SYSTEM DESCRIPTION

TKS-C

Solar inverter station with 2 x Protect PV
Medium-voltage supply

EN

AEG Power Solutions GmbH, Warstein-Belecke

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AEG POWER SOLUTIONS

Revision service

Status	Revision	Date	Name
00		26.10.2012	Hagelstein

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1 General Information

1.1 Validity

This description reflects the technical specifications of the equipment at the time of publication. It is a component part of the system.

Legal claims arising from this contractual relationship shall only be recognised by AEG Power Solutions GmbH subject to the terms agreed under the warranty obligation in the main contract.

1.2 Appropriate Use

The TKS-C inverter station has been designed conforming to IEC 62271-202 for use in solar power stations with two Protect PV.250, 500 or 630. The inverter station is delivered in a prefabricated container for installation outdoors.

Other components installed in the inverter station include a transformer rated based on output for electrical isolation, an MV switchgear for power supply to the local grid and order-specific control components.

The equipment may only be used for this purpose. Any other use constitutes misuse and can endanger personal safety.

Refer to the Protect PV operating instructions (OI) and component documentation for more information.

2 Safety

The qualified skilled personnel are responsible for safety.

The member of personnel who is responsible for the equipment must ensure that only suitably qualified persons are allowed access to the equipment.

To ensure safety in the electrical operating areas, these areas should be lockable; i.e. suitable locking systems should be installed by the owner at all exterior doors in the compact station.

2.1 Installation Location

The equipment is intended for use outdoors as an enclosed electrical unit.

- Environmental conditions: (→ Technical data) corresponding to DIN EN 60721-3-4)
- Freely accessible air vents for heat dissipation
- Ground pressure: min. 200 kN/m^2 (→ soil excavation plan)

Refer to the technical data for additional criteria.

When selecting the installation location, regional regulations governing noise emissions must be taken into account.

Minimum clearance:

- Keep at least 5 m away from flammable objects. Observe the applicable local fire protection requirements.

Drainage:

- Connection to on-site drainage system (→ soil excavation plan).

Do not install the equipment in areas subject to flooding or those with a high groundwater level.

2.2 Lightning Protection

A connection to the potential equalisation system provides the container station with effective protection against lightning strikes. Outdoor earthing stations must be provided on site conforming to the specifications set out by the grid operator. The container is connected via its zinc-plated earth terminal lug, which is located on the front face next to the door for entering the INV compartment.

The manufacturer's specifications must be implemented effectively in order to provide the photovoltaic system with suitable lightning protection measures.

Refer to the Protect PV operating instructions (OI) for more information about safety.

3 Scope of Delivery

Check that the following components are delivered with the equipment:

- 1 x TSK-C inverter station incl.:
  - 2 x Protect PV solar inverter
  - 1 x MV transformer corresponding to nominal output
  - 1 x medium-voltage system corresponding to nominal output

- Optional:
  - 1 x PV.LoG/PV.LoG+/PV.SerV communications cabinet
  - 1 x LV PV.LvS main distributor and station sub-distribution system
  - 1 x flashlight

- Technical documents comprising:
  - Technical data
  - Instructions for transport
  - Assembly and operating instructions for components
  - Drawings/circuit diagrams

Available to order

AEG Service can also provide the following documents:

- Spare parts list
- Service book

To place an order, please contact:

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4 Equipment Specifications

4.1 Dimensions

The dimensions are specified in the dimensional drawing.

4.2 Structure

The TKS-C inverter station is installed in a prefabricated container with integrated cable basement. Its roof can be removed.

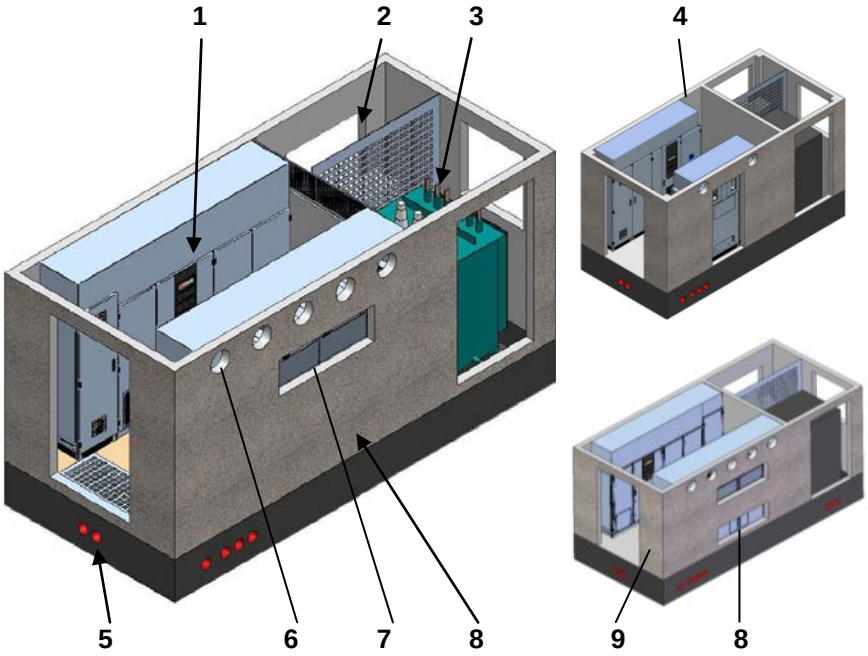

Fig. 1 - TKS-C inverter station

1 Inverter compartment
2 Switchgear compartment
3 Transformer compartment
4 TKS-C 500
5 Cable basement with cable feed-throughs
6 Exhaust air vents
7 INV air vent and service flap
8 INV supply air vent (optional)
9 TKS-C 1000 with optional supply air vent

4.2.1 Outer Walls

The outer walls are a component part of the prefabricated construction. Like the entire container station, they are made from LC 25/28 or C25/30 reinforced concrete. The facades can be made from exposed aggregate concrete or colour plastic render applied with a roller.

4.2.2 Roof

Fig. 2 - Top of roof

1	Trough platform roof	5	Rainwater inlet
2	Cover	6	Downpipe
3	Insert nuts	7	Outer wall
4	Threaded rope loop	8	Bracket with screw connection

The roof is designed as a trough platform roof. It is slide-mounted on the outer walls. The roof skin is coated with a water-repellent preservative impregnation.

So that the roof can be raised, four RD36 insert nuts have been cast in the four corners (on the top or side); these are usually covered over. Internally, the roof construction is held in place by 8 brackets with screw connections.

4.2.3 Cable Basement

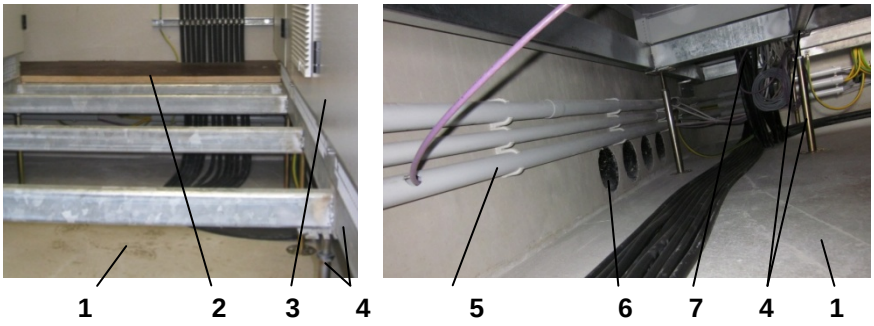

Fig. 3 - LV compartment cable basement

1 Concrete floor
2 Double floor
3 Protect PV
4 Supporting structure with frame
5 Cable duct
6 Cable feed-throughs
7 DC cable entry Protect PV

The cable basement is located underneath the inverter compartment. The components are mounted on an elevated supporting frame (double floor). Hauff or Roxtec feed-through systems are used for the cable feed-throughs in the outer walls.

All surfaces coming into contact with the earth are treated with 2 layers of insulating primer.

