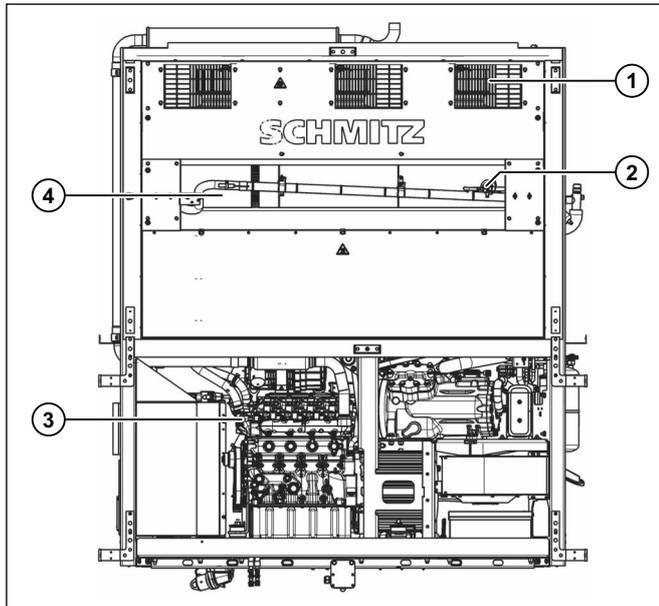


Figure 12: View of the assemblies from the rear
(S.CU dc90)

- 1 Evaporator fan
- 2 Expansion valve
- 3 Cooling water temperature sensor (TWD)
- 4 Air inlet temperature (TLE)

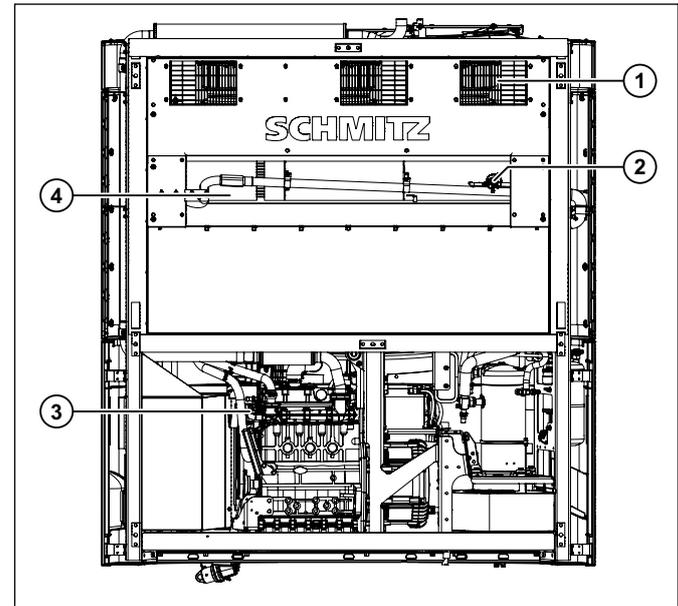


Figure 13: View of the assemblies from the rear
(S.CU d80 and S.CU e80)

- 1 Evaporator fan
- 2 Expansion valve
- 3 Cooling water temperature sensor (S.CU d80 only)
- 4 Air inlet temperature (TLE)

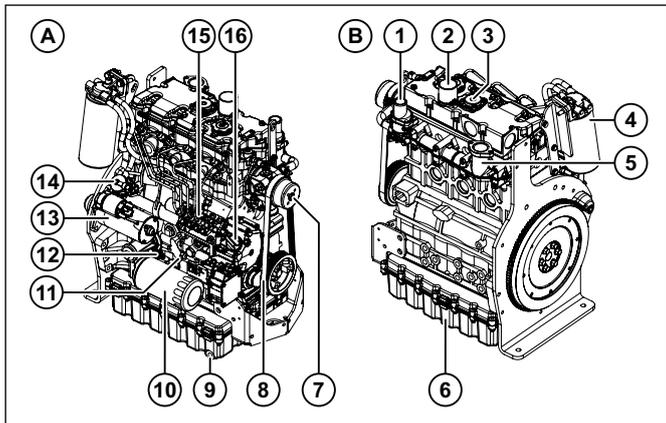


Figure 14: Diesel engine assemblies (Perkins diesel engine)

- A View from the front
- B View from the back

- | | |
|--|------------------------|
| 1 Cooling water thermostat housing | 9 Oil drain plug |
| 2 Air intake connection | 10 Oil filter |
| 3 Valve cap with crankcase ventilation | 11 Oil pressure switch |
| 4 Fuel filter | 12 Oil dipstick |
| 5 Exhaust gas flange | 13 Starter |
| 6 Oil pan | 14 Fuel supply pump |
| 7 Water pump | 15 Injection pump |
| 8 Drive belt for the water pump | 16 Oil filler neck cap |

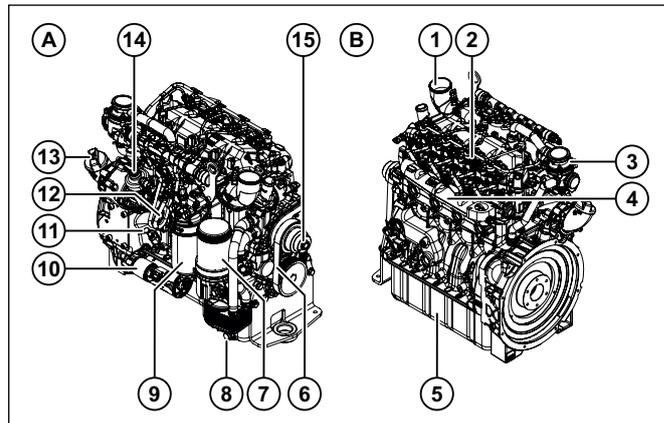


Figure 15: Diesel engine assemblies (Hatz diesel engine)

- A View from the front
- B View from the back

- | | |
|-------------------------------------|------------------------|
| 1 Air intake fittings | 7 Oil filter |
| 2 Injectors | 8 Oil drain plug |
| 3 Crankcase ventilation with filter | 9 Diesel main filter |
| 4 Exhaust manifold | 10 Starter |
| 5 Oil pan | 11 Oil dipstick |
| 6 Drive belt for the water pump | 12 Oil pressure sensor |
| | 13 Oil filler neck |
| | 14 High-pressure pump |
| | 15 Water pump |

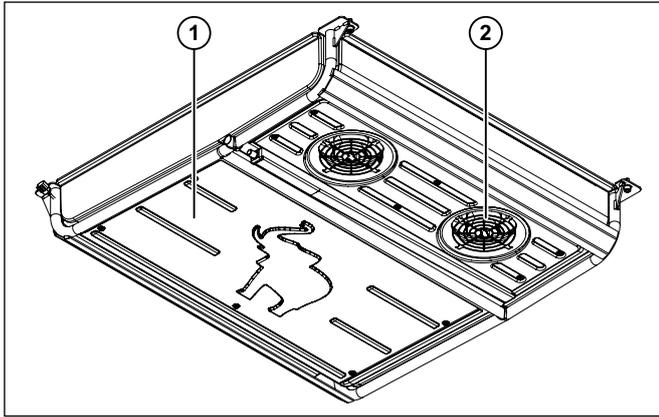


Figure 16: View of the roof auxiliary evaporator for the MultiTemp. design (2 and 3 chambers)

- 1 Evaporator unit
- 2 Evaporator fan

3.2 Function

The S.CU is a complete (ready for use) machine and is completely assembled on thermally insulated transport containers (e.g., trailers, railway carriages, swap bodies and semitrailers). It is used to heat or cool transport goods. The S.CU unit comprises

- a diesel engine generator drive unit (S.CU dc90 and S.CU d80 only),
- a heating section (condenser/cooler heat transfer and condensate fan)
- and a cold part (evaporator with an electrical heating device and fans)
- and on the MultiTemp design (2 and 3 chambers) with up to two roof auxiliary evaporators (with electrical heating device and fan).

The S.CU is supplied with electrical current via

- a 400 V socket (32 A fuse and Type K CEE plug),
 - an ePTO socket for the ePTO ready option (ePTO must have galvanic isolation)
- ⇒ see “11.6 Requirements for the ePTO interface“ p. 107
- or optionally from a three-phase generator driven by the diesel engine. The diesel engine is supplied with fuel from a tank that is located in front of the pallet box. The speed of the diesel engine varies during operation. Depending on the operating state, the three-phase generator supplies a respective diesel engine speed frequency between 30 and 70 Hz.

Standby

The S.CU is fully operational in operating mode “Ready”. Settings can be made in the menu, language, operating mode as well as setpoints can be made. The S.CU does not start, it remains in the standby mode for 10 minutes.

Cooling mode

In cooling mode, the interior of the chambers are cooled to the setpoint according to the menu setting and the configuration.

Heating mode

In heating mode, the interior of the chambers are heated to the setpoint according to the menu setting and the configuration. In doing so, the S.CU controls the required performance automatically and switches off the heating after reaching the setpoints.

Change of mode

A change of modes due to the external conditions or by changing the setpoints is controlled by the S.CU automatically.

3.3 Operating and display elements

The S.CU is put into and taken out of operation with the main switch in the control box.

⇒ see "5 Commissioning" p. 38

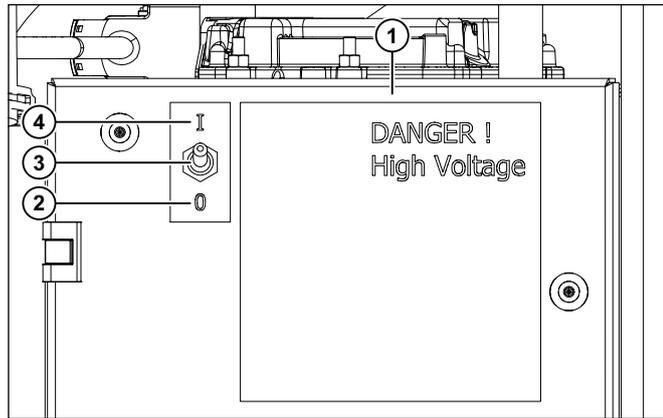


Figure 17: Main switch

- 1 Switch box
- 2 Position 0
- 3 Main switch
- 4 Position 1

The operation and display of information for the S.CU is carried out via the control unit on the left door of the S.CU.

⇒ see "6.1 Basic elements of the control unit" p. 45



Figure 18: Control unit

3.4 Operating modes / settings

The S.CU can always be operated using diesel or electric current. The following operating modes and settings are possible in diesel or electric operating mode:

| Operating mode | Explanation | S.CU d80 | S.CU dc90 | S.CU dc90 MT | S.CU e80 |
|---------------------------|---|----------|-----------|--------------|----------|
| normal/eco | Selection of the operating mode for maximum power (normal) or reduced fuel consumption (eco) | ● | X | ● | X |
| Start/Stop | Start/stop or continuous operation | ● | ● | ● | ● |
| Booster | The diesel engine runs once to a set setpoint with maximum speed | X | ● | ● | X |
| Performance Power | Maximum power and focus on low internal temperature deviations | X | ● | X | X |
| Performance Normal | Standard control behaviour, combination of efficient fuel consumption and good internal temperature control | X | ● | X | X |
| Performance Eco | Focus on fuel savings, reducing the engine speed and bigger temperature delta in the control | X | ● | X | X |

- Available
- (●) Fee-based update
- X Not available

| Setting | Explanation | S.CU d80 | S.CU dc90 | S.CU dc90 MT | S.CU e80 |
|----------------------------|---|----------|-----------|--------------|----------|
| Defrosting interval | The evaporators are defrosted after the set time. | ● | ● | ● | ● |
| Fresh goods | The air discharge temperature from the evaporator is limited. | ● | ● | ● | ● |
| Power failure | In event of a power failure, the S.CU is started in diesel mode depending on the specifications. | ● | ● | ● | ● |
| Operating block | Only the ON/OFF button is still active. | ● | ● | ● | ● |
| External start | The system can be started remotely. | (●)* | ●* | ●* | (●)* |
| Workshop mode | Setting for the service partner for working on the refrigerant circuit (can only be activated by the service partner) | ● | ● | ● | ● |

* Only in conjunction with a valid telematics contract.

The settings of the operating modes and the control buttons are described in detail in chapter Operation.

⇒ see "6 Operation" p. 45



When using the Performance mode, the normal/eco operating mode is no longer available.

3.5 Operating states

Depending if the refrigerating machine is active or inactive, the S.CU can be found in different operating states.

3.5.1 Operating states with inactive refrigerating machine

The following operating states apply for the semitrailer Cooling Unit S.CU dc85, dc85 MT, d80 and e80.

| Operating mode | Explanation |
|----------------|--|
| Start | The S.CU is switched on with the ON/OFF button. After switching on, the system as well as the electrics are completely initialised. Then the S.CU is on standby. |
| Standby | The S.CU is fully operational in standby state. Settings can be made in the menu, language, operating mode and the setpoint can be adjusted. The S.CU does not start, it remains in the standby mode for 10 minutes. If the system has not started until then, the electrics switch off completely. The S.CU is started with the respective chamber button. |

3.5.2 Operating states with active refrigerating machine

| Operating mode | Explanation |
|----------------|---|
| Cooling | In cooling mode, the interior of the individual chambers are cooled to the setpoint according to the menu setting and the configuration. In doing so, the S.CU controls the required performance automatically and switches off the refrigerant circuit for the associated chamber after reaching the setpoints. In the configuration Start/Stop, the diesel engine is also switched on for this time. The condition is represented by a blue LED on the associated chamber button. The currently measured temperature is shown on the display accurate to 1/10 °C. A change to heating mode is also possible due to the external conditions as well as by changing the respective setpoint. The S.CU regulates the mode change for each chamber independently and automatically. Pressing the respective chamber button switches the S.CU back to the stand-by state where it can then be switched off or re-started. All chambers are switched to standby before switching off or restarting. |

| Operating mode | Explanation |
|----------------|--|
| Heating | <p>In heating mode, the interior of the individual chambers are heated to the setpoint according to the menu setting and the configuration. In doing so, the S.CU controls the required performance automatically and switches off the refrigerant circuit for the associated chamber after reaching the setpoints. In the configuration Start/Stop, the diesel engine is also switched on for this time. The condition is represented by an orange LED on the associated chamber button. The currently measured temperature is shown on the display accurate to 1/10 °C.</p> <p>A change to cooling mode is also possible due to the external conditions as well as by changing the respective setpoint. The S.CU regulates the mode change for each chamber independently and automatically.</p> <p>Pressing the respective chamber button switches the S.CU back to the "standby" state where it can then be switched off or re-started. All chambers are switched to standby before switching off or restarting.</p> |

| Operating mode | Explanation |
|-----------------------|--|
| Defrosting | <p>The running defrosting procedure is shown in the display as well as by LEDs in the defrost button. This procedure can only be interrupted by switching off the S.CU. Otherwise, the defrosting is carried out. After thawing, the S.CU starts back in the set configuration again and controls the interior to the set setpoint.</p> <p>If one of the chambers is in heating mode, this will be interrupted during the defrosting process.</p> |
| External start | <p>When external start is activated in the menu, the S.CU can be remotely started via telematics. As soon as the S.CU is switched off with the ON/OFF button, the system goes into remote starting standby and the energy consumption is reduced to a minimum.</p> <p>If an external start is not performed within the next few days, the S.CU automatically switches all of the electronics off, even when the battery voltage is too low. The S.CU can be put in the standby operating state at any time with the ON/OFF button.</p> |

- ▶ Observe the procedure for commissioning.
 - ⇒ see "5.2 Commissioning before each use" p. 38
- ▶ Pay close attention to the warning instructions.
 - ⇒ see "5.3 Visual inspection" p. 39

4 Transport, storage, installation

4.1 Transport

Transport of the S.CU is only carried out at Schmitz Cargobull within the production and for assembly.

4.2 Storage

Storage of the S.CU is only intended at Schmitz Cargobull within the production and for assembly.

Storage of the ePTO connection cable

- ▶ Slide the protective cap onto the ePTO connection cable and store the ePTO connection cable with protective cap in a safe and dry place.
- ▶ When not in use, the protective cap must be stored in a safe and dry place.

4.3 Installation

Installation of the S.CU on the refrigerated body vehicle is carried out by Schmitz Cargobull. Schmitz Cargobull delivers the vehicle with a S.CU that is ready for operation.

5 Commissioning

5.1 Initial commissioning

Schmitz Cargobull installed the S.CU ready for operation and handed it over in proper condition.

[1] Take over the S.CU.

▶ When taking possession of the S.CU, obtain instruction and, where appropriate, ask questions in event of uncertainty.

[2] Fill with fuel.

⇒ *see "5.4 Checking and filling with fuel" p. 40*

[3] Switch the S.CU to standby with the main switch.

⇒ *see "5.5 Switching the main switch on and off" p. 41*

▷ The initial commissioning is complete.

5.2 Commissioning before each use

In order to guarantee the correction operating condition of the S.CU, the drivers of the system must check its correct function before using each time and switch it on.

