DISTRIBUTION SOLUTIONS

MNS-Up
Service Manual

- Capex and footprint reduction
- Reduced installation time as all the system is pre-tested
- Flexibility and scalability with full plug-in UPS modules
- On-premise and cloud base data collection and analysis with ABB Ability™

The MNS-Up system is an integrated low-voltage switchgear system comprised of incoming and central manual bypass feeders, MNS-Up UPS sections and MNS 3.0 outgoing sections.

The system is based on the well-known MNS system, in which the MNS-Up UPS is integrated.

Table of contents

01

Introduction

Introduction

This manual id dedicated to the MNS-Up section hosting the UPS modules; for the other cubicles and the UPS modules please refer to dedicated Manuals:

- MNS Installation and maintenance manual 1TGC902040B0201
- DPA 500 Operating Manual 04-3275 REV-C

02

Safety first

Safety first

Safety requirements when working on electrical systems

2.1 Safety relevance

This Service Manual contains further safety relevant aspects in the document. This is highlighted with the following symbol:

When working on specific tasks or areas in the switchgear it is mandatory to follow the safety requirements and advises outlined in this document.

2.2 Understanding and managing the risk

Any person working on or near electrical systems is required to understand the danger and risk such work may impose to his/her life as well as to any person and property in the vicinity.

It is of utmost importance that the danger of electrical energy is understood and following characteristics associated with electrical energy should be noted:

- Electrical energy cannot be seen, heard or smelt, with the result that it is not possible to determine whether a circuit is alive or dead by relying on senses. Electrical apparatus must therefore always be considered **LIVE** until it is proved to be DEAD.
- **DEAD** means zero volts between conductor and earth is confirmed.
- **LIVE** or **DEAD** status is determined and confirmed by equipment specifically designed for the purpose, **NEVER** by touch.

Personnel shall not work on any electrical apparatus until approval has been granted by the responsible authority and the working environment has been classified as safe, the following must be controlled:

- Any prohibited area,
- Compartments containing potentially live apparatus/conductors/and terminals.

Electrical energy will follow along the path of least resistance. This may include all metallic and conductive components, the human body and many fluids. Conditions that influence the flow of electrical energy are:

- Intact Insulation. Under these conditions the circuit fulfils its designed function and the flow of energy can be predicted.
- Breached Insulation. Under these conditions a short circuit may occur. This could prove hazardous to life and property. The flow of energy is random and may not be predictable. Damaged insulation must always be reported. There are two reasons for accidental contact with live parts:
  - Apparatus being made live whilst others are working on it,
  - Unsafe working practices.

The highest danger to human life and property is the situation with the occurrence of an electrical arc. An electric arc is a dangerous release of energy created by an electrical fault or short circuit. It contains thermal energy, pressure waves, acoustic energy and debris. The intense energy and very short duration of an electric arc flash represents a very unique event. The temperature of an electric arc can reach up to 20 000 °C (35 000 °F), or two to three times the surface temperature of the sun! Exposure to these extreme temperatures both burns the skin directly and causes ignition of clothing, which adds to the burn injuries.

An electrical arc flash describes an explosive electrical event that presents an extremely significant hazard to people and property. It is of vital importance to use suitable tools and instruments as well as personal protection equipment for commissioning, inspection or any kind of maintenance work on electrical systems.

2.3 Warning signs and labels

Electrical systems shall be labeled according to the hazard risk level. ISO3864 and its ANSI equivalent Z535.4 prescribes the layout and application of signs. Following sings are typically applied:

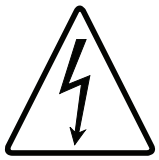
High Voltage ISO3864	Arc Flash Hazard ISO3864	Warning Sign ANSI Z535.4	Danger Sign ANSI Z535.4
			

Table 2-01 Typical warning signs and labels

2.4 Basic principles and precautions to be observed

In accordance with the valid local regulations, all installation and maintenance work involving MNS low voltage switchgear systems may only be performed by skilled and qualified personnel. For work at low voltage electrical system and components, the component to be modified or worked on must be isolated and confirmed dead. If in doubt of the task to be carried out, ABB Service technicians should be utilized for the work. Never utilize untrained personnel who are not certified with the system.

The mandatory guideline for working in electrical systems is the instruction EN50110-1 2013. Local country law for work on electrical systems must also be observed. Minimum precautions are to be observed:

- THINK – The greatest safety asset is an alert, focused mind,
- Maintain strict discipline regarding safety procedures,
- Use appropriate personnel protection equipment and tools,
- Communicate clearly and ensure all communications are fully understood,
- Query all instructions that are unclear, not understood or that appear to be in breach of safety requirements,
- Prove all circuits to be safe if they have been unattended for a period of time,
- Maintain safety clearance (air Insulation) when working in the proximity of live conductors,
- Do not improvise. Use purpose designed equipment and tools,
- Use the pre-start checklist prior to starting or commencing any work.

2.5 Areas of work

Working on electrical systems may occur at different times and different conditions. To clearly understand the conditions helps to understand and eliminate any risk. In low voltage switchgear systems following work conditions are defined:

- Operation (operation of circuit breaker, main switch or push button while all doors and compartments are closed – closed door condition)
- Visual inspection (open doors and compartments to perform any visual inspection, no parts are touched and no physical work is performed on the electrical system – open door condition)
- Any other maintenance and work (e.g. modification, extensions, cable connection) on low voltage electrical system (either open or closed door condition)

The procedure for performing switching operations is defined by the instruction EN50110-1 2013 “Operation of electrical installations”.

Keep doors and covers closed & locked whenever possible.
Check if lock couplings are utilised otherwise, each lock must be locked.

2.6 Five safety rules

The DEAD circuit condition must be established prior to commencement of work and must be ensured at the place of work for the duration of work in compliance with the five safety rules (EN50110-1 2013 chapter 6.2):

1. Disconnect completely;
2. Ensure no re-connection is possible;
3. Verify that the installation is dead;
4. Carry out earthing and install any shorting links required[1];
5. Ensure that any adjacent live parts are suitably shrouded and provide the required protection.

Any circuit that has not been proven dead is to be considered as **LIVE**.

2.7 Permit to work

Permission to start work shall be given by nominated person in control of electrical installation (plant-responsible person or PrP) to the nominated person in control of any work activity (work-responsible-person or WrP). The permit to start working must be recorded and signed by all parties in a Safety Permit to Work document.

2.8 Personal Protection Equipment (PPE)

Personal protection equipment refers to clothing and additional devices to enhance personal protection to a safe level while working on electrical systems. Depending on the area of work certain level of PPE is required.

When working on or near live parts the minimum standard for clothing is that products shall be capable of withstanding e.g. electrical arc with an incident energy of 8cal/cm^2. For the majority of work on or near energised systems, this means that the clothing provided must be manufactured and tested to the following standards:

- For IEC: **Class 1 Garments to IEC 61482-1-2** (Formerly ENV 50354 and CLC/TS 50354).

Specific Risk Assesment and Arc Flash analysis shall be carried out and as per the task the minimum PPE should be decided.

2.9 Special considerations when working on electrical equipment

2.9.1 Capacitors

The power supply to a capacitor by a remote auxiliary power source, if any, shall also be isolated. When the system has been isolated, allow the voltage stored in the capacitor to be discharged, the outgoing capacitor circuits must be tested for discharged condition using voltage measurement device. The automatic capacitor must be installed in accordance with the standards IEC 60831-1&2 and all national regulations.

2.9.2 CT´s

Ensure that the current transformer secondary circuits have been shorted when no load is connected.

2.9.3 Auxiliary or temporary supply

Ensure that any auxiliary supply that may be required to perform testing or commissioning tasks is securely switched off and protected against operation while working on the electrical equipment.

—

1 Earthing and shorting is not mandatory as per EN 50110-1 2013 ch 6.2.5.2. However, earthing becomes mandatory under the risks described therein and if also requested by local requirements or customer guidelines and where provision is made for earthing or other proper means are available.

03

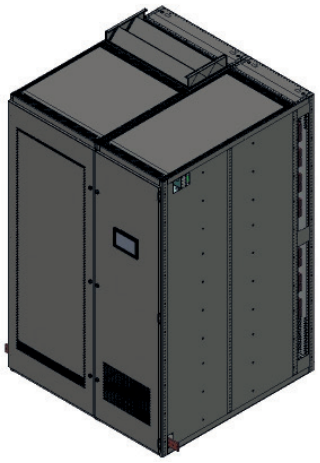
General technical data

General technical data

3 General technical data

Standards	Enclosed low-voltage switchgear and controlgear assemblies	General rules	IEC 61439 - 1
		Power switchgear and controlgear assemblies	IEC 61439 - 2
		Testing under conditions of arcing due to internal fault (internal arc)	IEC TR 61641
	Seismic	Recommended practices for nuclear generating station	IEC 60980
	Vibration	Environmental testing Test Fc: Vibration (sinusoidal)	IEC 60068-2-6
	Shock	Environmental testing Test Ea and guidance: Shock	IEC 60068-2-27
	Protection against electric shock	Common aspects for installation and equipment	IEC 61140
		General rules	IEC 61439-1
Test certificates		ASTA / United Kingdom, DEKRA / Netherlands, Germanischer Lloyd, Hamburg / Germany IPH, Institut für Prüffeld- und Hochspannungstechnik, Berlin / Germany High Power Laboratory, ABB AG, Ratingen / Germany Technology center laboratory, ABB s.r.o, Brno / Czech Republic	
Electrical data	Rated voltages	Rated insulation voltage U_i Rated operating voltage U_e Rated impulse withstand voltage U_{imp} Overvoltage category Degree of pollution Rated frequency	1 000 V 3~, 1 500 V- 690 V 3~, 750 V- 6 / 8 / 12 kV, depending on equipment II / III / IV 3 up to 60 Hz
	Rated currents	**Main busbar** Rated current I_e Rated peak withstand current I_{pk} Rated short-time withstand current I_{cw}	 up to 6 300 A up to 220 kA up to 100 kA
		Distribution bars Rated current I_e Rated peak withstand current I_{pk} Rated short-time withstand current I_{cw}	 up to 2 000 A up to 220 kA up to 100 kA
	Arc fault containment	Rated operational voltage Prospective short-circuit current Duration Criteria (IEC TR 61641)	up to 690 V up to 100 kA 300/500 ms 1 to 7
Mechanical characteristics	Dimensions	Sections and frames Recommended height Recommended width Recommended depth Basic grid size	ISO 2768 2 200 mm *) 400, 600, 800, 1 000, 1 200, 1 400 mm 400, 600, 800, 1 000, 1 200, 1 400, 1 600 mm E = 25 mm acc. to DIN 43660
	Surface protection	Frame incl. Internal subdivision Cladding, internal, roof and bottom plate Cladding, external, front, rear and side	Zinc or Alu-zinc coated Zinc or Alu-zinc coated Zinc or Alu-zinc coated and powder coated RAL 7035 (light grey)
	Degree of protection	According to IEC 61439	External from IP 30 to IP 54 External for UPS sections IP20 Internal from IP XXB
	Separation Form		up to form 4 up to form 3 UPS sections
	External mechanical impact (IK)		up to IK10
	Plastic components	Halogen-free, self-extinguishing, flame retardant, CFC-free	IEC 60707, DIN VDE 0304 part 3
	Steel components	Frame incl. internal subdivisions 2,0 / 2,5 mm Cladding, internal 1,5 / 2,0 mm; external 1,5 mm	
	Forms of separation	up to form 4 up to form 3 UPS sections	
	Internal subdivision	Equipment compartment Busbar compartment Cable compartment	
Extras	Paint finish	Enclosure	Special colours (standard RAL 7035, other colours on request)
	Busbar system	Busbars	Bare copper Insulated with heat shrinkable sleeving Silver or tin plating Aluminium busbar systems
	Optional	Project specific solutions available on request	

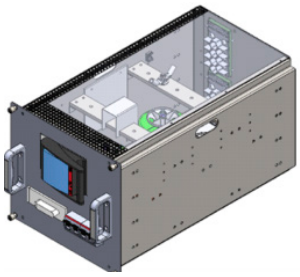
3.1 MNS-Up UPS general characteristics

General characteristics			
General characteristics - Frame		**Values**	**Unit**
	Model: MNS-Up 		
	Power ratings:		
	Apparent power per section	500	kVA
	Apparent active power per section	500	kW
	Power, range	100 - 3000	kW
	UPS type: on-line, transformer-free, modular, decentralized parallel		
	architecture		
	Parallel capability: up to 6 MNS-Up sections		
	Battery: not included		
	Performance classification: VFI-SS-111		
Mechanical			
	Dimensions (width × height × depth)	1400 x 2200 x 1400 or 1400 x 2200 x 1600	mm mm
	Mass, approx. per MNS-Up section (500kW system, with / without 5 modules)	1450 / 950	kg
	Acoustic noise at 1 m - in normal mode (at <=25°C) at 100% load - in normal mode (at <=25°C) at 50% load	 84,9 av. at later stage	 dBA dBA
Safety			
IEC 62040-1	Access: operator/restricted		
Electromagnetic compatibility			
IEC 62040-2	compliant		
	Emission UPS Cat/Immunity UPS Cat	C3	
Environmental			
	Storage temperature range	- 25 - + 70	°C
	Ambient temperature	0 - + 40	°C
	Relative humidity range (non-condensing)	≤ 95	%
	Max. altitude without de-rating	1000	m

General characteristics of active and passive module			
	Model: Conceptpower DPA500	**Values**	**Unit**
Active submodule			
Passive submodule			
	Power ratings:		
	apparent	100	kVA
	active	100	kW
	UPS type: on-line, transformer free, modular, decentralized parallel architecture		
	Parallel capability: up to 6 frames		

[1] For higher ambient temperatures, there is a restriction in the operating time in battery mode.

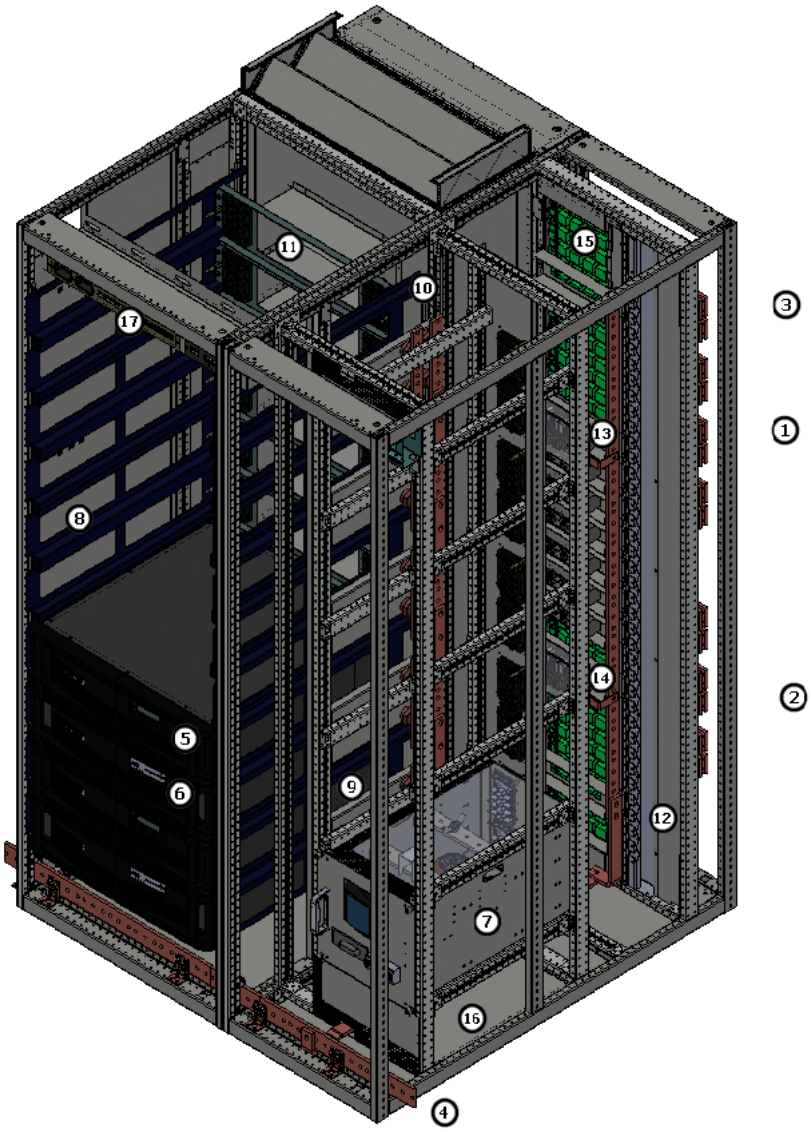
Mechanical			
	Dimensions (width × height × depth) active sub-module/passive sub-module	 710 x 178 x 750	mm mm
	Mass, approx: active sub-module/passive sub-module	 55 / 54	 kg
Additional useful information			
	Back feed protection: included		
	Color: black (RAL 9005)		

General characteristics of filter module			
Filter module			
	Power ratings:		
	apparent	100	kVA
	active	100	kW
	Mechanical		
	Dimensions (width × height × depth):	346 x 382 x 650	mm
	Mass, approx.:	41	kg

04

System description

System description



4.1 MNS-Up UPS section

1 Input main busbar
2 Output main busbar
3 Input and output neutral conductor
4 PE main busbar
5 Active MNS-Up UPS module
6 Passive MNS-Up UPS module
7 MNS-Up UPS Filter module
8 Active and passive module compartment
9 Filter module compartmen
10 Common battery connection bars
11 Ventilation chanel
12 Partition wall 3 to main busbar area
13 EMC filter board input line
14 EMC filter board output line
15 Multifunction wall
16 Bottom plates
17 Communication interfaces

05

Packing, storage and transportation

Packing, storage and transportation

5.1 General

MNS switchgear is shipped either in single section or in shipping units not exceeding 3 m in length depending on the type of equipment installed and on the space available for handling the switchgear at the erection site.

