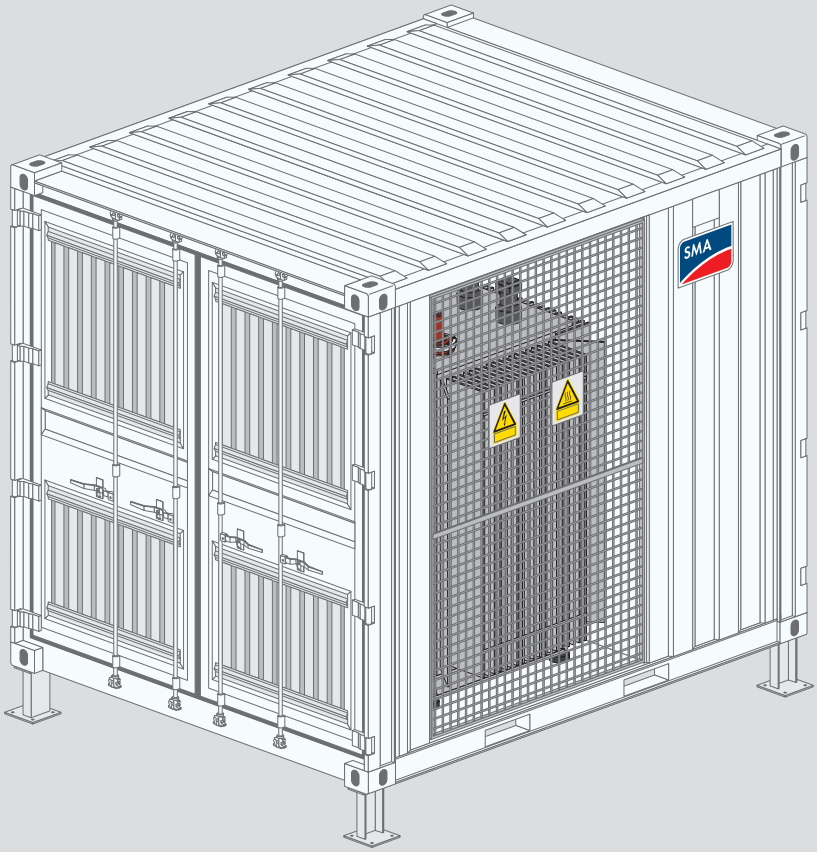
Transportation and Installation Requirements

MEDIUM VOLTAGE STATION 600 / 1200 / 1800 for SUNNY TRIPOWER 60



ENGLISH

MVS-STP-10-TA-en-11 | Version 1.1

Table of Contents

1 Information on this Document

1.1 Validity

This document is valid for the following device types:

Device type	Production version
MV Station 600 for Sunny Tripower 60 (MVS-600-STP-10)	1.0
MV Station 1200 for Sunny Tripower 60 (MVS-1200-STP-10)	
MV Station 1800 for Sunny Tripower 60 (MVS-1800-STP-10)	

The production version of the MV Station is indicated on the type label.

Illustrations in this document are reduced to the essential and may deviate from the real product.

1.2 Additional Information

Links to additional information can be found at www.SMA-Solar.com.

1.3 Nomenclature

Complete designation	Designation in this document
Sunny Tripower 60 STP 60-10	Sunny Tripower or inverter
MV Station for Sunny Tripower MVS-600-STP-10 MVS-1200-STP-10 MVS-1800-STP-10	MV Station
Medium-voltage switchgear	MV switchgear
Medium-voltage transformer	MV transformer

2 Product Overview

2.1 System Overview

The MV Station, together with a PV array and a number of Sunny Tripower inverters, forms a PV power plant.

All devices necessary for feeding the alternating current coming from the inverters into the medium-voltage grid are installed in the MV Station. The MV Station is based on a modular concept in which you can select the components according to the specific project requirements. Up to 30 Sunny Tripower inverters can be connected to the MV Station.

Several MV Stations can be connected together to form a ring or string on the medium-voltage side.

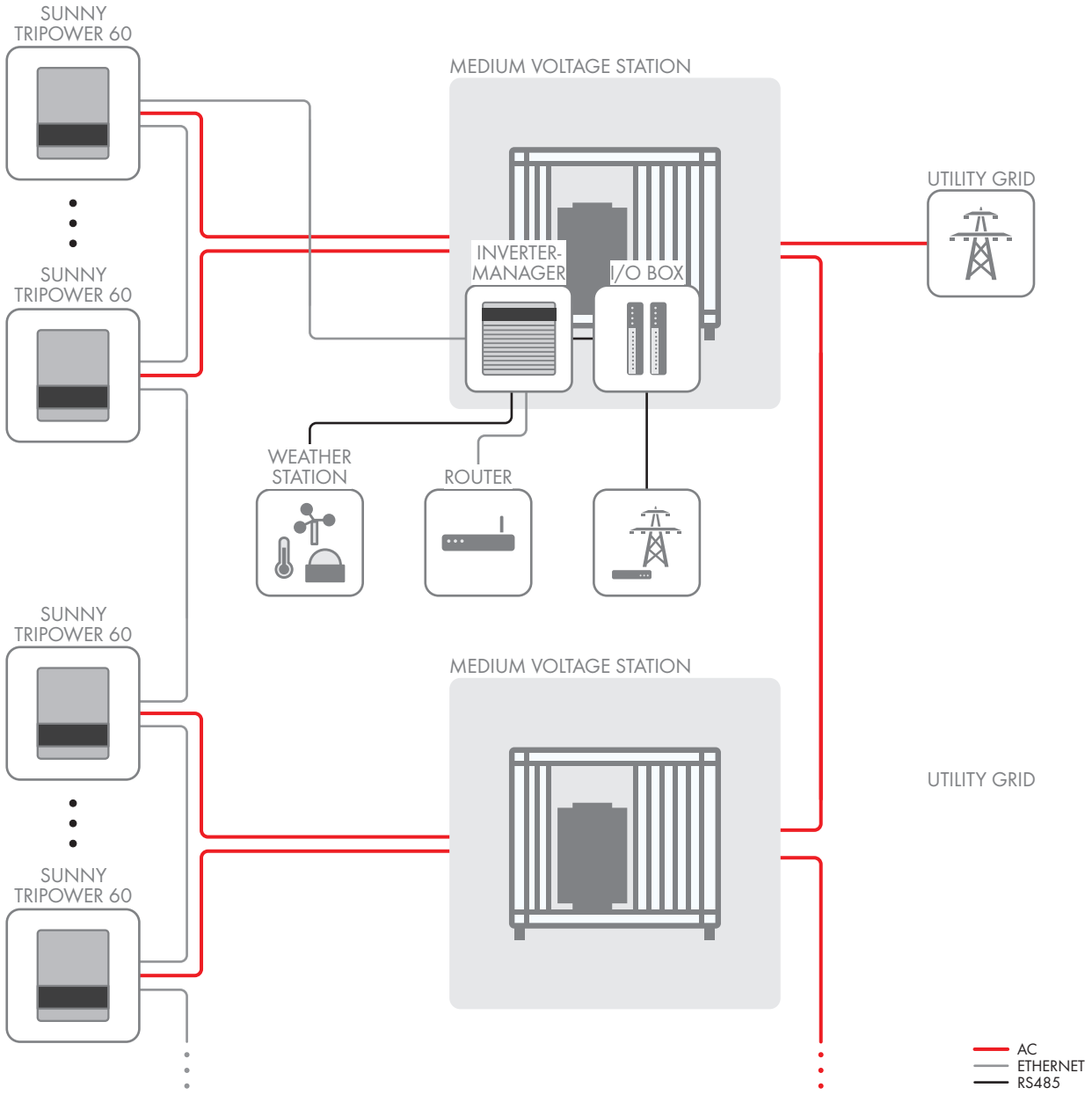


Figure 1: Design of the PV power plant with MV Stations (example)

The Inverter Manager and the I/O Box can be installed in the MV Station as an option and can control the output of the inverters. Up to 42 inverters can be connected to one Inverter Manager. This means that PV systems can be designed with several MV stations, whereby not every MV station has to be fitted with an Inverter Manager.