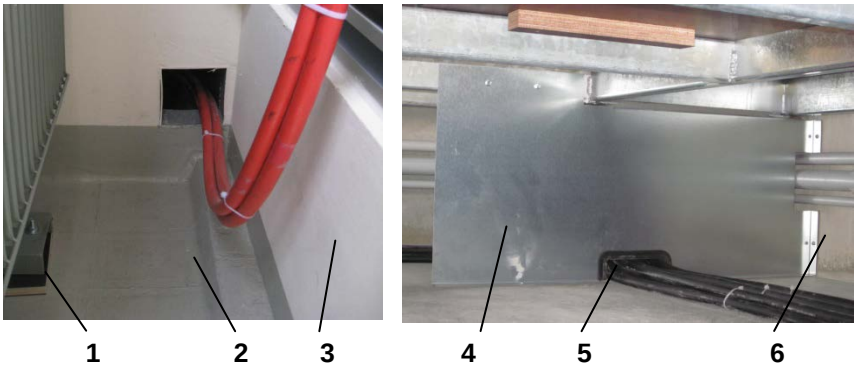

Fig. 4 - Trough and partition

1 Transformer guide rail/ vibration damper
2 Oil-tight/water-tight trough
3 Outer wall
4 Partition
5 Cable feed-through
6 Cable basement

The MV compartment for transformer and MV switchgear has been designed as an oil-tight and water-tight trough. The LV cables enter through a partition in the dividing wall and are routed upwards and across the ceiling towards the transformer.

4.2.4 Doors and Air Vents

Fig. 5 - Air vents

1 Louvre door (optional)
2 Flap with louvre vents (optional)
3 Ventilation shutters
4 Service flap with louvre vents

The louvre doors and louvre vents are made from anodised aluminium. They can be fitted with deflector plates as an option for weather protection. The ventilation elements have at least IP 23D protection in accordance with EN 60529.

The devices are forced-ventilated via all air inlets in the container from below through the cable basement. An additional air vent can be fitted as an option to cool the inverter stack.

To clean the air drawn in, the louvre door of the INV compartment can be fitted with type G4 pocket filters and the air vents or other doors can be fitted with filter mats.

4.3 Solar Inverter

Refer to the Protect PV operating instructions (OI) for information about the inverter.

4.4 PV.LvS-2 Control Cabinet

4.4.1 LV Main Distribution Board

The connections for the LV main distribution board are located in the cabinet of the PV.LvS-2 with one or two connector springs.

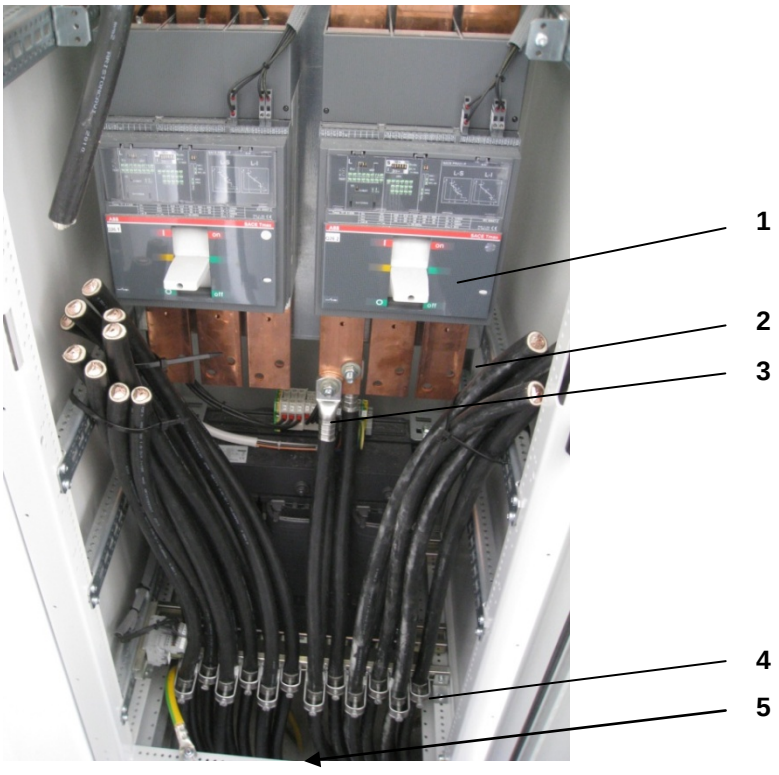

Fig. 6 - LV main distribution PV.LvS-2

1 Q26 load breaker
2 Copper bar power input
3 Connection with cable lug
4 Cable clips
5 Cable basement

4.4.2 Station Sub-Distribution System

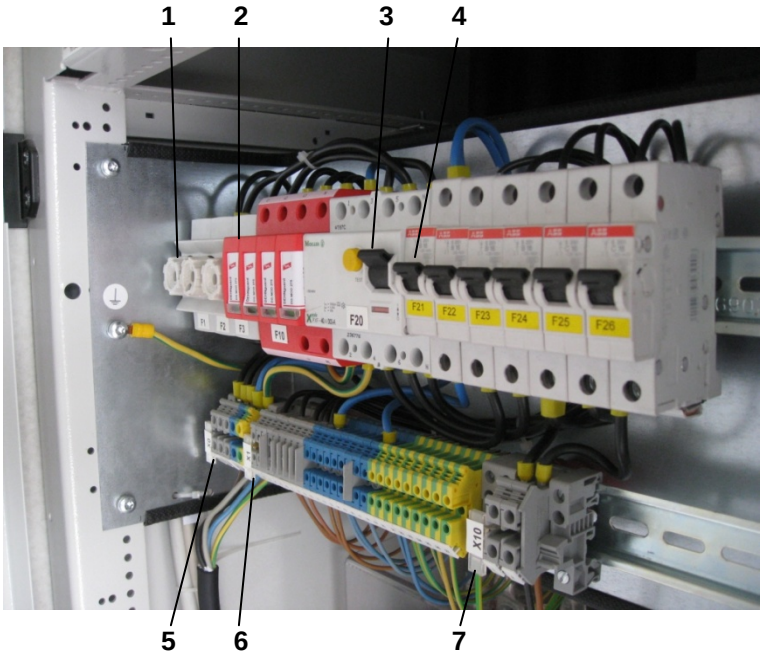

Fig. 7 - Station sub-distribution system in the LvS (example)

1 F1-3 Back-up fuses
2 F10 Overvoltage protection
3 F20 Residual-current-operated circuit-breaker
4 F21-26 Miniature circuit-breakers
5 X0 Terminals
6 X1 Terminals
7 X10 Terminals

The station sub-distribution system can be installed in the PV.LvS cabinet. However, it can also be installed in a separate cabinet.

4.5 PV.LoG Communications Cabinet

With the PV.LoG/LoG+/SerV, the TKS-C inverter station has a variety of interfaces for monitoring and control.

The PV.LoG exchanges data with the Protect PV, PV.IcX and transfer station controllers via Ethernet, Modbus, CAN bus and fibre optic cables.

Refer to the PV.LoG installation instructions for more information.

4.6 Central Earthing

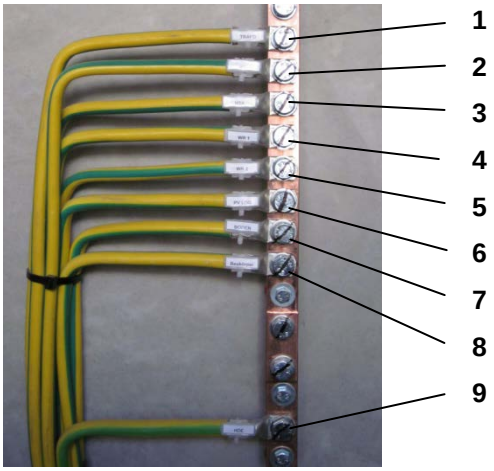

Fig. 8 - Central earthing (example)

No.	H07V-K [mm^2]	Name
1	70	Transformer
2	70	Medium-voltage system
3	70	Low-voltage panel
4	70	Inverter 1 Protect PV
5	70	Inverter 2 Protect PV
6	70	PV.LoG communications cabinet
7	70	Floor
8	70	Structural shell
9	95	HDE

Table 1 - Potential equalising strip

Potential equalisation is pre-installed in the INV compartment of the container station (→ circuit diagram). All connections must be made with cable lug and using the relevant tightening torque.

