Medium voltage products

PowerCube PB
Installation and maintenance instructions

Index

Power and productivity
for a better world™

For your safety!

- Make sure that the room is suitable for the installation of electrical apparatus.
- Make sure that all the installation, putting into service and maintenance operations are carried out by skilled personnel with in-depth knowledge of the apparatus.
- Make sure that all the installation, service and maintenance operations comply with standard and legal requirements for constructing the installations in accordance with the regulations for safety in the workplace.
- Strictly follow this instruction manual.
- Make sure that the ratings are not exceeded while the apparatus is in service.
- Pay the utmost attention to the notes shown in the manual by the following symbol:

- Make sure that the personnel working on the apparatus have this manual to hand and all the information required for correct intervention.

Responsible behaviour safeguards your own and others' safety!

For any requests, place contact the ABB Assistance Service.

Introduction

The instructions in this manual refer to standardised PowerCube type medium voltage modules.
The instructions applicable to both the PowerCube PB/M modules and to the PowerCube PB/E enclosures will refer to these as PowerCube “Units”.
For correct use of the apparatus, please read the manual carefully.
PowerCube modules are designed for a large number of installation configurations.
However, they do allow further technical and constructional modifications to satisfy special installation requirements.
Consequently, the information given below may sometimes not contain instructions concerning special configurations requested by the customer.
Apart from to the manual, it is therefore always necessary to consult the latest technical documentation (circuit and wiring diagrams, foundation plans, any protection coordination studies, etc.), especially regarding any variants requested in relation to the standardised configurations.
For maintenance use only original spare parts. For any further information, refer to Technical Catalogue 1VCP000091.
For instructions regarding the apparatus (circuit-breakers, contactors …), refer to the relative instruction booklets.

1. Packing and transport

Follow the symbols and instructions shown on the packing carefully

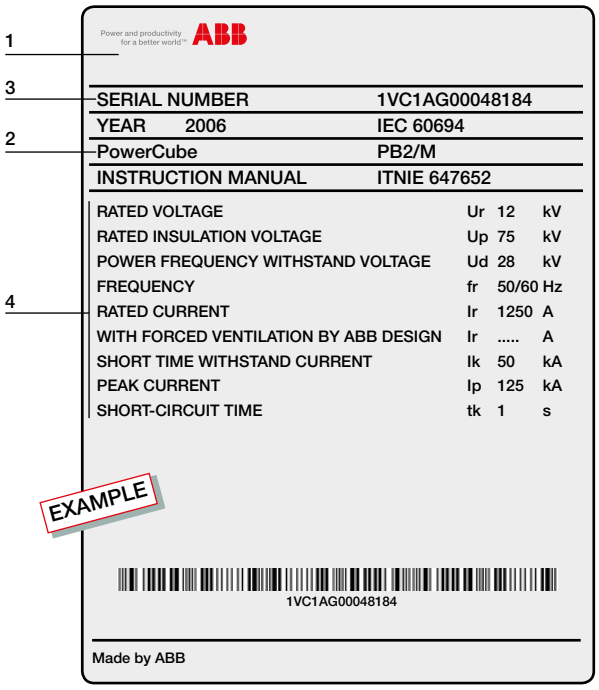
The PowerCube modules are shipped complete with trucks (voltage transformers) inserted in the relative compartments, except where otherwise agree with
the customer.
Each module is packed according to the shipping and storage requirements of the customer.
Each module is protected by a plastic cover to prevent any water entering during the loading and unloading stages and to keep it free of dust during storage.
The vehicle to be used to transport must have a loading platform not higher than 1.5 m from the ground so as to come within the maximum height of 4 metres. The loading platform must be slip-proof with a high friction coefficient.
The modules must be placed on the transport vehicle platform back-to-back and transversely, placing materials between them suitable for absorbing any compression and to avoid any direct contact between the surfaces of the various groups.
Special longitudinal members must be placed on the platform to space each module and prevent it moving either longitudinally or transversely.
The modules must be anchored to the structure of the vehicle with ropes, so that there is not deformation and to prevent tilting on bends or in the case of sudden stops.
The transport vehicle must also have a tarpaulin cover over the whole load.
The resting points of the lifting means must have a specific capacity to ensure proper weight distribution.
To unload the modules, there must be an area at the same level and with dimensions not less than 3 x 2 m in front of the access to the warehouse or switchboard room.
See paragraph 4 for handling.
Small differences in level can be compensated with temporary structures made using wooden boards.
Unloading must be carried out with the utmost care using suitable lifting equipment.
Special attention must be paid and the specific risks analysed for working in areas with live overhead lines.

2. Control on receipt

- **While handling the unit do not put stress on the insulating parts.**
- **Before performing any operation make sure that the operating device springs are discharged and the apparatus is in the open position.**

On receipt, immediately check the packing and the state of the apparatus.
Open the packing as shown in para. 4., taking care not to damage its materials. Check that no damage has occurred during transport and make sure that the nameplate data (fig. 1) corresponds to what is specified in the ABB order acknowledgement and in the shipping note.
Should any damage or irregularity be found in the supply, immediately notify ABB (directly, through the agent or the supplier) and the carrier who delivered the goods.
Notification of any irregularity, even after receipt, must indicate the module serial number shown on the nameplate located on the module itself.
The modules are only supplied complete with the accessories specified at the time of ordering and confirmed in the order acknowledgement sent by ABB.
The documents enclosed in the shipping packing are:
– adhesive labels showing the addressee and product type;
– this instruction manual;
– the test report;
– the electrical diagram.

2.1. Nameplate data



Caption
1 Trade mark
2 Enclosure type
3 Serial number
4 Electrical characteristics
5 Standards

Fig. 1

3. Storage

- **Please contact ABB in case of special storage conditions.**
- **If the gas pressure of the circuit-breaker (due to the altitude) has been reduced for shipping purposes, the nominal value the SF6 level must be restored (see para. 12.2.2) with SF6 gas in compliance with CEI 10-7 and IEC 60376 Standards.**
- **Gas recovery must be carried out either by our personnel or suitably qualified customer personnel with in-depth knowledge of the apparatus.**

If the apparatus has to be stored before installation, on request suitable packing for the conditions specified can be provided.
On receipt, the module must be unpacked and checked as described in “Control on receipt” (chapter 2), and then put back in the packing again using the original materials.
PowerCube modules must be stored in a dry, dust-free, non-corrosive place, at a temperature ranging from – 5 °C to + 45 °C without significant changes. If this is not possible, store the modules in a well-ventilated room, cover them with tarpaulins or waterproof sheets (e.g.: polyethylene) and supply the anti-condensation heaters to prevent any condensation.
The package contains dehydrating bags that must be replaced every six months.
For special requirements, please contact us.

4. Handling

4.1. Modules/enclosures

Each unit is usually fixed onto a wooden platform.
Handling should preferably be carried out by means of bridge or mobile cranes. Otherwise, use rollers or fork lift trucks.
Weights and dimensions of the various sections are indicated in the shipping documents and on the plant drawings.

4.1.1. Handling

To handle the modules containing the apparatus (circuit-breaker, contactor or service truck), it is compulsory to use the proper lifting eyebolts.

4.1.1.1. Handling with bridge or mobile crane and unpacking

Handling the wood packing

Lifting by means of a crane must be carried out using the circular slings (1) (fig. 2).
The slings must be inserted according to the lifting symbols marked on the crate.
Weight and lifting opening angle must be taken into account when choosing the circular slings.

Unpacking

- Remove the nails and crate lid and sides;
- open the door of the units and loosen the screws fixing the module to the pallet (if present);
- lift the module by means of the crane following the instructions below;
- slide the pallet out from under the unit;
- position the unloading shims;
- lower the unit onto the shims using the crane.

Only use a suitable balance lifting system of the type shown in the picture.

After unpacking it, lift the unit by means of a crane, using the special eyebolts (1) (fig. 3) and the ropes fitted with safety spring catches, following this procedure:
- take hold of the lifting eyebolts by the handle (3);
- insert the hooking irons (5) in the slots (4) made on the side of the unit and marked with self-adhesive labels;
- push the lifting bolts against the module and make them slide upwards until the hooking irons (5) hit the top of the slot (4);
- fully tighten the positioning screw (6);
- hook the rope spring catches to the unit eyebolts and lift.

After installation, remove the eyebolts used for lifting by proceeding in reverse order.

Handling the unit in the wooden crate

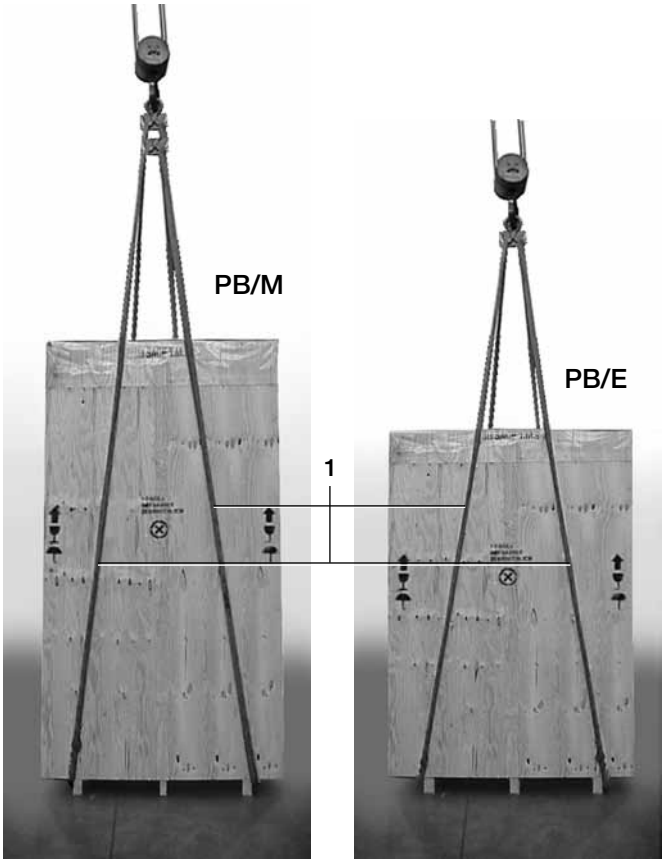


Fig. 2

Module handling

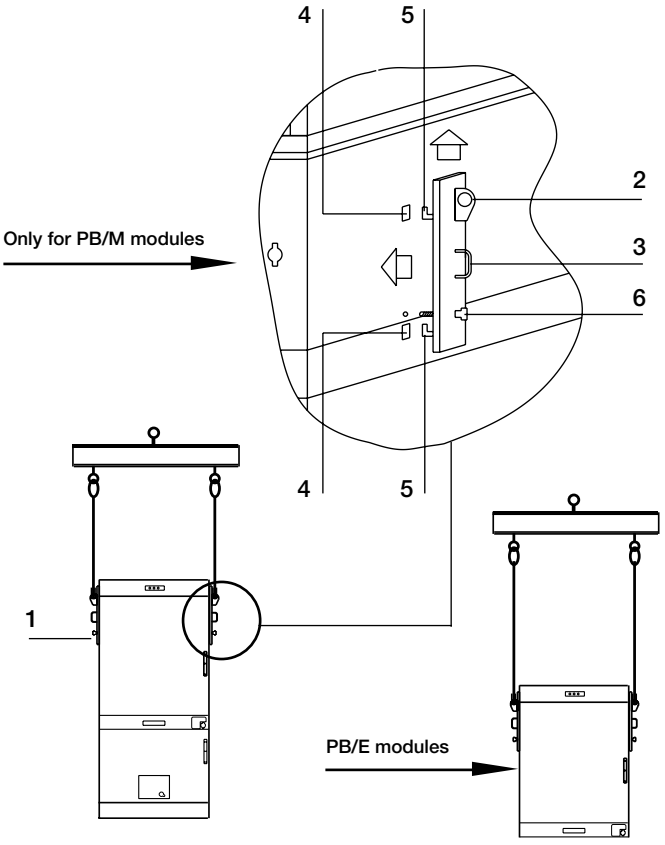


Fig. 3

4.1.1.2. Handling by means of rollers

- **The floor on which the rollers slide must be completely level.**
- **Move the module, avoiding any bumps which might turn it over.**

Lift the unit by means of a bridge or mobile crane or using jacks (fig. 3).
Remove the wooden pallet, loosening the screws fixing it to the switchboard section base.
Put a sturdy metal sheet between the rollers and the base of the units and place the unit on the sliding rollers (fig. 4).

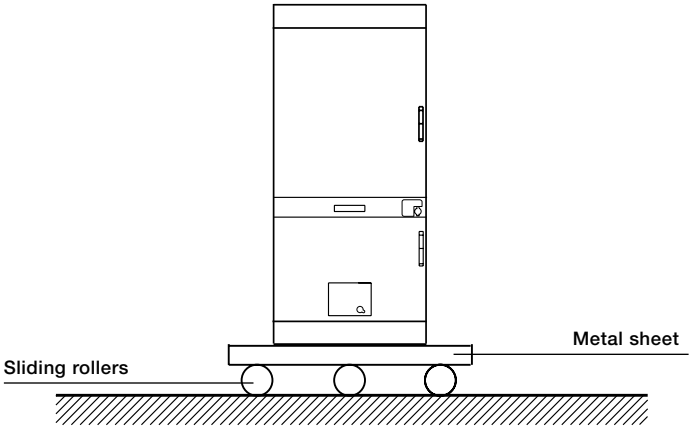


Fig. 4

4.1.1.3. Handling by means of transpallets or fork lift trucks

- **The floor on which the transpallets or fork lift trucks run must be completely**
- **Move the unit, avoiding any bumps which might turn it over.**

For greater stability, only lift the unit enough to allow handling.
Also check levelness of the forks.

Lifting a unit packed in a wooden crate.

4.2. Apparatus

The apparatus can be handled by means of cranes, fork lift trucks or using the special truck provided by ABB.
For each apparatus follow the instructions given in the relative booklet.

Unit handling.

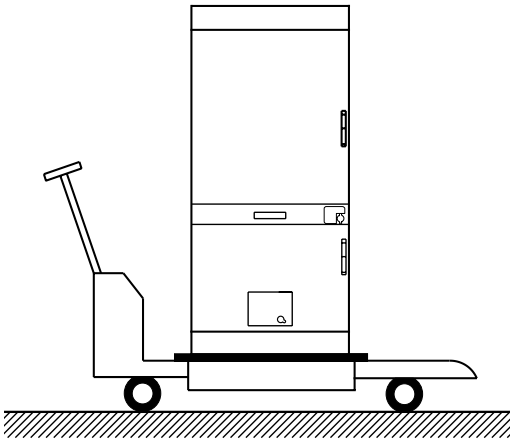


Fig. 5

5. Description

5.1. Unit construction features

The PowerCube units allow MV metal-clad switchboards with metal enclosure to be built, suitable for indoor installation.
The PowerCube units are pre-assembled and tested in the factory.
The PowerCube units are suitable for all primary distribution requirements with service voltages up to 24 kV and can take on different configurations according to customer requests.
For the instructions regarding the apparatus please refer to the relative manuals.
All normal service operations are carried out from the front of the unit with the doors closed. The doors on the front only need to be opened for maintenance operations and replacement of spare parts.

The circuit-breaker unit can be fitted with withdrawable circuit-breakers or contactors.
The switchgears built up with Power Cube units can be installed against walls since they are fully accessible from the front for the operations, maintenance and installation operations.
The PowerCube units allow arc-proof switchboards to be constructed in compliance with the prescriptions of the IEC 62271 - App. AA Standards, class of access (A) criteria (1 - 5).

The PowerCube units are designed with the following degrees of protection:

Degree of protection with doors open	IP2X
Degree of protection on the external enclosure	IP4X

Each unit (fig. 6) is divided internally into a circuit-breaker compartment and a feeder compartment.

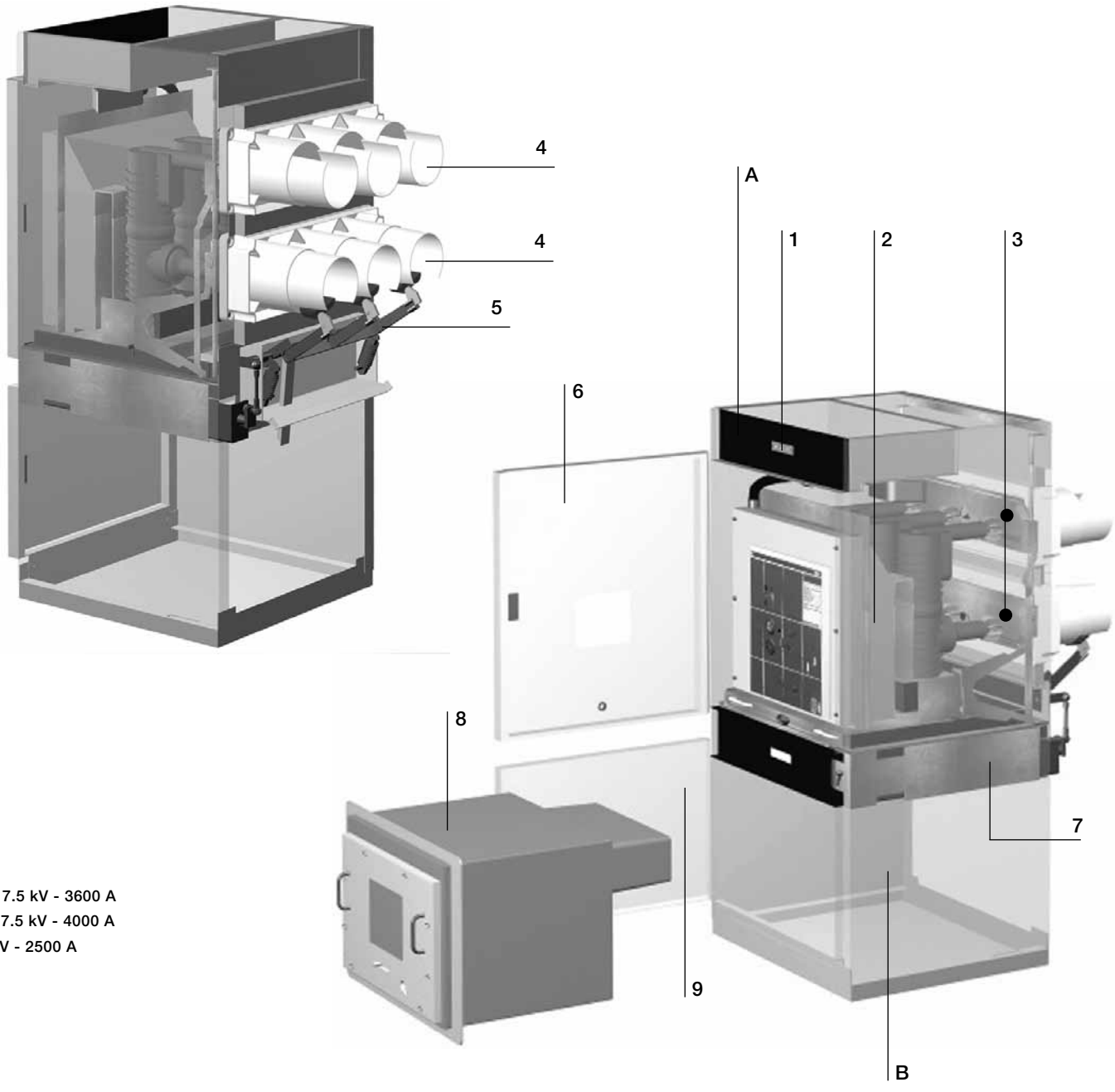
A Circuit-breaker compartment

1 Voltage signalling device (on request for PB/M only)
2 Circuit-breaker/contactor
3 Shutters
4 Lower and upper monoblocks
5 Earthing switch (on request)
6 Door
7 Fan (*)

B Feeder compartment (PB/M-PB/RM)

8 VT compartment on request (non available PB1/M - PB1/RM)
9 Door.

Standard cross-section

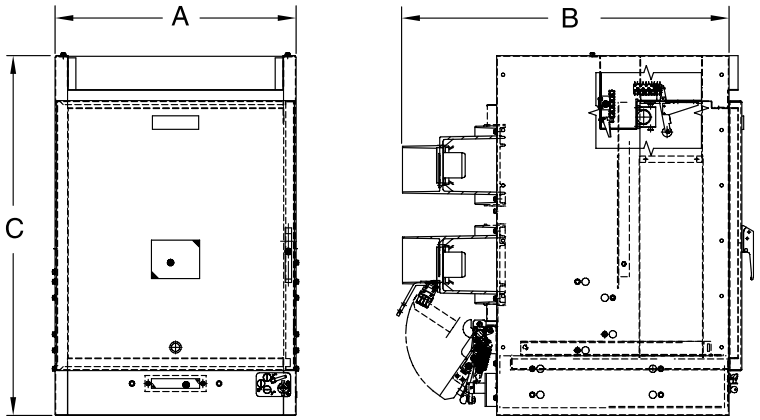


(*)12/17.5 kV - 3600 A
12/17.5 kV - 4000 A
24 kV - 2500 A

Fig. 6

5.2. Dimensions and weights

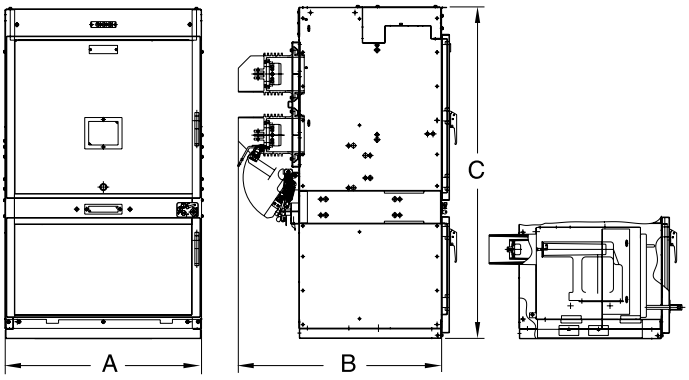
PB/E



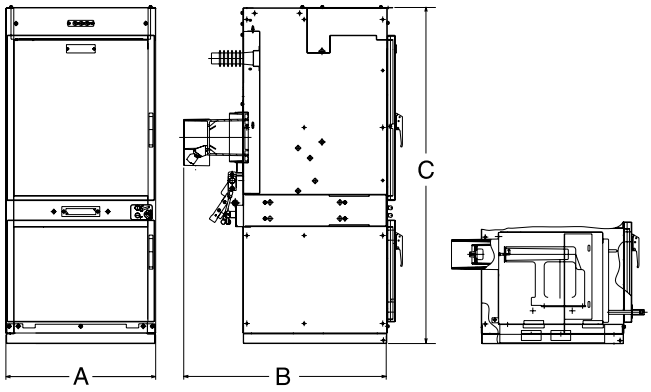
Unit	Rated voltage [kV]	Rated current [A]	Isc Icw [kV]	Table of dimensions	A [mm]	B [mm]	C [mm]	Weight [kg] (1)
PB1/E	12	630 - 1250	31.5	1VCD003369	600	1016	1120	180
	17.5	630 - 1250	31.5	1VCD003369	600	1016	1120	
PB2/E	12	630...2000	31.5	1VCD003370	750	1016	1120	200...240
	12	1250...2000	40-50	1VCD003370	750	1016	1120	
	17,5	630...2000	31.5	1VCD003370	750	1016	1120	
	17.5	1250...2000	40-50	1VCD003370	750	1016	1120	
PB3/E	12-17.5	2500	31.5	1VCD003371	1000	1030	1120	300
	12-17.5	3150	31.5	1VCD003372	1000	1030	1120	320
	12-17.5	3600...4000	31.5	1VCD003373	1000	1030	1120	350...380
	12-17.5	2500	40-50	1VCD003371	1000	1030	1120	300
	12-17.5	3150	40-50	1VCD003372	1000	1030	1120	320
	12-17.5	3600 - 4000	40-50	1VCD003373	1000	1030	1120	350...380
PB4/E	24	630 - 1250	31.5	1VCD003374	750	1246	1230	250
PB5/E	24	1600 - 2000	31.5	1VCD003376	1000	1246	1230	310
	24	2500	31.5	1VCD003376	1000	1246	1230	340
PB1/RE	17.5	NOT APPLICABLE	31.5	1VCD003377	600	1016 (2)	1120	165
PB2/RE	17.5		31.5	1VCD003378	750	1016 (2)	1120	165...215
	17.5		40-50	1VCD003378	750	1016 (2)	1120	165...215
PB3/RE	12-17.5		31.5	1VCD003379	1000	1030 (2)	1120	270
	12-17.5		40-50	1VCD003379	1000	1030 (2)	1120	270
PB4/RE	24		31.5	1VCD003380	750	1310 (2)	1230	215
PB5/RE	24		31.5	1VCD003381	1000	1246 (2)	1230	250

(1) Weight without earthing switch.
(2) Dimension with earthing switch.