2.2 Design of the MV Station

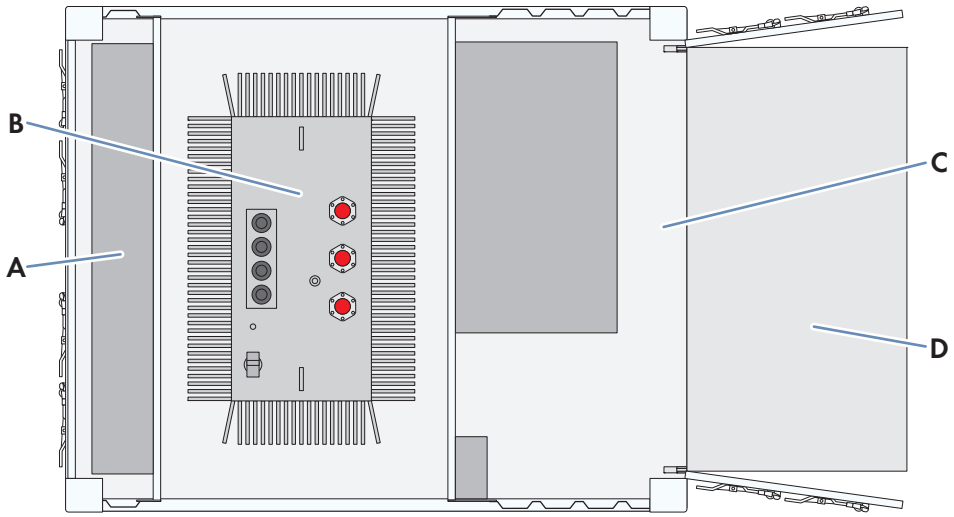


Figure 2: Design of the MV Station

Position	Designation	Explanation
A	Low-voltage compartment	The AC low-voltage cables from the inverters are connected in the low-voltage compartment.
B	MV transformer	The MV transformer converts the inverter output voltage to the voltage level of the medium-voltage grid.
C	Medium-voltage compartment	**MV switchgear*** The MV switchgear connects and disconnects the MV transformer to and from the medium-voltage grid.
		Station subdistribution The station subdistribution contains fuse elements for the supply of the station and the optional Inverter Manager.
		Inverter Manager* The Inverter Manager is a device for monitoring and controlling up to 42 Sunny Tripower inverters. The Inverter Manager receives the specifications from the optional I/O Box and controls all inverters in the system accordingly. Further information on the Inverter Manager is to be found in the documentation supplied with the Inverter Manager.
		I/O Box* The I/O Box is a multi-function interface for one Inverter Manager. The I/O Box receives commands for grid management services via digital signals and sends these specifications to the Inverter Manager. Further information on the I/O Box is to be found in the documentation supplied with the Inverter Manager.
D	Service platform	The elevated position of the service platform makes operating the devices in the medium-voltage compartment easier. The service platform is only folded out when operations are to be performed on the medium-voltage compartment.

* optional

2.3 Option code

The MV Station is available in various power classes:

MV Station	Inverter
MVS 600 STP	a maximum of 10 inverters
MVS 1200 STP	a maximum of 20 inverters
MVS 1800 STP	a maximum of 30 inverters

You can use the option code to select an MV Station configuration which is tailored specifically to your project. However, not all order options can be combined with each other. Consult your SMA contact person if you have any questions.

Order option	1	2	3	4	5	6	7	8	9	Description
MV transformer	0									Mineral oil, with full hermetic protection
	1									Organic oil with increased flash point above 300°C, with full hermetic protection
Nominal voltage		1								10.0 kV
		2								11.0 kV
		3								12.0 kV
		4								12.5 kV
		5								13.2 kV
		6								13.8 kV
		7								15.0 kV
		8								20.0 kV
		9								22.0 kV
		A								23.0 kV
		B								30.0 kV
		C								33.0 kV
		D								34.5 kV
Nominal frequency			0							50 Hz
			1							60 Hz
Transformer vector group				0						Dyn11
				1						YNyn0
Oil spill tray					0					Without
					1					With (separate component)

Order option	1	2	3	4	5	6	7	8	9	Description
Medium-voltage switchgear						0				Without
						1				Ring (3-field), transformer panel with fuses, rated voltage 24 kV
						2				Ring (3-field), transformer panel with circuit breaker, rated voltage 24 kV
						3				Ring (3-field), transformer panel with fuses, rated voltage 36 kV
						4				Ring (3-field), transformer panel with circuit breaker, rated voltage 36 kV
						5				Ring (3-field), transformer panel with fuses, rated voltage 38 kV
						6				Ring (3-field), transformer panel with circuit breaker, rated voltage 38 kV
Accessory for medium-voltage switchgear							0			Without
Packaging								0		Standard
								1		Sea freight, including sealing plate for transformer compartment, additional base plate and desiccant bags
Ambient temperature									0	−25 °C to +40 °C
									1	−25 °C to +50 °C

Continuation of the option code

Order option	10	11	12	13	14	15	16	17	Description
Installation altitude	0								0 m to 1000 m
	1								1001 m to 2000 m
Environment		0							Standard
		1							Protection against chemically active environment, e.g. sea salt (achieved via special paint on the MV transformer)
Additional equipment			0						Without

Order option	10	11	12	13	14	15	16	17	Description
Inverter Manager				0					Without
				1					With Inverter Manager and power supply unit
				2					With Inverter Manager, power supply unit and I/O Box
LV circuit breaker					0				Without
					1				With circuit breaker between MV transformer and low-voltage distribution, including 2 active fans
LV energy meter						0			Without
Country package							0		Without
Language								DE	German
								EN	English
								FR	French
								ES	Spanish

2.4 Scope of Delivery

Check the scope of delivery for completeness and any externally visible damage. Contact your distributor if the scope of delivery is incomplete or damaged.