[1] Perform a visual inspection for commissioning.

[2] Check the interior for cleanliness.

[3] Check the engine oil level.

[4] Check coolant level.

[5] Drain water and sediment from the fuel tank.

[6] Fill with fuel.

[7] If equipped, perform a visual inspection of the ePTO socket and ePTO connection cable.

[8] Switch the S.CU to standby with the main switch.

The listed checking tasks are described in the following chapters.

⇒ *See the following chapters 5.3 to 5.5.*

▶ Operate the S.CU only when it is in good condition.

▶ Avoid smoking, handling open flames or flying sparks.

▶ Have any identified defects repaired.

5.3 Visual inspection

DANGER

Danger of asphyxiation from exhaust gases during diesel operation in enclosed spaces!

The S.CU produces toxic exhaust gases during diesel operation. If operated in enclosed spaces, these exhaust gases cannot escape. There is a risk of death due to suffocation.

- ▶ In diesel mode, only operate the S.CU outdoors.
- ▶ Only operate S.CU indoors on diesel if an exhaust extraction system for diesel exhaust gases is available and turned on.
- ▶ When using the 2-way communication in closed spaces, operate the S.CU only in “Electric mode” if an exhaust extraction system for diesel exhaust gases is not available or not turned on.

WARNING

Danger from automatic start!

The S.CU is equipped with an automatic start / stop system and when in start / stop and external start operating mode, it can start at any time without prior warning.

- ▶ After opening the doors or for maintenance work, switch the main switch to the 0 position.

WARNING

Danger from incorrect work!

Work carried out incorrectly can lead to severe injuries and property damage.

- ▶ Perform a proper visual inspection.

- ▶ Before starting the S.CU, perform a thorough visual inspection to increase the service life and to ensure safe operation.

| Part | Information on the visual inspection |
|---|--|
| Protective covers | The protective covers must be secured correctly. Repair any damaged protective covers and replace missing protective covers. |
| Soiling | Wipe all caps and screw plugs before performing maintenance work on the diesel engine in order to rule out the risk of soiling the systems. |
| Engine cooling system (hoses, lines) | Take care that the coolant hoses are secured correctly and have a tight fit. Check for signs of leaks. Check the condition of all lines. |
| Lubricating system | Check the lubricating system for signs of oil leaks. |
| Fuel system | Check the fuel system for signs of leaks. Take note of loose fuel line clamps. |
| Electrics | Check the cable and cable harnesses for loose connections as well as worn or scuffed cables. Check if the earth strap has been connected correctly and if it is in a good condition. |
| Display instruments | Check the condition of the display instruments. Have damaged display instruments replaced. |

- ▶ Check the engine oil level.
 - ⇒ see “8.2.2 Checking engine oil level“ p. 76
- ▶ Check coolant level.
 - ⇒ see “8.2.4 Checking the coolant level“ p. 78
- ▶ Drain water and sediment from the fuel tank.
 - ⇒ see “8.2.6 Draining water and sediment from the fuel tank“ p. 80
- ▶ If you have difficulties starting, charge the battery.
 - ⇒ see “8.2.9 Charging the battery“ p. 82
- ▶ If you have difficulties starting, jump start the diesel engine.
 - ⇒ see “8.2.10 Jump starting the diesel engine“ p. 85
- ▶ Have any identified defects repaired.
 - ▷ The visual inspection is completed.

5.4 Checking and filling with fuel

DANGER

Explosion hazard due to fuel!

An incorrect filling procedure and incorrect handling of fuel may lead to explosions, fire, severe burns and injury.

- ▶ When filling the tank with fuel, switch the tractor engine and S.CU off.
- ▶ Avoid electrostatic discharges as well as electromagnetic radiation when filling the tank.
- ▶ When filling the tank, turn off your mobile phone and the radio device or other radio equipment.
- ▶ Avoid smoking, handling open flames or flying sparks.
- ▶ Observe the applicable safety instructions of the petrol station.

WARNING

Fire hazard due to flammable operating materials!

Escaping gases or liquids can ignite. Especially fuel or refrigerant R454A are highly flammable.

- ▶ Avoid smoking, handling open flames or flying sparks.

CAUTION

Property damage caused by incorrect fuel!

Incorrect fuel for diesel engines, such as, e.g., petrol, kerosene, heating oil or other deviating fuels as well as admixtures of alcohol can lead to severe damage to the engine and damage to the fuel system.

- ▶ Fill the tank only with approved diesel fuel.

There is a 240 litre fuel tank with filler neck and filling indicator on the right side of the vehicle. With several vehicle versions, there may be an additional filler neck on the left side of the driver.

- ▶ Check the fuel level every day, refill if necessary.
 - ▶ Before filling the tank, make sure that the diesel fuel approved for the diesel engine is filled.
- ⇒ see "11.4 Operating materials" p. 100

- [1]** Fold the side collision protection away.
⇒ *Observe the operating manual for the tractor.*
- [2]** Open the cap by turning it to the left.
- [3]** Fill the fuel tank with the prescribed diesel fuel.
- [4]** Close the cap by turning it to the right.
- [5]** Move the side collision protection to the driving position.
 - ▷ The fuel has been filled.

5.5 Switching the main switch on and off

The entire S.CU is switched on with the main switch. The S.CU and controller are additionally switched on and off on the control unit.

CAUTION

Property damage caused by switching off incorrectly!

Stopping the entire S.CU with the main switch may lead to damage to the S.CU.

- ▶ The entire S.CU should only be switched off using the main switch for maintenance and servicing work, for decommissioning or in event of emergency.
- ▶ Start the diesel engine following an emergency switch-off only once fault has been rectified.

The main switch is located behind the left door of the S.CU on the switch box.

Switching on the main switch

- [1]** Open the left door.
- [2]** Switch the main switch to the 1 position.
- [3]** Close the left door and lock against unauthorised access.
 - ▷ The entire S.CU is switched on for operation.

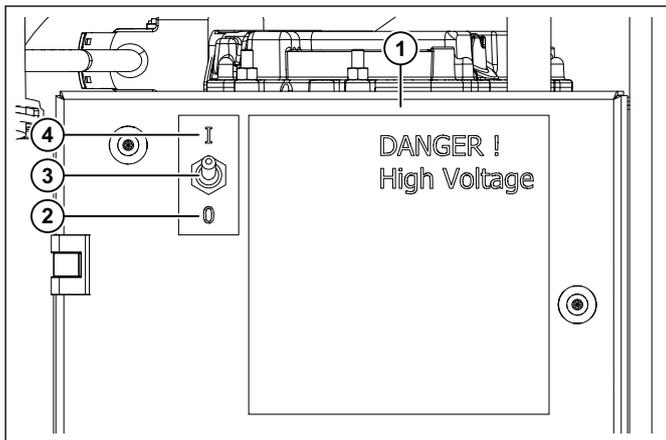


Figure 19: Main switch

- 1 Switch box
- 2 Position 0
- 3 Main switch
- 4 Position 1

Switching off the main switch

The S.CU is only switched off at the main switch for maintenance and servicing work, for decommissioning or in event of emergency.

- [1]** Open the left door.
- [2]** Switch the main switch to the 0 position.
- [3]** Close the left door and lock against unauthorised access.
 - ▷ The entire S.CU is switched off.

5.6 Operating at low ambient temperatures

CAUTION

Property damage caused by incorrect fuel!

Incorrect fuel for diesel engines, such as, e.g., petrol, kerosene, heating oil or other deviating fuels as well as admixtures of alcohol can lead to severe damage to the engine and damage to the fuel system.

- ▶ Avoid admixing alcohol or other substances.
- ▶ Fill the tank only with approved diesel fuel.

The diesel engine can also be reliably started and operated at ambient temperatures below 0 °C to -30 °C.

- ▶ Consider the following factors under cold conditions:

- Fuel
- Engine oil
- Coolant
- Battery

⇒ see "11 Technical data" p. 98

5.6.1 Fuel at low ambient temperatures

At temperatures below 0 °C, the diesel fuel can form paraffin crystals and impair the flowing properties in the fuel system.

- ▶ Use special fuel for the corresponding temperature range.
- ▶ Only use approved fuels.

⇒ see "11.4.1 Diesel fuel" p. 100

- ▶ Avoid condensation and sediments.

⇒ see "8.2.6 Draining water and sediment from the fuel tank" p. 80

At very low temperatures, Schmitz Cargobull recommends that the S.CU is equipped with a fuel heater.

- ▶ Contact Schmitz Cargobull customer service.

⇒ see "10.2 Customer services and service" p. 97

5.6.2 Engine oil at low ambient temperatures

The correct viscosity of the engine oil is of great significance for the wear and starting behaviour. The oil viscosity influences the torque required for turning the diesel engine.

- ▶ Use engine oils for the corresponding temperature range.
- ▶ Only use approved engine oils.

⇒ see "11.4.2 Engine oil" p. 102

5.6.3 Coolant at low ambient temperatures

The cooling system must be protected against the lowest ambient temperature to be expected.

- ▶ Use a mixture that offers protection at the lowest ambient temperature to be expected.
 - ▶ Check the antifreeze regularly.
 - ▶ Only use approved coolants.
- ⇒ see “11.4.3 Coolant“ p. 103

5.6.4 Battery at low ambient temperatures

At temperatures below 0 °C the charge state of the battery worsens until its failure.

- ▶ Keep the battery dry.
- ▶ Avoid frost.
- ▶ Check the battery charge level regularly.
- ▶ If the battery is in a poor charge state, charge the battery with an appropriate battery charger.

5.7 Using the ePTO ready option

To be able to run the Semitrailer Cooling Unit S.CU with the ePTO ready option, the S.CU must be started in electric operating mode. If the CEE connector is not connected and there is no voltage, the S.CU controller automatically checks the ePTO socket. If voltage is applied here, the Semitrailer Cooling Unit S.CU with the ePTO ready option starts in electric operating mode via the ePTO socket.

- ▶ In order that diesel operation starts automatically in case of a power failure, select the “Power failure” setting on the S.CU.
- ⇒ see “6.7 Settings/displays“ p. 53

6 Operation

6.1 Basic elements of the control unit

The control unit comprises display and control buttons with LEDs. An alarm LED is also fitted.

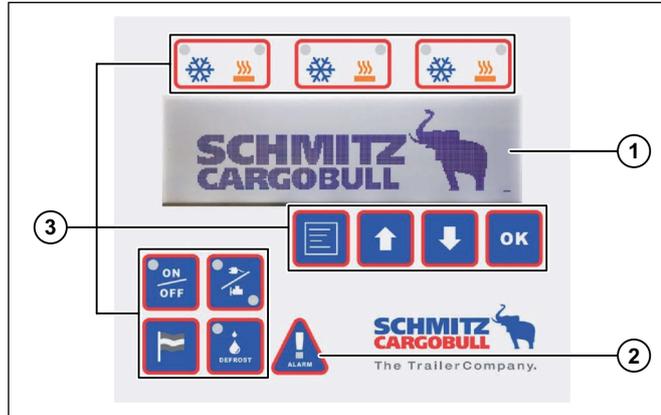


Figure 20: Control unit with start screen (3-chamber design)

- 1 Display
- 2 Alarm LED
- 3 Control buttons

6.2 Display

The display shows all information in the different operating states. Menus and settings are shown in the display.

After starting the S.CU, the start screen is displayed for a few seconds.

After starting up the S.CU, the standby display is shown.

With two or three chambers, the display changes every five seconds between the individual chambers.



Figure 21: Standby display

- 1 Status line with more information
- 2 OFF or current return run temperature
- 3 Setpoint set
- 4 Chamber set (in Figure: chamber 1)
- 5 Unit

6.3 Operating buttons

The following overview is intended as a brief description of the control buttons, the alarm LED and the corresponding functions.

| Button | Button | Function |
|----------------------------|--|---|
| ON/OFF |  | Switches the standby of the S.CU on or off. After switching on, the S.CU is on standby. |
| Chamber |  | Switching on individual chambers of the refrigeration unit. Depending on the setpoint temperature set in the menu, the corresponding chamber of the S.CU is heated or cooled. |
| Language |  | Set the language. The language is set via the selection buttons. |
| Menu |  | Call up the menu. By pressing the buttons, the menu level is switched on. |
| Switching diesel/ electric |  | Switching the operating modes diesel or electric mode. The operating mode set is saved and reset after a restart. |
| Selection |  | Select the settings. |
| Confirm/ OK |  | Confirm the settings. If the settings are not confirmed, the last settings set are adopted. |
| Defrosting |  | Defrost Starting the defrosting procedure. After starting, the process cannot be cancelled. |
| Alarm |  | Alarm (cannot be actuated) The LED illuminates with active alarm. |

6.4 Functions of the control buttons / alarm LED

The control buttons, alarm LEDs and their functions are described in the following.

6.4.1 Switching the standby of the S.CU on and off



The standby of the S.CU is switched on and off using the ON/OFF button. When the electronics are switched on, the LED in the button illuminates green.

Switching on the standby of the S.CU

- ▶ Press the ON/OFF button.
 - ▷ The S.CU standby is switched on.
 - ▷ The LED in the button lights up green. The procedure can take several seconds

Switching off the standby of the S.CU

- ▶ Press the ON/OFF button.
 - ▷ The S.CU standby is switched off.
 - ▷ The LED in the button is off.
 - ▷ The electronics save important parameters and closes all valves. This procedure may take several seconds.

6.4.2 Chamber button: Starting the chamber of the refrigeration unit



- ▶ Press the chamber button for the corresponding chamber.
 - ▷ The selected chamber of the refrigeration unit is switched on.

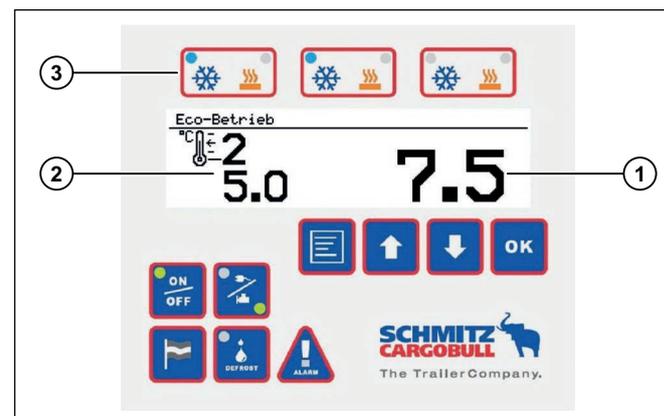


Figure 22: Refrigeration unit active (example: cooling mode in chambers 1 and 2, chamber 3 is off)

- 1 Current return air temperature in chamber 2
- 2 Setpoint set
- 3 Chamber button with blue illuminating LED

Due to the current return air temperature and the setpoints set (nominal temperature), the respective chamber of the refrigeration unit is operated in cooling or heating mode. Changing between the heating and cooling mode is possible due to the external conditions as well as by changing the setpoints. The S.CU controls the status change automatically.

- ▶ Press the chamber button for the corresponding chamber.
 - ▷ The selected chamber is set to standby.
- ▶ Before switching off or restarting, set the chambers to standby.
 - ▷ From the standby state, the S.CU can be switched off or restarted.

Cooling



In cooling mode, the interior of the respective chamber is cooled to the setpoint according to the menu setting and the configuration. In doing so, the S.CU controls the required performance automatically and switches off the refrigerant circuit after reaching the setpoints. In the configuration Start/Stop, the diesel engine is also switched on for this time.

- ▶ Cooling mode is read by the blue LED on the chamber button.
 - ▷ The currently measured temperature is shown on the display accurate to 1/10 °C.

Heating



In heating mode, the interior of the respective chamber is heated to the setpoint according to the menu setting and the configuration. In doing so, the S.CU controls the required performance automatically and switches off the refrigerant circuit after reaching the setpoints.

In the configuration Start/Stop, the diesel engine is also switched on for this time.

- ▶ Heating mode is read by the red LED on the chamber button.
 - ▷ The currently measured temperature is shown on the display accurate to 1/10 °C.

6.4.3 Setting the language



- [1] Press the language button.
- [2] Select the language using the selection buttons.
- [3] Adopt the language with the confirmation button [OK].
 - ▷ The display language is set.



Figure 23: Setting the language

If the language is not confirmed or you exit the language settings via the language button then the last language set remains.

6.4.4 Setting the units



- [1] Press and hold the language button for 3 s.
- [2] Select the units using the selection buttons.
- [3] Adopt the units with the confirmation button [OK].
 - ▷ The corresponding units are set.



Figure 24: Setting the units

If the units are not confirmed or you exit the language settings with the language button, then the last setting remains.

6.4.5 Menu



- [1] Press the menu button.
- [2] Press the confirmation button [OK].
 - ▷ The S.CU menu is shown.
- [3] Adjust the setting in the menu.
 - ⇒ see "6.7 Settings/displays" p. 53
- [4] Confirm the setting with the [OK] button.
 - ▶ Press the menu button again.
 - ▷ The menu will be advanced by one menu level.
 - ▷ After the last menu level, the display changes back to the standby display.