PB/M



PR/M



Unit	Rated voltage [kV]	Rated current [A]	Isc Icw [kV]	Table of dimensions	A [mm]	B [mm]	C [mm]	Weight [kg] (1)
PB1/M	12	630 - 1250	31.5	1VCD000023	600	1016	1680	
	17.5	630 - 1250	31.5	1VCD000028	600	1016	1680	200
PB2/M	12	630...2000	31.5	1VCD000024	750	1016	1680	
	12	1250...2000	40-50	1VCD000027	750	1016	1680	
	17.5	630...2000	31.5	1VCD000029	750	1016	1680	220...260
	17.5	1250...2000	40-50	1VCD000030	750	1016	1680	
PB3/M	12-17.5	2500	31.5	1VCD000025	1000	1030	1680	320
	12-17.5	3150	31.5	1VCD000026	1000	1030	1680	344
	12-17.5	3600...4000	31.5	1VCD000043	1000	1030	1680	370...400
	12-17.5	2500	40-50	1VCD000037	1000	1030	1680	320
	12-17.5	3150	40-50	1VCD000038	1000	1030	1680	344
	12-17.5	3600 - 4000	40-50	1VCD000039	1000	1030	1680	370...400
PB4/M	24	630 - 1250	31.5	1VCD000031	750	1310	1745	270
PB5/M	24	1600 - 2000	31.5	1VCD000032	1000	1246	1745	330
	24	2500	31.5	1VCD000044	1000	1246	1745	360

Unit	Rated voltage [kV]	Rated current [A]	Isc Icw [kV]	Table of dimensions	A [mm]	B [mm]	C [mm]	Weight [kg] (1)
PB1/RM	17.5	NOT APPLICABLE	31.5	1VCD000033	600	1016	1745	185
PB2/RM	12		31.5	1VCD000034	750	1016	1745	185...235
	17,5		40-50	1VCD000040	750	1016	1745	185...235
PB3/RM	12-17.5		31.5	1VCD000041	1000	1030	1680	290
	12-17.5		40-50	1VCD000042	1000	1030	1680	290
PB4/RM	24		31.5	1VCD000035	750	1310	1745	270
PB5/RM	24		31.5	1VCD000036	1000	1246	1745	270

(1) Weight without earthing switch and without VT compartment.
(2) Dimension with earthing switch.

5.3. Possibility of combining PowerCube units with ABB apparatus

Table 1 - VD4 withdrawable circuit-breakers for PowerCube type PB units (*)
Rated current of the VD4 circuit-breakers (A - 40 °C)

kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker		PowerCube
12-17.5	16	16	630						VD4/P 12.06.16 p150	VD4/P 17.06.16 p150	PB 1/E PB 1/M
	20	20	630						VD4/P 12.06.20 p150	VD4/P 17.06.20 p150	
	25	25	630						VD4/P 12.06.25 p150	VD4/P 17.06.25 p150	
	31.5	31.5	630						VD4/P 12.06.32 p150	VD4/P 17.06.32 p150	
	16	16	1250						VD4/P 12.12.16 p150	VD4/P 17.12.16 p150	
	20	20	1250						VD4/P 12.12.20 p150	VD4/P 17.12.20 p150	
	25	25	1250						VD4/P 12.12.25 p150	VD4/P 17.12.25 p150	
	31.5	31.5	1250						VD4/P 12.12.32 p150	VD4/P 17.12.32 p150	
	16	16		630					VD4/W 12.06.16 p210	VD4/W 17.06.16 p210	PB 2/E PB 2/M
	20	20		630					VD4/W 12.06.20 p210	VD4/W 17.06.20 p210	
	25	25		630					VD4/W 12.06.25 p210	VD4/W 17.06.25 p210	
	31.5	31.5		630					VD4/W 12.06.32 p210	VD4/W 17.06.32 p210	
	16	16		1250					VD4/W 12.12.16 p210	VD4/W 17.12.16 p210	
	20	20		1250					VD4/W 12.12.20 p210	VD4/W 17.12.20 p210	
	25	25		1250					VD4/W 12.12.25 p210	VD4/W 17.12.25 p210	
	31.5	31.5		1250					VD4/W 12.12.32 p210	VD4/W 17.12.32 p210	
	40	40		1250					–	–	
	50	50		1250					–	–	
	40	40			1250				VD4/P 12.12.40 p210 (3)	VD4/P 17.12.40 p210 (3)	
	50	50			1250				VD4/P 12.12.50 p210 (3)	VD4/P 17.12.50 p210 (3)	
	20	20			1600				VD4/P 12.16.20 p210	VD4/P 17.16.20 p210	
	25	25			1600				VD4/P 12.16.25 p210	VD4/P 17.16.25 p210	
	31.5	31.5			1600				VD4/P 12.16.32 p210	VD4/P 17.16.32 p210	
	40	40			1600				VD4/P 12.16.40 p210 (3)	VD4/P 17.16.40 p210 (3)	
	50	50			1600				VD4/P 12.16.50 p210 (3)	VD4/P 17.16.50 p210 (3)	
	20	20			2000				VD4/P 12.20.20 p210	VD4/P 17.20.20 p210	
	25	25			2000				VD4/P 12.20.25 p210	VD4/P 17.20.25 p210	
	31.5	31.5			2000				VD4/P 12.20.32 p210	VD4/P 17.20.32 p210	
	40	40			2000				VD4/P 12.20.40 p210 (3)	VD4/P 17.20.40 p210 (3)	
	50	50			2000				VD4/P 12.20.50 p210 (3)	VD4/P 17.20.50 p210 (3)	
	20	20				2500			VD4/P 12.25.20 p275	VD4/P 17.25.20 p275	PB 3/E PB 3/M
	25	25				2500			VD4/P 12.25.25 p275	VD4/P 17.25.25 p275	
	31.5	31.5				2500			VD4/P 12.25.32 p275	VD4/P 17.25.32 p275	
	40	40				2500			VD4/P 12.25.40 p275 (3)	VD4/P 17.25.40 p275 (3)	
	50	50				2500			VD4/P 12.25.50 p275 (3)	VD4/P 17.25.50 p275 (3)	
	31.5	31.5				3150			VD4/P 12.32.32 p275 (3)	VD4/P 17.32.32 p275 (3)	
	40	40				3150			VD4/W 12.32.40 p275 (3)	VD4/W 17.32.40 p275 (3)	
	50	50				3150			VD4/P 12.32.50 p275 (3)	VD4/P 17.32.50 p275 (3)	
	31.5	31.5				3600 (1)			VD4/P 12.32.32 p275 (3)	VD4/P 17.32.32 p275 (3)	
	40	40				3600 (1)			VD4/W 12.32.40 p275 (3)	VD4/W 17.32.40 p275 (3)	
	50	50				3600 (1)			VD4/P 12.32.50 p275 (3)	VD4/P 17.32.50 p275 (3)	
	31.5	31.5				4000 (1)			VD4/P 12.32.32 p275 (3)	VD4/P 17.32.32 p275 (3)	
	40	40				4000 (1)			VD4/W 12.32.40 p275 (3)	VD4/W 17.32.40 p275 (3)	
	50	50				4000 (1)			VD4/P 12.32.50 p275 (3)	VD4/P 17.32.50 p275 (3)	

kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker		PowerCube
	16	16					630		VD4/P 24.06.16 p210	–	
	20	20					630		VD4/P 24.06.20 p210	–	
	25	25					630		VD4/P 24.06.25 p210	–	PB 4/E
	16	16					1250		VD4/P 24.12.16 p210	–	PB 4/M
	20	20					1250		VD4/P 24.12.20 p210	–	
	25	25					1250		VD4/P 24.12.25 p210	–	
	16	16						1600	VD4/P 24.16.16 p275	–	
24	20	20						1600	VD4/P 24.16.20 p275	–	
	25	25						1600	VD4/P 24.16.25 p275	–	
	16	16						2000	VD4/P 24.20.16 p275	–	
	20	20						2000	VD4/P 24.20.20 p275	–	PB 5/E
	25	25						2000	VD4/P 24.20.25 p275	–	PB 5/M
	16	16						2500 (2)	VD4/P 24.25.16 p275	–	
	20	20						2500 (2)	VD4/P 24.25.20 p275	–	
	25	25						2500 (2)	VD4/P 24.25.25 p275	–	

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monbloc.
(*) The PowerCube units are not prepared for application of the “motorised truck” for VD4 circuit-breakers
(1) 3600 A with fan pre-installed in the PB3 units. For 4000 A it is necessary to install another fan in the back of the switchgear (by the customer).
(2) 2500 A with fan pre-installed in the PB5 units.
(3) Please ask ABB for availability.

Table 2 - Withdrawable HD4 circuit-breakers for PowerCube type PB units

Rated current of the HD4 circuit-breakers (A - 40 °C)

kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker		PowerCube
12-17.5	16	16	630						HD4/W 12.06.16 p150	HD4/W 17.06.16 p150	PB 1/E PB 1/M
	25	25	630						HD4/W 12.06.25 p150	HD4/W 17.06.25 p150	
	31.5	31.5	630						HD4/W 12.06.32 p150	HD4/W 17.06.32 p150	
	16	16	1250						HD4/W 12.12.16 p150	HD4/W 17.12.16 p150	
	25	25	1250						HD4/W 12.12.25 p150	HD4/W 17.12.25 p150	
	31.5	31.5	1250						HD4/W 12.12.32 p150	HD4/W 17.12.32 p150	
	16	16		630					HD4/W 12.06.16 p210	HD4/W 17.06.16 p210	PB 2/E PB 2/M
	25	25		630					HD4/W 12.06.25 p210	HD4/W 17.06.25 p210	
	31.5	31.5		630					HD4/W 12.06.32 p210	HD4/W 17.06.32 p210	
	16	16		1250					HD4/W 12.12.16 p210	HD4/W 17.12.16 p210	
	25	25		1250					HD4/W 12.12.25 p210	HD4/W 17.12.25 p210	
	31.5	31.5		1250					HD4/W 12.12.32 p210	HD4/W 17.12.32 p210	
	40	40		1250					HD4/W 12.12.40 p210	HD4/W 17.12.40 p210	
	50	50		1250					HD4/W 12.12.50 p210	HD4/W 17.12.50 p210	
	40	40			1250				–	–	
	50	50			1250				–	–	
	16	16			1600				HD4/W 12.16.16 p210	HD4/W 17.16.16 p210	
	25	25			1600				HD4/W 12.16.25 p210	HD4/W 17.16.25 p210	
	31.5	31.5			1600				HD4/W 12.16.32 p210	HD4/W 17.16.32 p210	
	40	40			1600				HD4/P 12.16.40 p210	HD4/P 17.16.40 p210	
	50	50			1600				HD4/P 12.16.50 p210	HD4/P 17.16.50 p210	
	16	16			2000				HD4/W 12.20.16 p210	HD4/W 17.20.16 p210	
	25	25			2000				HD4/W 12.20.25 p210	HD4/W 17.20.25 p210	
	31.5	31.5			2000				HD4/W 12.20.32 p210	HD4/W 17.20.32 p210	
	40	40			2000				HD4/P 12.20.40 p210	HD4/P 17.20.40 p210	
	50	50			2000				HD4/P 12.20.50 p210	HD4/P 17.20.50 p210	
	25	25				2500			HD4/P 12.25.25 p275	HD4/P 17.25.25 p275	PB 3/E PB 3/M
	31.5	31.5				2500			HD4/P 12.25.32 p275	HD4/P 17.25.32 p275	
	40	40				2500			HD4/P 12.25.40 p275	HD4/P 17.25.40 p275	
	50	50				2500			HD4/P 12.25.50 p275	HD4/P 17.25.50 p275	
	31.5	31.5				3150			HD4/W 12.32.32 p275	HD4/W 17.32.32 p275	
	40	40				3150			HD4/W 12.32.40 p275	HD4/W 17.32.40 p275	
	50	50				3150			HD4/W 12.32.50 p275	HD4/W 17.32.50 p275	
	31.5	31.5				3600 (1)			HD4/W 12.32.32 p275	HD4/W 17.32.32 p275	
	40	40				3600 (1)			HD4/W 12.32.40 p275	HD4/W 17.32.40 p275	
	50	50				3600 (1)			HD4/W 12.32.50 p275	HD4/W 17.32.50 p275	
	31.5	31.5				4000 (1)			HD4/W 12.32.32 p275	HD4/W 17.32.32 p275	
	40	40				4000 (1)			HD4/W 12.32.40 p275	HD4/W 17.32.40 p275	
	50	50				4000 (1)			HD4/W 12.32.50 p275	HD4/W 17.32.50 p275	

kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker		PowerCube
	16	16					630		HD4/W 24.06.16 p210	–	
	20	20					630		HD4/W 24.06.20 p210	–	
	25	25					630		HD4/W 24.06.25 p210	–	
	16	16					1250		HD4/W 24.12.16 p210	–	PB 4/E PB 4/M
	20	20					1250		HD4/W 24.12.20 p210	–	
	25	25					1250		HD4/W 24.12.25 p210	–	
	31.5	31.5					1250 (3)		HD4/P 24.12.32 p275	–	
	16	16						1600	HD4/P 24.16.16 p275	–	
	20	20						1600	HD4/P 24.16.20 p275	–	
24	25	25						1600	HD4/P 24.16.25 p275	–	
	31.5	31.5						1600 (3)	HD4/P 24.16.32 p275	–	
	16	16						2000	HD4/P 24.20.16 p275	–	
	20	20						2000	HD4/P 24.20.20 p275	–	PB 5/E PB 5/M
	25	25						2000	HD4/P 24.20.25 p275	–	
	31.5	31.5						2000 (3)	HD4/P 24.20.32 p275	–	
	16	16						2500 (2)	HD4/P 24.25.16 p275	–	
	20	20						2500 (2)	HD4/P 24.25.20 p275	–	
	25	25						2500 (2)	HD4/P 24.25.25 p275	–	
	31.5	31.5						2500 (2)(3)	HD4/P 24.25.32 p275	–	

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monbloc.
(1) 3600 A with fan pre-installed in the PB3 modules. For 4000 A it is necessary to install another fan in the back of the switchgear (by the customer).
(2) 2500 A with fan pre-installed in the PB5 modules.
(3) Please ask ABB for availability. Not available for PB/M.

Table 3 - Withdrawable VM1 circuit-breakers for PowerCube type PB units

Rated current of the VM1 circuit-breakers (A - 40 °C)

kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker		PowerCube
12-17.5	16	16	630						VM1/P 12.06.16 p150	VM1/P 17.06.16 p150	PB 1/E PB 1/M
	20	20	630						VM1/P 12.06.20 p150	VM1/P 17.06.20 p150	
	25	25	630						VM1/P 12.06.25 p150	VM1/P 17.06.25 p150	
	31.5	31.5	630						VM1/P 12.06.32 p150	VM1/P 17.06.32 p150	
	16	16	1250						VM1/P 12.12.16 p150	VM1/P 17.12.16 p150	
	20	20	1250						VM1/P 12.12.20 p150	VM1/P 17.12.20 p150	
	25	25	1250						VM1/P 12.12.25 p150	VM1/P 17.12.25 p150	
	31.5	31.5	1250						VM1/P 12.12.32 p150	VM1/P 17.12.32 p150	
	16	16		630					VM1/W 12.06.16 p210	VM1/W 17.06.16 p210	PB 2/E PB 2/M
	20	20		630					VM1/W 12.06.20 p210	VM1/W 17.06.20 p210	
	25	25		630					VM1/W 12.06.25 p210	VM1/W 17.06.25 p210	
	31.5	31.5		630					VM1/W 12.06.32 p210	VM1/W 17.06.32 p210	
	16	16		1250					VM1/W 12.12.16 p210	VM1/W 17.12.16 p210	
	20	20		1250					VM1/W 12.12.20 p210	VM1/W 17.12.20 p210	
	25	25		1250					VM1/W 12.12.25 p210	VM1/W 17.12.25 p210	
	31.5	31.5		1250					VM1/W 12.12.32 p210	VM1/W 17.12.32 p210	
	40	40		1250					–	–	
	50	50		1250					–	–	
	40	40			1250				–	–	
	50	50			1250				–	–	
	20	20			1600				VM1/P 12.16.20 p210	VM1/P 17.16.20 p210	
	25	25			1600				VM1/P 12.16.25 p210	VM1/P 17.16.25 p210	
	31.5	31.5			1600				VM1/P 12.16.32 p210	VM1/P 17.16.32 p210	
	40	40			1600				–	–	
	50	50			1600				–	–	
	20	20			2000				VM1/P 12.20.20 p210	VM1/P 17.20.20 p210	
	25	25			2000				VM1/P 12.20.25 p210	VM1/P 17.20.25 p210	
	31.5	31.5			2000				VM1/P 12.20.32 p210	VM1/P 17.20.32 p210	
	40	40			2000				–	–	
	50	50			2000				–	–	
	20	20				2500			VM1/P 12.25.20 p275	VM1/P 17.25.20 p275	PB 3/E PB 3/M
	25	25				2500			VM1/P 12.25.25 p275	VM1/P 17.25.25 p275	
	31.5	31.5				2500			VM1/P 12.25.32 p275	VM1/P 17.25.32 p275	
	40	40				2500			–	–	
	50	50				2500			–	–	
	31.5	31.5				3150			–	–	
	40	40				3150			–	–	
	50	50				3150			–	–	
	31.5	31.5				3600 (1)			–	–	
	40	40				3600 (1)			–	–	
	50	50				3600 (1)			–	–	
	31.5	31.5				4000 (1)			–	–	
	40	40				4000 (1)			–	–	
	50	50				4000 (1)			–	–	

kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker		PowerCube
	16	16					630		VM1/P 24.06.16 p210	–	
	20	20					630		VM1/P 24.06.20 p210	–	
	25	25					630		VM1/P 24.06.25 p210	–	PB 4/E
	16	16					1250		VM1/P 24.12.16 p210	–	PB 4/M
	20	20					1250		VM1/P 24.12.20 p210	–	
	25	25					1250		VM1/P 24.12.25 p210	–	
	16	16						1600	VM1/P 24.16.16 p275	–	
24	20	20						1600	VM1/P 24.16.20 p275	–	
	25	25						1600	VM1/P 24.16.25 p275	–	
	16	16						2000	VM1/P 24.20.16 p275	–	
	20	20						2000	VM1/P 24.20.20 p275	–	PB 5/E
	25	25						2000	VM1/P 24.20.25 p275	–	PB 5/M
	16	16						2500 (2)	VM1/P 24.25.16 p275 (3)	–	
	20	20						2500 (2)	VM1/P 24.25.20 p275 (3)	–	
	25	25						2500 (2)	VM1/P 24.25.25 p275 (3)	–	

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monbloc.
(1) 3600 A with fan pre-installed in the PB3 units. For 4000 A it is necessary to install another fan in the back of the switchgear (by the customer).
(2) 2500 A with fan pre-installed in the PB5 units.
(3) Please ask ABB for availability.

Table 4 - Withdrawable eVM1 circuit-breakers for PowerCube type PB units

			Rated current of the eVM1 circuit-breakers inserted in the PowerCube units (40°C) [A]						Withdrawable eVM1 for PowerCube unit		
kV	Isc [kA] 3s	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker type	Circuit-breaker type	PowerCube
7.2	16	16	630						eVM1/P 12.06.16 p150	eVM1/P 17.06.16 p150	PB1/E PB1/M
	20	20	630						eVM1/P 12.06.20 p150	eVM1/P 17.06.20 p150	
	25	25	630						eVM1/P 12.06.25 p150	eVM1/P 17.06.25 p150	
	31.5	31.5	630						eVM1/P 12.06.32 p150	eVM1/P 17.06.32 p150	
12	16	16	1250						eVM1/P 12.12.16 p150	eVM1/P 17.12.16 p150	
	20	20	1250						eVM1/P 12.12.20 p150	eVM1/P 17.12.20 p150	
	25	25	1250						eVM1/P 12.12.25 p150	eVM1/P 17.12.25 p150	
	31.5	31.5	1250						eVM1/P 12.12.32 p150	eVM1/P 17.12.32 p150	

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monobloc.
* Please contact us for availability.

Table 5 - Withdrawable Vmax circuit-breakers for PowerCube type PB units

			Rated current of the circuit-breakers Vmax inserted in the PowerCube units (40°C) [A]						Withdrawable Vmax for PowerCube units		
kV	Isc [kA] 3s	Icw [kA]	W=600 p=150 ul=205 H=260 ø=35	W=750 p=210 ul=310 H=280 ø=35	W=750 p=210 ul=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 ul=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Circuit-breaker type	Circuit-breaker type	PowerCube
7.2	16	16	630						Vmax/W 12.06.16 p150	Vmax/W 17.06.16 p150 *	PB1/E PB1/M
	20	20	630						Vmax/W 12.06.20 p150	Vmax/W 17.06.20 p150 *	
	25	25	630						Vmax/W 12.06.25 p150	Vmax/W 17.06.25 p150 *	
	31.5	31.5	630						Vmax/W 12.06.32 p150	Vmax/W 17.06.32 p150 *	
12	16	16	1250						Vmax/W 12.12.16 p150	Vmax/W 17.12.16 p150 *	
	20	20	1250						Vmax/W 12.12.20 p150	Vmax/W 17.12.20 p150 *	
	25	25	1250						Vmax/W 12.12.25 p150	Vmax/W 17.12.25 p150 *	
	31.5	31.5	1250						Vmax/W 12.12.32 p150	Vmax/W 17.12.32 p150 *	

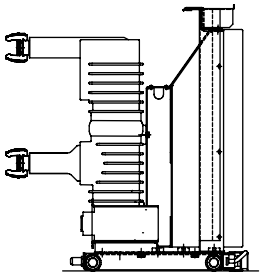
W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monobloc.
* Please contact us for availability.

