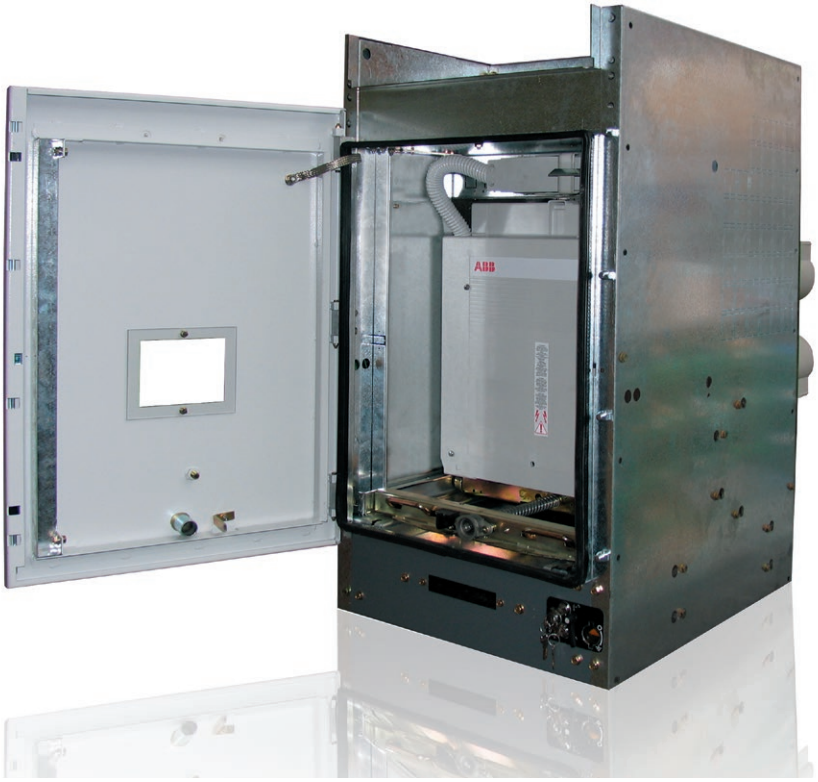
Medium voltage products

PowerCube type PB
Preassembled modules and enclosures for constructing medium voltage switchgear

Table of contents

1. General characteristics

PowerCube module type PB/M



PowerCube enclosure type PB/E

General information

PowerCube modules can be used to make metal-clad medium voltage air-insulated switchgear with the same rated current values as the enclosure.
The rated currents of the enclosures refer to versions tested in ABB UniSafe switchgear.
Use of the 4000 A PB3 enclosure allows a switchgear with the same rated current to be made so long as a suitable fan is installed in the rear part of the switchgear itself (consult ABB for further details).
PowerCube units type PB are available in two different versions: PB/M and PB/E.
PB/M: complete module that also includes the cable access cubicle, which can also be pre-engineered to house the withdrawable TV compartment.
PB/E: enclosure without cable access compartment thus unable to house the withdrawable VT which, being smaller in size, is more flexible and suitable for creating double-deck switchgear.

PowerCube modules are preassembled and tested in the factory. They can be used to make switchgear conforming to Standards IEC 62271-200, CEI 17-1, IEC 62271-1, CEI 17-6.

They are available with the following specifications:

Rated voltage (kV)	... 17.5	24
Rated current (A)	... 4000	... 2500
Rated short-time withstand current of main circuit (kA)	... 40 x 3s	... 31.5 x 3s
	... 50 x 1s	

The following apparatus can be installed in PowerCube modules:

- series VD4, VM1 and Vmax vacuum circuit-breakers
- series HD4 gas circuit-breakers
- series V-Contact VSC vacuum contactors
- service trolleys.

All the switching operations are carried out from the front of the module/enclosure.

Protection class

The protection classes of the PowerCube modules comply with IEC 60529 standards.

Interlocks

The PowerCube module is equipped with interlocks so as to prevent incorrect operations that could put the operators' safety at risk and compromise the efficiency and reliability of the actual equipment.
These interlocks inhibit the following operations:

- closing of the circuit-breaker unless the connected or isolated positions are reached
- plugging-out of the closed circuit-breaker
- plugging-in of the closed circuit-breaker
- door opening if the circuit-breaker is plugged in or halfway between being plugged in and isolated
- plugging-in of the circuit-breaker when the compartment door is open
- manual opening of the shutters.

Moreover, if the unit is equipped with an earthing switch:

- closing of the earthing switch if the circuit-breaker is plugged in or halfway between being plugged in and isolated
- plugging-in of the circuit-breaker with the earthing switch closed.
- opening of the feeder compartment door with the earthing switch open (PowerCube PB/M module only)
- opening of the earthing switch with the feeder compartment door open (PowerCube PB/M module only)

Note: some of the aforementioned interlocks are available on request or only available for certain versions.

Quality System

Conforms to ISO 9001 Standards, certified by an independent body.

Test laboratory

Conforms to ISO 45001 Standards, certified by an independent body.

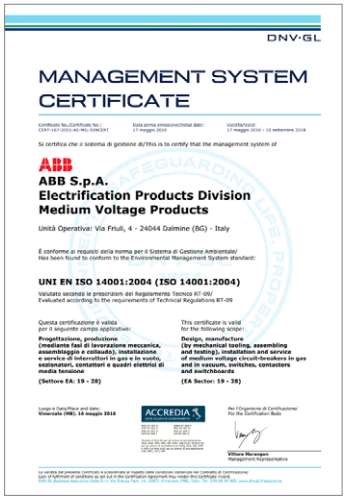
Environmental Management System

Conforms to ISO 14001 Standards, certified by an independent body.

Health and Safety Management System

Conforms to OHSAS 18001 Standards, certified by an independent body.


DNV·GL
MANAGEMENT SYSTEM CERTIFICATE
ABB S.p.A.
Electrification Products Division
Medium Voltage Products
UNI EN ISO 9001:2008 (ISO 9001:2008)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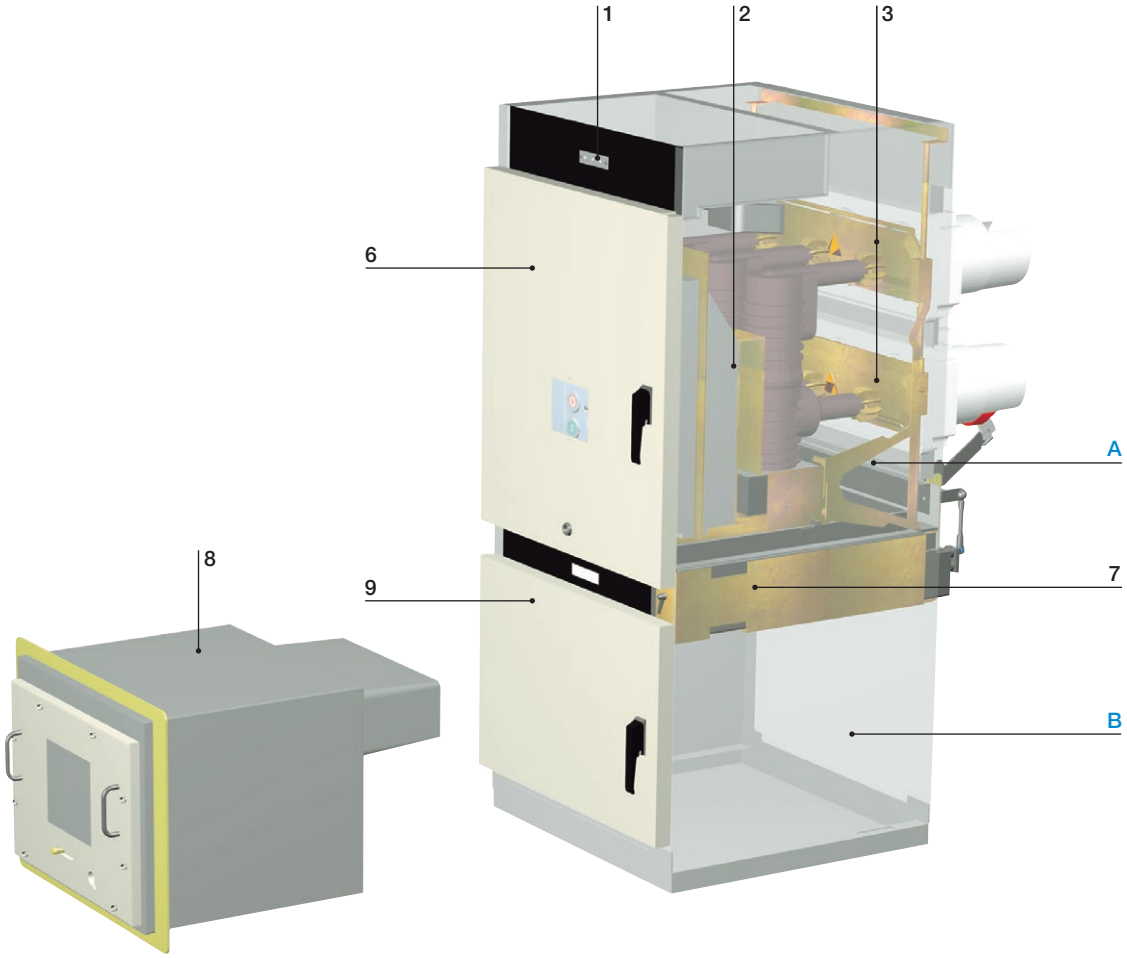
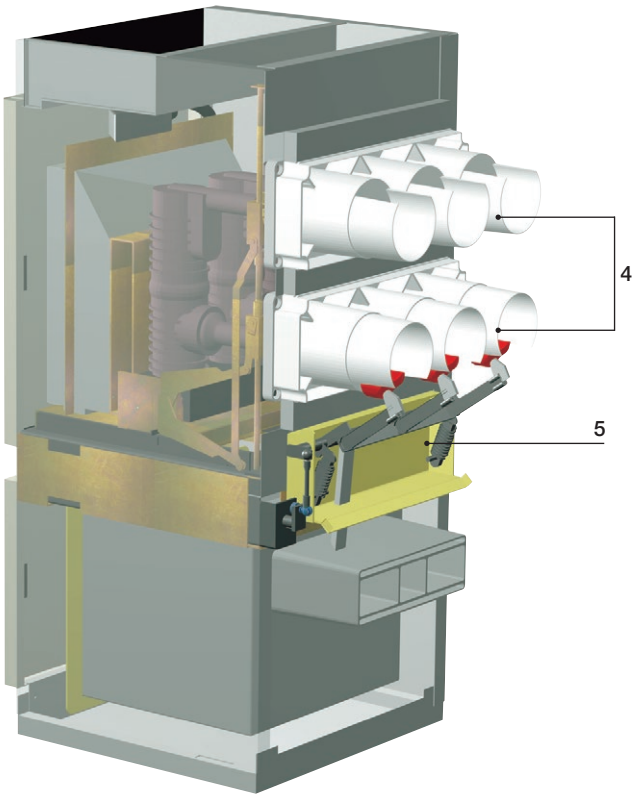
1. General characteristics





A Circuit-breaker compartment

1 Voltage signalling device (on request - for PowerCube PB/M only)
2 Circuit-breaker/contactor/trolley
3 Metal shutters
4 Lower and upper monoblocs
5 Earthing switch (on request)
6 Door
7 Fan (only for PB3 size 3600 A and 4000 A and for PB5 size 2500 A)

B Feeder compartment

8 TV compartment (on request - for PowerCube PB/M only)
9 Door

Electrical specifications of PowerCube unit

PowerCube Module/Enclosure			PB1	PB2	PB3	PB4	PB5	PB1/R	PB2/R	PB3/R	PB4/R	PB5/R	PB1/T	PB2/T	PB4/T
Module width		mm	600	750	1000	750	1000	600	750	1000	750	1000	600	750	750
Rated voltage	12	kV	■	■	■			■	■	■			■	■	
	17.5	kV	■	■	■			■	■	■			■	■	
	24	kV				■	■				■	■			■
Test Voltage at industrial frequency	28	kV	■	■	■			■	■	■			■	■	
	38	kV	■	■	■			■	■	■			■	■	
	50	kV				■	■				■	■			■
Impulse withstand voltage	75	kV	■	■	■			■	■	■			■	■	
	95	kV	■	■	■			■	■	■			■	■	
	125	kV				■	■				■	■			■
Short-time withstand current	25	kA (3s)	■	■	■	■	■								
	31.5	kA (3s)	■	■	■	■	■								
	40	kA (3s)		■	■										
	50	kA (1s)		■	■										
Peak current	63	kA	■	■	■	■	■								
	79	kA	■	■	■	■	■								
	100	kA		■	■										
	125	kA		■	■										
Rated currents	630	A	■	■		■									
	1250	A	■	■		■									
	1600	A		■			■								
	2000	A		■			■								
	2500	A			■		■ [1]								
	3150	A			■										
	3600	A			■ [1]										
	4000	A			■ [1]										

Not applicable

Electrical specifications of the earthing switch (on request)

PowerCube Module/Enclosure			PB1	PB2	PB3	PB4	PB5	PB1/R	PB2/R	PB3/R	PB4/R	PB5/R	PB1/T	PB2/T	PB4/T
Module width		mm	600	750	1000	750	1000	600	750	1000	750	1000	600	750	750
Short-time withstand current / Short-circuit making capacity	25	kA (3s)	■	■	■	■	■	■	■	■	■	■	■	■	■
	31.5	kA (3s)	■	■	■	■	■	■	■	■	■	■	■	■	■
	40	kA (1s)		■	■				■	■				■	
	50	kA (1s)		■	■				■	■				■	
Peak current	63	kA	■	■	■	■	■	■	■	■	■	■	■	■	■
	79	kA	■	■	■	■	■	■	■	■	■	■	■	■	■
	100	kA		■	■				■	■				■	
	125	kA		■	■				■	■				■	

[1] With forced ventilation in the circuit-breaker compartment: a further fan is required at the rear of the switchgear for 4000 A versions.