4.7 Transformer

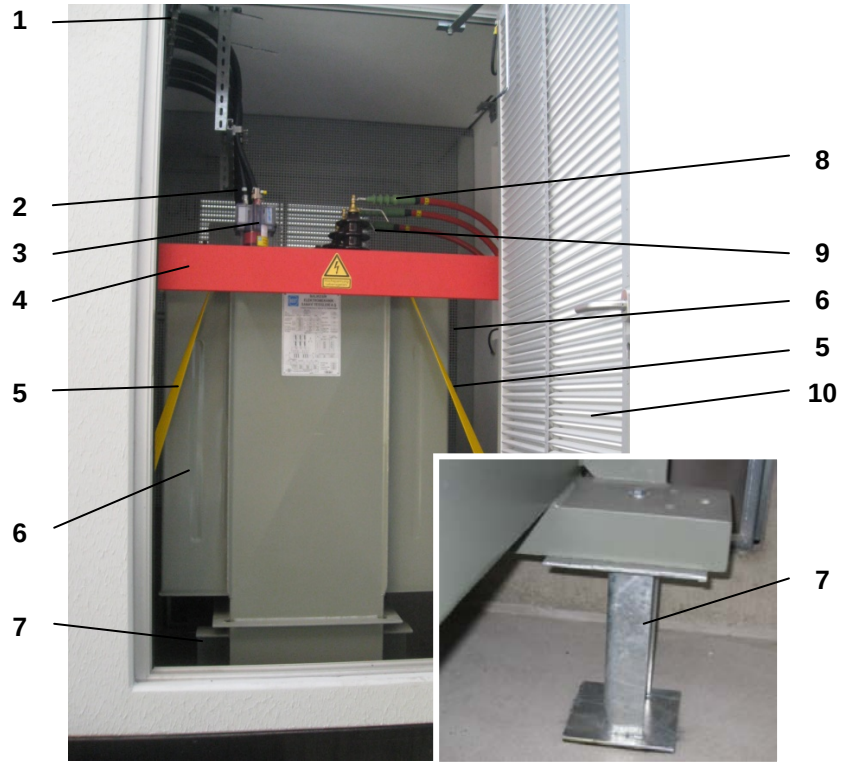

Fig. 9 - Transformer (example)

1	Cable clips (roof)	6	Cooling ribs
2	LV connection of LVMD	7	Transformer guide rail/ vibration damper
3	Temperature sensor	8	Connection to MV system
4	Safety bar	9	Porcelain feed-through
5	Transport strap	10	Louvre door

The transformer stands on a rubber mat for vibration damping and is secured for transport. The transport strap must not be removed for operation.

All internal connections to and from the transformer are pre-installed in the container station.

The transformer is fitted with temperature and oil level monitoring; this is connected to the PV.LoG and an warning is output if values are found to be abnormal.

Refer to the transformer documentation for more information.

4.8 Medium-Voltage System

Fig. 10 - Medium-voltage system (example)

The installation of the medium-voltage system involves an interior system. The type and number of panels vary from project to project.

Refer to the assembly and operating instructions supplied with the equipment or the manufacturer's catalogue for more information about the MV system.

5 Functional Description

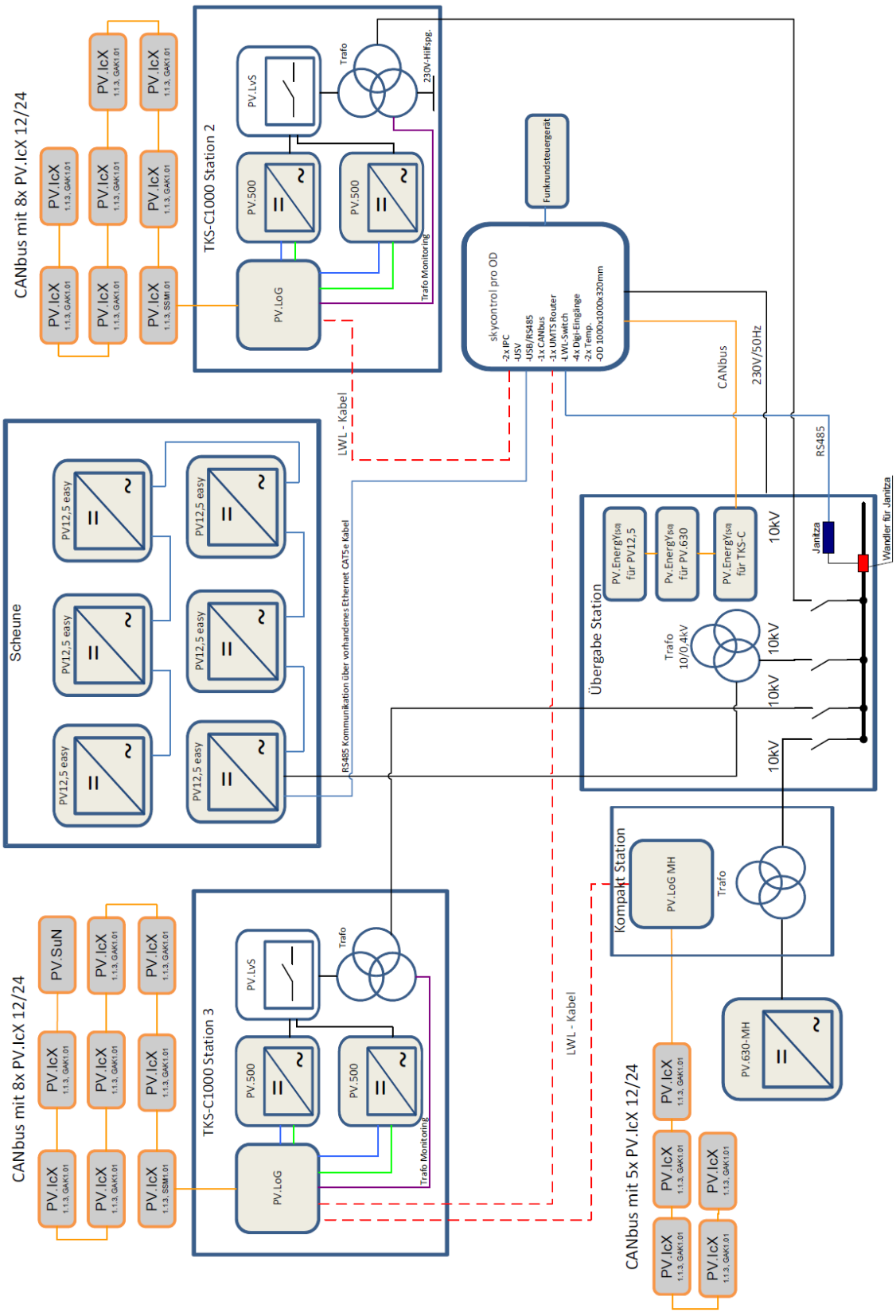

Fig. 11 - System diagram TKS-C 1000 in combination (example)

The container station is equipped as appropriate for the required nominal output.

The PV.Control unit is adapted to the power station capacity and the local feed conditions.

Refer to the Protect PV operating instructions and those for the PV components for more information about functions.

6. Transport

In the case of delivery free construction site, the station manufacturer (with the designated carrier) is responsible for securing the load correctly and safe transport. When the station is handed over, the manufacturer is given the necessary transportation documentation for unloading and storage.

The equipment must be transported conforming to the environmental conditions for transport set out in DIN EN 60721-3-2 (→ Technical specification).

DANGER

Suspended loads during transport

Possibility of death or crushing.

- ➔ Select lifting gear according to the total weight to be transported.
- ➔ Do not step under suspended loads.
- ➔ Secure the danger zone.
- ➔ Wear personal protective equipment.