Table 6 - V-Contact withdrawable contactors for PowerCube type PB units

			Rated current of the V-Contact contactors (A - 40 °C)							
kV	Isc [kA] (3)	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Contactor	PowerCube
7.2	16	6	400 (4)						V7/W VSC7/P	PB 1/E PB 1/M
	20	6	400 (4)							
	25	6	400 (4)							
	31.5	6	400 (4)							
12	16	6	400 (4)						V12/W VSC12/P	
	20	6	400 (4)							
	25	6	400 (4)							
	31.5	6	400 (4)							

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monobloc.
(1) 3600 A with fan pre-installed in the PB3 modules. For 4000 A it is necessary to install another fan in the back of the switchgear (by the customer).
(2) 2500 A with fan pre-installed in the PB5 modules.
(3) Guaranteed using suitable fuses.
(4) The rated current is subject to derating according to the rated current of the fuses.

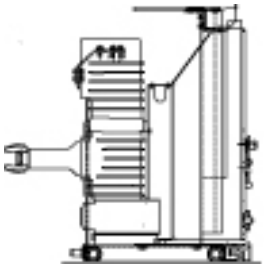
Table 7 – Isolating trucks for PowerCube type PB units



kV	Isc [kA]	Icw [kA]	Rated current of the isolating trucks (A - 40 °C) W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Isolating truck	PowerCube
12-17.5	16	16	...1250						S-HD4/W 17.12.32 p150	PB 1/E PB 1/M
	20	20								
	25	25								
	31.5	31.5								
	16	16		...1250					S-HD4/W 17.12.32 p210	PB 2/E PB 2/M
	20	20								
	25	25								
	31.5	31.5								
	40	40							S-HD4/W 17.12.50 p210	
	50	50								
	16	16			...2000				S-HD4/W 17.20.32 p210	
	20	20								
	25	25								
	31.5	31.5								
	40	40							S-HD4/P 17.20.50 p210	
	50	50								
	16	16				...2500			S-HD4/P 17.25.50 p275	PB 3/E PB 3/M
	20	20								
	25	25								
	31.5	31.5								
	40	40								
	50	50								
	16	16				...3150			S-HD4/P 17.32.50 p275	
	20	20								
	25	25								
	31.5	31.5								
	40	40								
	50	50								
	31.5	31.5				...3600 (1)			S-HD4/P 17.32.50 p275	
	40	40				...3600 (1)				
	50	50								
	31.5	31.5				...4000 (1)			S-HD4/P 17.32.50 p275	
	40	40				...4000 (1)				
	50	50								
24	16	16					...1250		S-HD4/W 24.12.25 p210	PB 4/E PB 4/M
	20	20								
	25	25								
	16	16						...2000	S-HD4/P 24.20.25 p275	PB 5/E PB 5/M
	20	20								
	25	25								
	16	16						...2500 (2)	S-HD4/P 24.25.25 p275	
	20	20								
	25	25								

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monobloc.
(1) 3600 A with fan pre-installed in the PB3 modules. For 4000 A it is necessary to install another fan in the back of the switchgear (by the customer).
(2) 2500 A with fan pre-installed in the PB5 modules.
(3) Guaranteed using suitable fuses.
(4) The rated current is subject to derating according to the rated current of the fuses.

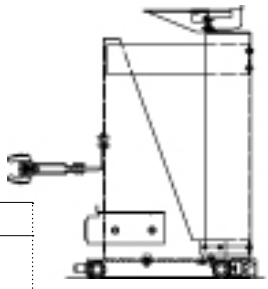
Table 8 – Earthing trucks with making capacity for PowerCube type PB units



kV	Isc [kA]	Icw [kA]	Rated current of the earthing trucks (A - 40 °C) W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Earthing truck (1)	PowerCube
12-17.5	16	16	...1250							
	20	20							EM-U/W 17.12.32 p150	PB 1/E PB 1/M
	25	25							EM-L/W 17.12.32 p150	
	31.5	31.5								
	16	16		...1250						
	20	20							EM-L/W 17.12.32 p210	
	25	25							EM-U/W 17.12.32 p210	
	31.5	31.5								
	40	40							EM-L/W 17.12.50 p210 (2)	
	50	50							EM-U/W 17.12.50 p210 (2)	PB 2/E PB 2/M
	16	16			...2000					
	20	20							EM-L/W 17.20.32 p210	
	25	25							EM-U/W 17.20.32 p210	
	31.5	31.5								
	40	40							EM-L/P 17.20.50 p210	
	50	50							EM-U/P 17.20.50 p210	
	16	16				...2500				
	20	20								
	25	25							EM-L/P 17.25.50 p275	
	31.5	31.5							EM-U/P 17.25.50 p275	
	40	40								
	50	50								PB 3/E PB 3/M
	16	16				3150				
	20	20								
	25	25							EM-L/P 17.32.50 p275	
	31.5	31.5							EM-U/P 17.32.50 p275	
	40	40								
	50	50								
24	16	16					...1250		EM-L/W 24.12.25 p210	
	20	20							EM-U/W 24.12.25 p210	PB 4/E PB 4/M
	25	25								
	16	16						...2000	EM-L/P 24.20.25 p275	
	20	20							EM-U/P 24.20.25 p275	
	25	25							EM-L/P 24.25.25 p275	
	16	16						...2500 (2)	EM-U/P 24.25.25 p275	PB 5/E
	20	20								
	25	25								

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube type PB unit monobloc.
(1) - EM-L... = Earthing truck with making capacity with bottom bushings (for cable earthing).
- EM-U... = Earthing truck with making capacity with top bushings (for earthing the busbar system).
(2) Ask ABB.

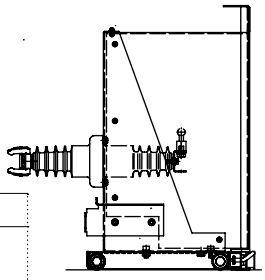
Table 9 - Earthing trucks without making capacity for PowerCube type PB units



			Rated current of the earthing trucks (A - 40 °C)							PowerCube
kV	Isc [kA]	Icw [kA]	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Earthing truck [1]	
12-17.5	16	16	...1250							PB 1/E PB 1/M
	20	20							E-U/W 17.12.32 p150	
	25	25							E-L/W 17.12.32 p150	
	31.5	31.5								
	16	16		...1250						PB 2/E PB 2/M
	20	20							E-L/W 17.12.32 p210	
	25	25							E-U/W 17.12.32 p210	
	31.5	31.5								
	40	40							E-L/W 17.12.50 p210 (2)	
	50	50							E-U/W 17.12.50 p210 (2)	
	16	16			...2000					
	20	20							E-L/W 17.20.32 p210	
	25	25							E-U/W 17.20.32 p210	
	31.5	31.5								
	40	40							E-L/P 17.20.50 p210	
	50	50							E-U/P 17.20.50 p210	
	16	16				...2500				PB 3/E PB 3/M
	20	20								
	25	25							E-L/P 17.25.50 p275	
	31.5	31.5							E-U/P 17.25.50 p275	
	40	40								
	50	50								
	16	16				...3150				
	20	20								
	25	25							E-L/P 17.32.50 p275	
	31.5	31.5							E-U/P 17.32.50 p275	
	40	40								
	50	50								
24	16	16					...1250		E-L/W 24.12.25 p210	PB 4/E PB 4/M
	20	20							E-U/W 24.12.25 p210	
	25	25								
	16	16						...2000	E-L/P 24.20.25 p275	PB 5/E PB 5/M
	20	20							E-U/P 24.20.25 p275	
	25	25								
	16	16						...2500	E-L/P 24.25.25 p275	
	20	20							E-U/P 24.25.25 p275	
	25	25								

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth.
Ø = Diameter of the contacts in the PowerCube unit monobloc.
(1) - EM-L... = Earthing truck without making capacity with bottom bushings (for cable earthing).
- EM-U... = Earthing truck without making capacity with top bushings (for earthing the busbar system).
(2) Ask ABB..

Table 10 – Cable testing trucks for PowerCube type PB units



			Rated current of the cable testing trucks (A - 40 °C)							PowerCube
kV	Isc [kA]	Icw (kAx3s)	W=600 p=150 u/l=205 H=260 ø=35	W=750 p=210 u/l=310 H=280 ø=35	W=750 p=210 u/l=310 H=280 ø=79	W=1000 p=275 u/l=310 H=280 ø=109	W=750 p=210 u/l=310 H=325 ø=35	W=1000 p=275 u/l=310 H=345 ø=79	Cable testing truck	
12-17.5	16	16	...1250						T/W 17.12 p150	PB 1/E PB 1/M
	20	20								
	25	25								
	31.5	31.5								
	16	16		...1250					T/W 17.12 p210	PB 2/E PB 2/M
	20	20								
	25	25								
	31.5	31.5								
	40	40							T/W 17.12 p210 (1)	
	50	50								
	16	16			...2000				T/P 17.20 p210	
	20	20								
	25	25								
	31.5	31.5								
	40	40							T/P 17.20 p210	
	50	50								
	16	16				2500			T/P 17.32 p275	PB 3/E PB 3/M
	20	20								
	25	25								
	31.5	31.5								
	40	40								
	50	50								
	16	16				3150				
	20	20								
	25	25								
	31.5	31.5								
	40	40								
	50	50								
24	16	16					...1250		T/W 24.12 p210	PB 4/E PB 4/M
	20	20								
	25	25								
	16	16						...2000	T/W 24.20 p275	PB 5/E PB 5/M
	20	20								
	25	25								
	16	16						...2500 (1)	T/P 24.25 p275	
	20	20								
	25	25								

W = Width of PowerCube unit.
P = Horizontal centre distance between circuit-breaker poles.
U/L = Distance between top and bottom terminal.
H = Distance between bottom terminal and earth
Ø = Diameter of the contacts in the PowerCube unit monobloc.
(1) Ask ABB.

Table 11 - PowerCube type PB units without apparatus

Enclosure characteristics				Configuration				
Rated voltage [kV]	Width (mm)	Rated current (A)	Isc [kA] (1)	Icw (kA x 3s/1s) (1)	Bus riser or direct incoming feeder with earthing switch	Bus riser or direct incoming feeder	Measuring (2)	Measuring (2)
12-17.5	600	1250	31.5	31.5	PB1/RE - PB1/RM	PB1/RE - PB1/RM	PB1/RE - PB1/RM	PB1/RE - PB1/RM
	750	2000	31.5	31.5	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM
	750	2000	40-50	40-50	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM
	1000	4000	31.5	31.5	PB3/RE - PB3/RM	PB3/RE - PB3/RM	PB3/RE - PB3/RM	PB3/RE - PB3/RM
	1000	4000	40-50	40-50	PB3/RE - PB3/RM	PB3/RE - PB3/RM	PB3/RE - PB3/RM	PB3/RE - PB3/RM
24	750	1250	25	25	PB4/RE - PB4/RM	PB4/RE - PB4/RM	PB4/RE - PB4/RM	PB4/RE - PB4/RM
	1000	2500	25	25	PB5/RE - PB5/RM	PB5/RE - PB5/RM	PB5/RE - PB5/RM	PB5/RE - PB5/RM

(1) On earthing switch, if provided.
(2) For units PB/RE end for PB1/RM, the VT compartment is not available. Construction at customer care.

5.4. Main components

5.4.1. Switchgear

PowerCube units can be equipped with the following switchgear:
– HD4 series SF6 circuit-breaker;
– VD4 and VM1 series vacuum circuit-breaker;
– V-Contact series vacuum contactor;
– operational trucks.
The apparatus is always the withdrawable version, mounted on a truck that allows the following positions in relation to the compartment:

CONNECTED: – main and auxiliary circuits connected;
ISOLATED: – partially isolated with main circuits disconnected and auxiliary circuits (plug connector connected);
– totally isolated with main and auxiliary circuits disconnected, (plug connector withdrawn);
WITHDRAWN: – main and auxiliary circuits disconnected and apparatus racked out of the switchboard.

In the connected and isolated positions the apparatus remains in the unit with the door closed is visible through switchboard inspection window.
The apparatus is equipped with special locks, located on the front crosspiece which allow their hooking into the corresponding slots of the unit. The front hooking crosspiece also allows the connecting/isolating operation, with the door closed, by means of the special operating lever.
A lock prevents truck insertion into the switchboard (for example when the earthing switch is closed).
If the truck is in the indefinite position (between connected and isolated), the lock prevents both mechanical and electrical circuit-breaker closing.
The truck is equipped with a locking magnet which, if deenergised, prevents its operation.
The connector (plug) for connection of the operating mechanism electrical accessories comes out of the front protection of the apparatus.
The strikers for actuating the contacts (connected/isolated) located in the switchboard are fixed in the upper part of the apparatus.
The slides for activating the segregation shutters of the medium voltage contacts are placed on the sides of the apparatus.
Please refer to the relative instruction booklet for further details.

5.4.2. Earthing switch

The earthing switch (1) (fig. 8) with making capacity is placed in the rear part whereas the front houses the operating mechanism (2).
The switch position is indicated in the flange of the operating seat (2).

The certain position of the earthing switch is indicated by the graphic symbols at the operating seat (2). The position of the earthing switch is indicated by the yellow arrow made directly on the operating shaft (5).
For enclosures up to 17 kV and rated current up to 3150 A, or enclosures of 24 kV and rated currents up to 2000 A, the position of the earthing switch can be checked either by means of the indicator (3), located inside the enclosure and visible through the inspection window (4) positioned on the bottom front part of the unit.

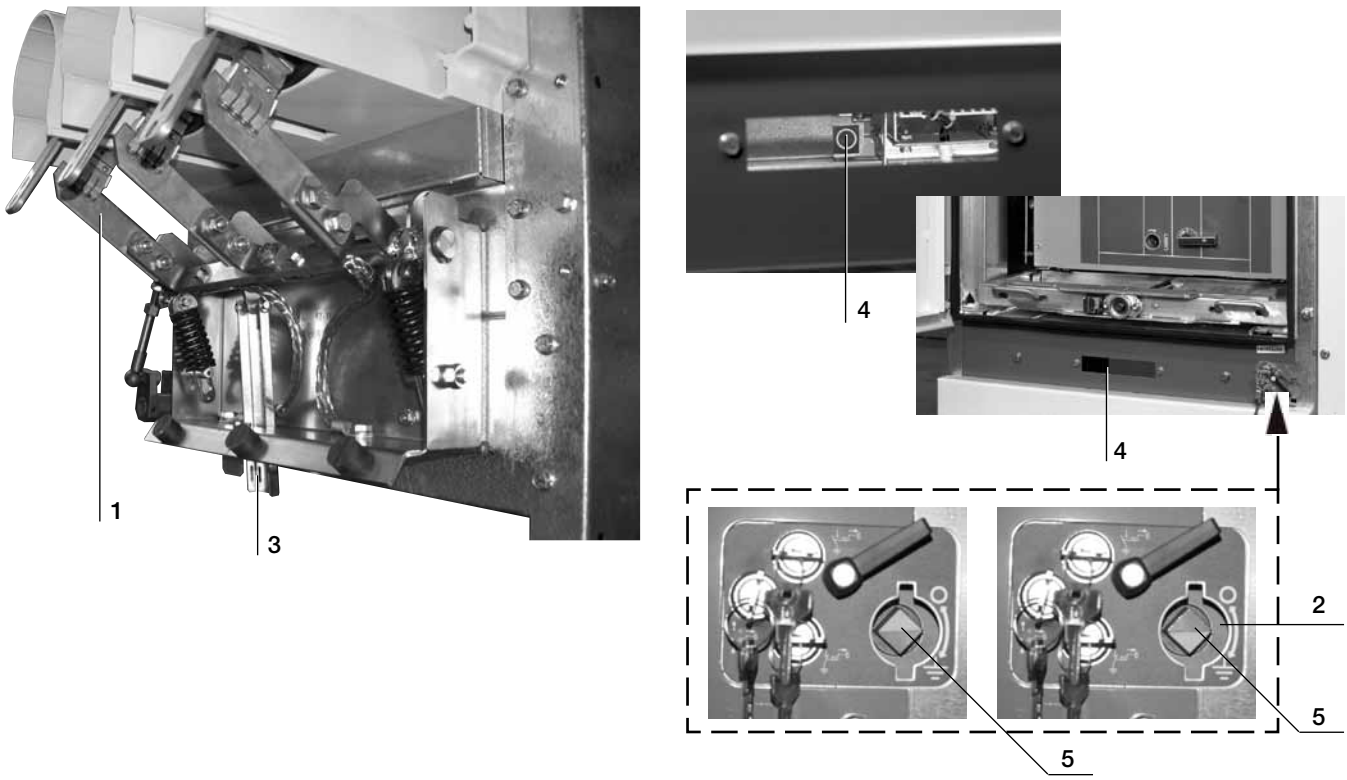


Fig. 8

5.4.3. Module units

5.4.3.1. Circuit-breaker and/or contactor unit

The parallelepiped metal structure is fitted with a front door and operating and control mechanisms on the external front side (fig. 9).
The apparatus must only be isolated and connected with the door closed.
The earthing switch control panel on the lower front part is fitted with:
– the earthing switch operating mechanism seat (10);
– the actuator (9) for operating the shutter (11) of the earthing switch operating mechanism seat;
– key lock with earthing switch open (8);
– key lock with earthing switch closed (12);
– key lock for preventing apparatus racking in (7).
The voltage indicator lamps (4) are mounted in the upper part of the unit (for PB/M only).
The door is fitted with:
– an opening-closing handle (5);
– an inspection window to see the apparatus position (3);
– a coupling (2) for the removable lever for apparatus racking in/ out with the door closed;
– screw for emergency unlock of the door lock (6).

The compartment houses the following components:
– truck guides (15);
– segregating shutters (18) of the fixed isolating contacts inside the monoblocks and the shutter operating mechanisms (16);
– socket for the mobile connector (22);
– mechanical lock (23) for preventing racking out of the auxiliary circuit connector when the circuit-breaker is connected;
– microswitch kinematics (21) for signalling circuit-breaker connected position;
– microswitch kinematics (24) for signalling the apparatus isolated position;
– mechanical lock for preventing either circuit-breaker racking in when the earthing switch is closed or earthing switch closing if the circuit-breaker is connected (27);
– on request, anti-condensation heater (25);
– on request, key lock for the earthing truck fitted with upper bushings (19);
– on request, earthing truck fitted with lower bushings (20);
– lock for preventing insertion of apparatus of different size than foreseen for the compartment (22).
The insulating monoblocks (14) for the power connections are on the rear of the compartment.

5.4.3.2. Feeder unit (PB/M-PB/RM units)

The feeder unit contains the earthing switch and relative auxiliary contacts. It allows access to the cable area working from the front.
The live components can be segregated by means of (fig. 10) earthing switch interlock (22) - in this case the door can only be opened when the earthing switch is closed.

Before accessing the cable terminals, make sure that the earthing switch position indicators (3) fig. 8, visible through the inspection window (4) and (5) fig. 8, visible from the operating seat of the earthing switch, confirm that closing has taken place.

5.4.3.3. VT unit and withdrawable truck (PB/M-PB/RM units)

The voltage transformer unit (fig. 11) consists of an enclosure (fig. 11d) where a withdrawable truck is inserted (fig. 11f), with the transformers on board (53) (fig. 11f) and the relative protection fuses.

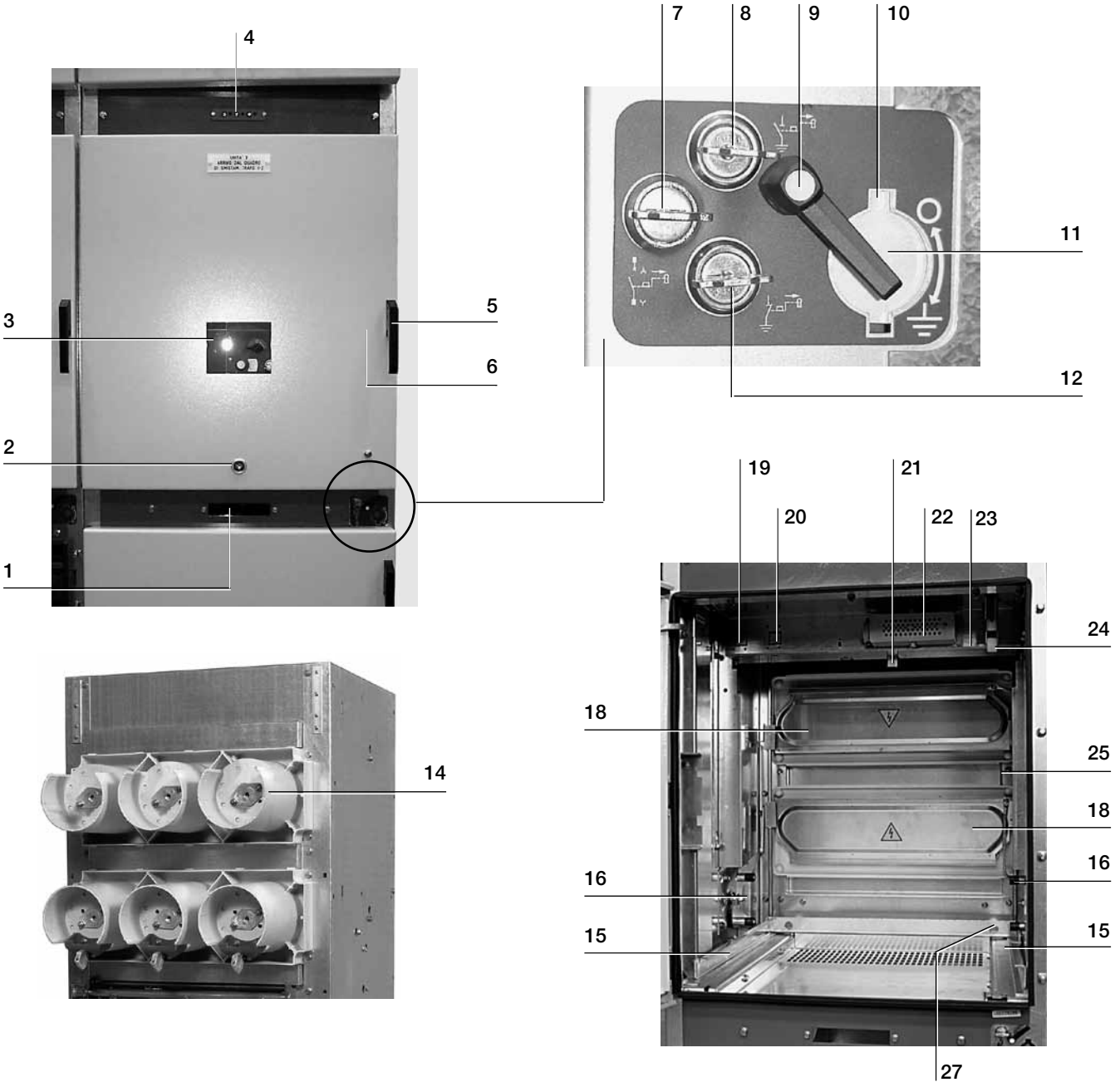


Fig. 9

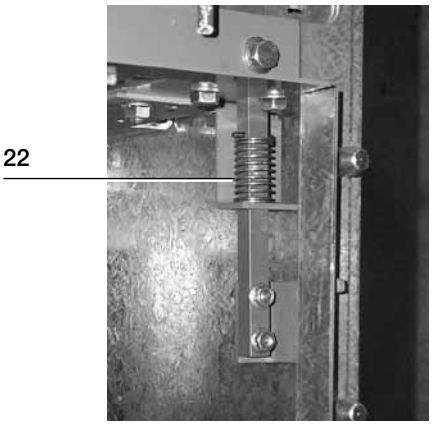


Fig. 10

The withdrawable truck (fig. 11f) can be fully withdrawn from the unit and allows safe fuse replacement.
A special metallic shutter (57) (fig. 11b) prevents contact with the medium voltage terminals when the truck is withdrawn.
The main measurement compartment features are:
– VTs mounted on a withdrawable truck inside the unit
– isolation of the VTs and relative fuses is by means of an operating handle outside the compartment;
– when the VTs are isolated the VT auxiliary circuits are also isolated automatically;
– travel of the VT truck automatically operates the metallic shutter;
– the fuses can be replaced opening the door, after VT isolation and its withdrawal from the compartment;
– the VTs can be replaced only after the truck is withdrawn from the compartment;
– on request, electrical signalling of VT inserted and withdrawn can be supplied.