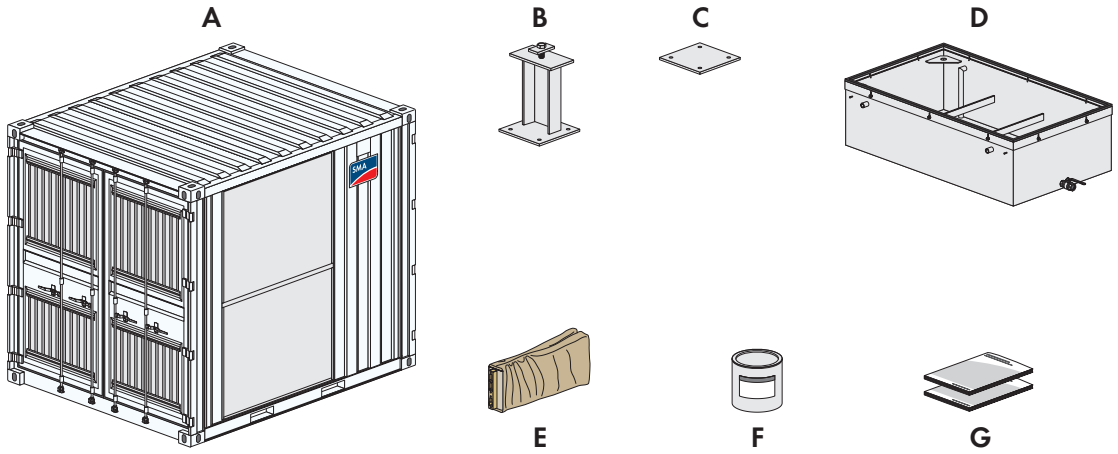


Figure 3: MV Station Scope of Delivery

Position	Quantity	Designation
A	1	MV Station
B	4	Support feet for the container
C	8	Base plates for the support feet for compensation of unevenness (four units available in two thicknesses: 2 mm and 5 mm)
D	1	Oil spill tray with oil drain valve*

Position	Quantity	Designation
E	1	LV/HRC fuse extractor with sleeve
F	1	Spare paint
G	1	Documentation: system manual, circuit diagram, MV transformer test protocol, delivery test protocol, MV switchgear documentation, MV Station test protocol

* optional

2.5 External dimensions and weights

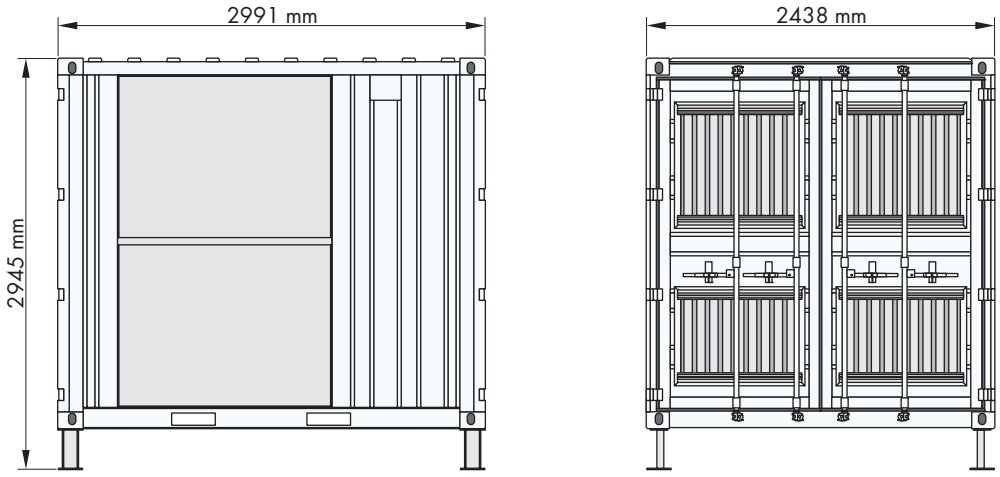


Figure 4: Dimensions of the MV Station

Dimensions of the MV Station without platform or support feet

	Width	Height	Depth	Weight
MV Station 600 / 1200 / 1800	2991 mm	2591 mm	2438 mm	< 9 t

Dimensions of the MV Station with platform and support feet

	Width	Height	Depth	Weight
MV Station 600 / 1200 / 1800	4013 mm	2945 mm	2438 mm	< 9 t

The weight of the MV Station may vary below the indicated weight depending on the selected nominal voltage and power class.

3 Transport and Mounting

3.1 Transport by truck or ship

The dimensions and shape of the MV Station correspond to those of an ISO container. This means that it can be loaded, secured for transport, transported and installed quickly and easily. It can be transported via truck or ship. A truck 16 m long, 2.7 m wide, 5 m high, and with a total weight of 50 t can transport up to four MV Stations. For transport, two MV stations each can be coupled together using special coupling elements.

All transport vehicles must be suitable for transporting containers.

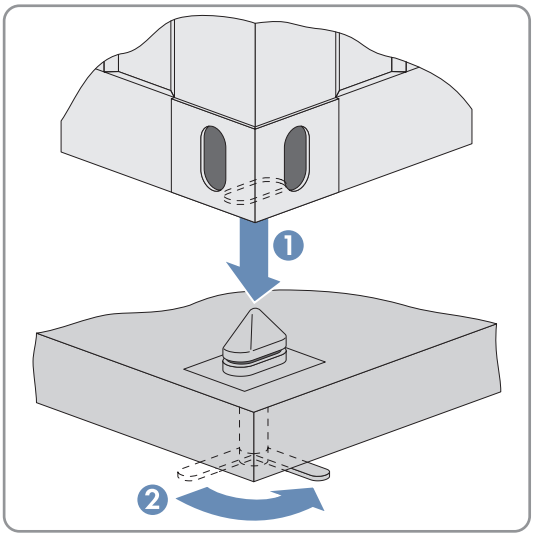
Transport via airfreight or railroad is not permitted.

During transport and unloading, damage to the paint of the station container may occur. Damage to the paint does not impair the function of the MV Station. However, any damage must be remedied using the spare paint supplied within three weeks at the latest.

For transportation by truck or ship, the MV Station must be secured at least at all four lower corner castings. This can be done by various methods, depending on the fastening system of the means of transportation. The most common methods are described below.

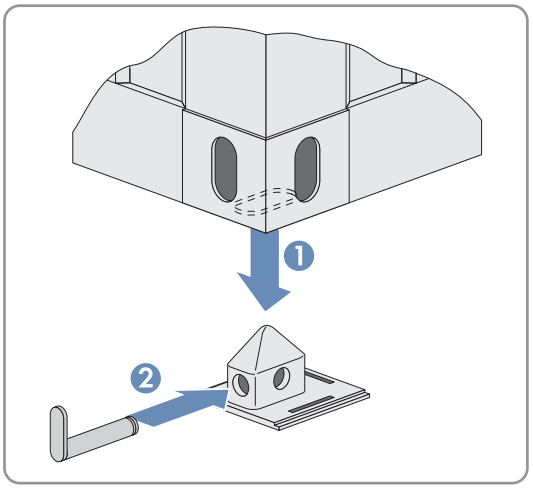
Twistlock

- The MV Station is set down on the locking mechanisms. By turning the twistlock, an interlocking is made.



Pinlock

- The MV Station is set down on the locking mechanisms. Any slippage of the load is prevented by inserting the pinlock.



For sea transport, two MV Stations can be coupled together using the quick-tie system. The respective sides in which the low-voltage compartments are situated are to be connected together.