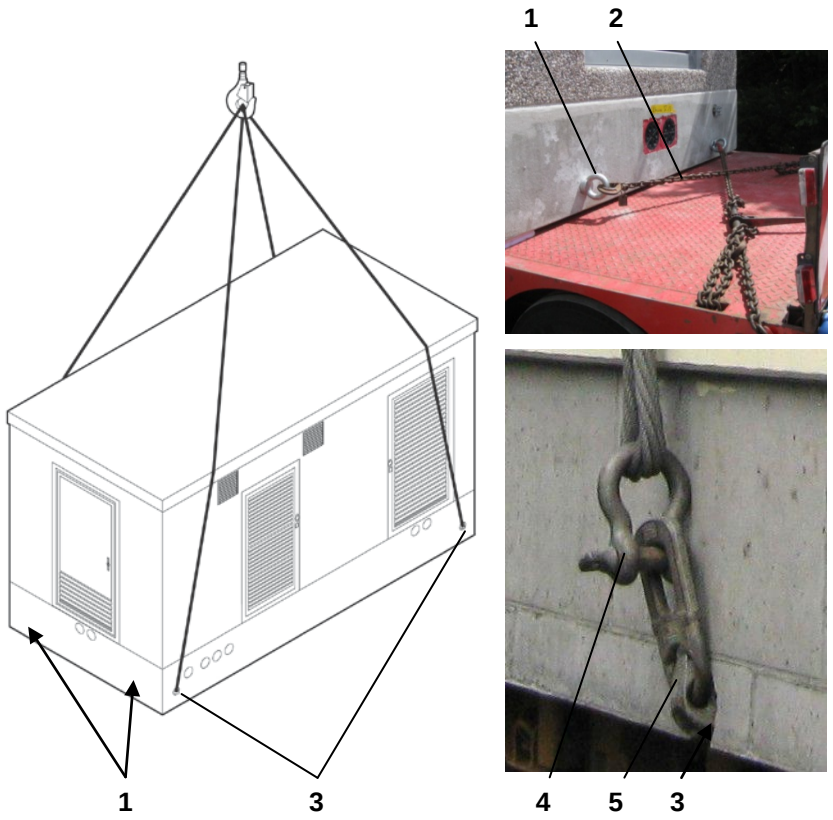

Fig. 12 - Crane transport TKS-C 500 (example)

1 Insert nuts with RD 36 eye bolts
2 Transport chain
3 Philipp KK transport anchor
4 Shackle with supporting cable
5 Spherical head lifting head with lip

The RD 36 eye bolts on the front faces of the station are used to secure the equipment for transport. Remove the eye bolts from the insert nuts after assembly and seal the openings with bolts or caps.

Use edge protection for the roof when lifting.

All load-carrying equipment used must have sufficient load-bearing capacity. The load must be distributed evenly among the four ropes/belts. Lifting on one side is not permitted.

Refer to the data sheet for the weight of the station.

The only permissible way to lift the station is with the transport anchors (e.g. Philipp KK anchors) arranged on the long sides using suitable load-carrying equipment (spherical head lifting head) (→ station manufacturer drawing).

Position the spherical head lifting head on the anchor head with the opening facing down and turn the lip to attach to the transport anchor. The lip must be pointing in the direction of pull.

Following assembly, detach the spherical head lifting heads from the transport anchors and seal the openings with caps.

7 Assembly

7.1 Setting up

The TSK-C container station does not require a foundation. Make ready the area for setting up the station as shown on the excavation plan.

Make sure that transport routes are unobstructed (remove power lines, fences, trees, etc. if necessary).

The route to the site and the site itself must be able to support the dimensions and weight of the articulated lorry and the crane.

- Gradient: ≤4% (otherwise an additional traction engine will be required)
- Ground clearance: 0.25 m
- Turning radius: approx. 16 m

Dimensions of articulated lorry:

- Length: 16 m
- Width: 3 m
- Height: 5 m
- Weight: 60 t.

Dimensions of crane:

- Length: 15 m
- Reach: min. 7 m with max. approx. 30 t (→ TD)
- Width: 3 m
- Height: 5 m
- Weight: max. 70 t.

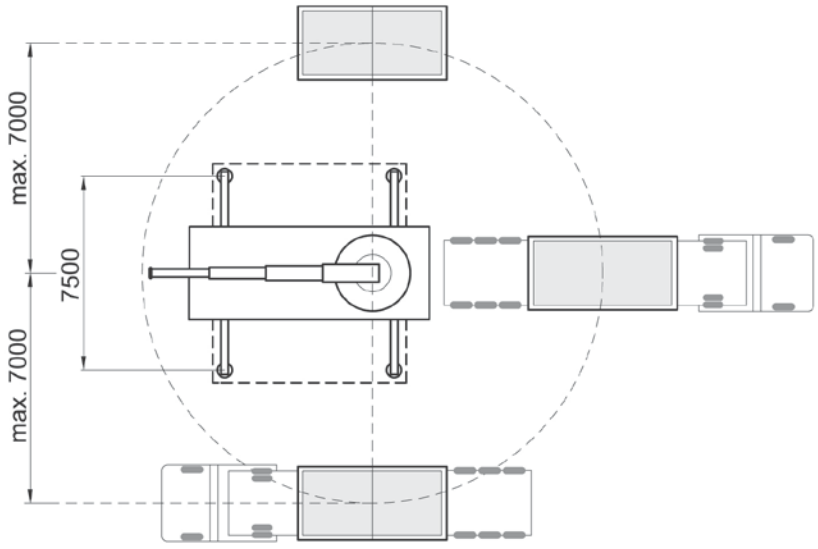

Fig. 13 - Arrangement for installation

If the conditions for installation cannot be observed, a site inspection must be carried out to identify the options for delivery and installation.

Fig. 14 - Installing the container station

The container station can only be installed using a crane (→ Chapter 6 - Transport).

7.2 Installation

⚠WARNING

Hinge side of the door when closing

Fingers or hands may be crushed.

➔ Do not hold the hinge side of the door.

➔ Take care while closing the cabinet door.

Observe the bending radius of the supply lines.
With one bend:
***bending radius = 10 x diameter of supply line**.*

Follow the instructions on shrinking and insulation for the cable feed-throughs provided by Hauff-Technik GmbH.

7.2.1 Cable Feed-Throughs

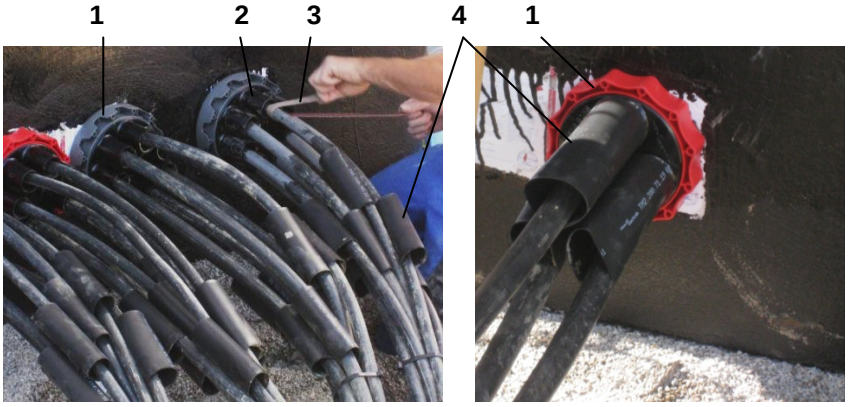

Fig. 15 - Hauff cable feed-through (example)

1 HSI 150 system cover
2 Hauff protective conduit connection
3 Clean/abrade cable
4 Hauff heat shrink sleeve

The cable feed-throughs can be populated with various Rohrsetten (Hauff pipes with sliding sockets), i.e. fitted with a varying number of protective conduits.

For tightness, the cable entry must be worked clean. If necessary, use Hauff KR60 cleaner (→Hauff assembly instructions).

Fill in cable trenches in the correct and proper way and watch out for potential subsidence. The cable feed-throughs must not be exposed to mechanical load.