2. Main components

Series HD4 gas circuit-breaker

Series VD4 vacuum circuit-breaker

Series VM1 vacuum circuit-breaker

Circuit-breakers

PowerCube Units can be equipped with HD4 series withdrawable gas circuit-breakers and VD4, VM1 and Vmax series withdrawable vacuum circuit-breakers.
The circuit-breakers come with a trolley that allows them to be racked in and out of the switchgear with the door closed.
Both types feature an extremely sturdy, compact, light structure with excellent mechanical strength. The operating mechanism and poles are fixed to the metal structure, which also acts as a support for the mechanism that operates the moving contacts.

Series HD4 gas circuit-breakers

The series HD4 medium voltage circuit-breakers use sulphur hexafluoride gas to extinguish the electric arc and as an insulating medium. The interruption principle of HD4 circuit-breakers is based on the compression and self-blasting technique so as to obtain the best performance for all the current values used and ensure that the arc is extinguished gradually, with no restrikes, switching overvoltage or chopping current. These characteristics provide the circuit-breaker with long electrical life with limited dynamic, dielectric and thermal stress on the installation. The circuit-breaker poles, which form the interrupting part, are life-long sealed pressure devices (Standards IEC 62271-100 and CEI 17.1-1) and are maintenance-free. The mechanical operating device is the trip-free stored energy type with independent opening and closing regardless of the operator's action.

Series VD4 and VM1 vacuum circuit-breakers

VD4, and VM1 circuit-breakers use vacuum as breaking and insulating medium.
Thanks to the advanced manufacturing techniques with which they are made, vacuum circuit-breakers provide a high performance in all operating conditions. The vacuum interrupters are encapsulated in the poles. This construction protects the interrupters from shock, humidity and environmental pollution.
The circuit-breaker poles, which form the interrupting part, are life-long sealed pressure devices (Standards IEC 62271-100 and CEI 17.1-1) and are maintenance-free.
VD4 and eVD4 circuit-breakers feature a mechanical type of operating device while VM1 and eVM1 circuit-breakers have magnetic actuators. Both operating mechanisms are the trip-free stored energy type with independent opening and closing regardless of the operator's action.

Series Vmax/W vacuum circuit-breaker

Series V-Contact vacuum contactor

TV truck

Series Vmax/W vacuum circuit-breakers

Vmax circuit-breakers consist of an insulator block in which three vacuum interrupters are installed. The insulator block and operating mechanism are fixed to a frame. The vacuum interrupters house the contacts are form the circuit-breaker's arcing chamber. Vmax circuit-breakers feature a trip-free mechanical operating device of the stored energy type, with independent opening and closing regardless of the operator's action. The simply designed mechanical operating device is easy to use and can be customized with a wide range of easily and quickly installed accessories. All this makes the apparatus reliable, long-lasting and with little need for maintenance. Vmax circuit-breakers are used in electrical distribution systems to control and protect cables, overhead feeders, transformer and distribution substations, motors, tansformers, generators and capacitator banks. The circuit-breaker's vacuum interrupters, which form the interrupting part, are life-long sealed pressure devices (Standards IEC 62271-100 and CEI 17.1-1) and are maintenance-free.

Series V-Contact VSC vacuum contactors

V-Contact series withdrawable contactors are used in PowerCube PB1 Units up to 12 kV. The contactors are suitable for controlling a.c. devices that need to a considerable number of operations. They consist of a resin monobloc that houses the vacuum interrupters, the moving apparatus, the operating mechanism, the multivoltage feeder and the auxiliary accessories. The monobloc also acts as a support for fuses installation. Fuses of various different sizes can be used according to both DIN and BS Standards thanks to the relative adapters. The type of fuseholder (BS or DIN) must be specified at the time of order. The contactor is prevented from closing if even only one of the fuses is missing. Activation of one of the three fuses automatically opens the contactor. The compact, sturdy construction guarantees extremely long electrical and mechanical life.

TV trucks

PTT/W TV trucks are used in PB/T measuring units.
The TV trucks are supplied without voltage transformers but the customer can order them from ABB.
The ABB voltage transformers suitable for these units are:

– ABB TJP-F 4.0 (12 kV)
– ABB TJP-F 5.0 (17 kV)
– ABB TJP-F 6.0 (24 kV).

2. Main components

Service trolleys

The PowerCube range includes all the service trolleys required to complete the switchgear and to enable the service and maintenance operations to be carried out.
The trolleys come in four different versions:

- earthing without making capacity
- earthing with making capacity
- cable test
- isolation.

Note: earthing trolleys with making capacity and isolation are only available as versions derived from the HD4 series.

• Earthing trolley without making capacity “E”

These trolleys provide the same function as earthing switches without making capacity. They are therefore unable to close energized circuits in fault conditions. They are used to provide an additional fixed earth, as required by the running and servicing procedures of the installations, thus a further guarantee for the personnel. Use of these trolleys requires removal of the switching device from the switchgear (circuit-breaker or contactor) and its replacement with the trolley itself.
Units pre-engineered for use of the earthing trolley can be equipped with key lock which, if activated, prevents the trolley from racking-in.
This trolley is available in two versions:

- earthing of the main busbar system (E/U series)
- earthing of the power cables (E/L series)

During the racking-in phase, the earthing trolley of the main busbars only activates the upper shutter and earths the contacts connected to the upper branches (and thus to the main busbar system) by means of the switchgear structure.
During the racking-in phase, the earthing trolley of the power cables only activates the lower shutter and earths the contacts connected to the lower branches (and thus to the power cables) by means of the switchgear structure. These trolleys can be used in incoming or outgoing units, or in dedicated units.
They can also be used in bus-tie units. In this case, they earth one of the two sides of the main bus-bar system.

• Earthing trolley with making capacity “EM”

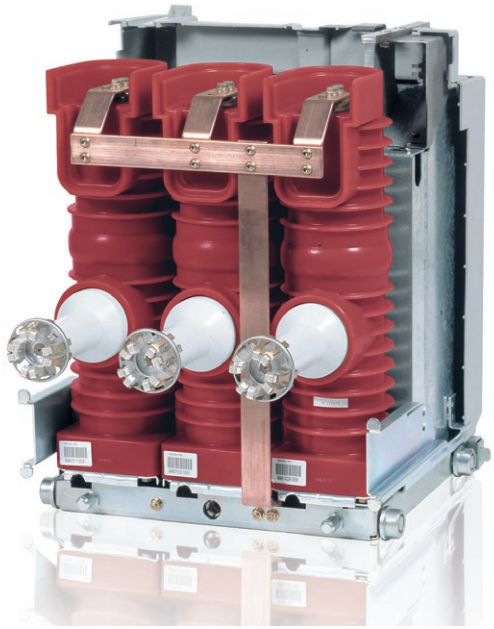
These trolleys act in the same way as earthing switches with making capacity. They consist of circuit-breakers with solely upper terminals (earthing of the main bus-bars) or lower terminals (earthing of the power cables). Contacts without terminals are short-citcuited by means of a copper bar earthed by means of the trolley of the device. They maintain all the characteristics of the circuit-breakers, such as full making capacity in energized circuits in fault conditions. They allow closing operations to be rapidly carried out with electrical remote controls.
Use of these trolleys requires removal of the switching device from the switchgear (circuit-breaker or contactor) and its replacement with the trolley itself. Units pre-engineered for use of the earthing trolley can be equipped with key lock which, if activated, prevents the trolley from racking-in.
This trolley is available in two versions:

- earthing of the main busbar system (EM/U series)
- earthing of the power cables (EM/L series)

During the racking-in phase, the earthing trolley of the main busbars only activates the upper shutter and arranges for the contacts connected to the upper branches (and thus to the main busbar system) to be earthed by means of a command.
During the racking-in phase, the earthing trolley of the power cables only activates the lower shutter and arranges for the contacts connected to the lower branches (and thus to the power cables) to be earthed by means of a command.
These trolleys can be used in incoming or outgoing units, or in dedicated units. They can also be used in bus-tie units. In this case, they earth one of the two sides of the main bus-bar system.

• Power cable test trolley “T”

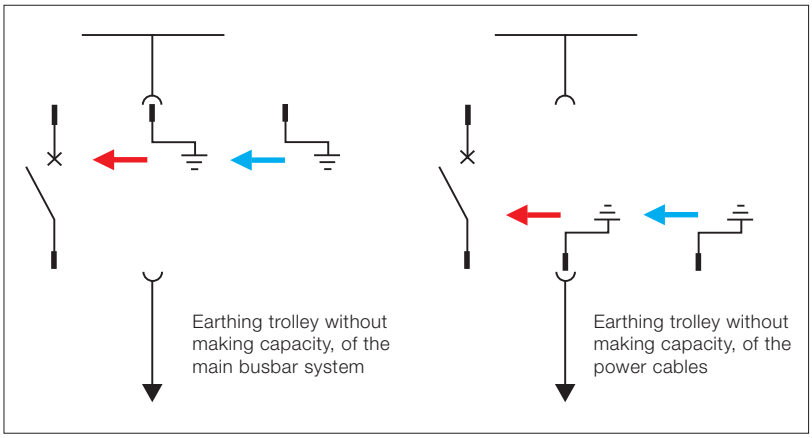
These trolleys allow insulation tests to be conducted without having to access the power grid cubicle or to disconnect the cables from the switchgear. Use of these trolleys requires removal of the switching device from the switchgear (circuit-breaker or contactor) and its replacement with the trolley.
During the racking-in phase, the trolley only lifts the lower shutter and, by means of the connectors with which it is

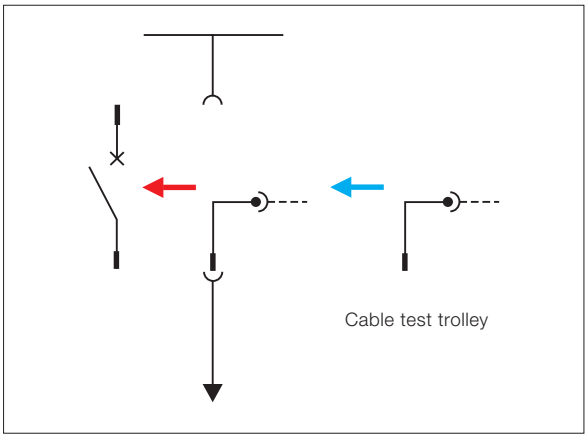


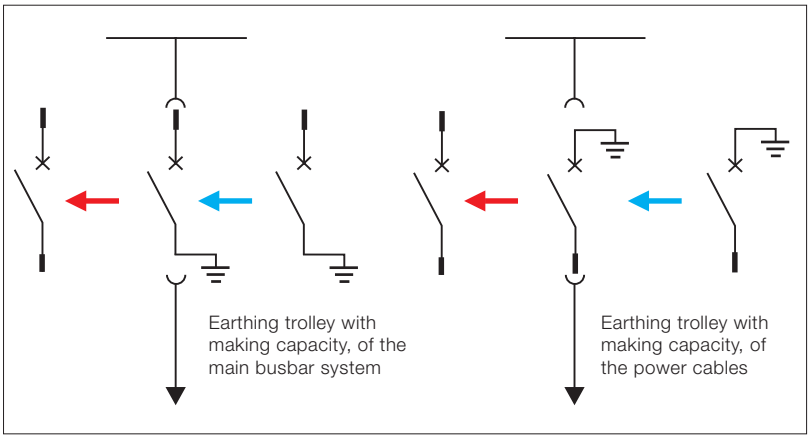
equipped, it allows the cables of the test apparatus to be connected by means of an insulating rod (the test apparatus and insulating rod are at the customer's charge). This trolley can only be used in incoming/outgoing units.