Maximum size of a shipping unit (length × width × height) in mm:
- Unpacked 3100 x 1300 x 2300
- Packed in crate 3300 x 1500 x 2590 (see also “3.1.1 Container shipment”)

The MNS-Up sections must be shipped as individual sections, due to their dimensions and weight.

In all cases the ACB must be transported separately from the section. It is not allowed to transport it within the section. The ACB requires special attention during transport and handling. Please refer to original manuals 1SDH000999R0002 and 1SDH001000R0002, Chapter 2: Transport and checking on receipt.

Note: Shipping dimensions and weights here are approximate. These are meant to be used a guide only. Please refer to project specific documentation.

Remove all ACBs from sections and transport them separately!

Module type		Protection circuit	Type	Module size
Withdrawable modules	Motor starters	Fuse	TOL / EOL	8E4 upto 24E
			UMC100	
			M10x	
		Circuit breaker	TOL / EOL	
			UMC100	
			M10x	
	Energy distirbution	Fuse	SFU	8E4 upto 24E
			Contactor feeder	
		Circuit breaker	MMS / MCCB	
			Contactor feeder	
Plugin modules	Energy distirbution	Fuse	SFU	6E upto 24E
			Contactor feeder	
			SlimLine	
		Circuit breaker	MMS / MCCB	
			Contactor feeder	

Table 5-01 General overview of standard module solutions (customer specific solutions not mentioned)

If no special instructions are given by the customer, packing is carried out based on ABB shipping guidelines and a suitable method of shipping is selected. Approximate weights for calculation are listed in below tables.

All weights for incoming feeders configured as below:
- Section weights are defined based on IP30-IP40 internal protection with bottom plate
- Section weight for EQ400 / EQ600 contains 200 mm main busbar area
- Section weight for EQ800 contains 400 mm main busbar area
- Section weights are defined with all possible CTs (measuring and protection), REF relay and SPD
- Section weights do not contain internal devices (except CTs, REF, SPD) and wiring
- Section weights do not contain side walls and main busbar end covers

All weights for couplers configured as below:
- Coupler weights do not contain internal devices (except CTs and REF) and wiring
- Coupler weights do not contain side walls and main busbar end cover
- The type of coupler with CTs utilizes different angle set (with more copper) to create place for CTs. If you use coupler without CTs, the overall weight might be significantly lower.

Approximate weight of one front access section without ACB					
Type of section	**Type of ACB**	**Section width [mm]**	**Weight of ACB [kg]**	**Standard (EQ400,EQ600)**	**High current (EQ800)**
Incoming feeder, 3 pole	E1.2 – upto 1600 A	400	20	250	–
Incoming feeder, 3 pole	E2.2 – upto 2000 A	400	53	300	–
Incoming feeder, 3 pole	E2.2 – upto 2500 A	600	53	350	–
Incoming feeder, 3 pole	E4.2 – upto 2500 A	800	67	400	700
Incoming feeder, 3 pole	E4.2 – upto 4000 A	800	67	500	700
Incoming feeder, 3 pole	E6.2 – upto 6300 A	1000 – 1200	129	750	1000
Coupler, 3 pole	E1.2 – upto 1600 A	400	20	250	–
Coupler, 3 pole	E2.2 – upto 2500 A	600	53	350	–
Coupler, 3 pole	E4.2 – upto 4000 A	800	67	500	700
Coupler, 3 pole	E6.2 – upto 6300 A	1200	129	750	1000
Incoming feeder, 4 pole	E1.2 – upto 1600 A	600	23	300	–
Incoming feeder, 4 pole	E2.2 – upto 2000 A	600	60	350	–
Incoming feeder, 4 pole	E2.2 – upto 2500 A	800	60	400	–
Incoming feeder, 4 pole	E4.2 – upto 2500 A	1000	81	500	800
Incoming feeder, 4 pole	E4.2 – upto 4000 A	1000	81	600	800
Incoming feeder, 4 pole	E6.2 – upto 6300 A	1200	143	900	1200
Coupler, 4 pole	E1.2 – upto 1600 A	600	23	300	–
Coupler, 4 pole	E2.2 – upto 2500 A	800	60	500	–
Coupler, 4 pole	E4.2 – upto 4000 A	1000	81	600	800
Coupler, 4 pole	E6.2 – upto 6300 A	1200	143	900	1200
Empty module section	–	1000	–	300	–

Table 5-02 Approximate weights per 3 and 4 pole ACB sections (incomming feeders and couplers)

Approximate weight of MNS-Up section	
Section type	**Approximate weight [kg]**
MNS-Up empty section (without UPS modules)	750

Table 5-03 Approximate weights of MNS-Up section

Approximate weight of UPS modules		
Module type	**UPS components**	**Approximate weight [kg]**
	100 KW active module	55
	100 KW passive module	45
Plugin modules	100 KW filter module	41

Table 5-04 Approximate weights of USP modules

Approximate weight of moduke acc. size		
Module type	**Module size**	Approximate weight [kg]
Withdrawable modules	8E / 4	4
	8E / 2	7
	4E	8
	6E	14
	8E	18
	12E	25
	16E	35
	24E	65
Plugin modules	6E	8
	8E	15
	12E	16
	16E	31
	24E	36

Table 5-05 Approximate weights of modules per size (customer specific solutions not mentioned)

Module size and weight highly depends on customer requirements and specification. Above mentioned values are only informative should detailed clarification be required please contact your local ABB representative.

For easy and safe operation, withdrawable modules above or equal 12E are equipped with additional side handles.

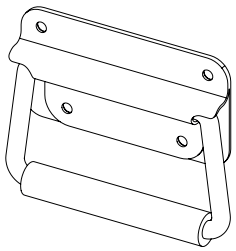


Figure 5-01 Module side handle

5.1.1 Container shipment

If container shipment transport is needed, consider the final packed dimension based on height of the HIGH CUBE CONTAINER internal dimension.

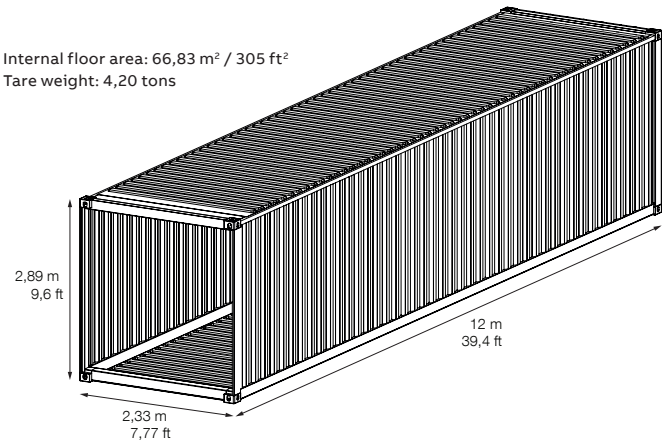


Figure 5-02 Inner dimensions of 40' high cube container

5.2 Recommended packing methods

The sections are protected by suitable packaging during transport and possible intermediate storage.

5.2.1 The packing for normal road transport

Transport frame consisting of:

- standardized or euro pallet
- plastic strips
- plastic film
- edge protection

The section are to be placed on standardized pallet. The sections are to be wrapped by plastic film and fixed with the cuplastic strips to the pallets. Edges of transport section are protected by standardized edge protection.

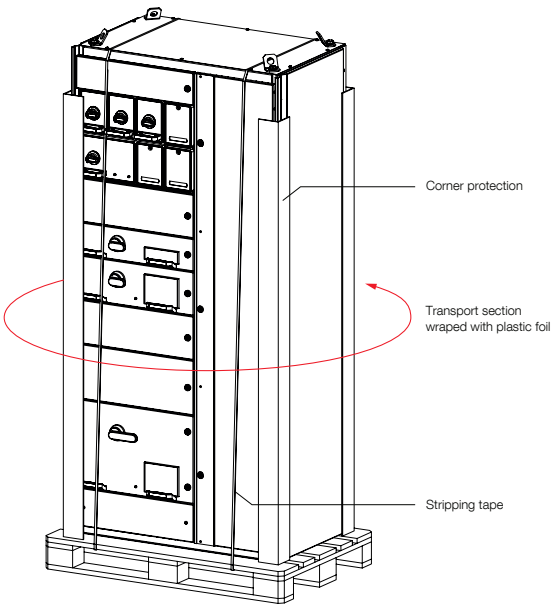


Figure 5-03 Packing for normal road transport

Standardized pallets are suitable for handling by forklit trucks. To protect them against moisture, the switchgear sections shall be encased in a foil. A protective drying agent (such as silicagel) shall be provided between the foil and the switchgear. This shall last for 12 or 24 months.

5.2.2 The seaworthy packing

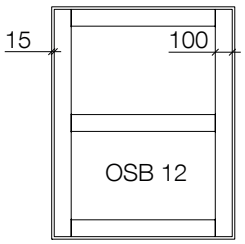
The export/seaworthy packaging (for sea transport and truck or train transport outside continental Europe) comprises:

1. Bottom
- Wooden beams (100 × 100 mm), bottom panel – boards (thickness 40 mm)
- Box packing length up to 800 mm – 2 × wooden beams
- Box packing length up to 1700 mm – 3 × wooden beams
- Box packing length up to 2500 mm – 4 × wooden beams
- Box packing length up to 3400 mm – 5 × wooden beams

2. Side walls
- Support beams 23 × 100 mm
- Side wall panels OSB 3 (thickness 12 mm)

3. Top
- Support beams 23 × 100 mm
- Top wall panel OSB 3 (thickness 12 mm)
- “Kartonplast” between Support beams and top wall panel

4. Additions
- Inner AL foil with drying agent



Inside dimensions:
A – Lenght
B – Width
C – Hight

Number of beams:
A < 800 mm – 2 × Beam
A < 1700 mm – 3 × Beam
A < 2500 mm – 4 × Beam
A < 3400 mm – 5 × Beam

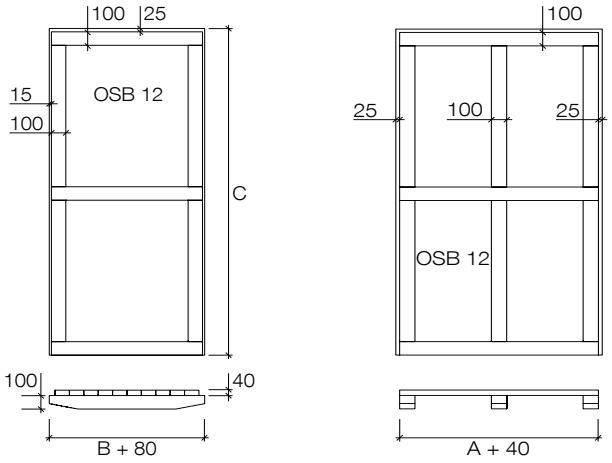
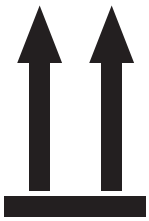


Figure 5-04 Wooden parts dimensions

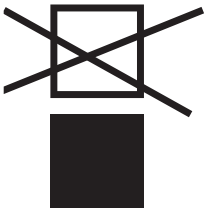


Do not incline

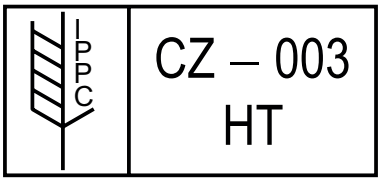
Fragile

Gravity center

Marking for ropes



Do not stack

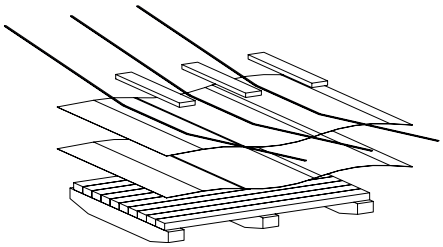


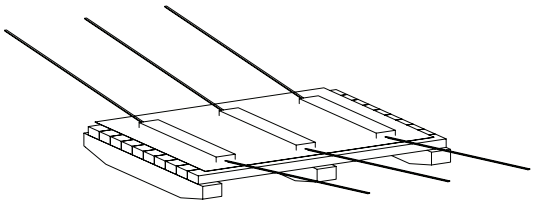
HT IPPC

Figure 5-05 Transport marking

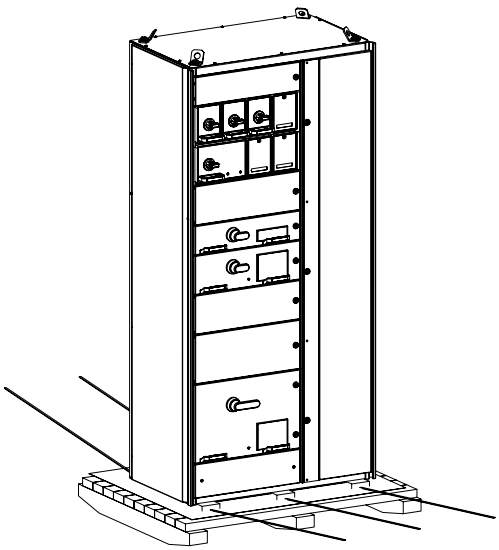
All sawn wood shall be thermal treated according ISPM 15 standard.

1. On the base a 2 mm miralon layer is placed and aluminium foil on top of it. Wooden boards and strips are placed on top of this AL foil.