6.4.6 Switching between diesel/electric



- ▶ Press the toggle button repeatedly.
 - Electric operation (top LED)
 - Diesel operation (bottom LED)
 - ▷ The button switches between the operating modes.
 - ▷ The current operating mode set is indicated by a green LED in the button.
 - ⇒ see "Figure 40: ePTO operating mode" p. 66
 - ▷ The operating mode set is saved and reset after a restart.



ePTO mode cannot be directly switched.

- ▶ Switch on electric operation on the control unit.
- ▶ Use the ePTO socket.
 - ▷ In ePTO mode, both LEDs are lit green.

6.4.7 Selection



- ▶ Press the selection button.
 - ▷ Changeable values, such as the setpoint, language and menu settings, can be adjusted.
- ▶ Set the selection up or down within the display.
- ▶ To change the setpoint of a chamber in 2 or 3 chamber mode, wait until the corresponding chamber is shown in the display.

6.4.8 Confirm/OK



- ▶ Press the confirmation button [OK].
 - ▷ The selected setting is saved.

No changes are made without confirmation. The last value set will be activated again.

- ▷ The alarm LED illuminates for 30 seconds and indicates that the settings carried out have not been confirmed.

6.4.9 Defrost



- ▶ Press the defrost button.
 - ▷ The defrost button starts the defrosting process in all the active chambers.
 - ▷ An active defrosting is indicated by the orange LED in the button. A note is also shown in the display and the setpoint set is shown.

Once started, the defrost procedure runs automatically. In case of emergency, defrosting can only be interrupted manually by switching off the S.CU.

When defrosting is complete, the S.CU starts back in the set configuration again and controls the interior to the set setpoint.

If a chamber is in heating mode at the start of the defrosting process, the heating mode is interrupted during the defrosting process.

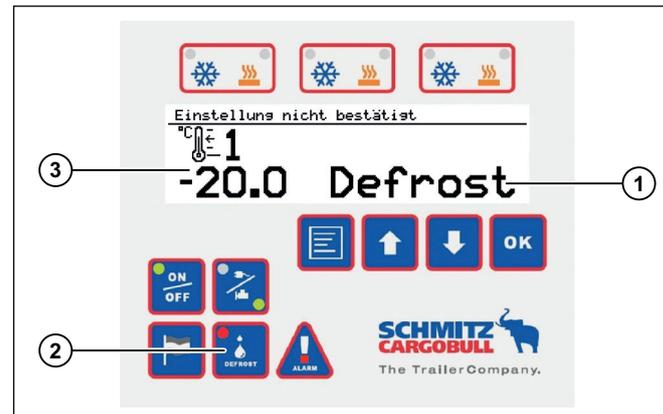


Figure 25: Defrosting active

- 1 Defrost display
- 2 Defrost button with orange illuminating LED
- 3 Currently set value

6.4.10 Alarm



When the alarm is active, the alarm LED illuminates red. The corresponding alarm text is shown in the alarm line of the display. For further details, the precise alarm point and alarm ID can be queried via the diagnosis menu.

⇒ see "6.8.1 Diagnosis sensor" p. 58

6.5 Operating modes

The S.CU can always be operated using diesel or electric current. The following operating modes and settings are possible in diesel or electric operating mode:

| Operating mode | Explanation | S.CU dc90 | S.CU dc90 MT | S.CU d80 | S.CU e80 |
|---------------------------|---|-----------|--------------|----------|----------|
| normal/eco | Selection of the operating mode for maximum power (normal) or reduced fuel consumption (eco) | X | • | • | • |
| Start/Stop | Start/stop or continuous operation | • | • | • | • |
| Booster | The diesel engine runs once to a set setpoint with maximum speed | • | • | X | X |
| Performance Power | Maximum power and focus on low internal temperature deviations | • | X | X | X |
| Performance Normal | Standard control behaviour, combination of efficient fuel consumption and good internal temperature control | • | X | X | X |
| Performance Eco | Focus on fuel savings, reducing the engine speed and bigger temperature delta in the control | • | X | X | X |

- Available
- X Not available

6.6 Procedure for changing settings

- [1] Switch on the S.CU.
 - ▷ The standby display is shown. The display switches between the individual chambers every five seconds.
- [2] Call up the menu.
 - ▷ The S.CU settings menu will be shown.
- [3] Press the confirmation button.
 - ▷ Menu level 1 is displayed.
- [4] Select the desired settings using the selection button.
- [5] Press the confirmation button.
 - ▷ The setting value is marked.
- [6] Make the desired settings using the selection button.
- [7] Press the confirmation button.
 - ▷ The setting is saved.



If the value is not confirmed with the confirmation button or the settings are cancelled using the menu button then the value last set is reactivated. In this case, a warning note is shown in the display for 30 seconds, that the settings have not been confirmed and thus have not been taken over.

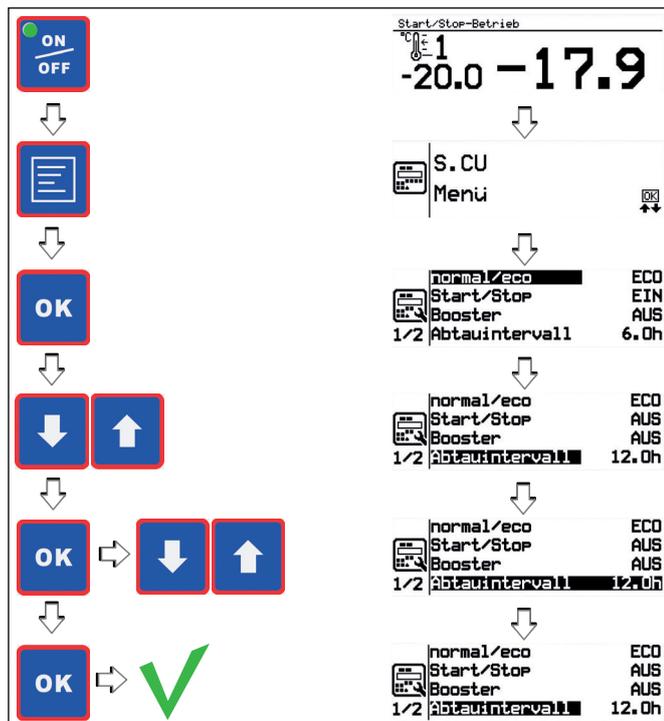


Figure 26: Process of a setting (example defrosting interval)

6.7 Settings/displays

6.7.1 Menu selection

- [1] Switch on the S.CU.
 - [2] Press the menu button.
 - [3] Press the confirmation button [OK].
 - ▷ The S.CU menu is shown.
 - [4] Select the desired menu using the selection buttons.
 - S.CU menu
 - ▷ Menu level 1 is displayed.
 - CargoSets menu
 - ▷ The CargoSets menu will be shown.
- ⇒ *Operating manual for telematics*
- SmartTrailer menu
 - ▷ The SmartTrailer menu will be shown.
- ⇒ *Operating manual for telematics*



Figure 27: S.CU menu



Figure 28: CargoSets menu (if available)

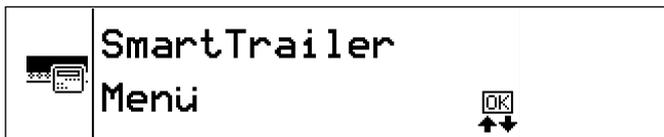


Figure 29: SmartTrailer menu

[5] Press the confirmation button.

6.7.2 Settings menu level 1 - S.CU menu

- ▶ Call up the menu.
- ⇒ see "6.7.1 Menu selection" p. 53
- ▶ Enter the settings in menu level 1.



Figure 30: Menu level 1, page 1 (example)

- 1 Normal/eco or Performance
- 2 Start/Stop
- 3 Booster (dc90)
- 4 Abtauintervall (Defrost interval)



Figure 31: Menu level 1, page 2 (example)

- 1 Frischware (Fresh goods)
- 2 Netzausfall (Power failure)
- 3 Bediensperre (Operating block)
- 4 Werkstattmodus (Workshop mode)

| Setting | Explanation |
|----------------------------|---|
| normal/eco | |
| normal | The diesel engine runs in the entire speed range for maximum performance |
| eco | The diesel engine runs at a reduced maximum speed to save fuel |
| Performance | |
| Power | Mode for low temperature deviation in the interior |
| normal | Average value between eco mode and Power mode |
| eco | Mode for saving fuel |
| Start/Stop | |
| EIN (ON) | When the defined setpoint is reached, the S.CU is switched off and starts again after a timeout of min. five minutes and a specified temperature difference from the setpoint. The minimum running time after the stop phase is five minutes. |
| AUS (OFF) | The S.CU operates in continuous operation. |
| Booster | |
| EIN (ON) | The diesel engine runs once to a set setpoint with maximum speed. After reaching the setpoint, the booster is automatically deactivated and can be reactivated manually via the menu point. |
| AUS (OFF) | The diesel engine runs according to the setting in the Performance mode menu item |
| Defrosting interval | |
| 3, 6 or 12 hours | The evaporators are defrosted after the set time. Requirement is that the outside temperature is < 0 °C. The defrosting clock is restarted after each defrosting or by the ON/OFF button. |



Performance mode offers the right focus for any trip with three options:

- Power with minimal deviation from the setpoint or
- Lower fuel consumption with greater deviations from the setpoint.

| Setting | Explanation |
|--------------------------------|---|
| Fresh goods | |
| Normal | No control of the air discharge temperature from the evaporator (maximum cooling capacity) |
| Empfindlich (Sensitive) | The air discharge temperature is limited at the evaporator to protect the goods (reduced cooling capacity). |
| Power failure | |
| EIN (ON) | If electric operation is set, the S.CU starts the diesel operation automatically after 5 minutes in the event of a power failure. When power is available, the S.CU starts electric operation. |
| ALARM | If electric operation is set, the S.CU remains on "standby" in the event of a power failure and sends Alarm 56 to the customer and to Schmitz Cargobull customer service. |
| AUS (OFF) | If electric operation is set, the S.CU checks the power input every 10 minutes. When power is available, the S.CU starts electric operation. The S.CU does not send an alarm in the event of a power failure. |

| Setting | Explanation |
|-------------------------|---|
| Operating block | |
| Changing the PIN | After entering the old PIN, a new PIN can be defined. The new PIN must be entered within 30 seconds, otherwise the procedure will be automatically aborted. |
| EIN (ON) | With the correct PIN entry, settings can be made. Selection of the CargoSets is an exception, they can be selected without entering the PIN. |
| AUS (OFF) | All settings can be changed. |
| Workshop mode | |
| EIN (ON) | Necessary for service work on the refrigerant circuit |
| AUS (OFF) | Deactivate workshop mode |
| External start | |
| EIN (ON) | External start activated |
| AUS (OFF) | External start deactivated |

6.7.3 Settings /displays in menu level 2 - S.CU menu

- ▶ Call up the menu.
- ⇒ see "6.7.1 Menu selection" p. 53
- ▶ Enter the settings in menu level 2.
- ▶ Read the displays in menu level 2.



Figure 32: Menu level 2, page 1

- 1 Dieselbetrieb (Diesel operation)
- 2 Netzbetrieb (Mains operation)
- 3 Wartungsintervall (Maintenance interval)



Figure 33: Menu level 2, page 2

- 1 Diagnose (Diagnosis)
- 2 FW-Version (FW version)
- 3 HW-Version (HW version)

| Setting | Explanation |
|-----------------------------|---|
| Diesel operation | Display of the diesel operating hours |
| Mains operation | Display of the mains operating hours |
| Maintenance interval | Remaining hours until the next inspection |
| Diagnosis | Selection and access to the diagnosis menu ⇒ see "6.8 Diagnosis sensor/messages" p. 58 |
| Sensor | Displays the current sensor values |
| Message | Displays the last six alarm messages |
| FW version | Current firmware version of the electronics |
| HW version | Current hardware version of the electronics |

6.8 Diagnosis sensor/messages

[1] Switch on the S.CU.

▷ The standby display is shown.

[2] Press the menu button twice.

▷ Menu level 2 is displayed.

[3] Select the diagnosis using the selection button.

[4] Press the confirmation button.

▷ The diagnosis is marked.

[5] Set the desired diagnosis (sensor or messages) with the selection buttons.

[6] Press the confirmation button.

▷ The diagnosis menu selected is displayed.

[7] To quit, press the menu button.

▷ The diagnosis is finished and the standby display is shown.

6.8.1 Diagnosis sensor

The diagnosis starts at sensor level 1.

In 1-chamber mode, the following values are shown at sensor level 1:

| | | | | |
|---|---------|-------|-------|------|
|  | TLE 1 | -17.9 | SMV 1 | 37 |
| | TLA 1 | -21.2 | PEA 1 | 1.3 |
| | TAS 1 | -35.6 | PKE | 0.4 |
| | 1/3 TKA | 85.3 | PKA | 25.7 |
| | | | | |

Figure 34: Sensor level 1 (example: 2-chamber mode)

| | |
|------------------|--|
| Temp. | TLE: return temperature in °C |
| | TLA: blow-out temperature in °C |
| | TAS: evaporator surface temperature in °C |
| | TKA: compressor head temperature in °C |
| SMV | Degree of opening of the suction pressure control valve in % |
| Druck (Pressure) | PKE: Compressor inlet pressure in bar |
| | PKA: Compressor outlet pressure in bar |
| | PEA: Evaporator outlet pressure in bar |

After pressing the selection button, the following values are shown at sensor level 2 in 1-chamber mode:

| | | | | |
|---|------|------|-------|------|
|  | U13 | 400 | SMV 1 | 37 |
| | U23 | 400 | TU | 23.7 |
| | UBat | 13.4 | TWD | 75.0 |
| | Iges | 10.0 | RPM | 1498 |
| | 3/3 | | | |

Figure 35: Sensor level 2 (example: 2-chamber mode)

| | |
|-----------------------------|---|
| Power U12 U23 | Phase conductor voltage between L1-L2 and L2-L3 in V |
| Batt. | Voltage: battery voltage in V |
| Gesamtstrom (Total current) | Total current consumption in A |
| SMV | Degree of opening of the suction pressure control valve in % |
| Temp. | TU: outside temperature in °C TWD: cooling water temperature in °C |
| Diesel | RPM: speed of the diesel engine in rpm |

In 2 or 3 chamber mode, the sequence of the display of the individual values varies. By pressing the selection button, you enter the respective next sensor level. The following values are shown in the individual sensor levels:

| | |
|-----------------------------|--|
| Temp. | TLE X ¹⁾ : return air temperature to the evaporator of the associated chamber in °C TLA X ¹⁾ : outlet temperature on the evaporator of the associated chamber in °C TAS X ¹⁾ : surface temperature of the evaporator of the associated chamber in °C TU: outside temperature in °C TKA: compressor head temperature in °C TWD: cooling water temperature in °C |
| Druck (Pressure) | PEA X ¹⁾ : outlet pressure of the evaporator of the associated chamber in bar PKA: Compressor outlet pressure in bar PKE: Compressor inlet pressure in bar |
| SMV X ¹⁾ | Opening angle of the suction pressure control valve of the respective chamber in % |
| PKE | Compressor inlet pressure in bar |
| PKA | Compressor outlet pressure in bar |
| TKA | compressor head temperature in °C |
| Power U12 U23 | Phase conductor voltage between L1-L2 and L2-L3 in V |
| Gesamtstrom (Total current) | Total current consumption in A |
| Diesel | RPM: speed of the diesel engine in rpm |
| Batt. | Voltage: battery voltage in V |

¹⁾ X stands for the respective chamber 1 or 2

6.8.2 Diagnosis messages (error memory)

The display of the messages 1 and 2 have the same layout. The last two S.CU errors are shown.

The errors entered can only be deactivated by an authorised service partner.

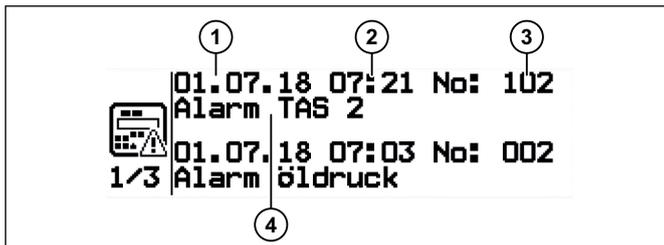


Figure 36: Message 1, fault memory layout

- 1 Date of the first occurrence after switching on the S.CU
- 2 Time of the first occurrence after switching on the S.CU
- 3 Error code
- 4 Display text of the alarm

6.9 Switching the S.CU and controller on and off

[1] Switch on the main switch.

⇒ see “5.5 Switching the main switch on and off“ p. 41

[2] Press the ON/OFF button.

⇒ see “6.4.1 Switching the standby of the S.CU on and off“ p. 47

[3] Press the chamber button.

⇒ see “6.4.2 Chamber button: Starting the chamber of the refrigeration unit“ p. 47

▷ The S.CU and the controller are in standby.



The S.CU is fully operational in standby state. Settings can be made in the menu, language, operating mode as well as the setpoints. The S.CU does not start, it remains in the standby mode for 10 minutes. If the S.CU has not started until then, the electronics switch off completely.