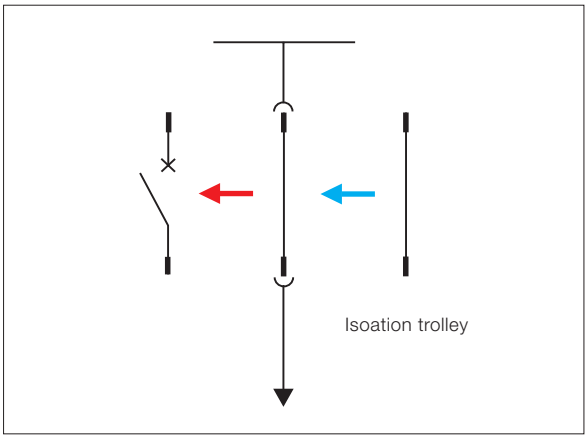
- **Isolation trolley "S"**

The isolation trolley allows the upper contacts of the switchgear to be directly connected to the lower ones. The connection is extremely safe since the poles of the circuit-breakers are used to insulate the connection bars from the outside environment. In incoming/outgoing units, the isolation trolley connects the main bus-bar system to the power cables while it connects the two sides of the bus-bar system in bus-tie units. This trolley can be used in switchgear for creating incoming/outgoing units without circuit-breaker in radial power grids, for cable connections between two switchgear standing in front of eachother, for creating interconnection units and bus-tie/riser units with double insulation (in this case, both units consist of bus-ties, one equipped with circuit-breaker and the other with the isolation trolley). Units pre-engineered for use of the isolation trolley can be equipped with key lock which, if activated, prevents the trolley from racking-in.





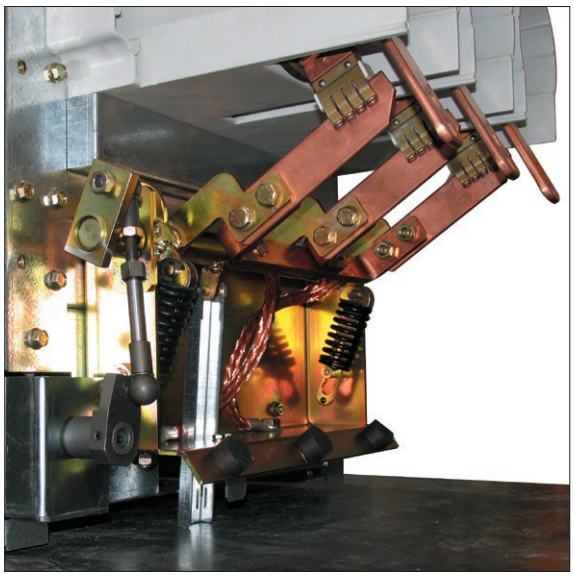


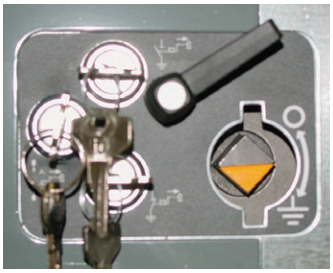


2. Main components

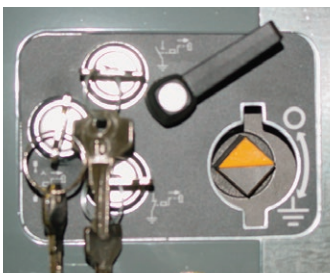
Earth switches

PowerCube units type PB can be equipped with an earthing switch. The earthing switch possesses short-circuit making capacity. On request, the opening and closing operations can be inhibited by means of a key lock. The earthing switch is controlled from the front of the module by means of a manual operation appropriately interlocked with the circuit-breaker's position.
The available accessories are listed in the tables from page 22 on.





Switch closed

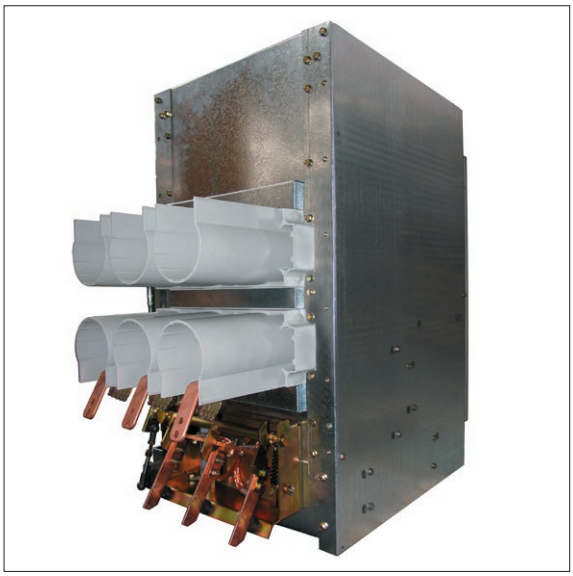


Switch open

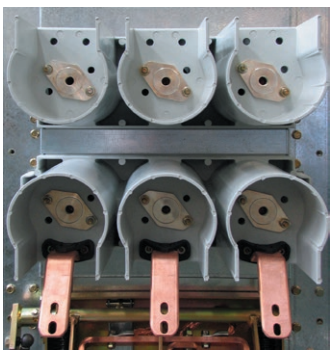
Fail-safe indication of the earthing switch (open/closed) visible from the front of the enclosure.

Insulator blocks and shutters

The insulator blocks consist of insulating bushings containing the upper and lower power connections of the circuit-breaker compartment, towards the power grid and busbar compartments respectively. TThe shutters are the metal type and are automatically activated when the circuit-breaker moves from the test/isolated position to the connected position and vice versa. They are always equipped with a fail-safe safety device to prevent them from being opened in the manual mode when the circuit-breaker has been removed. Each shutter can be locked by means of two separate padlocks (optional).



Segregating shutters with metal partitions



Insulator blocks (viewed from rear)

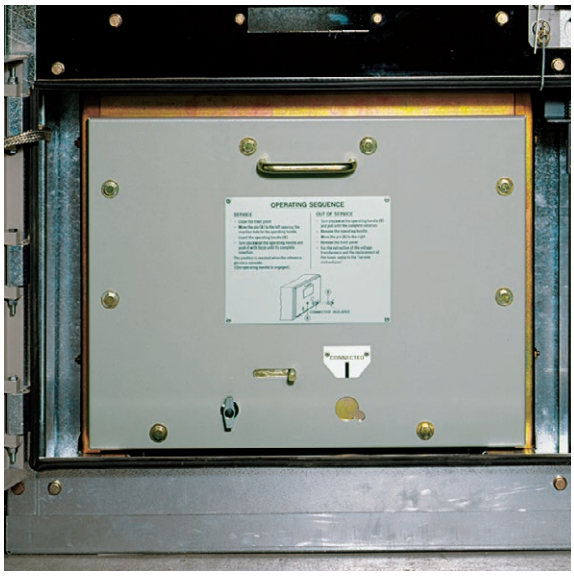
TV compartment (PB/M units only)

PowerCube modules can be equipped with a TV compartment with withdrawable voltage transformers.
The voltage transformers are the dedicated type and are protected by fuses. The fuses can be replaced when the switchgear is in service since the fuse compartment is segregated from the other compartments by metal partitions.
The TV compartment is available for 750 mm and 1000 mm width PowerCube modules.

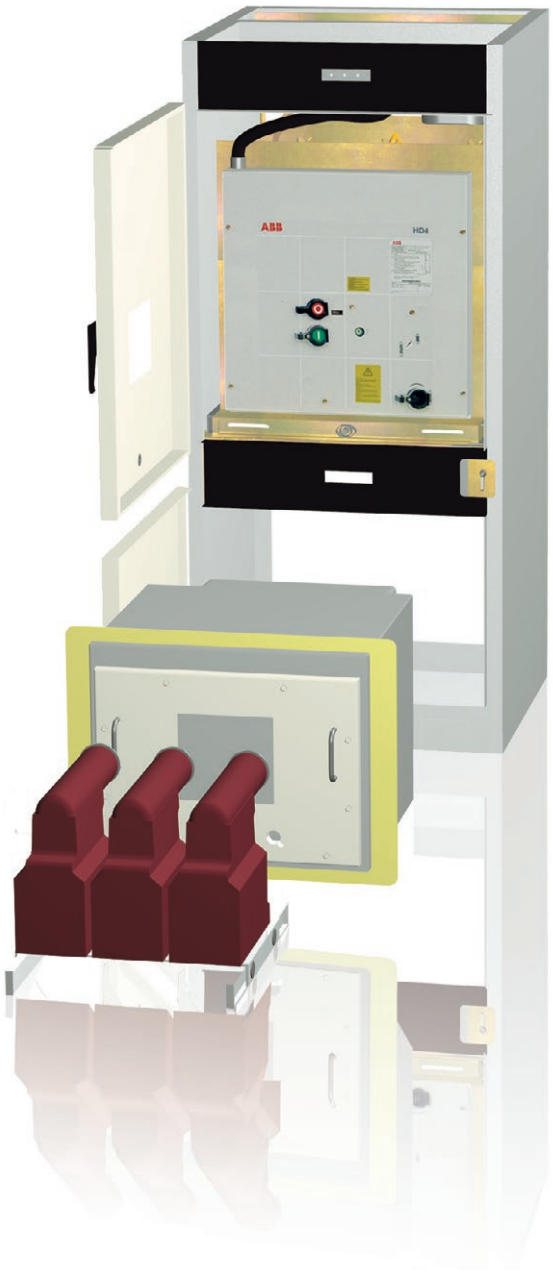
I trasformatori di tensione non sono forniti ma possono essere ordinati ad ABB direttamente dal cliente.
I trasformatori di tensione ABB adatti per queste unità sono:

– ABB TJP 4.3 (12 kV)
– ABB TJP 5.3 (17 kV)
– ABB TJP 6.3 (24 kV)

The available accessories are listed in the tables from page 22 on.



TV compartment with withdrawable voltage transformers

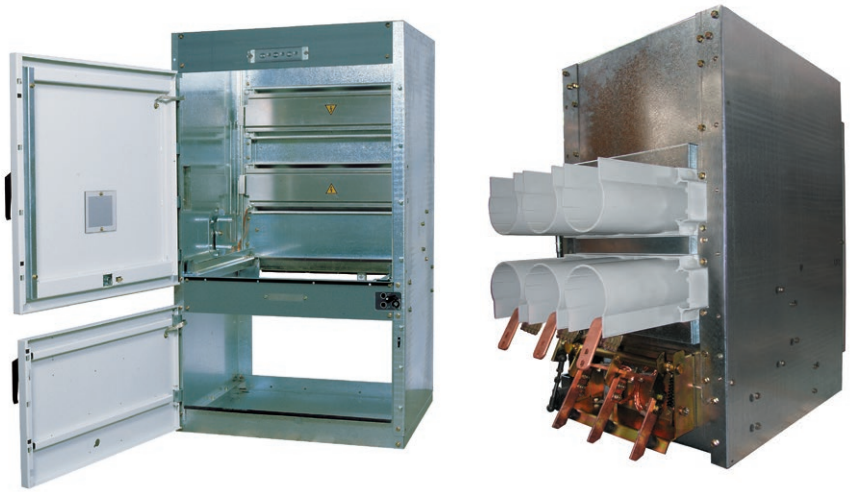


3. Available types and apparatus

Notes for use of PowerCube Units type PB

- **PowerCube Units type PB1 ... PB5** are recommended for making switchgear units of the incoming, outgoing and bus-tie type.
- **PowerCube Units type PR1 ... PR5** are recommended for making switchgear units of the riser, measurement and direct arrival in the busbar type.

Example of a PowerCube Unit type PB1 ... PB5 (front and rear views)

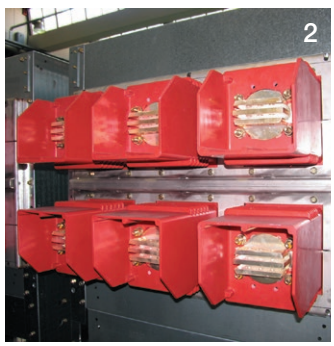


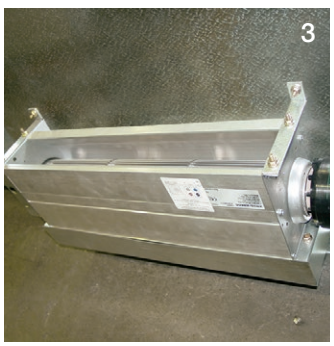
Example of a PowerCube Unit type PR1 ... PR5 (front and rear views)

1 Insulator blocks with contacts for rated current of up to 2500 A.

2 Insulator blocks with contacts for rated current of up to 4000 A.

3 Fan. Pre-installed in PB3 units size 3600 A and PB5 units size 2500 A. A further must be installed in the rear of the switchgear for 4000 A PB3 units (at the customer's charge).