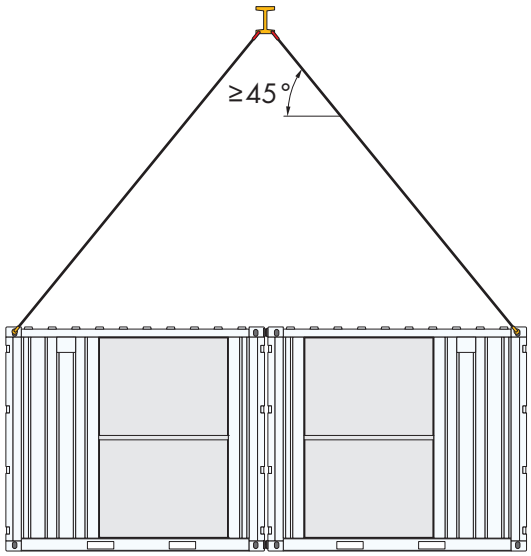


Figure 5: Coupling of 2 MV Stations for sea transport

Individual MV Stations can be loaded onto a 20° foot flat rack for sea transport. Three MV Stations can be loaded onto a 40° foot flat rack for sea transport.

Oil trays and inverters are transported in a separate container or as general cargo.

The exact transport conditions will be defined specifically for each project.

3.2 Storage

For storage of the MV Station, note the following points:

- Do not place the MV Station on an unstable, uneven surface.
- Once the MV Station has been set down, do not attempt to adjust its position by pulling or pushing.
- Prior to storage, ensure that the doors of the MV Station are securely closed.

3.3 Requirements for Transport Routes and Means of Transport

☐ The maximum permissible gradient of the access road is 4%.

☐ During unloading, a distance of at least 2 m to neighboring obstacles must be observed.

☐ The access road must be constructed to ensure that a truck (16 m long, 2.70 m wide, 5 m high, and a total weight of 50 t) can reach the unloading site. The curve radius of the truck must be taken into account.

☐ Transport must be carried out by truck with air-sprung chassis.

☐ For trucks with several containers, the access roads and the unloading site must be designed corresponding to the length, width, height, total weight and curve radius of the truck.

☐ The unloading site for the crane and truck must be firm, dry and horizontal.

3.4 Unloading

The MV Station is unloaded using a crane or forklift. To unload the MV Station, the crane requires a swivel radius of at least 6 m. To facilitate unloading, we recommend maintaining a distance of at least 2 m to neighboring obstacles such as fences or trees.

Depending on the conditions on-site, further measures may be necessary (e.g. for installations close to overhead power lines). The conditions at the unloading site must have been thoroughly checked before transport.

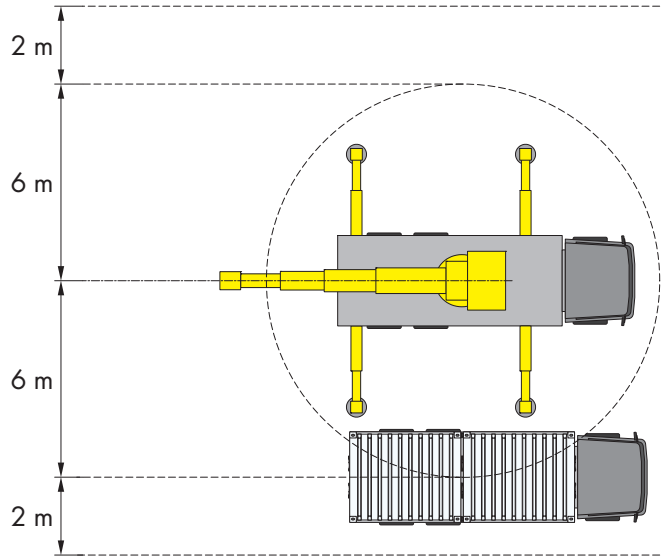


Figure 6: Swivel radius for unloading the MV Station

The MV Station is lifted by the four corner castings using a container crossbeam with chain sling. It can be lifted by the top or bottom corner castings. The angle between chain sling and the ground must be greater than 45°.

If two MV Stations have been coupled together for transport purposes, the MV Stations must be decoupled prior to installation and attachment of the support feet.

Attaching the Support Feet During Unloading

The MV Station must be mounted on four support feet. The support feet can be found in the accessory kit in the medium-voltage switchgear compartment. The support feet must be attached to the MV Station before it is placed on the foundation. To attach the support feet, an open-end wrench (AF 30) is required.

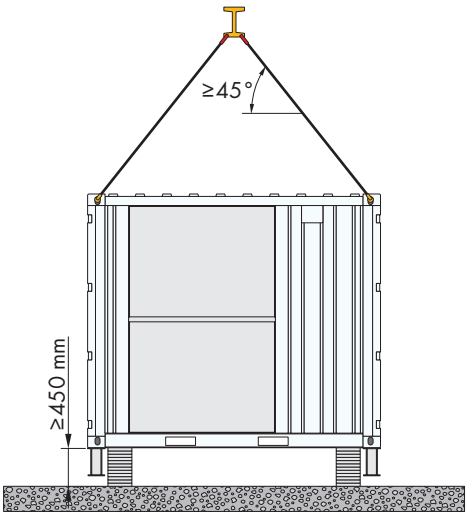


Figure 7: Attachment of the support feet during unloading of the MV Station at the mounting location

Attaching the MV Station support feet

To attach the support feet to the MV Station, the MV Station can be set down for a short while on temporary platforms (e.g. crane support plates). For the assembly of the support feet, the platforms must be at least 450 mm high.

or

The support feet can be attached while the MV Station is suspended from the crane. The MV Station should not be raised higher than 600 mm off the ground to attach the support feet. Intermediate storage on temporary platforms is recommended.

The space underneath the MV Station serves several purposes and must not be blocked by any object other than the oil tray:

- Escape of pressure from the medium-voltage switchgear in case of electric arcs
- Easy insertion of cables
- Protection from minor flooding

The clearance between the mounted MV Station and the ground must be at least 354 mm.

If the mounting location is subject to strong winds, the support feet should be anchored to the foundation. When mounting and installing the MV Station, observe all regulations applicable at the installation site.