The VT truck can take up the following positions:

INSERTED:	VT main and auxiliary circuits connected;
ISOLATED:	VT main and auxiliary circuits disconnected. The VT truck remains inside the compartment.
WITHDRAWN:	VT main and auxiliary circuits disconnected: VT truck withdrawn.

The voltage transformers insulated in resin for supplying power to instruments and protection devices, have the performances and precision classes normally provided by instrument transformer manufacturers. VT auxiliary circuits are connected by means of sliding contacts (58) (fig. 11c).
The cable area of wall-standing switchboards can be accessed by withdrawing the whole measurement compartment.

The following components are mounted in the VT compartment:

VT Compartment:

– door (41) (fig. 11a);
– operation sequence plate (42) (fig. 11a);
– operating seat of lever for VT truck racking in/out (43) (fig. 11a);
– truck guides (55) (fig. 11b);
– metallic shutter (57) (fig. 11b) for segregating the isolating contacts inside the monoblocks and segregation actuating kinematics (56) (fig. 11b);
– sliding contacts of the VT auxiliary circuits (58) (fig. 11c);
– contacts for signalling VT truck inserted (60) (fig. 11c);
– contacts for signalling VT truck isolated (61) (fig. 11c).

VT truck:

– actuator of the door closing bolt (45) (fig. 11d);
– operating seat of the racking in/out lever (46) (fig. 11d);
– pin for unlocking the door closing bolt (47) (fig. 11d);
– door closing screws (48) (fig. 11d);
– door locking bolt (50) (fig. 11e);
– pin plate for releasing the door closing bolt (49) (fig. 11e);
– voltage transformers (VTs) (53) (fig. 11f);
– left and right supplementary guides (52) (fig. 11f).

VT compartment

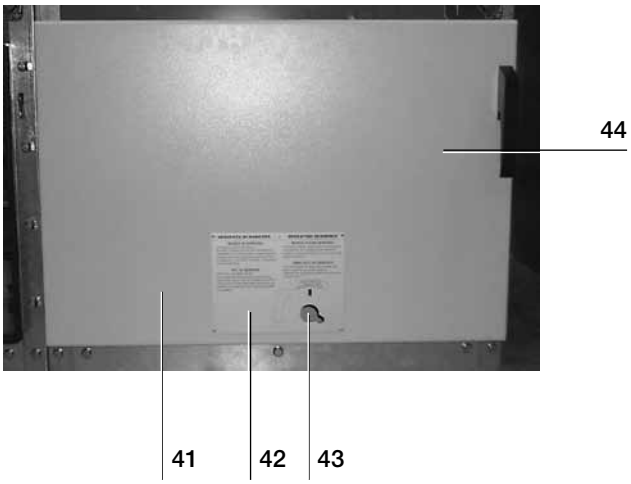


Fig. 11a

VT compartment (internal view)

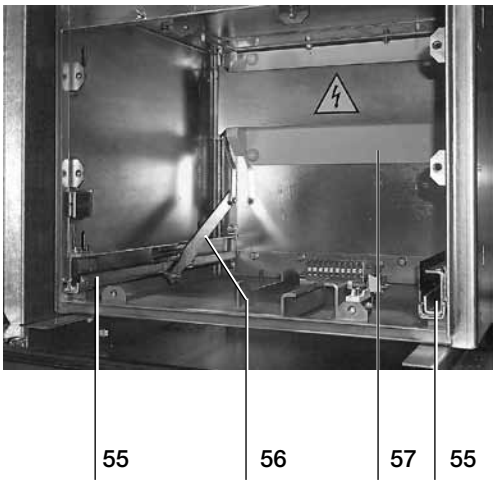


Fig. 11b

VT compartment (internal view)

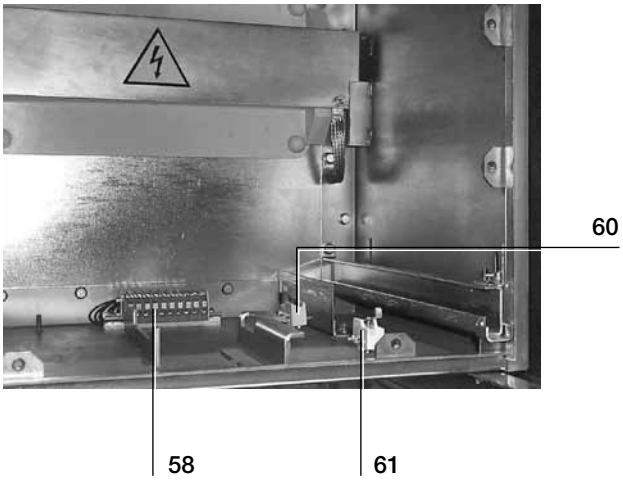


Fig.11c

VT truck

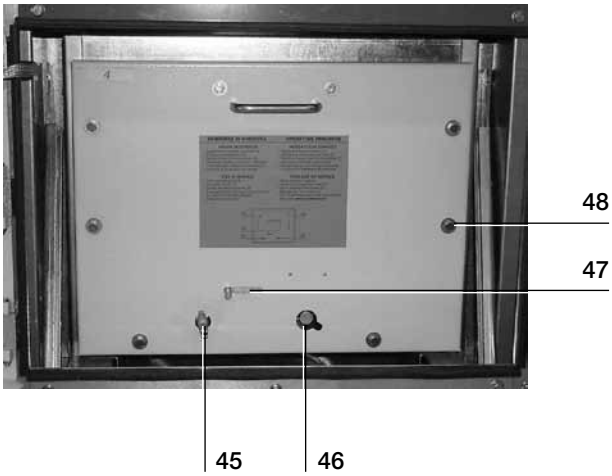


Fig. 11d

VT truck door

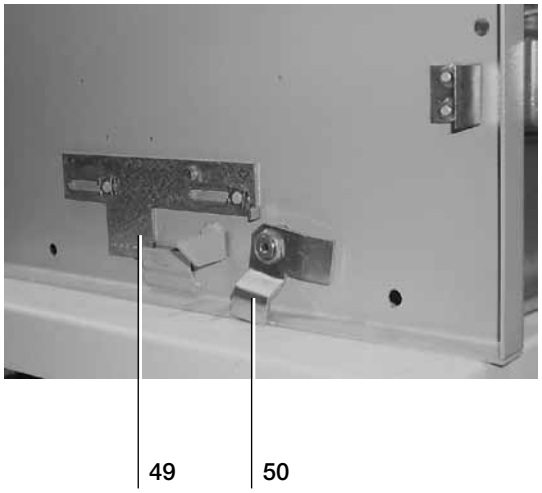


Fig.11e

VT truck

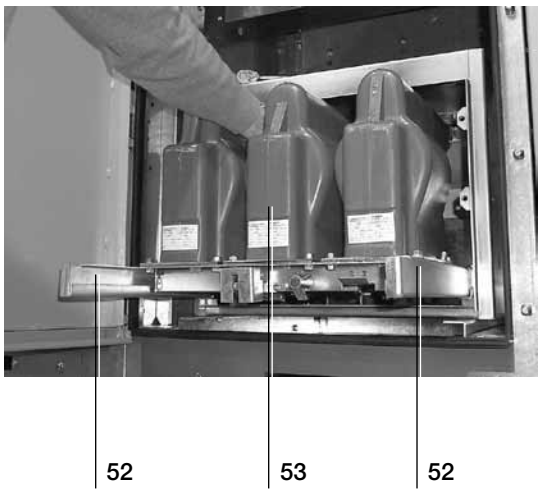


Fig. 11f

5.4.3.4. Voltage indicator and phase concordance device

- **Just indication of the device is not sufficient to prove that the system is out of service.**
- **Before accessing the indicator connections, make sure that the relative line is disconnected and the cables earthed.**

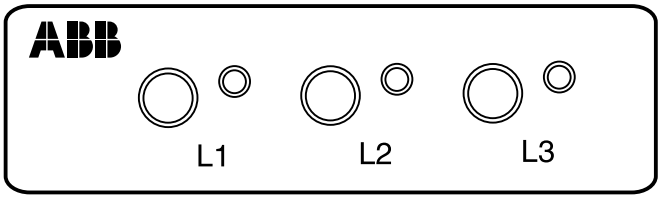
Voltage indicator

The voltage indicator (fig. 12) consists of capacitive dividers made of capacitors incorporated in insulators or in the CTs. They are connected to a device containing the signalling lamps and the bushings for checking phase concordance. The presence of voltage is indicated by the lamps either flashing or lit continuously.

Phase concordance checking device (on request)

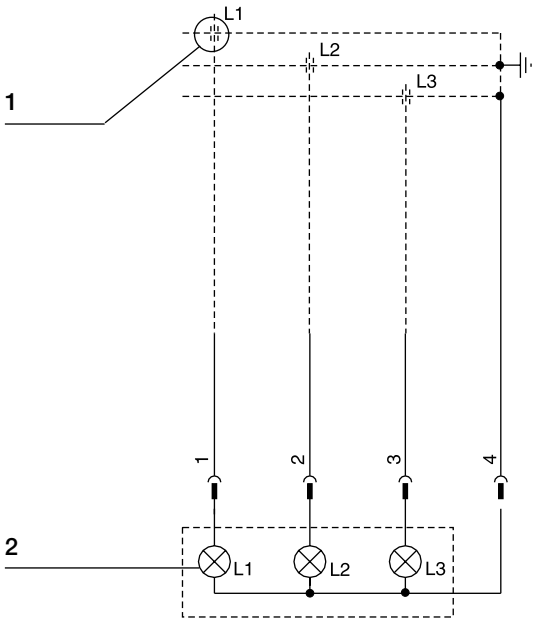
The device consists of electronic apparatus with which phase concordance can be checked using the voltage indicator. The instructions are included in the kit.

Voltage indicator



Phase concordance checking device

Electrical diagram



Caption

1 Capacitive socket shunted either from the insulator or from the current transformers with capacitive socket.

2 Voltage indicator lamps.

Fig. 12

5.5. Interlocks/locks

- **The operations must be carried out using normal operating force (not more than 200 N) only using the special levers.**
  Should the operations be prevented, do not force the mechanical interlocks and check that the operations are correct.
- **The locks can be activated with a maximum force of 400 N, using the special operating tools.**

The locks used in the PowerCube units are mechanical and electrical with microswitches for circuit continuity or interruption.
The mechanical locks are divided into:
– force locks;
– prevention locks;
– electromechanical locks;
– safety locks (padlocks/keys).
PowerCube modules can be equipped with the locks shown in the following table.

Lock description	Apparatus (1)	Apparatus compartment	Feeder compartment PB/M-PB/RM	compartment PB/M-PB/RM
Electric lock to prevent apparatus closing when the truck is not in the connected/isolated position.	■ (fig. 13r - det. 44)			
Mechanical lock to prevent apparatus racking in/out in the closed position.	■			
Mechanical lock which prevents closing the apparatus when the truck is not in the racked-in and isolated positions.	■ (not available for VM1 and eVM1)			
Lock to prevent racking-in apparatus in an enclosure preset for another type or size of apparatus. The lock is located in the connector.	■ (fig. 13a - det. 4)	■ (fig. 13a - det. 4)		
Locking electromagnet on the apparatus truck to prevent racking-in/out without power.	■ (fig. 13r - det. 43)			
Electromechanical lock to prevent door opening if the apparatus is not in the isolated position.		☐ (fig. 13c - det. 8)		
Mechanical lock to prevent apparatus racking-in with the door open.	☐ (fig. 13q - det. 17)	☐ (fig. 13d - det. 17)		■ (fig. 13m - det. 61)
Mechanical interlock with earthing switch: – the apparatus cannot be inserted when the earthing switch is closed; – the earthing switch cannot be closed when the apparatus is inserted or in the intermediate positions between connected and isolated.	■ (fig. 13n - det. 12) (fig. 13r - det. 12) ■ (fig. 13n - det. 60)	■ (fig. 13b - det. 12) ■ (fig. 13b - det. 12)		
Mechanical lock to prevent the manual opening of the shutters when the apparatus is withdrawn. (Fail-Safe).	☐ (fig. 13n - det. 3) (fig. 13o - det. 3)	☐ (fig. 13b - det. 3)		■ (fig. 11b - det. 56)
Key lock to prevent apparatus insertion. Only when the apparatus is in the isolated position can the lock be operated and the key released thus preventing apparatus insertion.	☐ (fig.13n - det. 12) (fig. 13r - det. 12)	☐ (fig. 13e - det. 35)		
Key lock with open earthing switch. It can only be operated when the earthing switch is open. The key can only be withdrawn with the lock activated.		☐ (fig. 13e - det. 33)		
Key lock with closed earthing switch. It can only be operated when the apparatus is isolated and the earthing switch is closed. The key can only be removed with the lock activated.		☐ (fig. 13e - det. 34)		
Padlock on the shutters in the closed position.		☐ (fig. 13g - det. 52)		
Key lock to prevent placing the earthing truck in the switchboard.		☐ (fig. 13a - det. 19)		
Mechanical lock to prevent the racking out of the auxiliarycircuit connector when the apparatus is connected and during apparatus racking in/out.		■ (fig. 13a - det. 20)		
Padlock for the door handles.		☐ (fig. 13h)		
Earthing switch electromechanical lock to prevent earthing switch opening and closing once the coil (BED) is deenergised.		☐ (fig. 13i - det. 53)		
Door lock with earthing switch open.			■ (fig. 13f - det. 22)	
Padlock lock to prevent manual apparatus closing.	☐ (fig. 13s)			

(1) HD4, VD4, V-Contact.
■ Standard
☐ On request

5.5.1. Locks in the apparatus compartment (circuit-breaker, contactor, VT compartment)

Positions of the locks with reference to the figures.

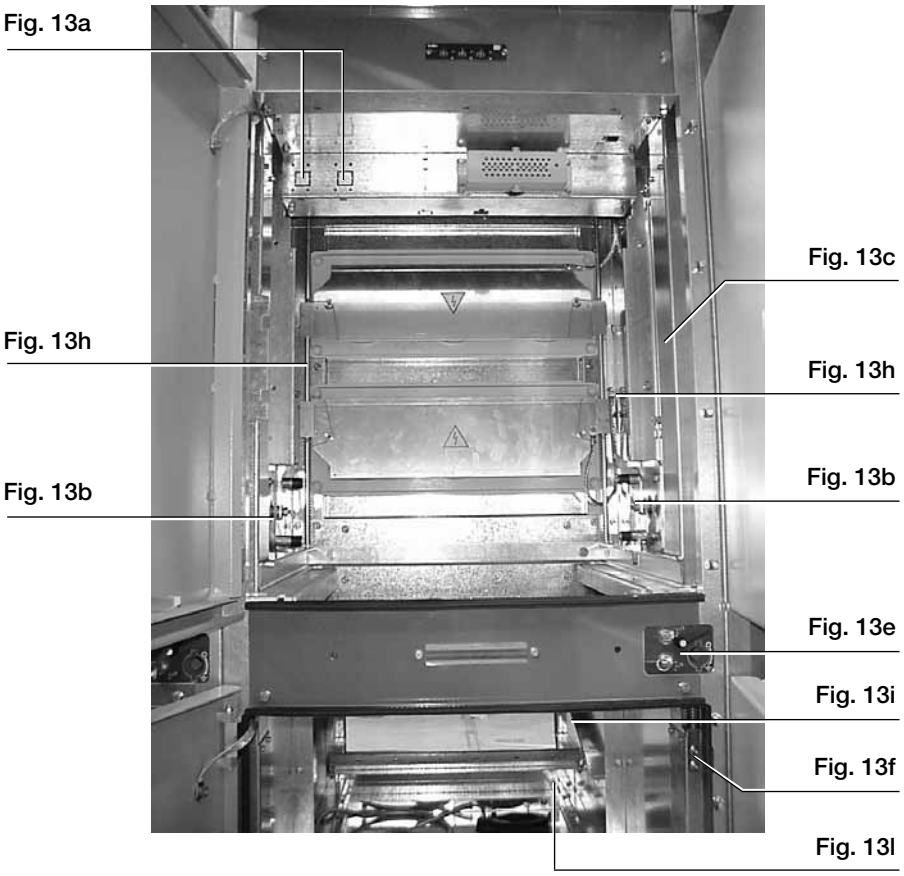


Fig. 13

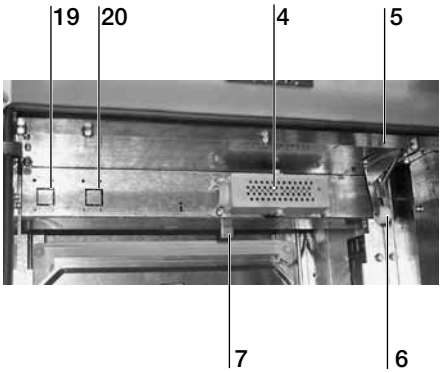


Fig. 13a

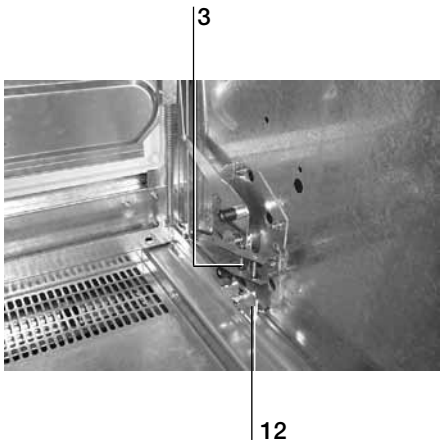


Fig. 13b

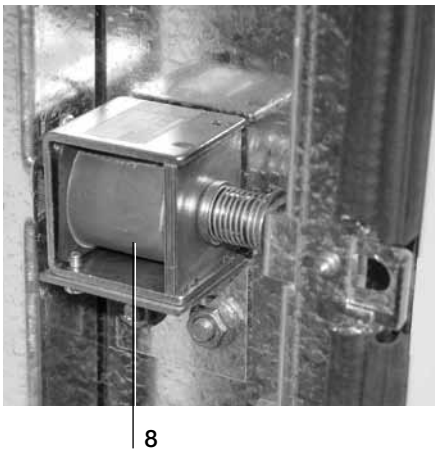


Fig. 13c

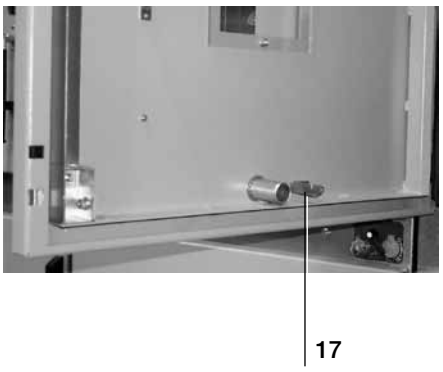


Fig. 13d

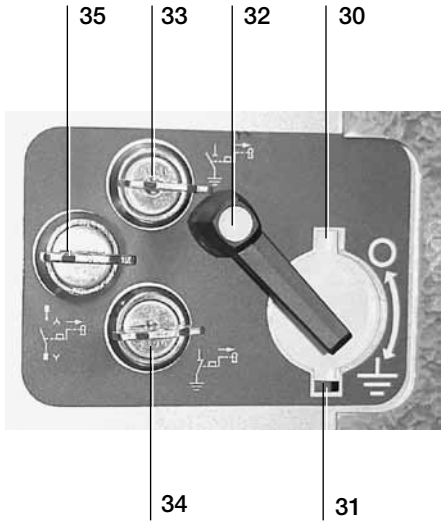


Fig. 13e

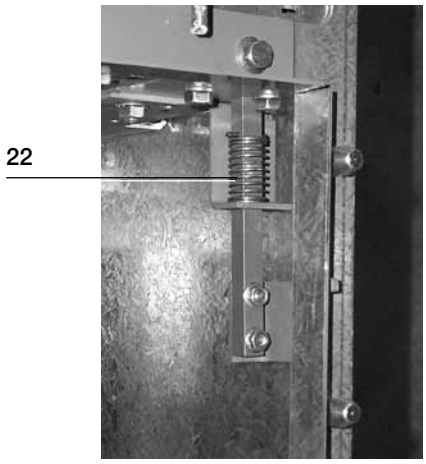


Fig. 13f

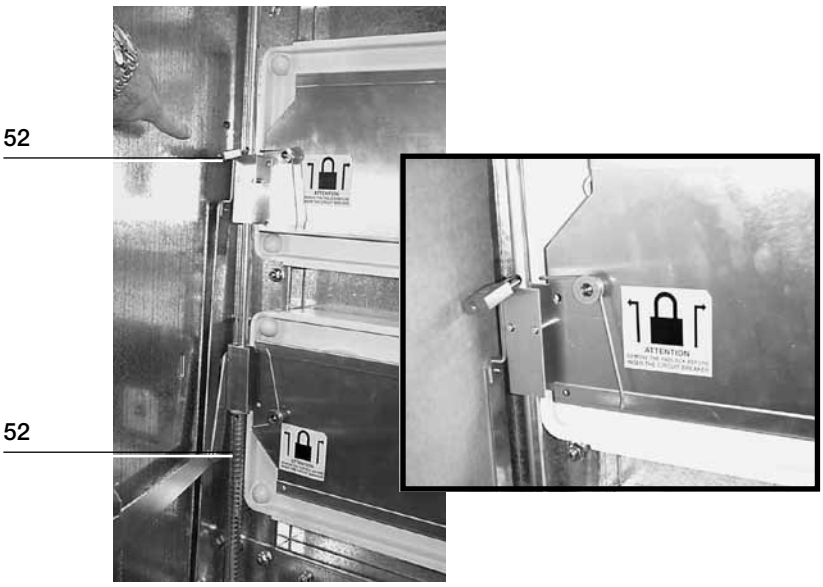


Fig. 13g

Fig. 13h

VT compartment door.

