

SOLAR ENERGY

USER MANUAL
*Installation, Use and
Maintenance*

English

**SUNWAY POWER
CONVERSION UNIT**

15P00SKB200
2020/03/24 R.00



- This manual is integrant and essential to the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
- This product is to be used only for the purposes it has been designed to. Other uses should be considered improper and dangerous. The manufacturer is not responsible for possible damages caused by improper, erroneous and irrational uses.
- Enertronica Santerno is responsible for the product in its original setting.
- Any changes to the structure or operating cycle of the product must be performed or authorized by Enertronica Santerno.
- Enertronica Santerno assumes no responsibility for the consequences resulting by the use of non-original spare-parts.
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TABLE OF CONTENTS

1	PRELIMINARY INFORMATION	6
1.1	SCOPE OF THIS MANUAL	6
1.2	FOR WHOM THIS MANUAL IS INTENDED	6
1.3	ATTACHED DOCUMENTATION	6
1.4	PRESERVATION OF THE DOCUMENTATION.....	6
1.5	SYMBOLS USED	6
1.6	DEFINITIONS.....	7
2	CAUTION STATEMENTS.....	8
2.1	INTENDED USE	9
2.2	QUALIFIED TECHNICAL PERSONNEL.....	9
2.3	EXECUTION OF WORK.....	9
3	SUNWAY POWER CONVERSION UNIT.....	10
3.1	PARTS NAMING	11
3.1.1	LAYOUT MONO.....	11
3.1.2	LAYOUT SPLIT	11
3.2	CONCRETE BASE	12
3.2.1	OIL AND RAINWATER MANAGEMENT	13
3.2.2	HOISTING TOOLS.....	13
3.3	SOLAR INVERTERS	14
3.4	MV/LV TRANSFORMER	14
3.4.1	MV/LV TRANSFORMER HOISTING.....	15
3.5	MV/LV CABIN.....	16
3.5.1	MV SWITCHGEAR	16
3.5.2	AUXILIARY CABINET	18
3.5.3	AUXILIARY TRANSFORMER.....	19
3.5.4	UPS	19
3.5.5	FIRE DETECTION SYSTEM.....	19
3.5.6	RODENT REPELLENT	20
3.5.7	EMERGENCY BUTTON	21
3.5.8	HUMAN PRESENCE DETECTION SYSTEM	21
3.5.9	KEY EXCHANGE BOXES.....	22
3.5.10	PERSONAL PROTECTIVE EQUIPMENT	23
3.5.11	FIRE EXTINGUISHER	23
3.5.12	DOORS.....	24
3.6	INSULATION FAULT MONITORING	24

3.7	LIGHTING SYSTEM AND SOCKETS	26
3.7.1	INTERNAL LIGHTS	26
3.7.2	EXTERNAL LIGHTS	26
3.7.3	POWER SOCKETS	26
3.8	WARNING SIGNS AND LOGOS	26
3.9	NAMEPLATES.....	26
3.10	SIGNALS.....	27
4	INSTALLATION	29
4.1	WORKFLOW	29
4.2	SITE PREPARATION	29
4.2.1	CONCRETE FOUNDATION SPECIFICATIONS (HOISTING).....	31
4.2.2	CONCRETE FOUNDATION SPECIFICATIONS (SLIDING).....	31
4.2.3	CLEARANCE	31
4.3	PLACEMENT.....	32
4.3.1	SAFETY	33
4.3.2	PRELIMINARY NOTES.....	33
4.3.3	EXTRACTION OF ANCILLARY MATERIAL.....	33
4.3.4	EXTRACTION ONTO THE CONCRETE FOUNDATION.....	33
4.3.5	EXTRACTION FROM THE CONTAINER ONTO RAILS	35
4.3.6	LIFTING FROM A TRUCK, RAILS OR GROUND	37
4.3.7	LIFTING ONTO A TRUCK.....	40
4.4	ASSEMBLY	40
5	ACTIVITIES TO BE PERFORMED BY THE CLIENT	41
5.1	CHECKS TO BE MADE BY THE CLIENT.....	41
5.2	EXTERNAL CONNECTIONS.....	41
5.2.1	FOREWORD.....	42
5.2.2	CONNECTIONS OVERVIEW.....	42
5.2.3	CABLE ROUTING.....	43
5.2.4	EXTERNAL GROUND BONDING	43
5.2.5	MV CABLES	44
5.2.6	DC SOURCE CABLES.....	46
5.2.7	COMMUNICATIONS CABLES.....	47
5.2.8	EXTERNAL ENVIRONMENTAL SENSORS	48
5.3	SITE FINALIZATION.....	49
5.3.1	ANCHORING	50
5.3.2	SEALING	51
5.3.3	LANDFILL	51

6	USE INSTRUCTIONS	52
6.1	POWER CONNECTIONS	53
6.2	SAFETY PROCEDURES	53
6.2.1	SAFETY PROCEDURE A	56
6.2.2	SAFETY PROCEDURE B	58
6.2.3	SAFETY PROCEDURE C	60
6.3	POWER UP PROCEDURE	61
6.4	START PROCEDURE	62
6.5	STOP PROCEDURE	62
6.6	POWER DOWN PROCEDURE	63
6.7	POWER SWITCH-OVER PROCEDURE	63
6.8	POWER FROM EMERGENCY GENERATOR PROCEDURE	64
6.8.1	SWITCHING TO EMERGENCY GENERATOR.....	64
6.8.2	SWITCHING FROM EMERGENCY GENERATOR TO SELF-SUPPLY	65
6.9	ACCESSING THE MV/LV TRANSFORMER.....	66
6.9.1	1-TRANSFORMER SUNWAY POWER CONVERSION UNITS	67
6.9.2	2-TRANSFORMER SUNWAY POWER CONVERSION UNITS	68
7	MAINTENANCE.....	70
7.1	MAINTENANCE SHEET	70
7.2	GLOBAL VISUAL INSPECTION	71
7.3	AIR FILTERS MAINTENANCE	71
7.3.1	CLEANING AIR FILTERS	71
7.4	GUTTER CLEANING	71
7.5	POWER CABLE TERMINALS TIGHTENING.....	71
7.6	CONCRETE BASE CHECK.....	72
7.7	LIGHTING SYSTEM CHECK.....	72
7.8	MV AND LV ROOM DOORS CHECK.....	72
7.9	EMERGENCY BUTTON TEST	72
7.10	LABELS AND WARNING SIGNS CHECK	73
8	NORMATIVE REFERENCES	74

1 PRELIMINARY INFORMATION

1.1 Scope of this manual

This manual describes the technical features of Sunway Power Conversion Units. It also outlines installation and use instructions and specifies maintenance requirements and operations.

1.2 For Whom this manual is intended

This manual must be read by:

- Installers
- Operators
- Plant Manager

of a photovoltaic system equipped with Sunway Power Conversion Units manufactured by Enertronica Santerno.

Please refer to section 1.6 Definitions.

1.3 Attached Documentation

Sunway Power Conversion Units are supplied complete with the following documents:

Name of the Document	Scope
Electrical Schematic of the product	This document contains detailed information on the internal layout and the interconnections of the product.
Electrical and Mechanical Schematic of all the cabinets installed in the Sunway Power Conversion Unit	This document contains detailed information on product's components.
Declaration of Conformity of the system to the state-of-the-art.	This document contains the Declaration of Conformity to the standards applicable to the product.
Production Test Reports of all the cabinets, systems and devices installed in the Sunway Power Conversion Unit	These documents contain all the information concerning the execution and outcome of the Production Tests.
Declaration of Conformity of all the cabinets and devices installed in the Sunway Power Conversion Unit	This document contains the Declaration of Conformity to the standards applicable to the product.

1.4 Preservation of the documentation

All documents relative to the Sunway Power Conversion Unit must be kept for the entire life span of the equipment together with the system documentation. They must be kept in a place where they are readily available.

1.5 Symbols used



DANGER

Indicates an operating procedure which, if not carried out correctly, may lead to injuries or even death caused by electric shock.



WARNING

Indicates an operating procedure which, if not carried out correctly, may cause serious damage to the equipment.



NOTE

Indicates important information concerning use of the equipment.

1.6 Definitions

Term	Definition
Installer	Technician responsible for setting up, positioning and installing the equipment in compliance with the system diagram and in accordance with first-class, professional criteria.
Instructed person	Someone who has been adequately advised or supervised by a skilled person to enable him/her to avoid the dangers which may be generated by electricity.
Person in charge of running the electrical system (System Manager)	Person with the highest level of responsibility concerning operation of the electrical system. If required, some of his/her tasks may be delegated to others.
Person in charge of working activities (Works Supervisor)	<p>Person with the highest level of responsibility concerning the execution of work. If required, some of his/her tasks may be delegated to others.</p> <p>The Works Supervisor must give all persons involved in the execution of work activities the relative instructions concerning reasonably foreseeable dangers which may not be immediately apparent.</p>
Plant manager	Person who co-ordinates or manages system management activities and is responsible for ensuring health and safety standards are adhered to.
Skilled electrician	Someone who has been trained and has enough technical knowledge or experience to enable him/her to avoid the dangers which may be generated by electricity.
Skilled operator	Worker who has been suitably trained and informed on the risks and relative safety procedures to be adopted. The operator can carry out routine maintenance on the equipment.
Technical room	<p>Place used for housing the technological systems such as the wiring, plumbing, heating, air-conditioning, lifting and telecommunications systems.</p> <p>It is equipped with suitable forced-air ventilation and/or air conditioning and is also fitted with appropriate safety devices governing access, maintenance and fire-prevention.</p>

2 CAUTION STATEMENTS

This section covers safety statements. The non-observance of the safety instructions below may cause serious injury or death and equipment failure. Carefully read the instructions below before installing, starting and operating the equipment.

Only competent personnel must carry out the equipment installation.



NOTE

Always read this instruction manual thoroughly before starting the equipment.



DANGER

ALWAYS GROUND THE EQUIPMENT.



DANGER

RISK OF ELECTRIC SHOCK – Do not touch electric components when the equipment is powered.

NEVER carry out operations on the equipment when it is powered.

EXPLOSION AND FIRE RISKS – The risk of explosion or fire may exist if the equipment is installed in places where flammable vapours are present. Do not install the equipment where there is a risk of explosion or fire.



WARNING

Make sure that all instructions provided by the Manufacturer are observed and that all check-up procedures are correctly performed, thus preventing any risks and ensuring the correct use of the equipment.

Accessing an electrical Sunway Power Conversion Unit is allowed only to authorized, skilled and trained personnel. The operating personnel shall be able to give first aid to an injured person.



WARNING

Do not connect supply voltages which exceed the rated voltage. If voltage exceeding the rated value is applied, the internal circuits may be damaged.

Do not carry out isolation tests between the power terminals or between the control terminals.

Observe the ambient conditions for installation.

The electronic boards contain components which are sensitive to electrostatic charges. Do not touch the boards unless absolutely necessary. Should this be the case, take all the necessary precautions to prevent damages caused by electrostatic discharges.



WARNING

Sunway Power Conversion Units are integrated all-in-one solutions comprising complex components. Carefully read, understand and observe the instructions provided in each component's Installation and Maintenance Manuals.

2.1 Intended Use



WARNING

The product must be used exclusively as described in this manual. Any use other than that described in this manual is to be considered improper and therefore non-compliant.

2.2 Qualified Technical Personnel

All work must be carried out by skilled technical electricians only (§1.6).

2.3 Execution of Work

Maintenance, configuration modifications and management operations require the involvement of production and maintenance personnel. These activities **must be carried out in observance of all applicable health and safety local and international regulations.**

Standard EN 50110-1, second edition, identifies the people who are granted access to the product:

- Person in charge of running the electrical system (System Manager).
- Person in charge of work activities (Works Supervisor).
- Skilled electrician.
- Instructed person.

See section 1.6 Definitions.

Standard EN 50110-1 governs the way work in a plant is carried out and the relationship between the aforementioned persons who may work on the plant to maintain the electrical safety conditions stipulated by European Directives.

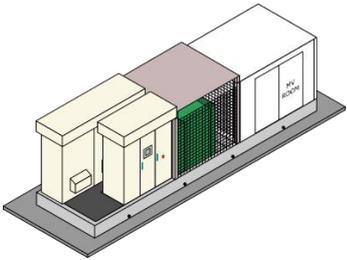
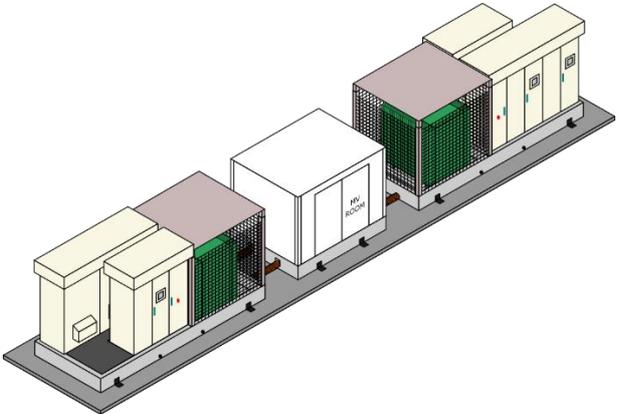
3 SUNWAY POWER CONVERSION UNIT

A Sunway Power Conversion Unit is a turn-key solution for photovoltaic plants integrating all the components to be connected between the photovoltaic panels and the plant medium voltage line. Typically, a Sunway Power Conversion Unit comprises:

- Sunway TG TE photovoltaic inverters
- MV/LV transformers
- MV switchgear
- auxiliary LV/LV transformer
- auxiliary LV cabinet

Sunway Power Conversion Units are highly customizable depending on customer’s needs and plant configuration. All components come installed on one or more reinforced concrete bases, fully in-factory cabled and tested.

Sunway Power Conversion Units may be designed according to one of the following layouts:

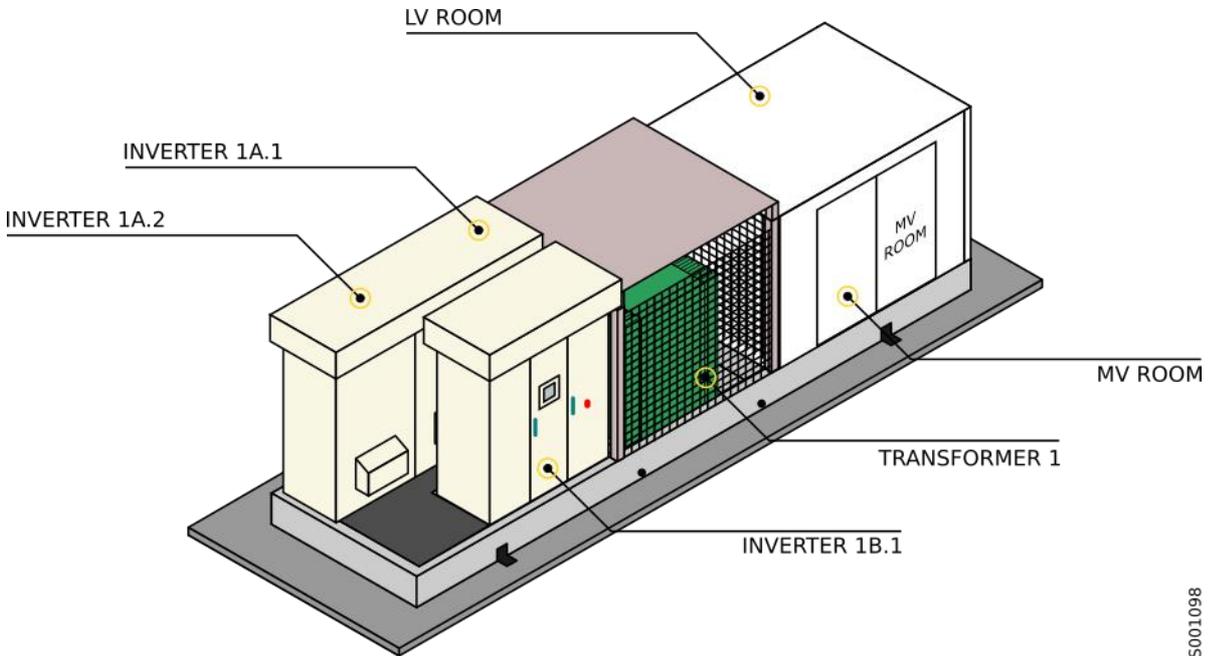
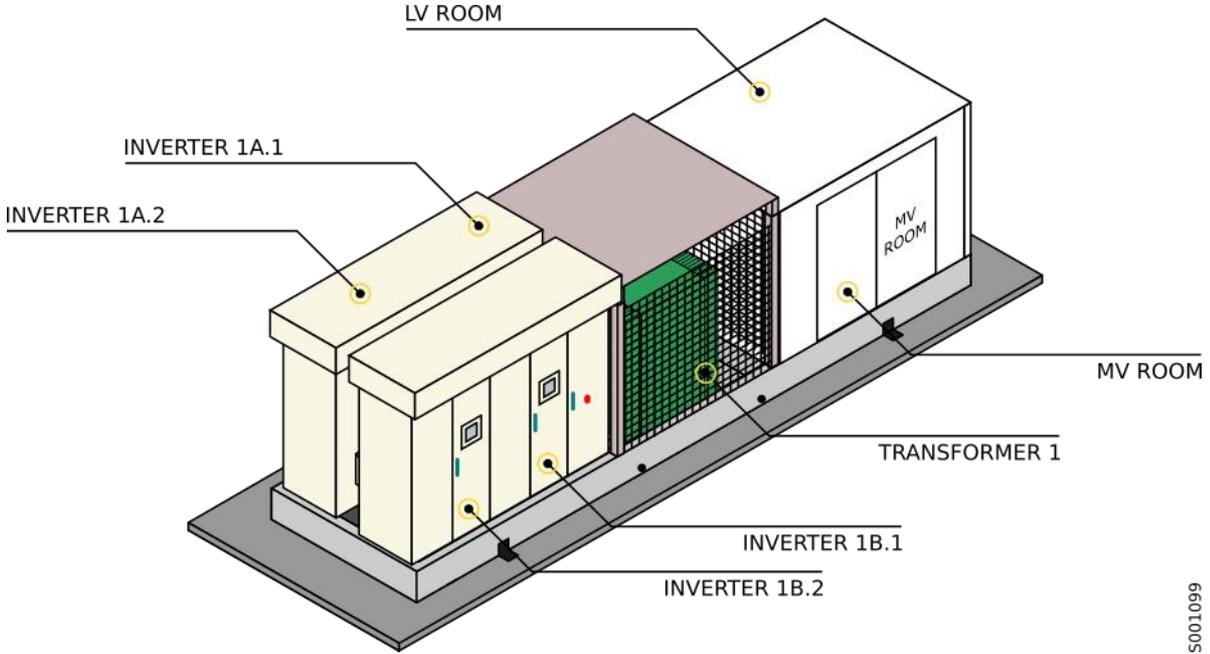
Layout		Description
MONO		<p>All components are installed on a single reinforced concrete base.</p>
SPLIT		<p>Sunway Power Conversion Unit is made up of two lateral Sunway Skids, integrating the photovoltaic inverters and the MV/LV transformers, and one central MV/LV cabin, housing the MV switchgear and the auxiliary LV components.</p>

Sunway Skids comprise a prefabricated base made of reinforced concrete on top of which outdoor components are mounted.

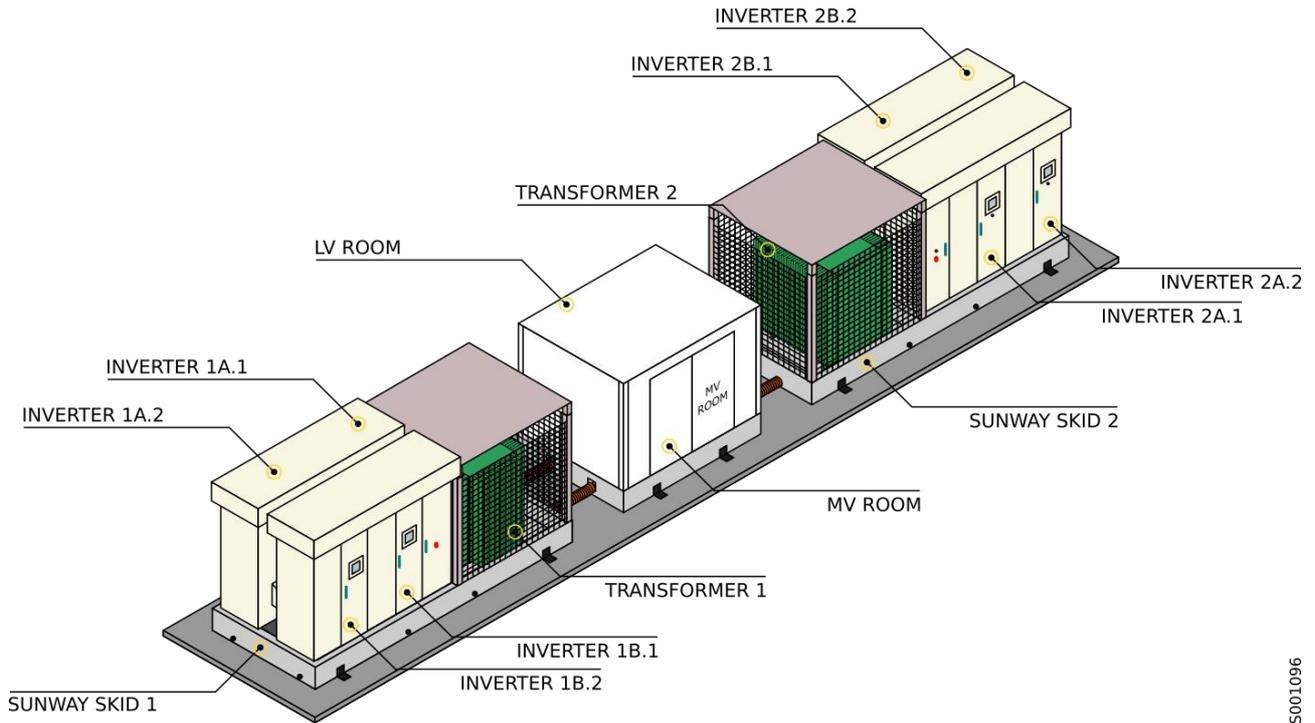
MV/LV cabins comprise a prefabricated base made of reinforced concrete and a cabin featuring sandwich panel walls and a floating floor acting as the support for the electrical equipment.