2. Switchgear shipping section is placed on those wooden boards.



3. Overhanging parts and sharp edges are covered by miralon to protect additional packing.

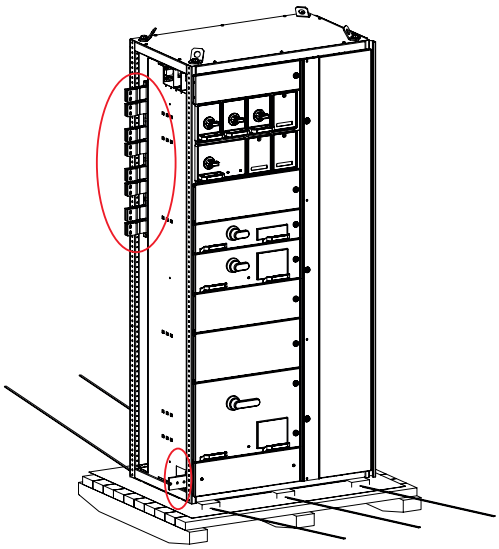
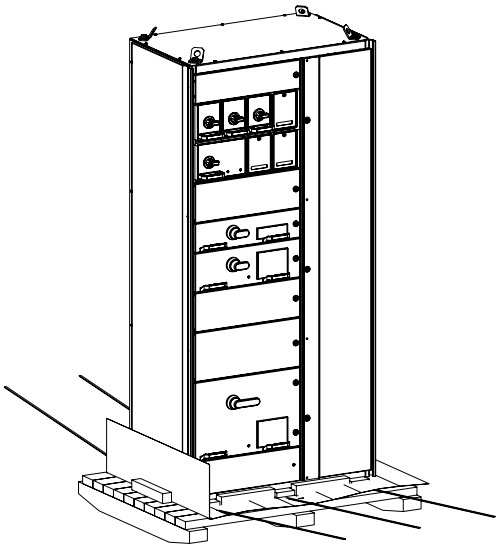


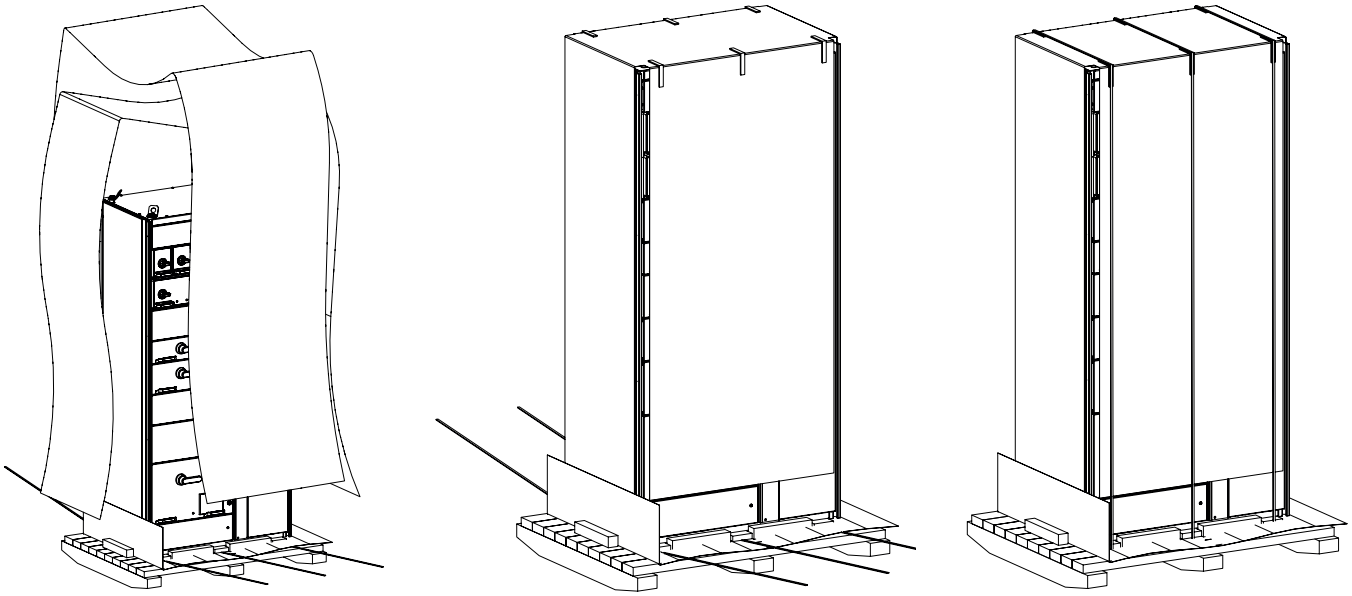
Figure 5-06 Seaworthy packing procedure, steps 1, 2 & 3

4. Unit is secured by placing wooden beams 5 × 5 cm right around the unit and secured to bottom platform against shifting.



When two shipping sections placed back to back into one wooden box fiber board 3,5 mm shall be used in between sections.

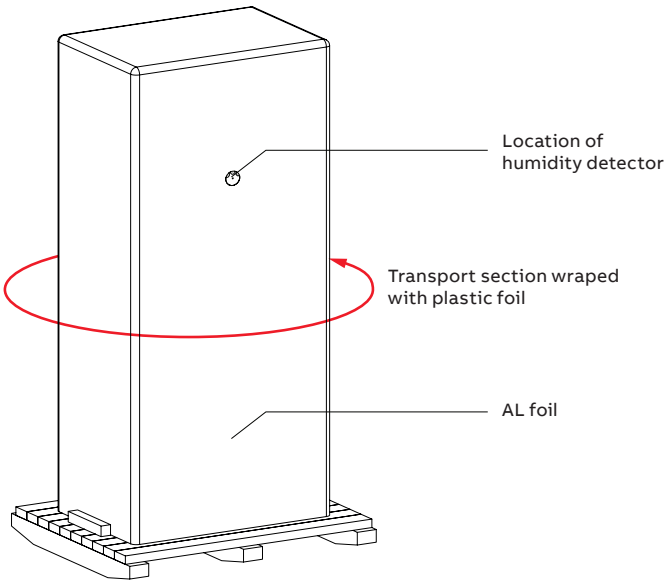
5. Miralon 2 mm is placed all over the shipping section and is stripped by tape. The tape is supported by plastic edge protection.



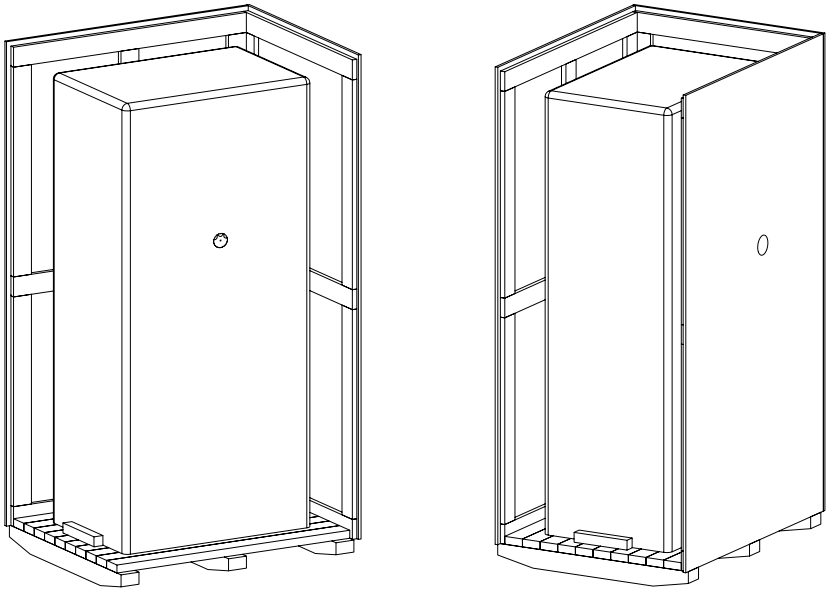
A drying agent is required for seaworthy packing. A single packet 32 DIN is required per 3 m^2 box.

Figure 5-07 Seaworthy packing procedure, steps 4 & 5

6. The shipping section is sealed in AL foil and the air is extracted. The unit is then wrapped by plastic film to strengthen the wrap.



7. Wooden box assembly and execution of aperture for humidity detector verification.



8. Shipping unit preparation from the top by wooden beams 5 × 5 cm against movement.

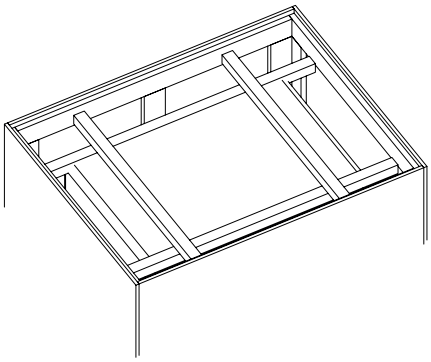
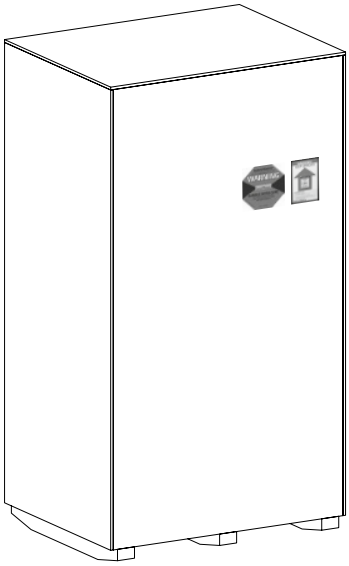


Figure 5-08 Seaworthy packing procedure, steps 6, 7 & 8

9. Location of crash and turnover protection (shockwatch label and tilt watch)



10. PE foil UV resistant shall be utilised on the top of the packing

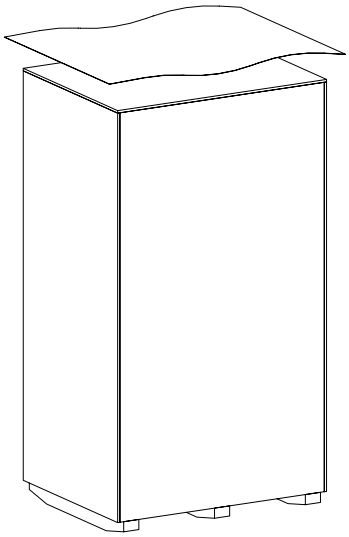


Figure 5-09 Seaworthy packing procedure, steps 9 & 10

The switchgear shall be wrapped with foil after upholstering sharp edges and corners. The joints of the foil shall be sealed.

A protective drying agent according DIN 55474 shall be utilised between the foil and the switchgear. No direct contact of this protective drying agent with the switchgear is allowed.

Only remove the packaging after delivery of the switchgear to site.
Only remove the transport frames from the section bases at the place of erection.

5.2.3 Horizontal transportation

In situations where that the structural conditions on site, e.g. height of door frame < 2200 mm, does enable the MNS sections to enter the e-room in standing (vertical) position, all individual sections may be transported horizontally.

As the vertical profiles do not support the complete weight of the section in the horizontal position, a reinforcement on the frame structure necessary. Therefore, following points are mandatory.

- Maximum width of section transport section is 1400 mm and the maximum weight of 800 kg shall not been exceeded. See also Table 3-02.
- Heavy weight devices shall be disassembled, as the weight-loading is not foreseen for horizontal transportation.
- Withdrawable breaker (Sace Emax) shall be transported in separate boxes.
- Also withdrawable modules shall be withdrawn and transported separately.
- See also in chapter ”3.2.4 Packaging of switchgear components”
- As the sections will be moved “from horizontal to vertical position” on site manually, special safety measures has to be taken to have less weight as possible.
- To avoid the deformation of vertical MNS profiles as well also the door hinge, a provisory transportation brace shall be mounted before the section is moved to the horizontal position.
- For horizontal transportation a longer euro pallet is required with 2.1 m length.
- All wires and cables for interconnections, between different transport sections, shall be fixed accordingly to avoid damages on cabling or enclosures.
- After the erection of the sections on site, all doors has to checked on their functionality and adjusted.

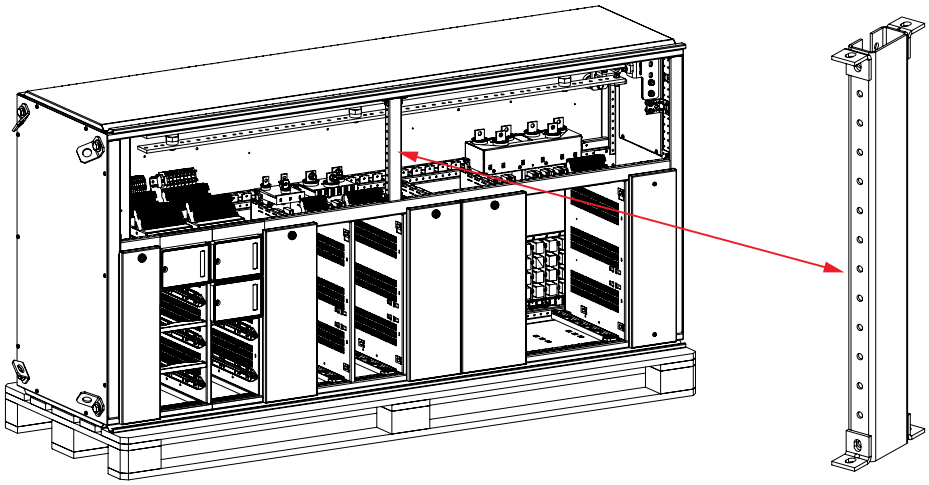


Figure 5-10 Reinforcement for horizontal transport

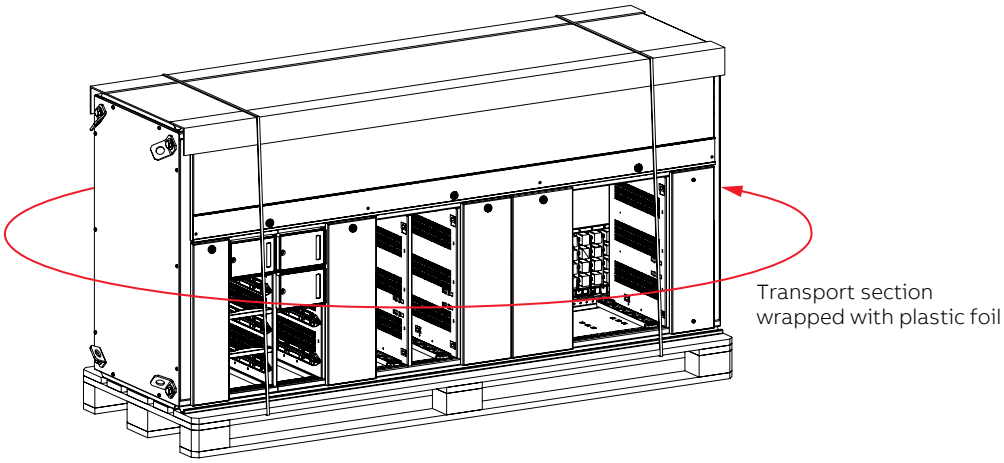


Figure 5-11 Example of horizontal transport

Horizontal transportation is not suitable for MNS Rear switchgear.

5.2.4 Packaging of switchgear components

The following devices and materials have to be delivered separately packed with the switchgear independent from the kind of transport:

- withdrawable air circuit breakers,
- withdrawable moulded case circuit breakers with a nominal current of more than 1000 A,
- transformers and reactors with a weight of more than 25 kg, in the case of floor mounted units of more than 100 kg,
- precision instruments of high value for measuring and indication,
- fluorescent tubes,
- modules with single phase control power transformers of more than 2 kg,
- spare withdrawable and P-/R-modules,
- top stripe holders,
- withdrawable modules with weight ≥ 30 kg,
- raised roof plates incl. mounting angles
- active/passive modules
- filter modules.

Stacking of active and passive modules is allowed up to two boxes.

If possible the original packaging material of the manufacturer should be reused for packaging.

Modules as spare parts or as supplementary parts for the switchgear shall be marked with the necessary technical data for the use (module location, type, order number). The fuses remain in the modules. Information concerning the procurement of standard boxes can be obtained from the ABB shipping department.

The quality of the internal packaging depends on the type of goods to be packaged and shall be selected by the ABB shipping department.

Materials to be used:
Padding (chips made of expanded polystyrene), corrugated cardboard, foil, expanded polystyrene board, cardboards.

Any special shipping requirements of the switchgear shipment shall be specified in the ordering phase.

5.3 Handling of switchgear components

5.3.1 Circuit breaker

Circuit breaker shall be handled in the following way:

- Fixed circuit breaker shall be braced additionally.
- All withdrawable air circuit breakers and withdrawable moulded case circuit breaker with a weight ≥40 kg shall be removed and packed separately.
- Heavy busbar constructions have to be supported during transport in an adequate way. It is necessary to attach a caution label demanding the removal of the used transport fixing material during switchgear erection.

If possible the original packaging material should be reused for packing the circuit breaker.

