

Operating instructions

Schmitz Cargobull Transport refrigeration unit



IMPRINT

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Translation of the original German operating instructions



Table of contents

1	Information on the operating instructions	6		
1.1	Operating instructions validity	6		
1.2	Product identification and nameplates	6		
1.2.1	Transport refrigeration unit nameplate	6		
1.2.2	Compressor nameplate	7		
1.2.3	Engine serial number	7		
1.3	Symbols used	7		
1.4	Figures used	8		
1.5	Relevant documents	8		
1.6	Storing documents	8		
1.7	Guarantee and liability	8		
2	For your safety	9		
2.1	Representation and layout of the warning instructions	9		
2.2	Danger grading and warning instructions	9		
2.3	Intended use	10		
2.4	Declaration of Conformity	10		
2.5	Personnel qualification	11		
2.5.1	Operating company	11		
2.5.2	Driving personnel	11		
2.5.3	Specialist personnel	12		
2.6	Danger zones	12		
2.7	Protective equipment	13		
2.8	Information, warning and prohibition signs	13		
2.9	General safety instructions	14		
2.10	Limits of use/anti-freeze	17		
2.11	Dealing with refrigerant	18		
2.12	Dealing with operating resources	20		
2.13	What has to be observed in case of emergency?	21		
3	Design and function	22		
3.1	Design	22		
3.1.1	Main assemblies	22		
3.1.2	Assemblies	23		
3.2	Function	26		
3.3	Operating and display elements	28		
3.4	Operating modes	29		
3.5	Operating states	29		
3.5.1	Operating states with inactive refrigerating machine	29		
3.5.2	Operating states with active refrigerating machine	30		
4	Commissioning	32		
4.1	Storage	32		
4.2	Transport	32		
4.3	Assembly	32		
4.4	Initial commissioning	32		
4.5	Commissioning before each use	32		
4.6	Perform a visual inspection for commissioning	33		

4.7	Checking engine oil level when commissioning	34	5.4.4	Menu	49
4.8	Checking coolant level when commissioning	35	5.4.5	Switching diesel/electric	49
4.9	Draining water and sediment from the fuel tank	36	5.4.6	Selection	50
4.10	Checking and filling with fuel.	36	5.4.7	Confirm/OK	50
4.11	Switching the main switch on and off	38	5.4.8	Thawing (defrosting)	50
4.12	Operating at low ambient temperatures	39	5.4.9	Alarm	51
4.12.1	Fuel at low ambient temperatures.	39	5.5	Process of a setting	52
4.12.2	Engine oil at low ambient temperatures	39	5.6	Settings/displaying in the menu levels.	53
4.12.3	Coolant at low ambient temperatures	40	5.6.1	Settings at menu level 1	53
4.12.4	Battery at low ambient temperatures	40	5.6.2	Settings/displaying in the menu level 2	54
4.13	Charging the battery	40	5.7	Diagnosis sensor/messages	55
4.14	Engine, remote starting.	42	5.7.1	Diagnosis sensor	55
5	Operation	46	5.7.2	Diagnosis messages (error memory)	57
5.1	Layout of the control unit.	46	5.8	Switching the Transport refrigeration unit and controller on and off	57
5.2	Display	46	5.9	Starting operating the Transport refrigeration unit	57
5.3	Operating buttons	46	5.9.1	Starting diesel operation	57
5.3.1	Operating buttons overview	47	5.9.2	Starting the electric operation	58
5.4	Functions of the control buttons/ alarm LED	47	6	Troubleshooting	60
5.4.1	Switching the stand-by of the Transport refrigeration unit on and off.	47			
5.4.2	Chamber button: Starting the chamber of the refrigeration unit	48			
5.4.3	Setting the language.	49			

7	Maintenance	61
7.1	Care and cleaning	61
7.1.1	Cleaning, outside	62
7.1.2	Cleaning the machine compartment	62
7.1.3	Cleaning, inside	63
7.2	Maintenance	64
7.2.1	Maintenance schedule	64
7.2.2	Checking the engine oil level	67
7.2.3	Adding engine oil	67
7.2.4	Checking coolant level	68
7.2.5	Topping up coolant	69
7.2.6	Carrying out visual inspection	71
7.2.7	Checking the defrosting water drain	72
7.3	Servicing	73
7.3.1	Replacing the battery	73
7.3.2	Checking and replacing fuses	75
7.3.3	Venting the fuel system	78
8	Decommissioning	79
8.1	Temporary decommissioning	79
8.2	Recommissioning	79
8.3	Final decommissioning/disposal	80
9	Spare parts and customer services ..	81
9.1	Spare parts	81
9.2	Customer services and service	81

10	Technical data	82
10.1	Dimensions	82
10.2	Overview of the data	83
10.3	Engine data	83
10.4	Operating materials	83
10.4.1	Diesel fuel	83
10.4.2	Engine oil	86
10.4.3	Coolant	87
10.5	Refrigerant	89
11	Content, sorted alphabetically	90

1 Information on the operating instructions

These operating instructions contain information and instructions for the safe operation, trouble-free operation as well as for maintenance of the Transport refrigeration unit. 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 instructions only apply for the "Schmitz Cargobull Transport refrigeration unit" device. The precise model can be obtained from the nameplate.

1.2 Product identification and nameplates

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

- Transport refrigeration unit
- Compressor
- Engine

1.2.1 Transport refrigeration unit nameplate

The nameplate is fixed on the switch cabinet, left side. The following details can be found on the nameplate:



Figure 1: Transport refrigeration unit nameplate

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

1.2.2 Compressor nameplate

The nameplate is fixed next to the front cylinder of the compressor and contains the following information:

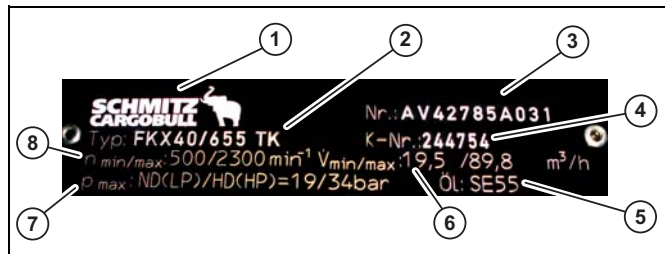


Figure 2: Compressor nameplate (example)

- 1 Manufacturer
- 2 Model designation
- 3 Machine number
- 4 Internal manufacturing number
- 5 Oil type filled ex-factory
- 6 Piston displacement flow
- 7 Low pressure (LP):
max. permissible stand still pressure, vacuum side
High pressure (HP):
max. permissible stand still pressure, high pressure side
- 8 Speed min./max.

1.2.3 Engine serial number

A serial number is fixed to the engine in order to be able to identify it. The serial number sign of the 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 symbols shown on the left are used in warning instructions and are categorised with regard to the severity of the risk.



Observe the information and explanations in the chapter for this purpose.



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.

- ▶ Please 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

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

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 documents completely 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" page 9)
- non-observance of the instructions, notices and prohibitions of the operating instructions,
- unauthorised changes made to the structure of the Transport refrigeration unit,
- incorrect monitoring of wearing parts,
- service work carried out incorrectly and not on time.

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 Transport refrigeration unit.

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

- ▶ Follow 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:

 DANGER
<p>Type and source of danger</p> <p>Explanation for the type and source of danger.</p> <p>▶ Measures for averting the danger.</p>


2.2 Danger grading and 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
<p>Immediate mortal danger or severe injuries.</p>

 DANGER
<p>Immediate mortal danger or severe injuries from electric shock.</p>

 WARNING
<p>Possible severe injuries.</p>

 CAUTION
<p>Possible slight injuries, damage to the environment or property.</p>

 Tips or additional information.

2.3 Intended use

The Schmitz Cargobull Transport refrigeration unit 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 Transport refrigeration unit only in a technically trouble-free state.
- ▶ Operate the Transport refrigeration unit only with the specified diesel fuels or the intended electric power.
- ▶ Have defects that impair safety immediately repaired by an authorised specialist workshop.

2.4 Declaration of Conformity

The Transport refrigeration unit complies with the Machinery Directive 2006/42/EC and the EMC Directive 2004/108/EC for the electromagnetic compatibility.



Konformitätserklärung / Conformity declaration

Wir als Hersteller der Maschine erklären, dass nachfolgend bezeichnete Maschine den unten angeführten Richtlinien und Normen entspricht.

As manufacturer of the machine we declare that the machine specified in the following corresponds to the directives and standards listed below.

Hersteller/ Manufacturer	Cargobull Cool GmbH & Co. KG Südlohner Diek 13 48691 Vreden
Bevollmächtigter für Dokumentation/ Authorised Person for Documents	Dr.-Ing. Norbert Flacke
Maschinentyp / Machine type	TKM
Seriennummer / Serial No.	Vorlage
Baujahr / Year of manufacture	2013
Richtlinien / Directives	Datum / Date
2006/42/EG	2006-06
2004/108/EG	2004-12
Regelungen / Regulations	Datum / Date
ECE-R10 (Rev.3)	2008-08
Normen / Standards	Datum / Date
EN 378-2	2012-08
EN 61000-6-2/-1	2006-03 / 2007-10
EN 61000-6-4/-3	2012-11
EN 61851-21 /-1	2002-10
DIN EN 60204-1	2011-01


 Vreden, 2012-12-19
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 Geschäftsführer: Dr. Norbert Flacke · Michael Trötschelmann

Figure 3: Declaration of Conformity

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.

The confirmation is carried out by an entry in the service manual of the operating company and returning the confirmation to the manufacturer.

The confirmation is a requirement for possible guarantee 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 Transport refrigeration unit.

The operating company must:

- have reached the legal minimum age,
- instruct the driving personnel in using the Transport refrigeration unit and
- make sure that the refrigerated vehicle including Transport refrigeration unit 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, where applicable, with passenger.

The driving personnel is responsible for the correct operation of the refrigerated vehicle with Transport refrigeration unit and must:

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

Only transport personnel should be tasked with operating the Transport refrigeration unit that have been instructed verbally and workplace-related once before commencing with their employment, and thereafter, at least once a year.

The instruction must be particularly focused on the following points:

- 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 (EC) no. 307/2008 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:

"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 German BGV and VDE, work may only be carried out on network and generator power circuits by specialist electricians.

In other European countries, a qualified person in electrical engineering is necessary.

The following certificates are necessary for assembly work on the Transport refrigeration unit:

- BGV A3 "Electrical systems and operating materials" and
- BGR A3 "Working under voltage on electrical systems and operating materials".

- BGR 500; Chapter 2.35 "Operation of refrigeration units, heat pumps and cooling devices" (former BGV D4 or VBG 20).
- Maintenance and servicing work must 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, electrics 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 to these components when the refrigerating machine is switched on. The possible hazards are described in the basic safety instructions.

⇒ see "2.9 General safety instructions" page 14

2.7 Protective equipment





The Transport refrigeration unit is secured against unauthorised persons by lockable doors.






- ▶ Always keep the doors of the Transport refrigeration unit locked.

2.8 Information, warning and prohibition signs

The warning instructions and prohibitions of these operating instructions are also attached to the Transport refrigeration unit 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" page 14

Sign	Explanation
	Danger from automatic start/stop
	Risk of crushing from drive belts
	Danger from sharp edged fan wheels
	Danger from strong magnetic fields

Sign	Explanation
	Risk of electric shock
	Danger from hot surfaces
	Switching off
	Disconnect the power supply
	Disconnect the battery

- ▶ Observe and follow these signs.
- ▶ Keep the signs clean and legible.
- ▶ Do not clean the signs with solvents, petrol or other attacking chemicals.
- ▶ Never remove, paint-over or stick over the signs.
- ▶ Replace illegible or missing signs immediately.

2.9 General safety instructions

The following are the general risks which exist and the residual risks with the associated measures when handling the Transport refrigeration unit.

Danger from automatic start

The Transport refrigeration unit is equipped with an automatic start/stop system and when in start/stop operating mode, can start at any time without prior warning.

- ▶ 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 Transport refrigeration unit produces poisonous exhaust gases when operating on diesel. If operated in enclosed spaces, these exhaust gases cannot escape.

- ▶ Only operate the Transport refrigeration unit outdoors when operating on diesel.
- ▶ Only operate the Transport refrigeration unit indoors on diesel when there is an exhaust extraction system for diesel exhaust gases present and 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 in-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.

- ▶ Never touch the fan wheel.
- ▶ After opening the doors or for maintenance work, switch the main switch to the 0 position.
- ▶ For maintenance tasks, make sure that the fan cannot start-up.
- ▶ Before performing maintenance tasks on rotating and moving parts, disconnect the battery.
- ▶ Put the Transport refrigeration unit into operation only with the covers mounted correctly.