7.2.2 DC Connections

Establish DC power connections and PE connections in accordance with the circuit diagram and using the relevant tightening torque (→ Electrical documentation).

Refer to the Protect PV instructions for installation and commissioning for more information about installation.

7.2.3 Low-Voltage Panel

Fig. 16 - LV panel

1 NH4 load interrupter switch - 1250 A
2 NH4 connection panel (Cu rails)
3 Cable lug
4 Protective cover
5 AC inputs
6 AC outputs

Establish AC power connections and PE cables in accordance with the circuit diagram and using the relevant tightening torque (→ Electrical documentation).

The order of the conductors (L1, L2, L3) must be adhered to.

Remove any cable debris and tools from the equipment and replace the protective cover on the connection panel.

7.2.4 Station Sub-Distribution System

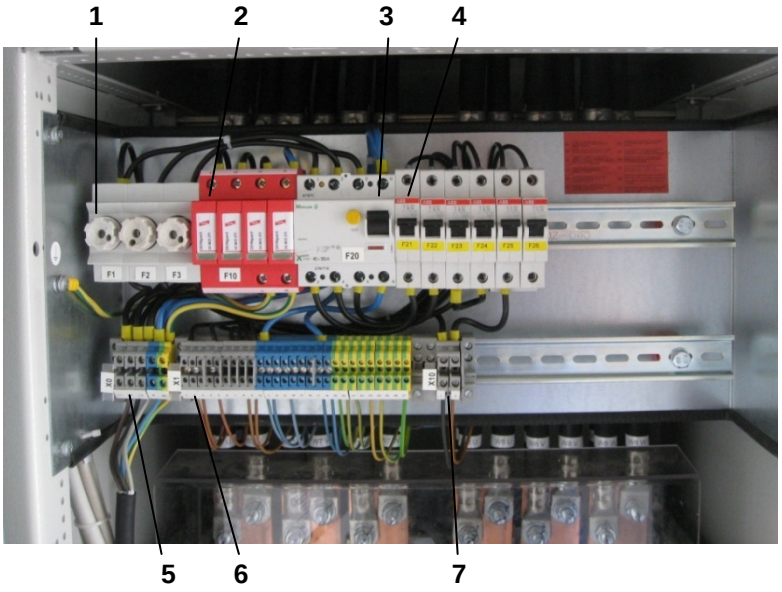

Fig. 17 - Station sub-distribution system (example)

1 F1-3 Fuses
2 F10 Overvoltage protection
3 F20 Residual-current-operated circuit-breaker
4 F21-26 Miniature circuit-breakers
5 X0 Terminals
6 X1 Terminals
7 X10 Terminals

Fuse		
F1	25 A	Back-up fuse
F2	25 A	Back-up fuse
F3	25 A	Back-up fuse
F10		Type 2 overvoltage protection
F20	25 A	Residual-current-operated circuit-breaker
F21	16 A	Lighting for MV and INV compartment
F22	16 A	Sockets, INV compartment
F23	16 A	Spare
F24	16 A	Spare
F25	16 A	Auxiliary voltage INV-1
F26	16 A	Auxiliary voltage INV-2

Table 2 - Fuses

Terminals	
X0	External power supply 400/230 V, 50 Hz
X1:1-3	Lighting, 230 V
X1:4-5	Sockets, 230 V
X1:8	Auxiliary voltage INV 1, 230 V
X1:9	Auxiliary voltage INV 2, 230 V
X10:1	External power supply PV.LoG, 400/230 V, 50 Hz
X10:2	Auxiliary voltage PV.LoG

Table 3 - Terminals

Establish connections in accordance with the circuit diagram and using the relevant tightening torque (→ Electrical documentation). Remove unused cables and tools from the equipment.

7.2.5 Medium-Voltage Transformer

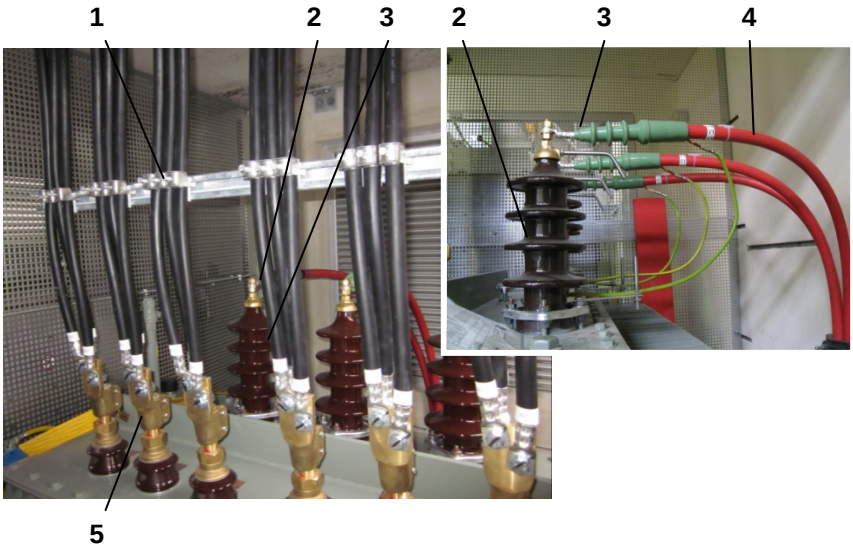

Fig. 18 - Transformer (example)

1 Retaining plate with cable clips
2 MV elbow connector
3 MV porcelain feed-through
4 MV cable to MV system
5 LV connection with porcelain feed-through

The oil transformer is assembled and wired in the container station. The LV connections are established in accordance with DIN EN 50386. Transformer and MV connections with porcelain insulators correspond to DIN EN 504180.

When replacing equipment, disconnect the electric cables then establish in the usual way using the relevant tightening torque and connecting the earthing terminals (→ Instructions for installation, commissioning and maintenance provided by the manufacturer).

7.2.6 Medium-Voltage System

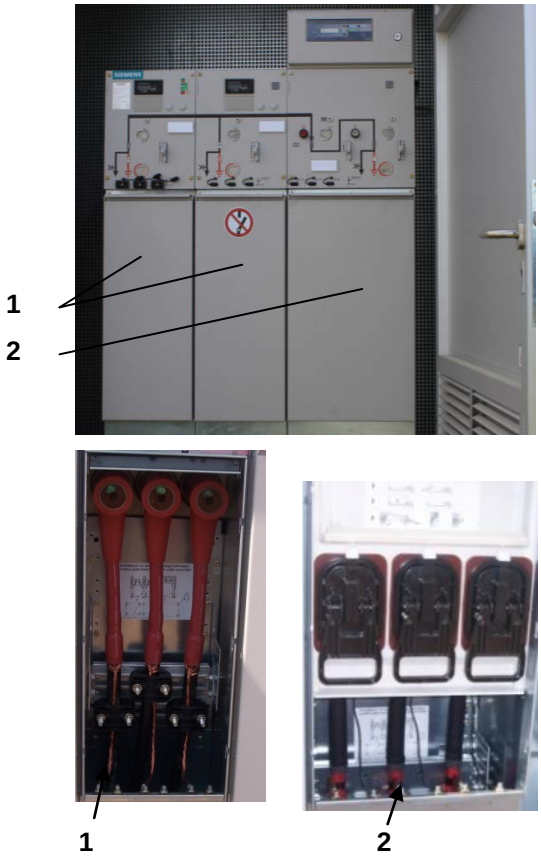

Fig. 19 - Medium-voltage system (example)

1 Cable branch L1/L2/L3 external AC connections
2 Transformer branch
internal AC connections from transformer with load interrupter switch

The MV system is pre-installed in the container station.

Use the power cables supplied with the equipment to establish the AC connections for the system and make the connections following the manufacturer's assembly instructions you will find in the system. The stub cables are routed into the MV system from below (→ Electrical documentation).

7.2.7 Central Earthing

Connect active earthing to the potential equalising strip in accordance with the circuit diagram (→ Electrical documentation).