The bracing shall be removed prior to commissioning.

Separately shipped circuit breakers are to be mounted in accordance with the mounting instructions enclosed.

5.3.2 Withdrawable modules

Withdrawable modules have to be secured for shipping by their own mechanical interlock operated by the switch handle (ON, OFF or TEST position). In addition, the withdrawable modules may be secured by a latch-type lock which works independently from the mechanical interlock and which may be operated by 5 mm double bit key or a cylinder type safety key.

Modules shall be secured with handles in the “OFF“ position.
Necessary switch positions prior to commissioning: Module handle must be in position “OFF”.

5.3.3 MNS-Up UPS modules

Active and passive MNS-Up modules must be removed from the MNS-Up section and packed in the original boxes before shipping.

5.3.4 MNS-Up Filter modules

MNS-Up filter modules must be removed from the MNS-Up section and packed in the original boxes before shipping.

5.4 Unloading and transport at site

The loads must be lowered onto a flat surface by either a crane or fork lift truck.

5.4.1 Ground transport

- By fork-lift truck (see Figure 3-13).
- By lifting and conveying devices.
- In an emergency, with rollers (min. 3 pieces). For roller transport the wooden cross-beams must be removed (only for sections with transverse sections up to 1200 kg, see Figure 3-14).
- Switchgear sections could be transported in the vertical or horizontal position (see also chapeter 3.2.3)
- Tilting and canting must be avoided (see Figure 3-15).
- Single sections (sections without withdrawable modules, circuit breaker sections without circuit breakers) may be briefly tilted into the horizontal position if the height of the doorway to the place of erection does not permit vertical transport. In this case the section sections must be supported over a wide area.

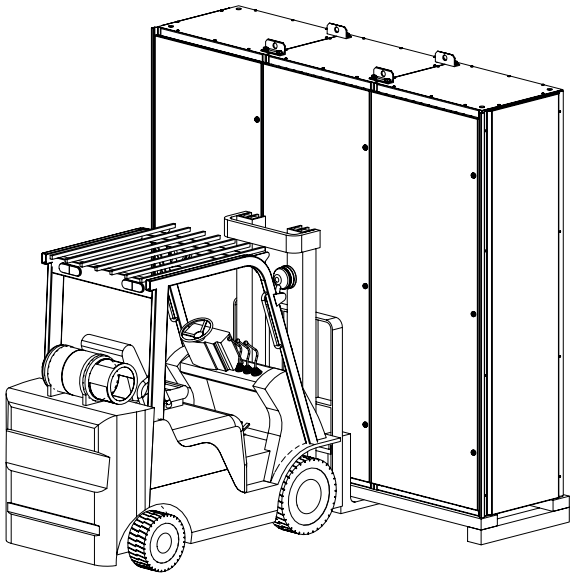


Figure 5-12 Fork-lift transport

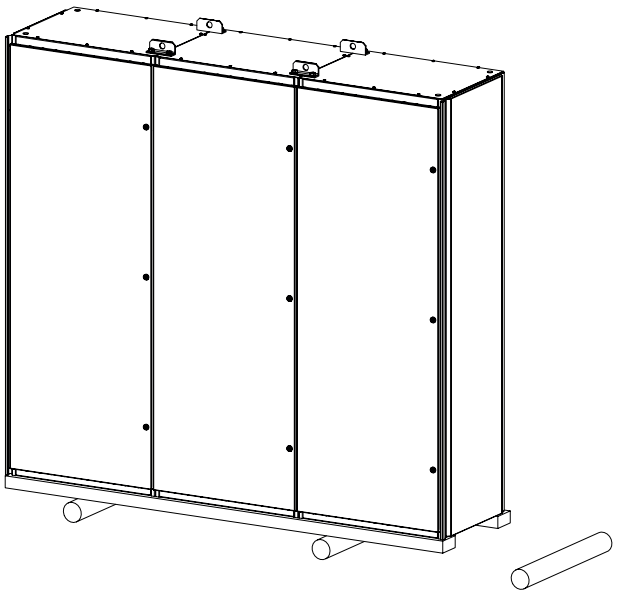


Figure 5-13 Roller transport (only for weight of transport units up to 1200 kg)

Sections may easily tip over when transported with a hand-pulled truck. Therefore the distance between the wooden cross beam or the pallet and the ground should not be more than 3 mm (see Figure 3-15).

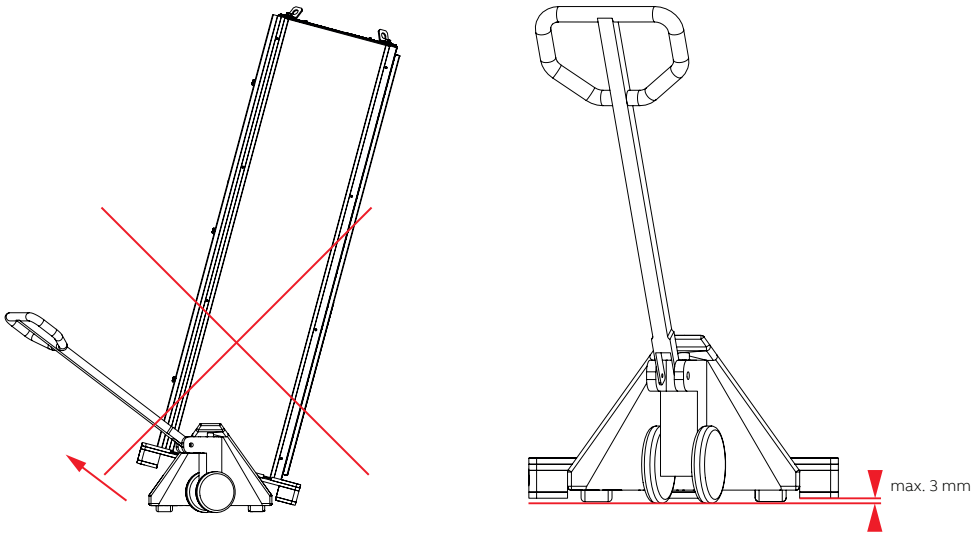


Figure 5-14 Transport with a hand-pulled truck

When using motor operated lifting truck or hand-pulled truck always check the position of gravity center mark. Note, marking of transport section with gravity center is always requried for seaworthy transport, otherwise the marking is optional.

5.4.2 Transport by crane

- For the transport by crane the shipping units are equipped with lifting angles (see Figure 3-15).
- Fastening of any lifting device directly to the frame sections is not permitted.
- The lifting rope angle at the crane hook must not be larger than 120° (see Figure 3-16).
- The lifting angles may be removed after the switchgear has been erected.
- The fastening holes for the lifting angles are to be plugged with plugs if removing the lifting angles. (see "4.13 Fastening of shipping sections")

Rope diameter [mm]	**Permissible load for a four-rope arrangement, rope angle at crane hook 120**		
	Hamp rope acc. DIN 83325	**Perlon ropes acc. DIN 83330**	**Steel ropes acc. DIN 15060 (160 kg / mm²)**
	[kg]	**[kg]**	**[kg]**
8	–	×	890
10	180	400	1440
12	280	600	2100
14	350	820	2900
16	470	1060	–
18	580	1340	–
20	720	1660	–
24	1000	2400	–
30	1600	–	–
36	2400	–	–

Table 5-06: Guide values for permissible rope loading

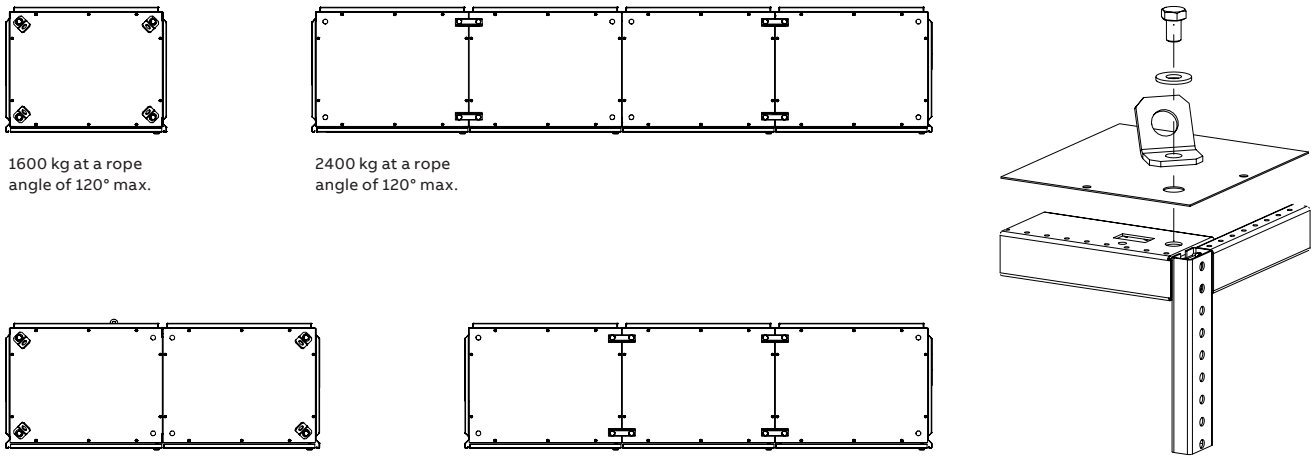


Figure 5-15 Arrangement of lifting angles (plan view of MNS section), detail values see Table 3-04

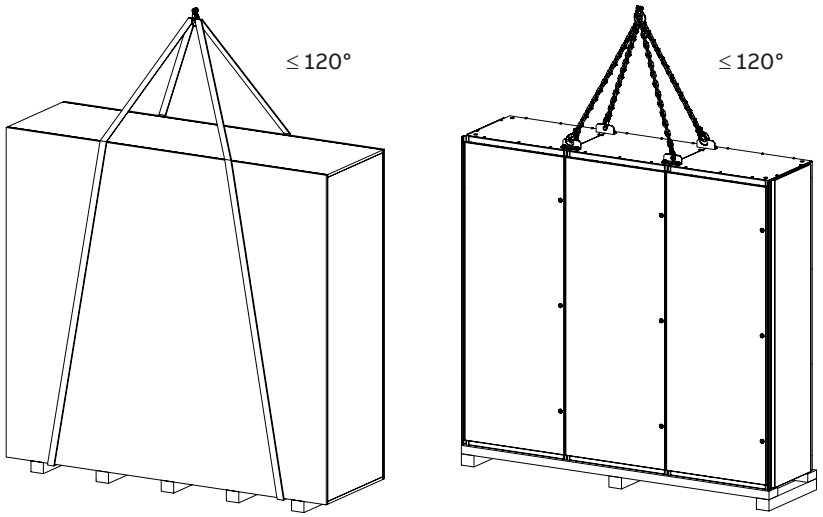


Figure 5-16 Crane transport packed sections (left side picture), crane transport unpacked sections (right side picture)

For a rope angle of 90° the permissible load is approximately 40 % larger than the values given in the table.
The arrangements of the lifting angles are shown in Figure 3-15.
Shipping units with one or two cubicles are equipped with single angles.
Shipping units consisting of three or four sections are equipped with dual angles.

The sign detailing the tilting danger must not be removed before all sections have been secured to the foundation.
Do NOT place the switchgear down on one edge, there is a danger of considerable mechanical damage.

5.4.3 Transport by truck

The loading of the sections can be undertaken with a fork lift from the side of the truck. In case of collocate sections an additional spacer between the sections is necessary (see Figure 3-18).

To protect the edges of the sections paperboard angles has to be attached. 32 mm wide steel straps must be strapped around the arrangement and the loading platform. The number of these steel straps depends upon the size of the switchboard.

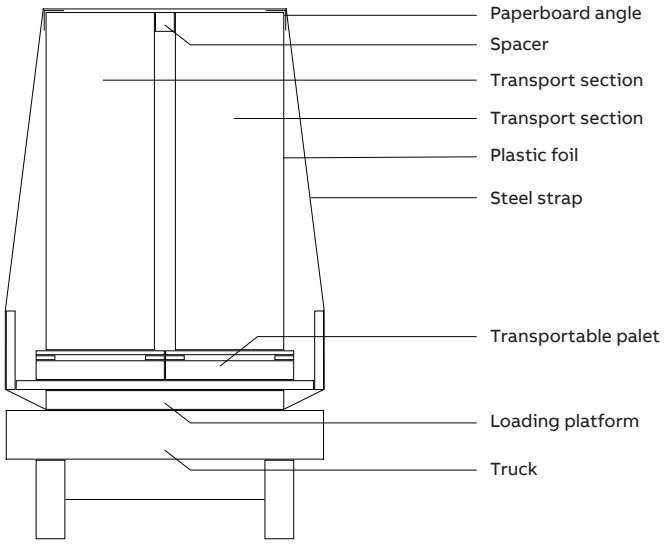


Figure 5-17 Transport by truck

5.5 Intermediate storage

The ambient temperature for storage and transport should not exceed below –50°C however, care should be taken to observe the any storage limits with respect to any electronic components and plastic materials.

Outdoor storage is not allowed!

The nature and duration of intermediate storage are dependent on the type of packaging.

Sections in standard packaging:
- Store indoor after arrival where no condensation can occur.
- Unpack immediately.
- Open the doors for several hours to acclimatize the equipment.
- Cover the sections with plastic sheeting for any subsequent storage periods.
- Check regularly for condensation forming under the sheeting prior to the start of installation.

Sections with export/seaworthy packaging (acc. “3.2.2 The seaworthy packing”):
- Moisture protection is only guaranteed if the packaging is undamaged.
- Storage period of maximum 12 months if wrapped in heat sealed PE sheeting and the packaging is undamaged.
- For duration of transport and storage from 12 months up to maximum 24 months and/or if the possibility to check the status of the drying agent is needed, the following can be used instead of heat-sealed PE-sheeting:
  - Heat-sealed aluminium-compound foil with integrated hygroscope which provides moisture protection for at least 24 months.
  - The hygroscope is visible from the outside through a opening in the transport box.
- When the storage period is exceeded, the drying agent must be replaced and the plastic sheeting has to be resealed.

5.5.1 Storage of spare modules

- Storage is only allowed in dry rooms.
- The modules have to be stored in undamaged original packing.
- Do not expose the modules to large temperature variations.
- Store the boxes with the top side to the top.
- Do not store modules with sizes ≥ 16E one on top of the other.

5.6 Enviromental conditions of transport, storage and installation

A special agreement shall be made between the assembly manufacturer and the user if the conditions during transport, storage and installation differ from those defined in IEC 61349-1.

Environmental conditions like ambient temperature and humidity, pollution degree and altitude must be specified during project phase. Acc. IEC 61439-1 the standard environmental conditions are:

Ambient air temperature
The air temperature does not exceed +40°C and it´s average over a period of 24 hours does not exceed +35°C. The lower limit of the ambient air temperature is -5°C.

Humidity conditions
The relative humidity of the air does not exceed 50% at a maximum temperature of +40°C. Higher relative humidity may be permitted at lower temperatures, for example 90 % at +20 °C.

Pollution degree
The pollution degree of the place for transport, storage and installation does not exceed pollution degree 3.

Altitude
The altitude of the place for transport, storage and installation does not exceed 2000 m above sea level.

06

Transport

Transport

6.1 MNS-Up section

- The MNS-Up sections must be shipped as individual sections, due to their dimensions and weight.
- ACB sections and MNS 3.0 sections may be shipped in sections of max 3 m in length or 3 sections. Shipping sections shall only be transported in upright position
- For single empty sections, it is possible the to tilt the section carefully to side for transport, if the door height on site does not allow upright transport

6.1.1 Rolling transport

Rolling transport of shipping sections up to 1200kg in weight with min. 3 rollers is possible. In case of higher weight, the transport must be done with a forklift.