3.1 Parts naming

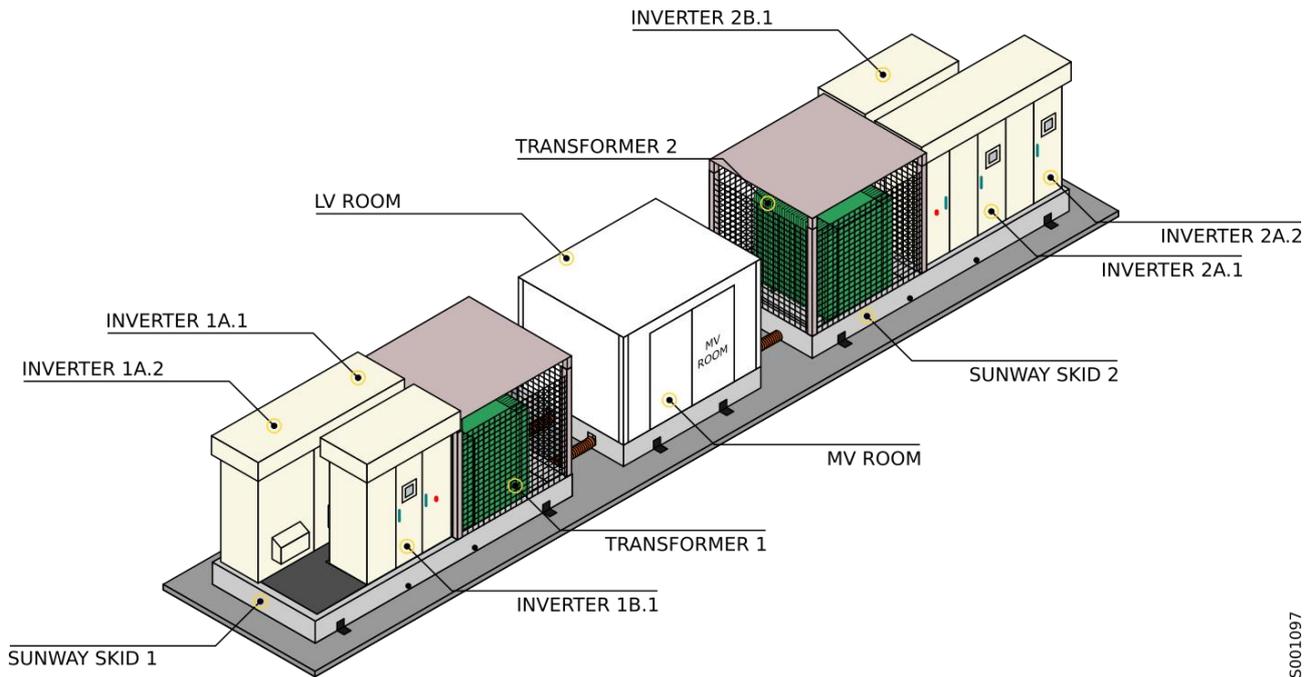
3.1.1 Layout MONO



3.1.2 Layout SPLIT



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5001097

3.2 Concrete base

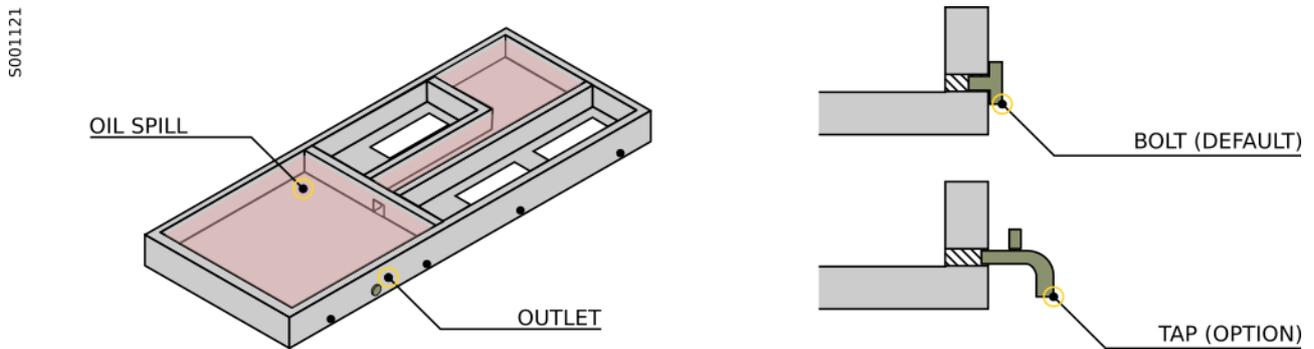
The base of all parts of a Sunway Power Conversion Unit is made up of reinforced concrete. Design of the base varies according to project requirements. Features characterizing the base across projects are:

- oil- and water-proof
- capacity greater than 120% of MV/LV transformer oil
- safety syphon for rainwater removal

- oil and water removal bushing
- pre-cut holes for routing cables (e.g. DC cables and MV cables) on bottom side
- pass-through pipes on side walls for routing cables
- MV/LV transformer holding threaded bars
- earthing threaded bars to connect the internal metal wireframe to earth
- hoisting tools

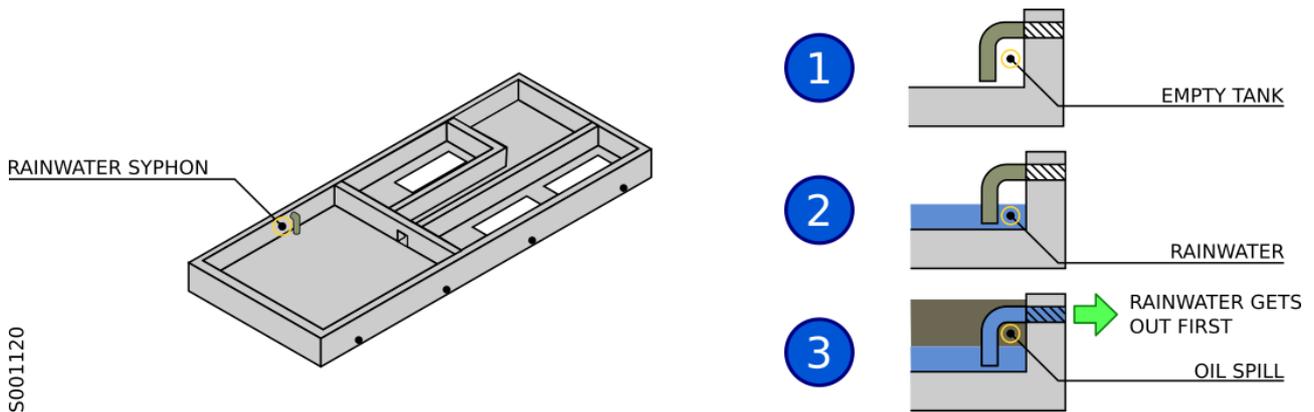
3.2.1 Oil and rainwater management

The concrete base is designed to work as an oil tank, in case of transformer oil spills.



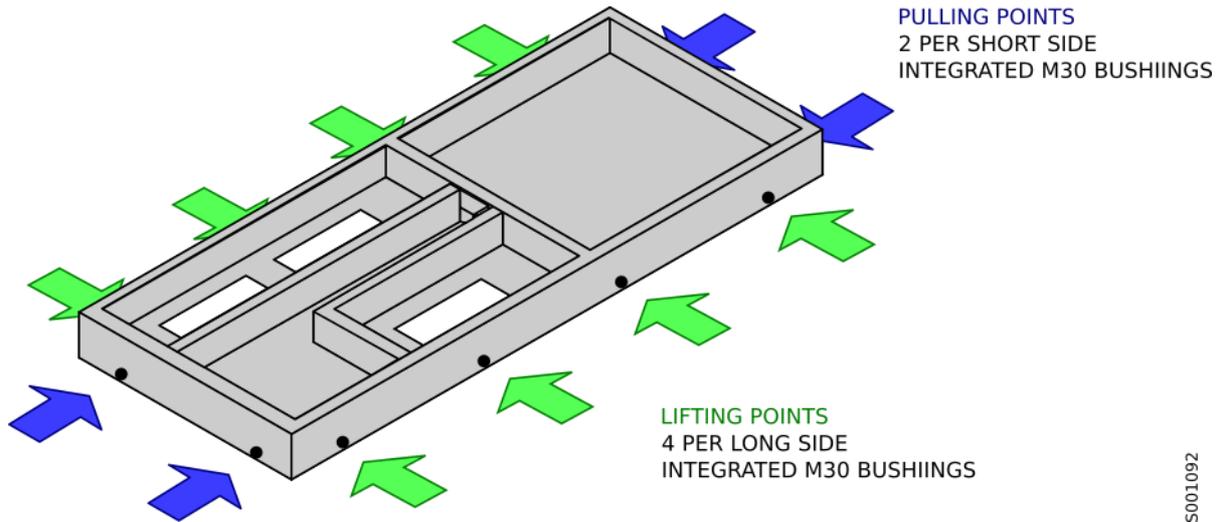
The concrete base integrates two devices for oil and rainwater management:

- A bushing for oil and rainwater removal. This bushing is closed by a bolt by default. Optionally, a tap may be bundled with the product or later purchased and installed by the customer.
- A rainwater syphon, which ensures that rainwater does not take up any of the volume meant for containing oil in case of oil spills.



3.2.2 Hoisting tools

M30 bushings are embedded in all sides of the concrete base of Sunway Skids and MV/LV cabins. Bushings on short sides are meant as an aid to pull the product out of containers. Bushings on the long sides are meant for mounting the hoisting tools needed for lifting.



3.3 Solar Inverters

For any information about the inverters installed, please refer to the applicable user manual available at santerno.com.

3.4 MV/LV Transformer

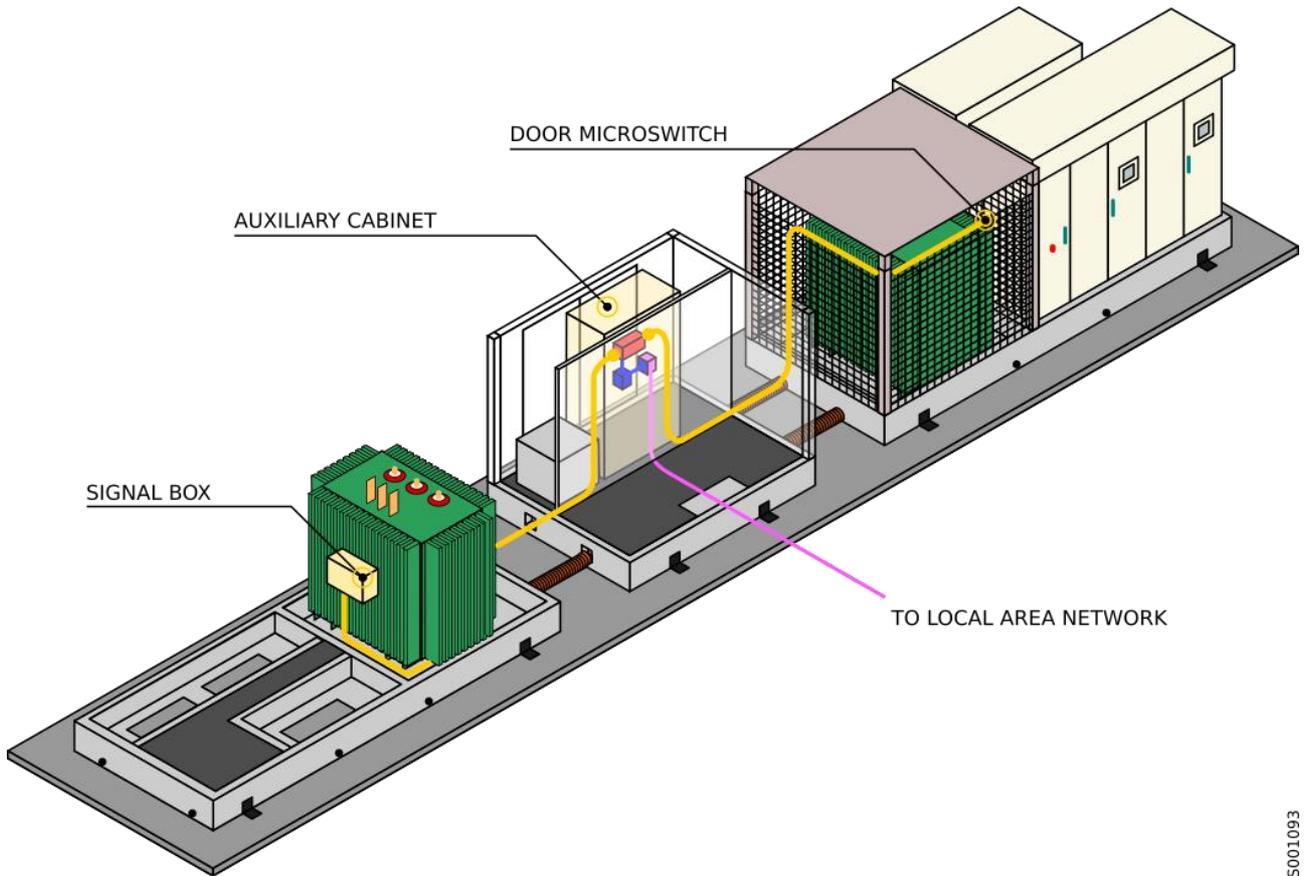
Sunway Power Conversion Units integrate one (§3.1.1 Layout MONO) or two (§3.1.2 Layout) oil-immersed, sealed transformers suitable for outdoor installation. Transformers are designed for air natural cooling (ONAN) and may feature one or two secondary windings depending on project requirements. Both primary winding and secondary windings voltage ratings may be tailored on a per-project basis.

The transformer is equipped with sensors and status indicators for:

- oil level (one NC or NO contact for threshold detection)
- oil pressure (one NC or NO contact for threshold detection)
- oil temperature (two NC or NO contacts for threshold detection)

Output contacts are routed to the auxiliary cabinet to open the upstream MV circuit breaker in case of problems and are also acquired by a remote I/O device connected to the plant LAN. Hence, transformer status can be fully monitored via SCADA.

The door of the MV/LV transformer room is made of IP3x metal net, equipped with a safety lock. As an option, door status is detected via a dedicated microswitch.

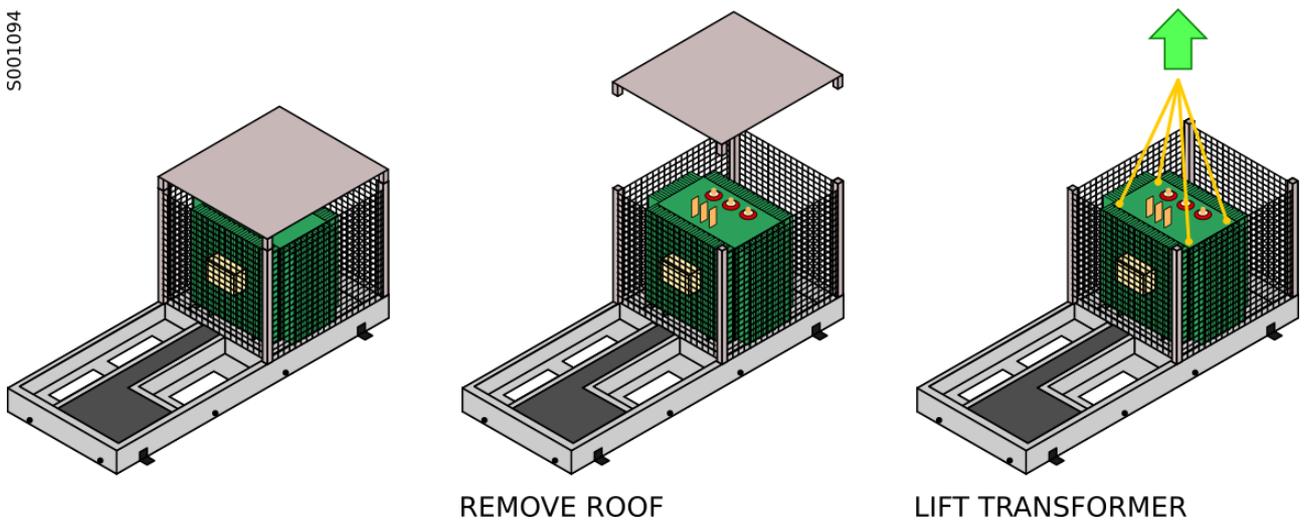


S001093

Detailed information about the transformer may be found in the manual released by the transformer's manufacturer.

3.4.1 MV/LV transformer hoisting

Hoisting points are fitted on the upper part of the transformer. The transformer may be extracted from the product removing the canopy and lifting the transformer from the top.



S001094

Detailed information about the transformer and hoisting recommendations may be found in the manual issued by the transformer's manufacturer.

3.5 MV/LV cabin

The sandwich panels forming the walls and roof are made of galvanized steel and the isolating material is polyurethane.

To protect the equipment inside the cabin from the fire in case of transformer rupture, the walls aside of the transformer are classified REI90 for fire resistance.

3.5.1 MV switchgear

The MV switchgear ensures high personnel safety:

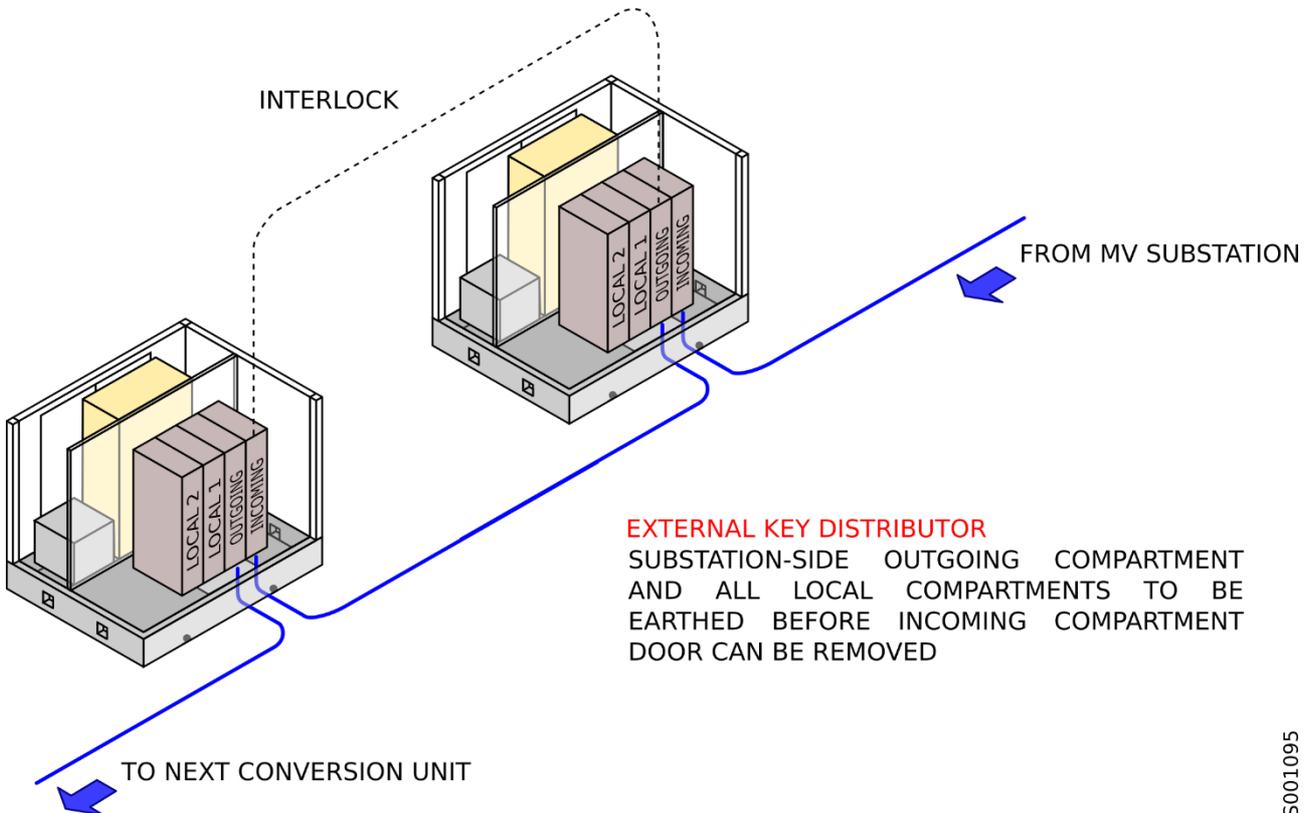
- Full segregation of the live parts, confined into a sealed stainless-steel vessel, filled with SF6 gas, equipped with vacuum circuit breakers and switch disconnectors;
- Earthing switches for the power cables;
- Mechanical interlocks for the correct operation sequence.
- For fuse-protected units, safe access to fuses with pre-emptive earthing;

The MV switchgear composition may vary according to specific project requirements, please refer to final electrical and mechanical schematic for the applicable configuration.

The MV switchgear is typically composed as follows:

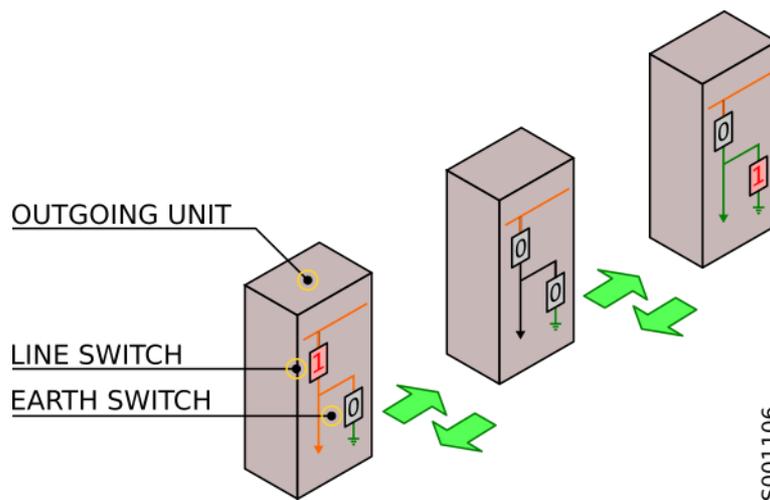
- **incoming line unit**

The incoming line unit is used to connect the incoming MV cables. No disconnect device is integrated into this unit. The front lid can be interlocked with the upstream disconnect switch via a key distributor.



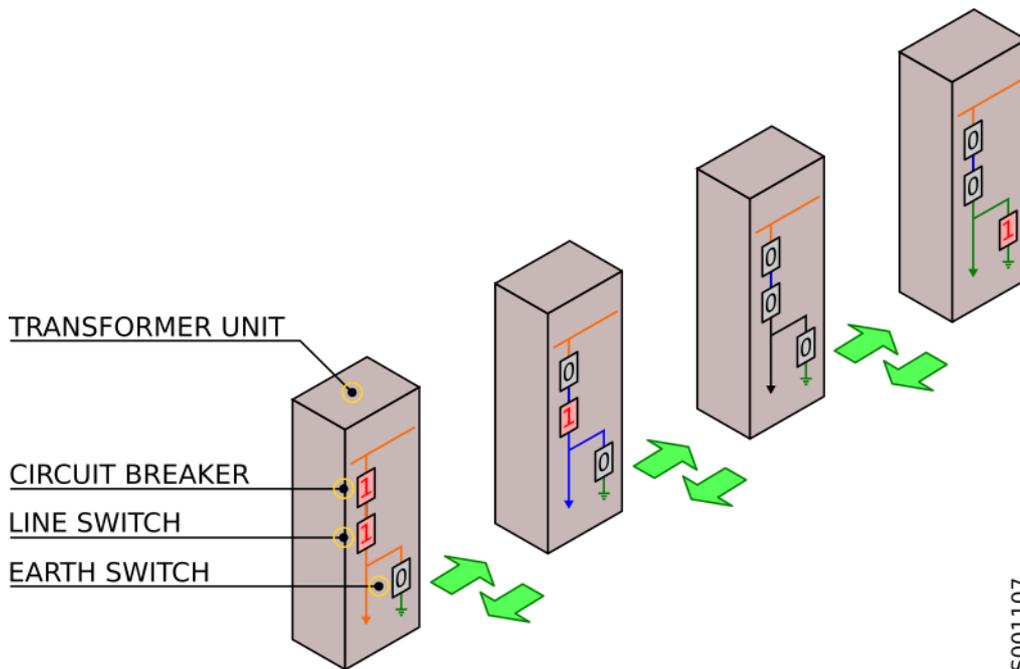
- **outgoing line unit**

The outgoing line unit integrates a switch disconnector and an earthing switch (or, equivalently, a three-position switch). Each switch is operated via a lever and a front panel actuating slot. Mechanical interlock internal to the switchgear ensures the two switches must be both open before closing any of them.



• **transformer protection unit(s)**

Each transformer protection unit integrates a line switch-disconnector, an earthing switch (or, equivalently, a three-position switch) and either fuses or a circuit breaker as a protection device.



• **gas exhauster**

Depending on MV switchgear and MV cabin configuration, a gas exhauster may be installed in the rear or side of the switchgear. Low-pressure SF6 gas avoids fire. An overpressure safety valve, located beneath the cabinet, allows gas exhaustion. A pressure gauge allows constant monitoring of the pressure inside the metal enclosure. Isolation with SF6 gas of all the live parts also reduces to a minimum the probability of faults between the phases or to ground.

• **external interlock keys**

The outgoing and transformer units come with three keys each for interlocking with external devices:

- key “LO” which can be extracted when the line switch is open and must be in place for the switch to close

- key “EO” which can be extracted when the earth switch is open and must be in place for the switch to close
- key “EC” which can be extracted when the earth switch is closed and must be in place for the switch to open

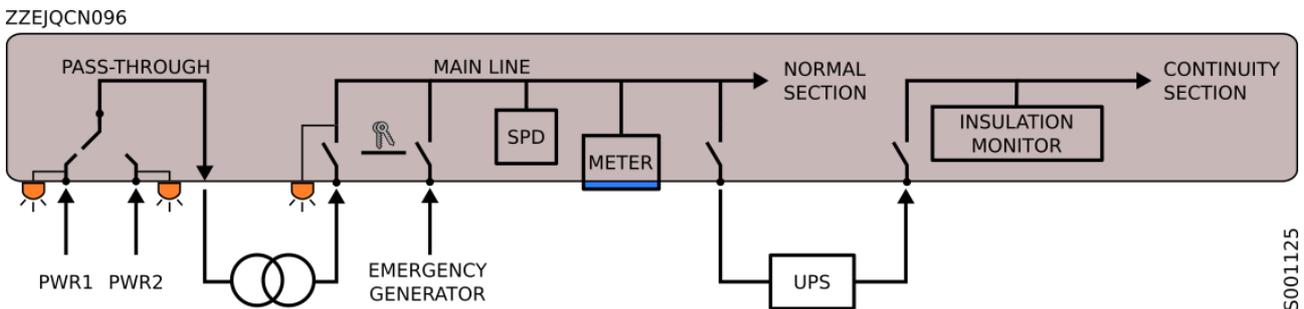
For more information on the MV switchgear, please refer to the applicable user manuals.