Risk of burns and scalding

The surfaces of separate components and lines may be very hot.

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

Risks from electric shocks

The generator produces a high-voltage of up to 690 V. Touching the live parts may lead to mortal or severe injuries.

- ▶ When working on electrical components, switch the voltage supply off immediately.

- ▶ Only specialist electricians may work on the electrical system.
- ▶ Never touch electric components with wet or moist parts of your body.
- ▶ Never pull on electric lines.
- ▶ Before performing maintenance work on the electrics (especially the generator), make sure that the Transport refrigeration unit 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 minus pole of the battery.
- ▶ Keep the battery clean.
- ▶ Use the Transport refrigeration unit only with the recommended cables, fittings and correctly installed cover of the battery box.

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 that lead to a risk of injury.

- ▶ Do not place any metallic objects on the battery.
- ▶ Avoid open fires and sparks when working on the battery and during charging.
- ▶ Use a voltmeter or acid tester to check the charge state of the battery.
- ▶ Never charge frozen batteries.
- ▶ Never disconnect the charge cable from the battery before the charge process is finished.

Danger from strong magnetic fields and high voltage

During operation, the generator generates a strong magnetic fields and high voltage. When the generator stands still, a part of the magnetic field remains.

- ▶ Keep persons with a cardiac pacemaker away from the Transport refrigeration unit during operation.
- ▶ Never dismantle the generator.

Danger from battery acid

Battery acid is corrosive and causes physical injuries.

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

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. Engines with insufficient earthing connections can be damaged from electrostatic discharge.

- ▶ Make regular checks to see if electrical cables are loose or damaged.
- ▶ Have damaged cables repaired.
- ▶ Before commissioning the engine, clean all electric cables and tighten them.
- ▶ Make regular checks that the electrical system of the engine is connected correctly to the earth.
- ▶ Make regular checks that all earthing connections have a tight fit and are free of corrosion.

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, switch off the electrics or the control of the Transport refrigeration unit immediately.
- ▶ Never attempt to repair the control and its display by yourself.
- ▶ In event of a defective control, contact Schmitz Cargobull Service immediately.

2.10 Limits of use/anti-freeze

Unfavourable conditions of use may lead to damaging the Transport refrigeration unit from corrosion, chemical and physical reactions.

- ▶ Observe the following requirements on the operational environment.
 - The Transport refrigeration unit has been designed for safe operation at outside temperatures from -30 °C to +44 °C.
 - ▶ Take note that temperatures below 0 °C require measures for frost protection.
- ⇒ see "4.12 Operating at low ambient temperatures" page 39

2.11 Dealing with refrigerant

Refrigerant is a liquefied gas under pressure. When used correctly, there should not be any health risk or damage to the environment. At ambient pressure and ambient temperature, refrigerant is heavier than air. The refrigerant accumulates in poorly ventilated rooms and pits and displaces the oxygen. The refrigerant has no odour.

- ▶ Never use another refrigerant other than the one specified.
- ▶ Details of the refrigerant used can be obtained from the nameplate.

⇒ see "1.2.1 Transport refrigeration unit nameplate" page 6

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

Basically, the following applies for refrigerant:

- ▶ Only specialist personnel must carry out work on the refrigerant circuit.
- ▶ Always wear chemical resistant protective gloves when working with refrigerant.
- ▶ Wear protective goggles to protect your eyes.
- ▶ Avoid breathing in concentrated vapours.
- ▶ In event of poor ventilation, ensure for sufficient ventilation/extraction or wear an appropriate self-contained breathing apparatus.

- ▶ Avoid contact with open flames and hot surfaces as these will form corrosive and highly toxic decomposition products.
 - ▶ Avoid contact with the fluid as there is a risk of freezing.
 - ▶ Avoid eye and skin contact with the fluid.
 - ▶ During maintenance work, dispose of refrigerant and refrigerant oil correctly.
- ⇒ see "8.3 Final decommissioning/disposal" page 80

If refrigerant should escape in greater quantities in event of a leak and the refrigerant collects in poorly ventilated rooms or in a pit, this then displaces the oxygen. As it is odourless, in event the oxygen is dispersed you may breathe it in without noticing that will impair your ability to escape.

If a leak occurs on the refrigerating machine, e.g., following an accident, then you have to observe the following measures.

- ▶ Always observe the basically applicable instructions.
- ▶ Ensure for a good ventilation or wear an appropriate self-contained breathing apparatus in event of potential high concentrations.
- ▶ Always wear chemical resistant protective gloves when working with refrigerant.
- ▶ Wear protective goggles to protect your eyes.
- ▶ Avoid breathing in concentrated vapours. Avoid contact with open flames and hot surfaces as these will form corrosive and highly toxic decomposition products.
- ▶ Avoid eye and skin contact with the fluid.

The following applies after breathing in refrigerant:

- ▶ Carry out the following measures.
 - 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:

- ▶ Carry out the following measures.
 - 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:

- ▶ Carry out the following measures.
 - 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:

- ▶ Carry out the following measures.
 - 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.

2.12 Dealing with operating resources

The following are operating resources:

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

Under certain circumstances, the operating resources can cause injuries. 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.

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.

- ▶ During maintenance work, always wear protective clothing and protective goggles.
- ▶ 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 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.
- ▶ The seal of the cooling system must only be opened very slowly during maintenance work to allow the pressure to be compensated without fluid running out.

Hot oil

Hot oil can lead to burns.

- ▶ Avoid contact with hot oil.
- ▶ During maintenance work, always wear protective clothing and protective goggles.

Flammable operating materials

Fuels, oils or lubricants may ignite on hot surfaces.

- ▶ Keep the surfaces of the Transport refrigeration unit in a clean state.
- ▶ Have defects or leakages detected eliminated 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.

- ▶ Always use a suitable collecting vessel when making checks for leaks.
- ▶ Take care that no fluids escape when carrying out maintenance work on the engine.
- ▶ Always use a suitable container for collecting the fluids.
- ▶ Keep the container available before opening a housing or a component containing fluid is disassembled.
- ▶ Dispose of operating materials collected according to the country-specific legislations for the disposal of fluids.

Property damage caused by incorrect operating materials

Incorrect operating materials can lead to loss in performance, damage to the engine and damage to the fuel system.

- ▶ Use only the approved operating materials.
- ⇒ see "10.4 Operating materials" page 83

2.13 What has to be observed in case of emergency?

In order to avoid further damage in event of an accident, initiate the following measures under the certain circumstances:

- ▶ Safeguard the accident location correctly.
- ▶ If necessary, provide first aid.
- ▶ Use an eyewash bottle in event of eye injury.
- ▶ Extinguish smaller fires using a fire extinguisher.
- ▶ Call the fire services and make a brief and objective description of the situation.
(You will be asked to provide detailed information.)
- ▶ Inform your employer.

3 Design and function

3.1 Design

3.1.1 Main assemblies

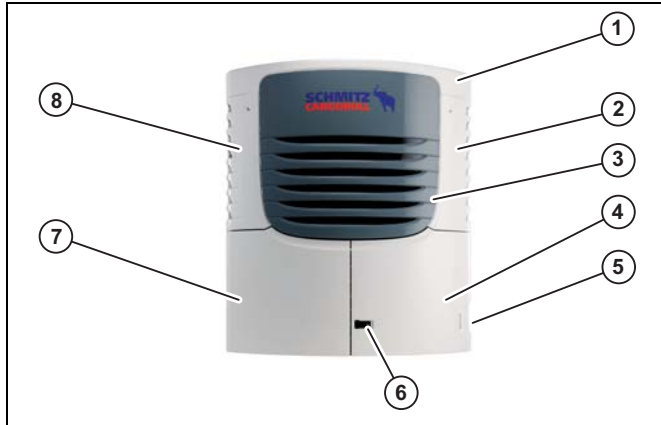


Figure 4: View from outside

- | | |
|-------------------------|--------------------------|
| 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 |

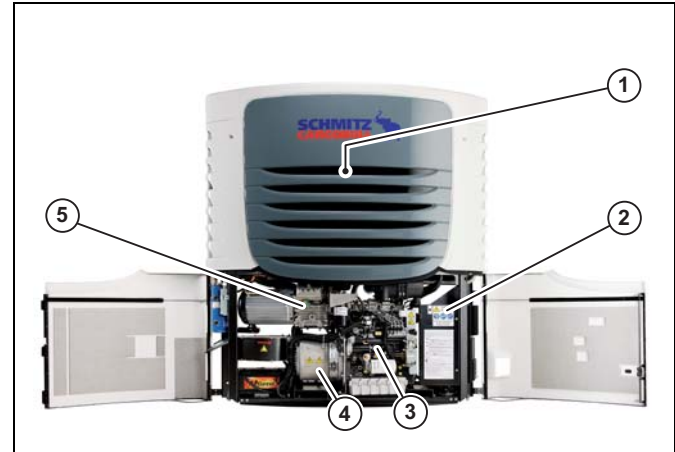


Figure 5: View with the doors open

- | | |
|------------------------------|-------------------------|
| 1 Cold section/hot section | 4 Three-phase generator |
| 2 Switch box with controller | 5 Compressor |
| 3 Engine | |

3.1.2 Assemblies

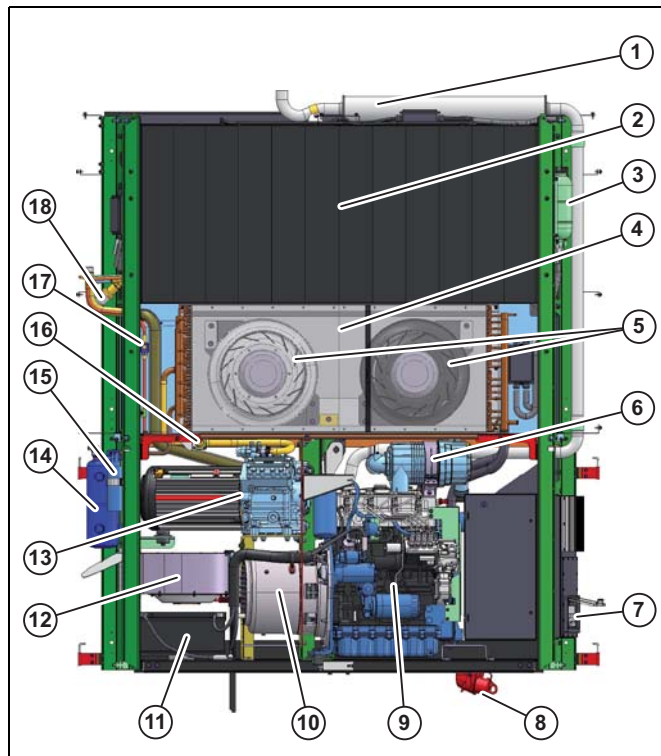


Figure 6: View of the assemblies from the front (displayed without covers)

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

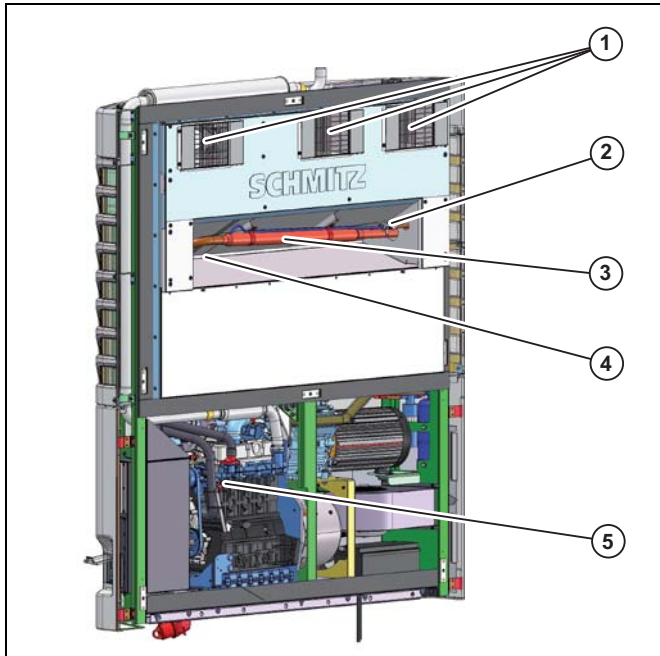


Figure 7: View of the assemblies from behind

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

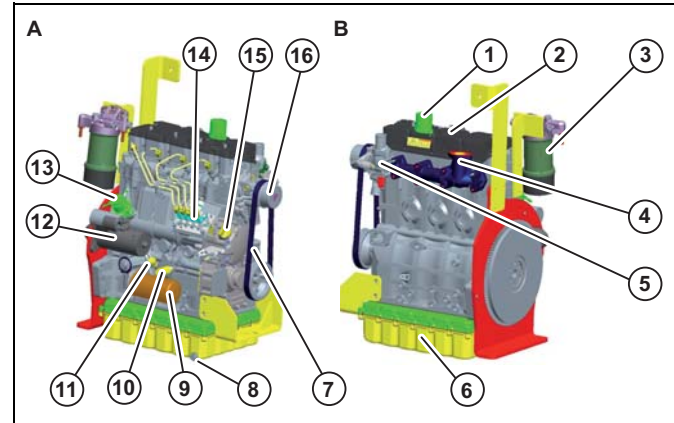


Figure 8: Engine assembly

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

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

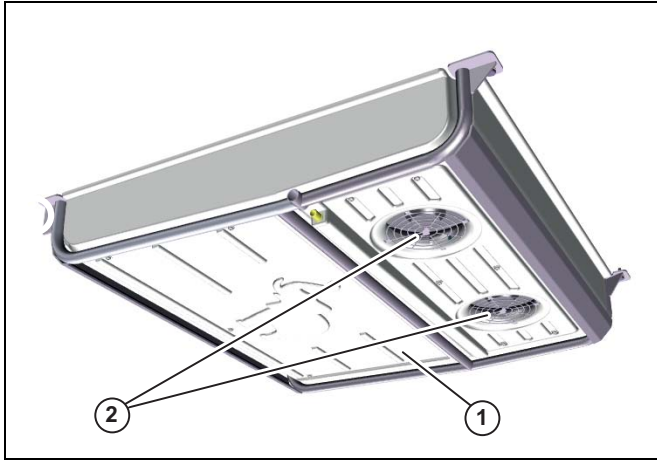


Figure 9: View of the roof auxiliary evaporator for the MultiTemp. design (2 and 3 chamber)