6.10 Starting operation of the S.CU

WARNING

Fire hazard due to flammable operating materials!

Escaping gases or liquids can ignite. Especially fuel or refrigerant R454A are highly flammable.

► Avoid smoking, handling open flames or flying sparks.

The S.CU unit can start in diesel or electric operating mode. Depending on the application case, the roof auxiliary evaporator can be additionally switched on or can also be run solo.

6.10.1 Starting diesel operation

In order to be able to start the S.CU in diesel operation, the system must be on standby.

⇒ see "5.5 Switching the main switch on and off" p. 41

► Starting diesel operation:

[1] Check the amount of fuel in the tank (top up if necessary).

⇒ see "5.4 Checking and filling with fuel" p. 40

[2] Switch on the S.CU on the control unit.

⇒ see "6.4.1 Switching the standby of the S.CU on and off" p. 47

[3] Select diesel operation on the control unit.

⇒ see "6.4.6 Switching between diesel/electric" p. 50

[4] Start the refrigeration unit on the control unit.

⇒ see "6.4.2 Chamber button: Starting the chamber of the refrigeration unit" p. 47

▷ The S.CU starts the diesel operation.

▷ Further settings are carried out on the control unit.

⇒ see "6.7 Settings/displays" p. 53

6.10.2 Electric operation – starting the CEE socket input

DANGER

Mortal danger from electric shock!

The use of unsuitable or damaged cables or sockets can lead electric shocks with serious injuries or even death.

► Before connecting the S.CU to the power supply, check the cables and sockets for possible damage.

► Use only flawless cables and sockets.

WARNING**Burns and property damage due to electric arc!**

Pulling the connector when it is under load can cause an electric arc. This can result in burns to the skin and eyes as well as property damage to the electric components.

- ▶ Never disconnect the CEE connector, ePTO connector or the connection cable under load.
- ▶ Before pulling out the power plug, switch off the S.CU or switch to diesel operation.

CAUTION**Property damage caused by incorrect voltage!**

Incorrect voltage may lead to severe damage to the electric system.

- ▶ Observe the requirements for the power connection.

There is a socket on the bottom of the S.CU for the electrical connection.

- ▶ Starting electric operation:

- [1] Remove the protective cap.
- [2] Connect the socket and power supply with a cable.

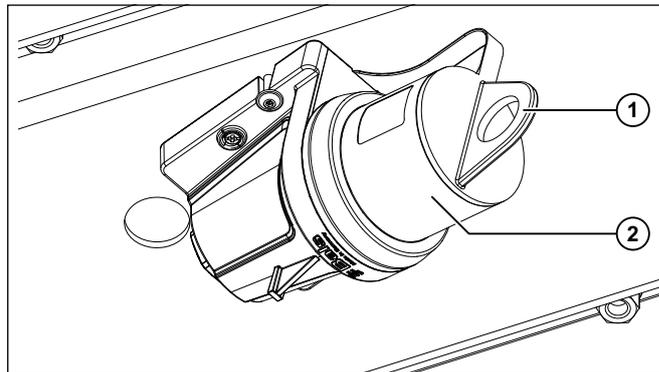


Figure 37: Power connection (CEE design)

- 1 Protective cap
- 2 Socket

- [3] Switch on the S.CU on the control unit.
 - ⇒ see "6.4.1 Switching the standby of the S.CU on and off" p. 47
- [4] Select electric operation on the control unit.
 - ⇒ see "6.4.6 Switching between diesel/electric" p. 50
 - ▷ This activates the battery charging.
- [5] Switch on the refrigeration unit on the control unit.
 - ⇒ see "6.4.2 Chamber button: Starting the chamber of the refrigeration unit" p. 47
 - ▷ The S.CU unit starts the electric operation.
 - ▷ Further settings are carried out on the control unit.
 - ⇒ see "6.7 Settings/displays" p. 53

6.10.3 Electric operation – starting the ePTO socket input

DANGER

Mortal danger from electric shock!

The use of unsuitable or damaged cables or sockets can lead to electric shocks with serious injuries or even death.

- ▶ Before connecting the S.CU to the power supply, check the cables and sockets for possible damage.
- ▶ Use only flawless cables and sockets.
- ▶ If the ePTO connection cable is damaged, disconnect the power from the S.CU.

WARNING

Burns and property damage due to electric arc!

Pulling the connector when it is under load can cause an electric arc. This can result in burns to the skin and eyes as well as property damage to the electric components.

- ▶ Never disconnect the CEE connector, ePTO connector or the connection cable under load.
- ▶ Before pulling out the power plug, switch off the S.CU or switch to diesel operation.

CAUTION

Property damage caused by incorrect voltage!

Incorrect voltage may lead to severe damage to the electric system.

- ▶ Observe the requirements for the power connection.

Using the ePTO ready option

To be able to run the Semitrailer Cooling Unit S.CU with the ePTO ready option, the S.CU must be started in electric operating mode. If the CEE connector is not connected and there is no voltage, the S.CU controller automatically checks the ePTO socket. If voltage is applied here, the Semitrailer Cooling Unit S.CU with the ePTO ready option starts in electric operating mode via the ePTO socket.

- ▶ In order that diesel operation starts automatically in case of a power failure, select the “Power failure” setting on the S.CU.

⇒ see “6.7 Settings/displays“ p. 53

For the electrical connection to the ePTO tractor, there is an ePTO socket on the underside of the Semitrailer Cooling Unit S.C.U with the ePTO ready option.

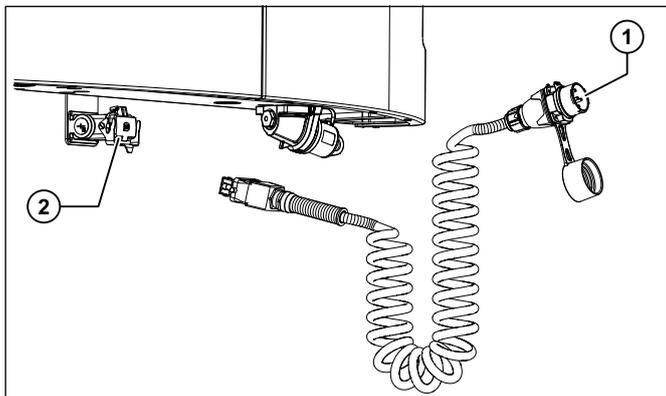


Figure 38: Power connection (ePTO design)

- 1 ePTO connection cable
- 2 ePTO socket

Requirements for the ePTO interface

- ▶ Observe the requirements for the ePTO interface of the tractor.
 - ⇒ *Tractor operating manual*
- ▶ Observe the technical data for the ePTO interface.
 - ⇒ *see "11.6 Requirements for the ePTO interface" p. 107*
- The ePTO interface on the tractor must have an adequate strain relief.
- Connection to the ePTO socket is possible in all operating modes of the Semitrailer Cooling Unit with the ePTO ready option.
- ▶ Disconnect the power cable and the connector of the ePTO socket only when the S.C.U is switched off or is in standby mode.
- ▶ Never disconnect the power cable and the connector for the ePTO socket under load.
- ▶ When the S.C.U is in electric mode (cooling/heating/defrosting) or the battery is being charged and the CEE connector or the ePTO connection cable should be disconnected, diesel operation must first be switched on or the S.C.U with the ePTO ready option must be switched off.



In the event of a power failure, the Semitrailer Cooling Unit S.CU with the ePTO ready option automatically switches to diesel operation after 2 minutes when the "Power failure" is switched on. After 30 minutes of continuous operation or a stop phase in start/stop mode, the S.CU controller automatically checks the voltage of the CEE socket and the ePTO socket. When voltage is available, the S.CU automatically switches to electric mode.

Connecting the ePTO interface

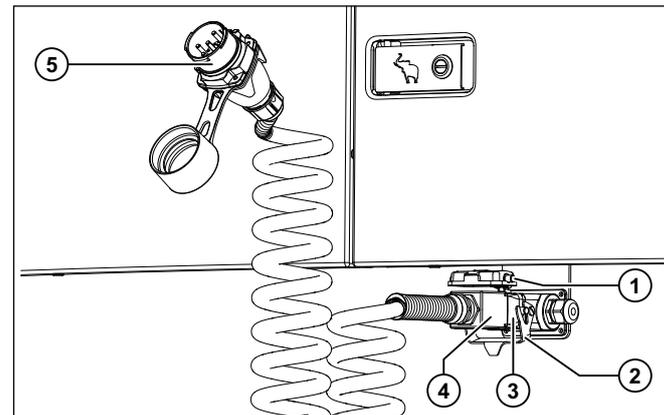


Figure 39: Overview of the ePTO interface on the S.CU

- 1 Sealing cap
- 2 Safety bracket
- 3 ePTO socket
- 4 ePTO connector
- 5 Connection cable

- [1] Switch the S.CU off on the control unit.
⇒ see "6.4.1 Switching the standby of the S.CU on and off" p. 47
- [2] Switch off the main switch.
⇒ see "5.5 Switching the main switch on and off" p. 41
- [3] Open the sealing cap on the ePTO socket.
▶ Fold the safety bracket down and release the lock.
▶ Fold the sealing cap up.
- [4] Insert the ePTO connector into the ePTO socket of the S.CU.
- [5] Fold the safety bracket over the pins of the ePTO connector.
- [6] Establish the strain relief on the tractor.
▶ Observe the specifications of the tractor manufacturer.
▷ The ePTO interface is securely connected.

Starting ePTO electric mode

- [1] Switch on the main switch.
- [2] Switch on the S.CU on the control unit.
- [3] Switch on the electric operation on the control unit.
⇒ see "6.4.6 Switching between diesel/electric" p. 50
▷ Battery charging is activated.
- [4] Start the refrigeration unit on the control unit.
▷ The S.CU unit starts the electric operation.
▷ Further settings are carried out on the control unit.

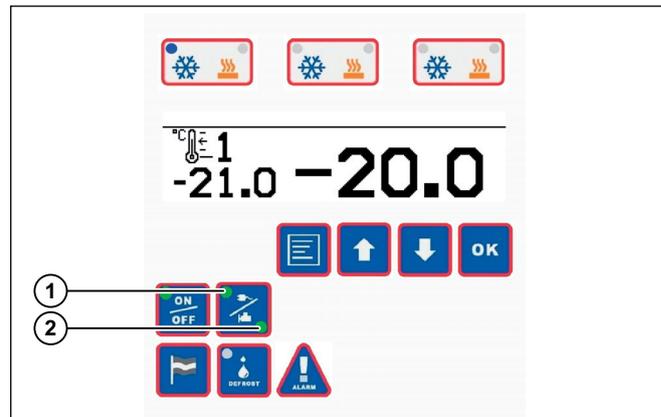


Figure 40: ePTO operating mode

- 1 LED for electric operation
- 2 LED for diesel operation



If the S.CU is running via the ePTO interface, both LEDs of the diesel/electric switchover button are illuminated on the control unit.

Disconnecting the ePTO interface

- [1]** Switch the S.CU off on the control unit.
⇒ see "6.4.1 Switching the standby of the S.CU on and off" p. 47
- [2]** Switch off the main switch.
⇒ see "5.5 Switching the main switch on and off" p. 41
- [3]** Fold the safety bracket down and release the lock.
- [4]** Pull ePTO connector from the ePTO socket of the S.CU.
- [5]** Close the sealing cap on the ePTO socket.
 - ▶ Fold the sealing cap down.
 - ▶ Fold the safety bracket over the pins and thus secure the sealing cap.
- [6]** Put the cap on the ePTO connection cable and secure it.
- [7]** Store the ePTO connection cable correctly.
 - ▶ When not in use, store the protective cap for the connection cable in a safe and dry place.
 - ▷ The ePTO interface is disconnected.



In a disconnected state, the protective cap on the ePTO connector and on the ePTO socket must be closed and locked to protect them against environmental conditions.

6.10.4 Starting recirculating air operation



Recirculating air operation must be switched on separately. Recirculating air operation is only activated when the chamber button is activated. If Setpoint 2 is adjusted, the S.CU switches to MultiTemp. operation.

- [1]** Enter Setpoint 1.
 - [2]** Select the first chamber by pressing the chamber button.
 - ▷ The S.CU starts operation.
 - [3]** Wait until the display switches to Setpoint 2.
 - [4]** Press and hold the arrow key until either -30 °C or +32 °C is displayed.
 - [5]** When the desired temperature is reached, press the arrow key again.
 - ▷ The ventilator symbol appears on the display.
- 
- [6]** Confirm the ventilator symbol with the OK button.
 - ▷ Recirculating air operation is selected.
 - [7]** Select the second chamber by pressing the chamber button.
 - ▷ Recirculating air operation is activated.

7 Troubleshooting

The overview helps to determine possible faults as well as their causes and to carry out suitable measures for troubleshooting.

| Fault | Fault remedy |
|--|--|
| Unit does not start, the starter does not function | <ul style="list-style-type: none"> ▶ Check the battery charge level. ▶ Check the battery connections. ▶ Check all fuses. |
| Unit does not start, the starter does function | <ul style="list-style-type: none"> ▶ Check the fuel fill level. ▶ Check the engine oil level. ▶ Check all fuses. |
| Unit goes off | <ul style="list-style-type: none"> ▶ Check the engine oil level. ▶ Check the cooling water. ▶ Check the fuel fill level. ▶ Check all fuses. |
| Insufficient cooling performance | <ul style="list-style-type: none"> ▶ Defrost unit. ▶ Make sure that the air supply on the evaporator is not impaired. ▶ Make sure that the air supply on the cooler/condenser is not impaired. ▶ Make sure that the cooler assembly is not damaged or has leaks. |

If a malfunction cannot be fixed:

- ▶ Contact an authorised service partner.
 - ▶ Contact Schmitz Cargobull customer service.
- ⇒ see "10.2 Customer services and service" p. 97

8 Maintenance

The maintenance is intended to maintain the operating readiness and to prevent preliminary wear. The maintenance is differentiated in:

- care and cleaning,
- maintenance and
- servicing.

8.1 Care and cleaning

The following warning instructions apply for all cleaning work.

WARNING

Risk of injury from sharp edges!

Sharp edged fins on the evaporator may lead to injuries.

- ▶ Do not touch the fins.
- ▶ Wear gloves for cleaning work.

CAUTION

Danger due to high pressures!

Compressed air and the water jet of a high-pressure cleaner may cause injuries.

- ▶ Always wear appropriate protective clothing when using compressed air or a high-pressure cleaner.
- ▶ Do not direct the water or compressed air jet at people.

CAUTION

Property damage from incompatible cleaning agents!

Incompatible cleaning agents may damage the S.CU and destroy seals.

- ▶ Do not use flammable liquids for cleaning.
- ▶ Use only cleaning agents that are compatible with the surfaces (paint, copper, aluminium, aluminium alloys, stainless steel) and the seals.
- ▶ In first two months after commissioning, do not use aggressive cleaning agents.

CAUTION

Property damage from incorrect cleaning!

Steam-jet devices or compressed air can damage the surfaces or components if not used correctly.

- ▶ In first two months after commissioning, do not use high-pressure cleaners for cleaning.
- ▶ Keep a minimum distance of approx. 0.5 m between the nozzle of the high-pressure cleaner and the area to be cleaned.
- ▶ Do not spray the water jet directly onto electric components, plug connectors, seals or hoses.
- ▶ Cover electric components.
- ▶ Set the water pressure below 2.75 bar.
- ▶ Set the air pressure below 2.05 bar.

CAUTION

Environmental damage due to chemicals!

When cleaning, in addition to dirt, there can be lubricants and cleaning agents in the waste water, which pose a hazard to the environment.

- ▶ Do not allow lubricants or cleaning agents to enter drains or sewers or seep into the ground.
- ▶ Perform cleaning work only at suitable washing stations with oil separators.
- ▶ Collect and dispose of operating materials and other chemicals in compliance with the national applicable regulations.

8.1.1 Cleaning, outside

- [1] Switch off the S.CU on the control unit (ON/OFF button).
- [2] Performing cleaning.
 - ▶ Clean the S.CU from the outside with plenty of water and an acid-free cleaning agent.
- [3] Check the S.CU after cleaning.
 - ▶ After cleaning, check S.CU for external damage and that the doors are closed correctly.
- [4] Switch on the S.CU on the control unit (ON/OFF button).
 - ▷ The exterior cleaning is complete.

8.1.2 Cleaning the machine compartment

In normal conditions, the machine compartment does not have to be cleaned. Due to certain circumstances, such as e.g., lots of leaves or sand, it would be necessary to clean the machine compartment including diesel engine, cooler and condenser.

- ▶ Have work in the machine compartment carried out only by Schmitz Cargobull sales partners or an authorised specialist workshop.
 - ▷ Cleaning the machine compartment is completed.