3.5.2 Auxiliary cabinet

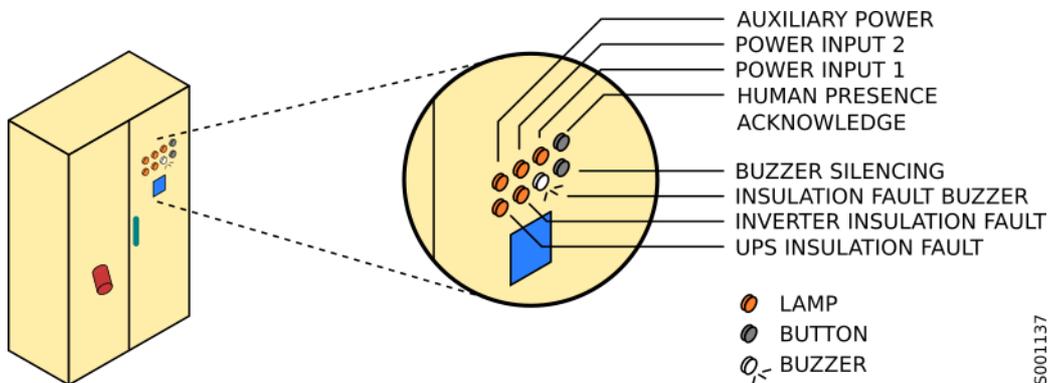
Sunway Power Conversion Units integrate an auxiliary cabinet housed in the LV room of the MV/LV cabin. This cabinet implements a diverse set of functions on a per-project basis:

- Distribution of power supplies to Sunway Power Conversion Unit components
- Distribution of UPS-backed power supplies to Sunway Power Conversion Unit components
- Measurement of consumption associated with local power supplies
- External data network entry point, either via fiber optic or Ethernet connection
- Networking of all Sunway Power Conversion Unit components
- Sunway Power Conversion Unit status and signal monitoring via remote I/Os devices
- Logging thanks to Enertronica Santerno’s Bridge Mini datalogging

The picture below shows a reference configuration of an auxiliary cabinet from the standpoint of power supplies distribution.



The typical auxiliary cabinet front panel features some feedback devices (visual and acoustic) and controls and a socket to connect an external emergency generator.



Provided the auxiliary cabinet may be extensively customized based on project requirements, please refer to the final electrical schematics for further details on the exact configuration of the auxiliary cabinet of interest.

3.5.3 Auxiliary transformer

The auxiliary transformer supplies auxiliary voltage to all the Sunway Power Conversion Unit services and is typically installed inside the LV room. Terminals are protected against direct contacts by means of an insulating sheet. The auxiliary transformer's primary winding is powered by the secondary winding of the MV/LV transformer, while its secondary winding output is fed into the auxiliary cabinet.

DANGER



THE TRANSFORMER TERMINALS MAY BE LIVE EVEN WHEN THE ROOM IS OFF DUTY. BEFORE ACCESSING THE TERMINALS, REMOVE VOLTAGE FROM ALL THE CONNECTED POWER SUPPLY SOURCES.

3.5.4 UPS

The LV room houses the UPS for the power supply of the Sunway Power Conversion Unit main loads even in case of power outages.

The UPS is a single-phase dual conversion UPS with automatic bypass in case of overload or power failure. The UPS input is powered by auxiliary cabinet. The UPS output is fed into a single-phase transformer isolating the continuity section of the auxiliary cabinet (IT system). The UPS integrates and indication relay board, controlling 6 isolated-contact signals to send SCADA information about the UPS status.

The UPS may be equipped with additional batteries to extend the backup time in case of outages.

DANGER

The UPS includes a power supply source, i.e. the battery. The UPS battery may be live even when the UPS is not connected to its input power supply.



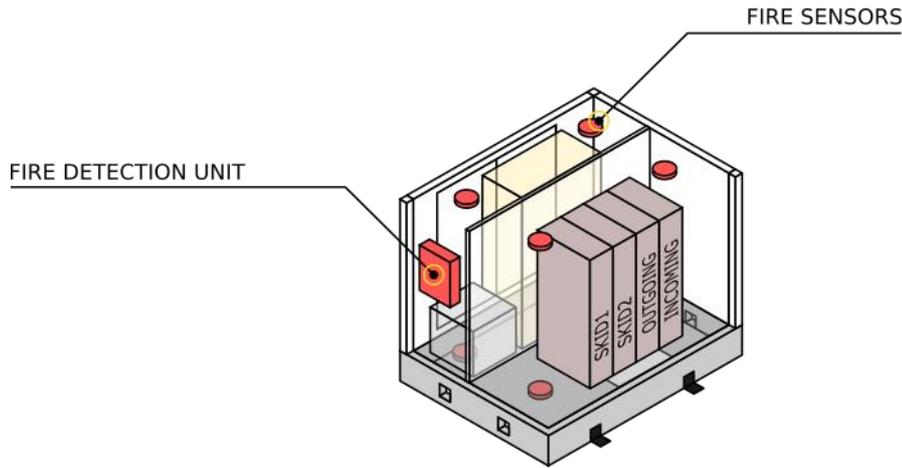
Do not tamper with or try to open the UPS battery. The UPS battery is watertight, does not require maintenance and contains harmful and polluting substances. Do not power on the UPS if you notice liquid leakage or white powder.

If the additional UPS battery kit is fitted and if batteries are to be kept OFF for a long time, set the ON_OFF switches located on the back of the battery pack case to OFF position.

3.5.5 Fire detection system

The MV/LV cabin may be equipped with a fire detection system, comprising:

- a control unit including a relay card for SCADA system and two sealed lead batteries. It complies with EN54 parts 2 and 4
- the optical smoke detectors sensitive to light emission. They are connected directly to the control unit of the fire detection system and are certified in compliance with EN54, part 7.
- Siren and strobe light for external visual and audio alarm signalling



S001103

Location of the smoke sensors may vary depending on customer requirements, please refer to final mechanical drawings for details.

The fire detection system outputs the following signals, all connected to SCADA:

- pre-alarm. This signal is activated when one or multiple sensors of the same zone are active. Lamp HL turns on when the pre-alarm output is activated; it may be manually deactivated by the operator by pressing the silencing button fitted on the control unit.
- Alarm. This signal is activated when one or multiple sensors of different zones are active. Activation of the alarm signal results in
 - circuit breakers opening in the MV switchgear transformer units
 - AC output circuit breakers and DC input disconnect switches opening in the photovoltaic inverters.
 - Siren going out. Siren may be manually deactivated by the operator by pressing the silencing button fitted on the control unit.

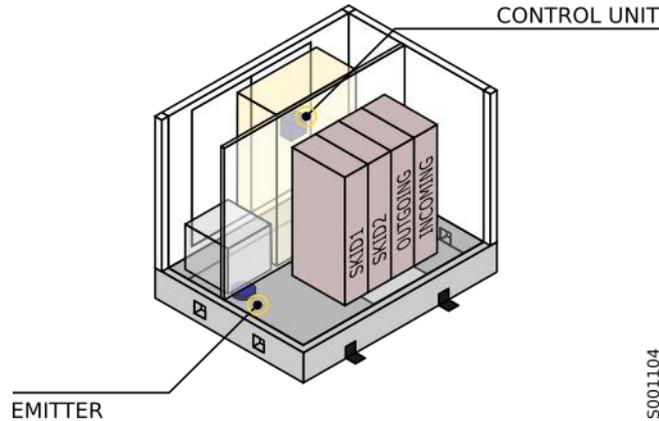
All sensors may be manually reset by the operator by way of the Reset button fitted on the control unit.

3.5.6 Rodent repellent

The rodent repellent system is composed of a control unit installed inside the auxiliary cabinet and an emitter installed inside the concrete base below the MV and LV rooms.

The emitter is an electronic transducer emitting medium-frequency vibrations. These vibrations, within the human audibility limit, have a calibrated acoustic pressure level, propagate through the air and are reflected by non-soundproof solid bodies. The system causes hearing hypersensitivity and disorientation to rodents.

The control unit is provided with a failure contact connected to the signal acquisition system.



5001104

3.5.7 Emergency button



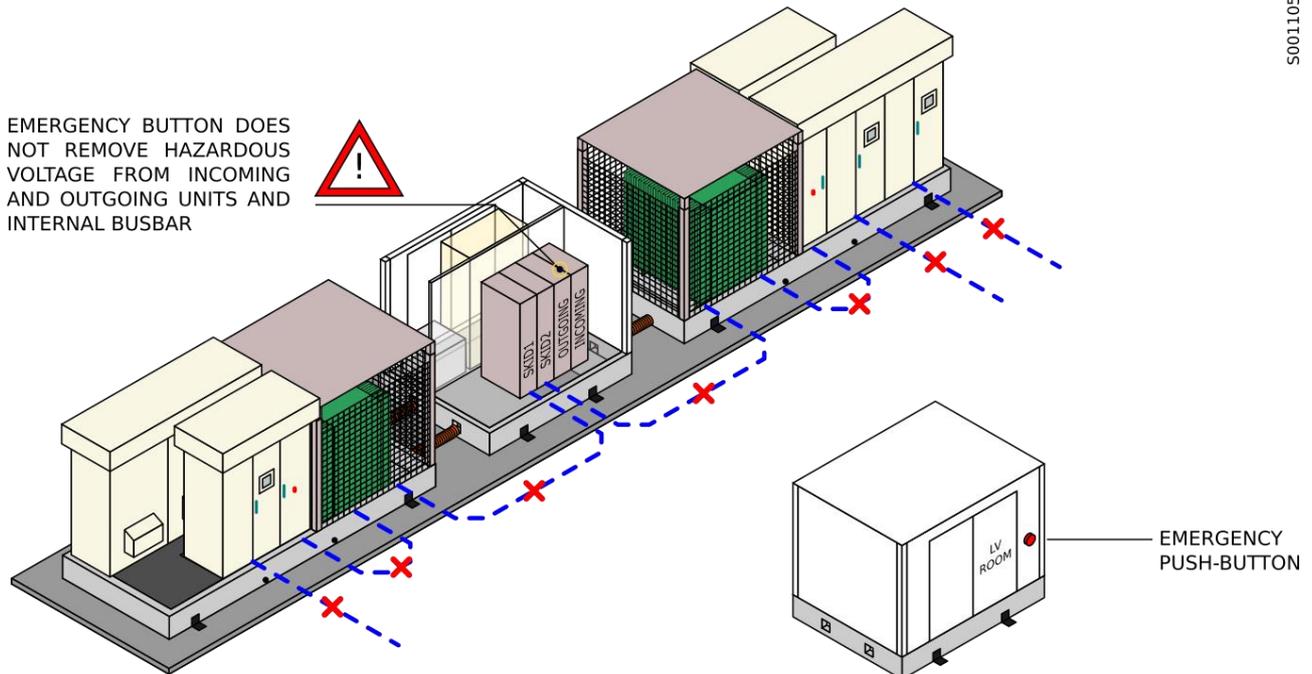
DANGER

Emergency button does not remove hazardous voltage from incoming and outgoing units of the MV switchgear.

Sunway Power Conversion Units may be equipped with an emergency push-button installed outside the MV/LV cabin and protected by a safety glass.

Breaking the glass with the hammer bundled with the emergency button releases the button, which in turn triggers the emergency circuit, resulting in the opening of:

- The disconnecter of all MV switchgear transformer units
- The AC output circuit breaker of the inverters
- The DC input circuit breaker of the inverters



5001105

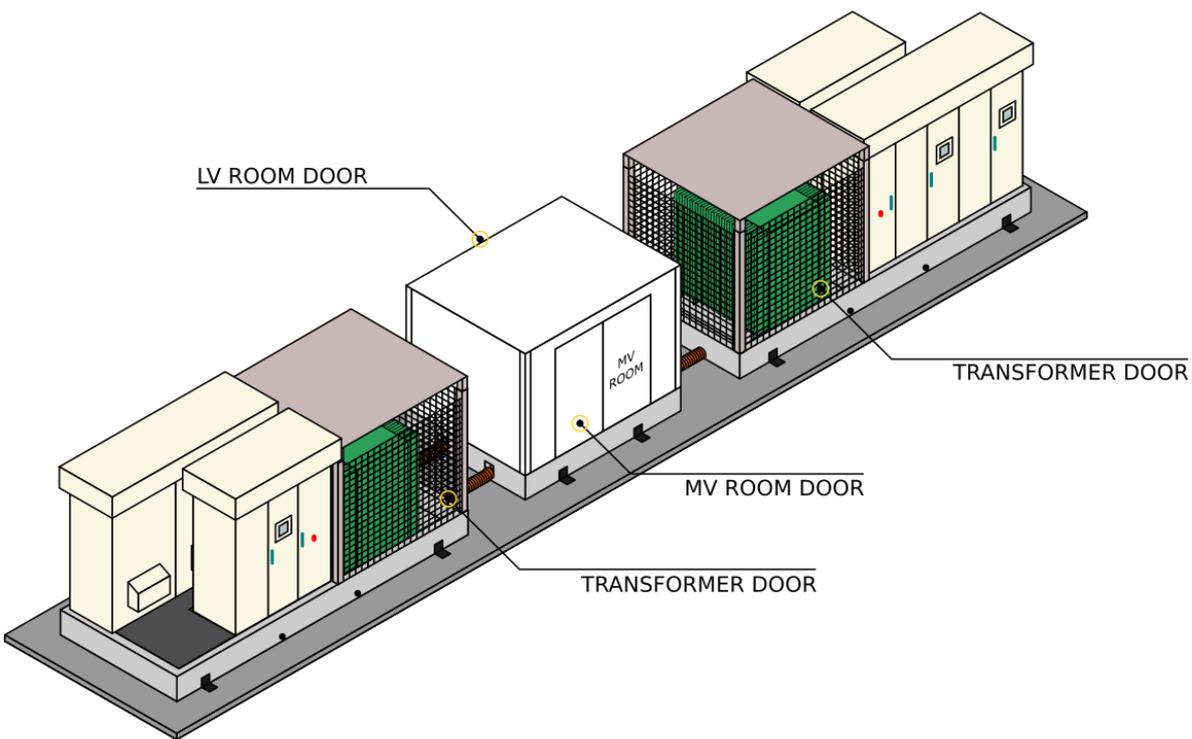
3.5.8 Human presence detection system

Sunway Power Conversion Units may come with a human presence detection system. Microswitches fitted on the LV room door, MV room doors and transformer doors trigger a visual feedback both on the auxiliary cabinet and the MV/LV cabin. A human presence signal is also activated and acquired by a remote I/O device, which makes it available to SCADA.

When any of the monitored doors is opened, the human presence detection system is triggered and the opening of the door is signalled visually on the MV/LV cabin and digitally to SCADA.

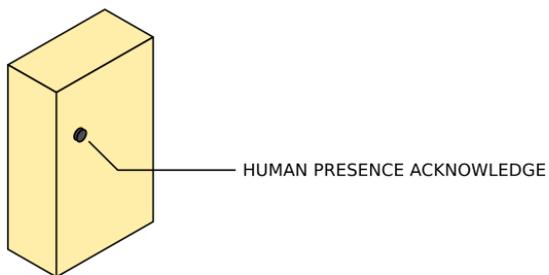
If the opening of the door is carried out by authorized personnel, they should acknowledge their presence by pressing the human presence acknowledge button on the front panel of the auxiliary cabinet. This deactivates the human presence detection system and all related signals.

After completion of works and closing of all doors, human presence detection system must be restarted by pressing the human presence reset button on the LV room external wall.

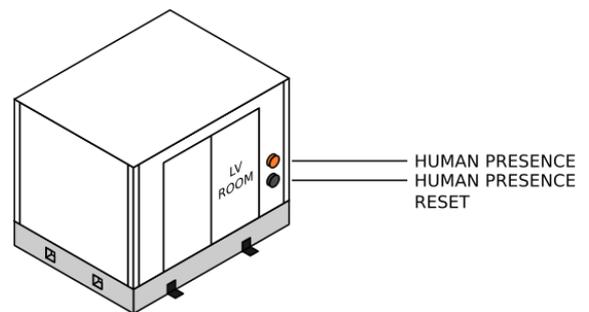


S001102

AUXILIARY CABINET

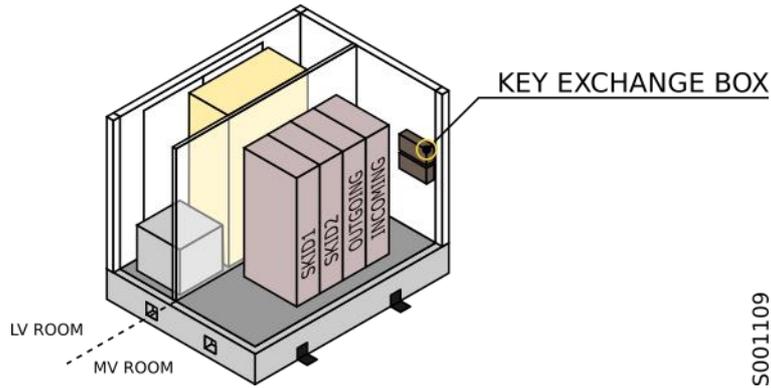


MV/LV CABIN



3.5.9 Key exchange boxes

Sunway Power Conversion Unit is equipped with key exchange boxes to ensure the MV/LV transformer doors can be opened only when no hazardous voltage is present on any transformer terminal.



Each key exchange box allows extraction of the associated transformer door key only when the respective inverter AC output circuit breakers and the MV switchgear transformer unit switch are open (\$6.9).

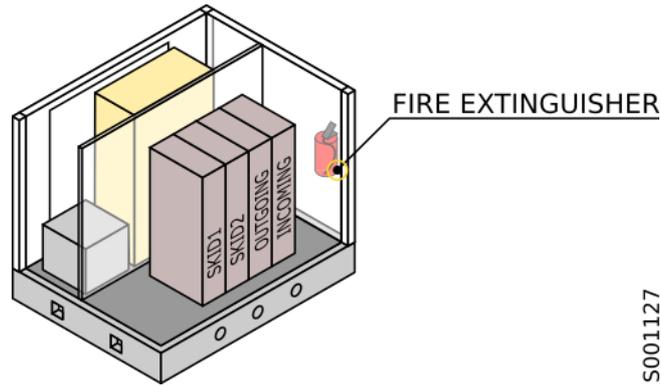
3.5.10 Personal Protective Equipment

The PPE below is supplied with the Sunway Power Conversion Unit:

Location	Description	Specifications
MV/LV cabin	Fire extinguisher	Powder or CO ₂ , as per local regulations.
MV room	Dielectric gloves	Testing voltage: 40 kV Operating voltage: 36 kV Length: 36 cm Compliant with European Standard CEI EN 60903 and ENEL EA 0065 unification table
MV room	Isolating mat 1000x500 mm	Testing voltage: 40 kV. Operating voltage: 36 kV. Thickness: 4mm. Grey, non-slip surface. With testing marking. Compliant with Standard CEI-IEC 1111 and CEI-ENV 61111.

3.5.11 Fire extinguisher

A fire extinguisher is installed on a side wall, external to the MV/LV cabin.



S001127

3.5.12 Doors

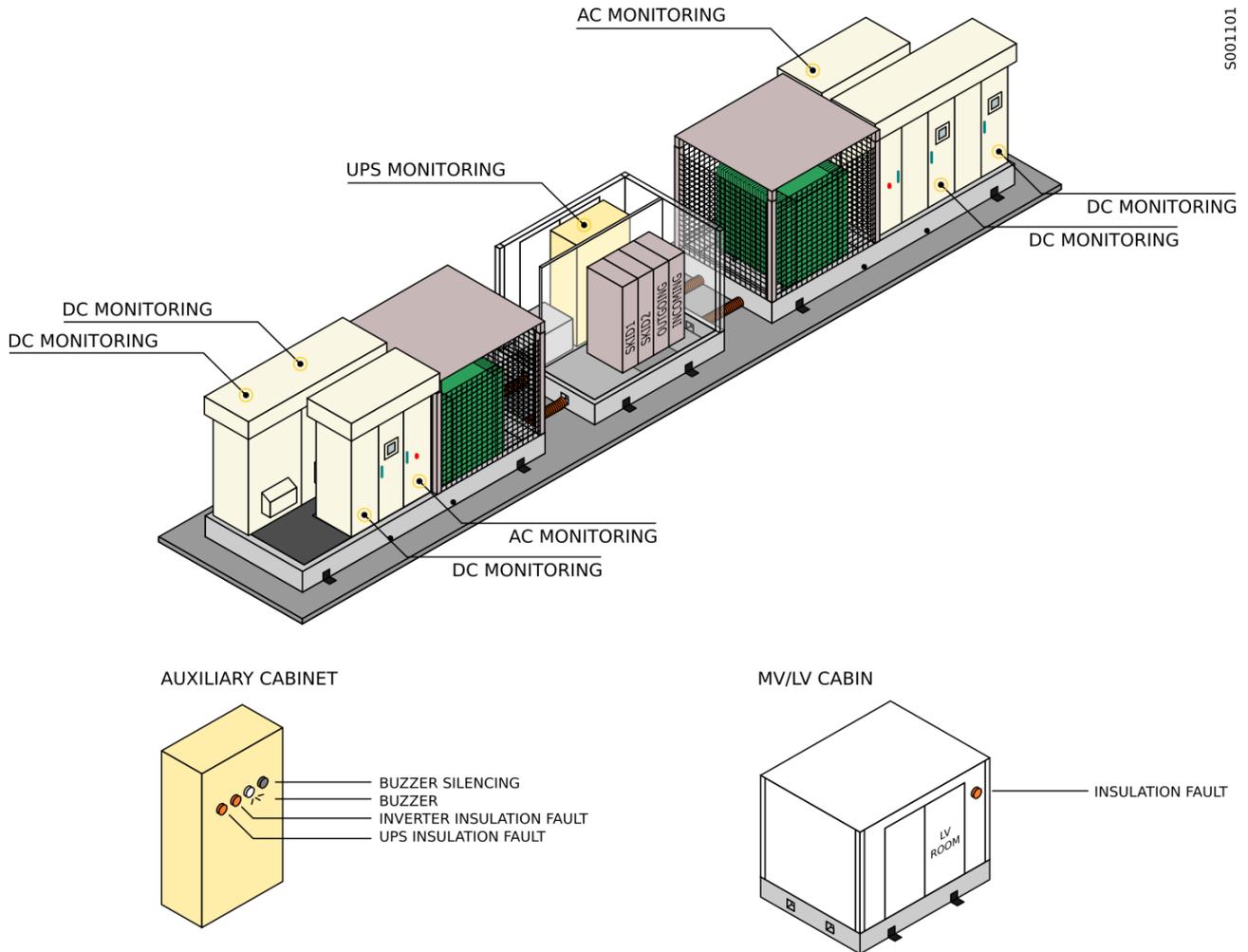
Air filter grilles with G3 class filtering felts are installed on all the doors.

3.6 Insulation fault monitoring

Isolation controls are implemented for the following circuits on a per-project basis:

- Inverter DC side. Insulation is monitored by a custom dedicated device integrated in the inverters. One device per independent MPPT is shipped with every conversion unit.
- Inverter AC side. Insulation is monitored by a commercial device integrated in the AC module of the inverters. One device per MV/LV transformer secondary winding is shipped with every conversion unit.
- UPS distribution side. Insulation is monitored by a commercial device integrated in the auxiliary cabinet.

Visual and audio feedback about the status of insulation at all points is provided on the front panel of the auxiliary cabinet. Visual feedback is also provided external to the MV cabin.



UPS Distribution Circuit Isolation Fault Control

When the control device detects a lower resistance than that of the preset threshold:

- Sends a signal to the signal acquisition system
- Turns on the lamp installed on the auxiliary cabinet front, activates the buzzer installed on the auxiliary cabinet front panel. The buzzer may be silenced by means of the button located on the auxiliary cabinet front panel.