Tab. 1 - VD4 withdrawable circuit-breakers for PowerCube units type PB(*)

			Rated current of VD4 circuit-breakers (40 °C) [A]								
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 20 25 31.5	16 20 25 31.5	630 630 630 630						VD4/P 12.06.16 p150 VD4/P 12.06.20 p150 VD4/P 12.06.25 p150 VD4/P 12.06.32 p150	VD4/P 17.06.16 p150 VD4/P 17.06.20 p150 VD4/P 17.06.25 p150 VD4/P 17.06.32 p150	PB 1/E PB 1/M
	16 20 25 31.5	16 20 25 31.5	1250 1250 1250 1250						VD4/P 12.12.16 p150 VD4/P 12.12.20 p150 VD4/P 12.12.25 p150 VD4/P 12.12.32 p150	VD4/P 17.12.16 p150 VD4/P 17.12.20 p150 VD4/P 17.12.25 p150 VD4/P 17.12.32 p150	
	16 20 25 31.5	16 20 25 31.5		630 630 630 630					VD4/W 12.06.16 p210 VD4/W 12.06.20 p210 VD4/W 12.06.25 p210 VD4/W 12.06.32 p210	VD4/W 17.06.16 p210 VD4/W 17.06.20 p210 VD4/W 17.06.25 p210 VD4/W 17.06.32 p210	PB 2/E PB 2/M
	16 20 25 31.5 40 50	16 20 25 31.5 40 50		1250 1250 1250 1250 1250 1250					VD4/W 12.12.16 p210 VD4/W 12.12.20 p210 VD4/W 12.12.25 p210 VD4/W 12.12.32 p210 VD4/W 12.12.40 p210 –	VD4/W 17.12.16 p210 VD4/W 17.12.20 p210 VD4/W 17.12.25 p210 VD4/W 17.12.32 p210 VD4/W 17.12.40 p210 –	
	40 50	40 50			1250 1250				VD4/P 12.12.40 p210 VD4/P 12.12.50 p210	VD4/P 17.12.40 p210 VD4/P 17.12.50 p210	
	20 25 31.5 40 50	20 25 31.5 40 50			1600 1600 1600 1600 1600				VD4/P 12.16.20 p210 VD4/P 12.16.25 p210 VD4/P 12.16.32 p210 VD4/P 12.16.40 p210 VD4/P 12.16.50 p210	VD4/P 17.16.20 p210 VD4/P 17.16.25 p210 VD4/P 17.16.32 p210 VD4/P 17.16.40 p210 VD4/P 17.16.50 p210	
	20 25 31.5 40 50	20 25 31.5 40 50			2000 2000 2000 2000 2000				VD4/P 12.20.20 p210 VD4/P 12.20.25 p210 VD4/P 12.20.32 p210 VD4/P 12.20.40 p210 VD4/P 12.20.50 p210	VD4/P 17.20.20 p210 VD4/P 17.20.25 p210 VD4/P 17.20.32 p210 VD4/P 17.20.40 p210 VD4/P 17.20.50 p210	
	20 25 31.5 40 50	20 25 31.5 40 50				2500 2500 2500 2500 2500			VD4/P 12.25.20 p275 VD4/P 12.25.25 p275 VD4/P 12.25.32 p275 VD4/P 12.25.40 p275 VD4/P 12.25.50 p275	VD4/P 17.25.20 p275 VD4/P 17.25.25 p275 VD4/P 17.25.32 p275 VD4/P 17.25.40 p275 VD4/P 17.25.50 p275	PB 3/E PB 3/M
	31.5 40 50	31.5 40 50				3150 3150 3150			VD4/W 12.32.32 p275 VD4/W 12.32.40 p275 VD4/W 12.32.50 p275	VD4/W 17.32.32 p275 VD4/W 17.32.40 p275 VD4/W 17.32.50 p275	
	31.5 40 50	31.5 40 50				3600(1) 3600(1) 3600(1)			VD4/W 12.32.32 p275 VD4/W 12.32.40 p275 VD4/W 12.32.50 p275	VD4/W 17.32.32 p275 VD4/W 17.32.40 p275 VD4/W 17.32.50 p275	
	31.5 40 50	31.5 40 50				4000(1) 4000(1) 4000(1)			VD4/W 12.32.32 p275 VD4/W 12.32.40 p275 VD4/W 12.32.50 p275	VD4/W 17.32.32 p275 VD4/W 17.32.40 p275 VD4/W 17.32.50 p275	
24	16 20 25	16 20 25					630 630 630		VD4/P 24.06.16 p210 VD4/P 24.06.20 p210 VD4/P 24.06.25 p210	– – –	PB 4/E PB 4/M
	16 20 25 31.5	16 20 25 31.5					1250 1250 1250 1250		VD4/P 24.12.16 p210 VD4/P 24.12.20 p210 VD4/P 24.12.25 p210 VD4/P 24.12.32 p210	– – – –	
	16 20 25 31.5	16 20 25 31.5						1600 1600 1600 1600	VD4/P 24.16.16 p275 VD4/P 24.16.20 p275 VD4/P 24.16.25 p275 VD4/P 24.16.32 p275	– – – –	PB 5/E PB 5/M
	16 20 25 31.5	16 20 25 31.5						2000 2000 2000 2000	VD4/P 24.20.16 p275 VD4/P 24.20.20 p275 VD4/P 24.20.25 p275 VD4/P 24.20.32 p275	– – – –	
	16 20 25 31.5	16 20 25 31.5						2500(2) 2500(2) 2500(2) 2500(2)	VD4/P 24.25.16 p275 VD4/P 24.25.20 p275 VD4/P 24.25.25 p275 VD4/P 24.25.32 p275	– – – –	

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(*) PowerCube units are not designed for the “powered trolley” application for VD4 circuit-breakers.
(1) 3600 A with fan pre-installed in the PB3 units. A further fan must be installed in the rear of the switchgear for 4000 A versions (at the customr’s charge).
(2) 2500 A with fan pre-installed in the PB5 units.

3. Available types and apparatus

Tab. 2 - HD4 withdrawable circuit-breakers for PowerCube units type PB

			Rated current of HD4 circuit-breakers (40 °C) [A]								
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 25 31.5	16 25 31.5	630 630 630						HD4/W 12.06.16 p150 HD4/W 12.06.25 p150 HD4/W 12.06.32 p150	HD4/W 17.06.16 p150 HD4/W 17.06.25 p150 HD4/W 17.06.32 p150	PB 1/E PB 1/M
	16 25 31.5	16 25 31.5	1250 1250 1250						HD4/W 12.12.16 p150 HD4/W 12.12.25 p150 HD4/W 12.12.32 p150	HD4/W 17.12.16 p150 HD4/W 17.12.25 p150 HD4/W 17.12.32 p150	
	16 25 31.5	16 25 31.5		630 630 630					HD4/W 12.06.16 p210 HD4/W 12.06.25 p210 HD4/W 12.06.32 p210	HD4/W 17.06.16 p210 HD4/W 17.06.25 p210 HD4/W 17.06.32 p210	PB 2/E PB 2/M
	16 25 31.5 40 50	16 25 31.5 40 50		1250 1250 1250 1250 1250					HD4/W 12.12.16 p210 HD4/W 12.12.25 p210 HD4/W 12.12.32 p210 HD4/W 12.12.40 p210 HD4/W 12.12.50 p210	HD4/W 17.12.16 p210 HD4/W 17.12.25 p210 HD4/W 17.12.32 p210 HD4/W 17.12.40 p210 HD4/W 17.12.50 p210	
	40 50	40 50			1250 1250				– –	– –	
	16 25 31.5 40 50	16 25 31.5 40 50			1600 1600 1600 1600 1600				HD4/W 12.16.16 p210 HD4/W 12.16.25 p210 HD4/W 12.16.32 p210 HD4/P 12.16.40 p210 HD4/P 12.16.50 p210	HD4/W 17.16.16 p210 HD4/W 17.16.25 p210 HD4/W 17.16.32 p210 HD4/P 17.16.40 p210 HD4/P 17.16.50 p210	
	16 25 31.5 40 50	16 25 31.5 40 50			2000 2000 2000 2000 2000				HD4/W 12.20.16 p210 HD4/W 12.20.25 p210 HD4/W 12.20.32 p210 HD4/P 12.20.40 p210 HD4/P 12.20.50 p210	HD4/W 17.20.16 p210 HD4/W 17.20.25 p210 HD4/W 17.20.32 p210 HD4/P 17.20.40 p210 HD4/P 17.20.50 p210	
	25 31.5 40 50	25 31.5 40 50				2500 2500 2500 2500			HD4/P 12.25.25 p275 HD4/P 12.25.32 p275 HD4/P 12.25.40 p275 HD4/P 12.25.50 p275	HD4/P 17.25.25 p275 HD4/P 17.25.32 p275 HD4/P 17.25.40 p275 HD4/P 17.25.50 p275	PB 3/E PB 3/M
	31.5 40 50	31.5 40 50				3150 3150 3150			HD4/W 12.32.32 p275 HD4/W 12.32.40 p275 HD4/W 12.32.50 p275	HD4/W 17.32.32 p275 HD4/W 17.32.40 p275 HD4/W 17.32.50 p275	
	31.5 40 50	31.5 40 50				3600[1] 3600[1] 3600[1]			HD4/W 12.32.32 p275 HD4/W 12.32.40 p275 HD4/W 12.32.50 p275	HD4/W 17.32.32 p275 HD4/W 17.32.40 p275 HD4/W 17.32.50 p275	
	31.5 40 50	31.5 40 50				4000[1] 4000[1] 4000[1]			HD4/W 12.32.32 p275 HD4/W 12.32.40 p275 HD4/W 12.32.50 p275	HD4/W 17.32.32 p275 HD4/W 17.32.40 p275 HD4/W 17.32.50 p275	
24	16 20 25	16 20 25					630 630 630		HD4/W 24.06.16 p210 HD4/W 24.06.20 p210 HD4/W 24.06.25 p210	– – –	PB 4/E PB 4/M
	16 20 25 31,5 40[3]	16 20 25 31,5 40[3]					1250 1250 1250 1250 1250		HD4/W 24.12.16 p210 HD4/W 24.12.20 p210 HD4/W 24.12.25 p210 HD4/P 24.12.32 p210 HD4/P 24.12.40 p210	– – – – –	
	16 20 25 31.5 40[3]	16 20 25 31.5 40[3]						1600 1600 1600 1600 1600	HD4/P 24.16.16 p275 HD4/P 24.16.20 p275 HD4/P 24.16.25 p275 HD4/P 24.16.32 p275 HD4/P 24.16.40 p275	– – – – –	PB 5/E PB 5/M
	16 20 25 31.5 40[3]	16 20 25 31.5 40[3]						2000 2000 2000 2000 2000	HD4/P 24.20.16 p275 HD4/P 24.20.20 p275 HD4/P 24.20.25 p275 HD4/P 24.20.32 p275 HD4/P 24.20.40 p275	– – – – –	
	16 20 25 31.5 40[3]	16 20 25 31.5 40[3]						2500[2] 2500[2] 2500[2] 2500[2] 2500[2]	HD4/P 24.25.16 p275 HD4/P 24.25.20 p275 HD4/P 24.25.25 p275 HD4/P 24.25.32 p275 HD4/P 24.25.40 p275	– – – – –	

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(1) 3600 A with fan pre-installed in the PB3 modules. A further fan must be installed in the rear of the switchgear for 4000 A versions (at the customr's charge).
(2) 2500 A with fan pre-installed in the PB5 modules.
(3) Unit without earthing switch, with IP30 door.

Tab. 3 - VM1 withdrawable circuit-breakers for PowerCube units type PB

			Rated current of **VM1** circuit-breakers (40 °C) [A]								
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	16	16	630						VM1/P 12.06.16 p150	VM1/P 17.06.16 p150	**PB 1/E**
17.5	20	20	630						VM1/P 12.06.20 p150	VM1/P 17.06.20 p150	**PB 1/M**
	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**
	20	20		630					VM1/W 12.06.20 p210	VM1/W 17.06.20 p210	**PB 2/M**
	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**
	25	25				2500			VM1/P 12.25.25 p275	VM1/P 17.25.25 p275	**PB 3/M**
	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]			–	–	
24	16	16					630		VM1/P 24.06.16 p210	–	**PB 4/E**
	20	20					630		VM1/P 24.06.20 p210	–	**PB 4/M**
	25	25					630		VM1/P 24.06.25 p210	–	
	16	16					1250		VM1/P 24.12.16 p210	–	
	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	–	**PB 5/E**
	20	20						1600	VM1/P 24.16.20 p275	–	**PB 5/M**
	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	–	
	25	25						2000	VM1/P 24.20.25 p275	–	
	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 Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(1) 3600 A with fan pre-installed in the PB3 modules. A further fan must be installed in the rear of the switchgear for 4000 A versions (at the customr's charge).
(2) 2500 A with fan pre-installed in the PB5 modules.
(3) Ask ABB whether available.