8.1.3 Cleaning the condenser

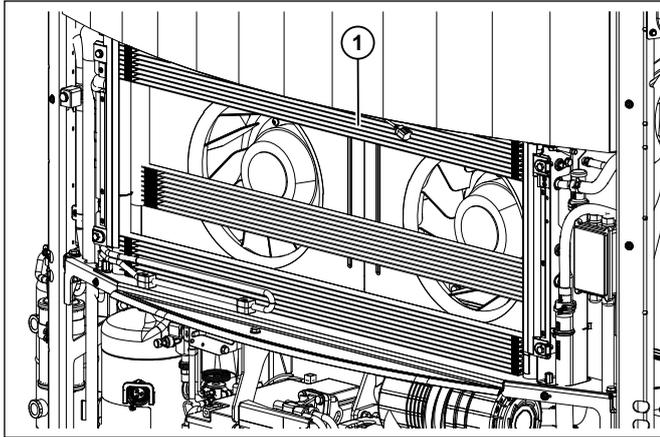


Figure 41: Cleaning the condenser
(S.CU dc90, S.CU d80 and S.CU e80)

1 Condenser

- ▶ Clean the condenser if there is visible soiling (e.g. dust, leaves).

8.1.4 Care and cleaning of the ePTO interface

- ▶ Clean the protective cap for the ePTO connector regularly.
- ▶ Clean the sealing cap for the ePTO socket regularly.
- ▶ Check the rubber seals on the sealing cap and protective cap for proper function.

8.1.5 Cleaning the interior

On the interior, the evaporator and the defrosting water drain must be cleaned.

[1] Switch off the S.CU on the control unit (ON/OFF button).

[2] Clean the evaporator.

[3] Clean the defrosting water drain.

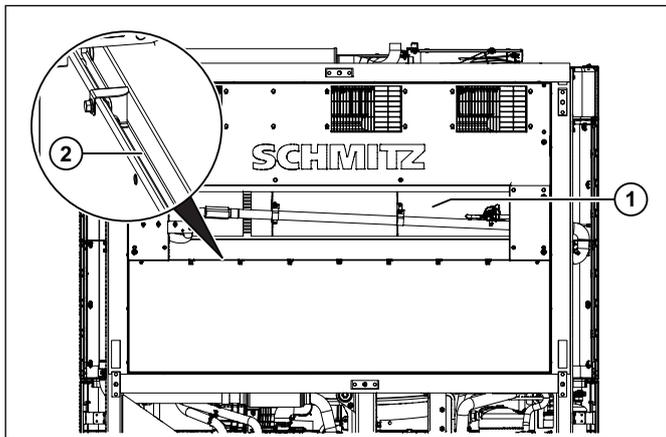


Figure 42: Cleaning the inside (example)

1 Evaporator

2 Defrosting water drain

[4] Perform cleaning.

- ▶ Use a high-pressure cleaner only after two months.
- ▶ Do not spray the water jet directly onto electric components, plug connectors, seals or hoses.
- ▶ Cover electric components.
- ▶ Keep a minimum distance of approx. 0.5 m between the nozzle of the high-pressure cleaner and the area to be cleaned.
- ▶ Use a high-pressure cleaner with max. 2.75 bar pressure and hot steam.
- ▶ Clean the S.C.U from the inside with plenty of water and an acid-free cleaning agent.
- ▶ Observe the specifications of the cleaning agent manufacturer.
- ▶ Remove water with compressed air at max. 2.05 bar.

[5] Check the interior of the S.C.U after cleaning.

- ▶ After cleaning, check the defrosting water drain for free flow.
- ▶ After cleaning, check the evaporator and its cooling fins for possible damage.

[6] Switch on the S.C.U on the control unit (ON/OFF button).

- ▷ Cleaning the interior is completed.

8.2 Maintenance

CAUTION

Property damage from maintenance work not carried out or carried out incorrectly!

Maintenance work not carried out or carried out incorrectly can lead to damage to the entire system.

- ▶ Have maintenance work carried out regularly at the specified intervals.
- ▶ Have maintenance work carried out by specialist personnel or an authorised specialist workshop.

8.2.1 Maintenance schedule

The maintenance schedule is represented on the following pages. The maintenance schedule shows which maintenance tasks have to be carried out in a specified period.

- ▶ Have maintenance work carried out only by Schmitz Cargobull sales partners or authorised specialist workshop according to the maintenance schedule.
- ▶ Have properly performed maintenance work documented.
- ▶ Have the check list for annual maintenance filled in and handed over to you.

| Maintenance work | annual review / 1,500 operating hours | Every 3,000 operating hours | Every 6,000 operating hours | Every 9,000 operating hours |
|--|--|--------------------------------|--------------------------------|--------------------------------|
| Check the device fastening (up to two units, depending on the number of chambers) | • | • | • | • |
| Leak test for refrigerant circuit | • | • | • | • |
| Check the engine oil fill level | • | • | • | • |
| Check the antifreeze fill level | • | • | • | • |
| Check water pump belt | • | • | • | • |
| Check engine mount | • | • | • | • |
| Visual check for leaks: Engine cooling system, engine oil, fuel system, refrigerant and shaft seal ring | • | • | • | • |
| Visual check of exhaust system | • | • | • | • |
| Drain water from the fuel filter (prefilter) | • | • | • | • |
| Check collector fill level (refrigerant) | • | • | • | • |
| Check compressor oil | • | • | • | • |
| Check the defrosting water drain (up to two units, depending on the number of chambers) | • | • | • | • |
| Check the evaporator (up to two units, depending on the number of chambers) | • | • | • | • |
| Check evaporator fan (up to five units, depending on the number of chambers) | • | • | • | • |
| Check condenser | • | • | • | • |
| Check condenser and machine room air fan | • | • | • | • |
| Check the electric components | • | • | • | • |
| Check battery | • | • | • | • |
| Check cooling operation | • | • | • | • |
| Check air filter and replace if necessary | • | • | • | • |

| Maintenance work | annual review / 1,500 operating hours | Every 3,000 operating hours | Every 6,000 operating hours | Every 9,000 operating hours |
|---|--|--------------------------------|--------------------------------|--------------------------------|
| Check defrosting operation | • | • | • | • |
| Check heating operation | • | • | • | • |
| Check the heating elements (up to 15 units, depending on the number of chambers) | • | • | • | • |
| Check the software version of the engine control unit, update if necessary | • | • | • | • |
| Check the firmware and parameter set of the S.CU control unit, update if necessary | • | • | • | • |
| Perform a functional test for electric and diesel operation | • | • | • | • |
| Change engine oil and filter (every 3,000 operating hours or at the end of the first year, at the latest at the end of the second year however) | | • | • | • |
| Replace the filter for pro-Vent crankshaft ventilation | | • | • | • |
| Replace fuel filter | | • | • | • |
| Replace air filter | | • | • | • |
| Check valve play, adjust if necessary | | • | • | • |
| Reset the service interval | | • | • | • |
| Check water pump bearing | | | • | • |
| Replace water pump belt | | | • | |
| Cooling system - change with commercially available high- pressure coolant (every 6000 operating hours or every 3 years) | | | • | |
| Replace compressor oil | | | | • |
| Replace dyer | | | | • |

The following describes maintenance work that can be performed independently as required.

⇒ See the following chapters 8.2.2 to 8.2.10.

8.2.2 Checking engine oil level

WARNING**Risk of burns and scalding!**

Hot oil can lead to burns.

- ▶ Avoid skin contact with hot oil.
- ▶ Wear protective clothing and protective goggles.

CAUTION**Property damage caused by incorrect engine oil!**

Incorrect engine oil can lead to severe damage to the engine.

- ▶ Only use approved engine oils.

- [1] Park the vehicle on a level surface.
- [2] Switch off the diesel engine and allow it to cool down.
- [3] Open the doors.
- [4] Check the oil level using the oil dipstick.

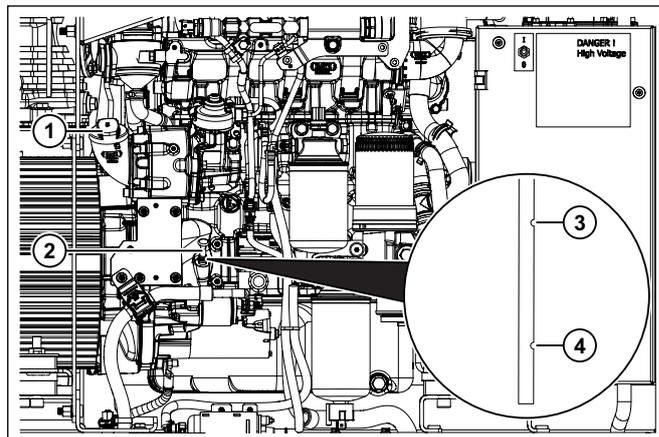


Figure 43: Checking the engine oil level (S.CU dc90)

- 1 Oil filler neck cap
- 2 Oil dipstick
- 3 MAX marking on the oil dipstick
- 4 MIN marking on the oil dipstick

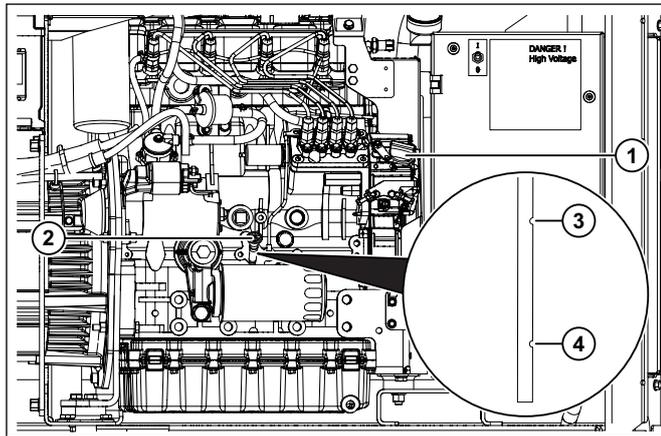


Figure 44: Checking engine oil level (S.CU d80)

- 1 Oil filler neck cap
 - 2 Oil dipstick
 - 3 MAX marking on the oil dipstick
 - 4 MIN marking on the oil dipstick
- ▶ Check that the oil level is between the MIN and MAX marking on the oil dipstick.
 - ▷ The oil level has been checked.
 - ▶ If the oil level is too low, top up with engine oil.
 - ⇒ see "8.2.3 Adding engine oil" p. 77
 - ▶ Only use approved engine oil.
 - ⇒ see "11.4.2 Engine oil" p. 102
 - ▷ The engine oil level is correct.

8.2.3 Adding engine oil

WARNING

Risk of burns and scalding!

Hot oil can lead to burns.

- ▶ Avoid skin contact with hot oil.
- ▶ Wear protective clothing and protective goggles.

CAUTION

Property damage caused by incorrect engine oil!

Incorrect engine oil can lead to severe damage to the engine.

- ▶ Only use approved engine oils.
- ▶ If the oil level too low, top up with engine oil.
- [1] Open the oil fill cap.
- [2] Fill with engine oil.
 - ▶ Only use approved engine oil.
 - ⇒ see "11.4.2 Engine oil" p. 102
 - ▶ Fill the engine oil to the MAX marking on the oil dipstick.
- [3] Clean the oil fill cover.
- [4] Close the oil fill cover.
- [5] Check the diesel engine for leaks.
 - ▶ Have any identified defects repaired.
 - ▷ The engine oil level is correct.

8.2.4 Checking the coolant level

WARNING**Risk of burns and scalding!**

Under normal operating conditions the coolant in the diesel engine and cooler is under pressure and is very hot. Contact with the coolant or hot surfaces can lead to severe burns.

- ▶ Do not touch hot surfaces.
- ▶ Wear protective clothing and protective goggles.
- ▶ Allow the diesel engine to cool down.
- ▶ The seal of the cooling system must only be opened very slowly to allow the pressure to be equalised without fluid running out.

CAUTION**Property damage caused by incorrect coolant!**

Incorrect coolant can lead to severe damage to the engine.

- ▶ Only use approved coolants.

- [1] Park the vehicle on a level surface.
- [2] Switch off the diesel engine and allow it to cool down.
- [3] Check the coolant level on the coolant compensating reservoir.

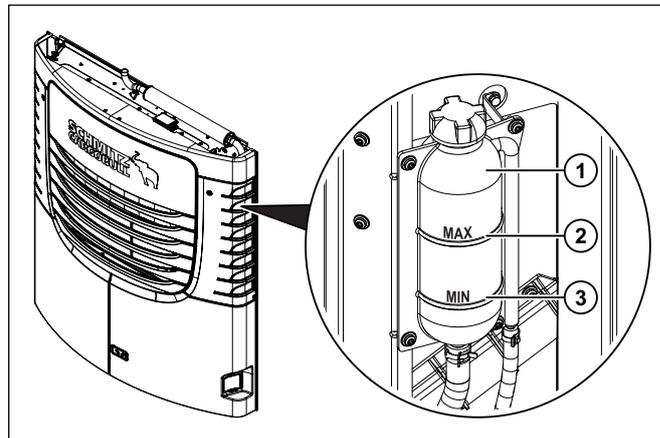


Figure 45: Checking coolant level

- 1 Coolant compensating reservoir
- 2 MAX marking
- 3 MIN marking

- ▶ Check whether the coolant level is between the MIN and MAX marking.

▷ The coolant level has been checked.

If the coolant level is too low, top up with coolant.

⇒ see "8.2.5 Topping up coolant" p. 79

- ▶ Only use approved coolants.

⇒ see "11.4.3 Coolant" p. 103

▷ The coolant level is correct.

8.2.5 Topping up coolant

WARNING

Risk of burns and scalding!

Under normal operating conditions the coolant in the diesel engine and cooler is under pressure and is very hot. Contact with the coolant or hot surfaces can lead to severe burns.

- ▶ Do not touch hot surfaces.
- ▶ Wear protective clothing and protective goggles.
- ▶ Allow the diesel engine to cool down.
- ▶ The seal of the cooling system must only be opened very slowly to allow the pressure to be equalised without fluid running out.

WARNING

Risk of falling!

When working on ladders, there is a risk of accidents resulting in injuries from falling.

- ▶ Use a stable and proper ladder.
- ▶ Make sure that the ground is level and load-bearing.

CAUTION

Property damage caused by incorrect coolant!

Incorrect coolant can lead to severe damage to the engine.

- ▶ Only use approved coolants.

- ▶ If the coolant level too low, top up with coolant.



The coolant is filled from the top. The cladding does not have to be removed for this purpose. Use a suitable ladder.

- [1] Slowly open the cover of the coolant compensating reservoir.
- [2] Fill with coolant.

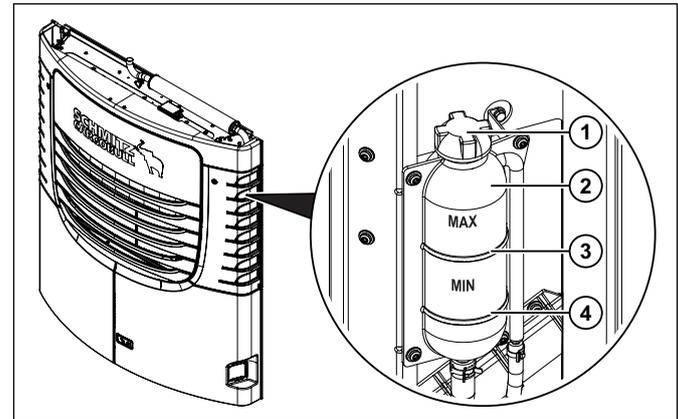


Figure 46: Filling with coolant

- 1 Cover on the coolant compensating reservoir
- 2 Coolant compensating reservoir
- 3 MAX marking
- 4 MIN marking

- ▶ Only use approved coolants.
- ⇒ see "11.4.3 Coolant" p. 103
- ▶ Fill the coolant up to the MAX marking on the compensating reservoir.
- [3]** Clean the coolant compensating reservoir cap.
- [4]** Close the coolant compensating reservoir with the cap.
- [5]** Check the cooling system for leaks.
- ▶ Have any identified defects repaired.
 - ▷ The coolant level is correct.

8.2.6 Draining water and sediment from the fuel tank

WARNING

Fire hazard due to flammable operating materials!

Escaping gases or liquids can ignite. Fuel in particular is highly flammable.

- ▶ Avoid smoking, handling open flames or flying sparks.

CAUTION

Property damage due to contamination!

Contamination in the tank may damage the fuel system.

- ▶ Drain condensation and sediment in the fuel tank before commissioning.

The quality of the fuel is an important criteria that influences the performance and the operating life of the diesel engine. Water and contamination in the fuel can lead to excessive wear of the fuel system. Water can enter the fuel tank when filling with fuel or from condensation. Fuel tanks must be equipped with a device for draining water and sediment from the base of the tank.

- ▶ Drain water and sediment using the corresponding device.
 - ⇒ See *vehicle documentation*

- ▶ Observe the preventive measures:

- Check the fuel every day.
- After filling the fuel tank, wait five minutes before draining water and sediment from the tank.
- Fill the tank after operating the diesel engine in order to force out moist air. This prevents condensation.
- Do not fill up to the edge of the tank as fuel expands when warm leading to it flowing out of the tank.