7.2.8 PV.LoG/LoG+ Communications Cabinet

The batteries installed in the cabinet for independent power supply belong to the communications cabinet.

Install the PV.LoG/LoG+ communications cabinet following the instructions in the PV.LoG/LoG+ installation manual.

Wiring is carried out in accordance with the circuit diagram (→ Electrical documentation).

Data is exchanged between the PV.IcX combiner boxes and the PV.LoG or PV.ControL via CAN bus (→ *.USP and operating instructions for PV.LoG and PV.ControL).

7.3 Tightening Torques for Screw Connections

Thread	Electrical connection	Mechanical connection		
		Cheese head screw strength category 5.8	Hexagon screw strength category 8.8	Slotted cheese head screws DIN 84
	[Nm]	[Nm]	[Nm]	[Nm]
M4	1.2	1.3	2.0	1.2
M5	2.0	2.65	4.0	2.0
M6	3.0	4.4	7.0	2.5
M8	6.0	10.5	17.0	3.5
M10	10.0	-	33.0	4.0
M12	15.5	-	56.0	-
M16	30.0	-	140.0	-
M20	52.0	-	260.0	-
M24	80.0	-	445.0	-

Table 4 - Tightening torques

These values apply to electrical and mechanical screw connections. They do not apply to floor attachment with dynamic stress applied.

8 Commissioning

DANGER

Working with voltages up to 1 kV

Risk to life due to electric shock.

➔ Comply with BGV A3, DIN VDE 0105100 (EN 50110, IEC 61243).

➔ Skilled personnel with a Working with Live Current certificate.

The electrical system must not be commissioned/operated if there are any traces of condensation.

Special AEG Power Solutions software and hardware tools must be used for initial commissioning. Only skilled personnel trained by AEG PS are in a position to use these tools correctly and to perform initial commissioning.

Once the equipment has been fully installed, the following aspects must be checked:

- Screw connections properly tightened
- Cable connections properly established
- Tools removed
- Protective covers properly installed

9 Operation

Refer to the Protect PV operating instructions for information about operation.

10 Maintenance

DANGER

Contact with voltage

Risk to life due to electric shock.

➔ Press emergency off.

➔ Move the victim away from live parts using dry insulating material.

➔ Get medical help and inform the control room.

➔ Disconnect the equipment safely.

DANGER

Working with voltages up to 1 kV

Risk to life due to electric shock.

➔ Comply with BGV A3, DIN VDE 0105100 (EN 50110, IEC 61243).

➔ Skilled personnel with a Working with Live Current certificate.

DANGER

Residual voltage from capacitors

Risk to life due to electric shock.

➔ Observe discharge time.

➔ Disconnect the equipment safely.

Keep the equipment clean to minimise leakage currents.

DANGER

Contact with leakage current

Risk to life due to electric shock.

➔ Disconnect the equipment safely.

DANGER

Suspended loads during transport

Possibility of death or crushing.

➔ Select lifting gear according to the total weight to be transported.

	➔ Do not step under suspended loads. ➔ Secure the danger zone. ➔ Wear personal protective equipment.

ATTENTION

Insufficient ventilation of equipment

Equipment may overheat.

➔ Keep air vents clear.

➔ Ensure the equipment is sufficiently ventilated.

WARNING

Heat generation in resistors

Risk of burning.

➔ Do not touch hot components.

WARNING

Hinge side of the door when closing

Fingers or hands may be crushed.

➔ Do not hold the hinge side of the door.

➔ Take care while closing the cabinet door.

WARNING

Entry of water into electrical equipment

Risk to life due to electric shock.

➔ Do not use water to clean the cabinets.

➔ Do not place any vessels containing fluids (beverage cups, for example) on electrical equipment.

5 safety rules

1. Disconnect safely.
2. Secure the equipment against being switched back on.
3. Verify that all poles are de-energised.
4. Earth the equipment, close the earthing switch and short-circuit the equipment.
5. Provide protection in the form of covers or barriers for any neighbouring live parts.

A safe disconnection certificate or a release certificate according to DIN VDE 0105-100 (EN 50110) must be presented prior to all maintenance and repair work.

The owner must draw up a safe disconnection procedure and brief personnel on this.

The owner is responsible for correct maintenance of the systems and the equipment. This also applies to system components that fall within the responsibility of the grid operator.

In order to ensure uninterrupted availability of the equipment, preventive maintenance work should be carried out based on the maintenance schedule. Regular maintenance reduces the risk of breakdowns and disruption due to technical faults.

To maintain the validity of the warranty:

- Regular maintenance must be carried out and documented according to the maintenance schedule.
- Only original AEG PS spare parts (or spare parts purchased from AEG PS) may be used.

For further details, please refer to the provisions of the individual contracts.

The owner must define work instructions for carrying out maintenance work, giving details of:

- Ambient conditions

- Tools, equipment, means of protection and auxiliary equipment

- Suitable personal protective equipment and organisational safety measures.

Maintenance work must be carried out in accordance with BGV A3 (DIN VDE 0100/VDE 0105) and DIN 31051 (DIN EN 13306).

AEG PS will rescind all obligations such as warranty agreements, service contracts, etc. entered into by AEG PS or its representatives without prior notice, in the event of anything other than original AEG PS spare parts being used.

10.1 Obligation to Keep a Written Record

Inspection results and details of any maintenance work carried out must be recorded in writing. Experience has shown that the best way to document inspection results is in the form of a test report.

The following information must be recorded:

- Maintenance schedule

- Date of the measure carried out
- Work performed
- Any special notes on the work performed
- Persons who carried out the work
- Signatures of the persons who carried out the work
- Signature of the person responsible (supervisor)

A correct test report, completed in full, is important for technicians as evidence of exoneration in case of later complaints or for investigations in case of damage. For this reason, test reports should be retained for a long time (around 10 years).

10.2 Maintenance and Inspection

10.2.1 Visual Inspection

Visual inspections should be carried out in accordance with DIN EN 13018.

Inspections must involve careful checks for the following in the equipment:

- Mechanical damage
- Corrosion, thermal changes to and tightness of the electrical connections
- Moisture
- Accumulation of conductive dirt or dust
- Defective fuses
- Foreign bodies
- Fans dirty or damaged (M2 and M3 when the air duct is open)
- Filter mat dirty or damaged
- Rain inlet clear

Safety devices and warning notices should be checked for damage and legibility.

If there is condensation in the equipment, the internal heating device should be checked to determine whether it is working properly.

10.2.2 Cleaning

Only equipment tested in accordance with DIN VDE 0680 may be used for cleaning.

If there is condensation in the equipment parts that are to be cleaned, cleaning must not be carried out.

The cleaning procedure used must comply with the relevant regulations and provisions of the accident prevention regulation VBG 4 "Elektrische Anlagen und Betriebsmittel" (Electrical installations and equipment) and DIN VDE 0105-100 (Operation of electrical installations). Only specially trained electricians may carry out cleaning work when the equipment is live.

The log for dry-cleaning low-voltage installations using a vacuum cleaner must be completed before and after cleaning work. Circuit and installation markings should be noted before cleaning, so that if a marking is damaged or falls off, this can be rectified.