3. Available types and apparatus

Tab. 4 - Vmax withdrawable circuit-breakers for PowerCube units type PB

			Rated current of the **Vmax** circuit-breakers (40 °C) [A]						**Vmax** for **PowerCube**		
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**
	16	16	630						Vmax/W 12.06.16 p150	Vmax/W 17.06.16 p150[1]	**PB1/E**
	20	20	630						Vmax/W 12.06.20 p150	Vmax/W 17.06.20 p150[1]	**PB1/M**
	25	25	630						Vmax/W 12.06.25 p150	Vmax/W 17.06.25 p150[1]	
	31.5	31.5	630						Vmax/W 12.06.32 p150	Vmax/W 17.06.32 p150[1]	
	16	16	1250						Vmax/W 12.12.16 p150	Vmax/W 17.12.16 p150[1]	
	20	20	1250						Vmax/W 12.12.20 p150	Vmax/W 17.12.20 p150[1]	
	25	25	1250						Vmax/W 12.12.25 p150	Vmax/W 17.12.25 p150[1]	
	31.5	31.5	1250						Vmax/W 12.12.32 p150	Vmax/W 17.12.32 p150[1]	

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

[1] Ask ABB whether available.

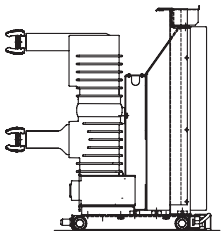
Tab. 5 - V-Contact withdrawable contactors for PowerCube units type PB

			Rated current of V-Contact circuit-breakers (40 °C) [A]							
kV	**Isc (kA)**[2]	**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[3]						VSC7/P	**PB 1/E**
	20	6	400[3]							**PB 1/M**
	25	6	400[3]							
	31.5	6	400[3]							
12	16	6	400[3]						VSC12/P	
	20	6	400[3]							
	25	6	400[3]							
	31.5	6	400[3]							

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

[1] Ask ABB whether available.
[2] Guaranteed, using suitable fuses.
[3] The rated current is liable to be derated depending on the rated current of the fuses.

Tab. 6 - Isolation trolleys for PowerCube units type PB



			Rated current of the isolation trolleys (40 °C) [A]							
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	**Isoation trolley**	**PowerCube**
12 **17.5**	16 20 25 31.5	16 20 25 31.5	...1250						S-HD4/W 17.12.32 p150	**PB 1/E** **PB 1/M**
	16 20 25 31.5 40 50	16 20 25 31.5 40 50		...1250					S-HD4/W 17.12.32 p210 S-HD4/W 17.12.50 p210	**PB 2/E** **PB 2/M**
	16 20 25 31.5 40 50	16 20 25 31.5 40 50			...2000				S-HD4/W 17.20.32 p210 S-HD4/P 17.20.50 p210	
	16 20 25 31.5 40 50	16 20 25 31.5 40 50				...2500			S-HD4/P 17.25.50 p275	**PB 3/E** **PB 3/M**
	16 20 25 31.5 40 50	16 20 25 31.5 40 50				...3150			S-HD4/P 17.32.50 p275	
	31.5 40 50	31.5 40 50				...3600(1) ...3600(1)			S-HD4/P 17.32.50 p275	
	31.5 40 50	31.5 40 50				...4000(1) ...4000(1)			S-HD4/P 17.32.50 p275	
24	16 20 25	16 20 25					...1250		S-HD4/W 24.12.25 p210	**PB 4/E** **PB 4/M**
	16 20 25	16 20 25						...2000	S-HD4/P 24.20.25 p275	**PB 5/E** **PB 5/M**
	16 20 25	16 20 25						...2500(2)	S-HD4/P 24.25.25 p275	

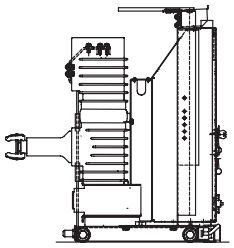
W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(1) 3600 A with fan pre-installed in the PB3 modules. A further fan must be installed in the rear of the switchgear for 4000 A versions (at the customr's charge).

(2) 2500 A with fan pre-installed in the PB5 modules.

3. Available types and apparatus

Tab. 7 - Earthing trolleys with making capacity for PowerCube units type PB

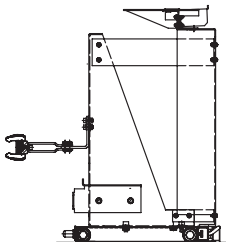


			Rated current of the earthing trolleys (40 °C) [A]							
kV	**Isc (kA)**	**Icw (kA)**	W=600 p=150 u/l=205 H=260 Ø=35	W=750 p=210 u/l=310 H=280 Ø=35	W=750 p=210 u/l=310 H=280 Ø=79	W=1000 p=275 u/l=310 H=280 Ø=109	W=750 p=210 u/l=310 H=325 Ø=35	W=1000 p=275 u/l=310 H=345 Ø=79	**Earthing trolley**[1]	**PowerCube**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

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(1) EM-L... = Earthing trolley with making capacity and lower insulating bushings (for earthing the cables).
EM-U... = Earthing trolley with making capacity and upper insulating bushings (for earthing the busbar system).
(2) Ask ABB.

Tab. 8 - Earthing trolleys without making capacity for PowerCube units type PB



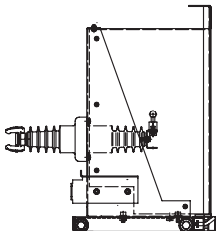
			Rated current of the earthing trolleys (40 °C) [A]							
kV	**Isc (kA)**	**Icw (kA)**	W=600 p=150 u/l=205 H=260 Ø=35	W=750 p=210 u/l=310 H=280 Ø=35	W=750 p=210 u/l=310 H=280 Ø=79	W=1000 p=275 u/l=310 H=280 Ø=109	W=750 p=210 u/l=310 H=325 Ø=35	W=1000 p=275 u/l=310 H=345 Ø=79	**Earthing trolley[1]**	**PowerCube**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

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(1) EM-L... = Earthing trolley without making capacity and with lower insulating bushings (for earthing the cables).
EM-U... = Earthing trolley without making capacity and with upper insulating bushings (for earthing the busbar system).
(2) Ask ABB.

3. Available types and apparatus

Tab. 9 - Cable test trolleys for PowerCube units type PB



			Rated current of the cable test trolleys (A - 40 °C)							
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 test trolley	PowerCube
12 17.5	16 20 25 31.5	16 20 25 31.5	...1250						T/W 17.12 p150	PB 1/E PB 1/M
	16 20 25 31.5 40 50	16 20 25 31.5 40 50		...1250					T/W 17.12 p210	PB 2/E PB 2/M
									T/W 17.12 p210[1]	
	16 20 25 31.5 40 50	16 20 25 31.5 40 50			...2000				T/W 17.20 p210	
									T/P 17.20 p210	
	16 20 25 31.5 40 50	16 20 25 31.5 40 50				2500			T/P 17.32 p275	PB 3/E PB 3/M
	16 20 25 31.5 40 50	16 20 25 31.5 40 50				3150				
24	16 20 25	16 20 25					...1250		T/W 24.12 p210	PB 4/E PB 4/M
	16 20 25	16 20 25						...2000	T/W 24.20 p275	PB 5/E PB 5/M
	16 20 25	16 20 25						...2500[1]	T/P 24.25 p275	

W = Width of PowerCube Units type PB.
P = Horizontal center distance between the circuit-breaker poles.
U/L = Distance between the upper and lower terminal.
H = Distance between the lower terminal and earth.
Ø = Diameter of the contacts in the insulator block of PowerCube Units type PB.

(1) Ask ABB.

Tab. 10 - Trucks for measuring TV type TJP-F X.3

kV	Isc/Icw	Dimensions	Truck type	PowerCube
12 17.5	16 20 25 31.5	W=600mm P=150mm h=405mm	PTT1/W	PB1/TE PB1/TM
12 17.5	40 50	W=750mm P=210mm h=590mm	PTT2/W	PB2/TE PB2/TM
24	16 20 25 31.5	W=600mm P=210mm h=635mm	PTT4/W	PB4/TE PB4/TM

Tab. 11 - PowerCube Units type PB without apparatus

Characteristics of the enclosure/module				Configuration				
Rated voltage (kV)	Width (mm)	Rated current (A)	Isc (kA)[1]	Icw (kA x 3s/1s)[1]	Riser or direct arrival with earthing switch	Riser or direct arrival	Measuring unit[2] with withdrawable TV compartment	Measuring unit[2] with withdrawable TV compartment and earthing switch
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
12-17.5	750	2000	31.5	31.5	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM
12-17.5	750	2000	40-50	40-50	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM	PB2/RE - PB2/RM
12-17.5	1000	4000	31.5	31.5	PB3/RE - PB3/RM	PB3/RE - PB3/RM	PB3/RE - PB3/RM	PB3/RE - PB3/RM
12-17.5	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	31.5	31.5	PB4/RE - PB4/RM	PB4/RE - PB4/RM	PB4/RE - PB4/RM	PB4/RE - PB4/RM
24	1000	2500	31.5	31.5	PB5/RE - PB5/RM	PB5/RE - PB5/RM	PB5/RE - PB5/RM	PB5/RE - PB5/RM

[1] On earthing switch, if requested.
[2] The TV cubicle cannot be supplied for any of the PB/RE units or for the PB1/RM unit. Construction is at the customer's charge.

3. Available types and apparatus

Accessories

1a Signalling contacts for circuit-breaker/contactor in connected/isolated position

The supply always comprises 10 contacts (5NO+5NC in change-over configuration) for signalling the connected status and another ten for signalling the isolated status. A second group of 10 contacts is available on request as an accessory for both signals.

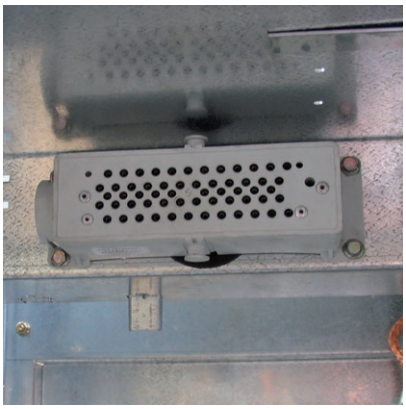
PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

Specifications		
Rated voltage	V	up to 250 a.c. (50-60 Hz)/d.c.
Insulation voltage 50 Hz/1 min	V	2000 (towards earth)
Rated current	A	5
Rated thermal current	A	17.5
Breaking capacity of auxiliary contacts		
Resistive load		
48 V (d.c.)	A	3
110 V (d.c.)	A	0.8
220 V (d.c.)	A	0.5
Inductive load: L/R = 5 ms		
48 V (d.c.)	A	1.5
110 V (d.c.)	A	0.5
220 V (d.c.)	A	0.3

1b Anti-racking-in lock for circuit-breakers with lower rated current than that of the cubicle or for apparatus not envisaged for the cubicle itself

Consists of a code on the socket that prevents the plug from being inserted if the rated current of the apparatus is incompatible with that of the PowerCube unit.
In order to function correctly, this lock requires a counter-part on the circuit-breaker, which consists of the code on the plug and the locking magnet on the trolley (-RL2). The plug cannot be removed when the apparatus is connected.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

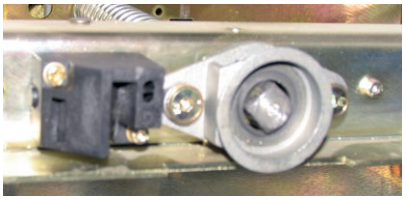


1c Lock to prevent racking-in with the door open

Prevents withdrawable apparatus from being switched from the withdrawn position to the plugged-in position (and vice versa) with the door open. In order to function correctly, tis lock requires a counterpart on the circuit-breaker.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incoming/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

Lock installed in internal part of door



Counterpart on the apparatus

1d Safety device for shutters (fail-safe)

It is a mechanical device that is always supplied and that prevents a person from opening the shutters in the manual mode in the absence of the isolatable apparatus.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incoming/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

3. Available types and apparatus

Accessories that must be obligatorily indicated when ordering

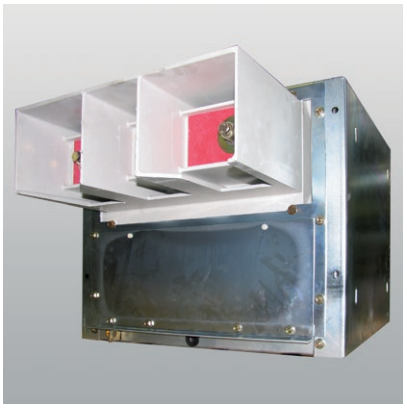
2 Withdrawable VT compartment (includes VT trolley)

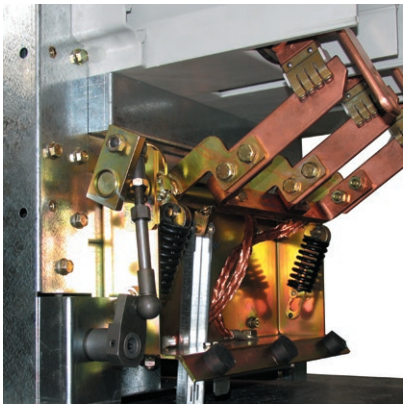
Can only be applied to module units (PB/M) for which the necessary presetting must be requested.
The voltage transformers (TV) are not included.
Use ABB VT:
TJP 4.3 – 12 kV units
TJP 5.3 – 17 kV units
TJP 6.3 – 24 kV units

3 Earthing switch ST/E with making capacity

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		no
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	no
PB2/T	750	■	■			■	no
PB4/T	750			■		■	no

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	yes
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes





4 Key locks on earthing switches

Two locks are available when the earthing switch is required:

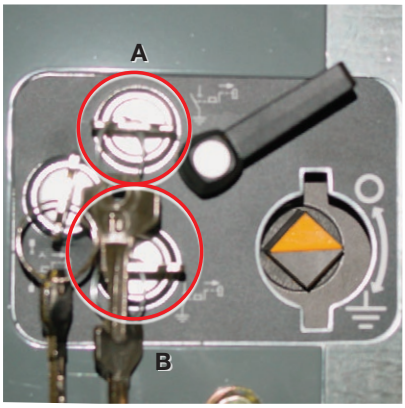
a) Key lock released when switch is open

b) Key lock released when switch is closed

Only one of the two locks or both may be ordered.