Draining at regular intervals and the use of high-quality fuels can prevent the accumulation of water in the fuel.

8.2.7 Carrying out visual inspection

WARNING

Danger from incorrect work!

Work carried out incorrectly can lead to severe injuries and property damage.

► Perform a proper visual inspection.

- Perform a visual inspection.
- ⇒ see "5.3 Visual inspection" p. 39
- Observe the warning information for the visual inspection.
- Have any identified defects repaired.
- ▷ The visual inspection is completed.

8.2.8 Checking the defrosting water drain

The defrosting water drain is located on the interior and it must run free.

- [1]** Switch off the S.CU on the control unit (ON/OFF button).
- [2]** Check the defrosting water drain and hoses for free flow.

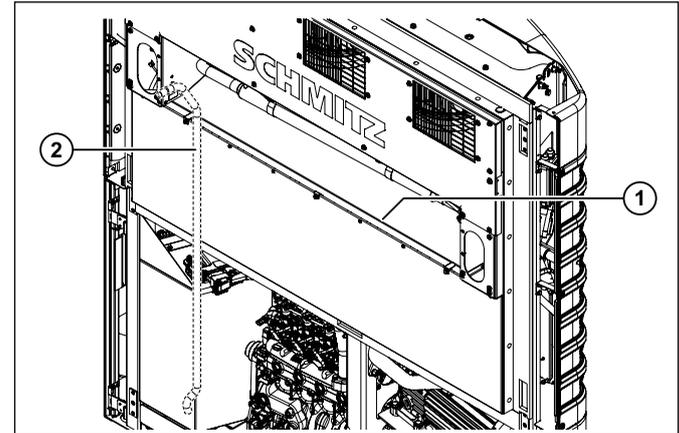


Figure 47: Checking defrosting water drain

- 1 Defrosting water drain
- 2 Defrosting hoses

- ▶ Clean the defrosting water drain if it is soiled.
⇒ see "8.1.5 Cleaning the interior" p. 72
- [3]** Switch on the S.CU on the control unit (ON/OFF button).
 - ▷ The test of the defrosting water drain is completed.

8.2.9 Charging the battery

DANGER

Risk of electric shock!

Incorrect work on the battery may lead to an electric shock with severe injuries or even death.

- ▶ Avoid short circuits.
- ▶ Do not place any metallic objects on the battery.
- ▶ Use suitable and undamaged jumper cables.

WARNING

Chemical burns due to battery acid!

There can be battery acid on the surfaces of batteries. Battery acid is corrosive and causes severe burns on the skin and serious eye damage. Irreversible damage is possible in cases of longer contact or higher concentrations.

- ▶ When working on the battery, always wear protective clothing, protective goggles and gloves.
- ▶ After touching the battery, always wash your hands thoroughly with water.

After eye contact:

- ▶ Immediately flush the eye with open eyelid under running water for at least 15 minutes.
- ▶ Promptly consult an eye specialist or emergency physician.

⚠ WARNING**Explosion hazard due to highly flammable hydrogen gas!**

The unit is equipped with a lead accumulator that, in normal cases, releases small amounts of combustible hydrogen gas. The battery may explode from being ignited or by connecting the charge cables incorrectly thus leading to severe injuries.

- ▶ Do not place any metallic objects on the battery.
- ▶ Avoid open flames and sparks when working on the battery and while charging.
- ▶ Use a voltmeter or acid tester to check the charge state of the battery.
- ▶ Do not charge the battery if it is frozen.
- ▶ Do not disconnect the charge cable from the battery before the charge process is finished.
- ▶ Keep the battery clean.
- ▶ Use the S.CU only with the recommended cables, fittings and correctly installed cover of the battery box.

CAUTION**Property damage caused by incorrect voltage!**

The electric system can be damaged from overvoltage or by switching the terminal poles.

- ▶ Only use a suitable charger for charging.
- ▶ Switch off the S.CU before connecting the charger cable.
- ▶ Connect the charger cable on the correct battery terminal.
- ▶ Connect the earth cable last.
- ▶ After charging, disconnect the earth cable first.

- [1] Switch off all additional electric consumers.
- [2] Open the left and right door.
- [3] Switch the main switch to the 0 position.
- [4] Connect the plus terminal of the charge cable to the positive terminal of the discharged battery.
⇒ see "3.1.2 Assemblies" p. 27
- [5] Connect the minus terminal of the charge cable to the engine block or the earthing point on the frame.



This prevents the ignition, sparking of flammable gases that could be developed from several batteries.

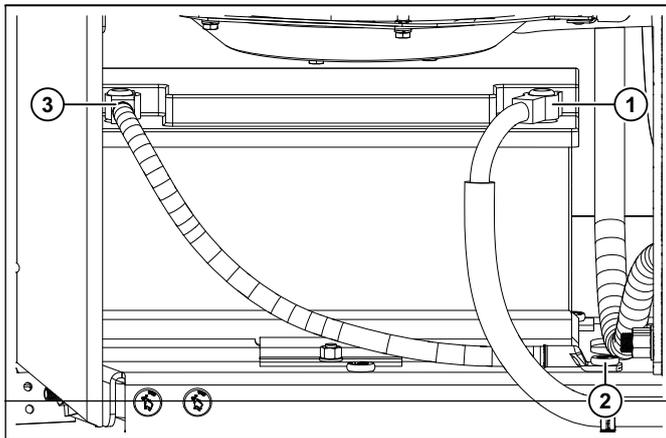


Figure 48: Charging the battery

- 1 Positive terminal
- 2 Earthing point on the frame
- 3 Negative terminal

▷ The battery is charging.

- ▶ Check the charge level on the charger display regularly.

Remove the charger cable

- [1] Disconnect the negative terminal of the charger cable from the earthing point on the frame.
- [2] Disconnect the positive terminal of the charger cable from the positive terminal of the battery.
- [3] Lock the left and right door.
 - ▷ The charging is completed.

8.2.10 Jump starting the diesel engine

DANGER

Risk of electric shock!

Incorrect work on the battery may lead to an electric shock with severe injuries or even death.

- ▶ Avoid short circuits.
- ▶ Do not place any metallic objects on the battery.
- ▶ Use suitable and undamaged jumper cables.

WARNING

Chemical burns due to battery acid!

There can be battery acid on the surfaces of batteries. Battery acid is corrosive and causes severe burns on the skin and serious eye damage. Irreversible damage is possible in cases of longer contact or higher concentrations.

- ▶ When working on the battery, always wear protective clothing, protective goggles and gloves.
- ▶ After touching the battery, always wash your hands thoroughly with water.

After eye contact:

- ▶ Immediately flush the eye with open eyelid under running water for at least 15 minutes.
- ▶ Promptly consult an eye specialist or emergency physician.

WARNING

Explosion hazard due to highly flammable hydrogen gas!

The unit is equipped with a lead accumulator that, in normal cases, releases small amounts of combustible hydrogen gas. The battery may explode from being ignited or by connecting the charge cables incorrectly thus leading to severe injuries.

- ▶ Do not place any metallic objects on the battery.
- ▶ Avoid open flames and sparks when working on the battery and while charging.
- ▶ Use a voltmeter or acid tester to check the charge state of the battery.
- ▶ Do not charge the battery if it is frozen.
- ▶ Do not disconnect the charge cable from the battery before the charge process is finished.
- ▶ Keep the battery clean.
- ▶ Use the S.CU only with the recommended cables, fittings and correctly installed cover of the battery box.

WARNING

Risk of crushing from drive belts for the water pump!

The water pump of the diesel engine is driven by a V-ribbed belt. Hands may be crushed between the drive belts and pulley.

- ▶ Do not reach between the drive belts and pulley.

WARNING

Risk of injury from sharp edged fan wheel!

Several components are equipped with fan wheels. Rotating parts are installed in the fan. Working without covers can lead to severe injuries.

- ▶ Do not reach into the fan.
- ▶ Put S.CU into operation only with properly installed covers.

CAUTION

Property damage caused by incorrect voltage!

The electric system can be damaged from overvoltage or by switching the terminal poles.

- ▶ For jump starting, use only a power source that has the same voltage.
- ▶ Switch off the S.CU before connecting the jumper cable.
- ▶ Connect the jumper cable to the correct battery terminal.
- ▶ Connect the earth cable last.
- ▶ After jump starting, disconnect the earth cable first.

If the battery is completely discharged, the diesel engine is jump started with jumper cables.

- [1] Switch off all additional electric consumers.
- [2] Open the left and right door.
- [3] Switch the main switch to the 0 position.
- [4] Connect the plus terminal of the jumper cable to the positive terminal of the discharged battery.
- [5] Connect the other plus terminal of the jumper cable to the positive terminal of the battery providing the power.
- [6] Connect the minus terminal of the jumper cable to the negative terminal of the battery providing the power.
- [7] Connect the other minus terminal of the jumper cable to the engine block or the earthing point on the frame.

⇒ see "Figure 49: Replacing the battery (example)" p. 88



This prevents the ignition, sparking of flammable gases that could be developed from several batteries.

- [8] Switch the main switch to the 1 position.
- [9] Switch on the diesel engine unit on the control unit.
 - ▷ The diesel engine has been started externally and is running.

When the diesel engine has started, disconnect the jumper cable.

- [1] Disconnect the minus terminal of the jumper cable from the earthing point on the frame.
- [2] Disconnect the minus terminal of the jumper cable from the negative terminal of the battery providing the power.
- [3] Disconnect the plus terminal of the jumper cable from the positive terminal of the battery providing the power.
- [4] Disconnect the plus terminal of the jumper cable to the positive terminal of the battery.
- [5] Lock the left and right door.
 - ▷ The remote starting is completed.

8.3 Servicing

WARNING

Risk of injury and asphyxiation due to refrigerant!

Technical knowledge is essential for handling the refrigeration unit and the utilised refrigerant. Improper work on the refrigeration unit and when handling the refrigerant lead to a risk of injury and asphyxiation.

- ▶ Have maintenance work on the refrigeration unit performed only by competent specialist personnel at an authorised specialist workshop.

WARNING

Risk of fire and explosion due to refrigerant!

If there are leaks or under unfavourable conditions, there is a risk of fire and explosion of the refrigerant R454A.

- ▶ Have maintenance work on the refrigeration unit performed only by competent specialist personnel at an authorised specialist workshop.
- ▶ Avoid ignition sources (such as heat, hot surfaces, sparks, smoking and open flames).

CAUTION

Property damage from incorrect servicing!

Servicing work not carried out or carried out incorrectly can lead to damage to the entire system.

- ▶ Have repair work carried out by specialist personnel or an authorised specialist workshop.

The following describes repair work that can be performed independently as required.

⇒ See the following chapters 8.3.1 to 8.3.2.

8.3.1 Replacing the battery

⚠ DANGER**Risk of electric shock!**

Incorrect work on electric components may lead to an electric shock with severe injuries or even death.

- ▶ Avoid short circuits.
- ▶ Do not place any metallic objects on the battery.
- ▶ Switch the main switch to the 0 position.
- ▶ Always remove the negative terminal on the battery first.

⚠ WARNING**Chemical burns due to battery acid!**

There can be battery acid on the surfaces of batteries. Battery acid is corrosive and causes severe burns on the skin and serious eye damage. Irreversible damage is possible in cases of longer contact or higher concentrations.

- ▶ When working on the battery, always wear protective clothing, protective goggles and gloves.
- ▶ After touching the battery, always wash your hands thoroughly with water.

After eye contact:

- ▶ Immediately flush the eye with open eyelid under running water for at least 15 minutes.
- ▶ Promptly consult an eye specialist or emergency physician.

If a battery can no longer be charged then it is defective and must be replaced.



For space reasons, the battery must comply with the specified dimensions and values.

⇒ see "11 Technical data" p. 98

The following image applies for the work steps for replacing the battery.

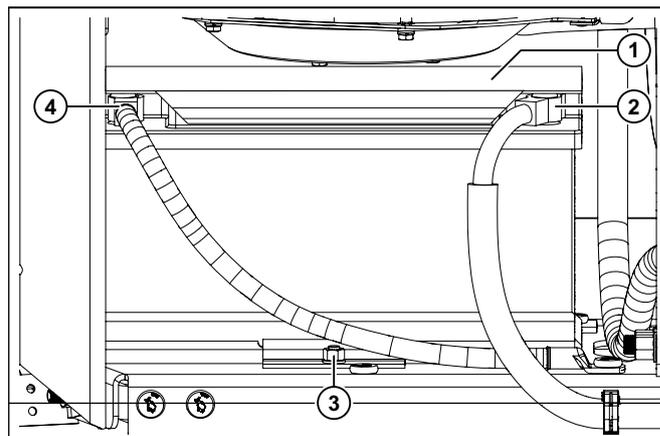


Figure 49: Replacing the battery (example)

- 1 Battery cover or terminal caps
- 2 Positive terminal
- 3 Battery fastening
- 4 Negative terminal

- [1] Switch off the S.CU on the control unit (ON/OFF button).
- [2] Open the doors.
- [3] Switch the main switch to the 0 position.
- [4] Take off the battery cover or terminal caps.
 - ⇒ *see "3.1.2 Assemblies" p. 27*
- [5] Disconnect the negative terminal of the battery.
 - ▶ Make sure that the cable cannot touch the terminal.
- [6] Disconnect the positive terminal of the battery.
- [7] Remove the old battery.
 - ▶ Remove the battery fastening.
- [8] Install the new battery.
 - ▶ Use the prescribed battery.
- ⇒ *see "11 Technical data" p. 98*
- ▶ Install the battery fastening.
- ▶ Check the battery for firm seating.
- [9] Connect the positive terminal.
- [10] Connect the negative terminal to the battery.
- [11] Put on the battery cover or terminal caps.
 - ▷ The battery is replaced.
 - ▶ Dispose of old batteries at your local waste disposal company.

8.3.2 Checking and replacing fuses

DANGER

Risk of electric shock!

Incorrect work on electric components may lead to an electric shock with severe injuries or even death. Unsuitable fuses can lead to fires.

- ▶ Avoid short circuits.
- ▶ Do not open any main fuses.
- ▶ Use only suitable fuses of the same rating.
- ▶ Do not bypass any fuses.
- ▶ Switch the main switch to the 0 position.
- ▶ Avoid the penetration of dirt and moisture in the open fuse box.

A fuse can melt due to overcurrents. Before a new fuse is inserted, the cause must be determined and eliminated.

A main fuse is defective if all fuses are functional and the system does not switch on. Then there is a fault in an electric component.

- ▶ If a main fuse is defective, contact the Cargobull Service department.

⇒ *see "10.2 Customer services and service" p. 97*

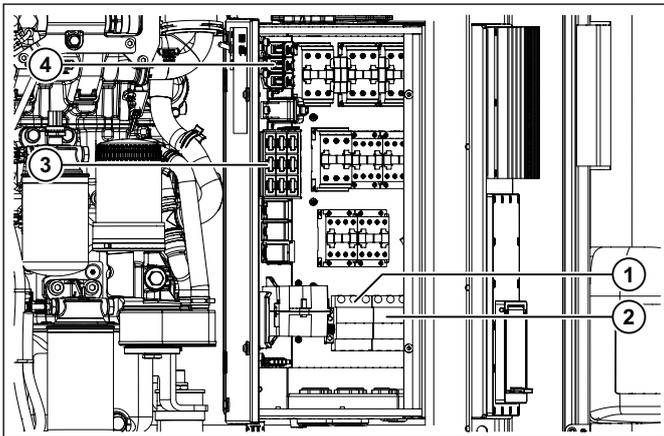


Figure 50: Overview of the fuses S.CU dc90

- 1 Safety fuse for fan (10 A)
- 2 Safety fuse for heater (15 A)
- 3 Flat plug-in fuses:
 controllers (7.5 A)
 control circuit (20 A)
 Telematics power supply, temperature recording device and tank indicator (10°A)
- 4 Main fuse



A circuit diagram has been attached to the control box as an assistance for troubleshooting.

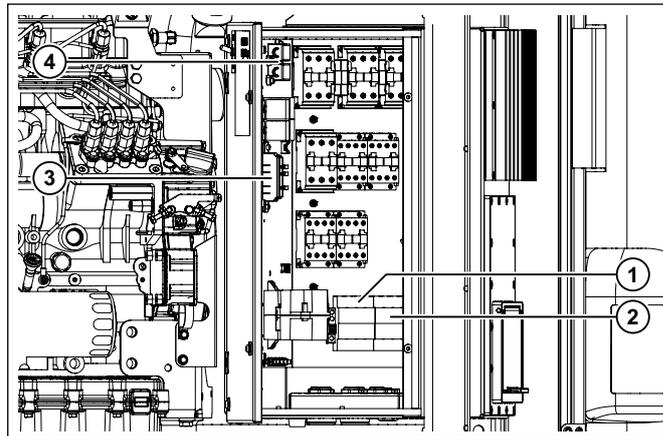


Figure 51: Overview of the fuses S.CU d80 and S.CU e80

- 1 Safety fuse for fan (10 A)
- 2 Safety fuse for heater (15 A)
- 3 Flat plug-in fuses:
 controllers (7.5 A)
 control circuit (15 A)
 Telematics power supply, temperature recording device and tank indicator (10°A)
- 4 Main fuse



A circuit diagram has been attached to the control box as an assistance for troubleshooting.