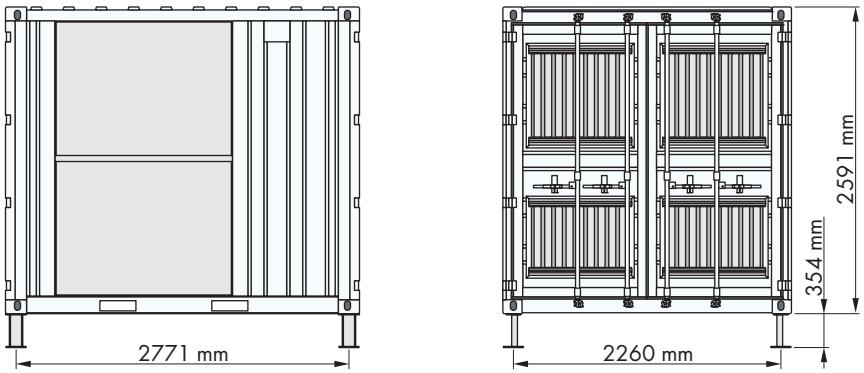


Figure 8: Position of the support feet

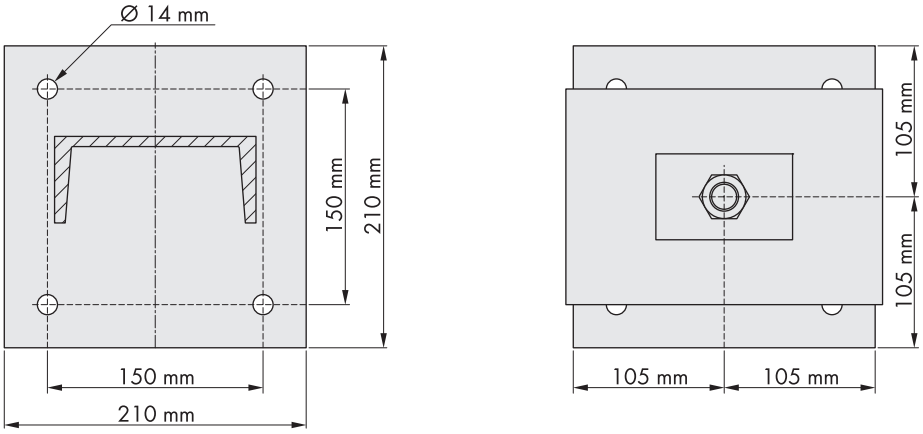
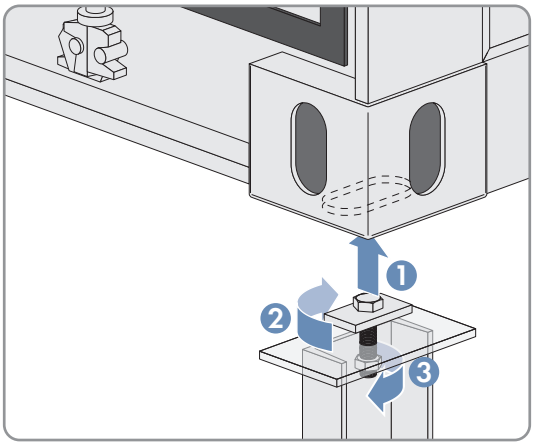


Figure 9: Dimensions of the support feet

- The support feet are connected to the MV Station via a twistlock.



- Any unevenness of the support surface can be compensated for using base plates.

4 Information for Installation

4.1 Minimum Clearances

Observe the following minimum clearances to ensure trouble-free operation of the MV Station. The minimum clearances are required to ensure trouble-free installation of the MV Station and easy replacement of the devices (for example, with a forklift) during service and maintenance. In addition, locally applicable regulations must be observed.

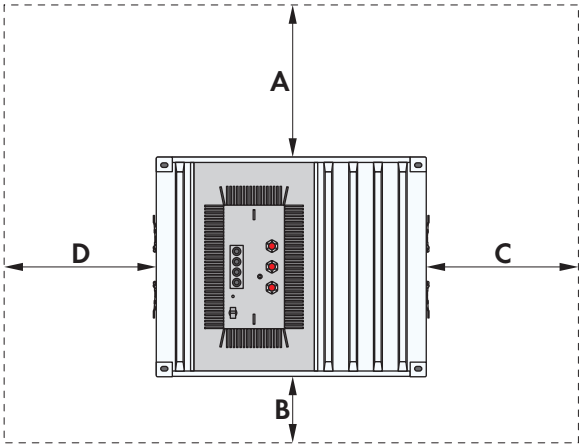


Figure 10: Minimum clearances

	Minimum clearances			
	A	B	C (Medium-voltage side)	D (Low-voltage side)
Minimum clearances required for servicing	6000 mm	1500 mm	6000 mm	6000 mm
Minimum clearances for trouble-free operation	1500 mm	1500 mm	1500 mm	1500 mm

The service platform is included in the specification of the minimum clearances.

4.2 Ambient Conditions

The standard version of the MV Station is suitable for mounting locations with ambient temperatures of up to +40°C. Ambient temperatures of up to +50°C are possible if the appropriate order option is selected.

The ambient conditions must comply with classification 4S2.

In the standard version, the MV Station meets the requirements of the classifications 4S2 and 4C1. The MV Station can be installed in chemically active environments, e.g. in coastal areas. In this case, you must select the appropriate order option. This order option provides the MV Station with enhanced protection against chemically active substances. The ambient conditions must then comply with classifications 4S2 and 4C2.

The air quality requirements are given in the following tables.

Air Quality Classification for Mechanically Active Substances

Ambient conditions for stationary application	Class 4S2
a) Sand in air [mg/m^3]	300
b) Dust (suspended matter) [mg/m^3]	5.0

Ambient conditions for stationary application	Class 4S2
c) Dust (precipitation) [mg/m³]	20
Installation sites where appropriate measures are taken to keep dust levels to a minimum	x
Installation sites where no special measures have been taken to reduce the sand or dust levels and which are not located in the vicinity of sand or dust sources	x

The air quality must comply with the following classification of air quality for chemically active substances:

Ambient conditions for stationary application	Class 4C1	Class 4C2	
	Threshold value	Mean value	Threshold value
a) Sea salt	–	Occurrence of salt spray	
b) Sulfur dioxide [mg/m³]	0.1	0.3	1.0
c) Hydrogen sulfide [mg/m³]	0.01	0.1	0.5
d) Chlorine [mg/m³]	0.1	0.1	0.3
e) Hydrogen chloride [mg/m³]	0.1	0.1	0.5
f) Hydrogen fluoride [mg/m³]	0.003	0.01	0.03
g) Ammonia [mg/m³]	0.03	1.0	3.0
h) Ozone [mg/m³]	0.01	0.05	0.1
i) Nitrogen oxides [mg/m³]	0.1	0.5	1.0
Installation sites in rural or densely populated areas with little industry and moderate traffic volume	x	x	
Installation sites in densely populated areas with industry and high traffic volume	–	x	

4.3 Installation

4.3.1 Design of the PV System with MV Station

i Closed electrical operating area

For safety reasons, the PV system with the MV Station must be installed in a closed electrical operating area in accordance with IEC 61936-1.

- Ensure that no unauthorized persons have access to the MV Station or the inverters.

4.3.2 Support surface

☐ The support surface must be a dry and solid foundation, e.g. gravel.

☐ For convenient working on the service platform on the medium-voltage compartment and trouble-free maintenance, the provision of a level, paved surface is recommended. The surface should be in accordance with the recommended minimum clearances for servicing operations.

☐ The support surface underneath the MV Station should be clean and firm to avoid any dust circulation.

☐ In areas subject to strong precipitation or high groundwater levels, a drainage system must be implemented.

- ☐ To avoid the ingress of water as a result of rain, the MV Station is not to be installed in a depression.
- ☐ To facilitate accessibility for servicing operations, the MV station is to be mounted at a height of no more than 0.5 m. Additional costs incurred during any servicing operations due to an increased mounting height must be covered by the customer.

4.3.3 Pea gravel ground

The support surface around the MV station must be prepared with a subgrade for drainage.

Installation of the MV Station with oil tray

If the MV Station is to be installed with an oil tray, the support surface must satisfy the following minimum requirements:

- ☐ A pit must me dug out for the oil tray.
- ☐ A drainage layer of 200 mm must be filled below the oil tray.
- ☐ Once the oil tray has been positioned, the pit must be filled with gravel.
- ☐ For convenient working on the service platform on the medium-voltage compartment and trouble-free maintenance, the provision of a level, paved surface is recommended.