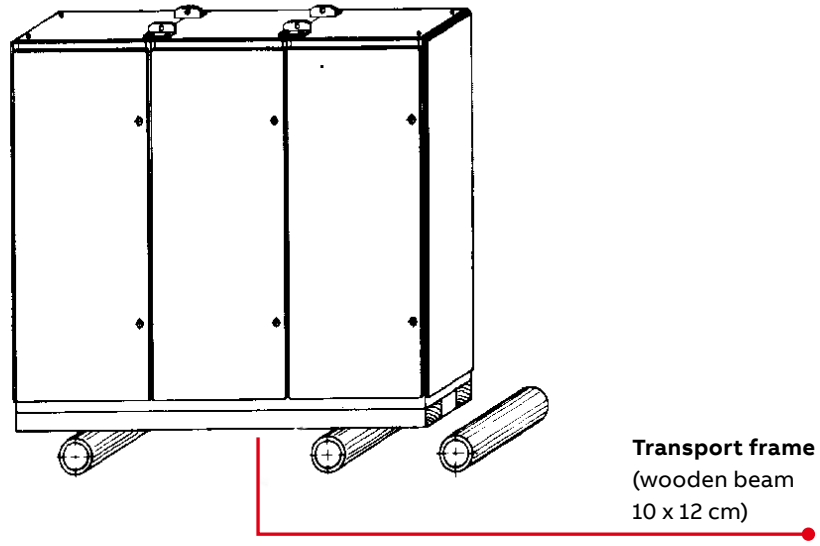
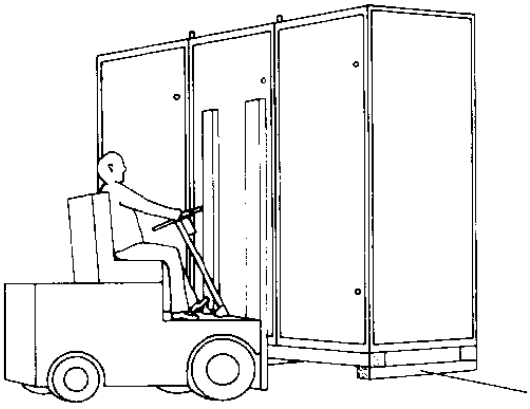
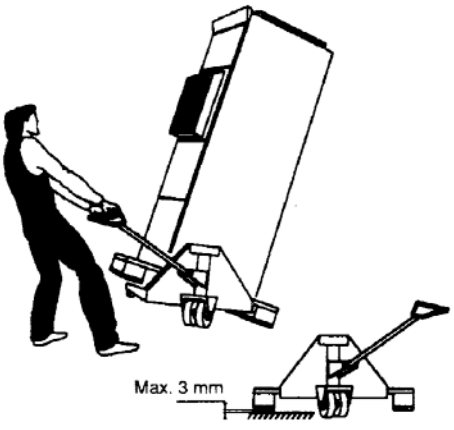


Figure 6-01 Rolling transport

6.1.2 Forklift transport

The transport pallets are supported with cross beams to allow the transport with a forklift or hand-lift truck





Sections may easily tip over when transported with a hand-lift truck. Therefore the distance between the wooden cross beam or the pallet and the ground should not be more than 3 mm (see fig. 24).

6.1.3 Crane transport

For transport by crane, the shipping units are equipped with lifting angles.

Fastening of any lifting device directly to the frame sections is not permitted.

The lifting rope angle at the crane hook must not be larger than 120°. The lifting angles may be removed after the switchgear has been erected.

The fastening holes for the lifting angles are to be plugged with plugs GMN 775 502 P18, if removing the lifting angles.

6.1.3.1 Guide values for permissible rope loading

Permissible load for a four-rope arrangement, rope angle at crane hook 120°			
Rope diam.	**Hamp ropes DIN 83325**	**Perlon ropes DIN 83330**	**Steel ropes DIN 15060 (160 kg/mm²)**
mm	**kg**	**kg**	**kg**
8	–	–	890
10	180	400	1440
12	280	600	2100
14	350	820	2900
16	470	1060	–
18	580	1340	–
20	720	1660	–
24	1000	2400	–
30	1600	–	–
36	2400	–	–

For a rope angle of 90°, the permissible load is approximately 40% larger than the values given in the table.

Shipping units with one or two sections are equipped with single angles.

Shipping units consisting of three or four sections are equipped with dual angles

The sign advertising the tilting danger must not be removed before all sections have been secured to the foundation. Do not put the switchgear down on one edge, because of the danger of considerable mechanical damage.

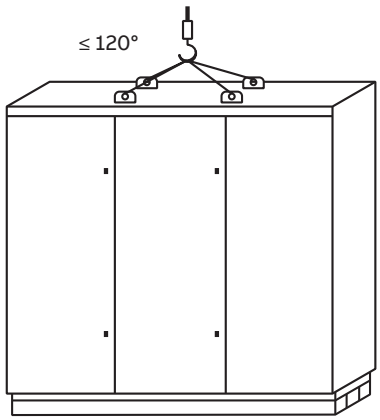


Figure 6-02 Crane transport, transport unit unpacked

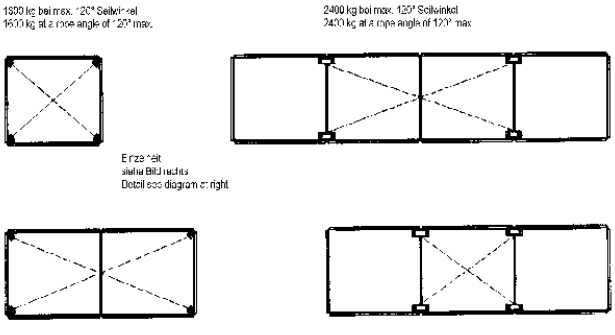


Figure 6-03 Arrangement of lifting angles (plan view of mns-sections)

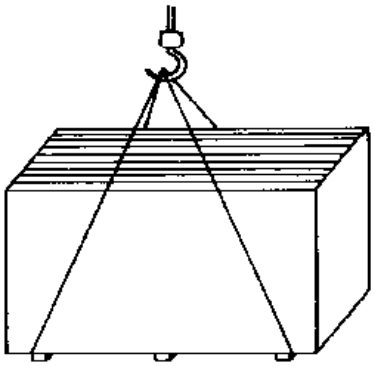


Figure 6-04 Crane transport, transport unit in box

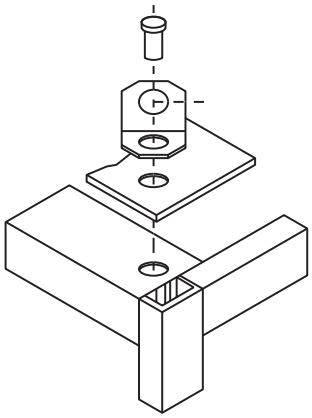


Figure 6-05 Frame corner joint with lifting angle

6.2 MNS-Up Modules

The MNS-Up active and passive modules must be shipped in their original packing. Stacking of boxes is allowed, up to two boxes.

6.3 Circuit breakers

Circuit breaker must be treated in the following way:

Fixed circuit breaker must be additionally braced. The bracing must be removed prior to commissioning.

Withdrawable air circuit breaker and withdrawable molded case circuit breaker with rated current of more than 1000 A must be removed and packed separately in their original packaging.

Heavy busbar constructions must be supported during transport in an adequate way. It is important to attach a caution label requiring the removal of the used transport fixing material during switchgear erection.

Separately shipped circuit breakers are to be inserted in accordance with the operating instructions of the manufacturer included in the boxes of the devices.

Stacking of boxes may be restricted by the original supplier of the equipment. This is clearly marked on the transport boxes.

07

Erecting

Erecting

7.1 Before installation

The switchgear room must be clean and free of dust before installation.

7.1.1 Ambient conditions

The UPS room must be air conditioned. The room temperature must be between + 5 - + 40 °C.

7.1.2 Floor cutouts

In case of cable connection from bottom, the following floor cut-outs need to be provided:
The holes in the gland plates need to be prepared on site, based on the number and cross section of the cables used.

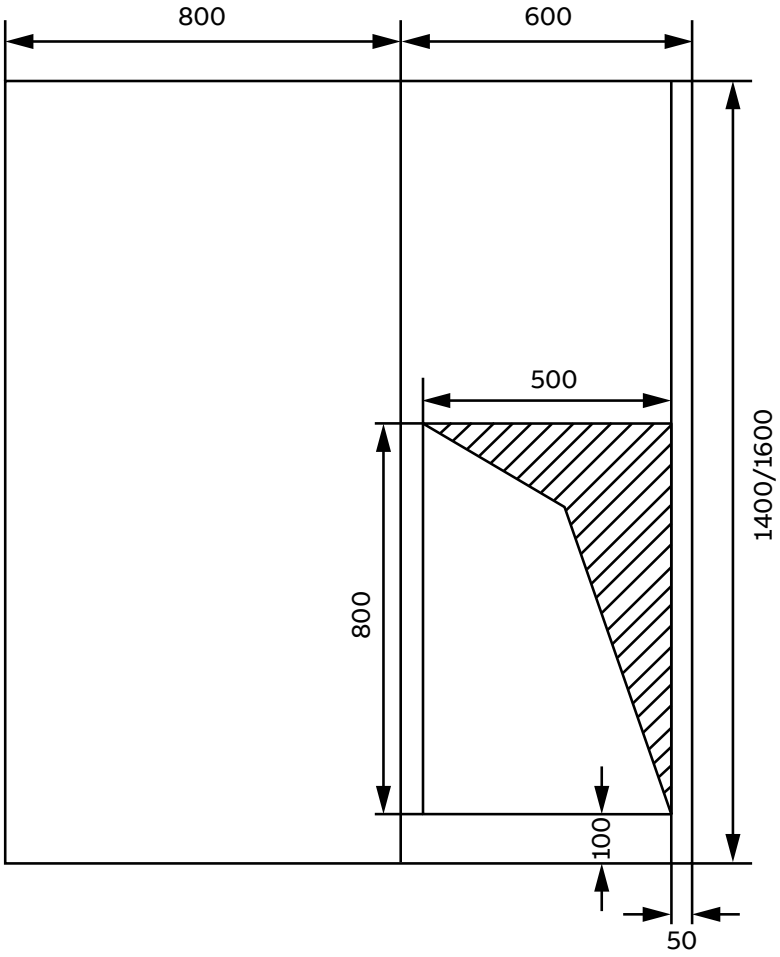


Figure 7-01 Floor cut-outs for MNS-Up ups section

Floor cut-outs for other MNS 3.0 sections shall be done as described in the MNS Service Manual.

7.2 Clearance above MNS-Up system

The MNS-Up system uses forced ventilation to keep the UPS module temperature constant.

The air inlet to the UPS section is from the front, the air outlet is on the top. Therefore, there must be a clear-ance of at least 100 cm above the MNS-Up UPS section.

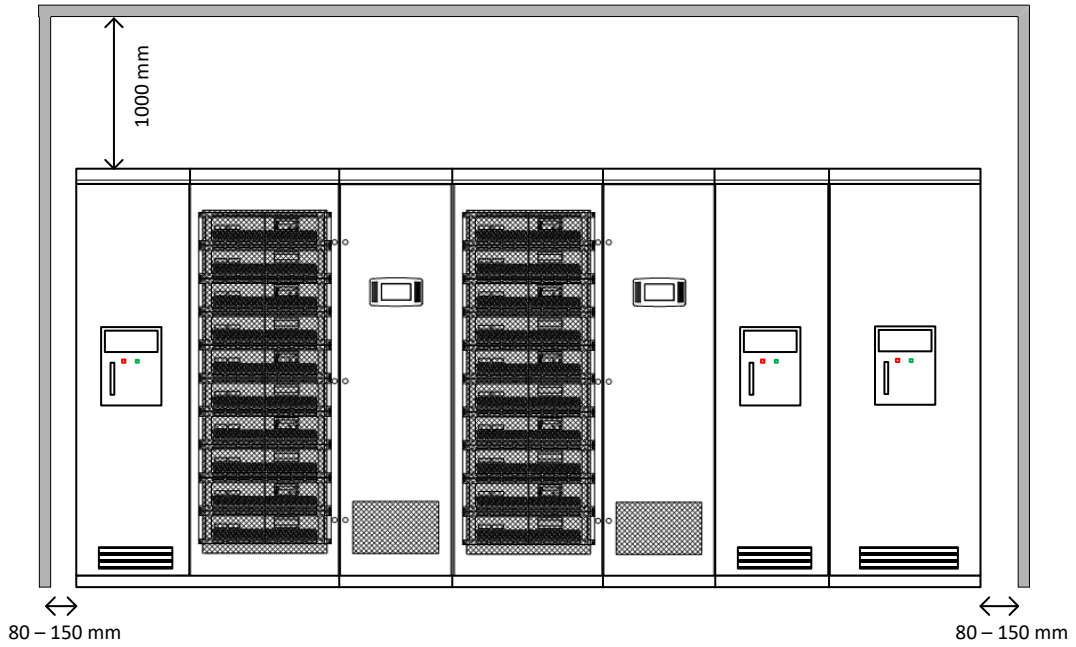


Figure 7-02 Clearance above MNS-Up system

7.3 Clearance behind MNS-Up system, clearance in front of the section

Clearance around MNS-Up sections must be:

Clearance to front	min. 1000 mm
Clearance to left side walls	min. 80 mm
Clearance to right side walls	min. 150 mm
Clearance to back wall	min. 80 mm

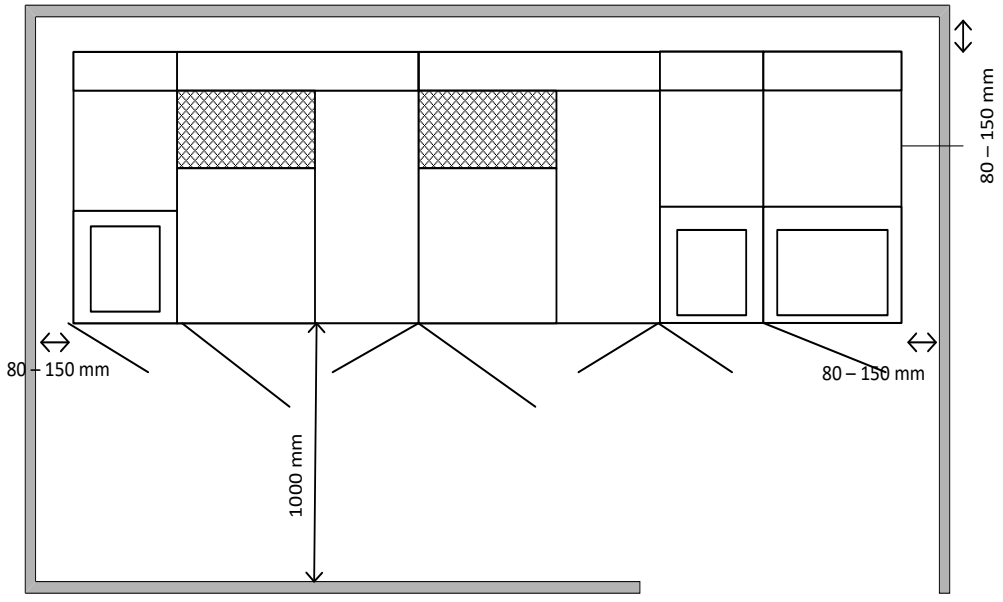


Figure 7-03 Clearance above MNS-Up system

7.4 Frame and enclosure

7.4.1 EMC measures for enclosure

7.4.1.1 EMC seals between sections

EMC seals must be provided between two UPS sections. Frame connections must be provided in 225 mm dis-tance.
EMC sealing must be provided between two MNS-Up sections as well as between MNS-Up sections and other MNS sections.

7.4.1.2 EMC seals for roof plates

Roof and bottom plates need to be fixed with all screw holes which are provided in 225mm distance. No addi-tional EMC sealing is required.

7.4.1.3 EMC seals for bottom plate

All MNS-Up sections require bottom plates due to EMC requirements. The bottom plates need to be fixed in a distance of 225 mm, and no additional EMC seals are required.

7.4.2 EMC seals for shipping splits

UPS sections shall be joined with partition wall 19 between two MNS-Up sections, as well as between MNS-Up section and MNS sections. EMC sealing needs to be provided on both sides of the partition wall 19, at top and bottom.