- 1 Evaporator unit
- 2 Evaporator fan

3.2 Function

The Transport refrigeration unit 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 Transport refrigeration unit comprises

- a diesel engine/generator drive unit,
- 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 supply of the Transport refrigeration unit with electric current is carried out via a 50 Hz socket (32 A) or selectively from a three-phase generator powered by a diesel engine. The diesel engine is supplied with fuel from a tank that is located in front of the pallet box. The diesel engine is equipped with an indirect fuel injection pump with an electronic speed controller. Depending on the operating state, the three-phase generator supplies a respective diesel engine speed frequency between 30 and 70 Hz.

In the "Stand-by" operating mode, the Transport refrigeration unit is fully operational. Settings can be made in the menu, language, operating mode as well as setpoints can be made. The Transport refrigeration unit does not start, rather remains in stand-by mode for 10 minutes.

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

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 Transport refrigeration unit controls the required performance automatically and switches off the heating after reaching the setpoints.

A change of modes due to the external conditions or by changing the setpoints is controlled by the Transport refrigeration unit automatically.

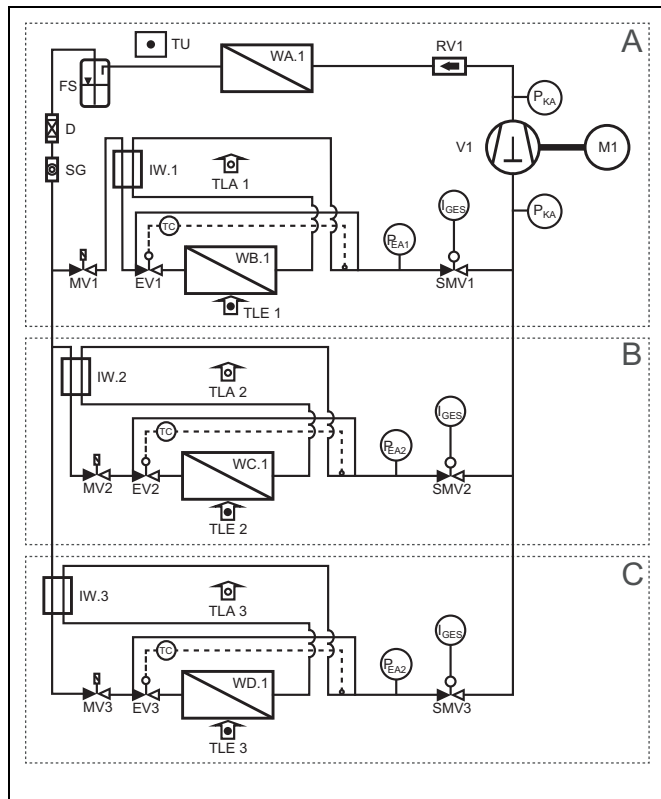


Figure 10: Refrigerant circuit diagram

- 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 switch
- PKE Low-pressure sensor
- RV1 Check valve
- M1 Compressor motor
- SMV1 Suction pressure regulator
- TLAx Air outlet sensor evaporator
- TLEx Air inlet sensor evaporator
- TU Ambient air sensor
- V1 Compressor
- IW.x Recuperators

3.3 Operating and display elements

The Transport refrigeration unit is put into and taken out of operation via the main switch in the control box.

⇒ see "4 Commissioning" page 32

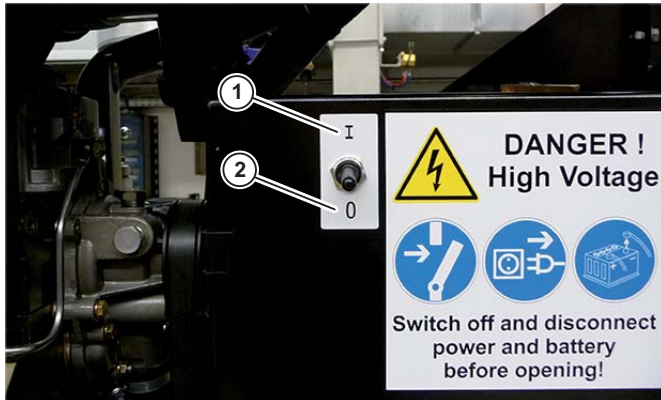


Figure 11: Main switch

- 1 Position 1
- 2 Position 0

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

⇒ see "5.1 Layout of the control unit" page 46



Figure 12: Control unit

3.4 Operating modes

The Transport refrigeration unit can be operated using diesel or electricity. The following operating modes and settings are possible in diesel or electric operating mode:

Operating mode	Explanation
normal/eco	Performance specification
Start/Stop	Start/stop or continuous operation
Booster	The diesel engine runs once to a set setpoint with maximum speed
Workshop mode	Necessary for service work on the refrigerant circuit

Setting	Explanation
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 Transport refrigeration unit is started in diesel mode depending on the specifications.
Operating block	Only the ON/OFF button is still active.

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

⇒ see "5 Operation" page 46

3.5 Operating states

Depending if the refrigerating machine is active or inactive, the Transport refrigeration unit can be found in different operating states.

3.5.1 Operating states with inactive refrigerating machine

Operating mode	Explanation
Start	The Transport refrigeration unit is switched on via the ON/OFF button. After switching on, the system as well as the electrics are completely initialised. Then the Transport refrigeration unit is on stand-by.
Stand-by	The Transport refrigeration unit is fully operational in the stand-by state. Settings can be made in the menu, language, operating mode and the setpoints can be made. The Transport refrigeration unit does not start, rather remains in stand-by mode for 10 minutes. If the system has not started until then, the electrics switch off completely. The Transport refrigeration unit is started via the respective chamber button.

3.5.2 Operating states with active refrigerating machine

Operating mode	Explanation
Cooling	<p>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 Transport refrigeration unit 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.</p> <p>A change to heating mode is also possible due to the external conditions as well as by changing the respective setpoint. The Transport refrigeration unit regulates the mode change for each chamber independently and automatically.</p> <p>Pressing the respective chamber button switches the Transport refrigeration unit back to the stand-by state where it can then be switched off or re-started. Please note that all the chambers must be switched to stand by before switching off or restarting.</p>

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 Transport refrigeration unit controls the required performance automatically and switches off the refrigerant circuit for the associated chamber after reaching the setpoint. 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 Transport refrigeration unit regulates the mode change for each chamber independently and automatically.</p> <p>Pressing the respective chamber button switches the Transport refrigeration unit back to the "stand-by" state where it can then be switched off or re-started. Please note that all the chambers must be switched to stand by 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 Transport refrigeration unit, otherwise the defrosting is carried out. After defrosting, the Transport refrigeration unit 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>

4 Commissioning

4.1 Storage

The storage of the Transport refrigeration unit is only intended at Schmitz Cargobull within the production and for assembly.

4.2 Transport

The transport of the Transport refrigeration unit is only carried out at Schmitz Cargobull within the production and for assembly.

4.3 Assembly

The assembly of the Transport refrigeration unit on the refrigerated body vehicle is carried out by Schmitz Cargobull. Schmitz Cargobull delivers the vehicle with a Transport refrigeration unit ready for use.

4.4 Initial commissioning

Schmitz Cargobull mounts the Transport refrigeration unit ready for use and has been handed over to you in a correct condition.

For the initial commissioning, proceed as described in the following steps:

- [1]** take over the Transport refrigeration unit.
 - ▶ during the handover, have yourself instructed about the Transport refrigeration unit and, if necessary, ask questions if you are unsure of anything.
- [2]** Fill with fuel.
 - ⇒ see "4.10 Checking and filling with fuel" page 36

- [3]** Switch the Transport refrigeration unit to stand-by on the main switch.

⇒ see "4.11 Switching the main switch on and off" page 38

▷ The initial commissioning is complete.

4.5 Commissioning before each use

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

For commissioning before using each time, proceed as described in the following steps:

- [1]** Perform a visual inspection for commissioning.
- [2]** Check the engine oil level.
- [3]** Check coolant level.
- [4]** Drain water and sediment from the fuel tank.
- [5]** Fill with fuel.
- [6]** Switch the Transport refrigeration unit to stand-by on the main switch.

The listed checking tasks are described in the following chapters.

⇒ See the following chapters 4.6 to 4.11.

- ▶ Operate the Transport refrigeration unit only if it is in a flawless state.
- ▶ If necessary, have defects detected rectified.

4.6 Perform a visual inspection for commissioning



WARNING

Danger from automatic start!

The Transport refrigeration unit is equipped with an automatic start/stop system and when in start/stop operating mode, 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.

- ▶ Carry out the visual inspections correctly.

In order to increase the operating life and to ensure for safe operation, before starting the Transport refrigeration unit, perform a careful visual inspection.

- ▶ Carry out the visual inspection according to the following table.

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 connections before performing maintenance work on the engine in order to rule out the risk of soiling the system.
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.

- ▶ Have possible defects detected repaired.
 - ▷ The commissioning visual inspection is completed.

4.7 Checking engine oil level when commissioning

WARNING

Risk of burns and scalding!

Hot oil can lead to burns.

- ▶ Avoid contact with hot oil.
- ▶ Always 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.

- ▶ Use only the approved engine oils.

Go through the following steps to check the engine oil level:

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

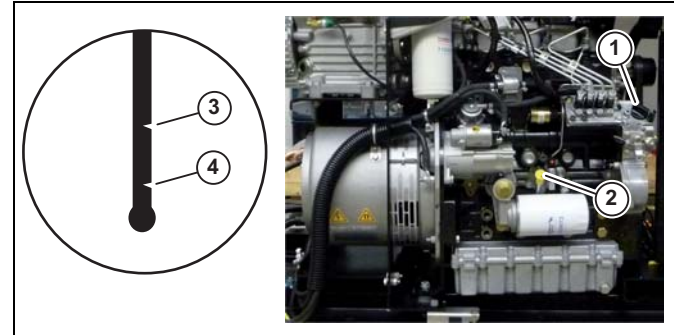


Figure 13: Checking engine oil level

- 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, then you have to top up with engine oil.

⇒ see "7.2.3 Adding engine oil" page 67

- ▶ Only use approved engine oil.

⇒ see "10.4.2 Engine oil" page 86

- ▷ The engine oil level is correct.

4.8 Checking coolant level when commissioning



WARNING

Risk of burns and scalding!

Under normal operating conditions the coolant in the 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.
- ▶ Always wear protective clothing and protective goggles.
- ▶ Let the engine cool down.
- ▶ The seal of the cooling system must only be opened very slowly to allow the pressure to be compensated without fluid running out.



CAUTION

Property damage caused by incorrect coolant!

Incorrect coolant can lead to severe damage to the engine.

- ▶ Use only the approved coolant.