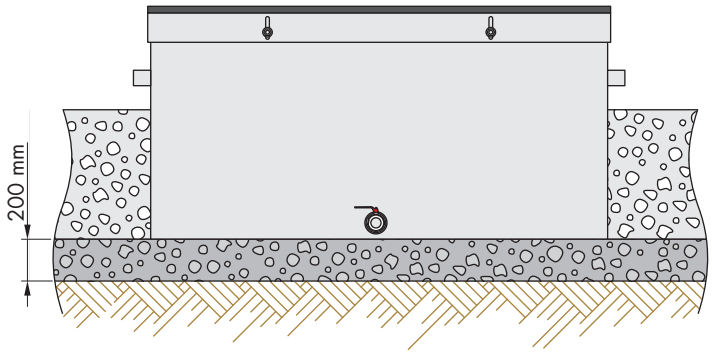


Figure 11: Overview of the drainage layer below the oil tray

Installation of the MV Station without oil tray

The subgrade must meet the following minimum requirements:

- ☐ The compression ratio of the subgrade must be 98%.
- ☐ The soil pressure must be 150 kN/m^2.
- ☐ The unevenness must be less than 0.25%.
- ☐ For convenient working on the service platform on the medium-voltage compartment and trouble-free maintenance, the provision of a level, paved surface is recommended.
- ☐ This area must have the following dimensions:

Position	Dimensions
Width	6000 mm
Depth	6440 mm

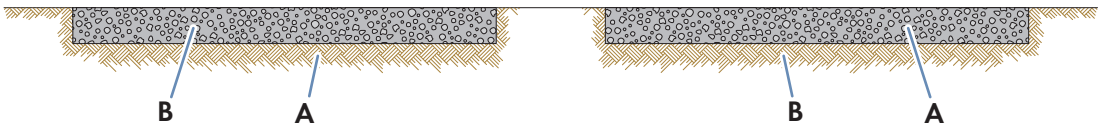


Figure 12: Structure of the support surface

Position	Designation
A	Pea gravel ground as required
B	Solid ground, e.g. gravel

4.3.4 Weight load

The weight load on each of the support feet of the MV Station is 3000 kg.

The support surfaces are to be designed accordingly.

4.3.5 Mounting options

The MV Station can be mounted on pile-driven steel pillars or concrete pillars.

The type of mounting foundation is the responsibility of the customer.

The service platform must be taken into account when planning the support surface (see Section 4.3.6, page 19).

4.3.5.1 Pile-driven steel pillars

Minimum length of the steel pillars

The driven depth of the steel pillars must satisfy the structural requirements.

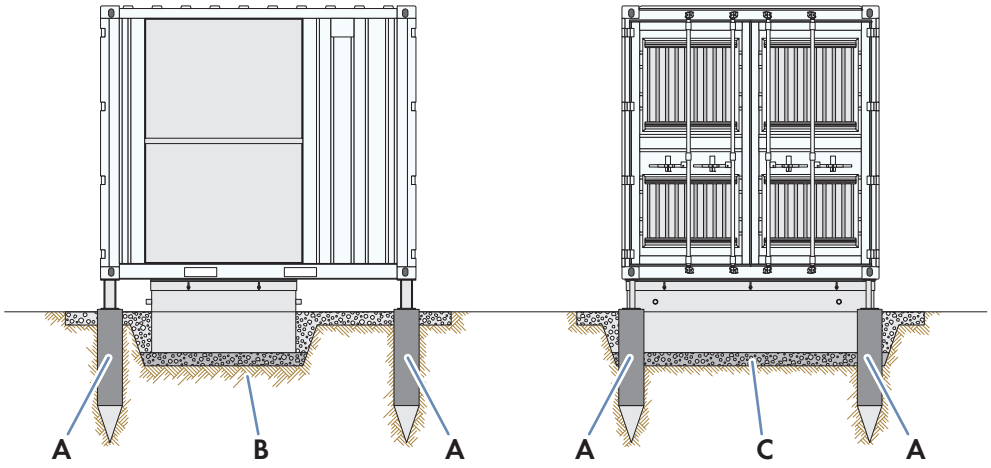


Figure 13: Pile-driven steel pillars (example)

Position	Designation
A	Pile-driven steel pillars
B	Solid ground, e.g. gravel
C	Pea gravel ground

4.3.5.2 Concrete pillar

Minimum lengths of the concrete pillars

The below-ground depth of the concrete pillars must satisfy the structural requirements.

The concrete pillars must have the following properties:

- ☐ The concrete pillars must be suitable for the weight of the product.
- ☐ The concrete pillars must be mounted on solid ground.
- ☐ The concrete pillars should have the following minimum dimensions:

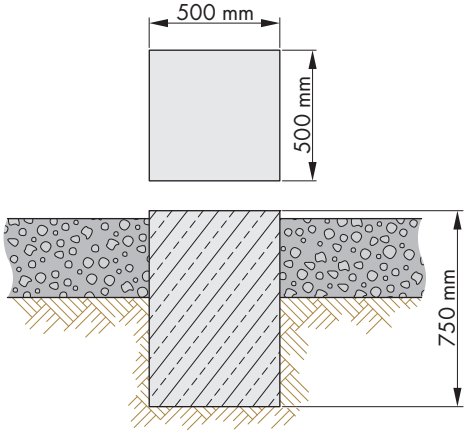


Figure 14: Dimensions of the concrete pillars (example)

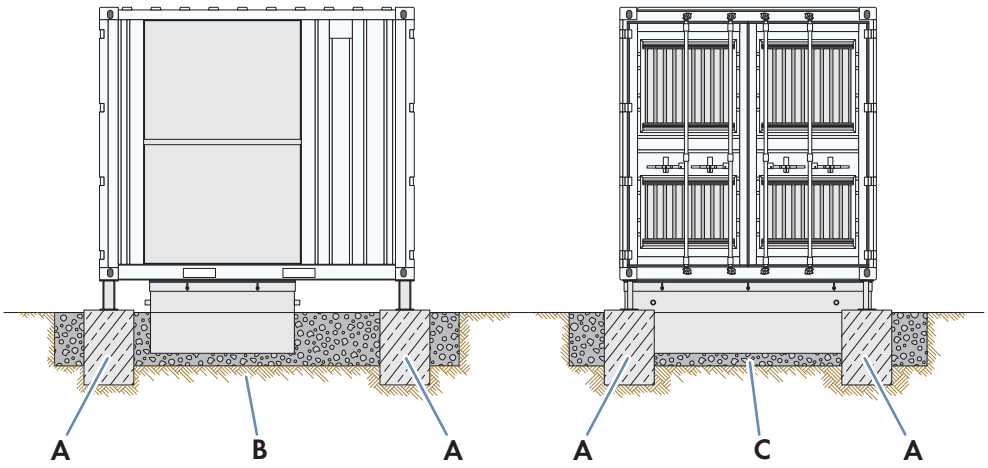


Figure 15: Concrete pillars (example)

Position	Designation
A	Concrete pillar
B	Solid ground, e.g. gravel
C	Pea gravel ground

4.3.6 Installation of the Temporary Service Platform

Areas for supporting the feet of the platform in front of the MV switchgear compartment must be provided for when planning the support surface.

The weight load for the support feet is 150 kg each. The use of flagstones is recommended for the support surface.