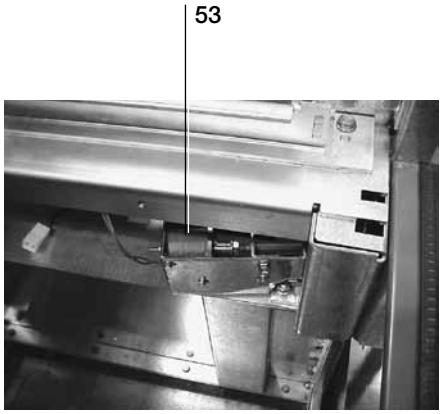


Fig. 13i

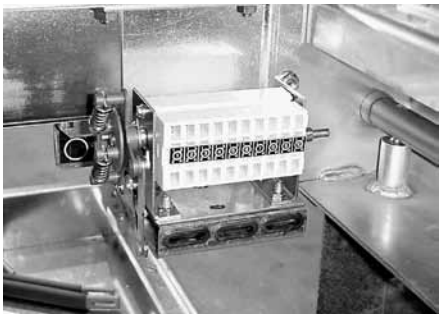


Fig. 13l

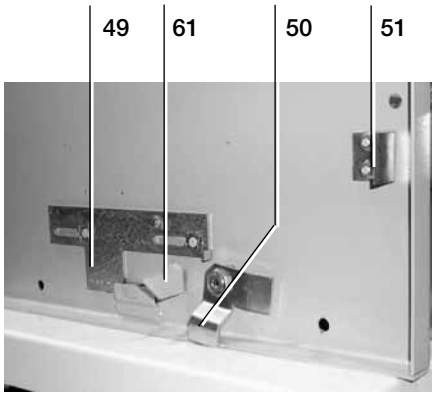


Fig. 13m

Apparatus locks

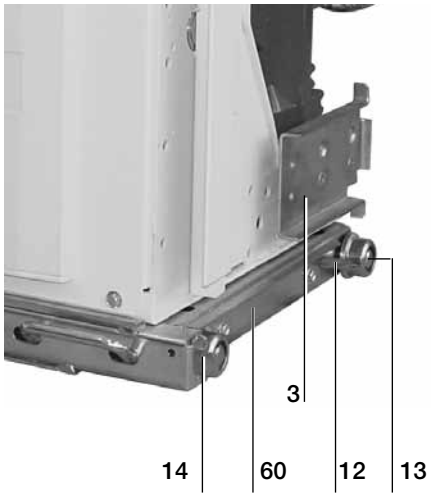


Fig. 13n

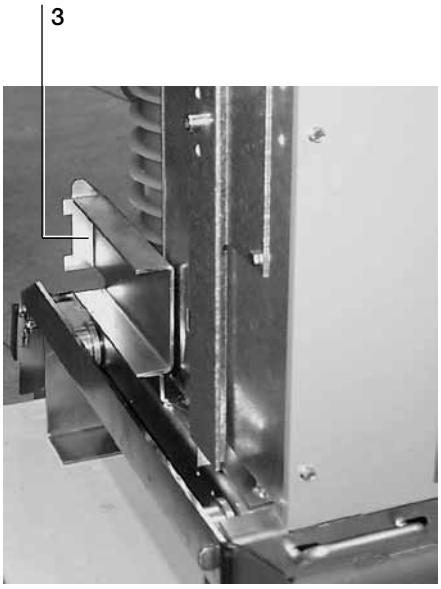


Fig. 13o

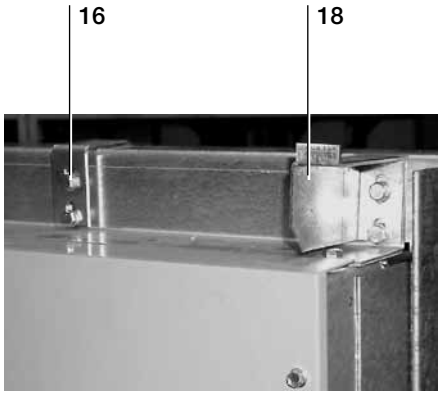


Fig. 13p

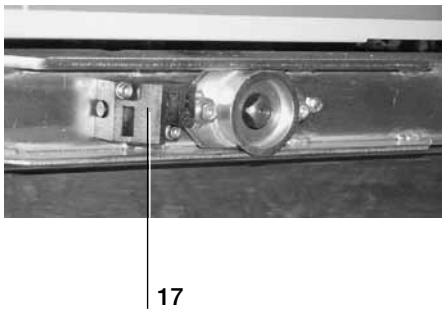


Fig. 13q

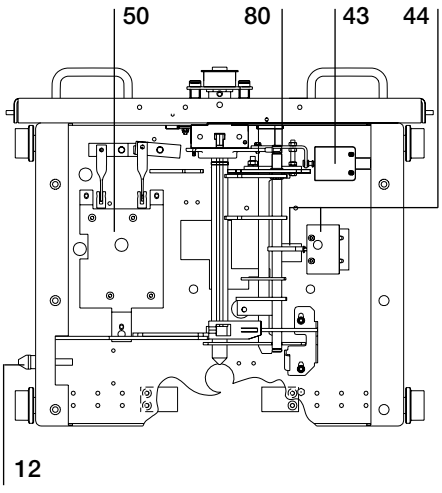


Fig. 13r

Fig. 13s

Coding the plug-socket connector of the auxiliary circuits

Coding the plug-socket connector of the auxiliary circuits allows the apparatus to be electrically combined with its panel.
For example, it only allows apparatus with different rated current to be combined with the panels they are destined for.
The operating mechanism cabling coding pins are inserted in the sockets, and must couple with the corresponding seats of the plug-socket connector.
Coding the plug-socket connector depends on the final configuration of the switchgear and must be carried out by the customer by closing the holes not used with the special plugs, according to the coding enclosed with this manual.

Socket references:
B1 - B2 - B3 - B4 - B5 - B6.

Plug references:
(B1) - (B2) - (B3) - (B4) - (B5) - (B6).

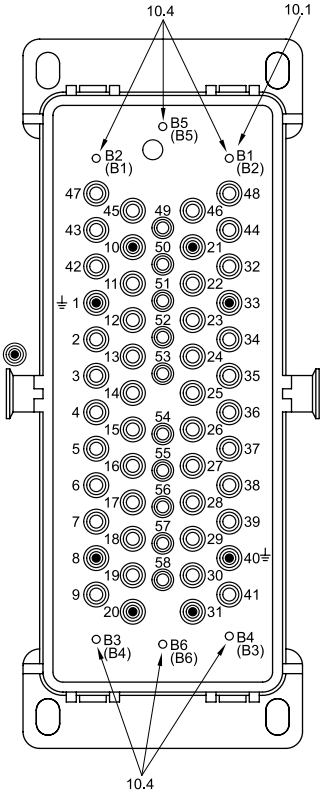


Fig. 13t

Application of locks on plug-socket

Ir	Apparatus	Pole center line	Isc	Ø contacts	B1	B2	B3	B4	B5	B6
400A	V-CONTACT	150	31.5 kA	35			■	■		
630A	HD4-VD4-VM1				■			■		
1250A	HD4-VD4-VM1				■					
1250A	HD4 isolating truck					■		■		
1250A	HD4-VD4-VM1	210	31.5 kA	35	■					
1250A	HD4 (UniSafe/PowerCube)		50 kA	35	■					
1250A	VD4		50 kA	79			■	■	■	
1250A	HD4 isolating truck		31.5-50 kA	79	■			■		
1600A	HD4-VD4-VM1							■	■	
2000A	HD4-VD4-VM1								■	
1250A	HD4 isolating truck					■	■			
2500A	HD4-VD4-VM1	275	31.5-50 kA	109						■
2000A	HD4 isolating truck									■
3150-3600-4000A	HD4-VD4									
2500A	HD4 isolating truck									
2500A	HD4 (UniSafe)	210	31.5 kA	35				■		■
2500A	HD4 isolating truck (UniSafe)						■			■
1600A	HD4-HXB/P p210	210	–	–					■	
The white boxes in the correspond with the assembly position of the rivets on the switchgear side socket.					B2	B1	B4	B3	B5	B6

Pin position in the plug (apparatus)

Hole position in the socket (switchgear)

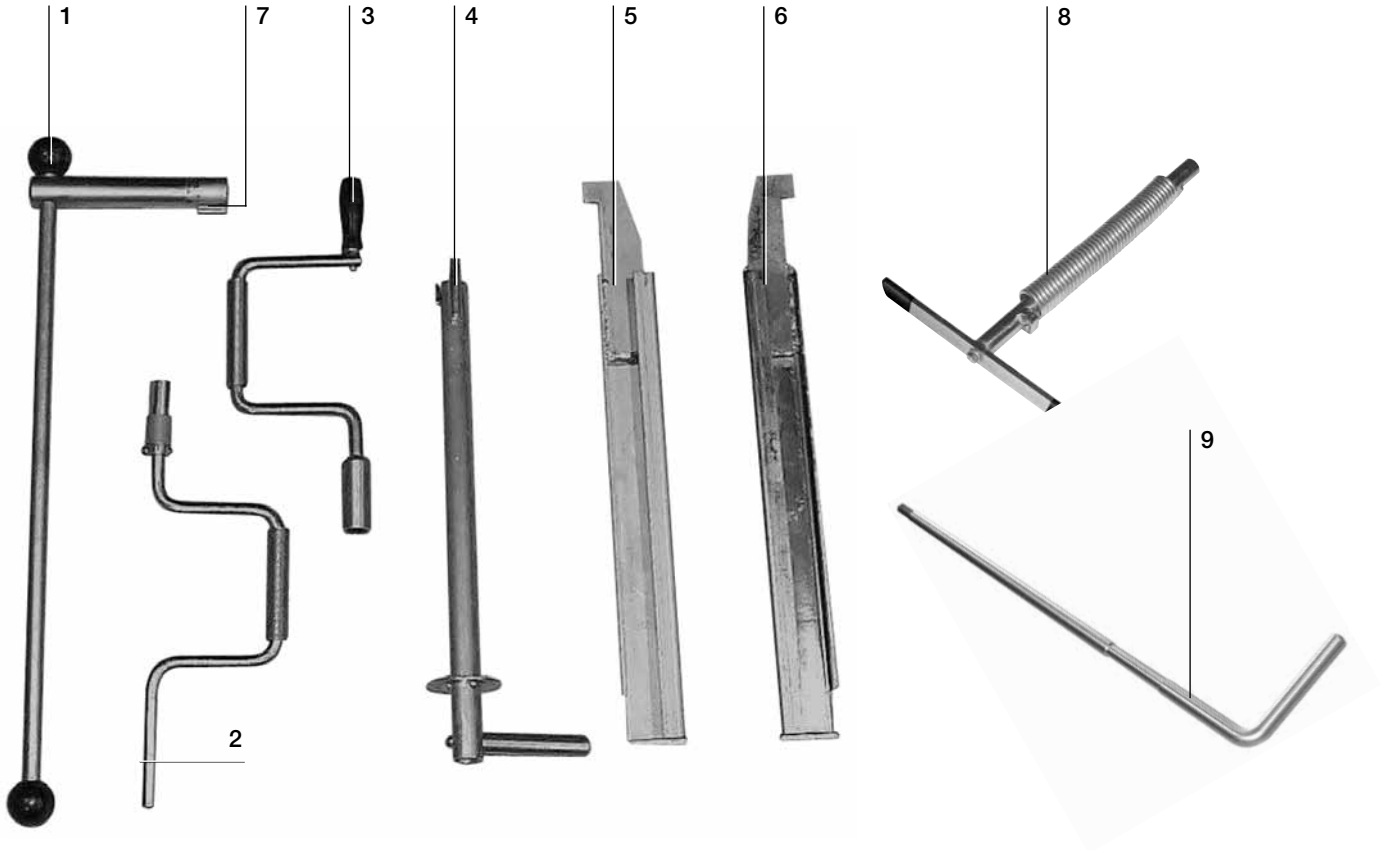
5.6. Reference Standards

IEC 60694	for general application
IEC 62271-200	for the switchgear
IEC 62271-102	for the earthing switch
IEC 60071-2	coordination of insulation
IEC 62271-100	for the circuit-breakers
IEC 60470	for the contactor
IEC 60265-1	for the switch-disconnector
CEI EN 60529	degrees of protection for the housings Classification.

6. Instructions for operating the apparatus and operation sequence of the units

- **Do not remove the circuit-breaker covering panels; if necessary, keep a safe distance during apparatus opening and closing operations to avoid any contact with moving parts.**
- **The operations must be carried out with normal activating force (not more than 200 Nm), only using the special tools (see para. 6.1). Should they be prevented, make sure that the operating sequence is correct.**

6.1. Operating accessories and devices



Caption

1 Earthing switch operating lever
2 Circuit-breaker charging-spring lever
3 Circuit-breaker racking in/out lever
4 VT truck racking in/out lever
5 Additional left guide for VT truck racking in/out
6 Additional right guide for VT truck racking in/out
7 Operating lever raised part
8 Emergency operating lever of VM1circuit-breakers
9 Emergency operating lever of VSC contactors

Fig. 14

6.2. Apparatus racking in/out

- **Should any operation be carried out while the apparatus is withdrawn from the switchboard, pay the utmost attention to the moving parts.**
- **The apparatus must be inserted into the unit only in the open position; its racking in/out must be gradual, so as to safeguard the mechanical interlocks against any deforming impact.**

6.2.1. Apparatus (circuit-breakers and contactors)

The following instructions refer to HD4 circuit-breakers but they are valid for VD4 circuit-breakers and V-Contact contactors as well.

a) Racking in

(1) Switching from circuit-breaker withdrawn to “isolated” position

– lift the apparatus (2) (fig. 15a) and place it on the handling truck (1) (fig. 15a), following the instructions in par. 4.2. “Circuit-breaker handling by means of truck”;
– open the door of the circuit-breaker compartment;
– draw the truck close to the switchboard (fig. 15a);
– insert the hooking bracket (4) (fig. 44b - c), and block the wheels (3) (fig. 15a);
– release the circuit-breaker from the truck by moving the handles (5) at the same time (fig. 15d) towards the circuitbreaker centre axis and at the same time gradually pushing the circuit-breaker handles towards the back of the module until the circuit-breaker locks with the handles (5) (fig. 15e) clicking laterally, inserting themselves into the slots (6) (fig. 15b);
– unlock the wheels (3) (fig. 15a), lift the hooking bracket (4) (fig. 15f) and remove the truck from the switchboard.

Make sure that the handles have tripped sideways (horizontal locks of the truck inserted in the enclosure)

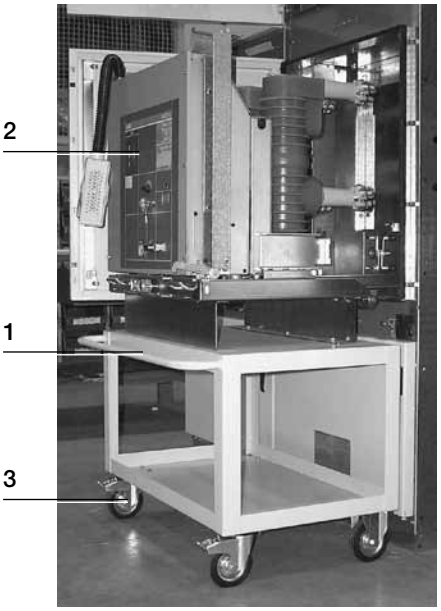


Fig. 15a

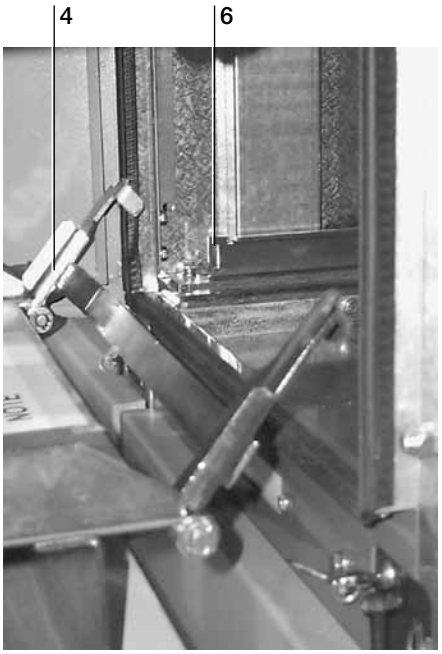


Fig. 15b

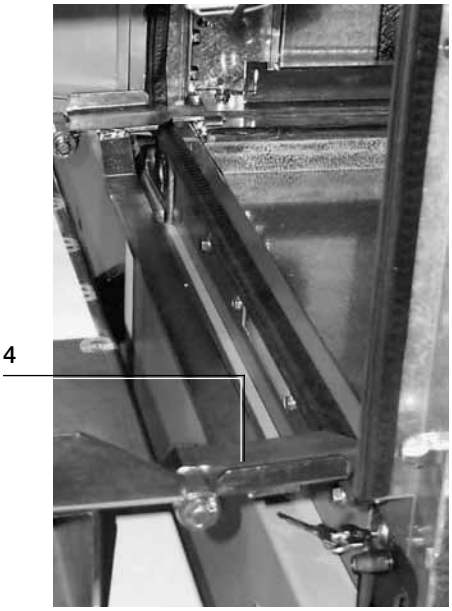


Fig. 15c

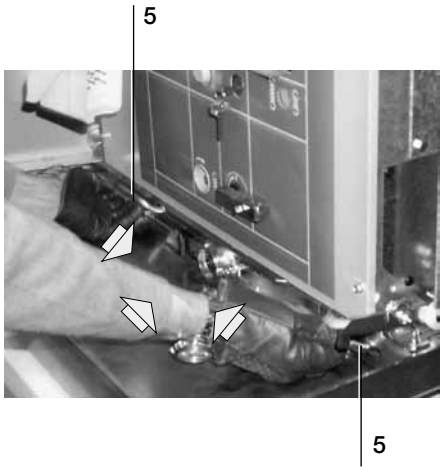


Fig. 15d

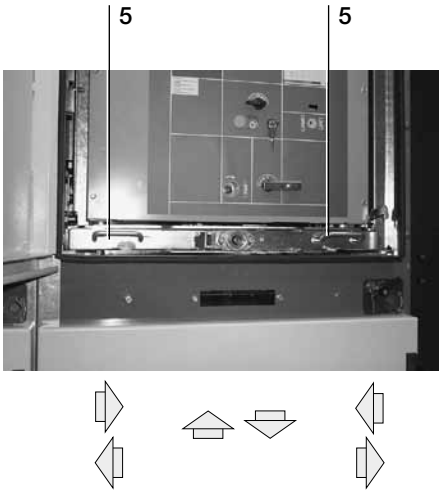


Fig. 15e

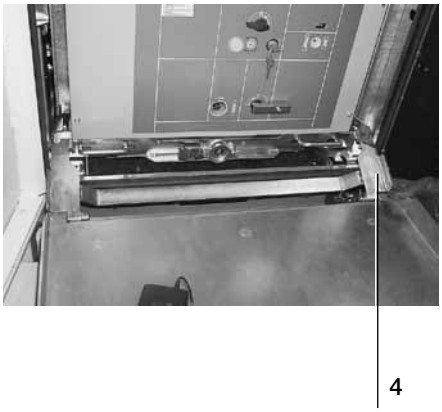


Fig. 15f

(2) Switching from “isolated” to “test” position (connection of auxiliary circuits).

– Insert and hook the mobile connector (1) (fig. 17) in the enclosure fixed socket (2) (fig. 16).

Make sure that the lever (3) (fig. 17) is fully pushed against the connector (1) (fig. 17).

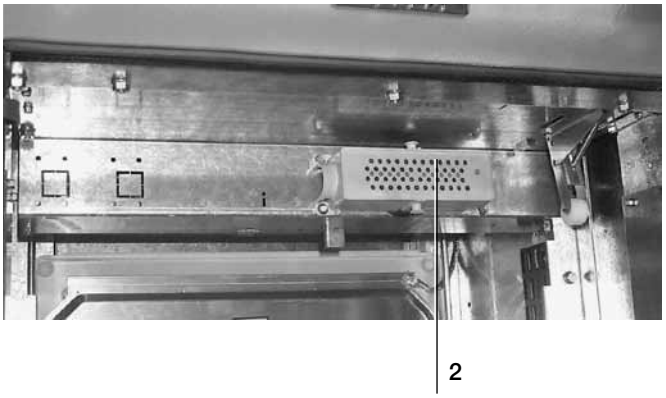


Fig. 16

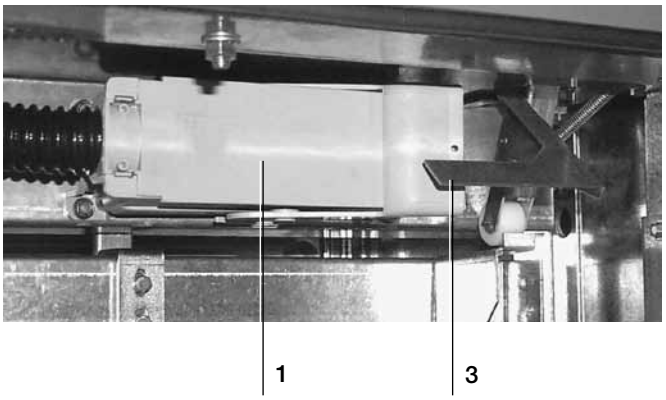


Fig. 17

(3) Switching from “test” to “connected” position (with earthing switch closed) (fig. 18)

– close the circuit-breaker compartment door (1) pushing the handle downwards;
– close the feeder compartment door (2) pushing the handle downwards;
– make sure that:
  • the locking electromagnet of the earthing switch is energised (if supplied);
  • the key locks (7-8-9) are disabled, if supplied;
– insert operating lever (13) into the seat of the earthing switch making the raised piece (12) coincide with one of the two slots (11);
– open the earthing switch, turning the operating lever anticlockwise (13);
– withdraw the operating lever (13) from the earthing switch seat;
– through the inspection window (6) and/or the operating seat (2 - fig. 8) for version without forced ventilation make sure that the earthing switch is open (indicator in the “O” position);

Make sure that the feeder unit door (2) is locked (PB/M-PB/RM).