Inverter AC Lines Isolation Fault Control

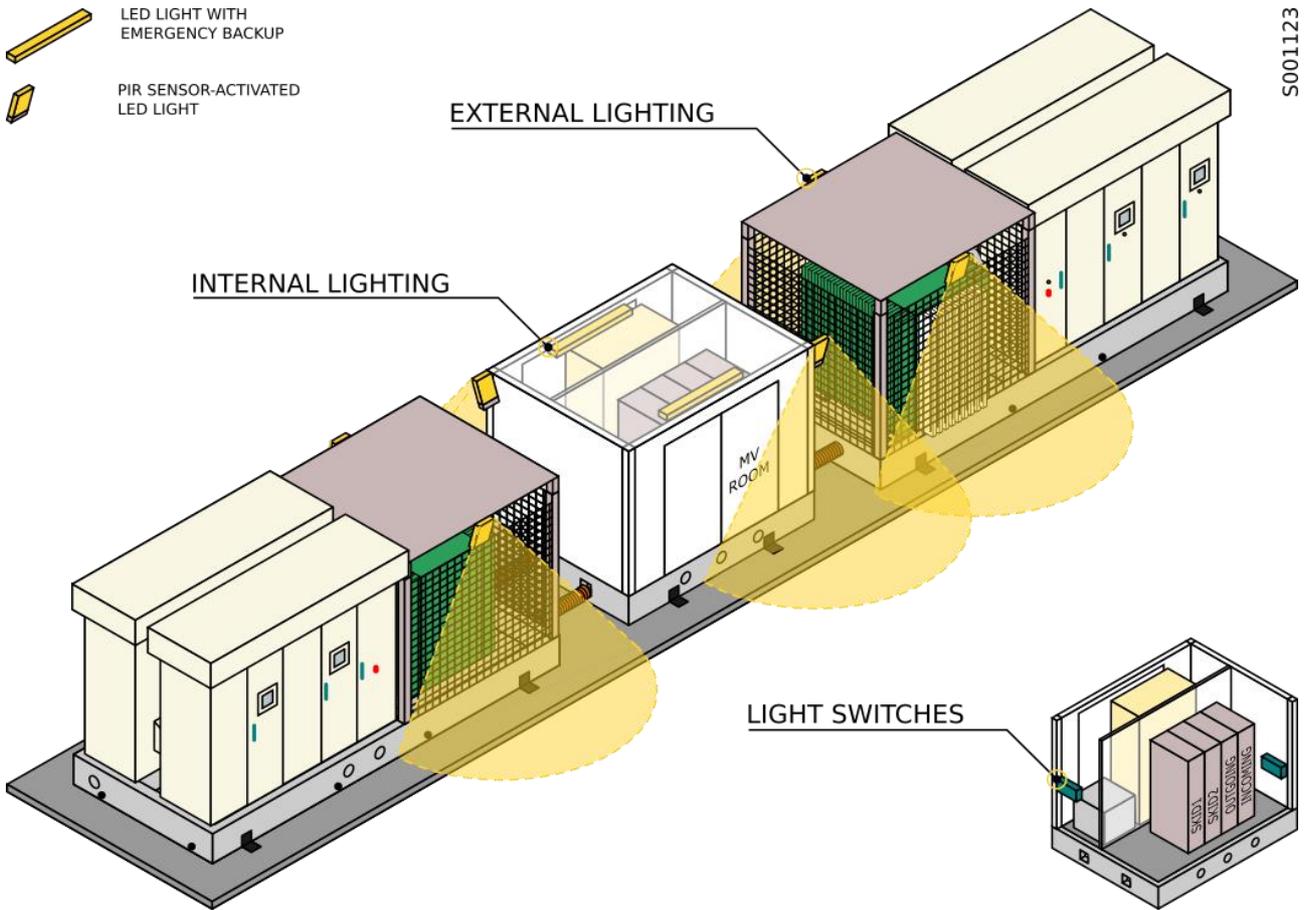
When the control device detects a lower resistance than that of the preset pre-alarm threshold:

- Sends a signal to the signal acquisition system

When the control device detects a lower resistance than that of the preset alarm threshold:

- Sends a signal to the signal acquisition system
- A warning message is shown on inverter displays, activates the lamp and the buzzer installed on the auxiliary cabinet front panel. The buzzer may be silenced by means of the button located on the auxiliary cabinet front panel.

3.7 Lighting system and sockets



3.7.1 Internal Lights

Internal lights can be turned on manually by means of dedicated switches installed in the MV room and in the LV room.

Internal lights feature an emergency mode thanks to which they automatically turn on in case of blackouts.

3.7.2 External Lights

External lights are activated by two PIR sensors installed on the MV cabin sides. PIR sensor on the MV room side activates the external MV room light and the transformers' lights on the same side. PIR sensor on the LV room side activates the external LV room light and the transformers' lights on the same side.

External lights can also be turned on manually by means of dedicated switches installed in the MV room and in the LV room. Switches control all lights on the same side of the room in which they are installed.

3.7.3 Power sockets

Power sockets for custom loads are available in both the LV and MV rooms. Please refer to final schematics for details on socket configuration and specifications.

3.8 Warning signs and logos

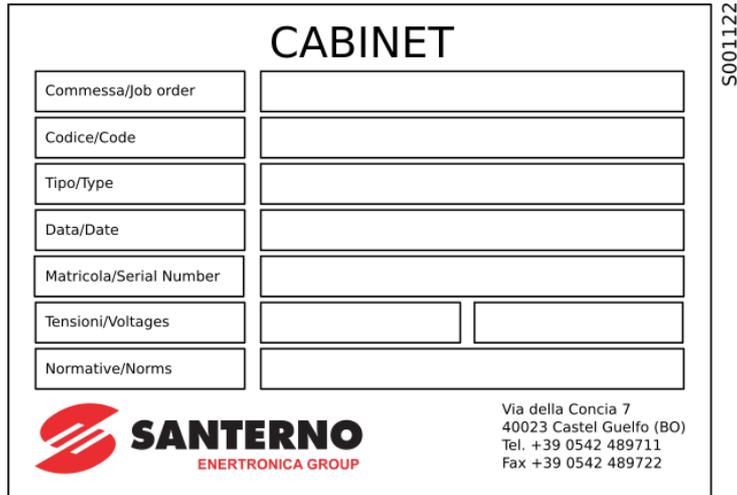
Nameplates and warning signs on how to identify and lift the Sunway Power Conversion Unit are installed inside and outside the Sunway Power Conversion Unit.

3.9 Nameplates

The identification data of the Sunway Power Conversion Unit are given on a 250x150 mm nameplate:

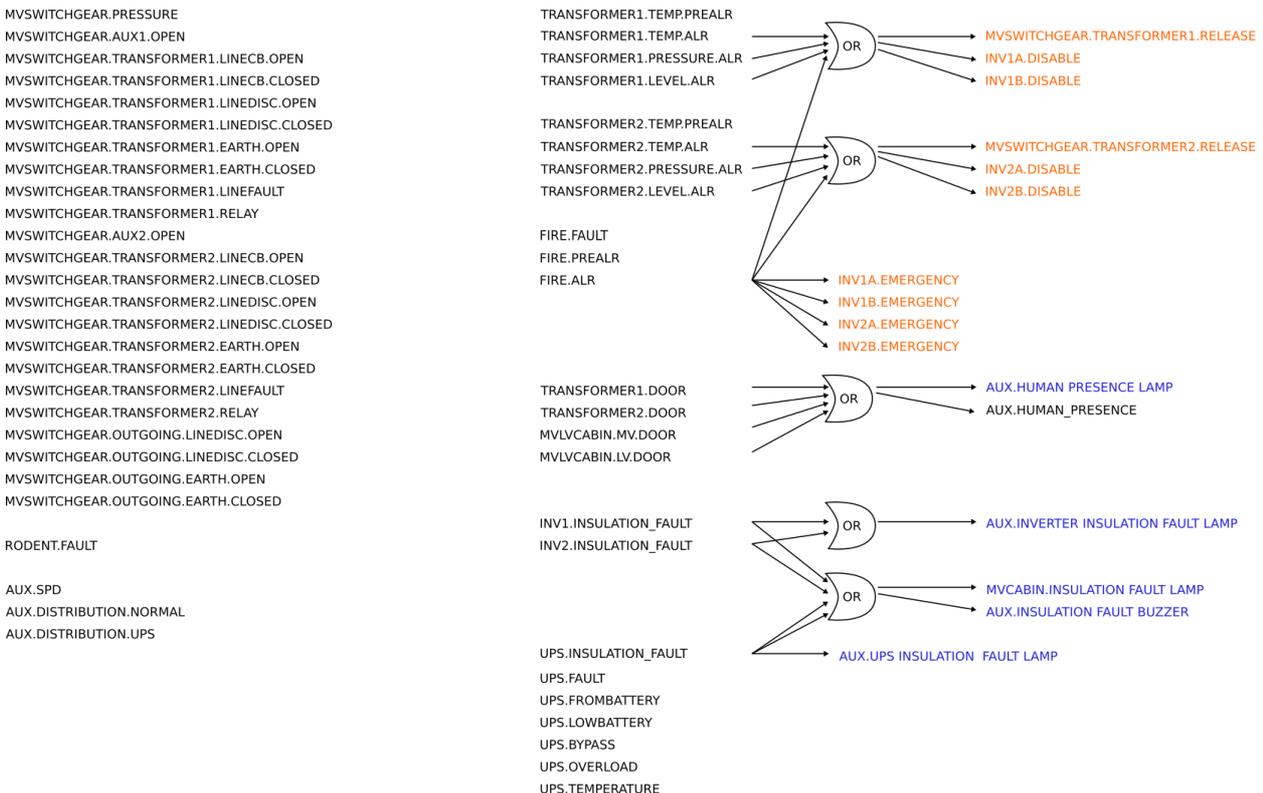
- Job order, Part Number (Code), Type and Serial Number
- Maximum DC voltage inside the Sunway Power Conversion Unit with reference to Low Voltage
- Rated AC voltage in the Sunway Power Conversion Unit with reference to Low Voltage
- Rated AC voltage in the Sunway Power Conversion Unit with reference to Medium Voltage
- Reference standards

Example of a nameplate:



3.10 Signals

A complete set of status, warning and alarm signals is available to be transmitted to the SCADA. In case that a risk for personnel is detected, also local alarms are activated and proper actions takes place.



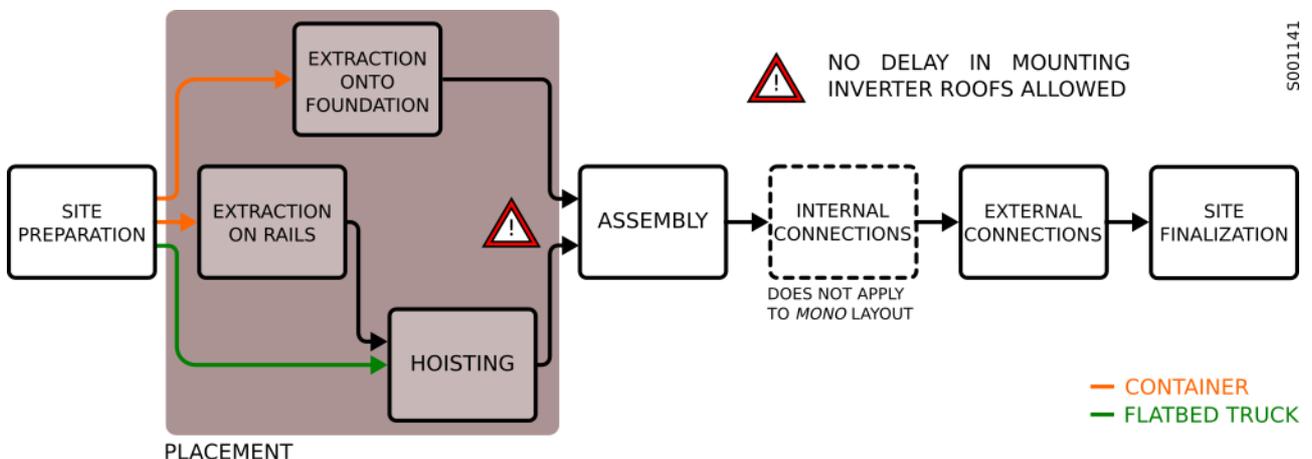
4 INSTALLATION

This section includes the guidelines for the site preparation, placement and assembly of the Sunway Power Conversion Unit and its parts.

4.1 Workflow

Sunway Power Conversion Units are installed by following a workflow comprising the following phases:

- Site preparation. In this phase site is prepared for receiving the Sunway Power Conversion Unit. Civil works are carried out, readying the concrete foundation and clearing the surrounding area to provide adequate room for the next phases. For details about this phase refer to §4.2.
- Placement. Sunway Power Conversion Unit is placed onto its concrete foundation. For details about this phase refer to §4.3.
- Assembly. Depending on the shipping method, some components may be shipped unmounted due to space constraints (e.g. shipment in containers). Assembly of these components takes place after placement, in the meanwhile keep the partially mounted equipment protected from weather conditions. For details about this phase refer to §4.4.
- Internal connections. This phase applies to dual layout Sunway Power Conversion Units only. It consists in routing all cables connecting the Sunway Skids and the MV/LV cabin. These operations are carried out by Enertronica Santerno staff only and are thus out of the scope of this manual.
- External connections. Once the Sunway Power Conversion Unit rests fully assembled on its concrete foundation, external connections are to be completed. Sunway Power Conversion Unit must be connected to plant earth mesh, MV grid and photovoltaic panels. For details about this phase refer to §5.2.
- Site finalization. After completing the external connections, site can be brought into its final state. For details about this phase refer to §5.3.



4.2 Site preparation



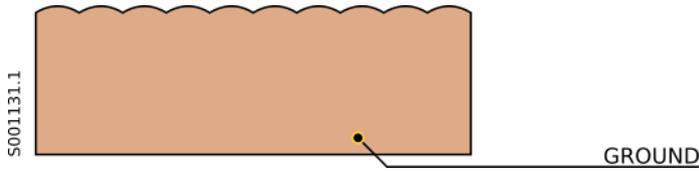
NOTE

The activities described in this paragraph are **NOT** included in Enertronica Santerno scope of work

The recommendations below are given as best practice and consolidated procedure to prepare the construction site for the Sunway Power Conversion Units. Peculiar site conditions (friability, slopes, etc) might require more complex and special foundations that shall be evaluated site by site.

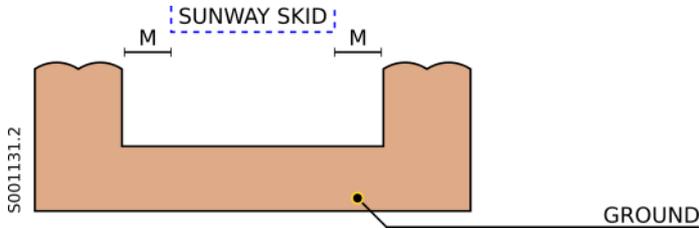
Sunway Power Conversion Units must be placed on the land surface level, not at a lower level than the natural water drainage level. Pipes and pits must be placed at a lower level than the concrete base level, in order to prevent water from flowing into the base of the skid.

The soil study and the strengthening works are not included in Enertronica Santerno scope of work.

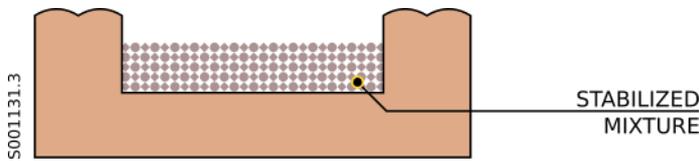


The excavated area must be 0.5m per side wider than the concrete base of the skid.

$$M \geq 0.5 \text{ m}$$

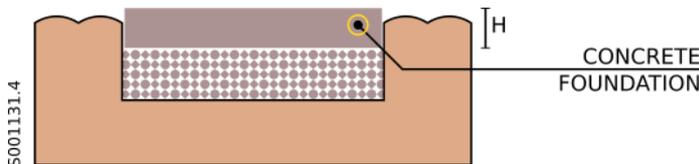


The excavated area is filled up with stabilized mixture.

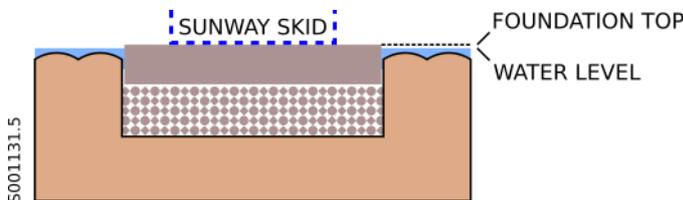


A 10 cm-high layer of lean concrete is laid. The laying surface must be perfectly horizontal and flat.

$$H \geq 0.1 \text{ m}$$



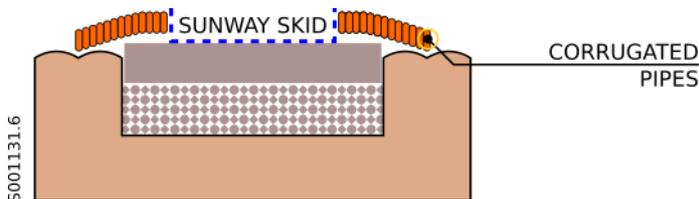
Please refer to §0 and §4.2.2 for further prescriptions about concrete foundation characteristics.



WARNING



Avoid installing Sunway Power Conversion Units where the ground sinks due to water stagnation and/or flooding due to heavy rain may occur.



The corrugated pipes are laid from the side or straight from below depending on cables' bending radius or routing convenience. A layer of fill material can be used to cover the pipes and give easy access to the equipment.

Technical details and design of the concrete foundation must be defined based on the final Sunway Power Conversion Unit drawings. Typically, the concrete foundation features:

- piping for routing cables in the exact position required to match cable inlets of the Sunway Power Conversion Unit concrete bases
- pits for rainwater and oil management
- earth mesh connection
- bushings for fixing anchoring brackets (§5.3.1)

4.2.1 Concrete foundation specifications (hoisting)

If the product is placed on its concrete foundation by lifting it, the concrete foundation shall be designed and realized flat and able to properly support the overall weight of product without sagging.

Surface planarity tolerance shall only be negative (concavity), no positive tolerance (convexity) is acceptable. Tolerance values shall be compliant to UNI 10462, SANS 2001-CC1 or other applicable local standards.

4.2.2 Concrete foundation specifications (sliding)

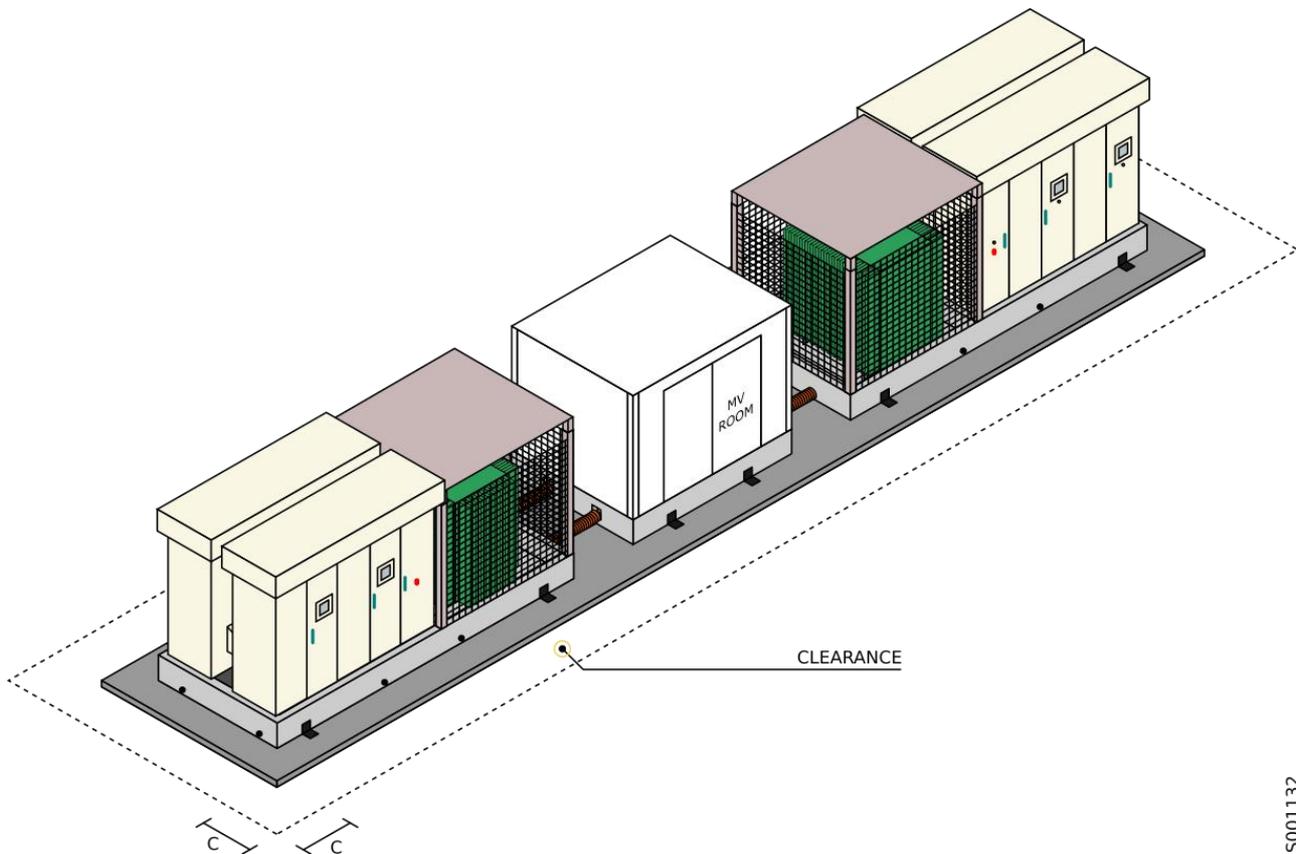
If the product is placed on its concrete foundation by sliding it, the concrete foundation shall be designed and realized flat and able to properly support the overall weight of the product without sagging, even during the operation of sliding, thus taking into account the additional mechanical stress which may arise during the sliding.

Surface planarity tolerance shall only be negative (concavity), no positive tolerance (convexity) is acceptable. Tolerance value on surface planarity shall be -10 mm. Other tolerance values shall be compliant to UNI 10462, SANS 2001-CC1 or other applicable local standards.

4.2.3 Clearance

A minimum clearance is required on all sides of the Sunway Power Conversion Unit. Site must be prepared so that it complies with this requirement.

Condition	Clearance C
Placement and Assembly	15 m
Final site configuration	3 m



S001132



NOTE

A greater clearance may be required for the access road (if any) in order to ensure that vehicles do not run or manoeuvre too close to the Sunway Power Conversion Unit.

4.3 Placement

It is the Client's responsibility to make sure that the requirements affecting the placement of all parts of the Sunway Power Conversion Unit - such as logistics, road communications for the transport of heavy loads, utilization of special transport means - are met. Enertronica Santerno, or authorized third party, may carry out on-the-spot investigations to inspect the site and the progress of work.

The minimum requirements for the placement of the Sunway Power Conversion Units are:

- The construction site shall allow heavy goods vehicles to pass through. Heavy goods vehicles will have a 60 T gross weight and won't be fit to run off-road. It is therefore required that the road surface is load-bearing and plain, with maximum 5% slope.
- Make sure that a truck crane can enter the installation site; also consider the room for manoeuvre required.
- To properly hoist the Sunway Power Conversion Unit or the container that contains the Sunway Power Conversion Unit, the crane shall have a lift capacity of 40 T, even at the longest arm extension required by the lifting procedure.
- To pull the Sunway Power Conversion Unit out of the container, a truck having a pulling capacity of 4 T shall be used. The truck shall be able to complete the operations on the ground conditions expected at the site. Alternatively, a winch with the same pulling capacity (engine & cable) and cable length of 15m can be used.
- The rigging equipment to hoist each part of the Sunway Power Conversion Unit is described further down in this manual. The rigging equipment to hoist the ISO 40 ft. High Cube container shall be suitable for this purpose.
- The truck crane shall be placed close to the installation site, not over 7 m far from the truck crane centre/excavation-foundation centre.
- The radius of curvature of the access road must be of at least 25 m.
- The minimum room for manoeuvring the crane arm must be 15 m in the air.
- The room for manoeuvring the truck and the crane must be of at least 30x30 m over tamped ground.
- The roadway must be at least 3 m wide.
- During the placement and assembly procedure, the clearance surrounding the installation place shall be free of obstacles (electrical cables, telephone cables, etc.) for at least 15 m from the installation perimeter and height.
- If Medium Voltage lines are to be found within the clearance surrounding the installation place, voltage must be removed from the MV line before placement and assembly of any part of the Sunway Power Conversion Unit.
- 8 M30 hooking bolts, certified working load 4 T, are required to extract a Sunway Skid from the container and hoist it with a crane. A dedicated, custom tool may be necessary to connect these bolts to the concrete base of the Sunway Power Conversion Unit parts.
- The Sunway Power Conversion Unit shall not be installed when traffic is forbidden or on Sundays and public holidays.

Rigging equipment, hooks, hooking bolts, spreader bars, shackles, ropes, rails, anchoring brackets and any other equipment necessary to properly handle and transport the Sunway Power Conversion Unit are out of Enertronica Santerno's scope of work. These parts can be provided by Enertronica Santerno on request and shall be agreed upon at the purchase order stage.



WARNING

Always contact Santerno about hooking items specifications before extraction and lifting operations.

**WARNING**

Hooking items are not included and must be ordered separately.

**DANGER**

Observe all the health and safety prescription of the regulations in force

4.3.1 Safety

Transportation, loading and unloading is governed by national H&S rules. All operations must be carried out in compliance with local regulations.

4.3.2 Preliminary notes

Sunway Skids and MV/LV cabins can be shipped and delivered to the site inside a 40 ft. High Cube ISO container or on a flatbed truck.

If shipped inside a container, the product is equipped with low profile sliders / rollers and suitable M30 threaded bushings integrated into the concrete base to help pulling it out of the container. It may be placed onto its foundation:

- by extracting it from the container directly onto the concrete foundation
- In a two-step fashion, by extracting it from the container onto rails, hence hoisting it onto the concrete foundation by means of a crane.