- [1] Switch off the S.CU on the control unit (ON/OFF button).
- [2] Isolate the socket and power supply (applies only for electric operation).
 - ▶ Disconnect the CEE connector and ePTO connection cable.
- [3] Open the doors.
- [4] Switch the main switch to the 0 position.
- [5] Take off the battery cover or terminal caps.
- [6] Disconnect the negative terminal of the battery.
 - ▶ Make sure that the cable cannot touch the battery terminal.

- [7] Open the switch box door.

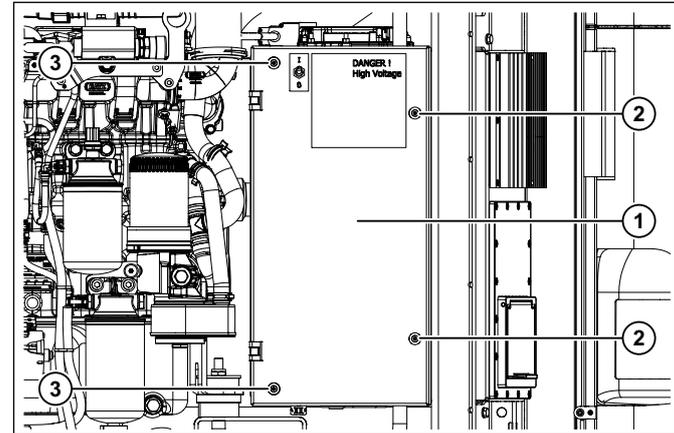


Figure 52: Opening the switch box door

- 1 Switch box door
- 2 Fastening screw for the switch box door
- 3 Additional fastening bolts for the MultiTemp. switch box door

- ▶ Screw the switch box open.

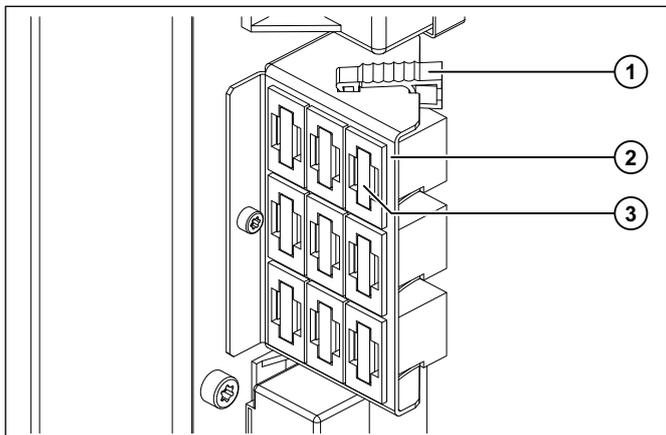
[8] Check and replace the flat plug-in fuses.

Figure 53: Checking and replacing the flat plug-in fuses
(S.CU dc90)

- 1 Fuse tool
- 2 Fuse holder
- 3 Flat plug-in fuses

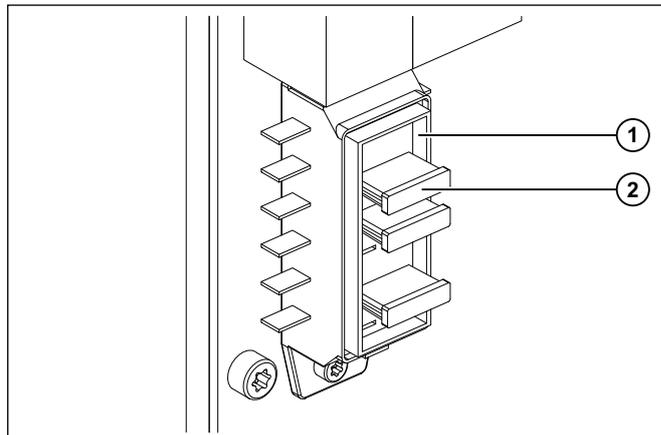


Figure 54: Checking and replacing the flat plug-in fuses
(S.CU d80 and S.CU e80)

- 1 Fuse holder
- 2 Flat plug-in fuses

- ▶ Check that the safety insert in the flat plug-in fuse is closed.
- ▶ Replace any defective flat plug-in fuses.
Insert a new flat plug-in fuse with the same rating in the fuse holder.

[9] Check and replace the safety fuses.

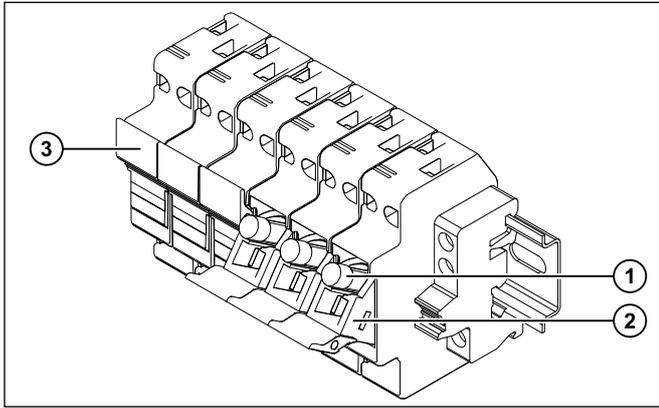


Figure 55: Checking and replacing the safety fuses

- 1 Safety fuse
- 2 Main fuse opened (fuse holder folded down)
- 3 Main fuse closed

- ▶ Open the main fuse. Pull the fuse holder down.
- ▶ Check if the safety fuse is okay.
- ▶ Replace any defective safety fuses.
Insert a new safety fuse with the same rating in the fuse holder.
- ▶ Close the main fuse. Pull the fuse holder up until it engages.
- ▷ The fuses have been checked and, where appropriate, replaced.

[10] Close the switch box door.

- ▶ Screw the switch box closed.

[11] Connect the negative terminal to the battery.

[12] Put on the battery cover or terminal caps.

[13] Switch the main switch to the 1 position.

[14] Lock the doors.

[15] Connect the socket and power supply
(applies only for electric operation).

- ▷ The S.CU can now be operated.

9 Decommissioning

9.1 Temporary decommissioning

[1] Open the left door.

[2] Switch the main switch to the 0 position.

⇒ see "Figure 19: Main switch" p. 42

▷ The system is switched off and not ready for operation.

To take the S.CU out of operation for a period longer than one month, the following measures must be carried out:

- ▶ At regular intervals, carry out a visual inspection of the external condition and the battery status.
 - ▶ Perform a diesel cooling operation once a month (setpoint -30 °C) system for at least 15 minutes in order to avoid or minimise servicing work the S.CU.
 - ▶ After being taken out of operation for longer periods, charge the battery with a suitable charger.
- ⇒ see "8.2.9 Charging the battery" p. 82
- ▶ Disconnect the battery.
 - ▷ The S.CU is temporarily taken out of operation.

9.2 Recommissioning

When the S.CU is put back into operation after a longer period of downtime, check it for proper functioning.

[1] Check the battery and charge if necessary.

⇒ see "8.2.9 Charging the battery" p. 82

[2] Perform the commissioning.

⇒ see "5.2 Commissioning before each use" p. 38

▷ Putting back into operation is complete.

9.3 Final decommissioning/disposal

WARNING

Risk of injury and asphyxiation due to refrigerant!

Technical knowledge is essential for handling the refrigeration unit and the utilised refrigerant. Improper work on the refrigeration unit and when handling the refrigerant lead to a risk of injury and asphyxiation.

- ▶ Disposal of refrigeration unit components, refrigerant and refrigerant oil may only be performed by competent specialist personnel in an authorised specialist workshop.

WARNING

Risk of fire and explosion due to refrigerant!

If there are leaks or under unfavourable conditions, there is a risk of fire and explosion of the refrigerant R454A.

- ▶ Disposal of refrigeration unit components, refrigerant and refrigerant oil may only be performed by competent specialist personnel in an authorised specialist workshop.
- ▶ Avoid ignition sources (such as heat, hot surfaces, sparks, smoking and open flames).

CAUTION

Environmental damage due to incorrect disposal!

The S.CU contains operating materials and electrical components that must be disposed of separately. Improper disposal can damage the environment. Operating materials may contaminate the ground water. Batteries may adversely affect the environment.

- ▶ Contact a specialist company for proper disposal.
- ▶ Dispose of all operating materials and old batteries properly.
- ▶ Observe national and local disposal regulations.

There is a potential risk to the environment when using different operating materials. During maintenance work or after the final decommissioning, the operating materials and components of the S.CU must be disposed of.

- ▶ Observe the country-specific legal regulations for disposal.
- ▶ Collect operating materials in suitable containers.
- ▶ Dispose of used filter inserts (fuel filter, oil filter, refrigerant filter) as special waste according to the substance filtered.
- ▶ Dispose of old batteries at the local waste management facility.

The refrigerant used is harmful to the ozone layer and impacts the climate. Thus, it must not escape into the atmosphere. Used refrigerant oil contains remnants of the refrigerant agent.

- ▶ Observe the safety instructions when handling the refrigerant.
 - ⇒ *see "2.11 Handling refrigerants" p. 20*
- ▶ When handling refrigerants, observe the current version of the safety data sheet.
 - ⇒ *see "1.5 Relevant documents" p. 10*
- ▶ Dispose of in accordance with the Regulation on fluorinated greenhouse gases (EU) 2024/573.
- ▶ Use an appropriate container for extracted refrigerant oil or refrigerant.
- ▶ Hand the container over to the respective specialist company for disposal.

10 Spare parts and customer services

10.1 Spare parts

The original spare parts are subjected to regular tests for safety and function. The use of original spare parts guarantees road and operating safety and the operating permit is retained.

- ▶ Use only Schmitz Cargobull original spare parts.
- ▶ Have the information on the vehicle name plate ready when ordering spare parts.

⇒ see "1.2 Product identification and name plates" p. 6

You can order the spare parts from us as follows:

Cargobull Parts & Services GmbH

Spare parts centre

Siemensstraße 49

D-48341 Altenberge

Telephone: +49 2558 / 81-2999

Email: Ersatzteil-Center@cargobull.com

Internet: www.cargobull.com

Or at one of our authorised service partners.

10.2 Customer services and service

In the event of breakdown, you can contact the Cargobull Euroservice at:

00800-24CARGOBULL

or

00800-24227462855

or

Telephone: +49 (0) 2558 / 81-55 11

11 Technical data

11.1 Dimensions

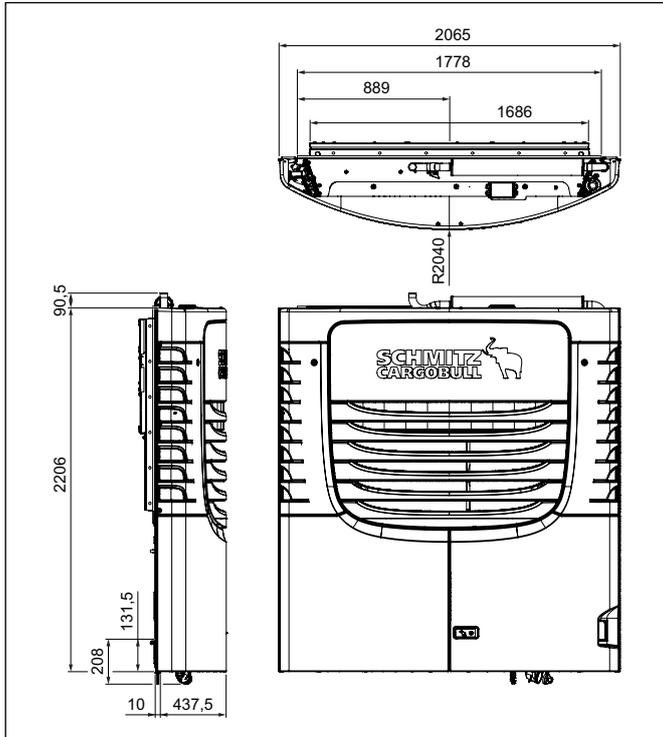


Figure 56: External dimensions of the S.C.U

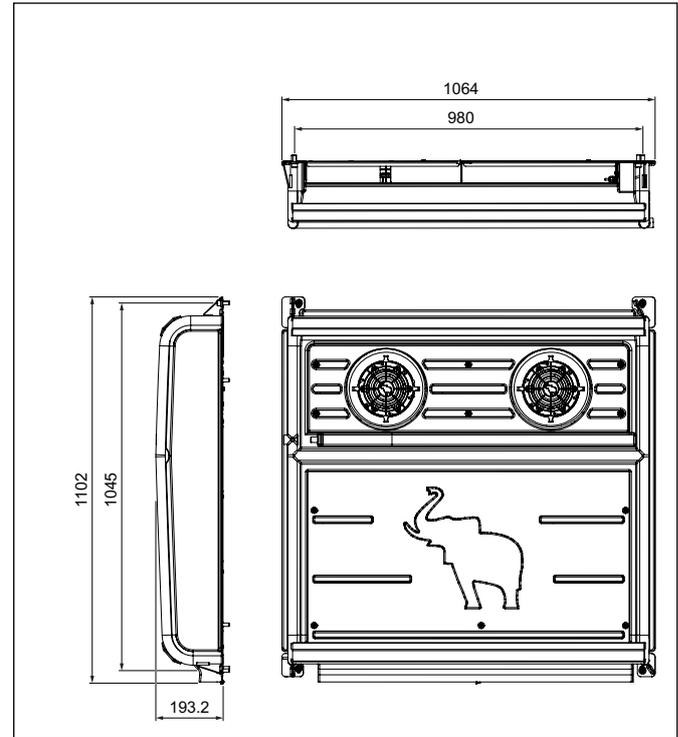


Figure 57: External dimensions of the additional ceiling evaporator

11.2 Overview of the data

| | |
|----------------------------------|--|
| Sound power level L_{WA} | S.CU d80 = 94.9 dB(A) S.CU dc90 = 97 dB(A) (MonoTemp.) S.CU dc90 MT = 97 dB(A) (MultiTemp.) S.CU e80 = 94.9 dB(A) |
| Refrigerant | Read the utilised refrigerant from the name plate. (⇒ see "1.2.1 Semitrailer Cooling Unit (S.CU) name plate" p. 7) |
| Refrigerant quantity | S.CU d80 = 5 kg S.CU dc90 = 5 kg (MonoTemp.) S.CU dc90 MT = 7 kg (MultiTemp.) S.CU e80 = 5 kg |
| Max. pressure positive/negative | 32/19 bar |
| Control voltage | 12 V DC |
| Mains voltage/frequency/pre-fuse | 400 V/50 Hz/32 A |
| Permitted battery | 12 V 100 Ah 830 A Observe the dimensions: Length: 353 mm Width: 175 mm Height: 190 mm (incl. terminals) |
| Total weight | S.CU d80 = 802 kg S.CU dc90 = 820 kg (MonoTemp.) S.CU dc90 MT = 833 kg (MultiTemp.) (MultiTemp. 2 chambers) S.CU e80 = 570 kg |

11.3 Engine data

| | |
|--------------------------------|--|
| Manufacturer/model | Perkins/404D-22 (S.CU d80) |
| Design | liquid cooled four-cycle diesel engine, four cylinders in-line |
| Bore and stroke | 84.0 x100.0 mm |
| Cubic capacity | 2.2 l |
| Power | 18.4 kW at 1500 r.p.m. |
| Air intake system | Self-priming (naturally-aspirated engine) |
| Injection | indirect |
| Engine oil quantity | 14.5 l |
| Cooling liquid, overall system | 6.4 l |
| Dimensions (LxHxW) | 946x513x854 mm |
| Total weight | 218 kg |

| | |
|--------------------------------|---|
| Manufacturer/model | Hatz/4H50N (S.CU dc90) |
| Design | Liquid cooled four-stroke diesel engine, four cylinders in-line |
| Bore and stroke | 84.0x88.0 mm |
| Cubic capacity | 1.952 l |
| Power | 18.9 kW at 1800 r.p.m. |
| Air intake system | Direct injection |
| Injection | Direct (1800 bar) |
| Engine oil quantity | 9.0 l |
| Cooling liquid, overall system | 4.7 l |
| Dimensions (LxHxW) | 751x650x613 mm |
| Total weight | 160 kg |

11.4 Operating materials

11.4.1 Diesel fuel

WARNING

Fire hazard due to flammable operating materials!

Escaping gases or liquids can ignite. Especially fuel or refrigerant are highly flammable.

- ▶ Avoid smoking, handling open flames or flying sparks.

CAUTION

Property damage caused by incorrect fuel!

The operation with incorrect fuel can lead to severe damage to the engine.

- ▶ Use the preferred fuel.
- ▶ Avoid the use of biofuels.