– close the cover of the earthing switch seat by turning the actuator (10) clockwise; this operation unlocks the circuit-breaker and trips a lock for preventing insertion of the operating lever into the earthing switch;
– make sure that the locking magnet on the circuit-breaker truck (if supplied) is energised and check that the key lock for preventing insertion (if supplied) is disabled;
– fully insert the operating lever of the circuit-breaker/truck (3) (fig. 14) in the corresponding coupling (5) and turn it clockwise until the circuit-breaker is fully connected;
– through the inspection window (4) make sure that the circuitbreaker is connected.

b) Racking out operation (only with circuit-breaker open)

(1) Switching from “connected” to “isolated for test” position (with circuit-breaker open) (fig. 18)

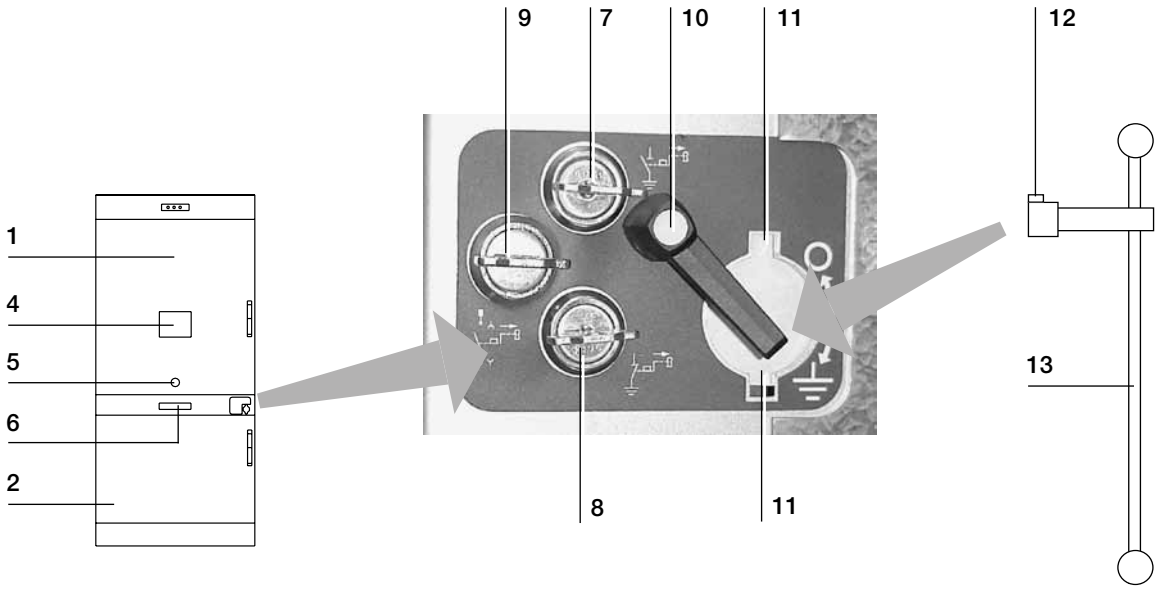
– through the inspection window (4) make sure that the earthing switch is open (indicator in the “O” position);
– fully insert the circuit-breaker truck/racking in/out lever (3) (fig. 14) in the relative coupling (5 - fig. 18) and turn it anticlockwise until the circuit-breaker stops;
– open the cover of the earthing switch operating seat by turning the actuator anticlockwise (10);
– insert the operating lever (13) in the earthing switch seat making the raised part (12) coincide with one of the two slots (11);
– close the earthing switch turning the operating lever clockwise;
– withdraw the operating lever (13) from the earthing switch seat;
– through the inspection window (6 - fig. 18) (for modules without forced ventilation) and the operating seat (2 - fig. 8) make sure that the earthing switch position indicator is in the “I” position showing closing;
– open the circuit-breaker compartment door (1) pulling the handle upwards.

(2) Switching from “isolated for test” to “isolated” position (auxiliary circuit disconnection)

– unlock the mobile connector (1) (fig. 17) and withdraw the latter from the enclosure fixed socket (2) (fig. 16);

(3) Switching from “isolated” to “withdrawn” position

– draw the truck close to the switchboard (fig. 15a);
– insert the hooking bracket (4) (fig. 15b-c) and block the wheels (3) (fig. 15a);
– move the two handles (5) (fig. 15d) at the same time towards the circuit-breaker centre and by means of the handles gradually pull the circuit-breaker outside on the truck;
– release the handles and continue withdrawal until the circuitbreaker stops (fig. 15a) and the handles trip sideways thus locking the circuit-breaker on the truck;
– unlock the wheels (3) (fig. 15a) and lift the hooking bracket (4) (fig. 15f);
– lift the hooking bracket (4) (fig. 15f) and remove the truck from the switchboard.



Caption of the earthing switch key locks

7 Lock with earthing switch open
8 lock with earthing switch closed
9 lock for preventing circuit-breaker insertion.

Fig. 18

6.2.2. VT unit (PB/M-PB/RM)

Putting the VT truck in and out of service must be carried out with the door closed

a) Racking truck into the unit

– open the unit door pulling the handle (3) (fig. 20m) upwards;
– insert the left and right additional guides (fig. 419a) in the lateral slots as in fig. 19b;
– lift the VT truck front part and insert the front wheels in the additional guides (fig. 19c);
– push the truck backwards, lift the rear part and insert the rear wheels in the additional guide slots (fig. 19d);
– push the truck backwards until it is blocked (fig. 19e);
– remove the left and right additional guides (fig. 19f);
– hook the door (fig. 20a) and insert the door earthing connection;
– tighten the door fixing screws (fig. 20b-fig. 20c);
– move the pin leftwards removing it from the slot of the operating lever (2) (fig. 20d);
– turn the lever of the door locking bolt clockwise (1) (fig. 20d);
– close the compartment door pushing the handle (3) (fig. 20e) downwards.

b) Truck racking out operation (with compartment unit deenergised)

– open the unit door pulling the handle upwards (3) (fig. 20e);
– move the pin rightwards to unlock the closing bolt of the VT truck front door (2) (fig. 20d);
– turn the actuator anticlockwise to lock the door bolt (1) (fig. 20d);
– loosen the door fixing screws (fig. 20b);
– remove the door (fig. 20a);
– insert through the inspection window (6) make sure that the earthing switch position indicator is in the “I” position showing closing; the left and right additional guides (fig. 19a) into the slots (fig. 19b);
– pull the truck outside until it is blocked;
– lift the truck rear part and remove the rear wheels from the additional guides (fig. 19c);
– pull the truck outside until it is blocked;
– lift the VT truck front part and remove the front wheels from the additional guides (fig. 19c);
– remove the left and right additional guides (fig. 19f);
– close the compartment door pushing the handle (3) downwards (fig. 20e).

Note

Use a lifting truck (fig. 20i), always positioning and moving the VT truck in the rotated position indicated in fig. 20m.

Operation for racking the truck in/out of the unit

Fig. 19a

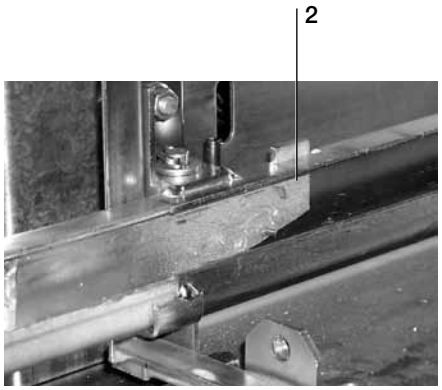


Fig. 19b

Fig. 19c

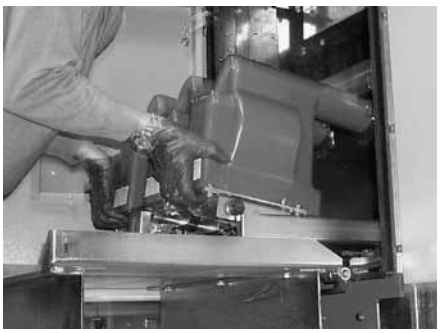


Fig. 19d

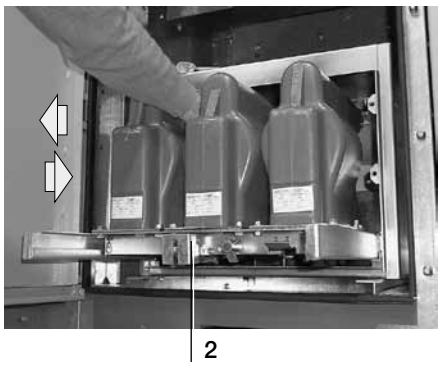


Fig. 19e

Fig. 19f

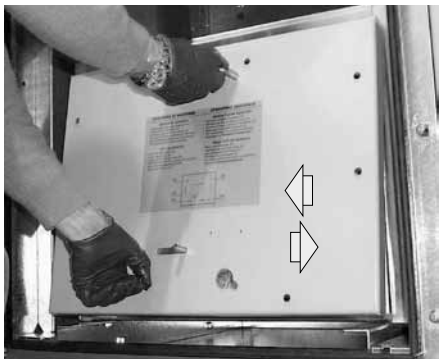


Fig. 20a

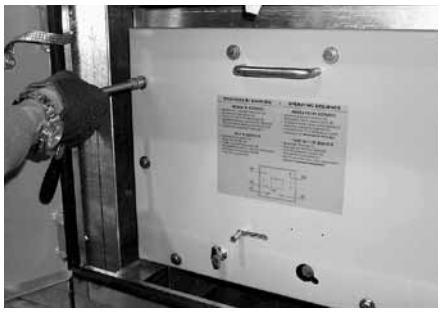


Fig. 20b

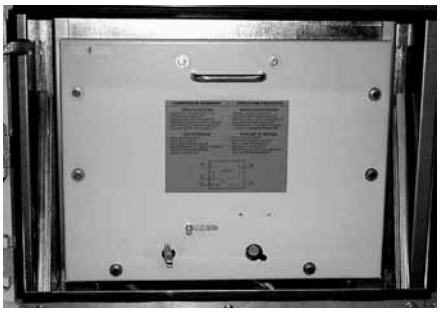


Fig. 20c

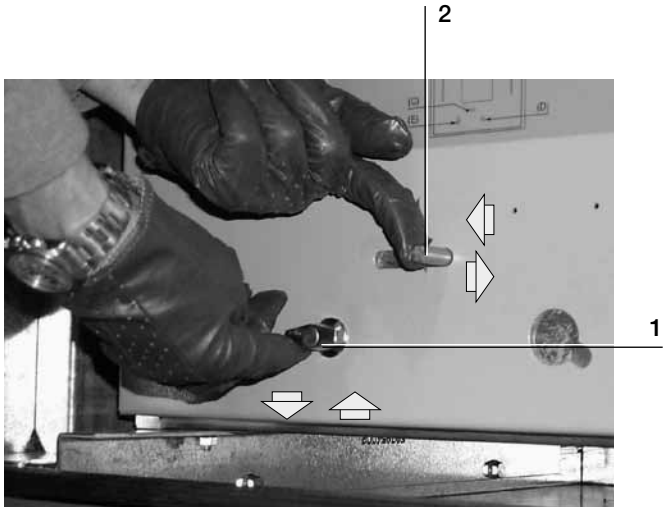


Fig. 20d

Fig. 20e

Fig. 20f

Fig. 20g

Fig. 20h

Fig. 20i

Fig.20l

Fig. 20m

6.3. Disabling the apparatus unit door lock

Skilled personnel with suitable knowledge of the apparatus and installation must carry out this operation only in case of emergency.

Should the door lock of the apparatus unit be activated and the switchboard door must be unlocked, loosen the screw (1), insert a 2-3 mm diameter rod in the hole, push the lever (2) and at the same time open the door, pulling the handle upwards.

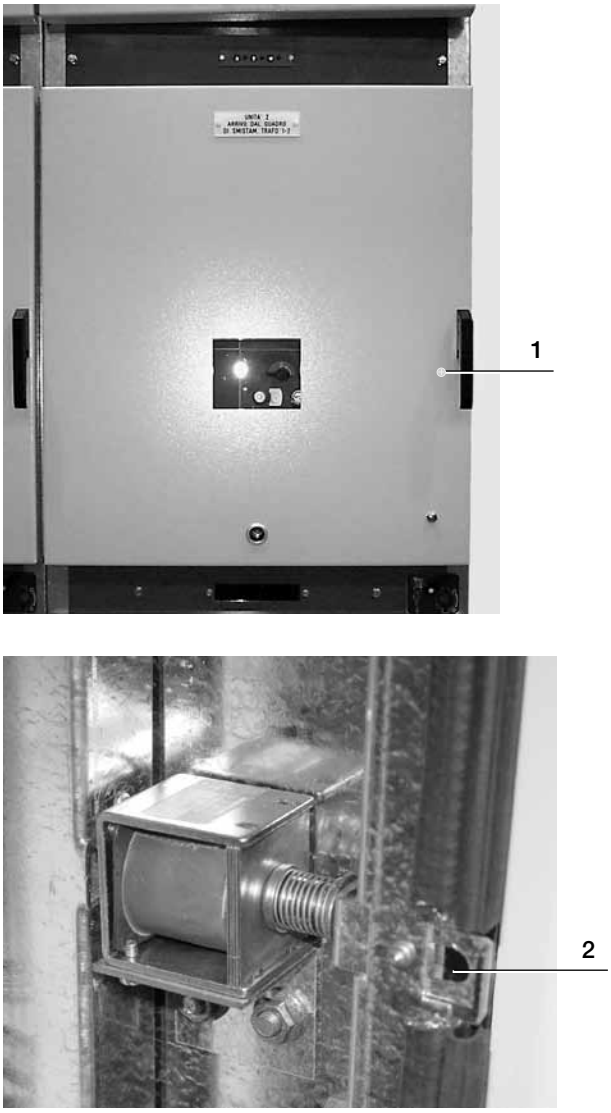


Fig. 21

6.4. Operating the apparatus

6.4.1. Earthing switch

- **Make sure that the earthing switch key locks (if supplied) are disabled and that the electromagnetic lock of the earthing switch (if supplied) is energised.**
- **The earthing switch can only be operated with the circuit-breaker in the isolated or withdrawn position.**
- **Once started, the operations must be completed.**

Closing (fig. 22)

– Make sure that the circuit-breaker is either in the isolated or withdrawn position;
– open the cover of the earthing switch operating seat by turning the operating actuator (10) anticlockwise; the earthing switch operating seat is freed;
– insert the operating lever (13) in the earthing switch seat making the raised part (12) coincide with one of the two slots (11);
– close the earthing switch by turning (13) the lever clockwise;
– remove the operating lever;
– check on the operating seat (5) and through the inspection window (6) (version without forced ventilation) that the earthing switch is closed (indicator in the "⏚" position).

Opening

– Insert the operating lever (13) in the earthing switch seat making the raised part (12) coincide with one of the two slots (11);
– open the earthing switch turning the operating lever anticlockwise (13);
– remove the operating lever (13) from the earthing switch seat;
– through the operation seat (5) and the inspection window (6) (version without forced ventilation) make sure that the earthing switch is open (indicator in the "O" position);
– close the cover of the earthing switch turning the actuator (10) clockwise; the circuit-breaker is thus unlocked while a lock for preventing operating lever insertion into the earthing switch is activated.

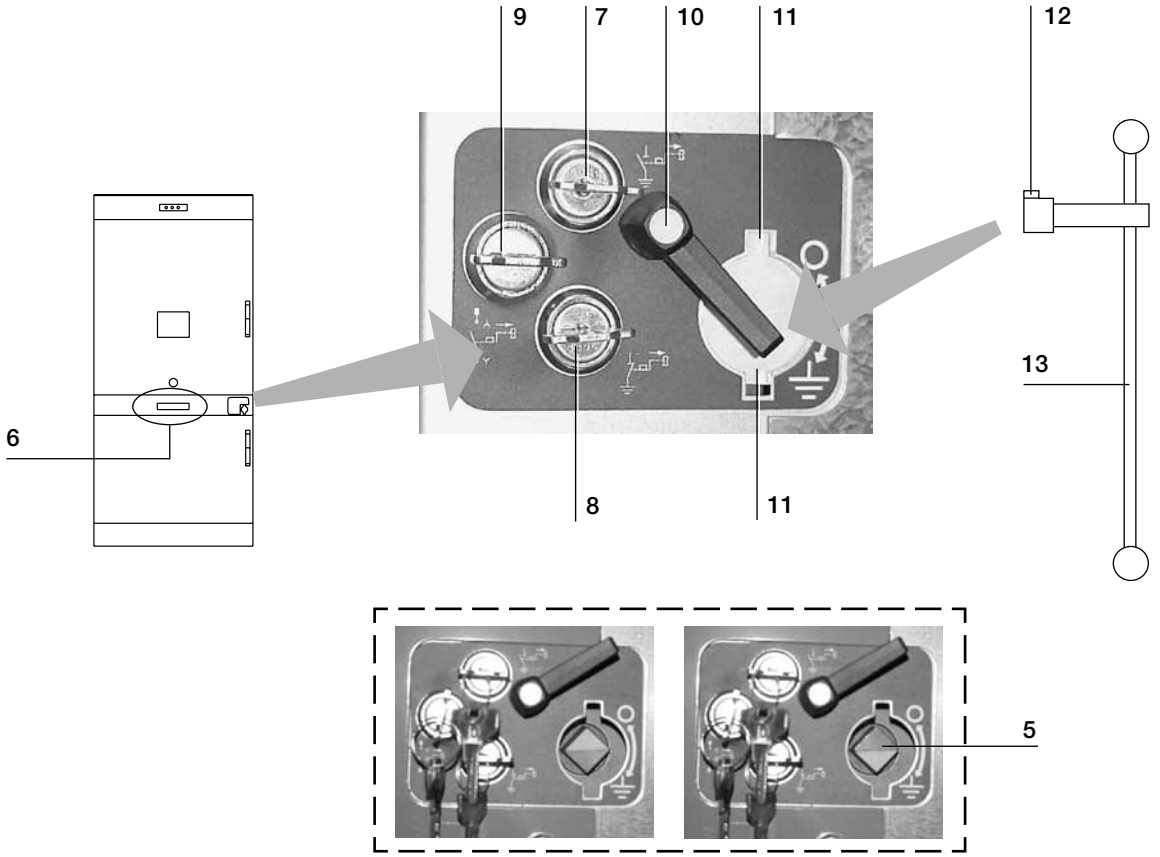
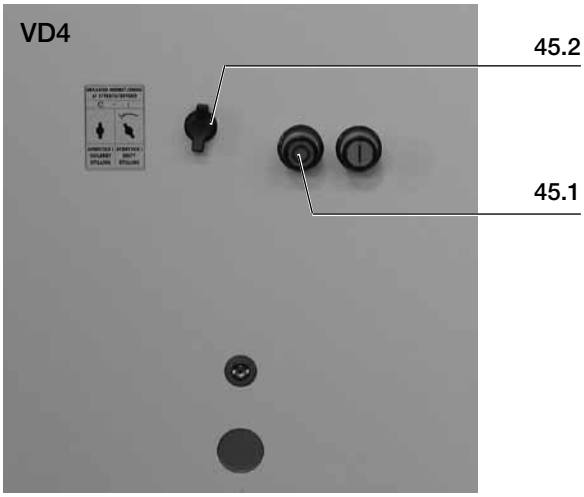
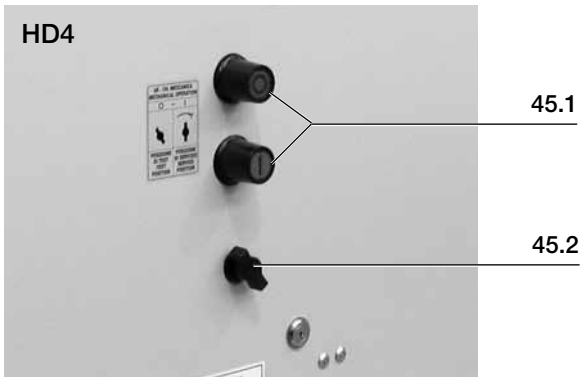


Fig. 22

6.4.2. Operation of HD4 - VD4 circuit-breakers with the door closed (application on request) (PB/E)

For operation of the apparatus, please also refer to the relative instruction manuals.
Pushbutton for circuit-breaker opening and closing operation with the door closed (on request). If the circuit-breaker is in the service position, the operation is carried out by rotating the knob 45.2 which takes the extension of operating rod 45.3 into position, allowing the operation by means of pressing the mechanical opening and closing pushbuttons (45.1).





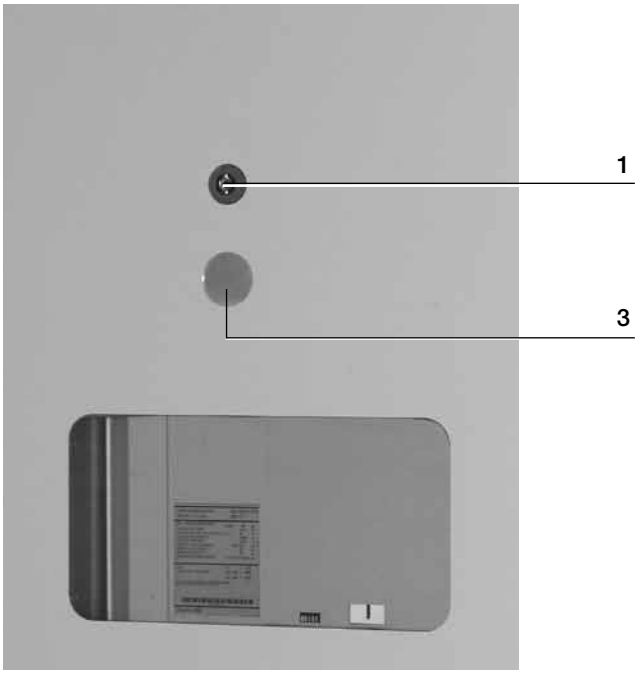
6.4.3. Emergency opening of VM1 circuit-breakers with the door closed

For operation of the apparatus, please also refer to the relative instruction manuals.

Opening due to fault on the auxiliary feeder:
– electrical opening is still possible within the first 200 s;
– after a period of 200 s, manual emergency opening is necessary.

Turn the small handle 1 to free the operating seat; insert operating lever 2 in the special opening so as to insert it in seat 3 and turn lever 2 until the apparatus opens.

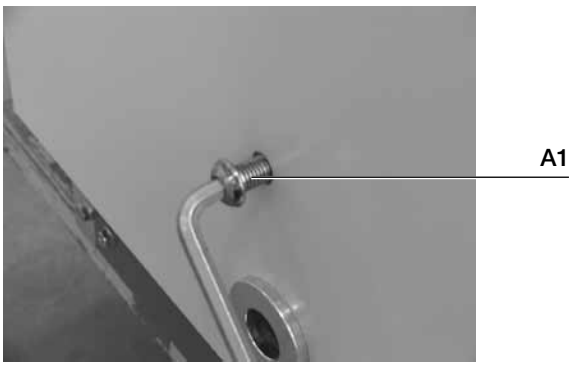
Just before reaching the run end, a little resistance on the emergency shaft must be overcome.



6.4.4. Emergency opening of VSC/P contactors with the door closed

For operation of the contactors, please also refer to the relative instruction manuals.
Unscrew screw A1 on the door using an 8 mm socket head wrench or the emergency operating lever of the contactor. Put the screw in a safe place and put the operating lever into the opening left by the screw (A1.1) inserting it in the special opening A2 on the contactor shield.
Turn the lever clockwise until the apparatus opens. Once opening has taken place, withdraw the lever and screw up the dome-headed screw on the door again.

CAUTION!
– Do not screw up the closing screw A1 – this would jeopardise the arc proofing of the door.



6.4.5. VT unit (PB/M-PB/RM)

Putting the VT truck in and out of service must be performed with door closed.

a) Putting into service

– Insert the operating lever (1) (fig. 23b) into the seat (2) (fig. 23a) making the raised piece (2) (fig. 23b) of the lever coincide with the slot (3) (fig. 23a);
– turn the lever clockwise (fig. 23c) and push hard until it is fully inserted;
– from the inserted position, turn the lever anticlockwise until the reference indicators coincide (4) and the operating lever is coupled (fig. 23d);
– make sure that by pulling the handle upwards the door does not open (fig. 23e).

b) Putting out of service

– Turn the lever (1) in fig. 23d clockwise and pull it outwards until the isolated position click;
– withdraw the operating lever (1) (fig. 23b) from the seat (fig. 23a) making the raised piece (2) (fig. 23b) of the lever coincide with the slot (3) (fig. 23a);
– open the door pulling the handle upwards. In this condition the VT truck is isolated and earthed and the VT auxiliary circuits are also isolated.