Before extracting the product from the container, all ancillary material found in the container must be removed (§ 4.3.3).

If shipped on a flatbed truck, Sunway Power Conversion Unit parts can be hoisted directly from the truck onto the concrete foundation.

4.3.3 Extraction of ancillary material

Before extracting the product from the container, all ancillary material found in the container must be removed. In particular, Sunway Skids for outdoor installation are shipped along with a wooden box containing the roof of the inverter(s), to be mounted once the Sunway Skid rests on its concrete foundation. The wooden box(es) must be removed from the container before extraction.

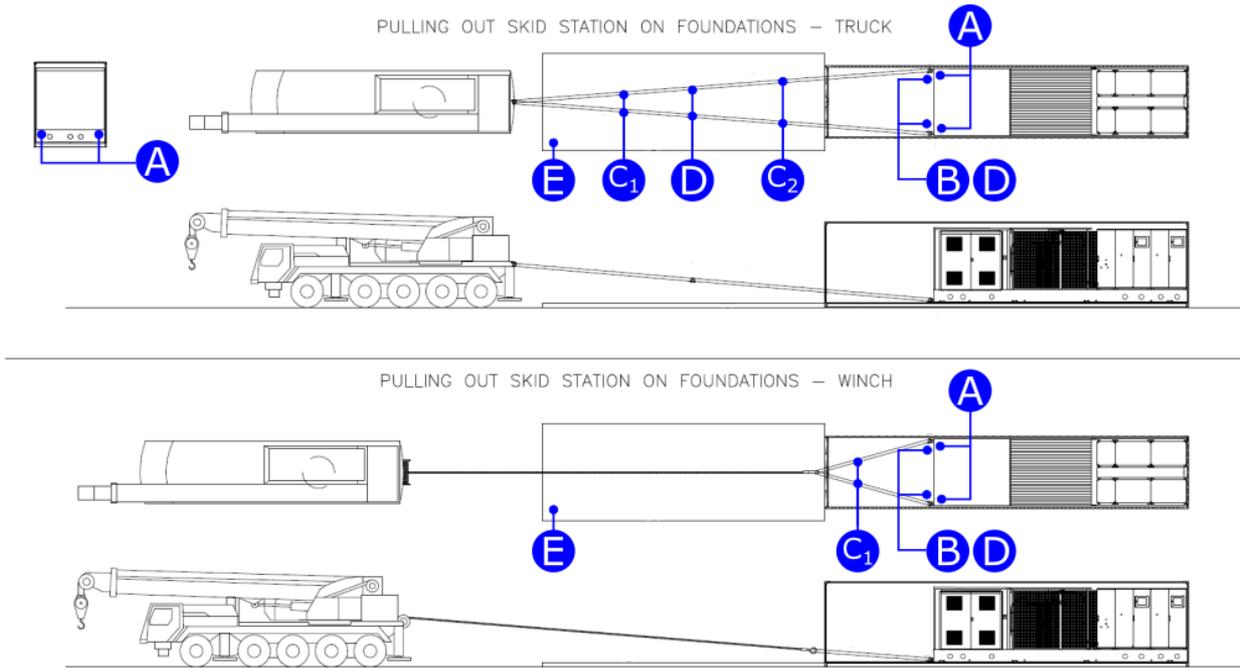
4.3.4 Extraction onto the Concrete Foundation**NOTE**

Eyebolts are not included in Enertronica Santerno's standard scope of work and must be ordered separately.

Extraction of the Sunway Power Conversion Unit parts from container can be carried out by sliding the Sunway Power Conversion Unit directly onto the receiving concrete foundation. This operation must be done on a flat ground, while the container internal floor is levelled to the concrete foundation and perfectly aligned.

Clearance in front of the container shall be equal to the length of the foundations + 15m + the length of the truck used to pull the Sunway Power Conversion Unit out.

In case that a winch is used, the clearance can be reduced to the length of the foundations + 5m + the length of the means equipped with the winch.



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ID	Item	Description
A	Pulling points	M30 threaded
B	Pulling hooks	M30 eyebolts Working load = 4 tons
C	Pulling ropes	Ropes, belts or chains C1: n.2, working load = 8 tons, length = 6m C2: n.2, working load = 8 tons, length = 8m
D	Shackles	n.6, working load = 8 tons
E	Foundations	Must meet requirements defined in 4.2.2

The product must be extracted from the container complying with the following procedure:

1. Clean up the surrounding area to avoid damage to the product and injuries to the personnel. All obstacles and debris must be removed.
2. Level and compact the ground around the foundation. The area onto which the container is placed shall be lower than the foundations for the internal floor for container to be perfectly levelled with the foundations themselves.
3. Get the container hovering by no more than 30 cm over the landing area.
4. Open the container doors and lock them in open position.
5. Put the container down on the landing area, next to the foundations so that its short edge lies exactly in line with the short edge of the foundation.
6. Check the horizontal alignment and height difference with the foundations.
7. Remove the locking devices between container and the product, used to keep the product in position during transportation.
8. Install the M30 eyebolts in the pulling points of the product.
9. Clean thoroughly the on-site foundations from any debris or obstacle. Even the smaller obstacle could block the pulling operations.

10. Place the truck in front of the container doors, at the opposite side of the foundations, with the tow hook toward the container. If a winch is used, the truck shall be placed at 4m distance from the foundations.
11. Prepare the pulling equipment according to the drawing above.
12. Insert the belts in the eyebolts and in the tow hooks of the truck. Use shackles if necessary.
13. Cordon off the working area using barriers in a 15m radius and warning signs before starting the pulling operations, thus avoiding injuries in case of breakage of a belt.
14. Slowly start pulling the product, moving the truck straight.
15. Check that the product moves out of the container without scratching the walls, adjusting the belts accordingly.
16. Continue pulling the product until it is in the final position.
17. Remove the pulling equipment and the eyebolts from the product.
18. Remove the container.

4.3.5 Extraction from the Container onto Rails



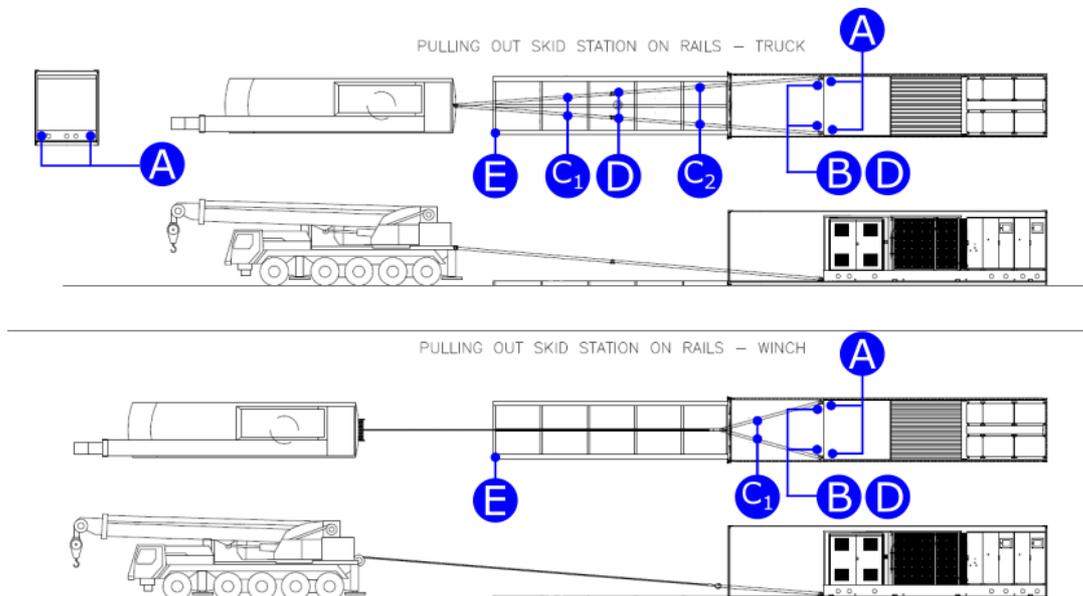
NOTE

Eyebolts, rails and rail brackets are not included in Enertronica Santerno standard scope of work and must be ordered separately.

Extraction of Sunway Power Conversion Unit parts from container can be carried out by pulling them onto rails. This operation must be done on a flat ground, while container floor and rails are levelled and perfectly aligned. Planarity of the ground shall be compliant to UNI 10462, SANS 2001-CC1 or equivalent local standard.

Clearance in front of the container shall be 25m + the length of the truck used to pull the product out.

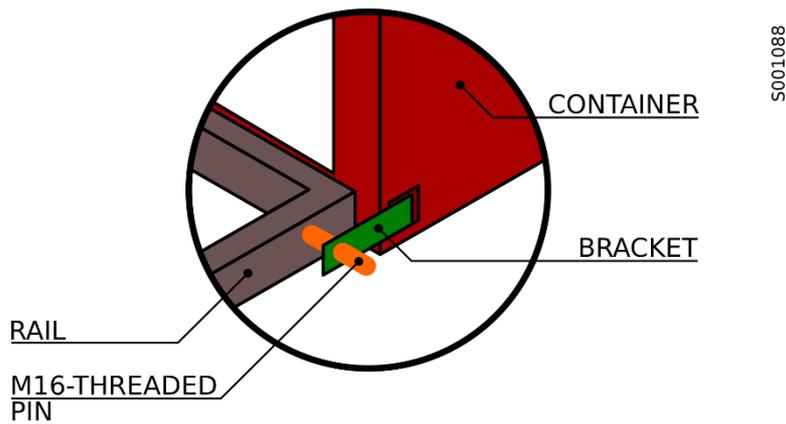
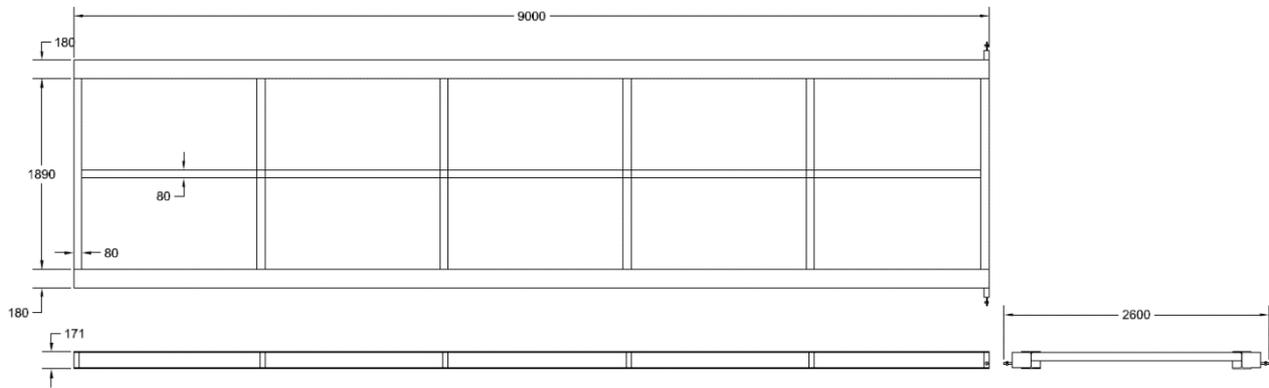
In case that a winch is used, the clearance can be reduced to 15m + the length of the mean equipped with the winch.



S000897

ID	Item	Description
A	Pulling points	M30 threaded
B	Pulling hooks	M30 eyebolts Working load = 4 tons
C	Lifting ropes	Ropes, belts or chains C1: n.2, working load = 8 tons, length = 6 m C2: n.2, working load = 8 tons, length = 8 m
D	Shackles	n.6, working load = 8 tons
E	Rails	Type HEA180, with internal frame n.2, width = 180 mm, height = 171 mm, length = 9 m

RAILS DIMENSIONS



The product must be extracted from the container complying with the following procedure:

1. Clean the surrounding area from any possible obstacle and debris to avoid damage to the product and injuries to the personnel
2. Place the truck in front of the container door, at 10m distance, with the tow hook toward the container. If a winch is used, the truck shall be placed at 14m distance from the container.
3. Open the container doors and lock them in the open position
4. Remove the locking devices between container and product, used to keep the product in position during transportation

5. Install the M30 eyebolts in the pulling points of the product concrete base
6. Place the rails in front of the container
7. Check planarity of the rails, in case level the ground under the rails according to UNI 10462, SANS 2001-CC1 or equivalent local standard
8. Secure the rails to the container corners with the angle brackets, to be bolted to the rails
9. Check planarity and horizontal alignment of the rails with the container, in case adjust the position of the rails
10. Prepare the pulling equipment according to the drawing above
11. Insert the belts in the eyebolts and in the tow hooks of the truck. Use shackles if necessary
12. Cordon off the working area using barriers in a 15m radius and warning signs before starting the pulling operations to avoid injuries in case of breakage of a belt
13. Slowly start pulling the product, moving the truck straight
14. Check that the product moves out of the container without scratching the walls, in case adjust the belts
15. Continue pulling the product until it is completely out of the container
16. Remove the pulling equipment and the eyebolts from the product.
17. Remove the angle brackets from the container and the rails
18. The product is now ready for lifting and hoisting.

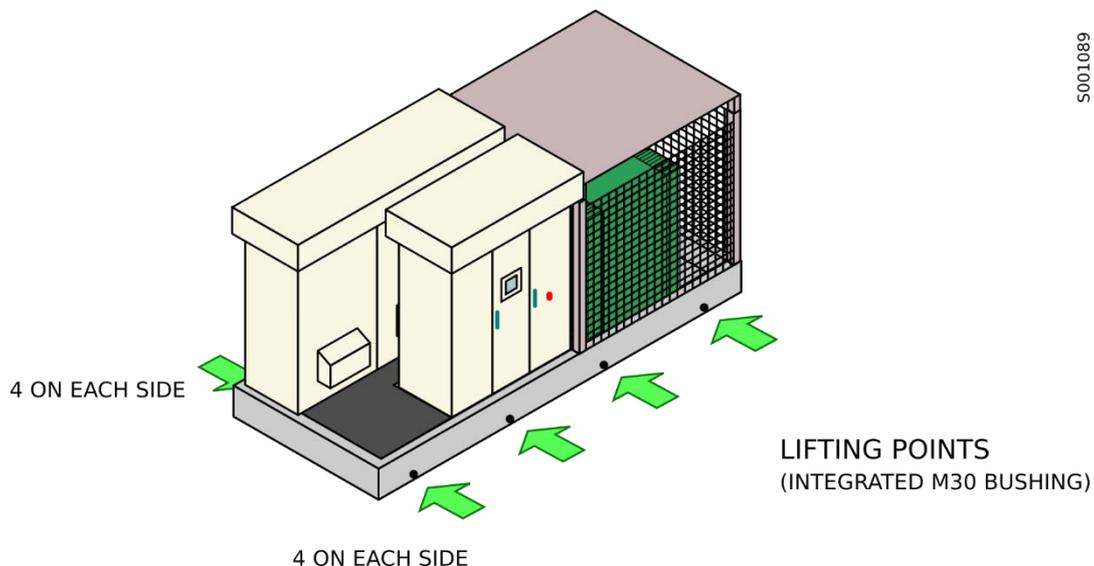
4.3.6 Lifting from a truck, rails or ground



NOTE

Hooking bolts and rails are not included in Enertronica Santerno's standard scope of work and must be ordered separately.

Sunway Power Conversion Unit parts feature some bushings integrated into the concrete base for installing hooking bolts. Hooking bolts can be used to attach belts and lift the product with a crane.

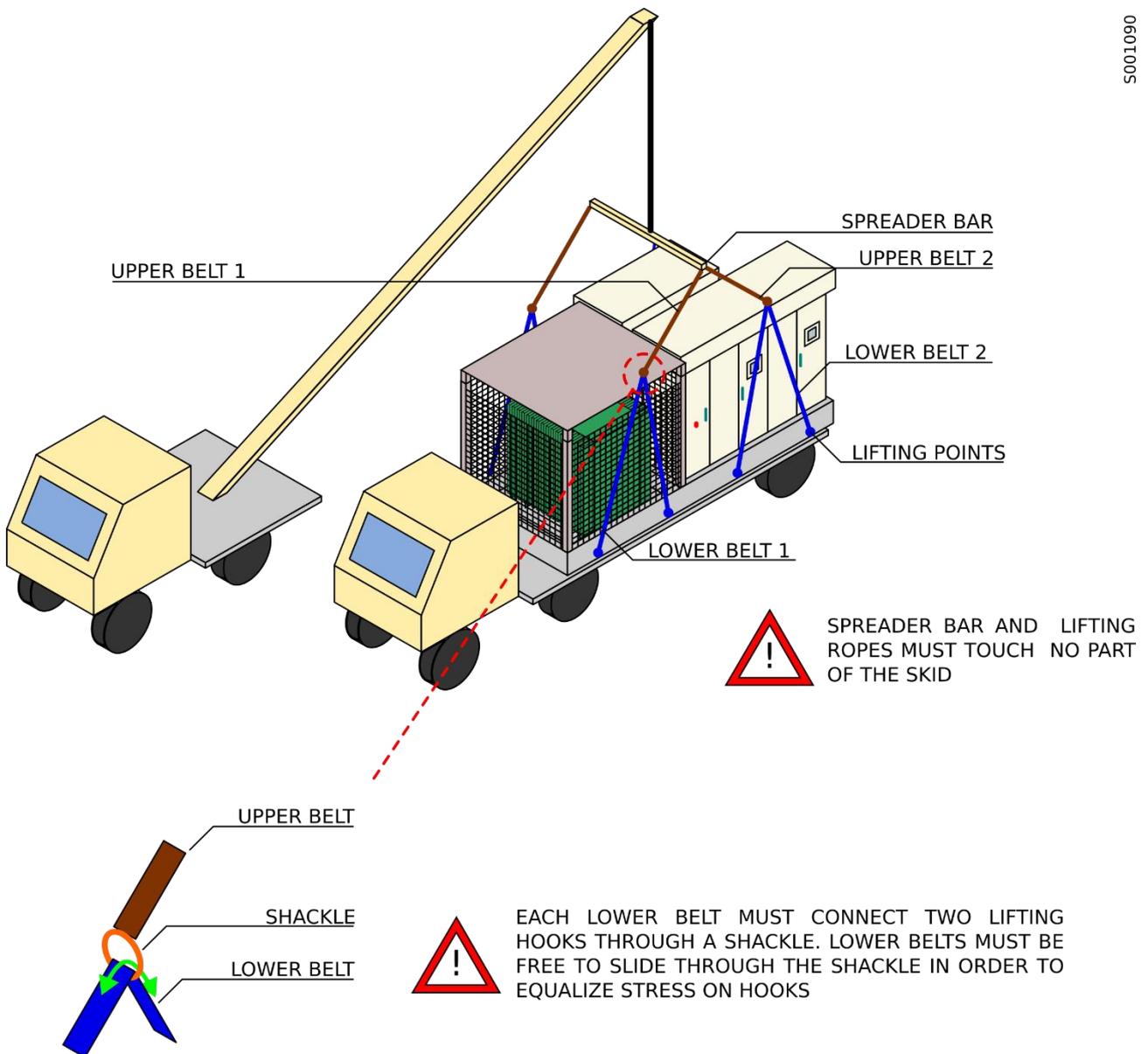


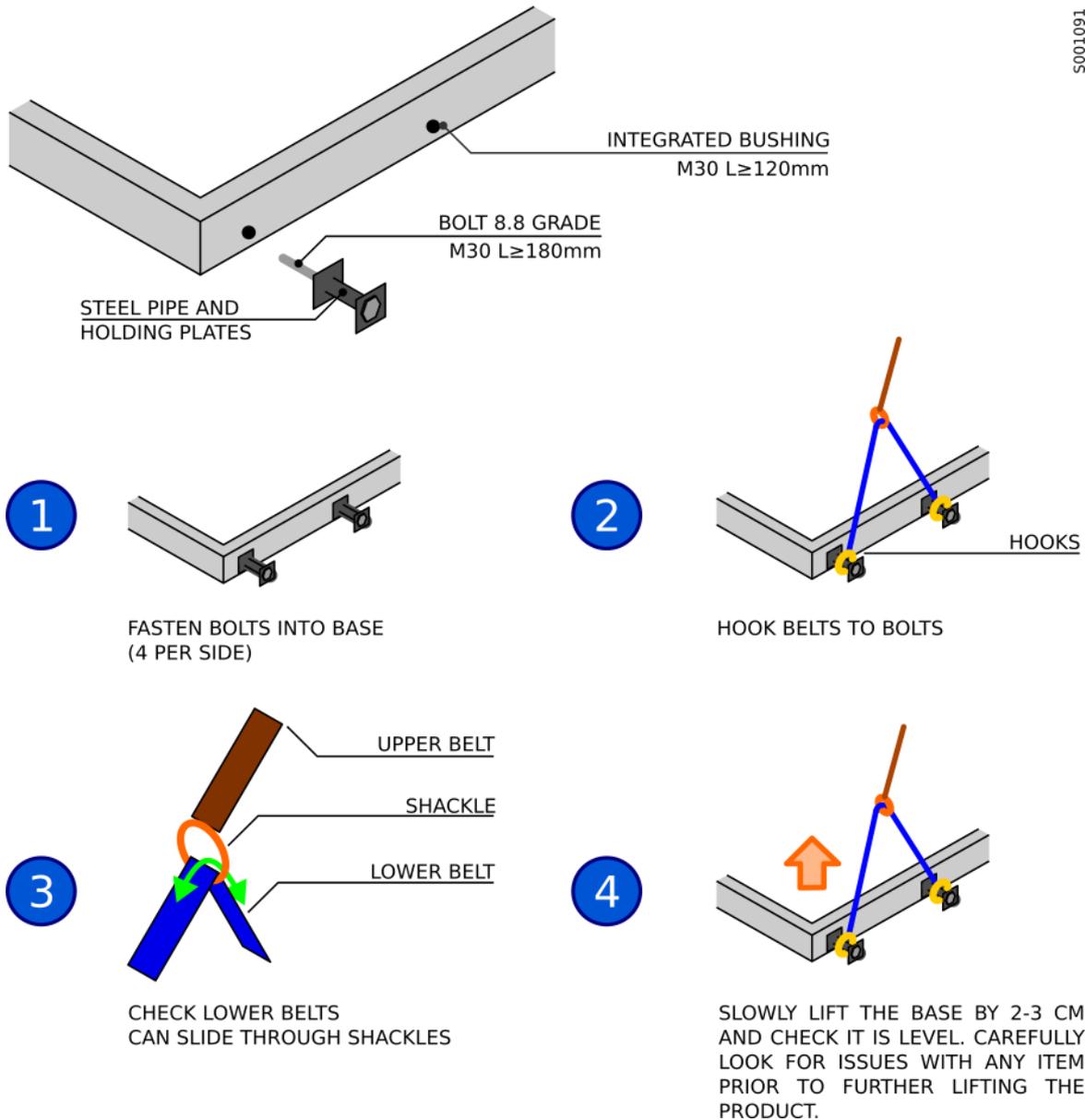
Lifting must take place as per the drawings below, using the following items:

- 1 spreader bar;
- Lifting belts, 4 per side;
- shackles and hooks;
- hooking bolts.

Item	Description
Spreader bar	Minimum working load = 30000 kg Length MIN = 2500mm MAX = 3000mm
Lifting bents	4 upper belts, working load = 10000 kg, length = 6m (BROWN) 4 lower belts, working load = 10000 kg, length = 8m (BLUE) 4 shackles, working load = 10000 kg (ORANGE)
Hooks	Steel grade 8.8 recommended. Working load = 10000 kg
Hooking bolts	8 M30-threaded hooking bolts (4 per side), steel grade 8.8 recommended.

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The following steps are to be met when hoisting the product onto the concrete foundation:

- Observe all the health and safety prescription of the regulations in force
- Clean the surrounding area and the installation site from any possible obstacle and debris to avoid damages to the Sunway Power Conversion Unit and injuries to the personnel
- Install 8 M30 hooking bolts in the hooking points
- Prepare the rigging equipment according to the drawings above
- Link the belts of the rigging equipment to the hooking items
- Check that all the lower belts can freely slide inside the shackles
- Slowly lift the product up to 2-3 cm from ground
- Check that the product remains horizontal. Adjust the belts to balance the product if necessary.
- Check that the belts do not touch the product to avoid damages
- Lift the product avoiding sudden movements and place it onto its concrete foundation
- Once the product lays in the final position, the rigging equipment and the hooking items can be removed

4.3.7 Lifting onto a truck



NOTE

Hooking bolts and eyebolts are not included in Enertronica Santerno's standard scope of work and must be ordered separately.

If necessary, product can be hoisted onto a truck by following this procedure:

1. Check that the truck is suitable for transportation of the product (i.e. overall dimensions, maximum load, etc.).
2. Check that all the permits for transportation that may be necessary are available.
3. Place the product on the truck according the lifting procedure described in §4.3.6.
4. Install 8 M30 eyebolts in the hooking points of the product. Overall size shall not exceed the limits for transportation
5. Anchor the eyebolts to the truck with chains.
6. Tighten the chains to avoid movements of the product.