Go through the following steps to check the coolant level:

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

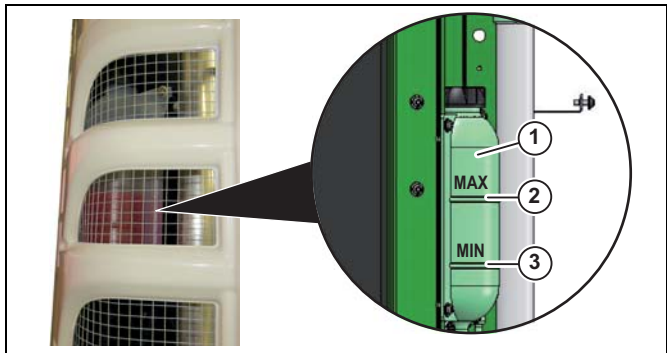


Figure 14: Checking coolant level

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

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

▷ The coolant level has been checked.

If the coolant level is too low, then you have to top up with coolant.

⇒ see "7.2.5 Topping up coolant" page 69

- ▶ Only ever use approved coolant.

⇒ see "10.4.3 Coolant" page 87

▷ The coolant level is correct.

4.9 Draining water and sediment from the fuel tank

CAUTION


Property damage due to contamination!

Contamination in the tank may damage the fuel system.

- ▶ Have the condensation and sediment in the fuel tank drained at regular intervals.

The quality of the fuel is an important criteria that influences the performance and the operating life of the motor. 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 the water and sediment using the respective device.
⇒ *see the vehicle documentation*
- ▶ Observe the following 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 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.

4.10 Checking and filling with fuel

DANGER

Danger of explosion!

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 and Transport refrigeration unit engines 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.
- ▶ Never fill the tank near to open flames, sparks or smouldering objects.
- ▶ Observe the applicable safety instructions of the filling station.



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 amount of fuel each day and fill the tank if necessary.
 - ▶ Before filling the tank, make sure that the diesel fuel approved for the engine is filled.
- ⇒ see "10.4 Operating materials" page 83

Go through the following steps to fill up the fuel:

- [1] Unlock the side collision protection.
- [2] Fold the side collision protection lower.
- [3] Open the cap by turning it to the left.

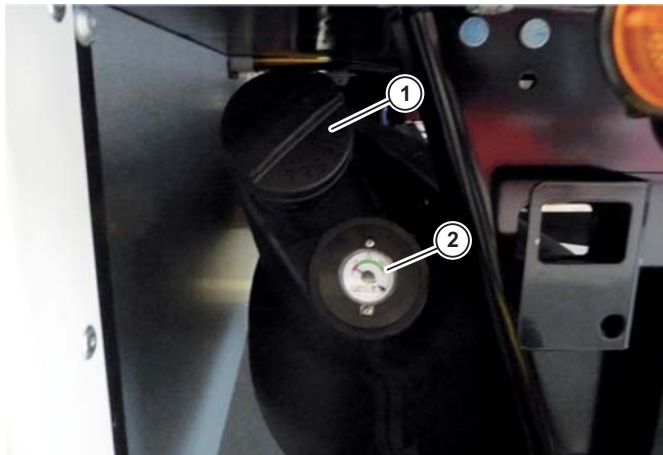


Figure 15: Fuel tank

- 1 Tank cap
- 2 Tank indicator

- [4] Fill the fuel tank with the prescribed diesel fuel.
- [5] Close the cap by turning it to the right.
- [6] Fold the side collision protection up and secure in place.
 - ▷ The fuel has been filled.

4.11 Switching the main switch on and off

The entire Transport refrigeration unit is switched on with the main switch. The Transport refrigeration unit and controller are also switched on and off on the operating unit.



CAUTION

Property damage caused by switching off incorrectly!

Stopping the entire Transport refrigeration unit with the main switch may lead to damage to the Transport refrigeration unit.

- ▶ The entire Transport refrigeration unit should only be switched off at the main switch for maintenance and servicing work, for decommissioning or in event of emergency.
- ▶ Only start the engine following an emergency switch-off once the cause of the fault has been rectified.

The main switch is located behind the left door of the Transport refrigeration unit on the switch box.

Switching on the main switch

For switching on, proceed as described in the following steps:

- [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 Transport refrigeration unit is switched on ready for operation.

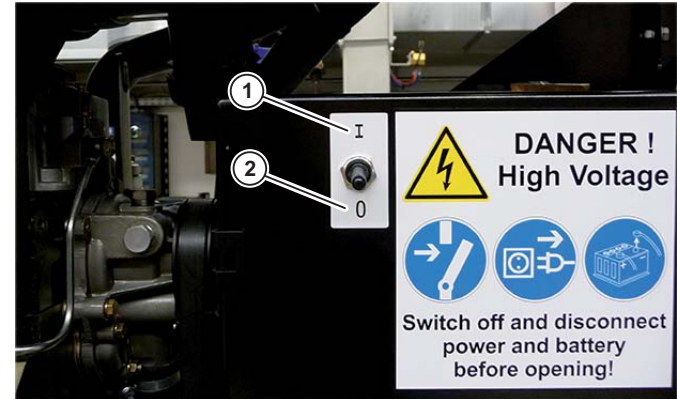


Figure 16: Main switch

- 1 Position 1
- 2 Position 0

Switching off the main switch

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

For switching off, proceed as described in the following steps:

- [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 Transport refrigeration unit is switched off.

4.12 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 if the following recommendations are observed.

- ▶ Consider the following factors with cold conditions:
 - Fuel
 - Engine oil
 - Coolant
 - Battery

4.12.1 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 a special fuel for the respective temperature ranges.
- ▶ Only ever use approved fuel.
 - ⇒ see "10.4.1 Diesel fuel" page 83
- ▶ Avoid condensation and sedimentation.
 - ⇒ see "4.9 Draining water and sediment from the fuel tank" page 36

At very low temperatures, Schmitz Cargobull recommends that the Transport refrigeration unit is equipped with a fuel heater.

- ▶ Contact the customer services of Schmitz Cargobull.
 - ⇒ see "9.2 Customer services and service" page 81

4.12.2 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 influence the torque required for turning the engine.

- ▶ Use the engine oil for the respective temperature range.
- ▶ Only use approved engine oils.
 - ⇒ see "10.4.2 Engine oil" page 86

4.12.3 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 anti-freeze at regular intervals.
 - ▶ Only ever use approved coolant.
- ⇒ see "10.4.3 Coolant" page 87

4.12.4 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 at regular intervals.
- ▶ If the battery is in a poor charge state, charge the battery with a respective battery charger.

4.13 Charging the battery



DANGER

Risk of electric shock!

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

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



WARNING

Danger from battery acid!

Battery acid is corrosive and causes physical injuries.

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



WARNING

Danger from an exploding battery!

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 fires and sparks when working on the battery and during charging.
- ▶ Use a voltmeter or acid tester to check the charge state of the battery.
- ▶ Never charge frozen batteries.
- ▶ Never disconnect the charge cable from the battery before the charge process is finished.
- ▶ Keep the battery clean.
- ▶ Use the Transport refrigeration unit 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.

- ▶ Use only a suitable battery charger for charging.
- ▶ Before connecting the charge cables, switch the Transport refrigeration unit off.
- ▶ Connect the charge cables to the correct battery terminals.
- ▶ Connect the earthing cable last.
- ▶ After charging, remove the earthing cable first.

In order to charge a battery, proceed as follows in the following steps:

- [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.

- [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 17: Charging the battery

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

▷ The battery is charging.

- ▶ Check the charge status on the indicator of the charge device at regular intervals.

Once the battery is charged, proceed as follows in the following steps:

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

4.14 Engine, remote starting



DANGER

Risk of electric shock!

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

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



WARNING

Danger from an exploding battery!

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 jump cables incorrectly thus leading to severe injuries.

- ▶ Do not place any metallic objects on the battery.
- ▶ Avoid open fires and sparks when working on the battery and during charging.
- ▶ Use a voltmeter or acid tester to check the charge state of the battery.
- ▶ Never jump start frozen batteries.
- ▶ Keep the battery clean.
- ▶ Use the Transport refrigeration unit only with the recommended cables, fittings and correctly installed cover of the battery box.



WARNING

Danger from battery acid!

Battery acid is corrosive and causes physical injuries.

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



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 in-between the drive belts and pulley.



WARNING

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.

- ▶ Never touch the fan wheel.
- ▶ Put the Transport refrigeration unit into operation only with the covers mounted correctly.



CAUTION

Property damage caused by incorrect voltage!

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

- ▶ For remote starting, use only a power source that has the same voltage.
- ▶ Before connecting the jump cables, switch the Transport refrigeration unit off.
- ▶ Connect the jump cables to the correct battery terminals.
- ▶ Connect the earthing cable last.
- ▶ After remote starting, remove the earth/ground cable first.

If the battery is completely discharged, than you have to use jumper cables to start the engine.

For remote starting, proceed as follows in the following steps:

- [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 17: Charging the battery" page 42



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 engine on operating unit.
 - ▶ The motor has been started remotely and is running.

Once the engine has started, proceed as follows in the following steps:

- [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.

5 Operation

5.1 Layout of the control unit

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

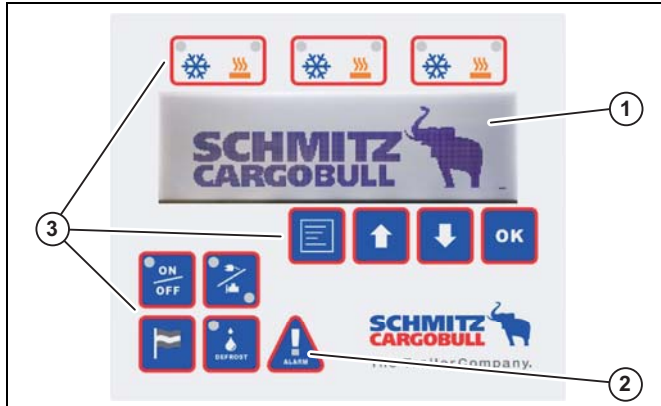


Figure 18: Control unit with start screen (3-chamber design)

- 1 Display
- 2 Alarm LED
- 3 Control buttons

5.2 Display

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

The start screen is displayed for a few seconds when the Transport refrigeration unit is started.

The stand-by display is shown after starting up the Transport refrigeration unit.

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

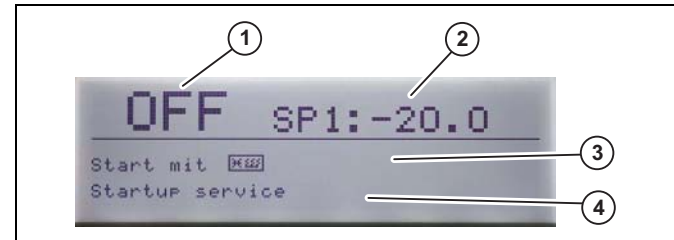











Figure 19: Stand-by display

- 1 OFF or current return run temperature
- 2 Chamber and the set-point selected (pictured: chamber 1)
- 3 Status line with more information
- 4 Alarm line with possible active alarm

5.3 Operating buttons

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

5.3.1 Operating buttons overview

Button	Button	Function
ON/OFF		Switches the stand-by of the Transport refrigeration unit on or off. After switching on, the Transport refrigeration unit is in stand-by.
Chamber		Switching on individual chambers of the refrigeration unit. The Transport refrigeration unit heats or cools depending on the setpoint temperature set in the menu.
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.
Diesel/ electric switch- over		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 taken over.
Defrosting		Thawing (defrosting) Starting the defrosting procedure. After starting, the process cannot be cancelled.
Alarm		Alarm (cannot be actuated) The LED illuminates with active alarm.

5.4 Functions of the control buttons/alarm LED

A detailed description of the control buttons, alarm LEDs and their functions is made in the following.

5.4.1 Switching the stand-by of the Transport refrigeration unit on and off



The stand-by of the Transport refrigeration unit is switched on and off using the ON/OFF button. When the electrics are switched on, the LED in the button illuminates green.

Switching on the stand-by of the Transport refrigeration unit

After pressing the ON/OFF button when switched off, the electrics, the display and the Transport refrigeration unit are initialised. The functions are only completely available after that. This procedure may take several seconds.

Switching off the stand-by of the Transport refrigeration unit

After pressing the ON/OFF button when switched on, the stand-by of the Transport refrigeration unit is switched off directly. The electrics save the most important parameters and closes all valves. This procedure may take several seconds.

5.4.2 Chamber button: Starting the chamber of the refrigeration unit



The respective chamber of the refrigeration unit is switched on by the chamber button.