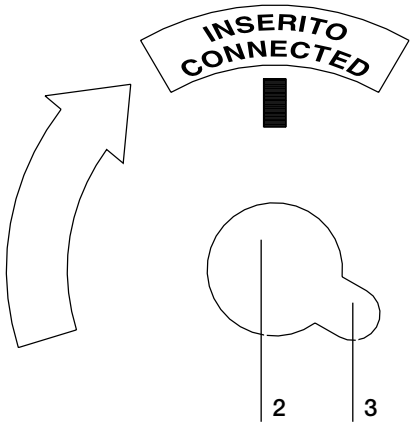


Fig. 23a

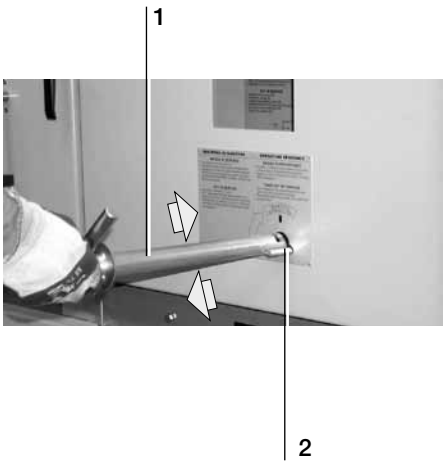


Fig. 23b

Fig. 23c

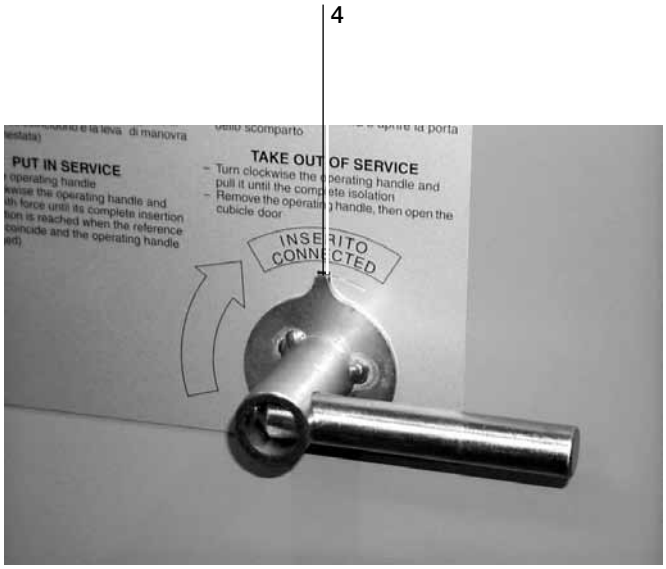


Fig. 23d

Fig. 23e

7. VT fuse replacement (PB/M-PB/RM)

- **All the operations below must only be carried out by qualified and skilled personnel with in-depth knowledge of the apparatus.**
- **Make sure that the rated normal current value of the fuses to be installed is the same as the one shown on the fuse-holder nameplate.**
- **Only use fuses indicated by ABB.**

Procedure

– Open the unit door pulling the handle (3) (fig. 24a) upwards;
– move the pin (2) (fig. 24q) right so as to unlock the closing lock bolt of the VT compartment door;
– turn the actuator of the door locking bolt anticlockwise (1) (fig. 24q);
– loosen the door fixing screws (fig. 24c);
– remove the door (fig. 24d);
– insert the left and right supplementary guides (fig. 24e);
– pull the truck outwards until it is blocked (fig. 24f);
– turn the fuse contact ring nut (fig. 24g) clockwise and remove it;
– remove the fuse and replace it (fig. 24h);
– insert the ring nut and turn it anticlockwise (fig. 24i);
– push the VT truck backwards until it is blocked (fig. 24l);
– remove the left and right supplementary guides (fig. 24m);
– hook the door (fig. 24n) and insert the door earthing connection;
– tighten the door fixing screws (fig. 24o - fig. 24p);
– move the pin leftwards thus freeing the coupling slot of the operating lever (2) (fig. 24q);
– turn the actuator of the door locking bolt clockwise (1) (fig. 24q);
– close the compartment door pushing the handle (3) (fig. 24a) downwards.

Replacing the VT compartment fuses

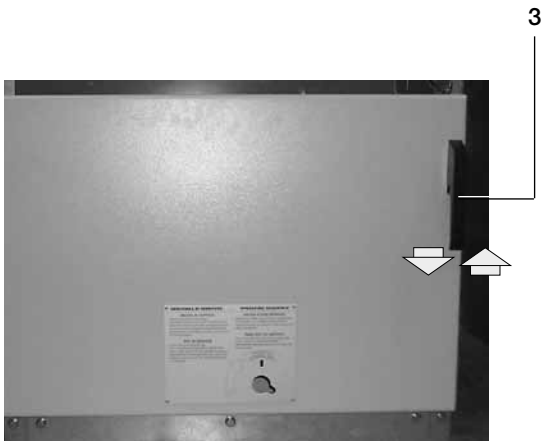


Fig. 24a

Fig. 24b

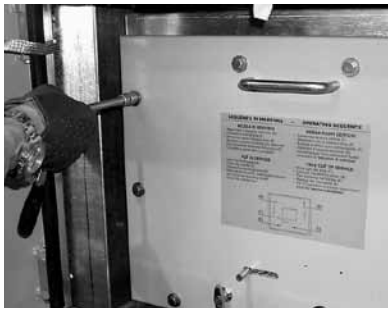


Fig. 24c

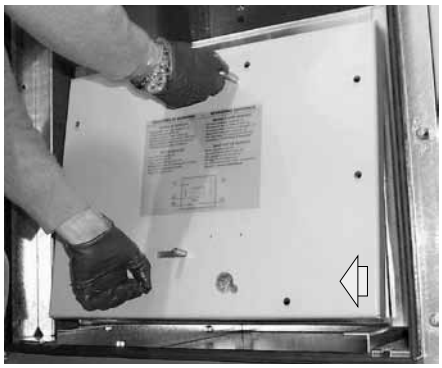


Fig. 24d

Fig. 24e

Fig. 24f

Fig. 24g

Fig. 24h

Fig. 24i

Fig. 24l

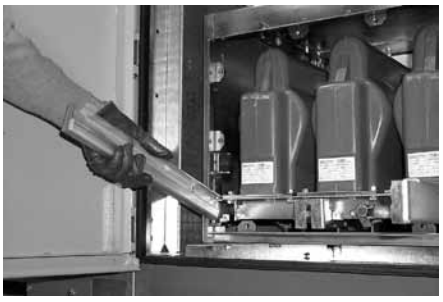


Fig. 24m

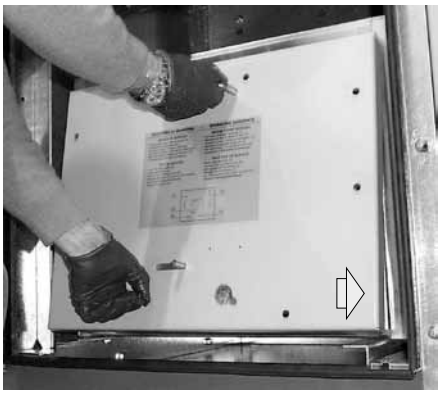


Fig. 24n

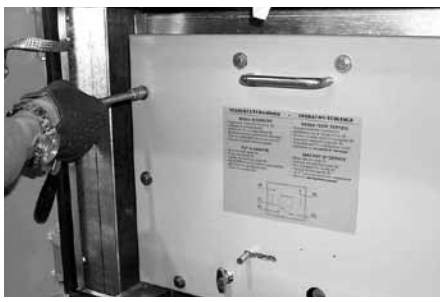


Fig. 24o

Fig. 24p

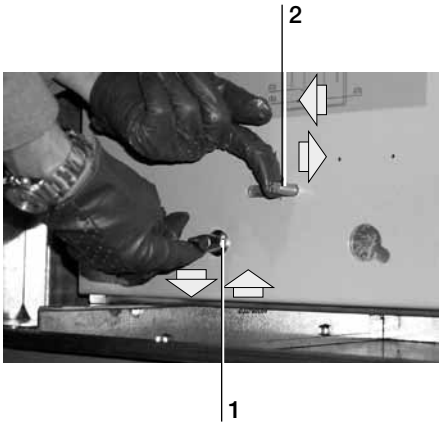


Fig. 24q

8. Installation

8.1. General information

- **Correct installation is of paramount importance. The instructions given by the manufacturer must be thoroughly studied and followed.**
- **Installation must be carried out by skilled personnel with in-depth knowledge of the apparatus.**
- **It is advisable to wear gloves for handling the components.**
- **Before removing the operating mechanism cover make sure that the circuit-breaker is open and the closing springs discharged.**

8.2. Normal installation room conditions

Maximum air temperature	+ 40 °C
Minimum air temperature	– 5 °C
Relative humidity	% ≤ 95
Altitude	≤ 1000

For shipping reasons, the gas pressure in the HD4 circuit-breakers can be reduced. In this case, before putting the apparatus into service recover the pressure using SF6 gas in compliance with the CEI 10-7 - IEC 60376 Standards.
Filling with gas must be carried out by ABB personnel or by suitably qualified customer personnel with indepth knowledge of the apparatus.

For any special conditions, please contact us.
For other installation room characteristics, please refer to the product standards (IEC 60694).
For any special conditions, please contact us.

8.3. Foundations and fixing surface (PB/M-PB/RM)

The floor or the foundation must be strong enough to bear the weight of the module (plus all the apparatus) without any deformation.
The general foundation drawing is shown in fig. 25a.
The switchboard can be fixed (fig. 25b) either to the floor or to special base irons (supplied on request):
– for floor fixing put the expansion and anchoring bolts in the fixing holes;
– special bolt blocks are supplied for base iron fixing. The base irons must be fixed and buried in concrete.

The base of each module is prepared with four fixing holes. For switchgear positioning, the planarity of the fixing surface must be checked, with special attention paid to longitudinal levelling (maximum planarity: 2/1000).

8.3.1. Module fixing systems (fig. 25b)

Fixing with base irons and masonry floor

The base irons, which can be supplied on request, must be installed in the slab before finishing the floor:
– rest the irons on the floor and line them up so that they are parallel and are spaced from each other as shown in the foundation drawing;
– level the irons both longitudinally and transversally;
– fix the base irons in this position with expansion anchor bolts, using the holes provided in the irons;
– complete the flooring so that the base irons extend out at least 0.5 mm from the finished floor surface.

Fixing to floor with anchoring and masonry floor

Procedure

– Clean the installation area;
– on the slab, visibly trace the perimeter of all the cubicles making up the switchboard, taking the minimum wall and obstacle clearances into account;
– level the floor both longitudinally and transversally;
– drill the floor at the fixing points foreseen, referring to our slab drilling drawings. To make the holes, use a hammer drill with a Ø = 16 mm bit;
– insert the expansion anchoring bolts in the holes.

Fixing to a floating floor

Procedure

– Clean the installation area;
– on the slab, visibly trace the perimeter of all the cubicles making up the switchboard, taking the minimum wall and obstacle clearances into account;
– drill the floor at the fixing points foreseen, referring to our slab drilling drawings. To make the holes, use a drill with a suitable bit for the type of fixing to be made (through or threaded hole).

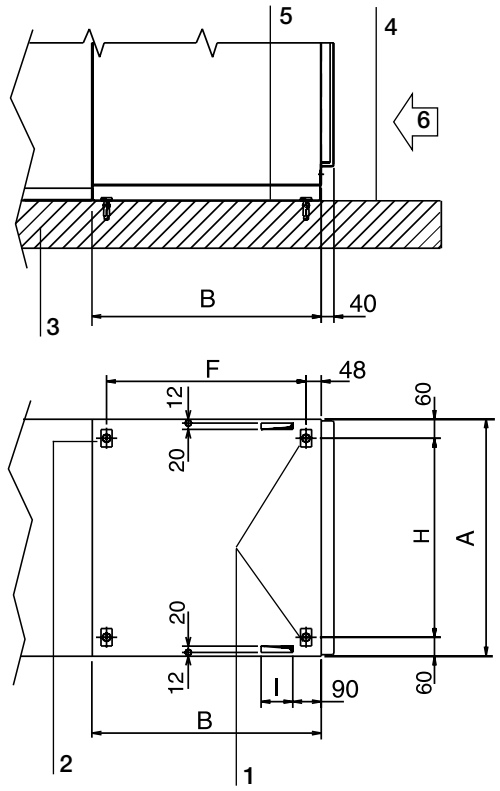
8.4. Tightening torque

The screw and nut tightening torque values for fixing and coupling switchboards and busbars are given in the table below.

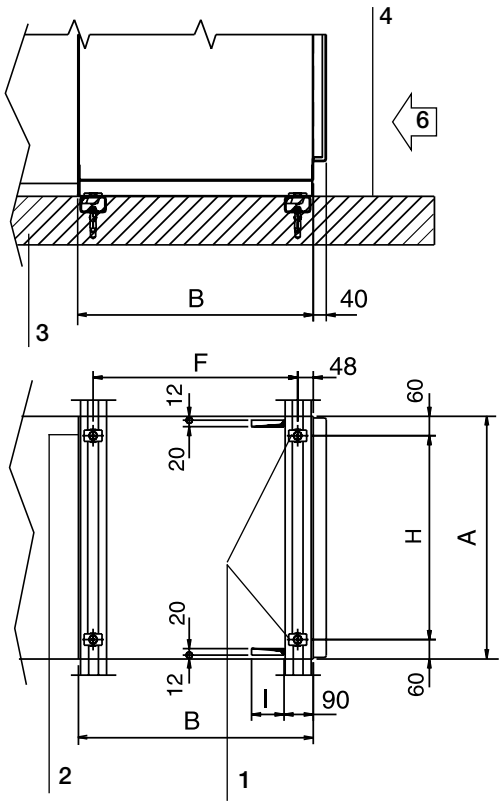
Nut or screw	Tightening torque (Nm)		Key for exhagonal nut or screw
	Acc. 4.8	Acc. 8.8	
M3	0.5	1.2	5.5
M4	1.1	2.7	7
M5	2	5	8
M6	3.7	9	10
M8	9	22	13
M10	18	45	17
M12	30	75	19
M16	75	185	24
M18	104	260	27
M20	148	370	30

Foundations

Version with anchoring bolts



Version with base irons



Module	A	B	F	H	I
12-17.5 kV	600	723	630	480	200
	750	723	630	630	200
	1000	723	630	880	200
24 kV	750	873	770	630	200
	1000	873	770	880	200

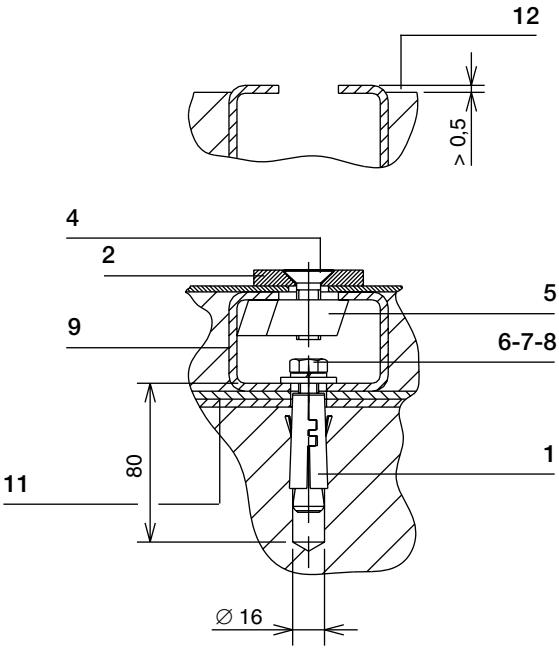
Caption

1 Passage of auxiliary circuit cables
2 Slot for module fixing
3 Slab
4 Finished floor surface
5 Module base sheet
6 Module front

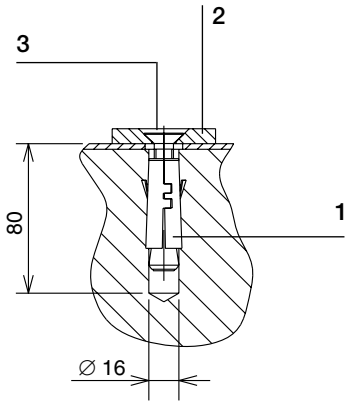
Fig. 25a

Masonry floor

Version with base iron

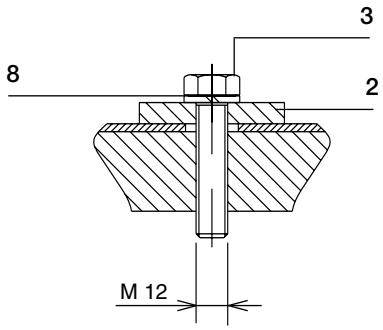


Version with anchoring bolts

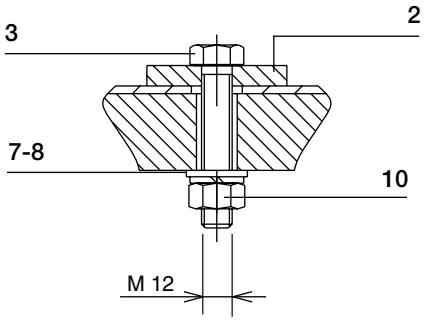


Metal structure

Version with threaded hole



Version with through hole



Caption

1 Anchoring bolt
2 Plate
3 Screw
4 Screw
5 Block
6 Hexagonal-head screw
7 Washer
8 Spring washer
9 Steel section
10 Nut
11 Level by means of suitable shims (not supplied)
12 Floor level

Fig. 25b

8.5. Access from the front to the cable connection area (PB/M)

8.5.1. Access through the feeder unit

Circuit-breaker racking out

Follow the instructions given in para. 6.2.

Dismantling the panels

Disconnect the fan power supply in the case of units with forced ventilation.

Procedure

– Loosen the fixing screws of the front panel (fig. 26a)
– loosen the two fixing screws (right side) of the circuit-breaker compartment panel (fig. 26b)
– loosen the two fixing screws (left side) of the circuit-breaker unit panel (fig. 26c)
– lift and remove the circuit-breaker unit panel (fig. 26d)
– access the cable connection area of the unit (fig. 26e).

8.5.2. Access through the VT unit

Racking the VT truck out

Follow the instructions in para. 6.2.

VT compartment dismantling

– Loosen the fixing screws (right and left side) of the VT unit (fig. 27b-27c);
– move the guides (right and left) against the switchboard walls (fig. 27d);
– loosen the panel fixing screws on the switchboard base (fig. 27e).
– loosen the fixing screws of the VT unit base (fig. 27f-27g);
– withdraw the VT unit as in fig. 27h;
– position the VT unit as in fig. 27i.

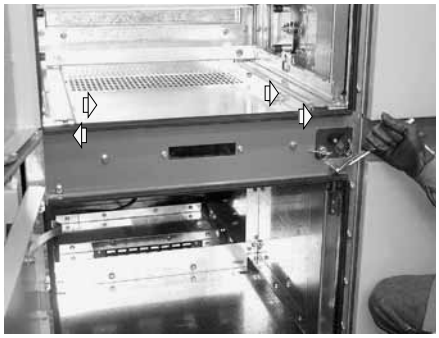


Fig. 26a

Fig. 26b

Fig. 26c

Fig. 26d

Fig. 26e

Fig. 27a

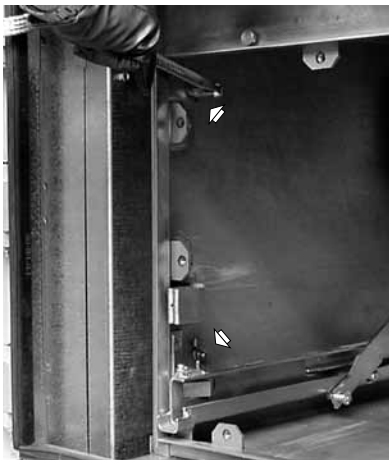


Fig. 27b

Fig. 27c

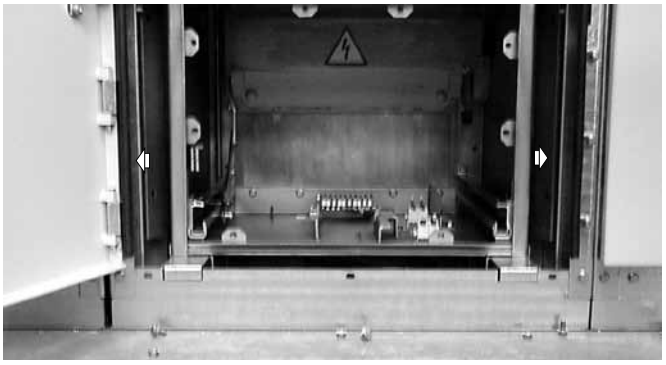


Fig. 27d

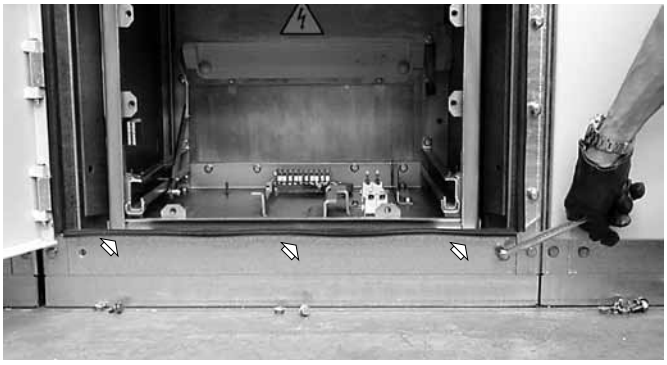


Fig. 27e

Fig. 27f

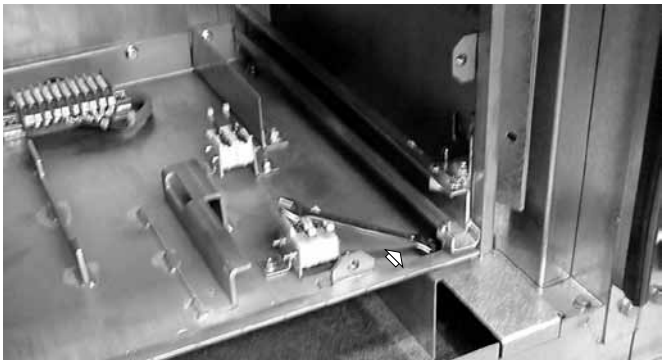


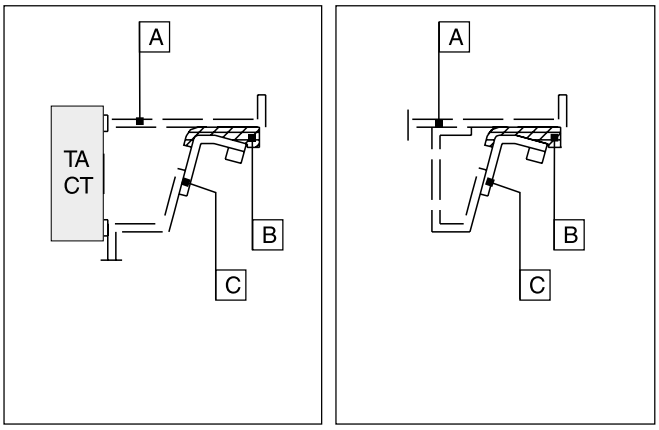
Fig. 27g

Fig. 27h

Fig. 27i

8.5.3. Connection of the lower terminals for units with earthing switch (with and without CT).

The PowerCube units are preset for connection of the CTs between the A and C contacts of the lower terminals.
If this is not done, connect contacts A and C to each other using a conductor with the same cross-section as the one in detail C.
In both cases, the connection must be made - by the customer - respecting the geometry indicated in the figure so that the making capacity of the earthing switch is guaranteed.