4.4 Assembly

The mounting operations will be performed by the personnel of Enertronica Santerno S.p.A. or authorized third party, with the means of Santerno S.p.A. or authorized third party, according to scheduled tasks agreed upon with the Client's Delegate.

Products for outdoor installation are shipped along with wooden box(es) containing the roof of the inverter(s). Once hoisting is finalized and the product lies on its concrete foundation, the roof of each inverter must be mounted, in order to prevent water and dust from entering the product. The roof of the inverter ensures the IP54 ingress protection degree. Failing to mount to inverter roofs promptly may permanently damage the product.

Before mounting the roof, any temporary protection (e.g. plastic sheet) found on top of the inverters must be removed. Such temporary protection shall be deemed equivalent to the roof itself under no respect. It is provided to protect the inverters during extraction of the product from the container only and its replacement with the roof shall not be deferred except for force majeure.

Details concerning the roof assembly procedure are to be found in the inverter manual.

WARNING



The roof of the inverter is strictly necessary to preserve the IP54 ingress protection degree. Failing to mount to inverter roofs promptly may permanently damage the product.

5 ACTIVITIES TO BE PERFORMED BY THE CLIENT



NOTE

The activities described in this paragraph are NOT included in Enertronica Santerno scope of work

After hoisting and assembly, Client is tasked with the following activities:

- Checks described in §.5.1 Checks to be made by the Client
- Site finalization as per § 5.2 External connections.
- Site finalization as per §.5.3 Site finalization
- Manoeuvres on MV cabinets

5.1 Checks to be made by the Client

After assembly of the Sunway Power Connection Unit and prior to working on connections, the Client shall check the following points:

- Visual inspection of the entire Power Conversion Unit for scratches, cracks or other minor problems to be readily fixed.
- Check if the entry points in the concrete bases match with the ducts, manhole or cableways for external connections prepared on site.
- Check if corrugated pipes or other ducts installed on assembly phase don't interfere with the ducts, manholes or cableways to be installed on site for cabling.
- Check if the cableways on site are ready to use and have not been obstructed or damaged during the previous works.
- In case some materials for cabling have been ordered to Enertronica Santerno (i.e. MV plugin connectors), check if all the necessary materials have been received. Depending on dimensions of the goods, they can be shipped within the Power Conversion Unit or in a separate crate.

5.2 External connections

WARNING



Before carrying out any operations on the equipment, the operator must perfectly know the functions and positions of all the controls. The operator must also be aware of the technical and functional characteristics of all devices installed in the Sunway Power Conversion Unit in order to avoid all risks involving people and equipment.

DANGER

Danger of death from electrocution and burns due to contact with live components of the AC Medium Voltage grid, Low Voltage Grid, UPS and photovoltaic field.

Before carrying out any operation, make sure that no voltage is applied to the equipment by opening all the switches that cut off the Sunway Power Conversion Unit input voltages: Medium Voltage Grid, Low Voltage Grid and photovoltaic field.



Sunway Power Conversion Units integrate an UPS which may output hazardous voltage even when all external sources are cut off.

All operations must be carried out while wearing proper PPE as per applicable norms and regulations.

5.2.1 Foreword

WARNING



To ensure high safety level, the equipment has been designed and constructed in compliance with all the applicable regulations. Moreover, essential information and instructions have been provided in this manual. However, the safety level also depends on the sense of responsibility infused in all the operators working on the installation.

In any case, *absolute safety does not exist*, as stated in the CEI 11 - 15 standard, paragraph 1.1.02 quoted below:

[Omissis.....]

No regulation, notwithstanding its degree of accuracy, is able to guarantee absolute immunity to people and goods against the dangers of electricity.

The implementation of the prescriptions contained in these standards can reduce hazard exposure but cannot avoid a condition in which accidental events may determine a dangerous situation for people and goods.

As a matter of facts, 'safe' stands as a synonym for 'compliant with state-of-the-art practices'. Such practices represent a set of rules that allow implementing a safety level which is considered to be acceptable by the community, on the basis of current technical and technological knowledge and economical resources.

The state of the art continually evolves and the standards describe its evolution over time.

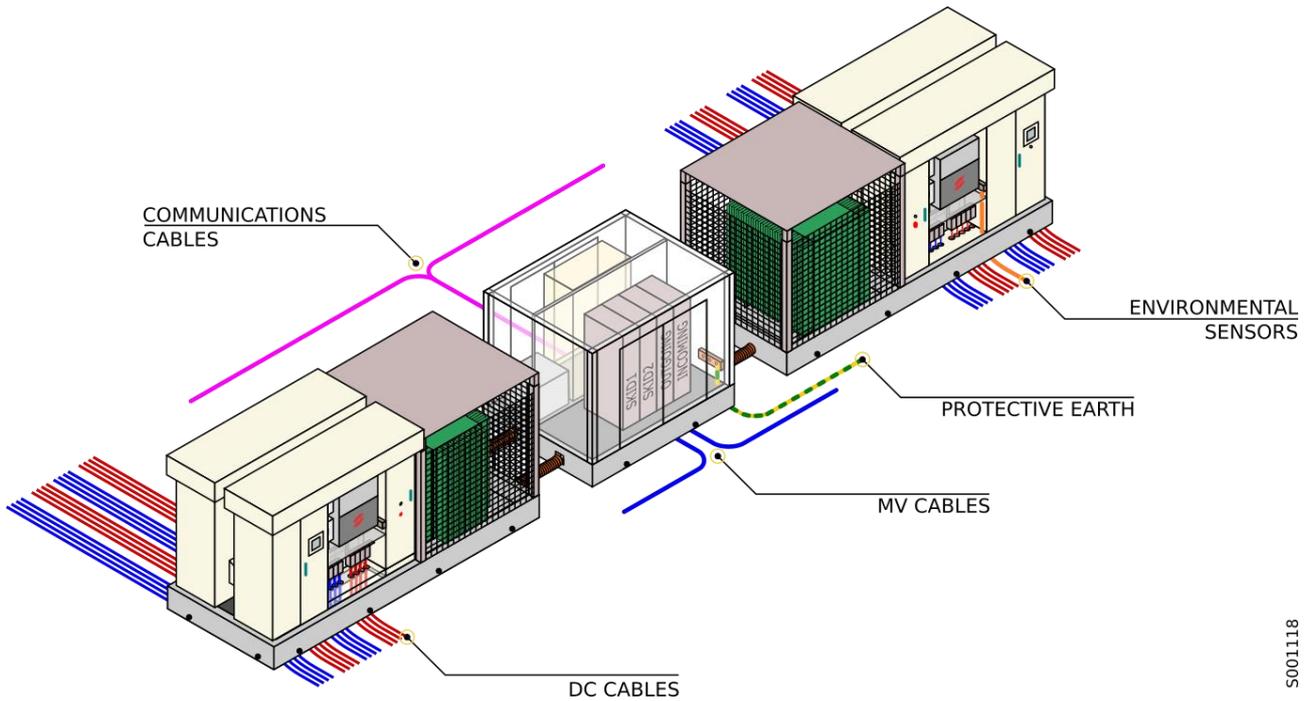
In particular, according to the Italian law no. 186 of March 1, 1968 a product compliant with CEI (Comitato Elettrotecnico Italiano) standards means a product constructed in compliance with state-of-the-art practices.

The equipment described in this manual is compliant with CEI standards and, therefore, it is to be considered **safe in the sense of what is described above**.

5.2.2 Connections overview

The Sunway Skids are pre-assembled, fully fitted out and tested. The Client is tasked with doing the following connections:

- external safety ground bondings (§5.2.4)
- MV cables (§5.2.5)
- DC source cables (§5.2.6)
- Communication cables (§5.2.7)
- External environmental sensors (§5.2.8)



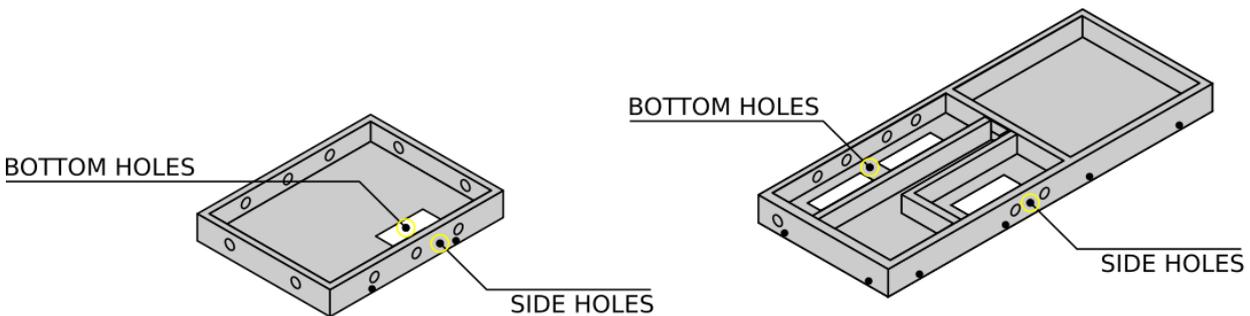
S001118

5.2.3 Cable routing

Bases of all parts of a Sunway Power Conversion Unit come with holes on both sides and bottom. Holes are placed in convenient places in order to provide customer with easy cable routing and multiple cable entry options.

Side holes are 160 mm-wide circular holes. Side holes are available around the MV room and LV room and at the inverters' DC inputs.

Bottom holes are rectangular openings in the base, placed below the MV switchgear and the inverter DC inputs.



S001112

Exact position of holes may vary according to specific project requirements. Please refer to final mechanical drawings for details.

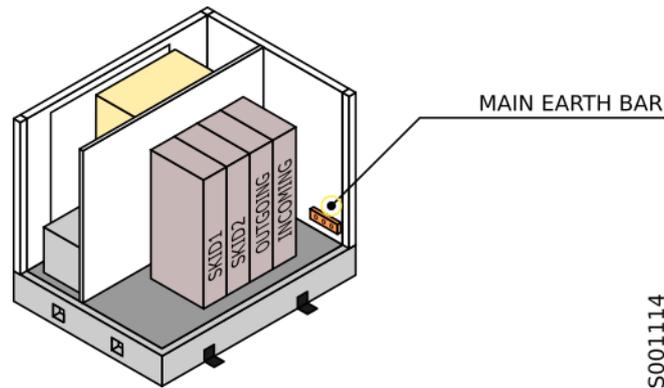


WARNING

Upon completion of all routing operations, all holes, including used and unused ones, must be sealed with foam.

5.2.4 External ground bonding

A main earth copper bar is provided inside the MV room for the connection to the external ground bonding.

**WARNING**

The Client is responsible for designing the ground bonding and connecting the ground to the Sunway Power Conversion Unit ground bars. The Client shall check the trip times of the protective devices when a fault current occurs (trip times are defined by the DSO).



The MV/LV cabin houses the main ground collector of the Sunway Power Conversion Unit. The Sunway Power Conversion Unit is supplied complete with equipotential circuits between the MV/LV cabin and the skids, inside the cabinets, the ground bonding and external power supply sources (if any), floor and ground collector bars.

The ground connections coming from the ground net of the plant shall be connected to the main ground bars in the MV/LV cabin with two cables from two different point of the external net.

For details on the ground bonding, please refer to the electrical schematics.

The Client is charged with doing the following:

1. Carry out and connect the external ground bondings to the ground collector bar in the MV/LV room;
2. Connect the ground cables from the PV field's ground net to the main earth bar;

5.2.5 MV cables**DANGER**

Hazardous voltage must be removed from incoming and outgoing MV cables before carrying out any routing operations.

DANGER

Hazardous voltage must be removed from transformer MV cables before carrying out any routing operations. Please refer to Error! Reference source not found. Error! Reference source not found..

DANGER

In case an MV switchgear unit remains unused (e.g. outgoing unit or transformer protection unit), the line switch of that unit must be set in the open position, while the earth switch must be set in closed position. Both switches must be key-locked in their respective positions.

WARNING



Connecting and operating the MV cabinet is to be done by “skilled personnel” only. Please refer to the electrical and mechanical schematics and to the Installation Manuals of the devices being used for details on all operations.

WARNING



Correct routing and integrity (e.g. insulation) of MV cables must be verified by the Client before carrying out any operations on the Sunway Power Conversion Unit.

NOTE



MV cable lugs/connectors are not included in Enertronica Santerno’s scope of work.

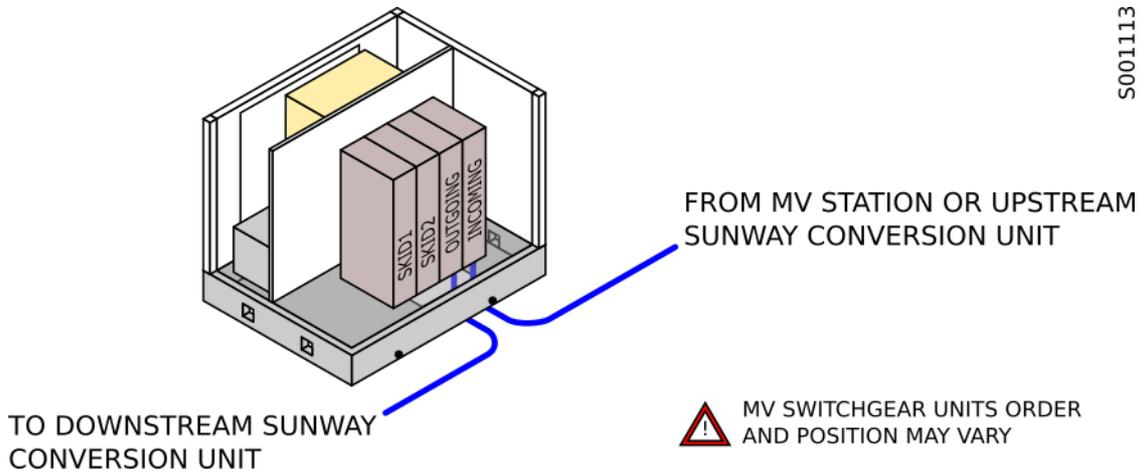
WARNING



Connect the shielding of the MV cables to the ground collector bars of the MV switchgear.

The Client is tasked with connecting the incoming and outgoing MV cables.

The cable path for the MV cable entry through the Sunway Power Conversion Unit concrete base is shown below.



1. Make sure no voltage is present on either incoming or outgoing MV cables
2. Make sure no voltage is present on transformer MV cables as per **Error! Reference source not found. Error! Reference source not found.**;
3. Make sure that no voltage is applied to the cabinet;
4. Incoming cables must be connected to the MV switchgear incoming unit;
5. Connect the line incoming cables and mark the conductors. **The phase sequence must be taken into account.** Please refer to the Medium Voltage cabinet for the activities to be done.
6. Outgoing cables must be connected to the MV switchgear outgoing unit;
7. Connect the line outgoing cables and mark the conductors. **The phase sequence must be taken into account.** Please refer to the Medium Voltage cabinet for the activities to be done.

8. In case an MV switchgear unit remains unused (e.g. outgoing unit or transformer unit) the respective disconnect switch must remain in the open position, earthed and locked. A warning sign shall be applied to prevent closure of the switch by maintenance personnel.
9. Properly seal the pipes for the cable inputs

For the type of connectors to be used for the connection to the isolated bushings installed in the MV switchgear, please refer to the MV switchgear datasheet and installation manual.

5.2.6 DC source cables



NOTE

Cable lugs are not included in Enertronica Santerno's scope of work.



WARNING

Correct routing and integrity (e.g. insulation) of DC cables must be verified by the Client before carrying out any operations on the Sunway Power Conversion Unit.



WARNING

DC cables polarity must match inverter's DC inputs polarity. Inverter's DC inputs polarity is clearly specified by labels. Please refer to these labels and to the inverter's user manual to make sure of the DC inputs polarity.



WARNING

Unused cable fittings must be sealed in order not to impair the ingress protection degree of the inverters.

The Client is tasked with routing DC cables connecting the photovoltaic field to the inverters. Cables must be terminated with a cable lug compatible with the fuse-holder and its integrated bolt. Cable lugs must be bi-metallic in case aluminium cables are used. Cable lugs are not included in Enertronica Santerno's scope of work.

Cables are to be routed through the bottom holes of the concrete base and the cable fittings pre-installed on the inverter bottom plates.

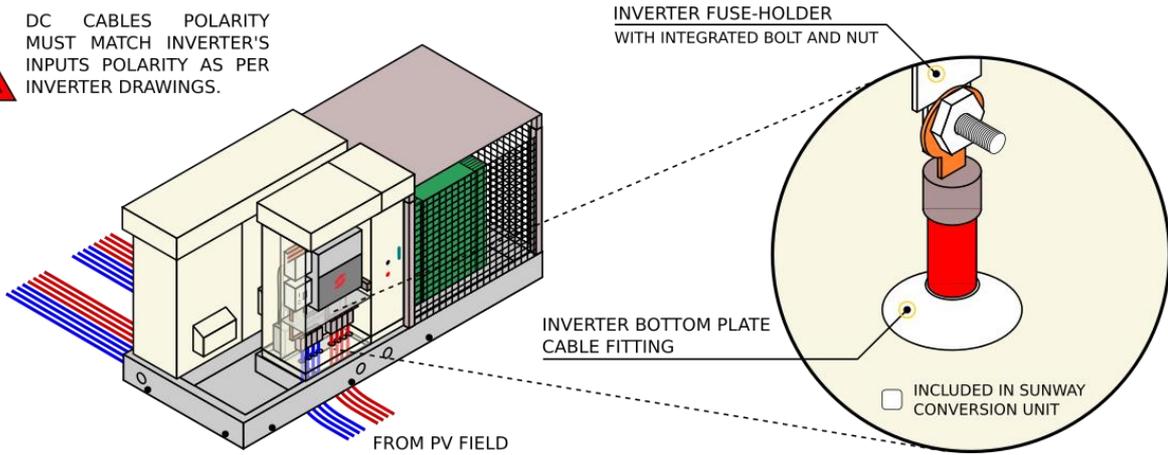
Cable lugs are to be connected to the fuse-holders and the nut bundled with the fuse-holder is to be tightened with controlled torque as per the specifications defined in the inverter manual.

Up to two cables can be connected on the same fuse-holder.

The Client must ensure that DC cables polarity matches the polarity of the inverter input terminals.



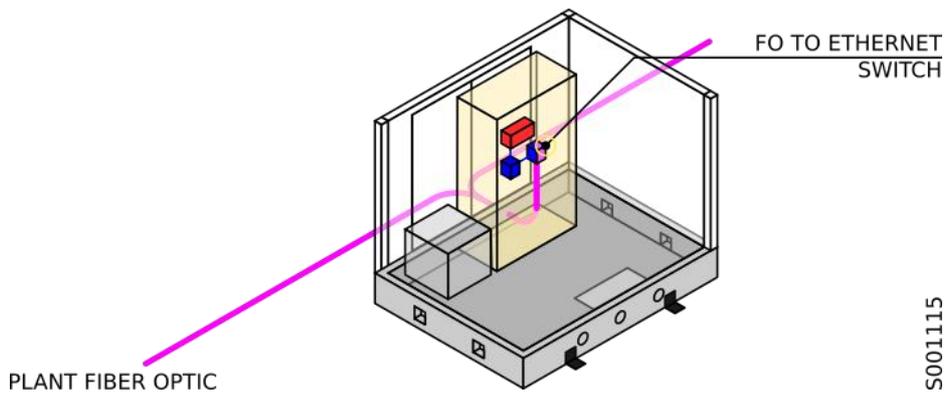
DC CABLES POLARITY MUST MATCH INVERTER'S INPUTS POLARITY AS PER INVERTER DRAWINGS.



S001117

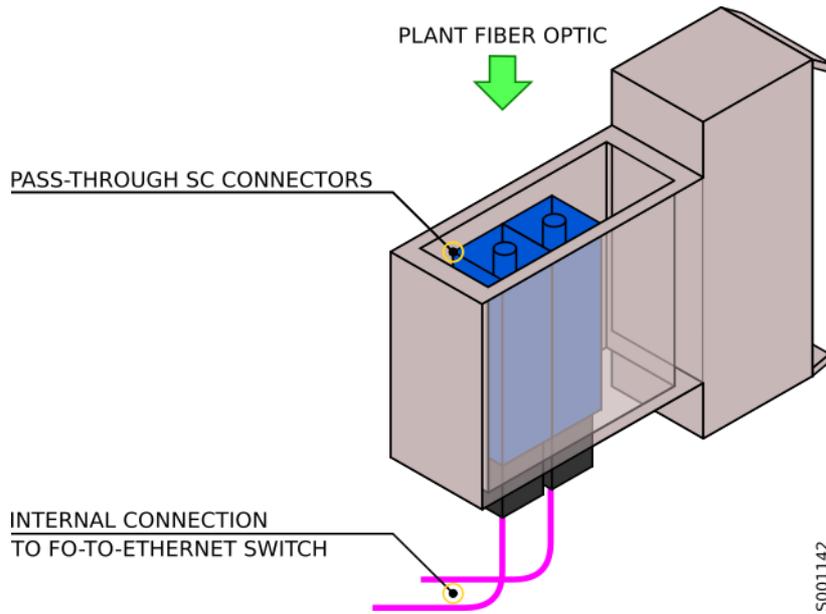
5.2.7 Communications cables

The Client is tasked with connecting the plant fiber optic to the fiber optic-to-ethernet switch or the plant LAN to the Ethernet switch installed in the auxiliary cabinet.

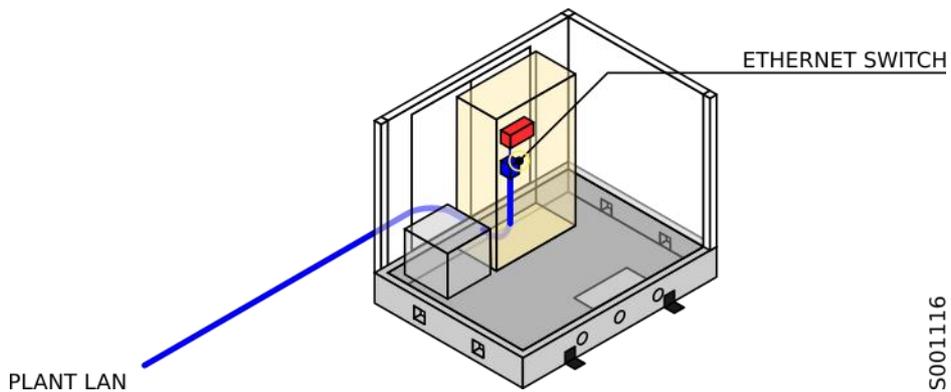


S001115

Connection of plant fiber cable to the fiber optic-to-Ethernet switch is made via a patch panel installed in the auxiliary cabinet. As a standard the fiber optic ports are SC type, suitable for connection of Single Mode fiber optics. Different configurations are available and shall be agreed at order stage. Terminals/pigtails for fiber optic coming from the plant are not included in Enertronica Santerno's scope of work.



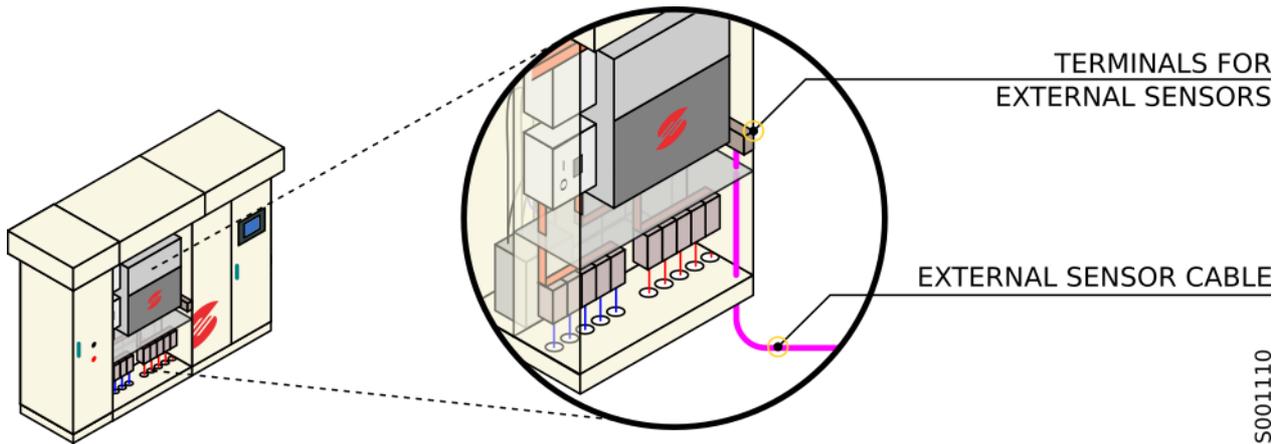
As for external Ethernet cable connection, this can be plugged directly into the Ethernet switch.