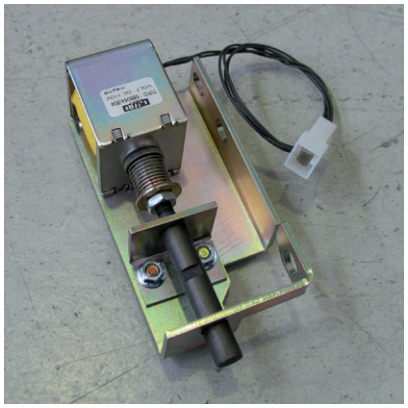
The application can be supplied with a reinforced key on request.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom- ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	yes
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes



5 Electromechanical lock on the earthing switch (BED)

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom- ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	yes
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes



Rated voltage		
d.c.	V	24-30-48-60-110-125-220-250
a.c. 50 Hz	V	110-220
a.c. 60 Hz	V	110-220
Rated power		
d.c.	W	10.5 ± 1.5
a.c.	VA	20 ± 3

3. Available types and apparatus

6 Auxiliary contacts for the earthing switch

Units equipped with earthing switches are available:

a) Pack of 5 auxiliary contacts

b) Pack of 10 auxiliary contacts.

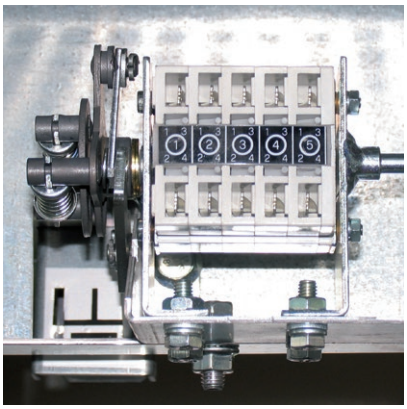
The customer can easily change the settings of the auxiliary contacts from normally open to normally closed and vice versa.

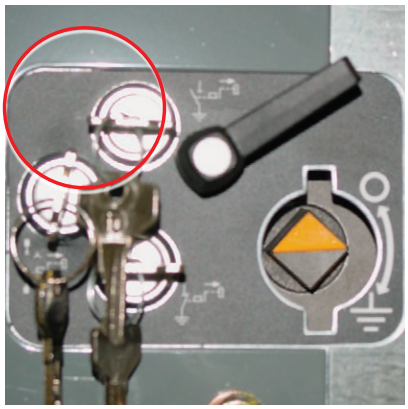
PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	yes
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

7 Circuit-breaker anti-racking-in lock

(the apparatus cannot be switched from the isolated position to the racked-in position when the key has been removed).

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes





Specifications		
Rated voltage	V	24-500 a.c. (50-60 Hz)/d.c.
Insulation voltage 50 Hz/1 min	V	2500
Rated thermal current	A	10
Breaking capacity of auxiliary contacts		
500 V (a.c. 50/60 Hz); cos=0.4	A	5
220 V (a.c. 50/60 Hz); cos=0.4	A	10
220 V (d.c.); L/R=10 ms	A	1
Number of operations	op/N°	8

8 Voltage signalling lamps (VPIS)

These lamps indicate when the medium voltage side is being energized. They can be pre-assembled on PB/M modules with the appropriate presetting while for PB/E enclosures and PB/F fixed parts, they can be supplied loose for assembly in instrument compartments at the customer's charge.
The signal can be transmitted to the lamps by means of post insulators with capacitive sockets, by combisensors or current transformers.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom- ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	yes
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

9 Opening or closing operations with the door closed

This accessory can be supplied for circuit-breakers with mechanical control. It consists of either the sole opening button or the opening and closing button. This accessory requires different specific doors for VD4 or HD4 circuit-breakers. A specific door with an opening where a lever can be inserted for emergency operations is available for VM1 and eVM1 circuit-breakers and for V-Contact VSC/P contactors. This accessory is not available for 50 kA VD4 circuit-breakers.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom- ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	no
PB2/T	750	■	■			■	no
PB4/T	750			■		■	no

3. Available types and apparatus

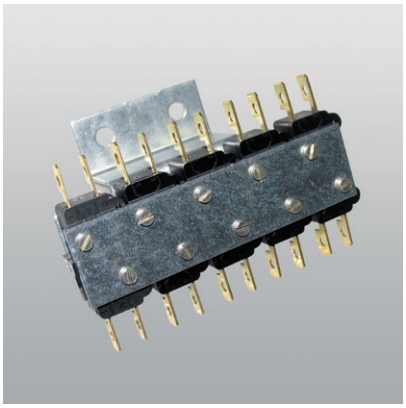
10 Contacts for signalling when earthing trolleys are racked in

Signal when the earthing trolley is in the racked-in position. Two kits are available:

a) Group of 5 contacts

b) Group of 10 contacts

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom- ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	no
PB2/T	750	■	■			■	no
PB4/T	750			■		■	no



Specifications:		
Rated voltage	V	up to 250 a.c. (50-60 Hz)/d.c.
Insulation voltage 50 Hz/1 min	V	2000 (towards earth)
Rated current	A	5
Rated thermal current	A	17.5
Breaking power of auxiliary contacts		
Resistive load		
48 V (d.c.)	A	3
110 V (d.c.)	A	0.8
220 V (d.c.)	A	0.5
Inductive load: L/R = 5 ms		
48 V (d.c.)	A	1.5
110 V (d.c.)	A	0.5
220 V (d.c.)	A	0.3

11 Electromechanical door lock

The lock only allows the door to be opened if the relative coil is energized.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom- ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

Rated voltage		
d.c.	V	24-30-48-60-110-125-220-250
a.c. 50 Hz	V	110-220
a.c. 60 Hz	V	110-220
Rated power		
d.c.	W	10.5 ± 1.5
a.c.	VA	20 ± 3
Operation		Unsuitable for continuous service (Energize to open door and normally leave de-energized)

Accessories that can be installed at the customer's charge

12 Anti-condensation heaters

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	yes
PB2/R	750	■	■			■	yes
PB3/R	1000	■	■			■	yes
PB4/R	750			■		■	yes
PB5/R	1000			■		■	yes
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

Rated voltage		
a.c. 50 Hz	V	110-220
a.c. 60 Hz	V	110-220
Rated power	W	150 ± 10

13 Shutter padlocks

Can be fitted to the upper, lower shutters, or both.

PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	yes
PB2/T	750	■	■			■	yes
PB4/T	750			■		■	yes

3. Available types and apparatus

14 Key lock to prevent earthing troller from being racked-in

Available in kits with two locks:

a) Key lock for earthing trolley with upper insulating bushings

b) Key lock for earthing trolley with lower insulating bushings.

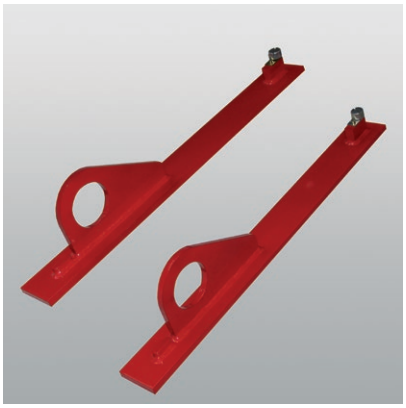
PowerCube unit		Rated voltage			Type of Unit		Available accessory
PB/E PB/M	Width (mm)	12 kV	17.5 kV	24 kV	Bus tie/ incoming/ outgoing	Direct incom-ing/ riser/ measurements	
PB1	600	■	■		■		yes
PB2	750	■	■		■		yes
PB3	1000	■	■		■		yes
PB4	750			■	■		yes
PB5	1000			■	■		yes
PB1/R	600	■	■			■	no
PB2/R	750	■	■			■	no
PB3/R	1000	■	■			■	no
PB4/R	750			■		■	no
PB5/R	1000			■		■	no
PB1/T	600	■	■			■	no
PB2/T	750	■	■			■	no
PB4/T	750			■		■	no

15 Earth switch operating lever

1 is supplied per confirmation or 1 per group of enclosures for the same confirmation position. Extra levers are supplied o request as accessories. Can be applied to any PowerCube equipped with earth switch.

16 Lifting bolts

Allow the module to be lifted when positioned at its sides. Can be applied to any PowerCube PB/M module.



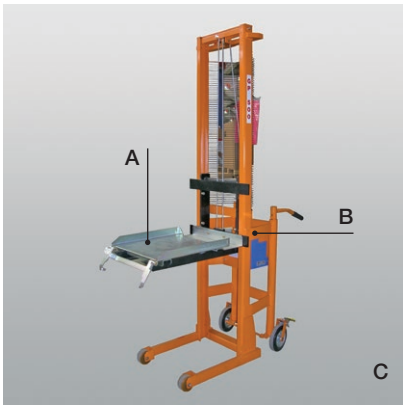
17 Transport trolley

With fixed height proportional to the height of PB/M modules. Allows the apparatus to be fitted into the module.

18 Circuit-breaker lifting and transporting unit

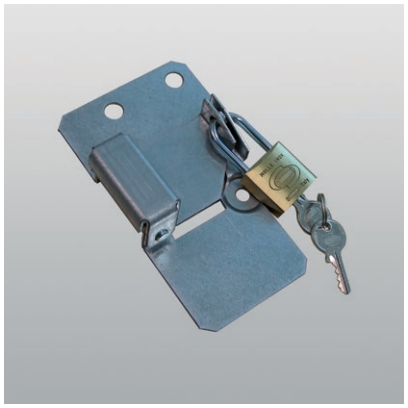
Allows the withdrawable apparatus to be lifted for insertion into the PowerCube unit. The sole lifting troller, the sole carrier plate or the two pre-assembled items can be ordered.

a) Carrier plate for lifting trolley
b) Lifting trolley
c) Complete kit (plate installed on trolley).



19 Padlock on earth switch

This is fitted to the operating seat of the earth switch and prevents this latter from being operated by means of a padlock.



3. Available types and apparatus

20 Emergency operating lever for V-Contact VSC contactors

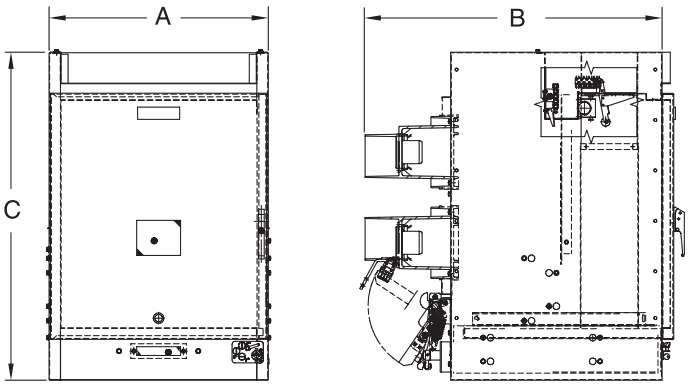
This operating lever allows the contactor to be opened in an eergency if the specific door has been requested.

21 Rear fan to install at rear of switchgear

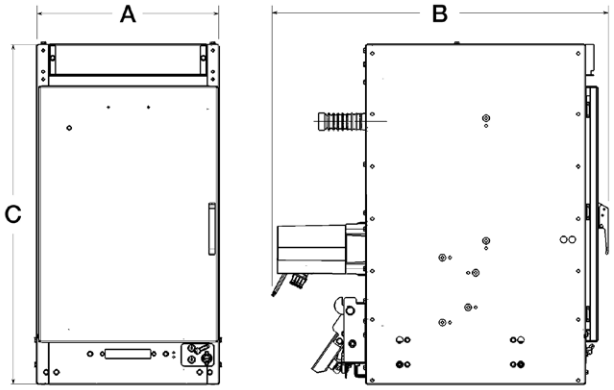
When installed according to the instructions in the PowerCube manual, this fan allows panels with 4000 A rated current to be made in 3600 A PowerCube PB3 enclosures.