7.4.3 Rear walls and side walls

Rear walls and side walls are unpainted on the inside surfaces where they touch the section frame.

Rear walls and side walls need to be screwed in a distance of 225 mm to the section frame. Required fixing holes are pro-vided. EMC sealing shall be added at the top and bottom of the rear walls and side walls.

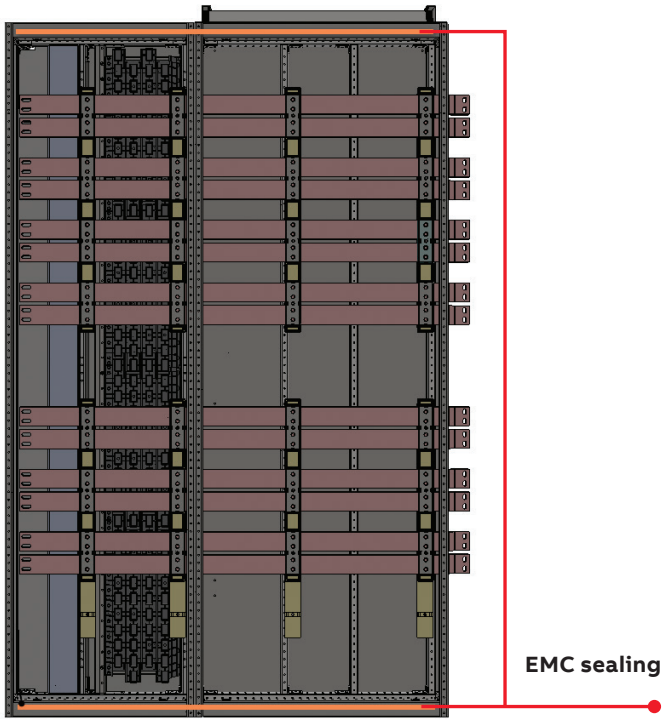


Figure 7-04 EMC sealing for rear walls of the MNS-Up section

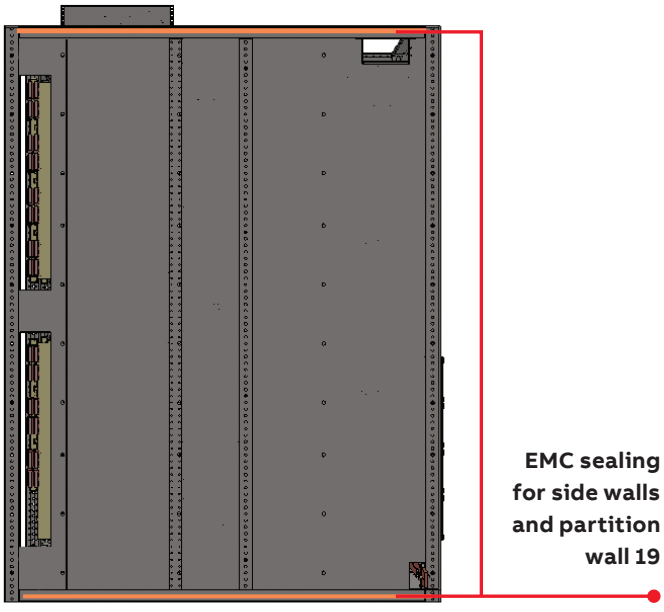


Figure 7-05 EMC sealing for side walls and partition wall 19

7.5 Main busbar

7.5.1 Busbar connection

7.5.1.1 Main busbars

The connecting material to join the main busbar and PE busbars is part of the assessor pack delivered with each shipping section.

Access to the shipping split is granted in the filter section of the MNS-Up section. To get access to the shipping split, all filter modules and partition wall 3 need to be removed.

Main busbar and PE busbar connections shall be done as described in the MNS Service Manual.

After connecting the main busbars, partition wall 3 must be installed and fixed with all screws.

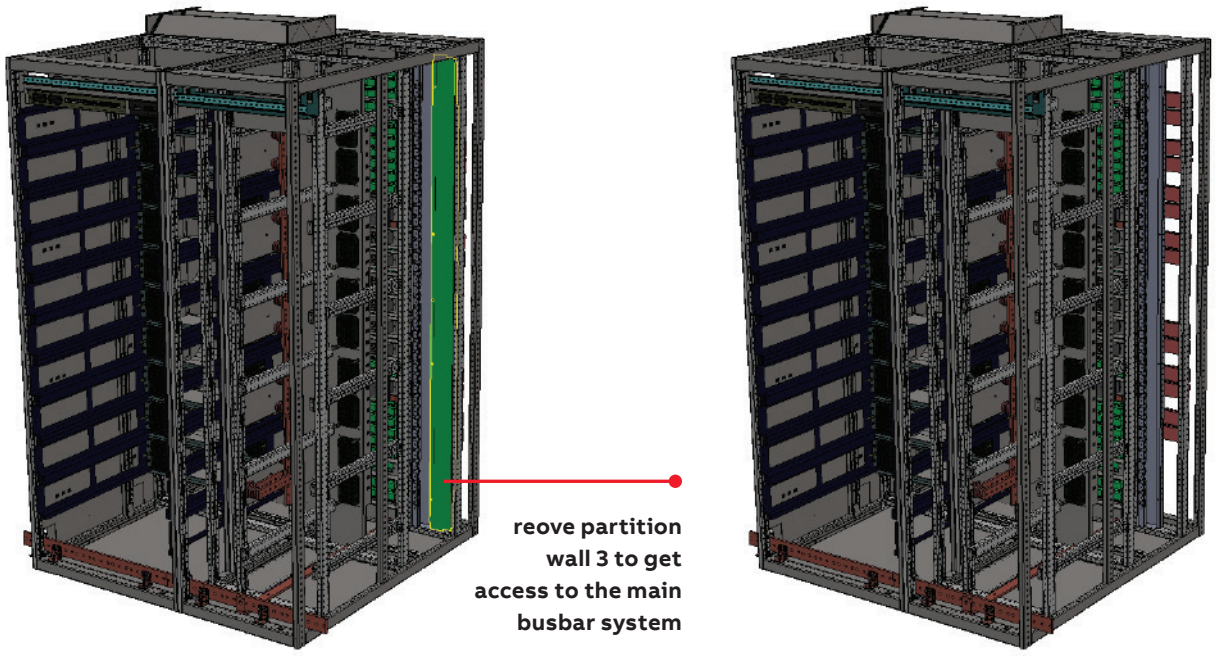


Figure 7-06 Access to main busbar area

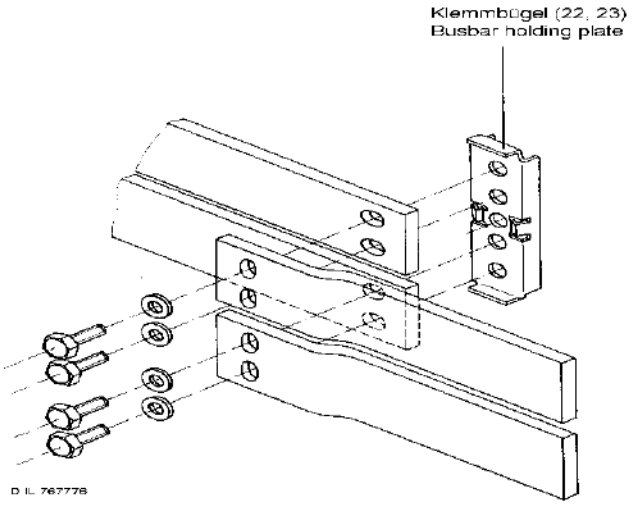


Figure 7-07 Main busbar connection (2 bars per phase), for tightening torques please refer to section 13 of this document

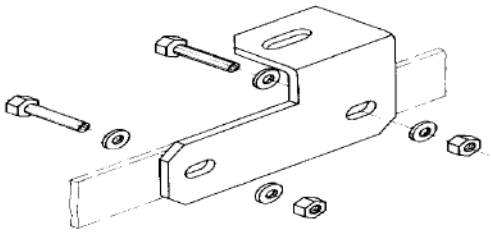


Figure 7-08 Pe bar connection in the filter section

See MNS service manual for the right torques for the busbar and pe bar joints.

After joining the main busbars, the partition wall must be reinstalled and correctly fixed.

The PE busbar is located in the front of the MNS-Up sections. The connection at shipping sections must be done according to the MNS service manual.

7.6 Battery connection

Battery connection can be done for each 100kW module individually or one complete section.

Battery connections need to be done before the filter modules are installed in the filter section.

7.6.1 Individual batteries

Battery connection bars are provided for each module level.

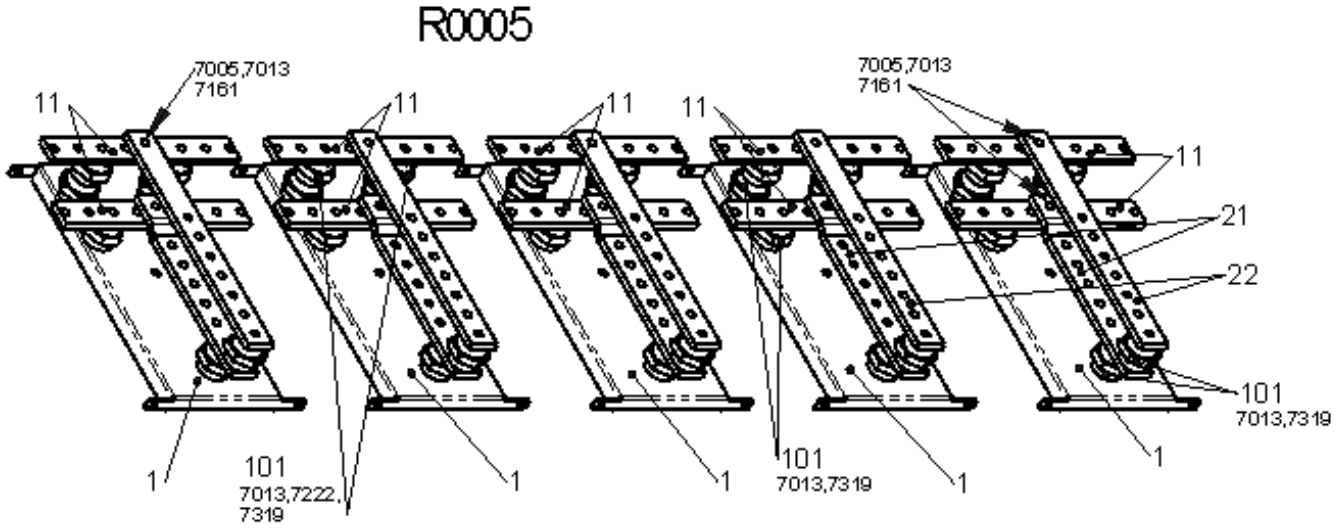


Figure 7-09 Individual battery connection

7.6.2 Common batteries

In case a common battery set must be connected to one MNS-Up section, the battery connection bars of the different module levels need to be connected using copper links.

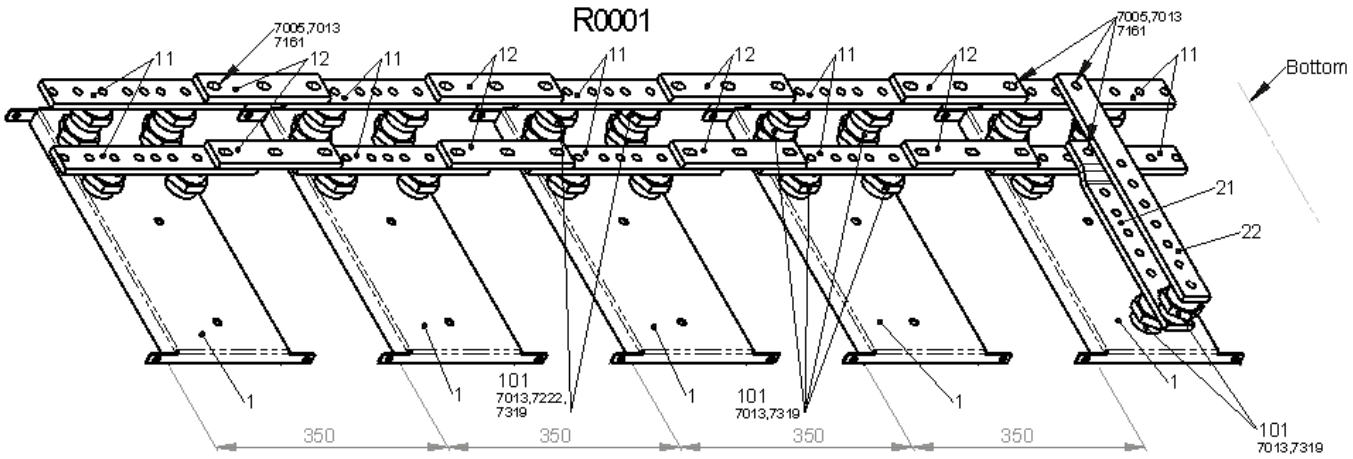


Figure 7-10 Common battery connection

08

MNS-Up configuration

MNS-Up configuration

8.1 Single MNS-Up UPS section configuration

A single section configuration requires one MNS-Up section equipped with 1-5 MNS-Up modules. The modules are feeding energy in parallel to the outgoing bar.

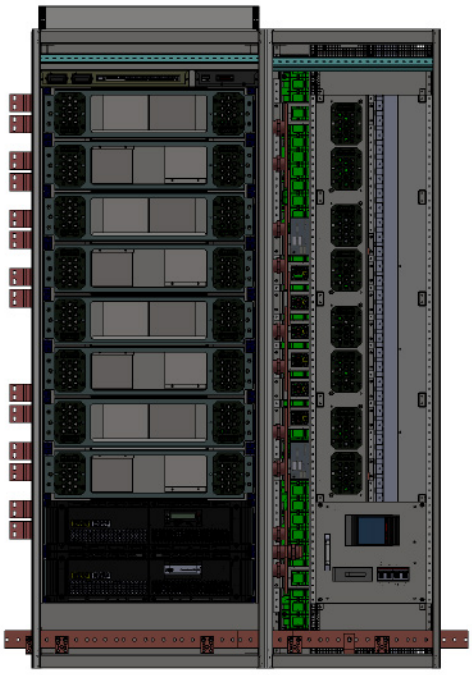


Figure 8-01 Single section 1 module - 100kw installed

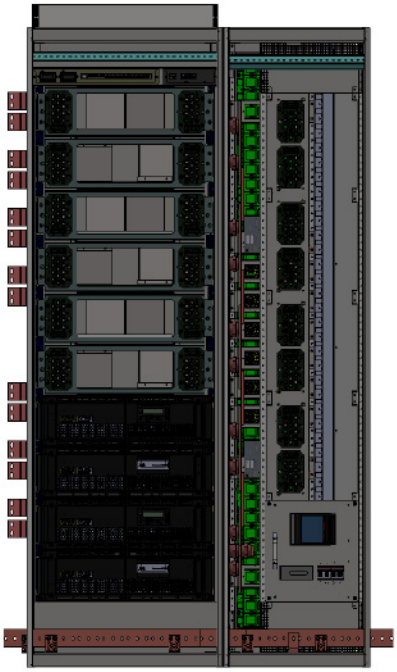


Figure 8-02 Single section 2 modules in parallel – 200kw installed

Please check DPA500 user manual section 2.5.

8.2 Multiple MNS-Up UPS section configuration

Multiple section configuration is possible for up to 6 sections with a maximum of 30 modules in parallel. Each of the sections can be equipped with 1-5 modules.

Multiple section systems require:

- Min. 2 MNS-Up sections
- Each section shall be equipped with min. 1 module
- One parallel cable and one multidrop cable connect

Figure 8-03 Multi-section configuration

Please check DPA500 user manual section 2.6.