Please refer to the final electrical schematic for details an auxiliary cabinet configuration.

5.2.8 External environmental sensors

External environmental sensors can be connected to Sunway TG TE inverters via a dedicated terminal block integrated in each independent MPPT module. Up to two sensors per independent MPPT module may be connected.



S001110

Please refer to the final Sunway Power Conversion Unit electrical schematic for inputs availability and to Sunway TG TE installation manual for terminal block details.

5.3 Site finalization

After completion of connections some activities shall be carried out on site.

Scope of these tasks is to avoid displacements for seismic events, guarantee waterproof of cables' tanks, improve accessibility to the equipment and protect cableways entering from the side of the concrete bases.

These finalization activities are the following:

- Anchoring (§5.3.1)
- Sealing (§5.3.2)
- Landfill (§5.3.3)

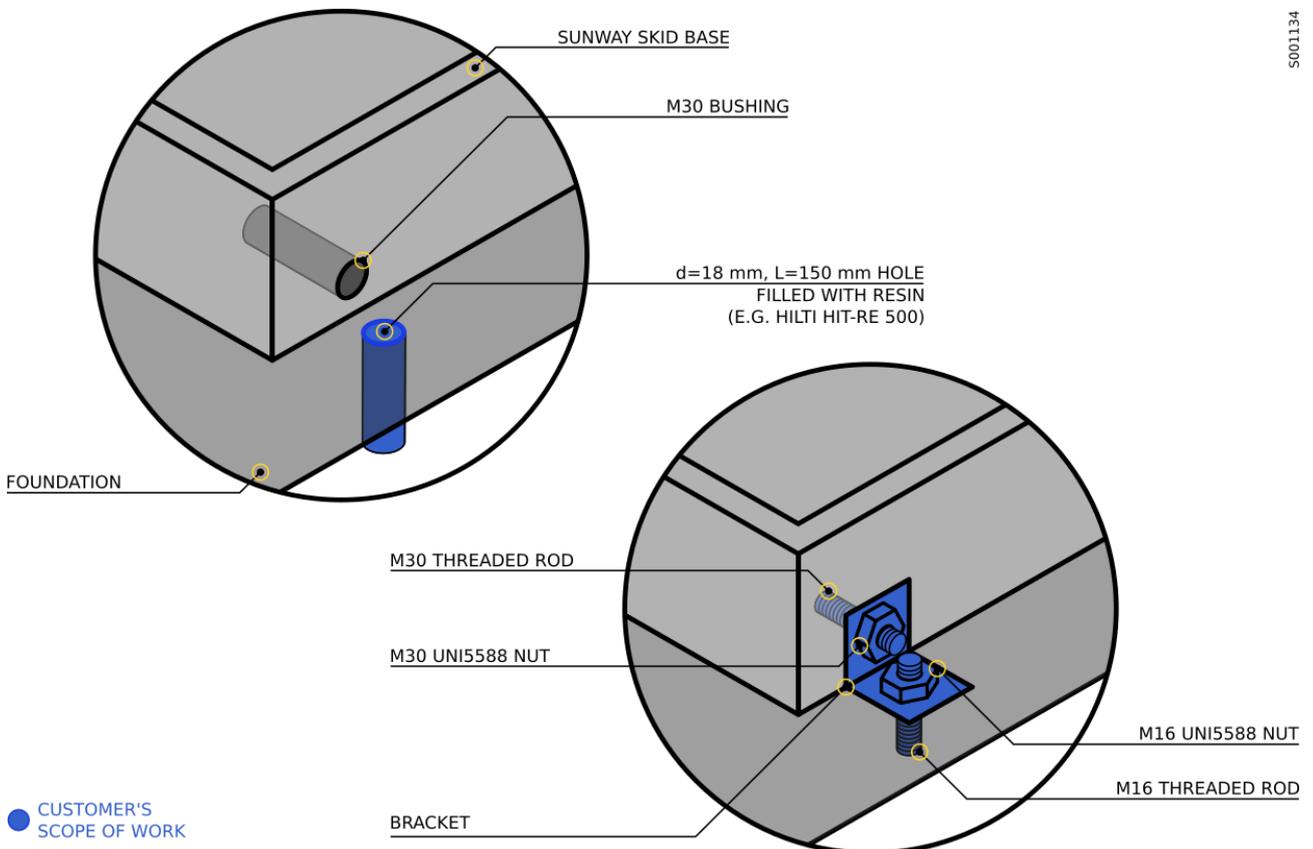
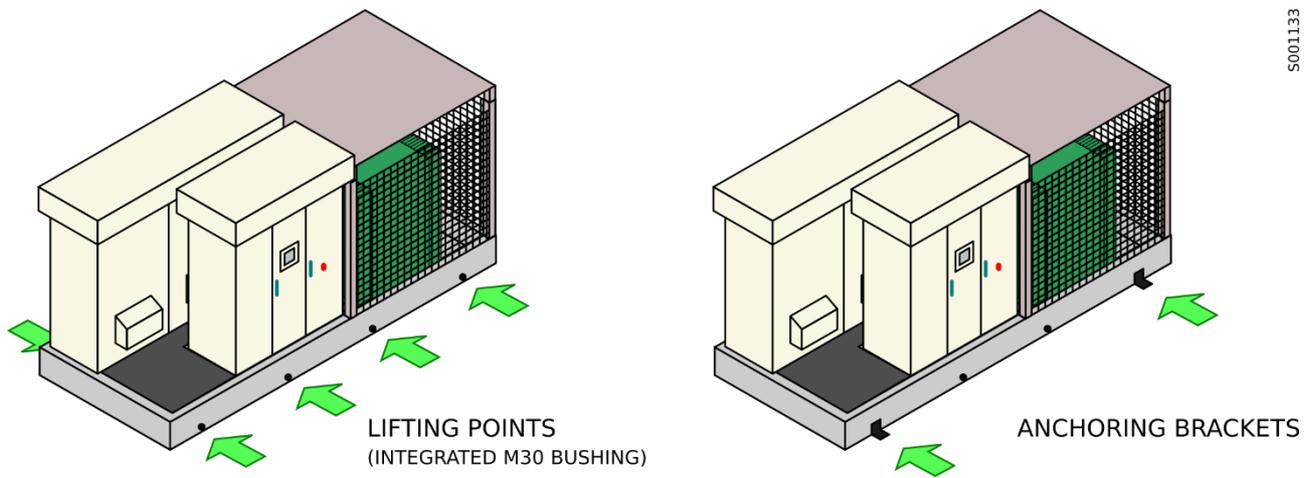
5.3.1 Anchoring

NOTE



Anchoring brackets are not included in Enertronica Santerno's standard scope of work. These parts can be provided by Enertronica Santerno on request and shall be agreed upon at the purchase order stage.

It is recommended to fix each part of a Sunway Power Conversion Unit to the ground by means of 4 anchoring brackets (2 per side). The brackets shall be fastened by means of threaded rods, nuts and epoxy mortar for perfect anchoring.



CUSTOMER'S SCOPE OF WORK

Anchoring instructions:

1. Drill an 18 mm-diameter hole in the platform, 150 mm depth
2. Fill up the hole with resin type Hilti hit-re 500
3. Insert the M16 threaded bar in the hole
4. Insert the M30 threaded bar in the M30 bushing integrated in the Sunway Power Conversion Unit base
5. Apply some Loctite 586 con both threaded bars
6. Tighten the threaded bars with an M16 UNI 5588 nut and an M30 UNI 5588 nut respectively.

This anchoring instructions shall be considered as a reference of common practice. If particular local requirements apply to the installation site, the choice of a more appropriate anchoring solution is entrusted to the Client.

5.3.2 Sealing

Subsequent to connecting external cables and anchoring activities, each opening used to enter in the concrete bases of the Sunway Power Conversion Unit shall be sealed to maintain the cables’ tanks water-proof.

Sealing is achieved with fire-resistant waterproof sealing foams or mortars specific for concrete materials and for buildings.

The sealant is to be applied all around the pipes or ducts that enters in the concrete bases in the quantity necessary to completely close the gap with the concrete.

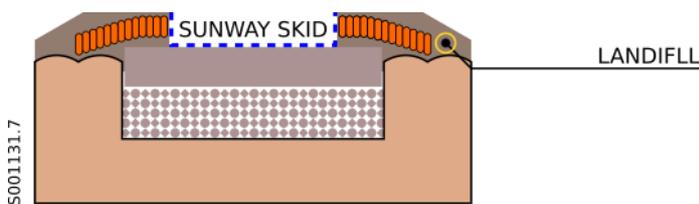
In case the other side of the pipes or duct is exposed to the open air, it is advisable to seal the cables at this entrance to avoid rainwater and pests. Specific pest blocking sealants shall be used.

Refer to sealants’ application procedures for detailed instructions.

5.3.3 Landfill

After installation of the Sunway Power Conversion Unit is complete, customer may choose to proceed with landfill all around the concrete base of the product.

This activity is recommended for ease of access to equipment



Optionally, product concrete base is surrounded by landfill.

6 USE INSTRUCTIONS

The Sunway Power Conversion Unit is a complex system composed of various high-power equipment, supplied from different power sources on a wide range of voltage levels.

This heading describes the standard procedures to operate the Sunway Conversion Unit properly and safely. Be sure to read and understand each step of the procedures before operating the equipment.

Only well trained and skilled technician shall be allowed to carry out these activities, in observance of the health and safety regulations described in section Execution of Work (§2.3).

DANGER



Danger of death from electrocution and burns due to contact with live components of the AC Medium Voltage grid, Low Voltage Grid and UPS.

Before carrying out any operation, open all the switches that cut off the Sunway Skid input voltage (LV and MV).

Before accessing the cabinet, make sure that no voltage is applied to the equipment. To do so, use special tools and wear proper PPE.

WARNING



Before operating on the MV switchgear circuit breakers and disconnectors, make sure that SF6 gas pressure is correct. Check pressure from the pressure gauge.

WARNING



All MV operations are described from the functional standpoint only. Personnel must be trained and informed about the correct and safe procedure for carrying out all MV operations.

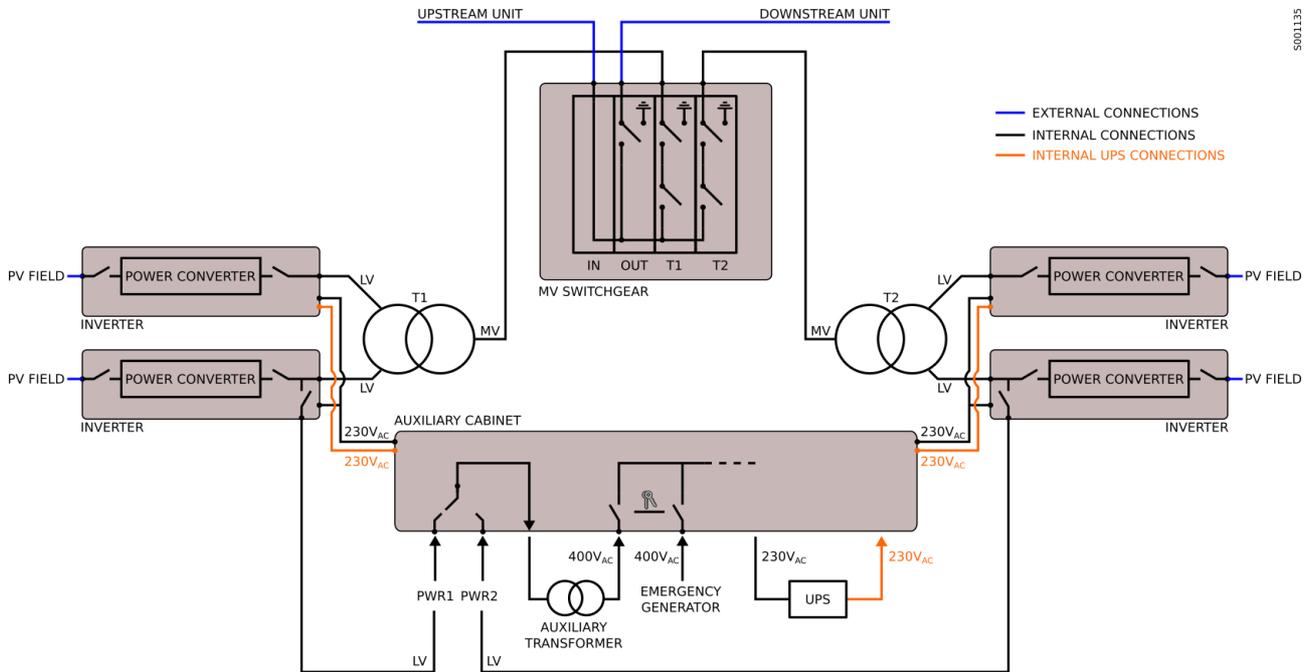
WARNING



The procedures described in this manual are meant for standard operation and maintenance activities only to be performed on Sunway Power Conversion Units after correct installation and commissioning.

6.1 Power connections

The following block diagram shows the typical architecture of Sunway Power Conversion Units in terms of power connections. Please refer to the final electrical schematic for details on the exact design of the product.



Sunway Power Conversion Units derive their power from the secondary winding of the MV/LV transformer. If the Sunway Power Conversion Unit integrates two transformers, power is derived from both but only one transformer at a time can be selected as a power source.

Secondary windings are connected to the auxiliary cabinet which lowers the voltage to the standard 400 V_{AC} three-phase by means of an external auxiliary transformer. Alternatively, the standard 400 V_{AC} three-phase voltage can be fed into the auxiliary cabinet by means of an emergency generator. All power connections for both components integrated into the auxiliary cabinet itself and components external to the auxiliary cabinet are derived from this main 400 V_{AC} three-phase line via dedicated circuit breakers.

Sunway Power Conversion Units may optionally integrate an UPS. In this case, UPS is powered by a 230 V_{AC} derived from the main 400 V_{AC} three-phase line and its output is fed into the auxiliary cabinet and further distributed to select loads via dedicated circuit breakers.

6.2 Safety Procedures



DANGER

Circuits may be live even when the master switches are in “disconnect” position.



WARNING

Check the safety statements in the User Manuals relative to the electrical cabinets installed in the Sunway Skid.



DANGER

Before accessing the input compartment of the MV Cabinet, disconnect the circuit breaker upstream and connect the circuit to ground.



DANGER

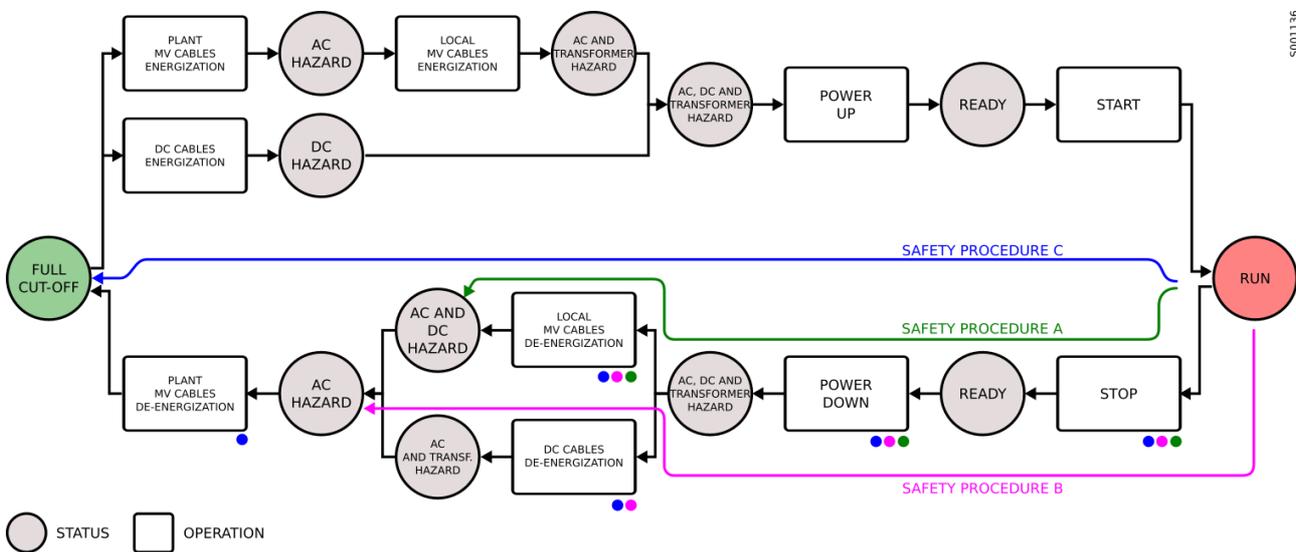
Make sure that gas pressure is correct before operating on the MV disconnect switches.



DANGER

In the Sunway Power Conversion Units with auxiliary power supply coming from external sources, disconnect the upstream circuit breaker before accessing the Auxiliary Cabinet.

Provided the complex architecture, featuring several circuit breakers and disconnect switches and mixed voltage levels (low voltage and medium voltage), this manual outlines different safety procedures to remove hazardous voltage from different parts of the product, depending on the operations to be carried out after completing the safety procedures themselves.



		FULLY CUT-OFF	AC HAZARD	DC HAZARD	AC AND DC HAZARD	AC AND TRANSFORMER HAZARD	AC, DC AND TRANSFORMER HAZARD	CU READY	RUN
SUNWAY POWER CONVERSION UNIT COMPONENT	Inverter DC input terminals, fuses and parallel bar	○	○	⚠	⚠	○	⚠	⚠	⚠
	Inverter other parts	○	○	○	○	○	○	⚠	⚠
	Inverter AC output terminals	○	○	○	○	⚠	⚠	⚠	⚠
	MV/LV transformer	○	○	○	○	⚠	⚠	⚠	⚠
	MV switchgear transformer unit terminals	○	○	○	○	⚠	⚠	⚠	⚠
	MV switchgear incoming and outgoing unit terminals	○	⚠	○	⚠	⚠	⚠	⚠	⚠
	Auxiliary cabinet	○	○	○	○	○	○	⚠	⚠
	Auxiliary transformer	○	○	○	○	○	○	⚠	⚠

Legend



No hazardous voltage present



Hazardous voltage present

6.2.1 Safety Procedure A

DANGER



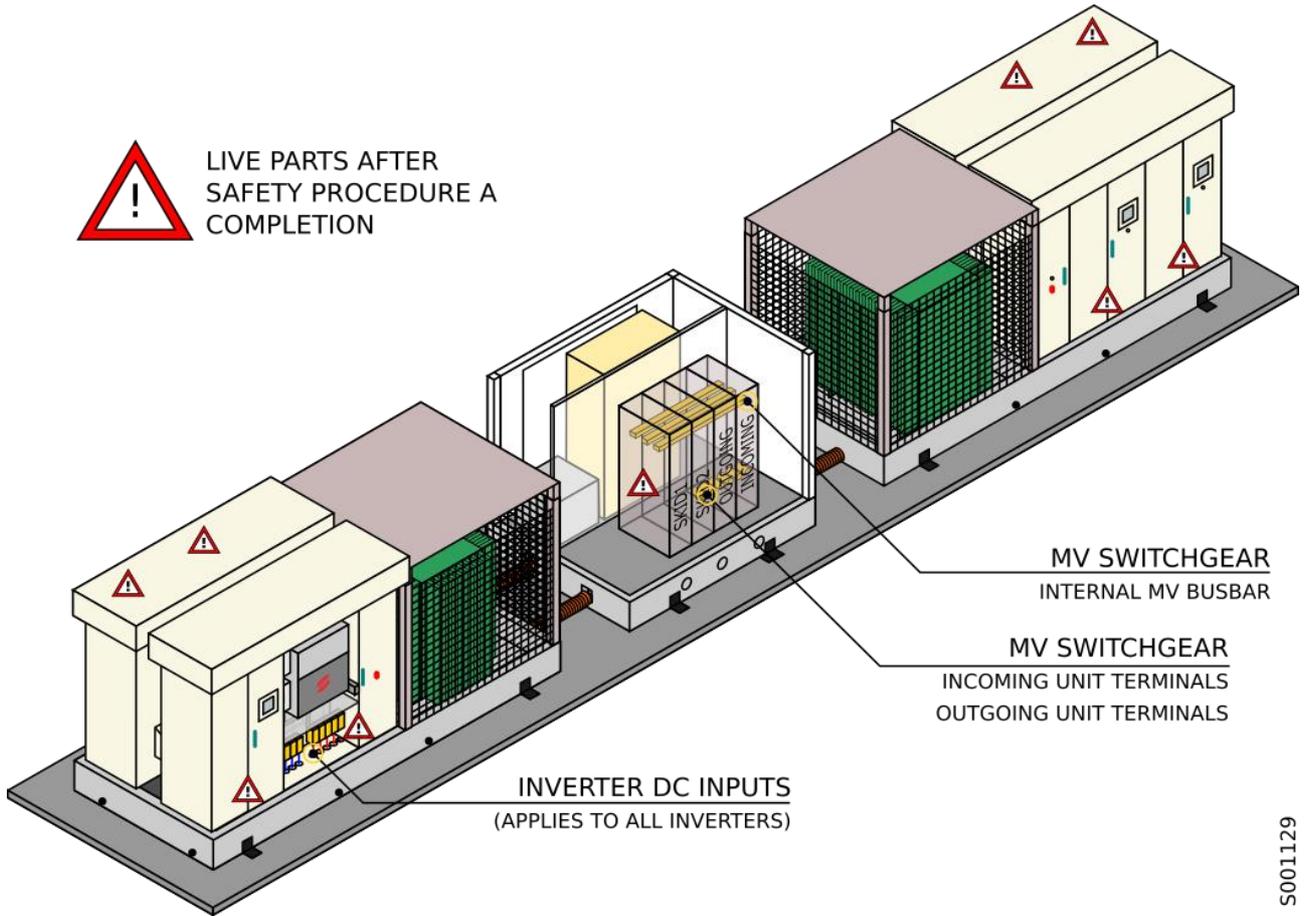
Safety procedure A does not remove hazardous voltage from all parts of the product. Inverter DC inputs and some parts of the MV switchgear remain live parts. Do not work on any of these parts even after carrying out the safety procedure A.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

1. Stop all inverters by pressing the STOP button of their respective display/keypads. Wait for STOP status to be display in each display/keypad.
2. Disable all inverters by turning the “ENABLE/DISABLE” key on each inverter’s front panel to the “DISABLE” position.
3. Open the DC input switch of all inverters.
4. Open the AC output circuit breaker of all inverters and pull out the key bundled with each AC circuit breaker in order to lock it in the OPEN position.
5. Open all circuit breakers interrupting the connection between the MV/LV transformer secondary windings and the auxiliary transformer.
6. Open the LV room doors:
 - a. Turn off the UPS and all its extension batteries, if any.
 - b. Disconnect the emergency generator from the auxiliary cabinet, if any.
7. Open the MV room doors.
 - a. Check the main grounding bar is connected to the external grounding net.
 - b. Open the line circuit breaker on all MV switchgear transformer units.
 - c. Open the line disconnecter on all MV switchgear transformer units.
 - d. Close the earth disconnecter on all MV switchgear transformer units.