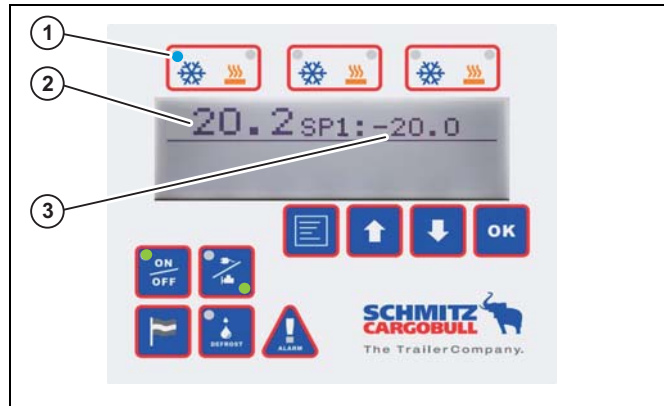


Figure 20: Refrigeration unit active (example: Cooling mode first chamber, second and third chamber off)

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

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 Transport refrigeration unit controls the status change automatically.

Pressing the chamber button puts the respective chamber of the Transport refrigeration unit back into stand-by. You can switch the Transport refrigeration unit off or restart it from stand-by. Please note that all the chambers must be switched to stand by before switching off or restarting.

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 Transport refrigeration unit 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.

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.

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 Transport refrigeration unit 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.

The condition is represented by a red LED on the associated chamber button. The currently measured temperature is shown on the display accurate to 1/10 °C.

5.4.3 Setting the language



You can change the display language using the language button. The selection is activated using the button. The individual languages can be selected using the selection buttons.

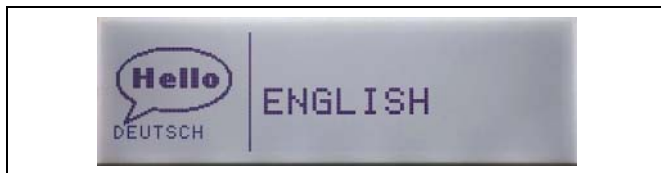


Figure 21: Setting the language

If a language is confirmed with the OK button, then the display language is set to this. If the language is not confirmed or you exit the language settings via the language button then the last language set remains.

5.4.4 Menu



You can change to the settings menu using the menu button. You switch to another menu level by pressing the button each time. After the last menu level, the display changes back to the stand-by display.

The possible settings in the menu are described in the next chapters.

⇒ see "5.6 Settings/displaying in the menu levels" page 53

5.4.5 Switching diesel/electric



This button switches between both operating modes:

- Diesel operation
- Electric operation

The current operating mode set is indicated by a green LED in the button.

The operating mode set is saved and reset after a restart.

5.4.6 Selection



With the selection button, you can select changeable settings, such as setpoint, language and menu settings.

You can make the selection upwards or downwards 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.

5.4.7 Confirm/OK



All settings selected are confirmed with the confirmation button. No changes are made without confirmation. The last value set will be activated again. In this case, the alarm LED illuminates for 30 seconds and indicates that the settings carried out have not been confirmed.

5.4.8 Thawing (defrosting)



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. The defrosting can only be interrupted manually by switching off the Transport refrigeration unit in case of emergency.

After defrosting has finished, the Transport refrigeration unit 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.

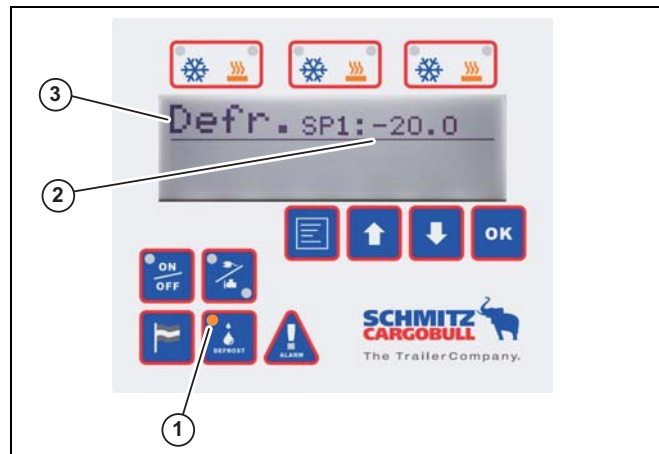


Figure 22: Defrosting active

- 1 Defrosting button with orange illuminating LED
- 2 Chamber 1 setpoint set
- 3 Defrosting display (thawing)

5.4.9 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, you can query the precise alarm point and alarm ID via the diagnosis menu.

⇒ see "5.7.1 Diagnosis sensor" page 55

5.5 Process of a setting

In order to carry out a setting, proceed as follows in the following steps:

- [1]** Switch on the Transport refrigeration unit.
 - ▷ The stand-by display is shown. The display switches between the individual chambers every five seconds.
- [2]** Call up the menu.
 - ▷ Menu level 1 is displayed.
- [3]** Select the desired settings using the selection button.
- [4]** Press the confirmation button.
 - ▷ The setting value is marked.
- [5]** Make the desired settings using the selection button.
- [6]** 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.

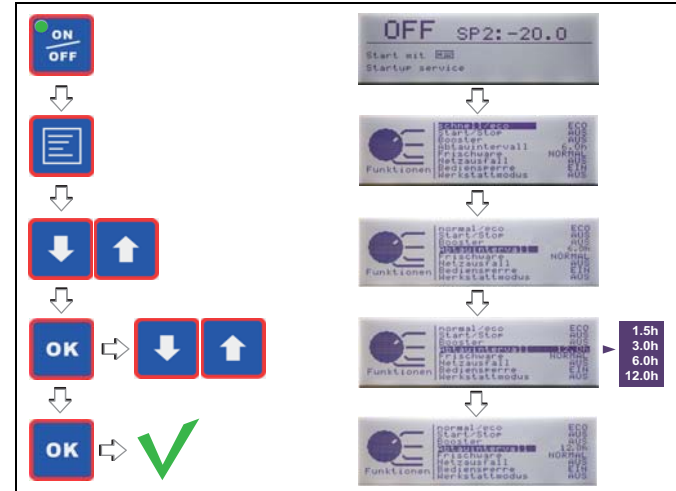


Figure 23: Process of a setting (example defrosting interval)

5.6 Settings/displaying in the menu levels

5.6.1 Settings at menu level 1

In menu level 1, you can make the following settings:

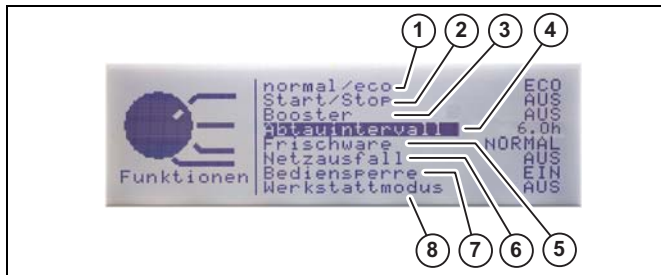


Figure 24: Menu level 1

- 1 normal/eco
- 2 Start/Stop
- 3 Booster
- 4 Abtauintervall (Defrost interval)
- 5 Frischware (Fresh goods)
- 6 Netzausfall (Power failure)
- 7 Bediensperre (Operating block)
- 8 Werkstattmodus (Workshop mode)

Setting	Explanation
normal/eco	
normal	The diesel engine runs in an engine speed range from 1,250 to 1,880 r.p.m.
eco	The diesel engine runs in an engine speed range from 1,250 to 1,500 r.p.m.
Start/Stop	
EIN (ON)	When reaching the setpoints set, the Transport refrigeration unit switches off and starts again after a dwell time of five minutes and a specified temperature difference of 2 °C. The minimum duration of the stop phase is five minutes.
AUS (OFF)	The Transport refrigeration unit operates continuously.
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 at a speed of max. 1,500 or 1,880 r.p.m. (depending on the setting at the menu point normal/eco)
Defrosting interval	
1.5 / 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.

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 Transport refrigeration unit will start up diesel operation automatically after 60 seconds in the event of a power failure.
AUS (OFF)	If the electric operation is set, in event of a power failure the Transport refrigeration unit remains in "Alarm mains operation" and then checks the mains input every 60 seconds. If mains power is available, the Transport refrigeration unit starts up the electric operation.
Operating block	
EIN (ON)	The confirmation button is deactivated here and settings cannot be changed. An exception is the menu point operating block, the confirmation button is active here.
AUS (OFF)	All settings can be changed.
Workshop mode	
EIN (ON)	Necessary for service work on the refrigerant circuit
AUS (OFF)	Deactivate workshop mode

5.6.2 Settings/displaying in the menu level 2

In menu level 2, you can have the following values displayed or make changes to the settings:

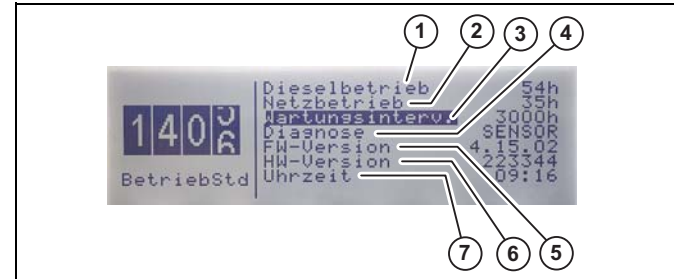


Figure 25: Menu level 2

- 1 Dieselbetrieb (Diesel operation)
- 2 Netzbetrieb (Mains operation)
- 3 Wartungsintervall (Maintenance interval)
- 4 Diagnose (Diagnostics)
- 5 FW-Version (FW version)
- 6 HW-Version (HW version)
- 7 Uhrzeit (Time)

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 "5.7 Diagnosis sensor/messages" page 55
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

5.7 Diagnosis sensor/messages

In order to carry out a diagnosis, proceed as follows in the following steps:

- [1] Switch on the Transport refrigeration unit.
 - ▷ The stand-by 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 stand-by display is shown.

5.7.1 Diagnosis sensor

The diagnosis starts at sensor level 1.

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

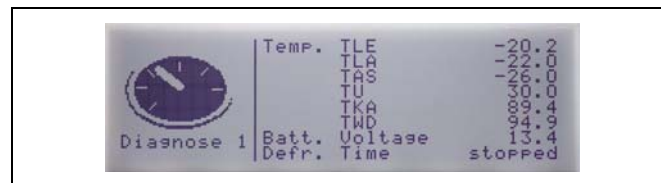


Figure 26: Sensor level 1 (example: 1-chamber mode)

- Temp. TLE: return temperature in °C
 TLA: blow-out temperature in °C
 TAS: evaporator surface temperature in °C
 TU: outside temperature in °C
 TKA: compressor head temperature in °C
 TWD: cooling water temperature in °C
- Batt. Voltage: battery voltage in V
 Defr. Time: remaining time until the next defrosting in h

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



Figure 27: Sensor level 2 (example: 1-chamber mode)

Power U12 U23	Phase conductor voltage between L1-L2 and L2-L3 in V
SMV	Opening angle of the suction pressure valve in %
Gesamtstrom (Total current)	Total current consumption in A
Druck (Pressure)	PKE: compressor inlet pressure in bar PKA: compressor outlet pressure in bar PEA: evaporator outlet pressure in bar
Diesel	RPM: speed of the diesel engine in rpm
Anzahl Restart (Number of restarts)	Number of restarts following a fault

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	RPM: speed of the diesel engine in rpm
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
Anzahl Restart (Number of restarts)	Number of restarts following a fault
Batt.	Voltage: battery voltage in V
Defr.	Time: remaining time until the next defrosting in h

¹⁾ X stands for the respective chamber 1, 2, or 3

5.7.2 Diagnosis messages (error memory)

The display of the messages 1 and 2 have the same layout. The last six faults on the Transport refrigeration unit are displayed.

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

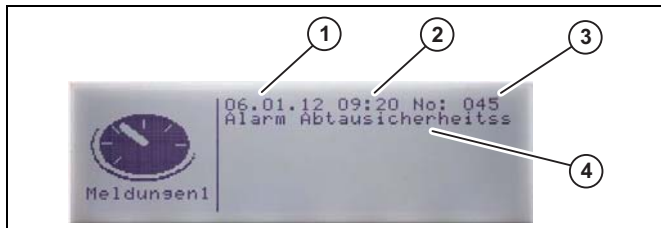


Figure 28: Message 1, fault memory layout

- 1 Date of the first occurrence after switching on the Transport refrigeration unit
- 2 Time of the first occurrence after switching on the Transport refrigeration unit
- 3 Fault code
- 4 Display text of the alarm

5.8 Switching the Transport refrigeration unit and controller on and off

When the main switch is switched on, the Transport refrigeration unit and the controller are switched on to stand-by on the operating unit via the ON/OFF button. The Transport refrigeration unit is started via the respective chamber button.

⇒ see "5.3 Operating buttons" page 46



The Transport refrigeration unit is fully operational in the stand-by state. Settings can be made in the menu, language, operating mode as well as the setpoints. The Transport refrigeration unit does not start, rather remains in stand-by mode for 10 minutes. If the Transport refrigeration unit has not started by then, switch the electrics off completely.