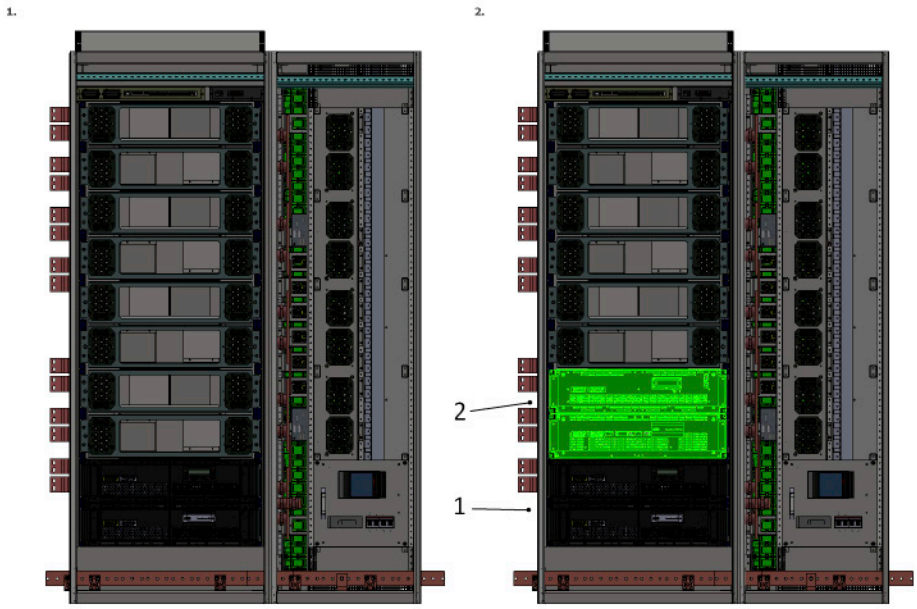
8.3 Active, passive and filter module placing

8.3.1 Module arrangement

The MNS-Up module sets must be installed from bottom to top.

One module set consists of:

- Passive module
- Active module
- Filter module



The compartment of active and passive modules is mechanically coded to prevent wrong placement of active and passive modules.

8.3.2 Space covers

Empty space compartments of active, passive and filter modules must be closed using the respective space covers.

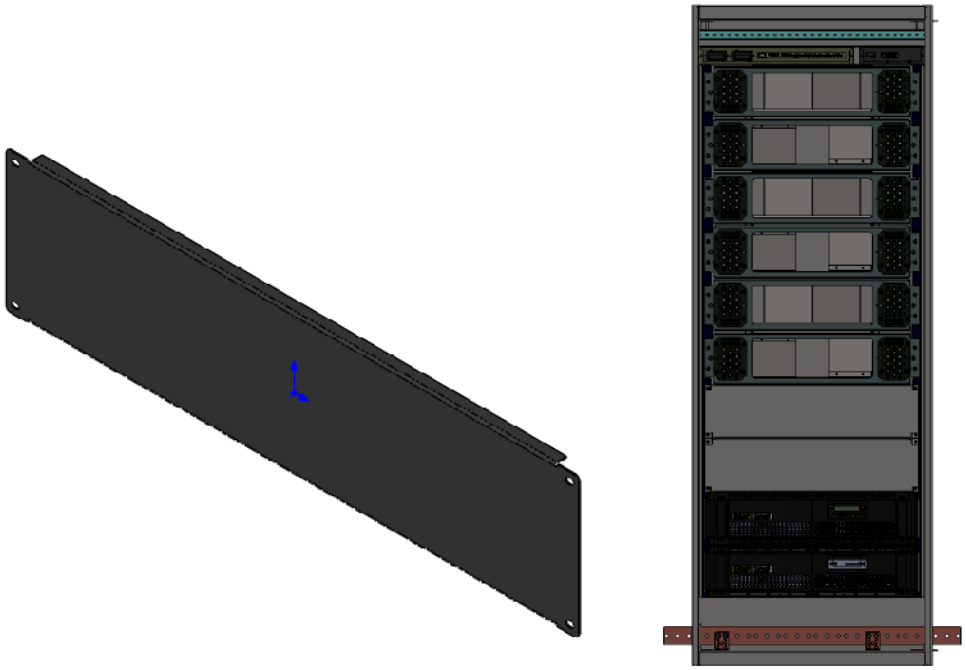


Figure 8-04 Space cover active passive module combination

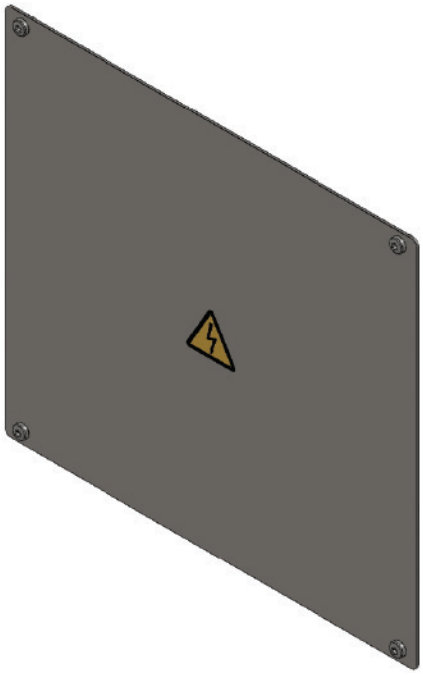


Figure 8-05 Space cover active passive module combination 1TGB100370r0101

09

MNS-Up Module installation

MNS-Up Module installation

9.1 Lifting of modules

Wheelchair lifts are recommended for lifting modules up or down.

Model:
NEWBINGO 100
(height 2000 mm, with shelf mounted over the forks)
Manufacturer/supplier:
LEVANTE Srl
Via dell'economia 10
46035 Ostiglia Mantova
Tel: 0039 0386801814
Web: www.levantelift.com

Figure 9-01 Forklift

9.2 Adding of module sets

MNS-Up modules are always installed as a complete set, since none of the modules can work independently.
To install a new module set the following steps are recommended:

If possible, switched OFF the complete system and disconnected the loads.

- If no redundancy is present, the load must be disconnected
- If redundancy N+1 is present, disconnecting the load is not mandatory
  (see “hot swappable” definition) but is recommended

- Remove the active and passive module space covers
- Install the passive module first
- Install active module
- Install filter module

Follow the start-up procedure as described in the DPA500 user manual section 5.15.2.2.

9.3 Removing of module sets

Turn down the MNS-Up module as described in the DPA500 manual 6.11.

- Disconnect and pull the filter module to isolate the MNS-Up module completely.
- Disconnect active module and pull to disconnected position.
- Disconnect passive module and pull to disconnected position.

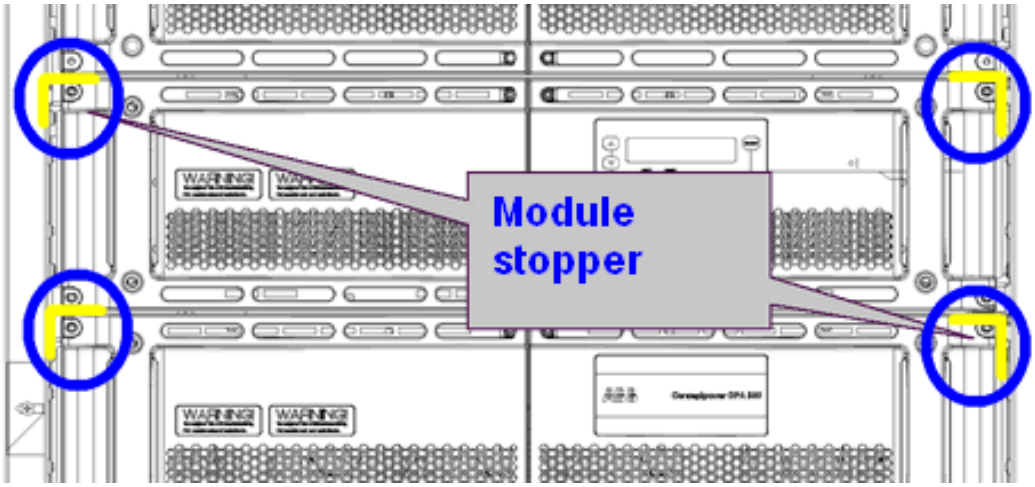


Figure 9-02 Module stoppers for active and passive modules to prevent dropping

10

Handling of EMC boards

Handling of EMC boards

In each of the MNS-Up sections, two EMC boards are installed on the distribution bars. The boards are located behind the filter modules. To access the boards, all the filter modules must be removed.

A complete system shutdown is required if emc boards must be accessed.

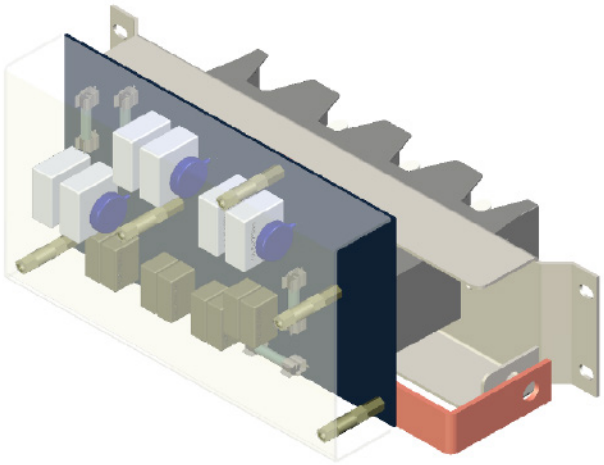


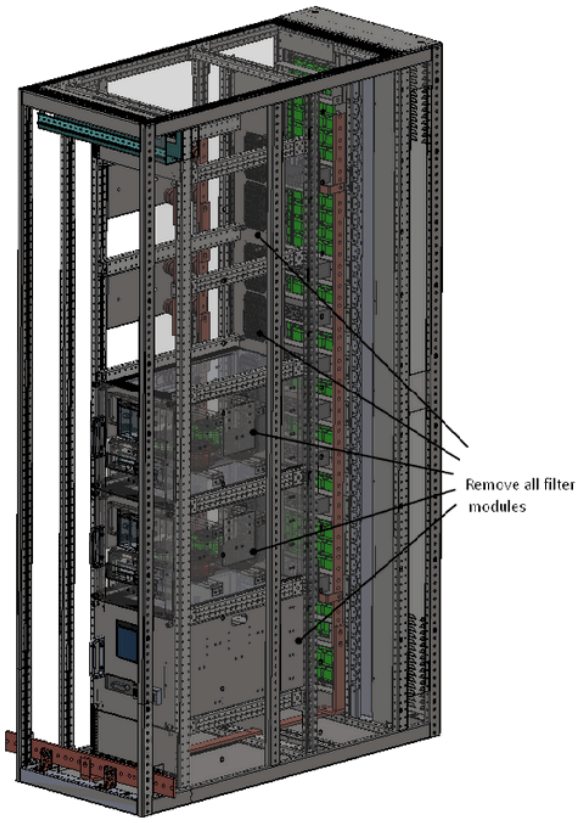
Figure 10-01 EMC filter module on distribution bars in filter sections

10.1 Replacing EMC boards

Turn down the MNS-Up module as described in the DPA500 manual section 6.11.

- Open and padlock all filter module breakers
- Switch OFF and padlock incoming feeders and bypass feeder to completely isolate the MNS-Up system
- Open remote and padlock battery breakers to isolate the battery connections
- Check that all connections are voltage free
- Earthing of incoming feeder
- Earthing of remote battery breaker
- Remove all filter modules in the filter section
- Remove the EMC filter module from distribution bars
- Incoming EMC filter is connected to the upper distribution bars
- Outgoing EMC filter is connected to the lower distribution bars

1.



2.

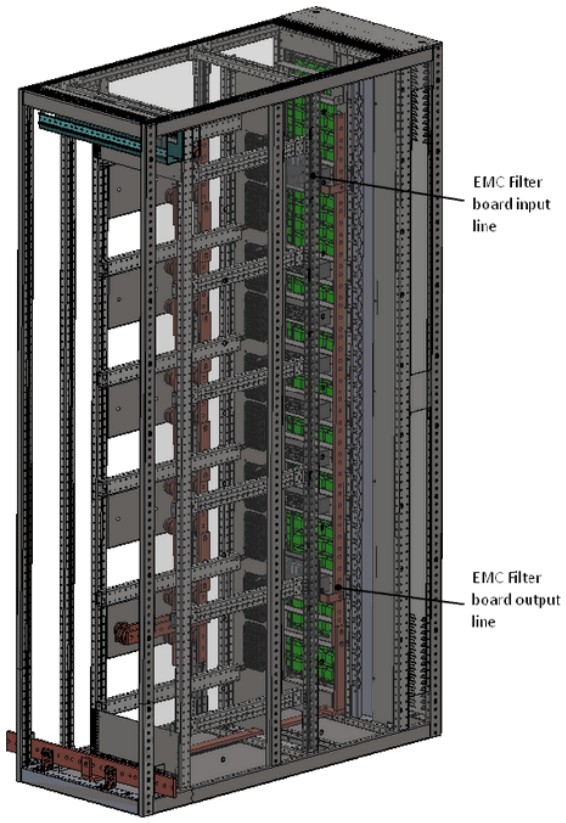


Figure 10-02 EMC board access in MNS-Up filter section

Reassemble in the opposite way.

Follow the start-up procedure as described in the DPA500 user manual section 6.7.

11

Communication boards

Communication boards

The communication boards are located below the control wiring duct in the MNS-Up module.

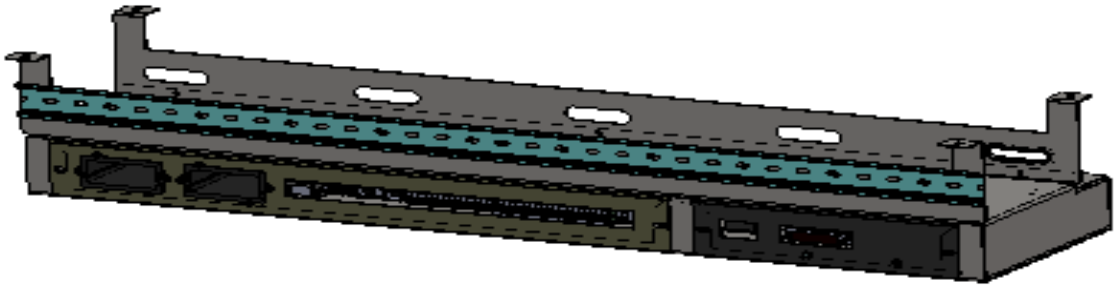


Figure 11-01 Control wiring duct with integrated communication ports

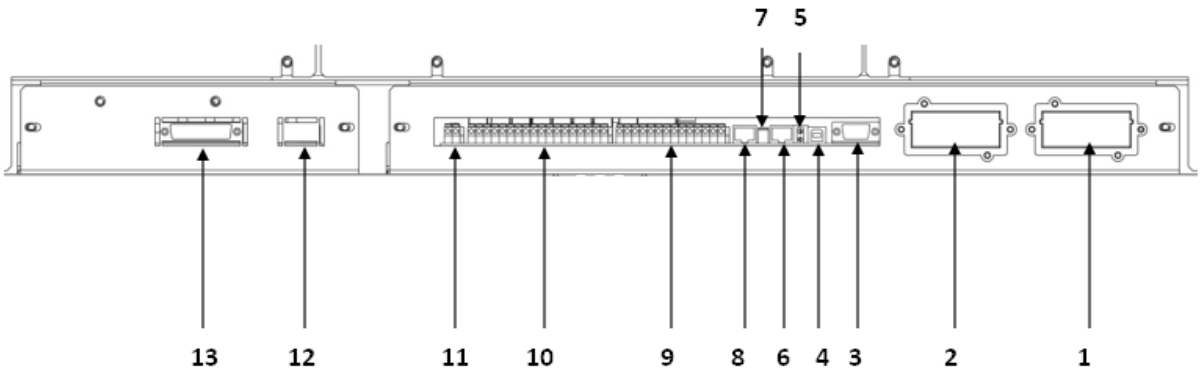


Figure 11-02 Communication ports in MNS-Up systems

1	Modem	Slot for optional Modem/Ethernet card ONLY
2	SNMP	Slot for optional SNMP card ONLY
3	JD1	RS232 Sub D9/female PC / laptop connection
4	USB	PC/laptop connection
5	2 LED's	green/red LED showing the status of the interface board
6	JR3	Graphical display connection
7	SW2	DIP-SWITCH for multidrop configuration
8	JR2	(RJ 45) multidrop connection (multi-cabinet configuration)
9	X3	UPS inputs and 12VDC source (X3 5/6)
10	X2	UPS outputs dry ports (potential free contacts)
11	X1	Interlock function
12	SW1-9	Multi-cabinet configuration switch (see 5.1.6 and 6.1.2.4)
13	JD8	Parallel bus connector
		ONLY for paralleling cabinets, use optional adapter: JD5 parallel bus - input connector JD6 parallel bus - output connecto

Turn down the MNS-Up module as described in the DPA500 manual section 5.