LIVE PARTS AFTER
SAFETY PROCEDURE A
COMPLETION



S001129

6.2.2 Safety Procedure B

DANGER



Safety procedure B does not remove hazardous voltage from all parts of the product. Some parts of the MV switchgear remain live parts. Do not work on any of these parts even after carrying out the safety procedure B.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

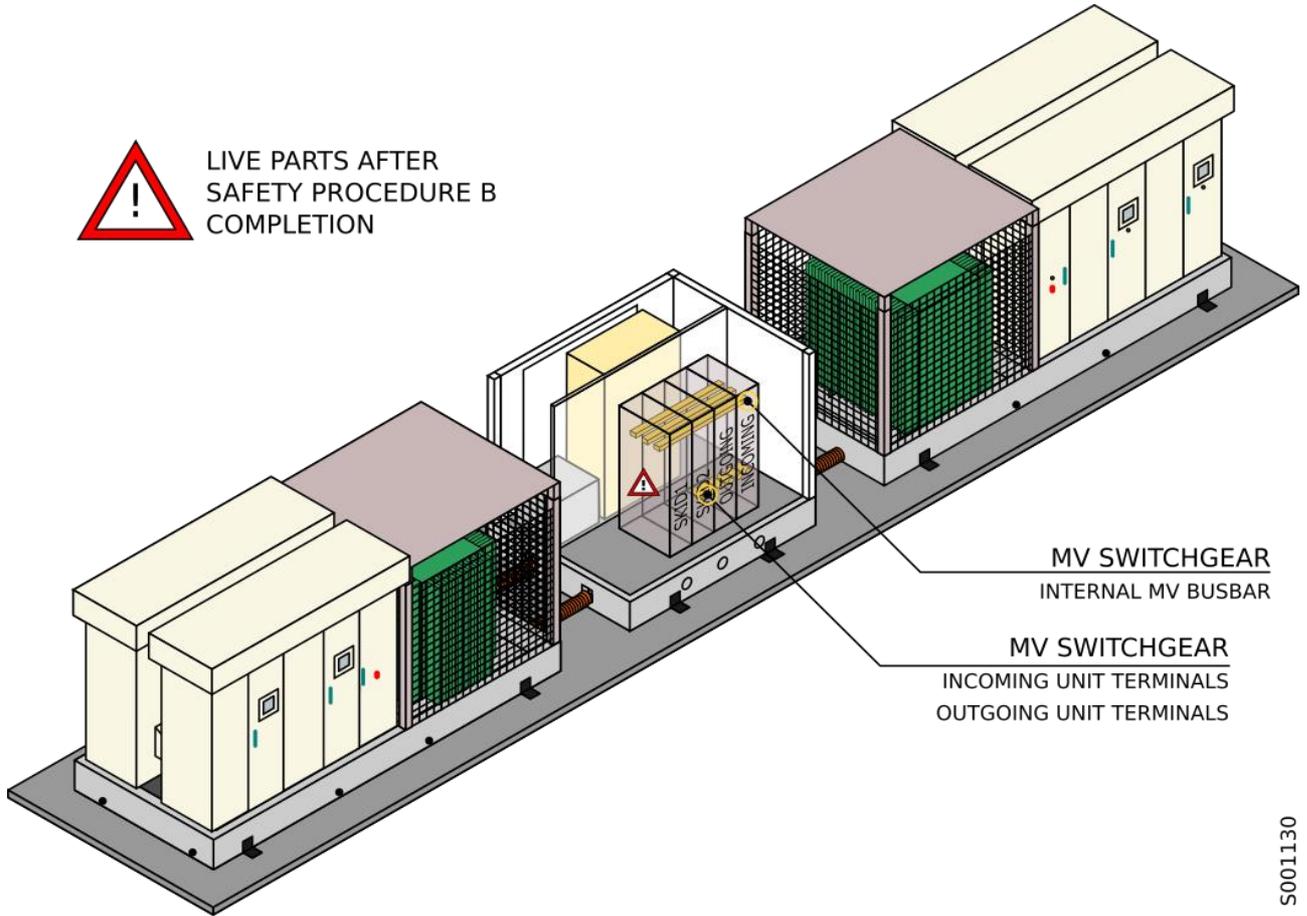
Before carrying out any operations inside or around the product, carry out the safety procedure B:

- Stop all inverters by pressing the STOP button of their respective display/keypads. Wait for STOP status to be display in each display/keypad.
- Disable all inverters by turning the “ENABLE/DISABLE” key on each inverter’s front panel to the “DISABLE” position.
- Open the DC input switch of all inverters.
- Open the AC output circuit breaker of all inverters and pull out the key bundled with each AC circuit breaker in order to lock it in the OPEN position.
 1. Open all circuit breakers interrupting the connection between the MV/LV transformer secondary windings and the auxiliary transformer.
- Open the LV room doors:
- Turn off the UPS and all its extension batteries, if any.
 - a. Disconnect the emergency generator from the auxiliary cabinet, if any.
- Open the MV room doors:
- Check the main grounding bar is connected to the external grounding net.
- Open the line circuit breaker on all MV switchgear transformer units.
- Open the line disconnecter on all MV switchgear transformer units.

- Close the earth disconnector on all MV switchgear transformer units.
- Open the DC output switch of all stringboxes connected to the Sunway Power Conversion Unit.



LIVE PARTS AFTER
SAFETY PROCEDURE B
COMPLETION



S001130

6.2.3 Safety Procedure C



WARNING

Safety procedure C requires temporarily putting out of work downstream Sunway Power Conversion Units.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Stop all inverters by pressing the STOP button of their respective display/keypads. Wait for STOP status to be display in each display/keypad.
- Disable all inverters by turning the “ENABLE/DISABLE” key on each inverter’s front panel to the “DISABLE” position.
- Open the DC input switch of all inverters.
- Open the AC output circuit breaker of all inverters and pull out the key bundled with each AC circuit breaker in order to lock it in the OPEN position.
 1. Open all circuit breakers interrupting the connection between the MV/LV transformer secondary windings and the auxiliary transformer.
- Open the LV room doors:
- Turn off the UPS and all its extension batteries, if any.
 - a. Disconnect the emergency generator from the auxiliary cabinet, if any.
- Open the MV room doors:
- Check the main grounding bar is connected to the external grounding net.
- Open the line circuit breaker on all MV switchgear transformer units.
- Open the line disconnecter on all MV switchgear transformer units.
- Close the earth disconnecter on all MV switchgear transformer units.
- Open the DC output switch of all stringboxes connected to the Sunway Power Conversion Unit.
- Stop and disable **all inverters of all downstream** Sunway Power Conversion Units.
- In next downstream Sunway Power Conversion Unit:

- Open the line circuit breakers of all MV switchgear transformer units
- Open the line disconnecter of all MV switchgear transformer units
- Close the earth disconnecter of all MV switchgear transformer units
- Open the line disconnecter of the MV switchgear outgoing unit
- Close the earth disconnecter of the MV switchgear outgoing unit
- In next upstream Sunway Power Conversion Unit:
- Open the line disconnecter of the MV switchgear outgoing unit
- Close the earth disconnecter of the MV switchgear outgoing unit
- Pull out the “earth disconnecter closed” key of the MV switchgear outgoing unit and keep it with you until all operations on target Sunway Power Conversion Unit are over.

6.3 Power up procedure

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Verify all inverters are disabled in virtue of their respective “ENABLE/DISABLE” key being set to “DISABLE”.
- Close all circuit breakers connecting the MV/LV transformer secondary windings to the auxiliary transformer.
- Open the LV room doors:
- Check the lamp signalling supply voltage presence on the auxiliary cabinet front panel is on.
- Turn on the UPS.
- Check all inverters’ display/keypads have turned on.
- Press STOP button on all inverters’ display/keypads and check all inverters switch to STOP status.
- Remove all inverters’ AC circuit breaker lock keys from the key exchange box in the MV room and plug them in their respective inverter’s AC circuit breakers to enable closing the inverters’ AC circuit breakers.
- Close all inverters’ AC output circuit breakers.
- Close all inverters’ DC input switches.

6.4 Start procedure

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Enable all inverters by setting their respective “ENABLE/DISABLE” key to “ENABLE”.
- Press START button on all inverters’ display/keypads and check all inverters switch to RUN status. Switching to RUN status may require some time, depending on the final settings of the inverters. Typically, inverters take up to 5 minutes to switch to RUN status.

6.5 Stop procedure

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Press STOP button on all inverters’ display/keypads and check all inverters switch to STOP status.

- Disable all inverters by setting their respective “ENABLE/DISABLE” key to “DISABLE”.

6.6 Power down procedure



WARNING

“STOP” procedure must be completed before carrying out this procedure.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Verify all inverters are disabled as a consequence of their respective “ENABLE/DISABLE” key being set to “DISABLE”.
- Open all inverters’ DC input switches.
- Open all inverters’ AC output circuit breakers.
- Lock all inverters’ AC output circuit breakers in OPEN position by extracting the lock key.
- Store inverters’ AC output circuit breakers lock key in the MV room key exchange box.
- Open all circuit breakers connecting the MV/LV transformer secondary windings to the auxiliary transformer.
- Open the LV room doors:
- Check the lamp signalling supply voltage presence on the auxiliary cabinet front panel is off.
- Turn off the UPS.
- Check all inverters’ display/keypads have turned off.

6.7 Power switch-over procedure



NOTE

This procedure applies to Sunway Power Conversion Units featuring two MV/LV transformers only.



WARNING

“STOP” procedure must be completed before carrying out this procedure.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

Sunway Power Conversion Units featuring two MV/LV transformers can derive local power supplies from either of the two transformers thanks to a switch selector integrated in the auxiliary cabinet. The switch selector allows connecting, in a mutually exclusive way, either the left-side transformer or the right-side transformer secondary winding to the auxiliary transformer primary winding. Switching from one to the other requires stopping the inverters and actuating the switch selector.

- Verify all inverters are in STOP status and disabled as a consequence of their respective “ENABLE/DISABLE” key being set to “DISABLE”.
- Set the incoming line selection switch in the auxiliary cabinet to the desired position. During the operation, a glitch in power supplied to Sunway Power Conversion Unit components may occur, save for those backed up by the UPS.

6.8 Power from emergency generator procedure

As an alternative to deriving local power supplies from the MV/LV transformer, Sunway Power Conversion Units can also be powered by an external generator. To this purpose, the auxiliary cabinet features a front panel socket and dedicated circuit breaker, interlocked with another circuit breaker on the auxiliary transformer output line.

6.8.1 Switching to emergency generator



WARNING

“STOP” procedure must be completed before carrying out this procedure.



WARNING

Emergency generator must not be connected to the auxiliary cabinet until this procedure explicitly mandates to connect it.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Verify all inverters are in STOP status and disabled as a consequence of their respective “ENABLE/DISABLE” key being set to “DISABLE”.
- Open the LV room door and auxiliary cabinet door.
- Open the auxiliary transformer output circuit breaker in the auxiliary cabinet. Doing so frees the key paired with the one enabling closing the emergency generator output circuit breaker.
- Plug the emergency generator output circuit breaker key into the circuit breaker.
- Close the emergency generator circuit breaker in the auxiliary cabinet.
- Close the auxiliary cabinet door.
- Check the auxiliary cabinet front panel lamp associated with auxiliary voltage presence is turned off.
- Check the emergency generator is turned off.
- Connect the emergency generator the auxiliary cabinet front panel socket.
- Turn the emergency generator on.
- Check the auxiliary cabinet front panel lamp associated with auxiliary voltage presence is turned on.

6.8.2 Switching from emergency generator to self-supply



WARNING

“Stop procedure” must be completed before carrying out this procedure.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals		
MV/LV transformer		
MV switchgear transformer unit terminals		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

- Verify all inverters are in STOP status and disabled as a consequence of their respective “ENABLE/DISABLE” key being set to “DISABLE”.
- Turn down the emergency generator.
- Open the LV room door.
- Disconnect the emergency generator from the auxiliary cabinet front panel socket.
- Check the auxiliary cabinet front panel lamp associated with auxiliary voltage presence is turned off.
- Open the emergency generator circuit breaker in the auxiliary cabinet. Doing so frees the key paired with the one enabling closing the auxiliary transformer output circuit breaker.
- Plug the auxiliary transformer output circuit breaker key into the circuit breaker.
- Close the auxiliary transformer output circuit breaker.
- Close the auxiliary cabinet door.
- Check the auxiliary cabinet front panel lamp associated with auxiliary voltage presence is turned on.

6.9 Accessing the MV/LV transformer

DANGER



Accessing the transformer compartment is allowed only when no voltage is applied to the transformer. Follow the procedures below to safely access the transformer compartment.

This paragraph outlines the procedure to gain access the MV/LV transformer. The MV/LV transformer compartment door is interlocked with both the corresponding MV switchgear transformer unit and the AC output circuit breakers of the inverters connected to transformer. Key for opening the MV/LV transformer compartment door is released from a dedicated key exchange box only after:

- Opening the MV switchgear transformer unit circuit breaker and line disconnecter.
- Opening the inverter AC output circuit breakers

This interlock configuration enforces removal of any hazardous voltage from the MV/LV transformer terminals prior to gaining access to the MV/LV transformer.

For two-transformer solutions, safe access to the target MV/LV transformer can be gained without putting the other one out of-service.

Item	Status before procedure	Status after procedure
Inverter DC input terminals, fuses and parallel bar		
Inverter other parts		
Inverter AC output terminals (target transformer side)		
Inverter AC output terminals (other transformer side)		
MV/LV transformer (target transformer)		
MV/LV transformer (target transformer)		
MV switchgear transformer unit terminals (target transformer unit)		
MV switchgear transformer unit terminals (target transformer unit)		
MV switchgear incoming and outgoing unit terminals		
Auxiliary cabinet		
Auxiliary transformer		

The doorlock of the MV/LV transformer compartment is composed of a cylinder activating the locking mechanism and of a matching part. Insert and rotate the key to open the door. The key will be kept locked until the door is safely locked.

The key locking the MV/LV transformer compartment is the left-most one in the MV cabinet key distributor and it can be released only once all the following keys are inserted in the right-most slots:

- Inverter AC circuit breaker “OPEN” key (the number of keys varies with the final Sunway Power Conversion Unit configuration).
- MV switchgear transformer unit “LINE OPEN” key.

6.9.1 1-transformer Sunway Power Conversion Units



WARNING

Accessing the MV/LV transformer in 1-transformer solutions results in shutting down all devices not powered by the UPS.

Follow these steps to access the MV/LV transformer compartment:

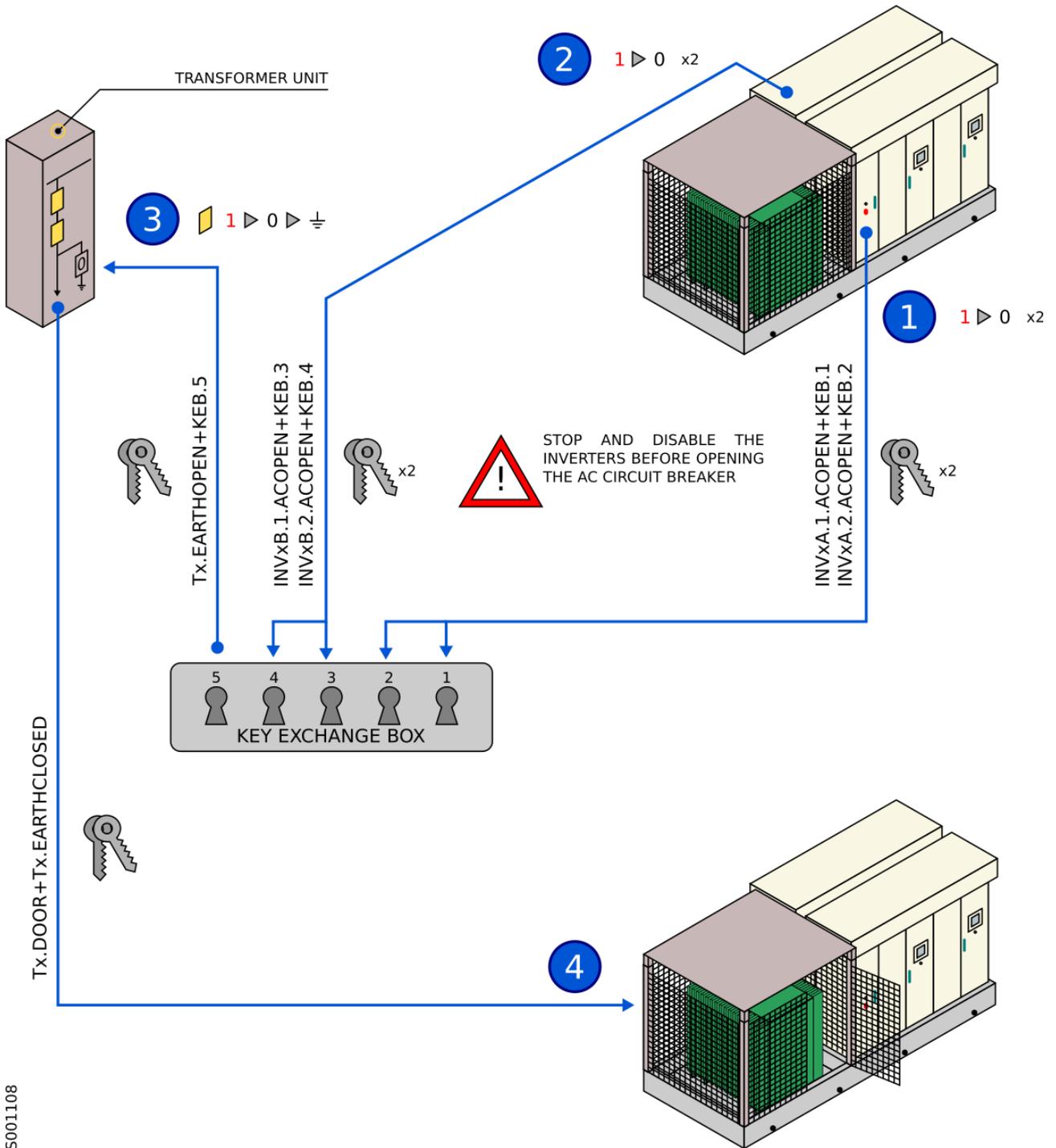
- Complete the “Stop procedure” (§6.5) for all inverters connected to the MV/LV transformer.
- Open the AC output circuit breakers of all inverters connected to the MV/LV transformer.

- Lock the inverter AC output circuit breakers in OPEN position by extracting the lock key.
- Insert the inverter AC output circuit breakers lock keys in the MV room key exchange box.
- Extract the left-most key from the key exchange box joint with “EARTH OPEN” key of the MV switchgear transformer unit powering the MV/LV transformer.
- Open the circuit breaker and line disconnecter of the MV switchgear transformer unit.
- Insert the “EARTH OPEN” key in the MV switchgear transformer unit and switch it in EARTHED position.
- Extract the MV switchgear transformer unit “EARTH CLOSED” key and use the key joint to it to open the MV/LV transformer compartment door.

6.9.2 2-transformer Sunway Power Conversion Units

Follow these steps to access the target MV/LV transformer compartment:

- Check which MV/LV transformer is selected for deriving the product’s auxiliary power.
- In case the target MV/LV transformer is used, complete the “Power switch-over procedure” (§6.7) selecting the other transformer as the auxiliary power source.
- Complete the “Stop procedure” (§6.5) for the inverters connected to the target MV/LV transformer.
- Open the AC output circuit breakers of all inverters connected to the target MV/LV transformer.
- Lock the inverter AC output circuit breakers in OPEN position by extracting the lock key.
- Insert the inverter AC output circuit breakers lock keys in the MV room key exchange box.
- Extract the left-most key from the key exchange box joint with “EARTH OPEN” key of the MV switchgear transformer unit powering the MV/LV transformer.
- Open the circuit breaker and line disconnecter of the MV switchgear transformer unit.
- Insert the “EARTH OPEN” key in the MV switchgear transformer unit and switch it in EARTHED position.
- Extract the MV switchgear transformer unit “EARTH CLOSED” key and use the key joint to it to open the MV/LV transformer compartment door.



7 MAINTENANCE

Adequate maintenance ensures power conversion performance and product reliability is maintained over time. This heading describes all the activities required to keep product parts which are subject to wear and deterioration and/or components which are essential for guaranteeing safety and optimum performance in good condition.

Access to products for the purpose of maintenance, modifications and management involves all persons responsible for production and maintenance. It must be carried out in observance of the health and safety regulations described in section Execution of Work (§2.3).



WARNING

Failure in complying with maintenance recommendations voids the product warranty.



NOTE

In the event of any fault, please contact the Enertronica Santerno SpA CUSTOMER SERVICE for instructions on the necessary corrective actions to be taken.

7.1 Maintenance sheet



NOTE

The frequency of scheduled maintenance may need to be increased depending on the location in which the equipment is installed and the relevant ambient conditions.

Task	Minimum Frequency
Global visual inspection	12 months
Air filters maintenance	12 months
Gutter cleaning	12 months
Power cables tightening	12 months
Concrete base check	12 months
Lighting system check	12 months
MV and LV room doors check (switches, locks, hinges)	12 months
Emergency button test	12 months
Labels and signs check	24 months
Fire extinguisher check	According to local regulations
Inverters maintenance	Refer to product manual
Auxiliary cabinet maintenance	Refer to product manual
Medium Voltage switchgear maintenance	Refer to product manual
MV/LV transformers maintenance	Refer to product manual

Table 1: Maintenance sheet

7.2 Global visual inspection

Visually inspect the Sunway Power Conversion Unit outside and inside to check that the walls or the doors are not damaged and to make sure that no rust, dirt, humidity, condensation are found. Take the necessary corrective actions.

7.3 Air filters maintenance

The air filter felts are to be cleaned or replaced with equivalent felts featuring dust collection efficiency class G3 periodically. For the inverters please refer to the relative manual since filters' efficiency class may be different.

7.3.1 Cleaning air filters

Remove the felts from the air filters to clean them.

Clean the felts with compressed air or wash them with water (max 40 °C) and gentle soap.

When felts are clean and dry, put them back into their frame.

7.4 Gutter cleaning

Gutters are to be cleaned periodically in order to prevent water from leaking into the Sunway Power Conversion Unit. On top of blocking the intended flow of water, leaves, bird nests and solid matters that build up and decay into the gutters may bring about the formation of acid solutions that could lead to gutter deterioration associated with rain seepage.

To clean the gutters, do the following:

- Suck the solid waste;
- Thoroughly de-clog the gutters;
- Use compressed air to clean the gutters;

Once the gutters are clean and free of any unwanted items, carefully look for cracks or fissures and replace gutters if such cracks and fissures might lead to water leaks.

WARNING



***Do not climb onto the Sunway Power Conversion Unit roof to clean the gutters.
Do not rest the ladder against the gutter.***

DANGER



Observe the national regulations in terms of minimum health and safety requirements when using special equipment (such as ladders, scaffolding and access/position systems with ropes) for overhead works.

7.5 Power cable terminals tightening

DANGER



Danger of death from electrocution and burns due to contact with live components of the AC and DC Low Voltage grid, Medium Voltage grid and UPS.

Before carrying out any operations, go through Safety Procedure C (§6.2.3).

Make sure that no voltage is applied prior to start operating.

By means of a calibrated torque wrench, check the correct tightening of all terminals of the following power cables:

- Cables connecting the inverters to the MV/LV transformer
- Cables connecting the MV/LV transformers to the MV switchgear
- Cables coming the MV switchgear to the plant MV grid
- Cables for auxiliary power derivation from the MV/LV transformer secondary winding to the auxiliary cabinet

The recommended tightening torques are to be found in the user manual of each device.

Pay attention to any color variations or anomalies affecting the isolating cables or the terminals. Replace any damaged connections or corroded contact elements.

7.6 Concrete Base check

Look for any damage, crack or deterioration affecting the concrete base.

Check the water safety syphon is unclogged and in good state.

The lower compartment below the LV and MV rooms where cables are routed shall be dry and clean. Make sure that no animal can enter it. Take the necessary corrective actions.

To inspect the lower compartment below the LV and MV rooms, remove the floor panels taking care of putting them back into place after inspection.

Even if no cables are laid between the inverters, the concrete base in this area can be inspected in the same way.

7.7 Lighting system check

Where the lighting system complete with emergency circuit is fitted, periodically perform a full discharge/charge cycle of the battery to check it is fully operational.

In case the battery discharge time is insufficient and in any case after 4 years from installation, replace it by an identical (brand and model) new one.

The battery must be disposed of in compliance with local regulations.

7.8 MV and LV room doors check

Check door locks open and close smoothly. Check door hinges operate smoothly. Check correct operation of the door stops. Take any necessary corrective actions.

Check door switches are fully working. Opening any door must result in the human presence lamp in the auxiliary cabinet front panel turning on.

7.9 Emergency button test



DANGER

Danger of death from electrocution and burns due to contact with live components of the AC- and DC Low Voltage grid, Medium Voltage grid and UPS.

- Stop all inverters (§6.5 Stop procedure)
- Open the front cover of the emergency stop button and remove the safe crash glass. Removing the safe crash results in the Emergency Stop circuit being activated:
- Circuit breaker must open in all MV/LV switchgear transformer units
- AC output circuit breaker must open in all inverters
- DC input switch must open in all inverters
- Check all circuit breakers and switches have tripped.

- Restore the emergency button and all the tripped switches.
- Restart inverters (§6.4 Start procedure).

7.10 Labels and warning signs check

Check all labels and warning signs are readable and in good conditions, as per final product drawings. Take any corrective actions, if any.

8 NORMATIVE REFERENCES

CEI 0-16	Reference technical rules for the connection of active and passive consumers to the HV and MV electrical networks of distribution Company
CEI 11-1	Power installations exceeding 1 kV a.c.
CEI 11-35	Guida per l'esecuzione di cabine elettriche MT/BT del cliente/utente finale (Guidelines for the construction of MV/LV electrical substation of the customer/end user)
CEI 20-22/2	Tests on electric cables under fire conditions Part 2: Fire propagation
CEI 64-8	Electrical installations with rated voltage not exceeding 1000V AC and 1500V DC
CEI EN 50522	Earthing of power installations exceeding 1 kV a.c.
CEI EN 60529 (CEI 70-1)	Degrees of protection provided by enclosures (IP Code)
IEC 60076-1	Power transformers – Part 1 General
IEC 60076-11	Power transformers – Part 11 Dry-type transformers
IEC 61439-1	Low-voltage switchgear and controlgear assemblies – Part 1: General rules
IEC 61936-1	Power installations exceeding 1 kV a.c. – Part 1: Common rules
IEC 62271-200	AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV



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