Caption
A = Lower terminal
B = Insulating support
C = Fixed contact

Fig. 27I

8.6. Hints on constructing switchgear units with 4000 A rated current

The PowerCube modules are provided for rated currents up to 3600 A, but can also be used to construct switchgear units with rated current up to 4000 A.
This can be done thanks to applying a special fan in the rear part of the unit.
The characteristics of the fan used are listed below. This fan can be ordered as an accessory for the 3600 A enclosure. Assembly is to be carried out by the customer. In any case, certification of the completed switchgear remains the responsibility of the customer.

Fan characteristics

			50 Hz	60 Hz
Frequency	f	Hz	50	60
Rated voltage	U	V	230	230
Power consumption	P_1	W	270	280
Speed	n	min^{-1}	2470	2600
Capacity	C	µF	6	6
Max air volume	V	m^3/h	1180	1240
Minimum pressure			80Pa	80Pa

Performance curve

We suggest putting the fan in the position shown in the figure 28b.

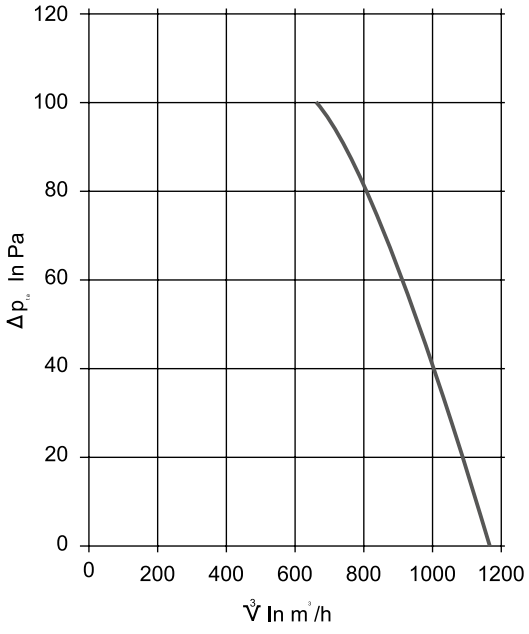
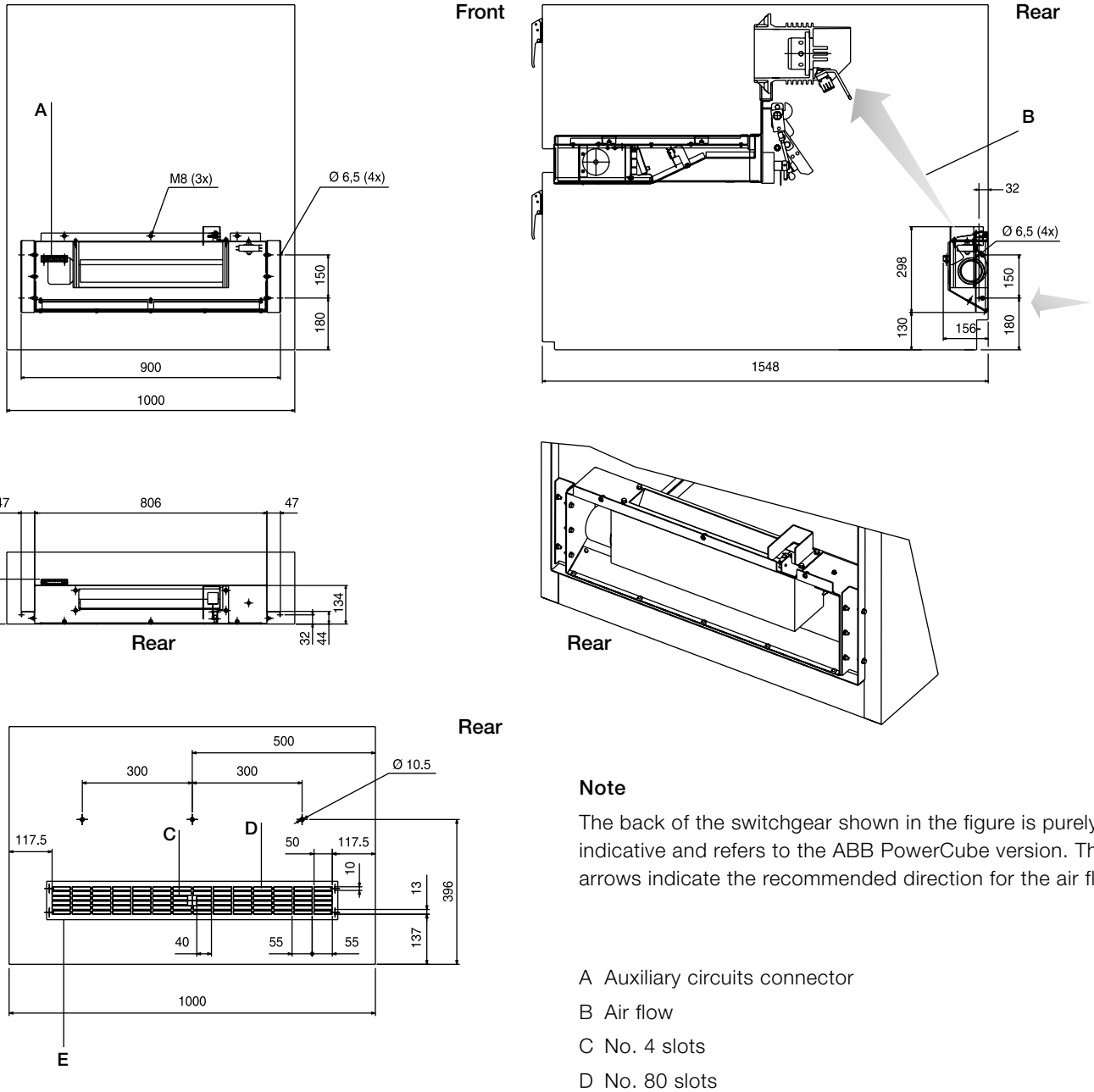


Fig. 28a



Note

The back of the switchgear shown in the figure is purely indicative and refers to the ABB PowerCube version. The arrows indicate the recommended direction for the air flow.

A Auxiliary circuits connector

B Air flow

C No. 4 slots

D No. 80 slots

E Rear sheet steel cut out of the panel

Note

We recommend the following procedures for turning the fans fitted on the PowerCube modules on and off.

PowerCube Modules PB3 12-17 kV / 3600-4000 A

Turning fans on if at least one phase exceeds the following current thresholds:

– 3000 A: delay of 60 s and consequent turning on of just the front fan
– 3600 A: delay of 60 s and consequent turning on of the rear fan as well as the front one

Turning fans off if all the phases drop below the following current thresholds:

– 3500 A: delay of 300 s and consequent turning off of just the rear fan
– 2900 A: delay of 300 s and consequent turning off of the front fan.

PowerCube Modules PB5 24 kV / 2500 A

Turning the fans on if at least one phase exceeds the 2250 A threshold: delay of 60 s and consequent turning on of the front fan.

Turning fans off if all the phases drop below the 2150 A threshold: delay of 300 s and consequent turning off of the front fan.

Fig. 28b

9. Putting into service

- **All operations for putting into service must be carried out by skilled personnel.**
- **Should the operations be prevented, do not force the mechanical interlocks but make sure that the operating sequence is correct.**
- **Before opening the door check the apparatus position through the inspection windows.**

Before putting into service, all the apparatus installed must be checked and tested as prescribed below, bearing in mind that in case of special installation configurations, **the tests indicated in the table may have to be integrated with others which are to be established by the plant technical manager.**

9.1. Preliminary operations

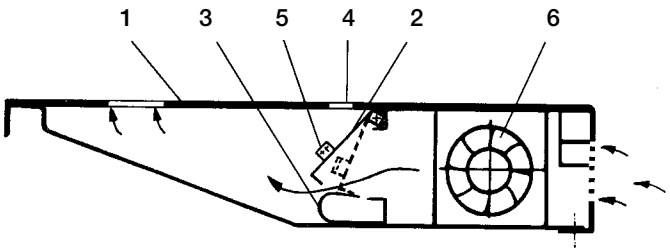
– Make sure there is no evident damage and remove any foreign bodies;
– make sure that the internal metal segregations (if supplied) are present;
– make sure that any insulating barriers or hoods previously removed have been remounted;
– check connection tightness;
– make sure that the sheets have been properly mounted and have not been deformed;
– make sure that all the metallic frame screws have been properly tightened;
– thoroughly clean the sheets and the insulating components by means of brushes and clean, dry cloths. Avoid any compressed air blasts unless they are dry and free of lubricating oil;
– remove dust and dirt from any air vent grids and ventilation ducts;
– for the units with 3600 A and 4000 A circuit-breaker up to 17.5 kV and 2500 A up to 24 kV, check operation of the fan and the free movement of the internal flap (see fig. 29);
– make sure that the vacuum interrupters of the V-Contact contactor and VD4, Vmax, VM1, eVM1 circuit-breaker have not been accidentally damaged, **in case of doubt do not hesitate to contact us;**
– insert the apparatus into the compartments in the isolated position with the apparatus open and insert the auxiliary instrument connectors;
– power the auxiliary circuits;
– make sure that the value of the circuit power supply ranges between 85% and 110% of the apparatus rated voltage value.

If all the above tests have been successful, carry out the inspection and testing procedures indicated in para. 11.2. **Should any problem arise, do not hesitate to contact us.**

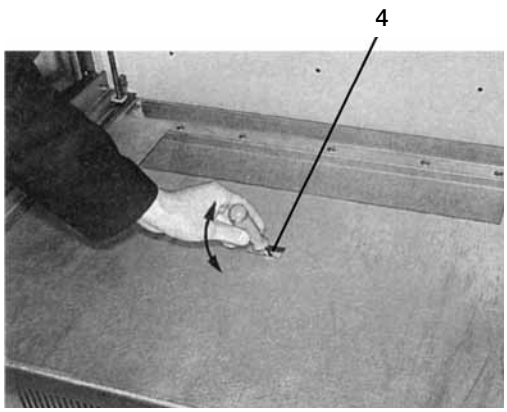
9.2. Measurements and tests

Carry out the tests indicated below only after performing the preliminary operations prescribed in para. 9.1.

- **The check is only successful if all the above tests have been passed successfully.**
- **If the inspection gives negative results, do not put the apparatus into service but contact us if necessary.**
- **Only supply the module with circuit-breakers open and doors closed.**



1 Horizontal surface
2 Flap
3 Spring hook
4 Opening for inspection
5 Stop
6 Centrifugal fan



Lateral view of fan application.
The internal flap is shown in the service position (open).

Fig. 29

Subject of inspection		Procedure	Positive test
1	Insulation resistance.	Main circuit: by means of a 5000 V Megger, measure the insulating resistance between phases as well as between phases and the exposed conductive part.	The insulation resistance value should not be lower than 1000 MΩ and constant in time.
2	Industrial frequency voltage test.	Main circuit: the voltage test is performed after installation in order to check the busbar duct connection insulation. The voltage test value must reach 80% of the test value prescribed for the individual tests (IEC 60271-200)	No electrical discharges should occur.
3	Electrical functionality test.	Supply the auxiliary circuits and perform some operations.	Normal operations and signals.
4	Open/closed control indicator. Operation counter (if supplied).	Put the apparatus in the isolated for test position and perform a few openings and closings.	Normal operations and signals.
5	Apparatus operations.	With the apparatus open, close the enclosure door and perform racking in, carry out a few openings and closings.	Normal operations and signals.
6	Electromechanical door interlock with apparatus in the inserted and intermediate positions (if supplied).	With the door closed, insert the apparatus first partially and then fully.i.	The door must not open after about two handle turns.
		Isolate the truck and try to open the door.	The door opens.
7	Mechanical and electrical lock for preventing apparatus closing in the position between connected and isolated.	Put the truck in the intermediate position between isolated and connected. Attempt contactor closing.	Closing is not possible.
8	Lock for preventing racking in between apparatus with different characteristics.	From the withdrawn position, try to insert the plug into the socket.	Insertion is not possible.
9	Truck locking electromagnet.	De-energise the electromagnet and try to move it using the relevant handle.	The truck does not move.
10	Mechanical lock for preventing apparatus racking in/out when closed.	Put the truck in the isolated position, close the apparatus and try the racking in operation.	The operation is not possible.
11	Key lock for preventing racking in (if supplied).	With the contactor in the isolated position, turn the key 90°	Apparatus racking-in is prevented after about two handle turns. The key can be removed.
12	IEC lock with plug-socket.	With apparatus racked in and in the positions between connected and isolated.	The plug-socket cannot be removed.
13	Shutter mechanical lock when the apparatus is withdrawn (if supplied).	With apparatus withdrawn try to manually move the shutters.	It is not possible to open the shutters.
14	Key lock for preventing earthing truck racking in (if supplied).	Trip the lock turning the key 180° and remove it.	The earthing truck cannot be inserted switching from the withdrawn to the isolated position.
15	Earthing switch (if supplied).	With isolated apparatus, close the earthing switch and re-open it.	The operation is possible. Check that the position signalled on the circuit-breaker front is correct.
		Try to close the earthing switch with the apparatus inserted.	The earthing switch cannot be closed.
		Try to insert the apparatus with isolated apparatus and earthing switch closed.	The operation is prevented after about two handle turns.
		Try to operate the earthing switch with the apparatus in the intermediate position between isolated and connected.	The earthing switch operating lever cannot be inserted.
16	Key lock for earthing switch open (if supplied).	Turn the key 90° with apparatus isolated, earthing switch open and lever withdrawn.	The earthing switch operating lever cannot be inserted.
17	Key lock for earthing switch closed (if supplied).	Turn the key 90° with apparatus isolated, earthing switch closed and lever withdrawn.	The earthing switch operating lever cannot be inserted.
18	Double key lock for earthing switch open and closed (if supplied).	Turn the key 90° with apparatus isolated, earthing switch closed and lever withdrawn.	The earthing switch operating lever cannot be inserted.
19	Earthing switch electromechanical lock (if supplied).	With earthing switch open or closed and lock deenergised.	The earthing switch operations are not possible.
20	Operating pushbuttons with the apparatus door closed (if provided).	For HD4 and VD4, carry out the opening and closing operations using the pushbuttons. For VM1 and contactors carry out the emergency opening operation.	The operations are normal.

After performing the tests, make sure that all normal service conditions are restored.
Check that all the mechanical and electrical locks, (if deenergised to carry out the putting into service tests with switchboard disconnected) have been restored.

10. Periodic checks

- **The periodic checks must be carried out by skilled personnel.**
- **Before carrying out any operation, make sure that the apparatus is open with springs discharged.**
- **Before opening the door check the apparatus and earthing switch positions through the inspection windows.**

10.1. General information

During normal service the modules are maintenance-free. Any possible intervention depends on specific installation aspects such as operation frequency, interrupted current value, power factor and ambient conditions.
As a precaution, the paragraph below shows the inspection programme table with the relevant periodic checks. At least for the first check, it is advisable to follow what is specified in the table.
According to the results obtained, establish the best interval for subsequent operations.
It is advisable to keep a maintenance card and a service book containing all the operations performed along with date, description of possible anomalies, reference to the data needed to identify the apparatus (see chapter 2) etc.
For further information, refer to article 10 of IEC 60694 Standards.
In any case, should there be any problems, do not hesitate to contact us.
It is recommendable to perform an inspection within one year from putting the apparatus into service.

10.2. Inspection programme

Subject of inspection		Time intervals	Procedure
1	Carry out two mechanical closing and opening operations of the apparatus.	3 years and in any case after a time not exceeding the one specified.	Check operation and transmission functionality. The apparatus must work normally without stopping in intermediate positions and the torque applied must not exceed 200 Nm.
2	Visual inspection of insulating parts.	3 years and in any case in relation to the environmental pollution.	Insulating parts must be free from dust, dirt, cracks, traces of surface discharges and damage. Remove any dust and dirt by means of a vacuum cleaner and dry, clean cloths.
3	Auxiliary contacts.	3 years. In any case, refer to the specific manuals of the apparatus.	Check functionality and signals.
4	Auxiliary circuit conductors.	5 years.	Check whether any cabling strap is loose or broken and connection tightness.
5	Interlocks.	3 years.	Check device functionality.
6	Visual inspection of earthing switch contacts.	5 years.	Check that contacts are not deformed, eroded or oxidised. Lubricate the contacts with Molydal EL/5 (Industrial Service) grease or Vaseline.
7	Apparatus springs.	5 years. In any case, refer to the specific manuals of the apparatus.	Check that the seal placed on the spring register is intact.
8	Power connections.	3 years.	The connections must be tight and have no traces of overheating or oxidisation.
9	Insulation resistance measurement.	3 years.	See para. 9.2. (table).

For the routine checks and maintenance of apparatus and protection devices, please refer to the relative instruction manuals.

11. Maintenance operations

- **Maintenance must be carried out either by our personnel or by qualified skilled personnel. Should the customer's personnel be in charge of maintenance, the customer is responsible for any operation performed on the apparatus.**
- **While performing routine checks and maintenance operations, de-energise all the components.**
- **The spare parts shown in the table "List of spare parts/accessories" can only be replaced by our personnel. For the apparatus, consult the relevant manuals.**
- **Use original spare parts only.**

11.1. General information

Thanks to their simple design, PowrBox modules do not require any particular maintenance except for the "Periodic checks" in paragraph 10.
In order to avoid any hazardous deterioration of the insulating level, it is advisable to perform the first inspection six months after putting into service so as to establish the routine check intervals and the maintenance card.
Moreover, it is recommendable to follow the instructions for the single items according to the instruction manuals supplied with the apparatus.
It is advisable to keep a maintenance card and a service book containing all the operations performed along with date, description of possible anomalies, reference to the data needed to identify the apparatus (see chapter 2) etc.
For further information, refer to article 10 of the IEC 60694 Standards.
Should you have any problems, do not hesitate to contact us.
The electrical apparatus is easily affected by ambient conditions and can be damaged by abnormal service conditions.
Dust, heat, humidity, corrosive atmosphere, chemical residues, fumes, vibrations and other elements can influence apparatus and the life of the electrical apparatus.
Especially when combined, these conditions cause premature faults.
The most important rules to follow are:
– keep clean;
– keep dry;
– tighten bolts and connections;
– preserve the mechanical parts from excessive friction.

The instructions concerning the operations to be carried out on the various parts of the module, excluding the apparatus for which the relevant instruction manuals should be referred to.

11.2. Metallic structure

This comprises the supporting construction complete with removable panels, vertical and horizontal segregating sheets, hinges, doors and locks.
These parts can either be galvanised or painted.

Painted parts

The module doors are painted using epoxy powder paints whose minimum thickness is more than 40 µm.

Painting

Any damage, scratches or scrapes caused to the module external paint during installation can be touched up using the paint supplied with the special paint.

Touching up

On request, sufficient paint for touching up after installation can be supplied with the module. For its use follow the paint supplier's instructions. If these are not available, proceed as follows:
– clean the part to be touched up with damp abrasive paper and smooth off the edges of the damaged area;
– prepare the necessary amount of paint adding some catalyst (30% of the paint by weight);
– try the paint on a piece of sheet first and see the result. Any brush marks can be reduced by adding more solvent to the paint, which can be kept in the fridge for about 24 hours before it solidifies.

Cleaning

The painted components can be cleaned using either a cloth with water and soap or a paint solvent when very dirty. In this case, try the solvent on a surface out of sight to make sure it doesn't remove the paint coating.

Galvanised components

The galvanised and passivated components can be cleaned by means of a dry cloth.
Oil and grease can be removed using a cloth soaked in a suitable solvent. To polish the surface, repeat the previous operation.

11.3. Mechanical actuators

The mechanical actuators comprise all the mechanical parts of the module for carrying out the operations, locks and safety devices. The force, prevention and safety locks are all considered mechanical actuators.
The moving components are lubricated and tested while assembling the switchboard. Contact our personnel for mounting any accessories on a switchboard already installed.

The mechanical interlocks must not be ignored, but used properly so as to avoid any hazardous situations.

The mechanical interlocks must reach the final locked/unlocked positions without any intermediate stops.
They must be tested several times to check that they operate perfectly. The operating force required must also be checked.
Always make sure that the mechanical interlock position corresponds with the position of both the part controlled device and with the interlocked apparatus.
If excessive force is required to activate the device it means that the mechanism is prevented from moving.
In this case, please contact us.

12. Accessories and spare parts

- **Either our personnel or qualified skilled customer personnel must mount the spare parts and/or the accessories carefully following the instructions enclosed.**
- **Before performing any operation make sure that all the apparatus is open and de-energised (main circuit and auxiliary circuits).**

To order spare parts or accessories, always specify the serial number of the modules in which the spare parts are to be installed.
For any enquiry about spare part availability and ordering, please contact us.

12.1. Accessories and tools for operations

Standard completion accessories:

The module is usually supplied complete with:
– operating lever for any earthing switches;
– emergency opening lever for VM1circuit-breaker and VSC contactor.
– handle for circuit-breaker racking in/out;
– project diagrams and drawings;
– instructions for installation, service and maintenance;
– auxiliary position contacts (5 isolated changeover contacts plus 5 connected changeover contacts).

Completion items and accessories on request

On request, the module can be completed with supply of the following accessories:
– lifting eyebolts;
– truck for transporting the circuit-breaker out of switchboard;
– auxiliary contacts for signalling earthing switch open/closed (5-10 closing contacts plus 5-10 opening contacts);
– voltage indicators;
– anti-condensation heaters and thermostat (rated voltage values: 110-220 V);
– opening and closing pushbutton for VD4-HD4 circuit-breakers (to be specified at the time of ordering because they cannot be applied afterwards (only for PB/E);
– rear fan;
– electro-mechanical lock on the earthing switch

Other components

– shutter Fail-safe device;
– contact for signalling connected and key lock on earthing truck insertion
– electromechanical interlock on circuit-breaker unit door.

12.2 . Spare parts

For the apparatus, refer to the relative installation, service and maintenance instructions.
The module spare parts normally supplied as a rule are listed in the table below.

Description of spare part	Assembly by the customer
Earthing switch	No
Auxiliary contacts for limit switch inserted	Yes
Auxiliary contacts for limit switch isolated	Yes

For more information please contact:

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