Cleaning the heat sink

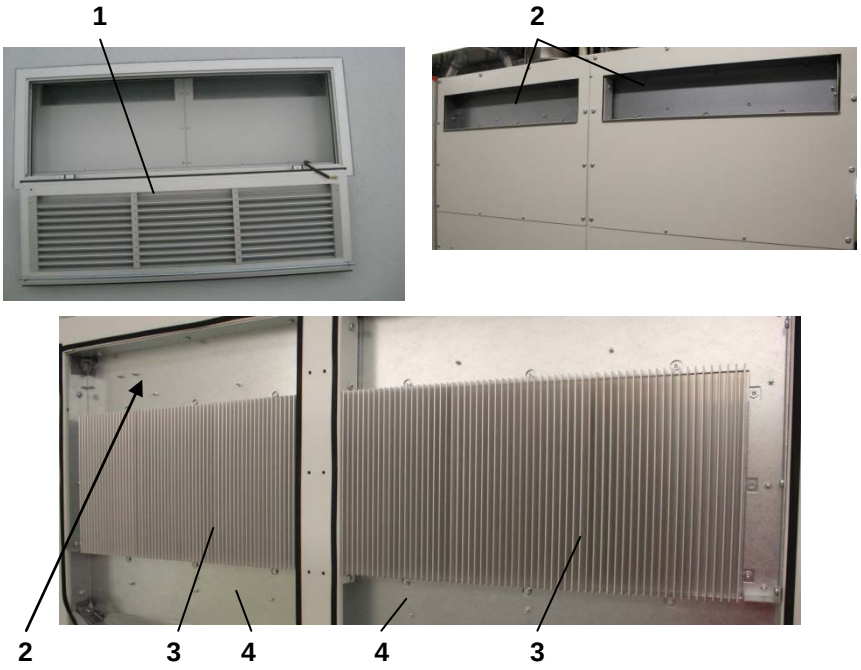

Figure 20 - Protect PV.500/630 heat sink

1 Service flap
2 INV rear wall with air outlets
3 Heat sink INV stack (A1, A2)
4 Ventilation duct M1 INV control cabinet

⚠WARNING

Hot surfaces/heat sink

Risk of burning.

➔ Do not touch hot components.

Release and open the service flap

1. Unscrew and remove the two accessible parts of the INV rear wall with air outlets.
2. Clean the heat sink carefully using compressed air from bottom to top, for example. (Wear protective goggles.)
3. Close the rear wall and service flap.

Cleaning the rainwater inlet

The rainwater inlet is located on the roof and connected to the rainfall downpipe. Remove any evidence of soiling from the inlet. There should be no stagnant water on the roof.

10.2.3 Functional Test

> Always perform a functional test after completing any maintenance work and before starting operation.

Electrical equipment must only be started up if it is in perfect working order and must be kept in this condition.

Following repair, replacement or modification work, a functional test must be performed in accordance with the commissioning log. For repeat tests, functional testing of the equipment or its components need only be carried out to an extent that verifies the safety of the equipment.

10.2.4 Testing/Measuring

The aim of testing/measuring is to verify that the electrical equipment complies with the installation standards.

In the case of recurrent tests, all measurements must be taken as appropriate for initial commissioning and DIN VDE 0105100, and compliance with all values/limits must be verified.

> *All measuring and monitoring devices used for testing must comply with standards DIN VDE 0413/EN 61557 and DIN 0404 and must be tested and calibrated regularly in accordance with ISO 9001:2000.*

The equipment has various diagnostic functions (some of which are optional), which can significantly reduce the time required for maintenance work and troubleshooting.

Self-diagnosis:

This is activated when the equipment is switched on. Internal auxiliary programs monitor the bus system, the control PCBs and the sensors (amongst other things), and signal any faults that occur.

Data logger:

Measured data, parameters and fault indications are saved continuously. Measured data and performance data, as well as fault histories, can be read out and evaluated as required.

> *The operating instructions describe how to output performance and fault histories.*

BGV A2 requires the owner to perform repeat tests at stipulated times in order to verify that the electrical equipment is in perfect working order.

At stipulated times, the owner must check that the fault current, differential current and fault voltage protection devices are functioning properly.

Manual insulation testing should be carried out in accordance with → Protect PV operating instructions.

10.2.5 Care

Lubrication

Carry out the following care measures for the station:

- Lubricate hinges, rods and guide rails after cleaning.
- After cleaning rubber seals, rub lightly with a rubber care product such as deer tallow.

Replacing filter mats (optional)

Clean or replace the air filter mats depending on the degree of soiling; however, all air filter mats must be replaced at least annually in accordance with DIN EN 779.

1. Unscrew the filter mat insert from the inside.
2. Remove the old filter mat and screw in the new one.
3. Screw the filter mat insert back on.

Replacing pocket filters (optional)

Clean or replace the type G4 pocket filters depending on the degree of soiling; however, all pocket filters must be replaced at least annually in accordance with DIN EN 779.

1. Unscrew the filter insert from the inside.
2. Remove the pocket filter and screw in a new filter.
3. Screw the filter insert back on.

Replacing the battery (Protect PV)

The 3 V Li-battery on PCB A17 should be replaced as a precaution after around 5 years, as it is exposed to thermal loads.

Replacing radial ventilators/fans (Protect PV)

WARNING

Rotating parts

Injury to fingers and hands possible.

→ Do not reach into rotating parts.

	➔ De-energise fans.

A radial fan must be replaced if it is defective or runs out of round; however, this must be carried out after 10 years of operation at the latest.

When fans are replaced, the starting capacitors must be replaced too.

Radial ventilator M1 is located in the lower ventilation duct of the INV control cabinet. Removal and installation must be carried out in accordance with the Protect PV maintenance instructions.

Fans M2 and M3 are located in the air duct on the INV cabinet roof.

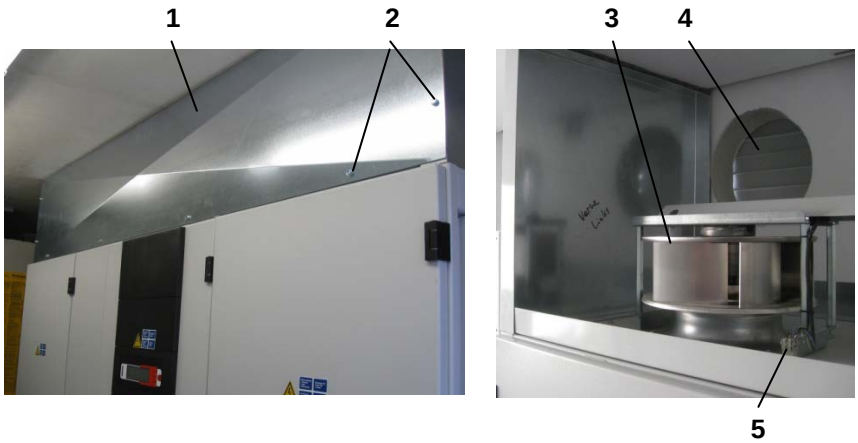

Fig. 21 - Protect PV air duct (example)

1 Cover for duct
2 Screw connection
3 Fan M2
4 Air outlets with shutter
5 Fan connector X91.2

1. Open the air duct by unscrewing and lifting off the duct cover.
2. Remove fan connectors X91.2 and X91.3.

Remaining instructions for replacing fans → Protect PV maintenance instructions.

Once maintenance work is complete, check the function of the fans.

Replacing the output contactor K7 (Protect PV)

The service life of a 3-pin contactor is determined by the number of operating cycles it engages in:

- Electrical service life ≤ 440 V approx. 200,000 operating cycles
- Mechanical service life approx. 500,000 operating cycles

The operating cycles are recorded in the memory and indicate when the contactor should be replaced. The electrical service life can be extended by replacing the coil.

Replacing the capacitors C86 and C87 (Protect PV)

The capacitors in front of the inverter stacks have a service life of approx. 100,000 operating hours and should be replaced when this is reached.

10.3 Repairs

Repairs and modifications to the compact station may only be carried out by AEG PS skilled personnel.

If you want other personnel to carry out this work, this will need to be authorised by means of written approval from AEG PS.

Only original AEG PS spare parts (or spare parts purchased from AEG PS) may be used.

10.3.1 Testing after Repairs

Each time the equipment is repaired or modified, all recurrent tests/measurements are to be carried out and documented in accordance with DIN VDE 0105 (commissioning log) once the work is complete.

10.3.2 Replacement Work

10.3.2.1 Replacing the Transformer

DANGER

Suspended loads during transport

Possibility of death or crushing.

➔ Select lifting gear according to the total weight to be transported.

➔ Do not step under suspended loads.

➔ Secure the danger zone.

➔ Wear personal protective equipment.

The transformer is accessed via the removable roof or a door. It can only be replaced with the roof structure removed.