12

MNS 3.0 sections

MNS 3.0 sections

12.1 Handling of ACBs

For operating and maintenance on ACBs, check the respective service manuals.

12.2 Earthing of transformer/generator connection

A complete system shut off is required in case of:
- Extension of the system by adding additional sections
- Replacement of the EMC boards on the incoming or outgoing distribution bar
- Maintenance on the main busbar section
- Maintenance on the distribution bar
- Maintenance on the incoming and/or outgoing feeder connection bars
- Maintenance on the central manual bypass breaker connection bars

For save maintenance on the MNS-Up system, suitable earthing means must be provided in all ACB sections, as shown below..

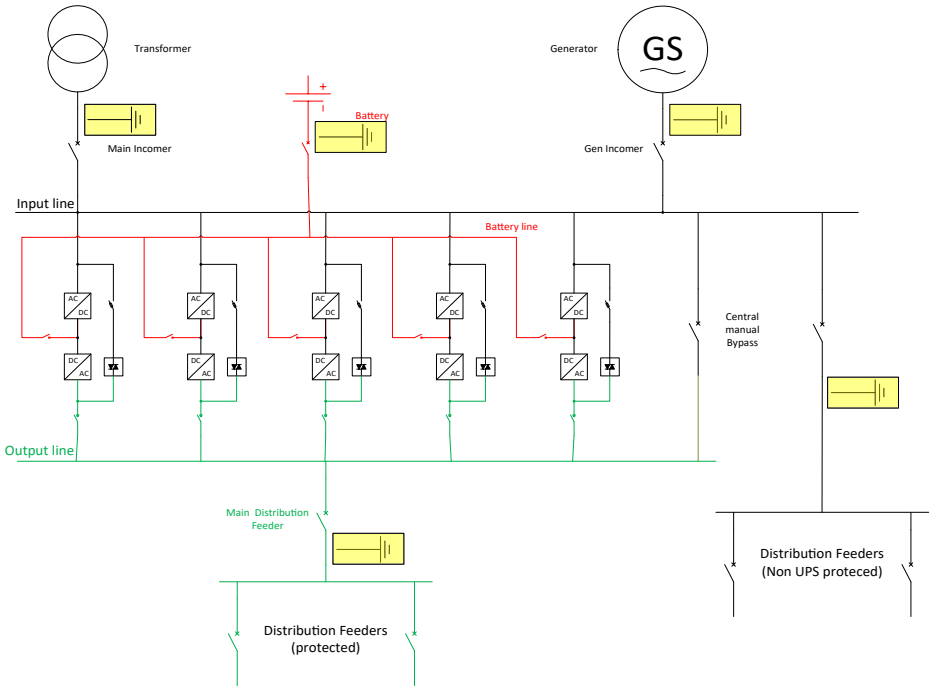


Figure 12-01 Earthing means for safe maintenance

In case of maintenance on the MNS-Up modules a system shutoff is not required.

12.3 Central manual bypass

The central manual bypass is used to bypass the UPS system in case maintenance on the MNS-Up UPS modules is required. The central maintenance bypass can be closed even if the MNS-Up UPS modules are switched on.

For save operation of the MNS-Up system using central maintenance bypass breaker, refer to concept power DPA500 manual section 6.2.7.

13

Commissioning

Commissioning

Follow the two steps for the commissioning.

Follow the commissioning procedure as described in the MNS service manual 1TGC902040B0201 section 5.

Exception:
While performing the insulation test on the main busbar system, the fuses of the EMC boards have to be disconnected.

Follow the start-up procedure as described in the DPA 500 user manual section 6.7.

14

Operating of MNS-Up system

Operating of MNS-Up system

14.1 MNS-Up system operation

For operating instructions for the MNS-Up ups system please refere to the conceptpower DPA500 user manual doc no 043275_OPM_ABB_CONCEPTPOWER_DPA_500kW_EN_REV-C.

14.2 Handling/operating ACBs

For operating and maintenance on acbs check the respective service manuals supplied with the system.

14.3 Other electrical devices

User manuals are supplied for all electrical devices with the MNS-Up documentation package.

For operating and maintenance on any additional electrical device, please refer to the respective service manuals supplied with the system.

15

Tightening torques for screw connection in MNS-Up

Tightening torques for screw connection in MNS-Up

15.1 Self-tapping screws in plastic material

Screw type and ident no.	Dimensions	Thermoplastics and duroplastics PUR			
		Thermoplastics and duroplastics		PUR	
	mm	Set value (nominal) Nm	Max. value *) Nm	Set value (nominal) Nm	Max. value *) Nm
TORX pan head tapping screws	4.2	1.7	2.0	–	–
1TGB 000 116 P....	5.5	3.8	4.5	3.0	3.5
and 1TGB 000 117 P....	6.3	4.7	5.5	3.0	3.5

*) Do not exceed max. Tightening torques.

15.2 Thread rolling screws in metal

Hexalobular socket pan head screw, ISO 14583	**Cross recessed pan head screws, ISO 7045**	**Hexagon socket head cap screws, ISO 4762**	**Hexalobular socket countersunk flat head screw, ISO 14581**	**Hexagon head screws, fully threaded, ISO 4017**
				

Screw type and ident no.	**Dim.**	**Tightening torques**								
		Sheet steel			**AL-sheet**			**Cu-bars**		
		Material thickness	**Set value (nominal)**	**Max. value *)**	**Material**	**Material thickness**	**Max. value *)**	**Material thickness**	**Set value (nominal)**	**Max. value *)**
		mm	**Nm**	**Nm**			**Nm**	**mm**	**Nm**	**Nm**
TORX pan head thread rolling screws 9ADA 629-... TORX countersunk head thread rolling screws 9ADA 633-...	M3	1.5	0.9	1.0	3.0	0.9	1.0	–	–	–
Cheese head thread rolling screws GILN 100 082 P....	M4	1.5	1.7	2.0	3.0	1.7	2.0	–	–	–
TORX pan head thread rolling screws 1TGB 000 118 P.... Hex head thread rolling screws GZN 490 181 P....	M5	1.5	3.8	4.5	3.0	3.8	4.5	–	–	–
Cross recess. pan head rolling screws 1TGB 000 002 P....	M6	2.0	4.7	5.5	3.0	4.7	5.5	–	–	–
Cross recess. pan head rolling screws 1TGB 000 003 P.... Hex head thread rolling screws 1TSA 273 000 P....	M8	3.0	8.1	9.5	3.0	4.77	5.5	5.0	8.1	9.5

*) Do not exceed max. Tightening torques.

If self-tapping or tread rolling screws are loosened,they need to be re-tightened with a hand screwdriver.

15.3 Screws for busbar connections (Cu) and system connections (steel/steel)

Hexagon head screws, fully threaded, ISO 4017

Screw type and ident no.	Dimensions	Tightening torques	
		Set value (nominal) Nm	Max. value *) Nm
Hex socket head cap screws DIN00912 with ESLOK GILN 200 124 P... Hex head bolts DIN00931 with ESLOK GILN 200 123 P.... Hex head screws DIN00933 with ESLOK GILN 200 125 P.... Hex socket head cap screws ISO4762 9ADA 183-... Hex head bolts ISO4014 9ADA 56-... Hex head screws ISO4017 9ADA 120-...	M6	6.8	8
	M8	17	20
	M10	34	40
	M12	60	70
	M16	119	140

*) Do not exceed max. Tightening torques.

16

Spare parts

Spare parts

Item	Description	Id-No.	Additional information
1	MNS-Up active module (40 °C)	04-3404_SP284	40 °C ambient temperature module
1a	MNS-Up active module (35 °C)	04-3404	35 °C ambient temperature module
2	MNS-Up passive module (40 °C)	04-3405_SP284	40 °C ambient temperature module
2a	MNS-Up passive module (35 °C)	04-3405	35 °C ambient temperature module
3	MNS-Up filter module	1TGB100355R0001	
4	MNS-Up EMC filter module	1TGB100363R1000	
5	MNS-Up communication boards - Parallel adapter boards - SNMP board - Profibus card	 04-3862 04-3862 04-0594	
6	MNS-Up HMI	04-2939	
7	Battery bar links		For later connection of battery bars to allow group or common battery
8	EMC sealing for doors	1TSA383011P0001	
9	EMC sealing for enclosure parts	1TSA330001P0004	
10	5 year maintenance kit for DPA500	4NWP101234R0001	Preventive maintenance kit

For MNS spare parts, see the MNS Service Manual.

17

Onsite inspection and maintenance

Onsite inspection and maintenance

Please refer to MNS Service Manual 1TGC902040B0201 section 7 and maintenance instructions as described in the DPA500 manual section 7.2.

18

Maintenance intervals

Maintenance intervals

Please refer to MNS Service Manual 1TGC902040B0201 section 7 and DPA500 manual section 7.

General visual inspection (repetitive tests):
- External inspection
- Completion of the interior
- Switchgear and control gear assemblies (withdrawable or plug-in modules)

Additional inspections:
- – Withdrawable technique
- – Plug-in, technique
- – Direct connection of incoming and outgoing power feeders with circuit breakers, e.g. Emax, ISOMAX or Tmax

Notes on the inspection lists on the following pages:
- The frequency refers to time intervals (monthly, annually, etc.), service hours, starting frequency, etc.
  The following abbreviations are used to denote the frequency:
  - m: monthly
  - a: annually
  - n: insertion cycles of modules
  - x: test in the event of a fault (e.g. after a short-circuit)
- “Installation category” column
  A distinction is made between the following installation categories, because the frequency of maintenance or inspection depends on the operating conditions:
  - Installation category A: Normal operation
  - Installation category B: Heavy-duty operation, e.g. cement factory
  - Installation category C: Short circuit (fault)

18.1 Maintenance checklist

Item no.	Work to be performed	Measured, test and limit values, operating and auxiliary materials	Frequency installation category A	B	C	Remarks
1.0	General visual inspection (repetitive tests)					
1.1	External inspection					
1.1.1	Verify ambient conditions	– Room temperature ≤ 35°C – Air, aggressive gases such as SO_2, H2S etc. – Relative humidity ≤ 50 % at 40°C – Dust	1a	6m	X	Unpleasant smell Auxiliary heating possibly required
1.1.2	Check ventilation system (efficiency) – Operating room – Switchgear system Check condition of enclosure/outside paint	 – Air supply to and air discharge from section not obstructed – max. temperature inside the section: ≤ 60°C	6m	6m	X	 Touch fronts with hand surface, check section if hand-warm spots are found
1.1.3	– Check condition of enclosure/outside paint	– Damaged / corroded – Missing parts such as module doors or covers – Ventilation louver dusty/ covered – Roof plate contaminated/ covered/obstructed/etc. – Fastening of cable compartment doors, side and back panels – Position of withdrawable modules in the section (operating or isolated position) – Cable/equipment compartment doors closed/open – Escape route ≥ 650 mm	1a	6m	X	
1.1.4	Accessibility	– Escape route ≥ 650 mm	1a	6m	X	
1.2	Completion of the interior					
1.2.1	Equipment compartment – Check filling factor and equipment – Internal conditions	– Arrangement of modules in accordance with engineering documents – Contamination, e.g. dust	1a	6m	X	 Clean
1.2.2	Cable compartment/ cable terminal compartment	– Incoming feeder in accordance with documents (busbar/cable laterally/top/bottom) – Sufficient room/strain relief – Cable routing; bending radii				
	Personal protection/ protective bellows	– Protective bellows				
1.2.3	Busbar compartment – Check transport connections	– Color changes at bolted connections – Proper installation of cover in partition wall 3	1a	6m	X	Check using thermo-vision exposures
	– Check busbar supports	– Contamination or flashover – Formation of cracks or creeping paths				
	Visual inspection of the condition of the busbar insulation	– Shrink-on tube brittle				

Item no.	Work to be performed	Measured, test and limit values, operating and auxiliary materials	Frequency installation category			Remarks
			A	B	C	
1.3	General inspection of the switchgear assembly (with-drawable or plug-in MNS-Up modules)					
1.3.1	Design of conductors and conductor installation	Condition of insulation	2a	1a	X	Measure the insulation resistance For the complete maintenance work, observe the instructions of the equipment manufacturer
1.3.2	Check electrical equipment installed	– Bracing – Check contact corrosion, contact gaps, ionization chamber, arc splitter, rated currents, settings and tripping – Minimum creepage distance ≥ 12,5 mm – Check minimum clearance for arcing space				Cf. equipment manufacturer
1.3.5	Required protection class	– EN 60529				
1.3.6	Check efficiency of protec-tive conductor connection	– Check continuity with signal test apparatus	2a	1a	X	
1.3.7	Function test of the control device	– In accordance with circuit diagram	2a	1a	X	Control connection cable
1.3.8	Check measuring loops	– In accordance with circuit diagram	2a	1a	X	
1.3.9	Check function of the MNS-Up modules and bat-teries	See Conceptpower DPA500 manual	6m	6m	6m	
2.0	Withdrawable technique					
2.1.1	Compact modules (6E/4 + 6E/2/8E/4 + 8E/2) – Check easy movement of module in compartment	– Remove dust and grease from guide rail if neces-sary	2 - 3a	1a	X	
	– Function test of mechanical interlock	– Lubricate with Omnigliss	2 - 3a	1a	X	
	– Check electrical contact-making		2a1	1a1	X	
	– Main contacts	– Visual inspection – In case of doubt check contact clearance – Greasing				Refer to chapter 5.5 Refer to chapter 5.6
	– Control plugs – Visual inspection of module compartment	– Remove dust from guide rail with vacuum cleaner – Actuate limit switch rocker (if available) – Check condition of mating contacts				
	Check efficiency of protective conductor connection	– Check cam condition at supporting rail				Artificial light source
	Withdrawable modules ≥ 4E – Check easy movement of module in compartment – Function test of mechanical interlock					

Item no.	Work to be performed	Measured, test and limit values, operating and auxiliary materials	Frequency installation category A	B	C	Remarks
1	Main contact to be checked either according to mentioned time intervals or at latest, after 100 cycles.					
	– Check electrical contacts – Main contact	– Visual inspection – Check of contact force – Greasing	2a1	1a1	X	Refer to chapter 5.5 Refer to chapter 5.6
	– Control plug – Fastening of outgoing cable unit	– Position; the outgoing cable unit might be pressed out of its normal position by strong cable forces				
	– Protective conductor connection	– Condition of the roller in the compartment bottom plate				
2.2 2.2.1	Fixed, PI-, modules MCCs and outgoing energy distribution feeders					Cf. also item no. 1.3: General inspection
2.3	Direct connection (incoming and outgoing feeders with circuit breaker					Analogous to item 1.3 “General inspection of switchgear assembly”
	Additional checks: – Check main switching device	– Visual inspection of main connections	1a	6m	X	Procedure in accordance with manufacturer´s instructions
		– Color change at switch main connections – Condition of main and eroded contacts				
		– Function test	1a	6m	X	
	– Check current transformer arrangement	– Fastening of transformers – Secondary cable routing – Condition of transformer housings				
	– Check supports at angle and connection sets	– Check screwed connections – Mechanical condition of supporting plate	1a	6m	X	
	– Condition of partitioning (if available)	– Formation of creepage paths				
	– Check external connections	– Check screwed connections – Check cable strain relief – Cable routing, min. bending radii, edge protection, etc.				

m: monthly
a: annually
n: insertion cycles of modules
x: test in the event of a fault (e.g. after a short-circuit)

Additional information
We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

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