4. Overall dimensions and weights

Type PB/E units



Type PB/RE units

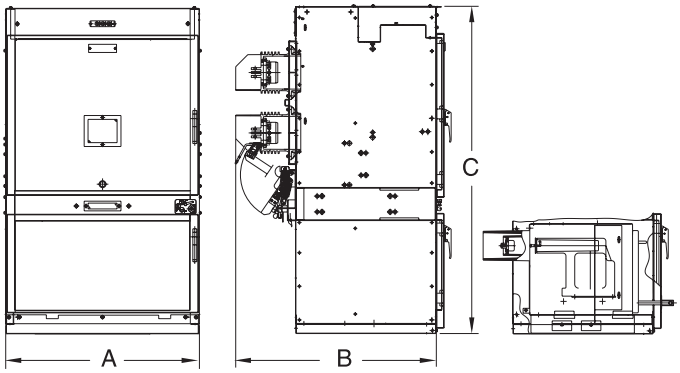


Module	Rated voltage [kV]	Rated current [A]	Isc Icw [kA]	Dimension table	A [mm]	B [mm]	C [mm]	Weight [kg](1)
PB1/E	12	630 - 1250	31.5	1VCD003369	600	1016	1120	180
	17.5	630 - 1250	31.5	1VCD003369	600	1016	1120	
PB2/E	12	630...2000	31.5	1VCD003370	750	1016	1120	200...240
	12	1250...2000	40-50	1VCD003370	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	1VCD003375	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	1246(2)	1230	215
PB5/RE	24		31.5	1VCD003381	1000	1246(2)	1230	250
PB1/TE	12-17.5	not applicable	31.5	1VCD003636	600	1016	1120	165
PB2/TE	12-17.5		40-50	1VCD003637	750	1016	1120	200
PB4/TE	24		31.5	1VCD003638	750	1246	1230	220

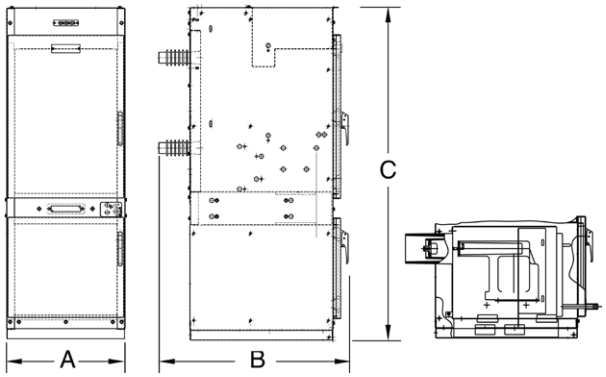
(1) Weight without earth switch.
(2) Dimension with earth switch applied.

4. Overall dimensions and weights

Type PB/M units



Type PB/RM units



Module	Rated voltage [kV]	Rated current [A]	Isc Icw [kA]	Dimension table	A [mm]	B [mm]	C [mm]	Weight [kg](1)
PB1/M	12	630 - 1250	31.5	1VCD000023	600	1016	1680	200
	17.5	630 - 1250	31.5	1VCD000028	600	1016	1680	
PB2/M	12	630...2000	31.5	1VCD000024	750	1016	1680	220...260
	12	1250...2000	40-50	1VCD000027	750	1016	1680	
	17.5	630...2000	31.5	1VCD000029	750	1016	1680	
	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	1246	1745	270
PB5/M	24	1600 - 2000	31.5	1VCD000032	1000	1246	1745	330
	24	2500	31.5	1VCD000044	1000	1246	1745	360

Module	Rated voltage [kV]	Rated current [A]	Isc Icw [kA]	Dimension table	A [mm]	B [mm](2)	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	1246	1745	270
PB5/RM	24		31.5	1VCD000036	1000	1246	1745	270
PB1/TM	12-17.5	not applicable	31.5	1VCD003639	600	1016	1745	185
PB2/TM	12-17.5		40-50	1VCD003640	750	1016	1745	185...235
PB4/TM	24		31.5	1VCD003641	750	1246	1745	270

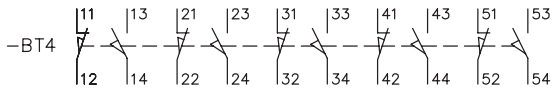
(1) Weight without earth switch and without TV compartment.
(2) Dimension with earth switch applied.

5. Wiring diagrams

Application diagrams

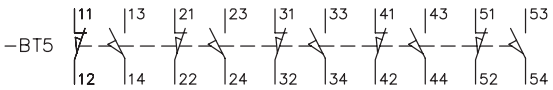
∗C)

1



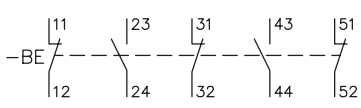
∗C) D)

3



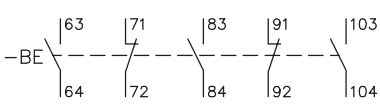
∗B)

21



∗B)

22



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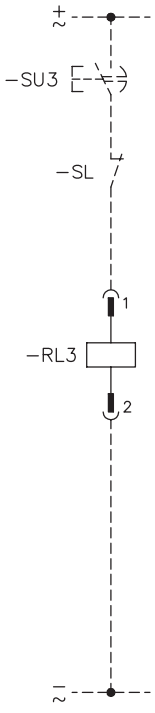
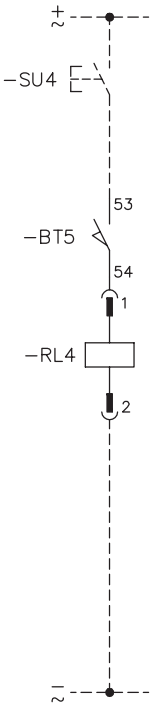


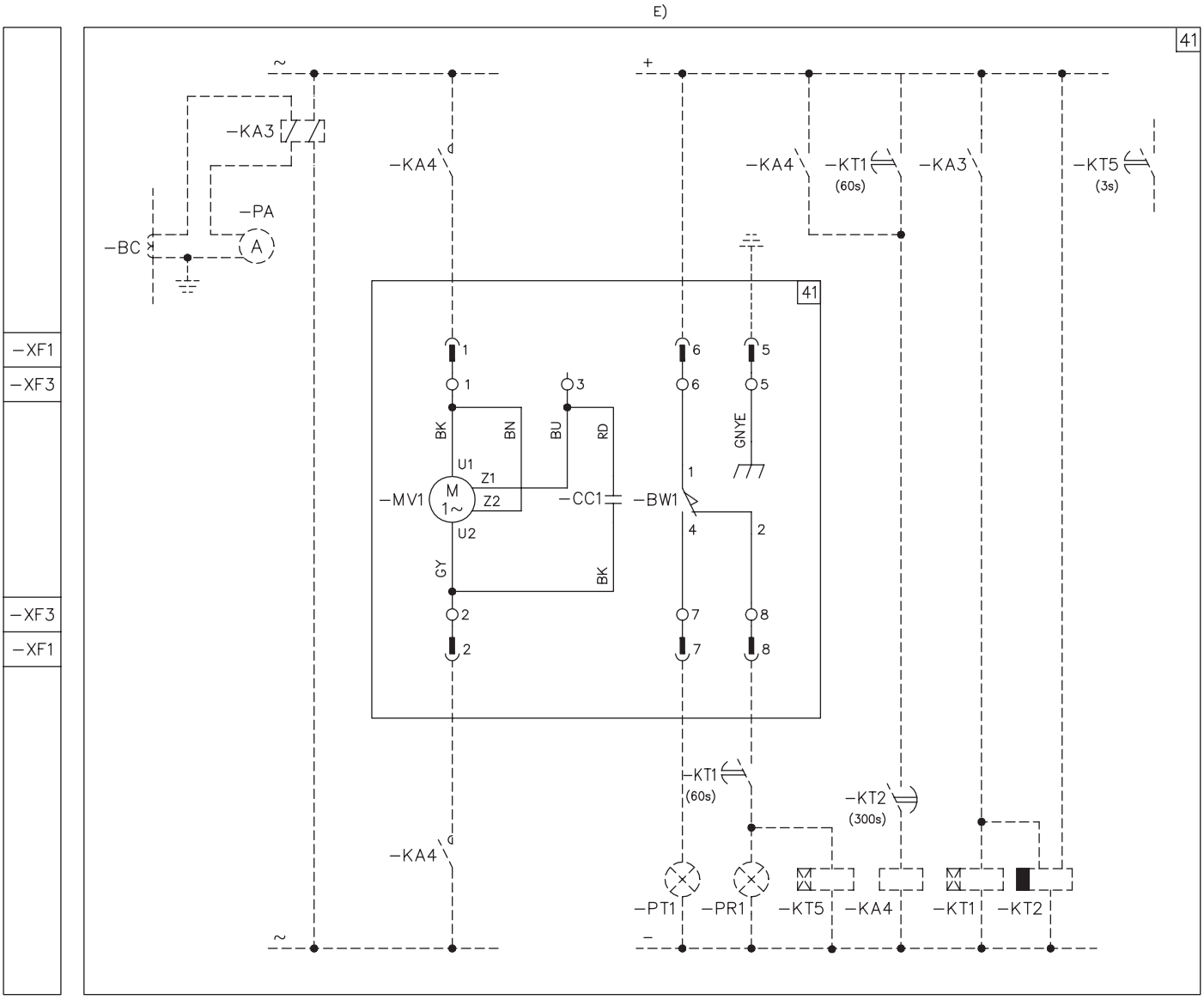
∗D)

23

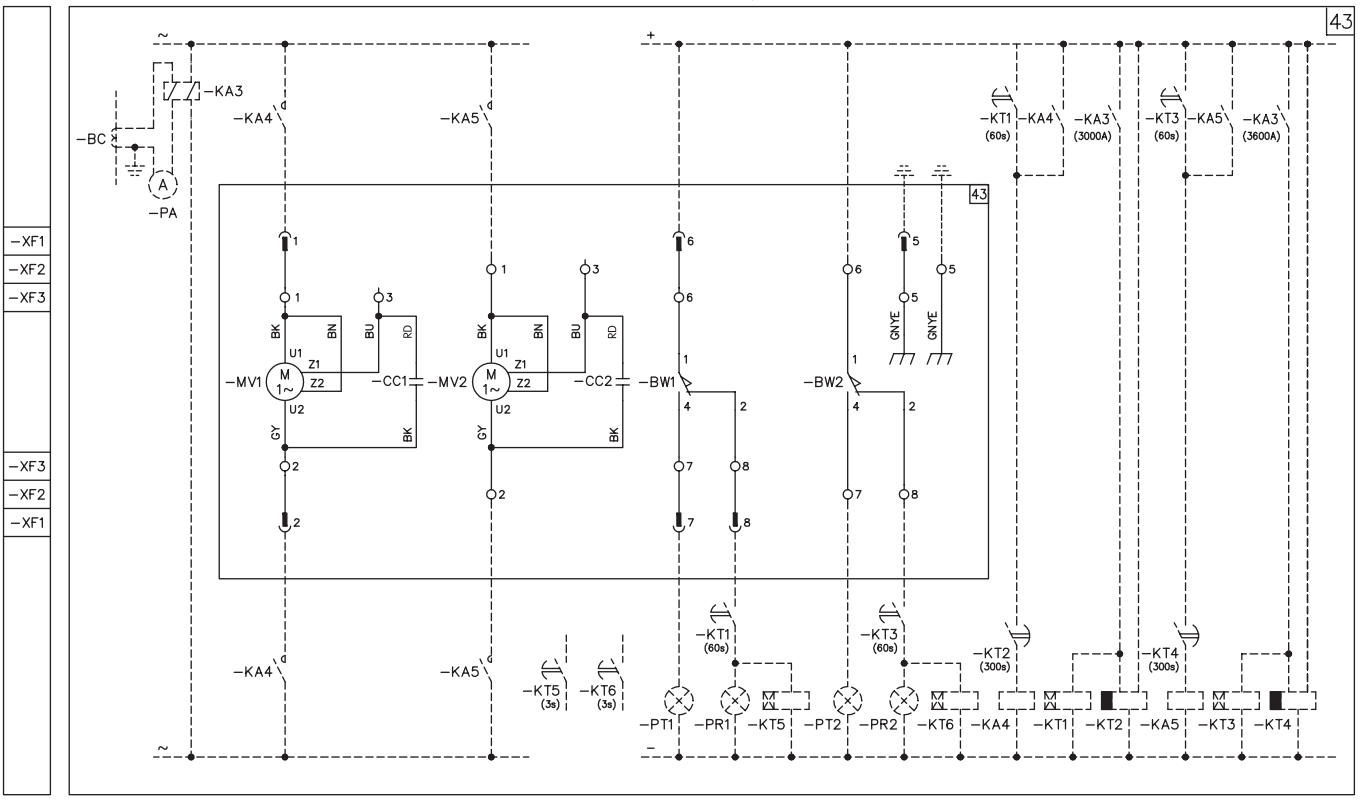


5. Wiring diagrams

Application diagrams



E)


43
~
+
−
−KA3
−KA4
−KA5
−BC
A
−PA
−XF1
−XF2
−XF3
−MV1
−MV2
−CC1
−CC2
−BW1
−BW2
BK
BN
BU
RD
GY
GNYE
U1
Z1
Z2
U2
M
1~
−KT1
(60s)
−KA3
(3000A)
−KT3
(60s)
−KA3
(3600A)
−KT5
(3s)
−KT6
(3s)
−PT1
−PR1
−KT5
−PT2
−PR2
−KT6
−KA4
−KT1
−KT2
−KA5
−KT3
−KT4
−KT2
(300s)
−KT4
(300s)

5. Wiring diagrams

Reference designations

(in compliance with standard IEC 61346-2 and technical standard ABB 2NBA000001).