Diesel engines can be operated using different types of fuels. The fuels differ in their quality and act on the fuel consumption and wear. The fuels are categorised in four general groups:

| Fuel group | Classification | Explanation |
|----------------|-------------------|---|
| Group 1 | Preferred fuel | Maximum performance and full operating life of the diesel engine. |
| Group 2 | Permissible fuels | This fuel may reduce the performance and operating life of the diesel engine. |

| Fuel group | Classification | Explanation |
|----------------------|--|--|
| Group 3 | Biodiesel | Biodiesel fuels are available in different versions. Biodiesel reduces the performance and the operating life of the diesel engine. Damage may be caused to the fuel system. |
| Special fuels | Fuel for use at lower ambient temperatures | Diesel fuel mixed with an additive that reduces the flocculation at low temperatures. |

- ▶ Use the best possible fuel group.
- ▶ Use only fuels that comply with the specifications of Schmitz Cargobull.
- ▶ Use low-sulphur fuel in accordance with the region.

| Region | Fuel requirements from 2010 |
|--|--|
| EPA (EU and ACP states = group of the African, Caribbean and Pacific states) | Extreme low sulphur max. 15 ppm |
| EU | Design 404D-22 Extreme low sulphur max. 10 ppm for below or up to 37 kW |
| Regions without provisions on exhaust emissions | Sulphur limit below 4,000 ppm |

If only fuel is available with a high sulphur content, then engine oil with a high alkaline content must be used in the diesel engine or, the oil change interval must be reduced.

- ▶ Contact Schmitz Cargobull if you have any questions.
- ⇒ see “10.2 Customer services and service“ p. 97

Group 1: preferred fuels

Fuels with the specifications of this group are termed as preferred approved:

- EN 590 DERV Category A, B, C, E, F, Class, 0, 1, 2, 3 and 4
- ASTM D975, Cat. 2D S15 and Cat. 2D S500
- JIS K2204 Categories 1, 2, 3 and Special category 3
Fuels of these categories must meet the minimum requirements on lubricating properties.
- BS2869 class A2 red diesel fuel for use outside public roads

Group 2: approved fuels

Fuels with the specifications of this group are termed as approved as long as they have been displaced with fuel additive. These fuels can have an adverse effect on the operating life and the performance of the diesel engine.

- ASTM D975, Cat. 1D S15 and cat. 1D S500
- JP7 (MIL-T-38219)
- NATO F63



JP7 and NATO F63 can only be used if the sulphur content complies with the requirements listed.

Group 3: Biodiesel

Biodiesel is a fuel that has been gained from different raw materials. The raw material used can have an effect on the fuel quality. Amongst others, the cold flowing properties and the oxidation resistance are influenced. This leads to a reduction in the engine performance and increases wear to the diesel engine.

- ▶ Avoid the use of biofuels.

Special fuels: Fuel for use at lower ambient temperatures

The European standard EN 590 includes weather-related requirements and a series of options. The applicability of the options may be different in each country. There are five classes that are assigned to in winter, the Arctic climate and extremely low ambient temperatures: 0, 1, 2, 3 and 4.

Fuels that comply with EN 590 Class 4 can be used at low ambient temperatures down to -44 °C. The European standard EN 590 contains a detailed list of the physical fuel properties.

The fuel used in the USA according to ASTM D975 1-D can be used at low temperatures to -18 °C.

With extremely low ambient temperatures, the following fuels listed can also be used. The fuels have been dimensioned so that they can be used at operating temperatures up to -54 °C.

| Specification | Class |
|----------------|---------|
| US-MII.-5624U | JP-5 |
| US-MII.-83133E | JP-8 |
| ASTM D1655 | Jet-A-1 |



These fuels may be used if they are mixed with an appropriate fuel additive and the minimum requirements are fulfilled.

11.4.2 Engine oil

CAUTION

Property damage caused by incorrect engine oil!

The operation with incorrect engine oil can lead to severe damage to the engine.

- ▶ Use oils of the preferred specification.
 - ▶ Observe the viscosity grade of the oil.
 - ▶ Avoid the use of oil additives.
-
- ▶ Only use engine oils with the following specification. (Manufacturer recommendation):
 - Shell Rimula R6 LM 10W-40
 - Aral Mega Turboral LA 10W-40
 - EMA-DHD-1 multi-grade all-season oil (preferred)
 - API, CH-4, CI-4 multi-grade all-season oil (preferred)
 - ACEAE5
 - ▶ Observe the viscosity of the oil.

The correct viscosity grade (according to SAE) of the oil is determined by the lowest ambient temperature at which the diesel engine has to be started and the highest ambient temperature during operation of the engine.

The viscosity grades and the ambient temperatures are represented in the following table.

| Viscosity | Ambient temperature | |
|-----------|---------------------|-------|
| | Min. | Max. |
| SAE 0W20 | -40°C | 10°C |
| SAE 0W30 | -40°C | 30°C |
| SAE 0W40 | -40°C | 40°C |
| SAE 5W30 | -30°C | 30°C |
| SAE 5W40 | -30°C | 40°C |
| SAE 10W30 | -20°C | 40°C |
| SAE 15W40 | -10°C | 50°C |
| SAE 10W40 | -20°C | 30 °C |

A synthetic engine oil may be used if this oil fulfils the specifications and viscosity specified above.

- ▶ Avoid the use of oil additives.

The oil change interval of 3,000 operating hours is only possible when using the following oils:

Hatz/4H50N (generally fully synthetic diesel engine oil):

- ACEA E6, E7 or E9
- ACEA C1, C2, C3 or C4
- API CK-4, CJ-4 or CI-4
- SAE 10W-40

Perkins/404D-22:

- Shell Rimula R6 LM 10W-40
- Mobile Delvac 1 5W40, CAT DEO SYN 5W40
- Aral Mega Turboral LA 10W-40
- ▶ For different oils, contact the Schmitz Cargobull Service department.

⇒ see "10.2 Customer services and service" p. 97

11.4.3 Coolant

CAUTION

Property damage caused by incorrect coolant!

The operation with incorrect coolant can lead to severe damage to the engine.

- ▶ Use coolant with the preferred specification.
- ▶ Observe the antifreeze content.

The quality of the coolant is just as important as the quality of the fuel and engine oil.

- ▶ Use Perkins long-life coolant or Hatz H50 coolant or a commercially available HP anti-freeze agent that meets the specifications according to ASTM D4985.
- ▶ Avoid the use of coolants that only meet the specification ASTM D3306.
- ▶ Use a mixture that offers protection at the lowest ambient temperatures to be expected.

Coolant normally comprises three components:

- water,
- coolant additive and
- glycerol.

Water

Water is used in the system for transferring heat.

- ▶ Use distilled water or fully desalinated water.
- ▶ Observe the limit values for water:

| Content/properties | Upper limit value (Perkins) |
|-----------------------------|-----------------------------|
| Chlorine (Cl) | 40 mg/l |
| Sulphate (SO ₄) | 100 mg/l |
| Total hardness | 170 mg/l |
| Total solid matter quantity | 340 mg/l |
| pH value | 5.5 to 9.0 |

| Content/properties | Upper limit value (Hatz) |
|-----------------------------|--------------------------|
| Chlorine (Cl) | 100 ppm |
| Sulphate (SO ₄) | 100 ppm |
| Total hardness | 20°dGH |
| Total hardness | 3.6 mmol/l |

Coolant additive

Coolant additives (Supplemental Coolant Additives = SCA) protect the metal surfaces of a cooling system filled with high-pressure antifreeze agent. Insufficient concentration or missing additive leads to:

- corrosion,
 - formation of mineral sedimentation and
 - formation of foam.
- ▶ Use a coolant additive when using high-pressure antifreeze.
 - ▶ Avoid coolant additive when using long-life coolant (Extended Life Coolant = ELC).

Glycerol

The glycerol in the coolant protects against:

- boiling,
 - freezing and
 - cavitation of the water pump.
- ▶ Use an equal mixture of water and glycerol (1:1).
 - ▶ Observe the following information:



The 1:1 mixture offers optimum performance as a high-pressure antifreeze agent. If a better antifreeze should be necessary, the ratio of water to glycerol can be changed to 1:2.

i 100% pure glycerol freezes at a temperature of -23 °C and is not permitted.

i Ethylene glycol is used with most conventional anti-freeze agents. Propylene glycol can also be used. With a mixture of an equal content of water, ethylene glycol and propylene glycol offer a comparative boiling and freezing protection.

Ethylene glycol:

50% concentration = freezing protection to -36 °C

60% concentration = freezing protection to -51 °C

Propylene glycol:

50% concentration = freezing protection to -29 °C

i Due to the reduced heat dissipation properties of propylene glycol, the concentration used with glycol must not be more than 50%. When using in ambient temperatures that requires an additional freezing or boiling protection, ethylene glycol must be used.

11.5 Refrigerant

WARNING

Fire hazard due to refrigerant!

Escaping gases or liquids can ignite. The utilised refrigerants differ in terms of the flammability.

R452A: Safety class A1, not flammable

R454A: Safety class A2L, highly flammable

- ▶ Use refrigerant as specified on the name plate.
- ▶ Observe the current safety data sheet for the refrigerant.
- ▶ Avoid smoking, handling open flames or flying sparks.

CAUTION

Property damage caused by incorrect refrigerant!

The operation with incorrect refrigerant can damage the cooling device.

- ▶ Only use the refrigerant specified on the name plate.
- ▶ Do not mix different refrigerants.

CAUTION

Property damage due to additives!

Operation with additives can damage the cooling device.

- ▶ Use refrigerants without additives in compliance with the name plate.

The refrigeration unit of the S.CU is filled with refrigerant R452A or R454A.

- ▶ Observe the information on the name plate for the utilised refrigerant.
- ⇒ see “1.2.1 Semitrailer Cooling Unit (S.CU) name plate“ p. 7
- ▶ Only use the specified refrigerant.
- ▶ Do not mix different refrigerants.
- ▶ Do not use additives.



Use of additives such as “FLUORESCEIN” will void the warranty.

| Properties | Refrigerant R452A | Refrigerant R454A |
|--|-------------------|--------------------|
| Colour | clear, colourless | clear, colourless |
| Odour | Faint, like ether | Faintly like ether |
| Initial boiling point at normal pressure (1.013 bar) | -47°C | -48.3°C |
| Flammability | Not flammable | Flammable |

11.5.1 Refrigerant R452A

⇒ See safety data sheet: Chap. 2.2 Labelling elements

Labelling (REGULATION (EC) No. 1272/2008)

| | | |
|---------------------|--------------------------------|--|
| Hazard pictograms | | |
| Signal word | Caution | |
| Hazard statements | H280 | Contains gas under pressure; may explode if heated |
| Safety instructions | Storage: P410 + P403 | Protect from sunlight. Store in a well-ventilated place. |

Additional labelling

Contains fluorinated greenhouse gases (HFKW-125, HFKW-1234yf, HFKW-32)

11.5.2 Refrigerant R454A

⇒ See safety data sheet: Chap. 2.2 Labelling elements

Labelling (REGULATION (EC) No. 1272/2008)

| | | |
|---------------------|---|--|
| Hazard pictograms |  | |
| Signal word | Danger | |
| Hazard statements | H221 H280 | Flammable gas. Contains gas under pressure; may explode if heated |
| Safety instructions | Prevention: P210 | Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. |
| | Reaction: P377 P381 | Leaking gas fire: Do not extinguish unless leak can be stopped safely. In case of leakage, eliminate all ignition sources. |
| | Storage: P410 + P403 | Protect from sunlight. Store in a well-ventilated place. |

Additional labelling

Contains fluorinated greenhouse gases. (HFKW-32)

11.6 Requirements for the ePTO interface

| | |
|----------------------------------|--|
| Power supply via ePTO interface | 400V AC/32 A/50 Hz |
| Max. apparent power | 22 kVA |
| Max. active power | 22 kW |
| Cos(phi) | 0.76-0.99 |
| Voltage range | 360-48 V |
| Frequency range | 46-65 Hz |
| Max. starting current (duration) | <120 A (250 ms) |
| Max. continuous current | 32 A |
| Neutral conductor | yes |
| Tractor connector | ⇒ <i>Tractor operating manual</i> |
| S.CU connector | Harting Han M & HMC |
| Electrical insulation | Galvanic isolation |
| Filter | All-pole sinusoidal filter on ePTO output side |

11.7 Refrigerant circuit diagram

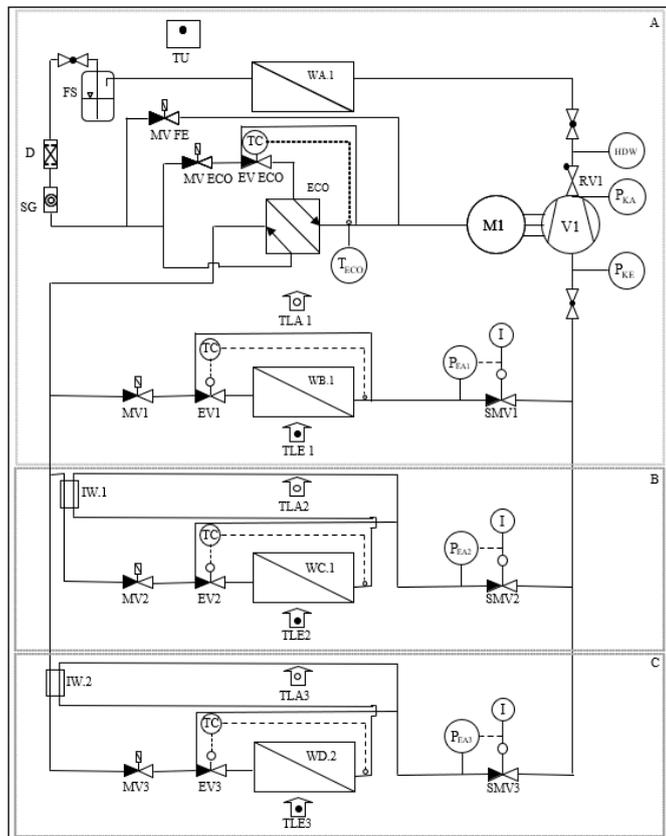


Figure 58: Refrigerant circuit diagram (S.CU dc90)

| | |
|------|--|
| A | Front wall device |
| B | Roof auxiliary evaporator 1 |
| C | Roof auxiliary evaporator 2 |
| D | Dryer |
| SG | Sight glass |
| FS | Liquid accumulator |
| WA.1 | Condenser |
| WB.1 | Evaporator |
| WC.1 | Aux. evaporator 1 |
| WD.1 | Aux. evaporator 2 |
| EVx | E-valve evaporator |
| MVx | Solenoid valves |
| PEAx | Low pressure sensor, evaporator |
| PKA | High-pressure sensor |
| PKE | Low-pressure sensor |
| HDW | High-pressure switch |
| RV1 | Check valve |
| V1 | Compressor |
| M1 | Compressor motor |
| SMVx | Suction pressure regulator |
| TLAx | Air outlet sensor evaporator |
| TLEx | Air inlet sensor evaporator |
| TU | Ambient air sensor |
| IW.x | Recuperators |
| ECO | Economizer |
| TECO | Temperature sensor for intermediate injection / Economizer |

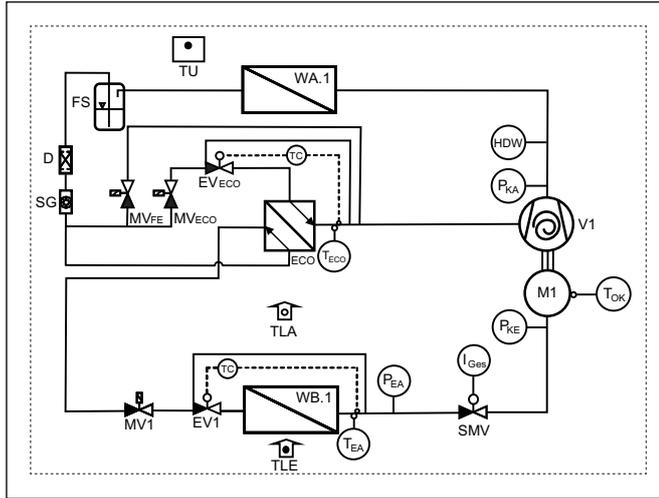


Figure 59: Refrigerant circuit diagram (S.CU d80 and S.CU e80)

| | |
|------|--|
| D | Filter drier |
| SG | Sight glass |
| FS | Liquid accumulator |
| WA.1 | Condenser |
| WB.1 | Evaporator |
| EVx | E-valve evaporator |
| MVx | Solenoid valves |
| M1 | Compressor motor |
| V1 | Compressor |
| SMV | Suction pressure regulator |
| TLE | Air inlet sensor evaporator |
| TLA | Air outlet sensor evaporator |
| TU | Ambient air sensor |
| ECO | Economizer |
| PEA | Low pressure sensor, evaporator |
| PKE | Low-pressure sensor |
| PKA | High-pressure sensor |
| HDW | High-pressure switch |
| TECO | Temperature sensor for intermediate injection / Economizer |
| TOK | Temperature sensor for compressor surface |
| TEA | Temperature sensor for evaporator outlet |

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