5.9 Starting operating the Transport refrigeration unit

You can start the Transport refrigeration unit in diesel operation or diesel operation.

5.9.1 Starting diesel operation

To start the Transport refrigeration unit in diesel operation, the system must be in stand-by.

⇒ see "4.11 Switching the main switch on and off" page 38

Go through the following steps to start the diesel operation:

- [1]** Check the amount of fuel in the tank (top up if necessary).
⇒ see "4.10 Checking and filling with fuel" page 36
 - [2]** Switch the entire system to stand-by.
⇒ see "4.11 Switching the main switch on and off" page 38
 - [3]** Switch on the Transport refrigeration unit on the operating unit.
 - [4]** Switch on the refrigerating machine on operating unit.
 - [5]** Switch on diesel operation on the operating unit.
⇒ see "5.9.1 Starting diesel operation" page 57
 - ▷ The Transport refrigeration unit starts in diesel operation.
 - ▷ Further settings are carried out on the operating unit.
- ⇒ see "5.6 Settings/displaying in the menu levels" page 53

5.9.2 Starting the electric operation



DANGER

Mortal danger from electric shock!

The use of unsuitable or damaged cables or sockets can lead to mortal electric shocks.

- ▶ Before connecting the Transport refrigeration unit to the mains network, check the cable and sockets for possible damage.
- ▶ Use only flawless cables and sockets.



CAUTION

Property damage from current with incorrect voltage!

Current with incorrect voltage may lead to damage to the system.

- ▶ Observe the power connection requirements.

There is a socket on the bottom of the Transport refrigeration unit for the electrical connection.

Go through the following steps to start the electrical operation:

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

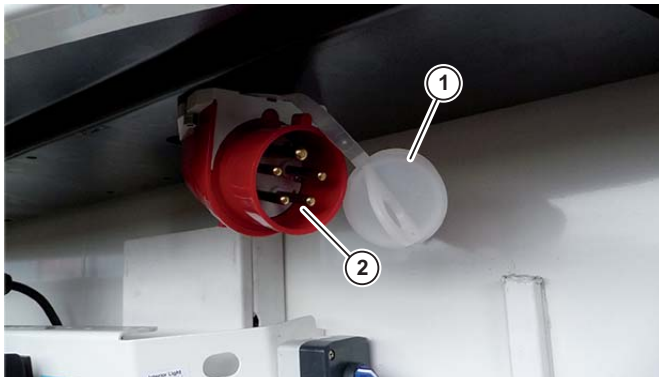


Figure 29: Power connection (CEE design)

- 1 Protective cap
- 2 Socket

[3] Switch on the Transport refrigeration unit on the operating unit.

[4] Switch on the electric operation on operating unit.

▷ This activates the battery charging.

[5] Switch on the refrigerating machine on operating unit.

⇒ see "5.4.2 Chamber button: Starting the chamber of the refrigeration unit" page 48

▷ The Transport refrigeration unit starts in electric operation.

▷ Further settings are carried out on the operating unit.

⇒ see "5.6 Settings/displaying in the menu levels" page 53

6 Troubleshooting

The following overview assists you 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 you cannot rectify a fault, then contact an authorised service partner or contact the service partner from Schmitz Cargobull.

⇒ see "9.2 Customer services and service" page 81

7 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.

7.1 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.

- ▶ Avoid touching the fins.
- ▶ Wear gloves when cleaning.



WARNING

Danger from pressure!

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.
- ▶ Never direct water or compressed air jets at persons.



CAUTION

Property damage from incompatible cleaning agents!

Incompatible cleaning agents may damage the Transport refrigeration unit and destroy seals.

- ▶ Do not use flammable fluids for cleaning.
- ▶ Use only cleaning agents that are compatible with the surfaces (paint, copper, aluminium, aluminium alloys, stainless steel) and the seals.
- ▶ In the 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 the 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.
- ▶ Avoid spraying the water jet directly onto electrical components, plug connectors, seals or hoses.
- ▶ Cover electrical components.
- ▶ Use a water pressure below 2.75 bar.
- ▶ Use an air pressure below 2.05 bar.



CAUTION

Potential environmental risks!

Cleaning agents and lubricants can contaminate the ground water.

- ▶ Carry out cleaning work only in intended areas that have a water separator.

7.1.1 Cleaning, outside

For cleaning outside, proceed as follows in the following steps:

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

7.1.2 Cleaning the machine compartment

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

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

7.1.3 Cleaning, inside

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

For cleaning inside, proceed as follows in the following steps:

- [1] Switch off the Transport refrigeration unit on the operating unit (ON/OFF button).
- [2] Clean the evaporator and defrosting water drain.

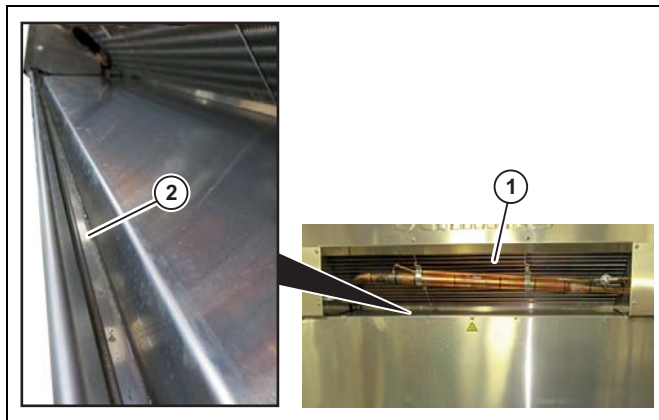


Figure 30: Cleaning, inside

- 1 Evaporator
- 2 Defrosting water drain

- ▶ Use a high-pressure cleaner with max. 2.75 bar pressure and hot steam.
- ▶ Clean the Transport refrigeration unit on the inside with plenty of water and acid-free cleaning agent.
- ▶ Follow the manufacturer instructions of the cleaning agent.
- [3] Check the interior of the Transport refrigeration unit after cleaning.
 - ▶ After cleaning, check the defrosting water drain for free flow.
 - ▶ After cleaning, check the evaporator and its cooling fins for possible damage.
- [4] Switch on the Transport refrigeration unit on the operating unit (ON/OFF button).
 - ▷ Cleaning the interior is completed.

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

7.2.1 Maintenance schedule

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

- ▶ Have maintenance work only carried out by Schmitz Cargobull sales partners or from an authorised specialist workshop according to the maintenance schedule.
- ▶ Have the maintenance work carried out correctly recorded in writing.


Maintenance work	annual inspection	every 3000 operating hours	every 6000 operating hours	every 9000 operating hours
Check device fastening	•	•	•	•
Check engine oil level	•	•	•	•
Check water pump belt	•	•	•	•
Check engine mount	•	•	•	•
Visual check for leaks: engine cooling system, engine oil, fuel system, refrigerant	•	•	•	•
Check refrigerant level	•	•	•	•
Check compressor oil	•	•	•	•
Check defrosting water drain	•	•	•	•
Check the evaporator (up to three units, depending on the number of chambers)	•	•	•	•
Check evaporator fan (up to three units, depending on the number of chambers)	•	•	•	•
Check condenser	•	•	•	•
Check condenser and machine room air fan	•	•	•	•
Visual check of the electric components	•	•	•	•
Check battery	•	•	•	•
Check cooling operation	•	•	•	•
Check air filter and replace if necessary	•	•	•	•
Check defrosting operation	•	•	•	•
Check heating 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 fuel filter		•	•	•
Replace air filter		•	•	•

Maintenance work	annual inspection	every 3000 operating hours	every 6000 operating hours	every 9000 operating hours
Check valve play		•	•	•
Check water pump bearing			•	•
Replace water pump belt			•	
Cooling system – change with commercially available high-pressure coolant (every 6000 years or every 3 years)			•	
Replace compressor shaft seal				•
Replace compressor oil				•
Replace dryer				•

In the following, maintenance work is described that you may have to carry out yourself.

⇒ See the following chapters 7.2.2 to 7.2.7.

7.2.2 Checking the engine oil level


WARNING

Risk of burns and scalding!

Hot oil can lead to burns.

- ▶ Avoid contact with hot oil.
- ▶ Always wear protective clothing and protective goggles.

Go through the following steps to check the engine oil level:

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

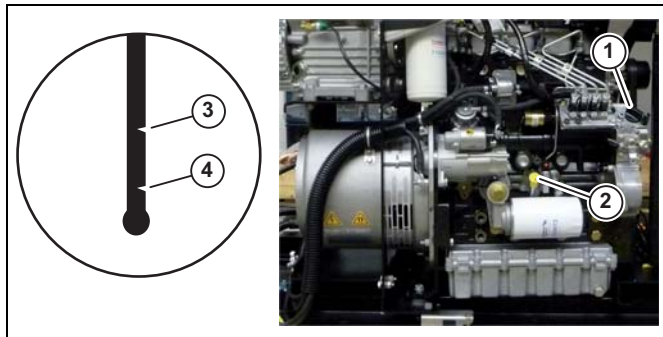



Figure 31: Checking engine oil level

- 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.


7.2.3 Adding engine oil


WARNING

Risk of burns and scalding!

Hot oil can lead to burns.

- ▶ Avoid contact with hot oil.
- ▶ Always 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.

- ▶ Use only the approved engine oils.

If the oil level is too low, then you have to top up with engine oil. Proceed as described in the following steps:

- [1] Open the oil fill cap.
- [2] Fill with engine oil.
 - ▶ Only use approved engine oil.
 - ⇒ see "10.4.2 Engine oil" page 86
 - ▶ 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 engine for leaks.
 - ▶ If necessary, have defects detected rectified.
 - ▷ The engine oil level is correct.

7.2.4 Checking coolant level



WARNING

Risk of burns and scalding!

Under normal operating conditions the coolant in the 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.
- ▶ Always wear protective clothing and protective goggles.
- ▶ Let the engine cool down.
- ▶ The seal of the cooling system must only be opened very slowly to allow the pressure to be compensated without fluid running out.

Go through the following steps to check the coolant level:

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

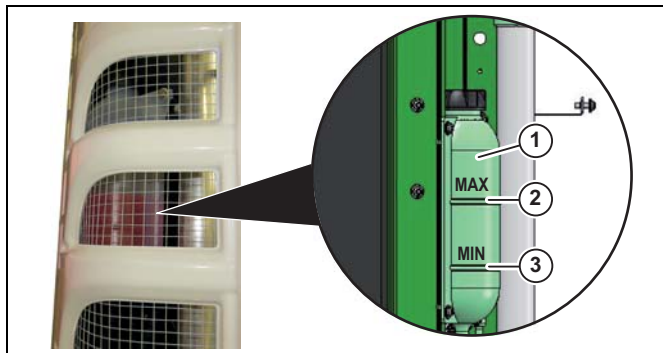


Figure 32: Checking coolant level

- 1 Coolant compensating reservoir
 - 2 MAX marking
 - 3 MIN marking
- ▶ Check that the coolant level is between the MIN and MAX marking.
 - ▷ The coolant level has been checked.

7.2.5 Topping up coolant



WARNING

Risk of burns and scalding!

Under normal operating conditions the coolant in the 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.
- ▶ Always wear protective clothing and protective goggles.
- ▶ Let the engine cool down.
- ▶ The seal of the cooling system must only be opened very slowly to allow the pressure to be compensated 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 correct ladder.
- ▶ Make sure that there is a level and bearing surface.

CAUTION

Property damage caused by incorrect coolant!

Incorrect coolant can lead to severe damage to the engine.

- ▶ Use only the approved coolant.

If the coolant level is too low, then you have to top up with coolant. Proceed as described in the following steps:



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

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

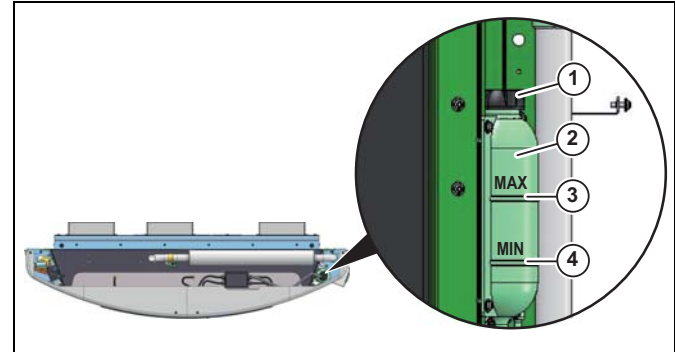



Figure 33: Filling with coolant

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

- ▶ Only ever use approved coolant.
- ⇒ see "10.4.3 Coolant" page 87
- ▶ Fill the coolant to the MAX marking on the compensation tank.
- [3] Clean the coolant compensating reservoir cap.
- [4] Close the coolant compensating reservoir with cap.
- [5] Check the cooling system for leaks.
 - ▶ If necessary, have defects detected rectified.
 - ▷ The coolant level is correct.