- Recommended dimensions of flagstones: 400 mm x 400 mm x 60 mm

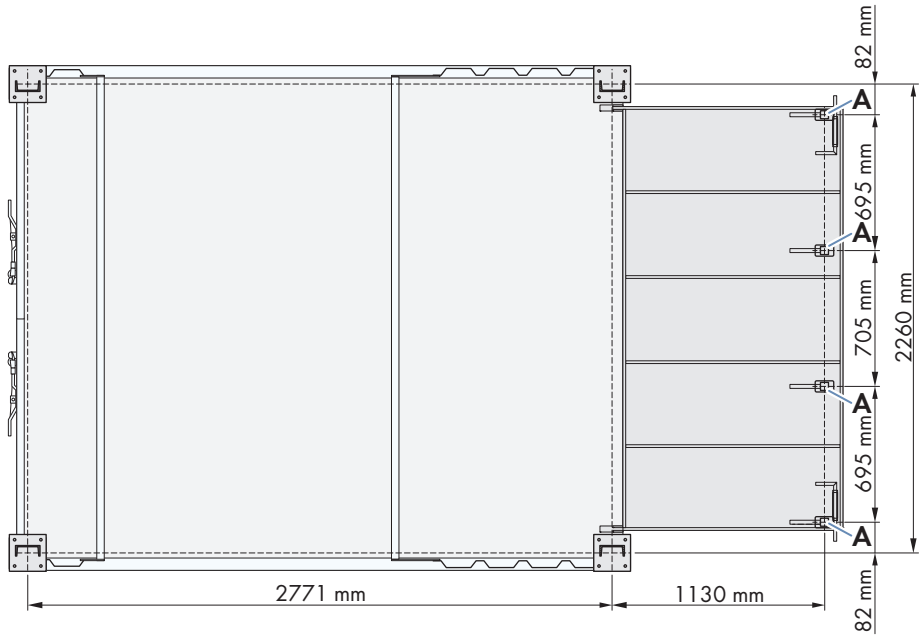


Figure 16: Position of the support feet of the service platforms

Position	Designation
A	Support feet of the work platform in front of the medium-voltage switchgear compartment*

* Only folded out temporarily

The service platforms are included in the specification of the minimum clearances.

Open areas underneath the MV Station

The open areas underneath the MV Station must not be blocked by any other installations or groundfill. The only permissible exception is the oil containment. The areas underneath the MV Station are needed for pressure dissipation in the event of arc faults.

Disregarding this information can lead to personal injury or device failure. SMA Solar Technology AG does not accept liability for any resulting damage.

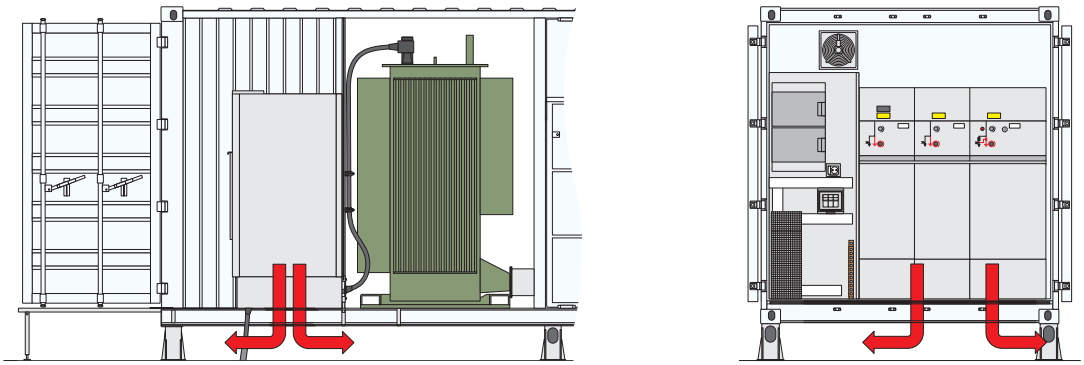


Figure 17: MV°Station internal arc pressure

4.3.7 Recesses in the Support Surface

Recesses for cable routing and for the oil tray must be provided in the support surface.

During planning of the recesses in the support surface, the positions of the support feet for the station and the service platform must be taken into account.

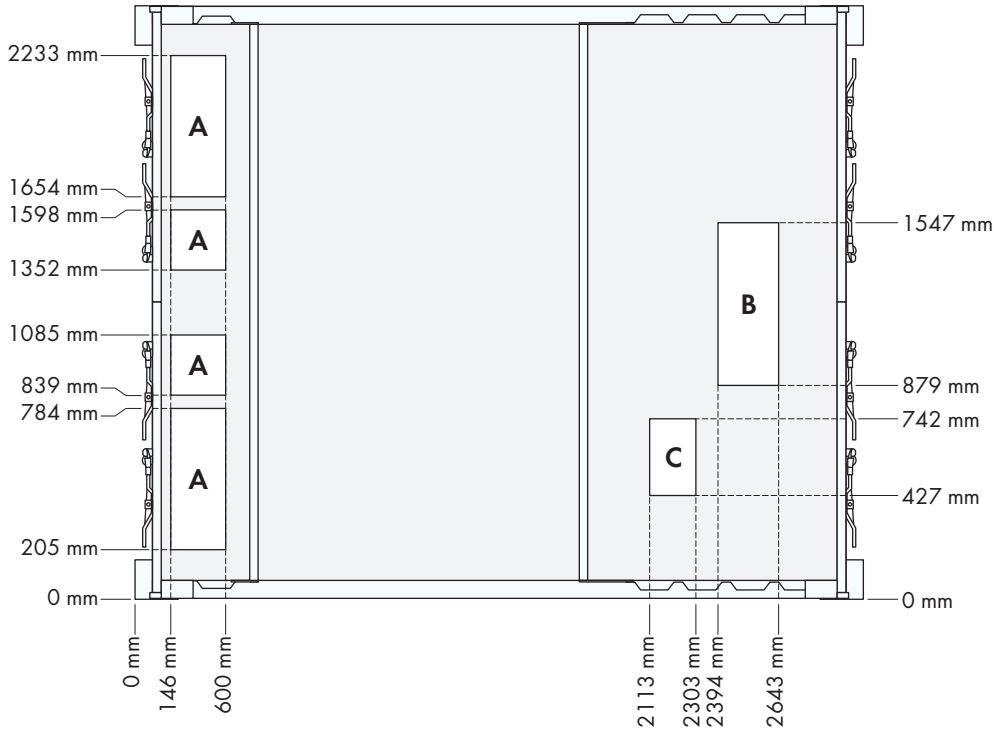


Figure 18: Position and dimensions of the recesses in the station container

Position	Designation
A	Recess underneath the low-voltage compartment for insertion of the low-voltage cables from the inverters: • Maximum 30 cables, maximum cable cross-section: 95 mm^2, maximum 30 cable support sleeves, diameter 14 mm to 68 mm
B	Recess underneath the medium-voltage switchgear for insertion of the medium-voltage cables: • Maximum 3 single-core cables per cable panel, 3 cable support sleeves per cable panel, diameter 14 mm to 68 mm
C	Recess underneath the Inverter Manager for insertion of the data cables and grounding cables: • 3x for cable diameters 5 mm to 9 mm • 3x for cable diameters 9 mm to 13 mm • 4x for cable diameters 11 mm to 16 mm • 4x for cable diameters 14 mm to 21 mm

4.4 Oil Containment

The oil tray is only a component part of the MV Station if the option "Oil tray: With" was selected.

The oil containment collects oil which may leak from the MV transformer under fault conditions. The oil tray must be positioned underneath the MV transformer and embedded in the support surface.