1. Disconnect the equipment safely.
2. Disconnect and make safe all electrical and PE connections from the transformer.

The trough roof weighs approx. 5000 kg.

Use load category 6.3 t load-carrying equipment.

3. Remove the covers from the insert nuts. Screw all four RD 36 threaded anchors in fully and attach.
   - Top: Philipp threaded rope loops
   - Side: Philipp-Wirbelstar
4. Open all of the station doors and unscrew the 8x2 screw connections on the ceiling. To unscrew the screw connections above the Protect PV, the air duct must be opened.
5. Using a suitable traverse cross bar only, carefully lift the roof up and off the station and set it down safely and securely.
6. Attach the existing transformer to the transport eyelets and secure.
7. Unscrew the screw connections which attach the transformer guide rails to the vibration dampers and lift out the transformer carefully with lifting gear (→Technical data for the transformer).
8. Assemble a new transformer in the usual way on the vibration damper in the trough of the MV compartment and establish the connections (→Transformer OI). Then carefully set the trough roof down on top of the outer walls and make the screw connections.

10.3.2.2 Replacing the Medium-Voltage System

DANGER

Toppling of cargo during transport by industrial trucks

Possibility of death or crushing.

➔ Lift cargo under its centre of gravity.

➔ Secure the cargo and danger zone.

➔ Wear personal protective equipment.

1. Disconnect the equipment safely.
2. Disconnect and make safe all electrical and PE connections from the MV system.
3. Unscrew the screw connections on the MV system and use an industrial truck to lift systems with a maximum width of 1050 mm (door opening: 1250 mm wide) out of the station (→ Type 8DJH switchgear catalogue).

If the system is wider than this, it must be lifted out via the roof (like the transformer).

10.4 Maintenance Schedule

The maintenance schedule does not release the owner from his obligation to create his own maintenance and operating instructions for the location and to document them fully as quickly as possible.

The maintenance instructions set out by the component manufacturer must be referred to when drawing up a detailed specification of the scope of maintenance work.

> *For recurrent measurements and measurements after repair work as per BGV A3, compliance with the DIN VDE 0105-100 inspection intervals is mandatory.*

Ongoing
Check the measured results of the equipment for plausibility. Replace defective measuring instrumentation at the end of production.
Data bus: Ongoing functional testing in operation.

Monthly
Test lamps (Protect PV) and replace diodes if necessary.
Check the function of the system's internal measuring instrumentation by comparing the values during operation with the values displayed.
Check the function of the measuring instruments and accessory systems required for operation and maintenance.
Check the interior area and equipment for moisture and, if necessary, establish the cause and dry the equipment.
Clean interior compartments/cable basement of the container station (operating area) as necessary.

Every 6 months

Check the fastenings and function of the electrical connections of all components in the station.
Check the function of the fault current, differential current and fault voltage protective circuits.
Carry out recurrent measurements in accordance with DIN VDE 0105.
Check Protect PV fans for damage and whether they are working correctly (rotation), and repair or replace if necessary.
Check fans, louvres (optional: filters), shutters and weather protection covering (if present) for soiling and clean if necessary.
Check the function of the heating devices (BG20, A1 and A2) in the DC/AC and INV control cabinet, especially before cold spells. No condensation may be present in the equipment during operation.
Check the function of the overtemperature warning system by opening the sensor path.
Clean interior compartments/cable basement of the container station (operating area).

Annually
Measuring and monitoring devices must comply with the VDE 0413 standard. Check and calibrate all measuring instruments.
Check that the equipment as a whole is in perfect working order: - Check the container incl. roof and rainwater drainage for soiling and damage - Check line connections for dirt and corrosion - Check protective covers for damage and check their fastenings
Check all input, monitoring and output values in the equipment and also in interaction with the external control system. Check the control behaviour of the equipment and readjust, correct or change the limit values if required.
Check the function of the peripheral connections, i.e. all connections of the various accessory systems, and repair them if required.
Clean the equipment to minimise creepage currents (do not use water). Comply with BGV A3, DIN VDE 0105-100 during this process.
Clean louvre vents, protective grid and holder and replace air filters if necessary.
Clean the heat sink of the IGBT INV stacks (A1, A2).
Check that the safety signs are complete and legible, and replace if required. (Must be checked by an expert every 2 years.)
Check that the lighting in the container station is in working order, replace if necessary.

Every 2 years
Check of the safety signs in the operating area and in the equipment by an expert.

Every 3 years
Replace 3 V lithium battery on PCB A17 (Protect PV, INV).

Every 10 years
Replace radial ventilators/fans in equipment ventilation system and clean ventilation duct and cooling fins.
Replace starting capacitors.
Replace output contactor K7 coils.

10.5 Storing Spare Parts

> *When ordering spare parts, you must provide the component designation, installation location and component number as well as the unit number of the Protect PV.*

AEG PS recommends that you have the following spare parts available:

Item	Component
F41.x	DC input fuses, l.v. h.b.c. fuse L2-2 1200 V
A12, A13 (optional)	Remote signalling P8 - CCC
A91.1	Fan monitoring
M1	Radial ventilator (IGBT inverter stack)
M2, M3	Radial fan (INV control cabinet)
K7	AC output contactor
	Sealing profile 1 and 2

Table 5 - Spare parts (example)

The AEG PS customer service department will be happy to send you a complete spare parts list on request.

11 Decommissioning and Dismantling

The TKS-C station can be decommissioned or dismantled for the purpose of relocation or disposal.

Before beginning any work on the equipment, it must be de-energised. For this purpose, the **five safety rules** of electrical engineering in accordance with DIN VDE 0105 (EN 50110) must be observed:

5 safety rules

1. Disconnect safely.
2. Secure the equipment against being switched back on.
3. Verify that all poles are de-energised.
4. Earth the equipment, close the earthing switch and short-circuit the equipment.
5. Provide protection in the form of covers or barriers for any neighbouring live parts.

The owner must draw up a safe disconnection procedure and brief personnel on this.

11.1 Removing Connection Cables

- Disconnect the power connections.
- Disconnect the power supply and auxiliary power supply.
- Disconnect all external control cables.
- Disconnect the earthing line clips from the central earthing.

11.2 Dismantling

DANGER

Suspended loads during transport

Possibility of death or crushing.

➔ Select lifting gear according to the total weight to be transported.

➔ Do not step under suspended loads.

➔ Secure the danger zone.

➔ Wear personal protective equipment.

DANGER

Toppling of cargo during transport by industrial trucks

Possibility of death or crushing.

➔ Lift cargo under its centre of gravity.

➔ Secure the cargo and danger zone.

➔ Wear personal protective equipment.

➔ Secure the transformer against slipping if necessary.

➔ Attach suitable load-carrying equipment to the compact station (transport eyelets on the concrete base).

➔ Lift the equipment carefully and remove cables.

11.3 Disposal

11.3.1 Statutory Provisions

Equipment at the end of its life is electrical scrap.

In commercial contexts, the manufacturer is responsible for the disposal of electrical scrap unless otherwise agreed. Electrical scrap must always be disposed of by an expert.

Electrical and electronic scrap may only be disposed of in compliance with local legislation and regulations (German Electrical and Electronic Equipment Act, 2002/96/EC (WEEE) and the Basel Convention).

Electronic scrap consists of valuable materials which can be reclaimed as secondary raw materials, but it also contains environmentally harmful substances.

Commercial disposal companies have information on the best way to recycle material (e.g. in the form of a recycling handbook).

For example, it is possible to recycle:

- PCBs and circuit boards
- Electronic components, EPROMs, ICs and relays
- Chips, processors, hard disks and drives
- Batteries

11.3.2 Chemical System Components

AEG PS complies with the restrictions on the use of hazardous substances in electrical and electronic units according to the German Electric and Electronic Equipment Act Section 5 (2002/95/EC).

Do not dispose of old batteries with refuse. They contain environmentally harmful materials (Hg, Cd or Pb).

Ensure compliance with local legislation and regulations governing the storage, handling and disposal of batteries.

Components such as plastics and insulating materials should be disposed of as industrial waste and should be recycled.

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