7.2.6 Carrying out visual inspection

 **WARNING**

Danger from automatic start!

The Transport refrigeration unit is equipped with an automatic start/stop system and when in start/stop operating mode, 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.

- ▶ Carry out the visual inspections correctly.

In order to increase the operating life and to ensure for safe operation, before starting the Transport refrigeration unit, perform a careful visual inspection.

- ▶ Carry out the visual inspection according to the following table.

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 connections before performing maintenance work on the engine in order to rule out the risk of soiling the system.
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.

- ▶ Have possible defects detected repaired.
 - ▷ The visual inspection is completed.

7.2.7 Checking the defrosting water drain

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

Go through the following steps to check that the defrosting water drain runs:

- [1] Switch off the Transport refrigeration unit on the operating unit (ON/OFF button).
- [2] Check the defrosting water drain for free running.

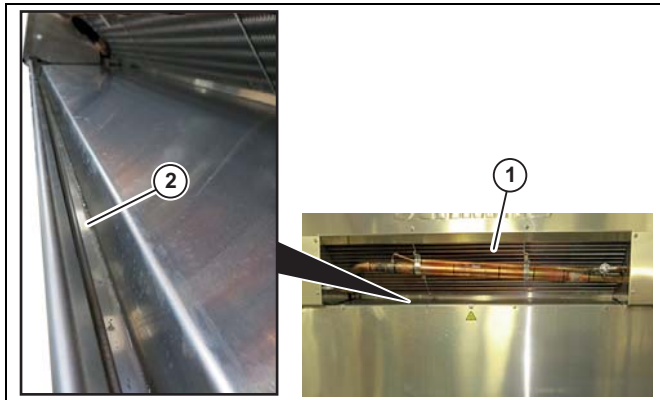


Figure 34: Checking defrosting water drain

- 1 Evaporator
- 2 Defrosting water drain

► Clean the defrosting water drain if it is dirty.

⇒ see "7.1.3 Cleaning, inside" page 63

[3] Switch on the Transport refrigeration unit on the operating unit (ON/OFF button).

▷ The test of the defrosting water drain is completed.

7.3 Servicing



CAUTION

Property damage from incorrect servicing!

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

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

In the following, servicing work is described that you may have to carry out yourself.

⇒ See the following chapters 7.3.1 to 7.3.3.

7.3.1 Replacing the battery



DANGER

Risk of electric shock!

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

- ▶ Avoid short-circuits.
- ▶ Do not place any metallic objects on the battery.
- ▶ Turn the main switch to 0.
- ▶ First remove the negative terminal on the battery.



WARNING

Danger from battery acid!

Battery acid is corrosive and causes physical injuries.

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

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

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

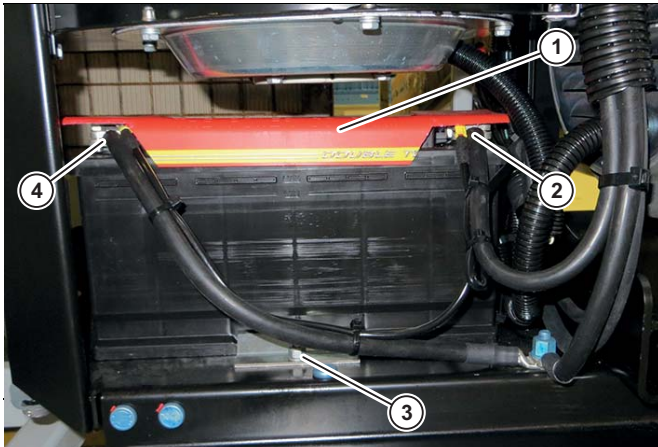


Figure 35: Replacing the battery

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

Go through the following steps to replace the battery:

- [1] Switch off the Transport refrigeration unit on the operating unit (ON/OFF button).
- [2] Open the doors.
- [3] Switch the main switch to the 0 position.
- [4] Remove the battery cover (if fitted).
- [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 a battery that has the same design.
 - ▶ Mount the battery fastening.
 - ▶ Check the bracket for its correct fit.
- [9] Connect the positive terminal.
- [10] Connect the negative terminal to the battery.
- [11] Attach the battery cover (if available).
 - ▷ The battery is replaced.
 - ▶ Dispose of the old battery at your local waste disposal company.

7.3.2 Checking and replacing fuses



DANGER

Risk of electric shock!

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

- ▶ Avoid short-circuits.
- ▶ Never open main fuses.
- ▶ Use only suitable fuses of the same strength.
- ▶ Never by-pass fuses.
- ▶ Turn the main switch to 0.
- ▶ Avoid the penetration of dirt and moisture in the open fuse box.

A fuse can melt from overvoltage. 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, Cargobull Service must be contacted.

⇒ see "9.2 Customer services and service" page 81

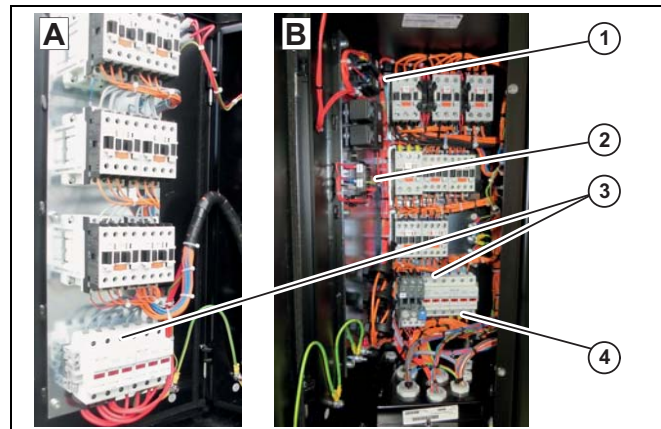


Figure 36: Overview of fuses

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



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

Go through the following steps to check and replace the fuses:

- [1] Switch off the Transport refrigeration unit on the operating unit (ON/OFF button).
- [2] Isolate the socket and power supply (applies only for electric operation).
- [3] Open the doors.
- [4] Switch the main switch to the 0 position.
- [5] Remove the battery cover (if fitted).
- [6] Disconnect the negative terminal of the battery.
 - ▶ Make sure that the cable cannot touch the battery terminal.
- [7] Open the switch box door.

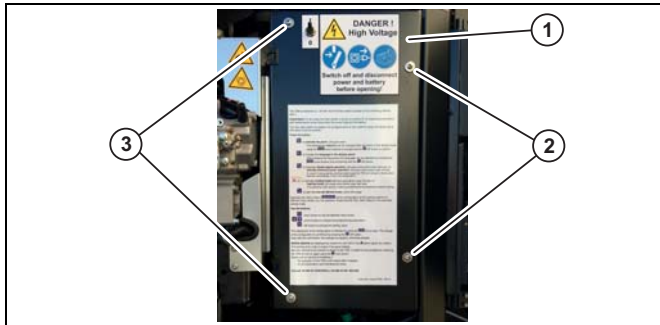


Figure 37: Opening the switch box door

- 1 Switch box door
 - 2 Fastening screw for the switch box door
 - 3 Additional mounting screws for the MultiTemp. Switch box door
- ▶ Screw the switch box open.

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

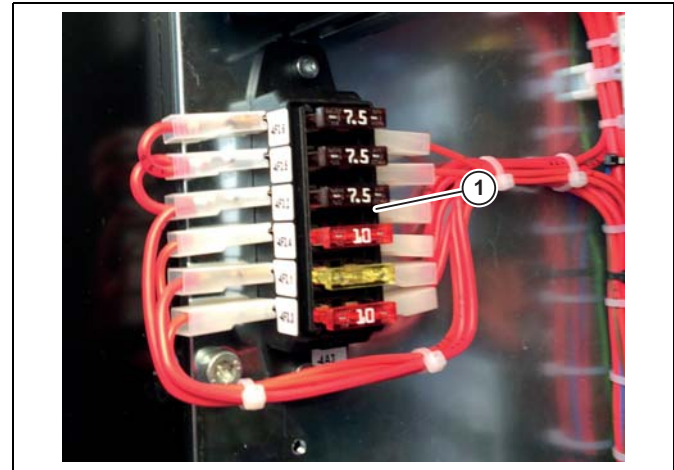


Figure 38: Checking and replacing the flat plug-in fuses

1 Fuse holder with flat plug-in fuses

- ▶ Check that the safety insert in the flat plug-in fuse is closed.
- ▶ Replace a defective flat plug-in fuse by inserting a new flat plug-in fuse into the fuse holder with the same thickness.

[9] Check and replace the safety fuses.

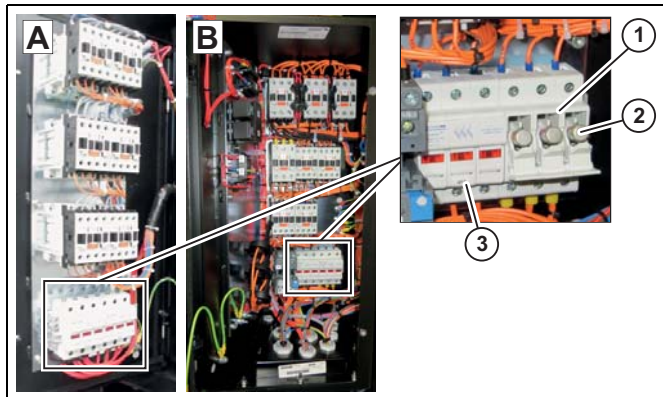


Figure 39: Checking and replacing the safety fuses

A Switch cabinet door

B Switch cabinet

1 Main fuse opened (fuse holder folded down)

2 Safety fuse

3 Main fuse closed

- ▶ Open the main fuse by pulling the fuse holder down.
- ▶ Check if the safety switch is okay.
- ▶ Replace a defective safety fuse by inserting a new safety fuse into the fuse holder with the same thickness.
- ▶ Close the main fuse by pulling 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] Attach the battery cover (if available).

[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 Transport refrigeration unit can now be operated.

7.3.3 Venting the fuel system

In normal state, the fuel system vents itself automatically. However, air may penetrate from leaking lines, or similar. If the alarm LED illuminates and the operating unit shows the message "Alarm Motorstart" (alarm engine start) in the display, then air may be in the fuel system.

Go through the following steps for venting the fuel system:

- [1]** Switch on the Transport refrigeration unit on the operating unit (ON/OFF button).
 - [2]** Select diesel operation.
 - [3]** Start the Transport refrigeration unit via the chamber button.
 - [4]** The fuel system is being vented.
If the diesel engine has not started after four start attempts, an alarm message appears.
 - [5]** Switch the Transport refrigeration unit off at the operating unit (ON/OFF button) and repeat steps 1-4 until the diesel engine runs.
- Carry this out a maximum of three times.
- ▷ The fuel system is vented.

If the alarm message is displayed more than four times then contact unauthorised specialist workshop or the Cargobull Service.

⇒ see "9.2 Customer services and service" page 81

8 Decommissioning

8.1 Temporary decommissioning

In order to temporarily take a system out of operation, proceed as described in the following steps:

- [1] Open the left door.
- [2] Switch the main switch to the 0 position.

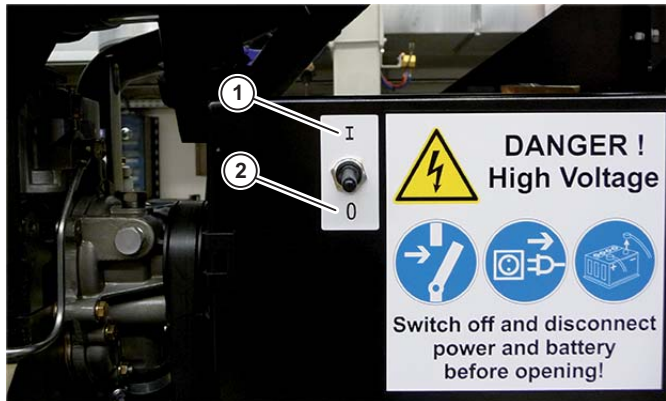


Figure 40: Main switch

- 1 Position 1
- 2 Position 0

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

If you want to take the Transport refrigeration unit 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.
 - ▶ Carry out a cooling operation of the system once a month (Setpoint $-30\text{ }^{\circ}\text{C}$) for at least 15 minutes in order to avoid or minimise servicing work on the refrigerant circuit.
 - ▶ In event of being taken out of operation for longer periods, charge the battery with a suitable battery charger.
- ⇒ see "4.13 Charging the battery" page 40
- ▷ The Transport refrigeration unit is temporarily taken out of operation.