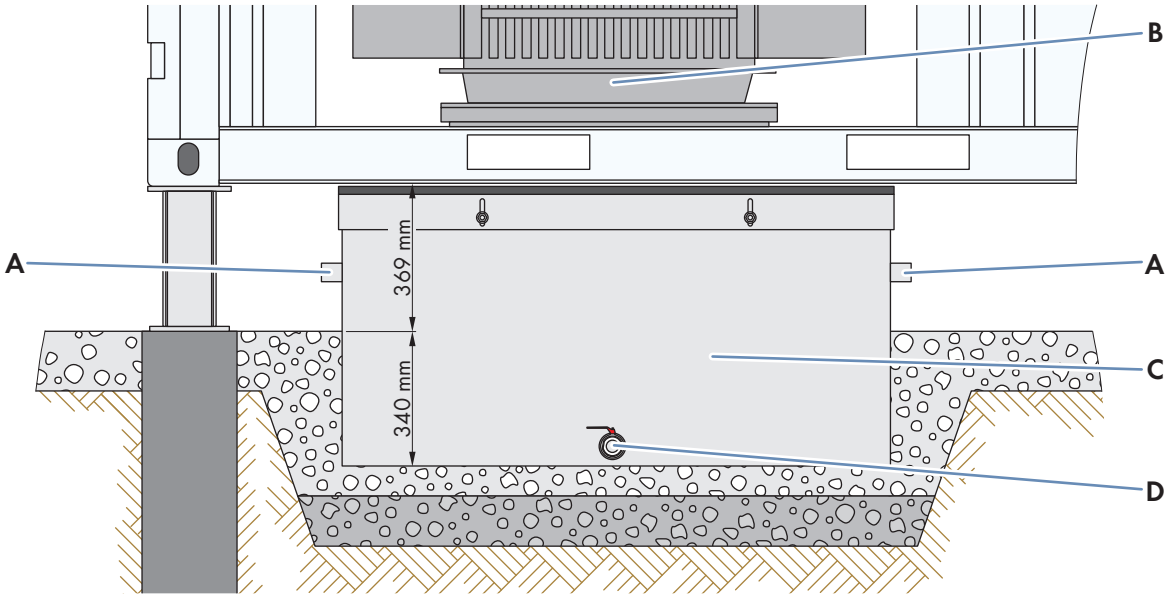


Figure 19: Position of the oil tray

Position	Designation
A	Oil tray overflow for rain water
B	MV transformer
C	Oil tray
D	Oil drain valve

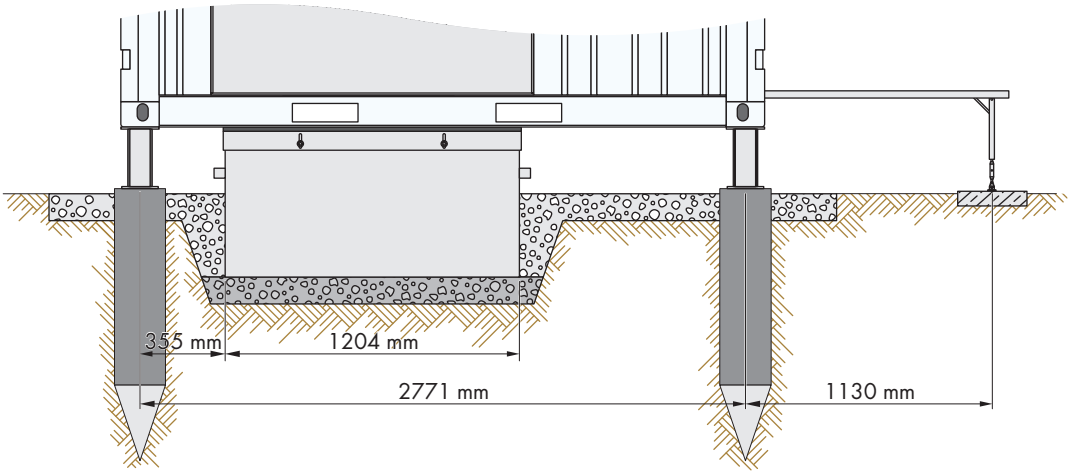


Figure 20: Oil tray dimensions

5 Electrical Connection

5.1 Grounding Concept

The recommended meshed design of the MV transformer grounding reduces leakage current levels.

It is recommend that optical fiber technology is used for the transmission of signals, for example, when using cameras and monitoring equipment. This will counteract possible interference sources.

Grounding of the oil tray must be carried out during installation. The two grounding bolts located on the sides of the oil tray can be used for this.

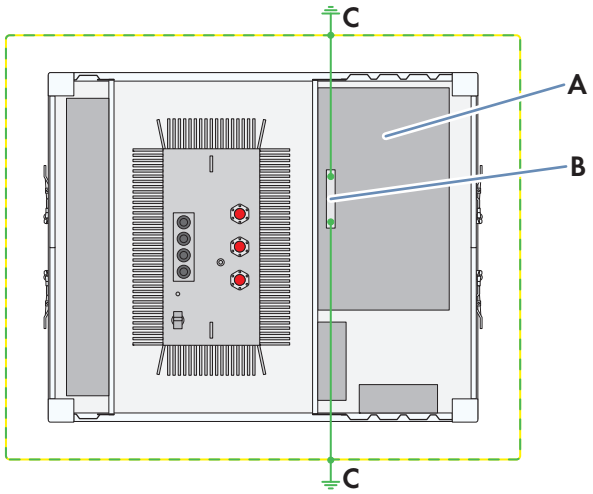


Figure 21: Grounding concept (example)

Position	Designation
A	MV switchgear
B	Grounding busbar
C	Ground electrode

Double grounding of the MV Station

We recommend that the grounding concept provides for double grounding of the MV Station.

5.2 Cable Entry

Cable entries are fitted underneath the low-voltage area, the medium-voltage switchgear and the station sub-distribution. Plastic tubing without grooves is recommended for cable. The use of plastic tubes without grooves makes for easier cable insertion.

Upon completion of the installation work, the cable entry areas must be protected to prevent animals from entering the connection area.

5.3 Cable Requirements

Terminal	Cable requirements
Low-voltage cables for inverters	• Connection with tin-plated aluminum or copper terminal lug (for screw diameter: 8 mm) • Copper or aluminum cable • Cable cross-section: 16 mm^2 to 95 mm^2 Temperature-resistant cables (90°C) must be used if ambient temperatures are higher than 40°C.
Medium-voltage cables	• Connection with outer-cone angle plug type C
Communication interface	Connection with Ethernet cables • The cables must be shielded and pair-twisted. • The cables must be at least category 5 (CAT 5). • Maximum cable length: 100 m
Ground electrode	Cable cross-section copper cable: minimum 1 x 95 mm^2 to maximum 2 x 95 mm^2
Oil containtment grounding	• Connection with tin-plated copper terminal lug • Cable cross-section copper cable: 50 mm^2

6 On-Site Services

The following supplies and performances are not included in the scope of delivery of the product:

- Transport to the construction site (can be carried out by us on request)
- Crane or forklift for unloading the product at the construction site (SMA can perform the offloading on request)
- Foundation for the product
- Installation of the optional oil tray including oil tray grounding
- Protective tubes for cable entry
- Ground electrode or external grounding system
- All mounting and connection work at the construction site
- Door locks
- Screws and wall plugs for the attachment of the support feet at the foundation
- Protection test of the medium-voltage switchgear
- Inspection of the grounding arrangement

The MV Station must be commissioned by SMA Solar Technology AG or an authorized service partner.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