8.2 Recommissioning

In order to recommission, proceed as described in the following steps:

- [1] Check the battery and charge if necessary.
⇒ see "4.13 Charging the battery" page 40
 - [2] Perform the commissioning.
⇒ see "4.5 Commissioning before each use" page 32
- ▷ Putting back into operation is complete.

8.3 Final decommissioning/disposal



CAUTION

Potential environmental risks!

Operating materials may contaminate the ground water. Batteries may adversely affect the environment.

- ▶ Dispose of all operating materials and old batteries correctly.

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 Transport refrigeration unit must be disposed of.

- ▶ When disposing, observe the legal guidelines specific to the country.
- ▶ Collect operating materials in suitable containers.
- ▶ Dispose of used filter inserts (fuel filter, oil filter, refrigerant filter) as special waste depending on the substance filtered.
- ▶ Dispose of old batteries at your local waste disposal company.

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.

- ▶ Use an appropriate container for extracted refrigerant oil or refrigerant agent.
- ▶ Hand the container over to the respective specialist company for disposal.

9 Spare parts and customer services

9.1 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.

- ▶ Only use Schmitz Cargobull original spare parts.
- ▶ Have the information on the vehicle nameplate ready when ordering spare parts.

⇒ see "1.2 Product identification and nameplates" page 6

You can order the spare parts from us as follows:

Schmitz Cargobull Parts & Services GmbH
Spare Parts Centre
Siemensstraße 49
48341 Altenberge, Germany

Telephone: +49 2558 / 81-2999

Fax: +49 2558 / 81-2381

Fax: +49 2558 / 81-2718

E-mail: Ersatzteil-Center@cargobull.com

Internet: www.cargobull.com

Or at one of our authorised service partners.

9.2 Customer services and service

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

00800-24CARGOBULL

or

00800-24227462855

10 Technical data

10.1 Dimensions

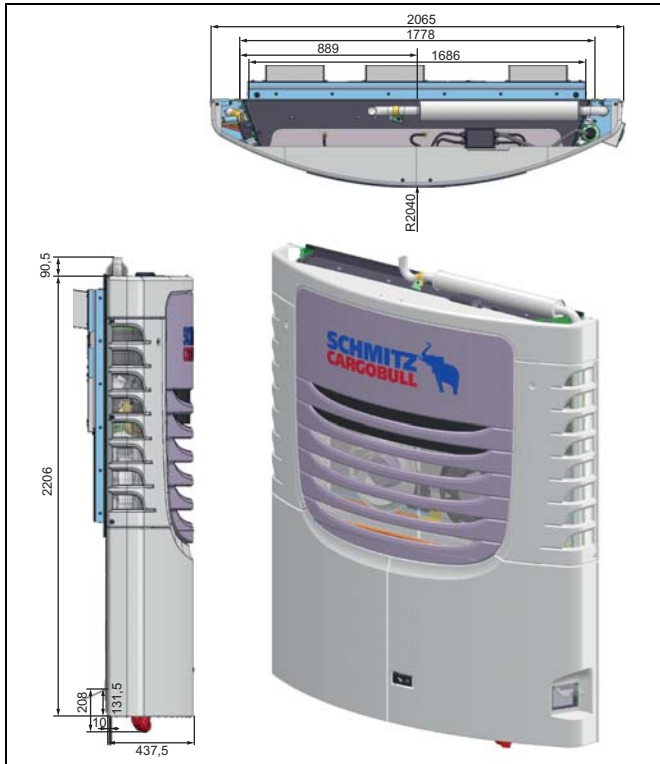


Figure 41: External dimensions Transport refrigeration unit

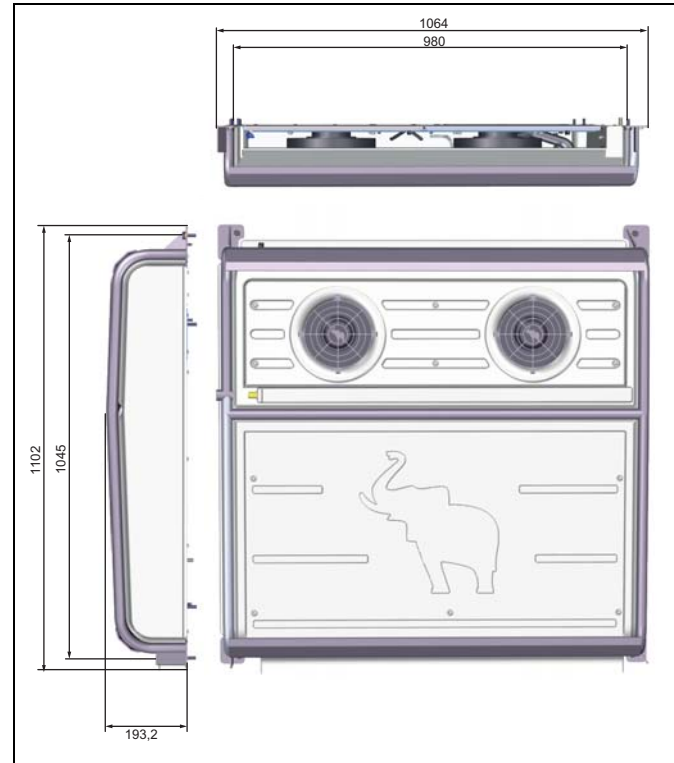


Figure 42: External dimensions: additional ceiling evaporator

10.2 Overview of the data

Sound power level L_{WA}	99.8 dB(A)
Refrigerant	The coolant used can be found on the nameplate (⇒ see "1.2.1 Transport refrigeration unit nameplate" page 6)
Refrigerant quantity	6.5 kg (MonoTemp.) 9 kg (MultiTemp.)
Max. pressure positive/negative	32/19 bar
Control voltage	12 V DC
Mains voltage/frequency/pre-fuse	400 V/50 Hz/32 A
Battery	12 V 95 Ah
Overall weight	865 kg (MonoTemp.) 913 kg (MultiTemp. 2 chamber) 961 kg (MultiTemp. 3 chamber)

10.3 Engine data

Manufacturer/model	Perkins/404D-22
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	31.4 kW at 2,600 r.p.m.
Air intake system	self-priming (naturally-aspirated engine)
Injection	indirect
Engine oil quantity	14.5 l
Cooling liquid, engine/overall system	3.6 l/6.4 l
Dimensions (LxHxW)	946x513x854 mm
Overall weight	218 kg

10.4 Operating materials

10.4.1 Diesel fuel



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 using bio fuels.

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 engine.
Group 2	Permissible fuels	This fuel may reduce the performance and operating life of the engine.
Group 3	Biodiesel	Biodiesel fuels are available in different versions. Biodiesel reduces the performance and the operating life of the 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.

- ▶ Depending on the region, use a fuel with low sulphur content.

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 emission regulations	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 engine or, the oil change interval must be reduced.

- ▶ Contact Schmitz Cargobull if you have any questions.
- ⇨ see "9.2 Customer services and service" page 81

Group 1: preferred fuels

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

- EN590 DERV Category A, B, C, E, F, Class, 0, 1, 2, 3 and 4
- ASTM D975, Category 2D S15 and Category 2D S500

- JIS K2204 Categories 1, 2, 3 and special category 3
Fuels of these categories must fulfil 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 diesel fuels can have an adverse affect to the operating life and the performance of the 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 engine.

- ▶ Avoid using bio fuels.

Special fuels: Fuel for use at lower ambient temperatures

The European standard EN590 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 according to EN590 Class 4 can be used at low ambient temperature to -44 °C. In the European standard EN590, you are provided with 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-MIL.-5624U	JP-5
US-MIL.-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.

10.4.2 Engine oil

 CAUTION
<p>Property damage caused by incorrect engine oil!</p> <p>The operation with incorrect engine oil can lead to severe damage to the engine.</p> <ul style="list-style-type: none"> ▶ Use only oils of the preferred specification. ▶ Observe the viscosity degree of the oil. ▶ Avoid using oil additives.

- ▶ Use only engine oils of the following specification:
 - 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 that the 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 using oil additives.

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

- Shell Rimula R6 LM 10W-40
- Mobile Delvac 1 5W40, CAT DEO SYN 5W40

The approval of more oils is currently being planned. If you want to us another oil, please contact Schmitz Cargobull Service.

⇒ see "9.2 Customer services and service" page 81

10.4.3 Coolant



CAUTION

Property damage caused by incorrect coolant!

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

- ▶ Use only coolant of the preferred specification.
- ▶ Observe the anti-freeze content.

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

- ▶ Use the Perkins long-life coolant or a commercially available D anti-freeze agent that fulfils the specifications according to ASTM D4985.
- ▶ Avoid the use of coolant that only fulfils 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 following limit values for the water:

Content/properties	Upper limit value
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

Coolant additive


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


- corrosion,
 - formation of mineral sedimentation and
 - formation of foam.
- ▶ Use a coolant additive when applying high-pressure anti-freeze agent.
 - ▶ Avoid coolant additives 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 mixture of 1:1 offers an optimum performance as high-pressure anti-freeze agent. If a better anti-freeze should be necessary, the ratio of water to glycerol can be changed to 1:2.

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



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



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.

10.5 Refrigerant



CAUTION

Property damage caused by incorrect refrigerant!

The operation with incorrect refrigerant can damage the cooling device.

- ▶ Use the refrigerant specified by Cargobull.

The cooling device on the Transport refrigeration unit is filled with a refrigerant.

The refrigerant used can be found on the nameplate of the Transport refrigeration unit.

- ▶ Use only the specified refrigerant.

11 Content, sorted alphabetically

Adding engine oil	67
Alarm	51
Assemblies	23
Assembly	32
Battery at low ambient temperatures	40
Care and cleaning	61
Carrying out visual inspection	71
Chamber button: Starting the chamber of the refrigeration unit	48
Charging the battery	40
Checking and filling with fuel	36
Checking and replacing fuses	75
Checking coolant level	68
Checking coolant level when commissioning	35
Checking engine oil level when commissioning	34
Checking the defrosting water drain	72
Checking the engine oil level	67
Cleaning the machine compartment	62
Cleaning, inside	63
Cleaning, outside	62
Commissioning	32
Commissioning before each use	32
Compressor nameplate	7
Confirm/OK	50
Content, sorted alphabetically	90
Coolant	87
Coolant at low ambient temperatures	40
Customer services and service	81
Danger grading and warning instructions	9
Danger zones	12

Dealing with operating resources	20
Dealing with refrigerant	18
Declaration of Conformity	10
Decommissioning	79
Design	22
Design and function	22
Diagnosis messages (error memory)	57
Diagnosis sensor	55
Diagnosis sensor/messages	55
Diesel fuel	83
Dimensions	82
Display	46
Draining water and sediment from the fuel tank	36
Driving personnel	11
Engine data	83
Engine oil	86
Engine oil at low ambient temperatures	39
Engine serial number	7
Engine, remote starting	42
Figures used	8
Final decommissioning/disposal	80
For your safety	9
Fuel at low ambient temperatures	39
Function	26
Functions of the control buttons/alarm LED	47
General safety instructions	14
Guarantee and liability	8
Information on the operating instructions	6
Information, warning and prohibition signs	13
Initial commissioning	32
Intended use	10
Layout of the control unit	46

Limits of use/anti-freeze	17	Setting the language	49
Main assemblies	22	Settings at menu level 1	53
Maintenance	61	Settings/displaying in the menu level 2	54
Maintenance	64	Settings/displaying in the menu levels	53
Maintenance schedule	64	Spare parts	81
Menu	49	Spare parts and customer services	81
Operating and display elements	28	Specialist personnel	12
Operating at low ambient temperatures	39	Starting diesel operation	57
Operating buttons	46	Starting operating the	
Operating buttons overview	47	Transport refrigeration unit	57
Operating company	11	Starting the electric operation	58
Operating instructions validity	6	Storage	32
Operating materials	83	Storing documents	8
Operating modes	29	Switching diesel/electric	49
Operating states	29	Switching the main switch on and off	38
Operating states with active refrigerating machine	30	Switching the stand-by of the Transport refrigeration unit	
Operating states with inactive refrigerating machine	29	on and off	47
Operation	46	Switching the Transport refrigeration unit and controller	
Overview of the data	83	on and off	57
Perform a visual inspection for commissioning	33	Symbols used	7
Personnel qualification	11	Technical data	82
Process of a setting	52	Temporary decommissioning	79
Product identification and nameplates	6	Thawing (defrosting)	50
Protective equipment	13	Topping up coolant	69
Recommissioning	79	Transport	32
Refrigerant	89	Transport refrigeration unit nameplate	6
Relevant documents	8	Troubleshooting	60
Replacing the battery	73	Venting the fuel system	78
Representation and layout of the warning instructions	9	What has to be observed in case of emergency?	21
Selection	50		
Servicing	73		

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