Designation	Description
□	Figure number of the diagram
-BC	Current transformer
-BE	Auxiliary contacts of the earth switch (see note B)
-BT4	Contacts on switchgear for signalling trolley in racked-in position (see note C)
-BT5	Contacts on switchgear for signalling trolley in isolated position (see note C)
-BW1	Front fan position contact
-BW2	Rear fan position contact
-CC1	Capacitor for front fan
-CC2	Capacitor for rear fan
-KA3	Current metering relay
-KA4	Auxiliary contact for front fan operation
-KA5	Auxiliary contact for rear fan operation
-KT1, -KT2	Timed auxiliary relays for forced front fan operation
-KT3, -KT4	Timed auxiliary relays for forced rear fan operation
-KT5	Timed auxiliary relay for forced front ventilation failure alarm signal
-KT6	Timed auxiliary relay for forced rear ventilation failure alarm signal
-MV1	Front fan (see note E)
-MV2	Rear fan (see note E)
-PA	Ammeter
-PR1	Red lamp for forced front ventilation failure alarm signal
-PR2	Red lamp for forced rear ventilation failure alarm signal
-PT1	White lamp for forced front ventilation operation alarm signal
-PT2	White lamp for forced rear ventilation operation alarm signal
-RL3	Electromechanical lock on earth switch closing operation
-RL4	Locking magnet. Mechanically inhibits door opening if de-energized
-SL	Contact for locking earth switch operation
-SU3	Delay button for enabling earth switch operation (maximum permissible delay 1 minute)
-SU3	Door release button
-XF1	Connector for disconnecting the forced front ventilation circuits
-XF2	Connector for the forced rear ventilation circuits
-XF3	Connector for the forced front ventilation circuits

Figure	Description
Fig. 1	Electrical signalling contacts for switch in plugged-in position (see note C)
Fig. 3	Electrical signalling contacts for switch in isolated position (see note C)
Fig. 20	Circuit of electromechanical lock on earth switch closing operation: the operation is only permitted with coil -RL3 energized
Fig. 21	First pack of auxiliary contacts of the earth switch (see note B)
Fig. 22	Second pack of auxiliary contacts of the earth switch (see note B)
Fig. 23	Circuit of electromechanical door opening lock: opening is only permitted with coil -RL3 energized
Fig. 41	Forced front ventilation circuit
Fig. 43	Forced front and rear ventilation circuit

Notes

A) The switchgear comes solely equipped with the specific applications in the order confirmation

B) The auxiliary contacts -BE are supplied in the position indicated in the diagram. However, the user can easily convert them from make contacts to break contacts or vice versa.

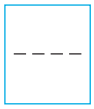
C) Position contacts -BT4 and BT5 are switch contacts. This means that the make contact and the break contact belonging to the same position contact cannot be powered with different voltage values.

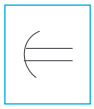
D) When fig. 23 is required, the contact -BT5 (terminals 51-52-53-54) of fig. 3 is not available

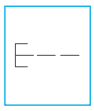
E) The fans must activate when at least one phase exceeds the following thresholds for 60 seconds:
- UniSafe 12-17.5 kV 3600 A = 3000 A (front fan)
- UniSafe 12-17.5 kV 4000 A = 3000 A (front fan) and 3600 A (rear fan)
- UniSafe 24 kV 2500 A = 2250 A (front fan).

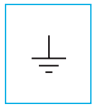
The fans must disconnect when the current of all three phases is lower than the following values for 300 seconds:
- UniSafe 12-17.5 kV 3600 A = 2900 A (front fan)
- UniSafe 12-17.5 kV 4000 A = 2900 A (front fan) and 3500 A (rear fan)
- UniSafe 24 kV 2500 A = 2150 A (front fan).

Symbols (in compliance with Standards IEC 60617 and CEI EN 60617)

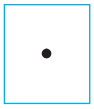

Mechanical, pneumatic or hydraulic connection

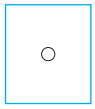

Delayed movement (in the movement of the arc towards its center)

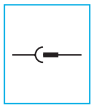

Pushbuttonactuaor

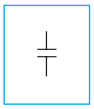

Earth (general symbol)

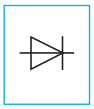

Earth, frame

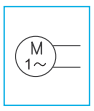

Conductor connections


Terminal

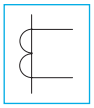

Socket and plug (female and male)

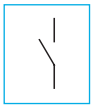

Capacitor (general symbol)

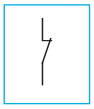

Semiconductor diode (general symbol)

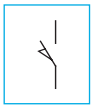


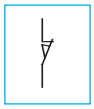
Single-phase asynchro-nous otor, short-circuited rotor, terminals for aux. phase routed outside

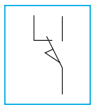

Current transformer

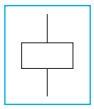

Make contact

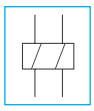

Break contact

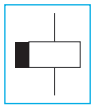

Make position contact (limit)

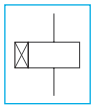

Make position contact (limit)

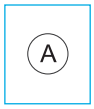

Position change-over break before make contact (limit)


Control coil (general symbol)


Control coil with two separate windings


Control coil of a slow-releasing relay


Control coil of a slow-operating relay



Ammeter


Lamp (general symbol)

6. Switchgear completion

ABB can also supply the following components to complete the switchgear.
Please consult ABB for further details.

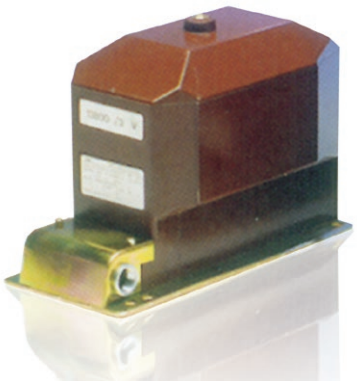
REF 601 switchgear protection device

Relay REF 601 is a device that protects against overcurrents, with tripping curves in compliance with standard IEC 255-3. It protects against overload (51), instantaneous and delayed short-circuits (50-51), instantaneous and delayed homopolar earth faults (50N and 51N). It also detects the magnetizing current of a threephase transformer to prevent it from tripping in an untimely way when a transformer switches in (68). elay REF 601 must be energized in order to function.
The REF 601 relay can operate with up to 3 inputs from current sensors of the Rogowsky coil type and an input from an external toroidal current transformer. 4 rated current values can be entered via the keyboard: 40, 80, 250, 1250 A.
If the circuit-breaker is equipped with 3 current sensors, the 50N and 51N protection functions are accomplished with the vector sum of the phase currents. On the other hand, the external toroidal current transformer must be installed for the 50N and 51N functions if 2 current sensors are used. The external toroidal transformer can have either an openable or closed core and any transformer ratio, so long as there is 1 A secondary current.

Specific features of the REF 601 relay:
- Accurate interventions
- Wide setting ranges
- Single and contemporaneous adjustment of the three phases
- No limitation (due to the current sensors) to the rated breaking capacity or to the short-time withstand current of the circuit-breaker
- Local electric operating buttons
- 5 separate indicators: “relay operating”, “relay at tripping threshold”, “relay tripped”, “relay tripped due to phase overcurrent”, “relay tripped due to earth fault overcurrent”
- Interface consisting of an LCD display and by “arrow”, “enter” and “esc” keys for user-friendly browsing amongst the “measuring”, “data recording”, “event recording”, “settings”, “configuration” and “test” menus
- Three user levels: “Operator” (display only, free access), “configurator” (same as the previous level, but with the ability to enter the protection parameters and, if applicable, the communication parameters - access limited by a password), “administrator” (same as the previous level but with the ability to enter the passwords and configure the settings according to the device - access limited by a password)
- Continuous display of the current in the most loaded phase and the earth current
- Recording of the values of the currents that caused the device to trip
- Storage of the number of openings caused by the device
- Event recording (storage of the previously described parameters in the last 5 tripping actions of the device) in a non-volatile memory
- On request, version with RS485 serial link, 4 wires - MODBUS RTU full duplex protocol
- 24…240 V CA/DC multivoltage feeder.

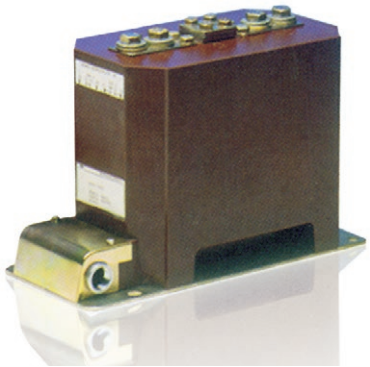
Relay REF 601 is also available in a specific version, in accordance with standard CEI 0-16 (for the Italian market), with reference to the point where MV energy is delivered to the distribution user.

Voltage transformers



The voltage transformers are insulated in resin and are used for powering measuring devices and protections. They are available for fixed assembly or for istallation on withdrawable trolleys.
They conform to standard IEC 60044-2.
The dimensions normally comply with Standard DIN 42600, while the transformers designed for installation on withdrawable trolleys are the dedicated type.
These transformers can have one or two poles and possess performance and accuracy classes that suit the functional requirements of the instruments to which they are connected.
When they are installed on withdrawable trolleys, they are equipped with medium voltage protection fuses. The fuses can be replaced whilst the switchgear is in service.

Current transformers



The current transformers are insulated in resin and are used for powering measuring devices and protections. These transformers can have a wound core or bushing bar with one or more cores and come with performance and accuracy classes that suit the requirements of the installation.
They conform to standard IEC 60044-1.
The dimensions normally comply with standard DIN 42600.
The current transformers can also be supplied with a capacitive socket for connection to voltage signalling lamps.

Measuring sensors (for applications with microprocessor protection units)

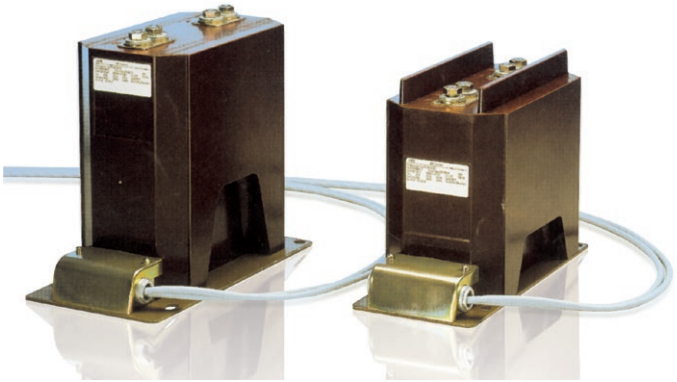


ABB KEDCD voltage-current combi-sensors

Use of digital technologies for electrical protection and measuring instruments has deeply modified the performance that transformers must provide.
The analog input levels of the instruments have become significantly lower than those of conventional systems.
This is why ABB has introduced a new range of sensors that meets the specifications of the new generation instruments in an optimal way.
The switchgear can be equipped with up to 24 kV ABB KEVCD Block Type sensors.
The current sensors comply with standards IEC 60044-8 (CDV), while the voltage sensors comply with standard IEC 60044-7.
The dimensions normally comply with standard DIN 42600 Narrow Type.
The resin casing can house current sensors and voltage sensors at the same time, or just the current sensor. A capacitive divider is also installed for connection to the voltage signalling lamps.
ABB multifunction units and measuring sensors comply with accuracy class CI.1.

6. Switchgear completion

Current sensor

The current sensor consists of a Rogowski coil without ferromagnetic core, thus unaffected by saturation phenomena. If a core is formed by a uniform winding over a non-magnetic closed core with a constant section, the voltage indiced in the secondary circuit will be directly proportional to the variations in the let-through current. This voltage must be integrated in order to obtain a signal proportional to the current provided. The multifunction devices accomplish this function and use the signal obtained for both the measurements and protections.

Main features of the current sensors

- Linear response over the entire measuring range;
- no saturation;
- no hysteresis;
- one single instrument for both protections and measurements;
- high accuracy class;
- high degree of immunity to electromagnetic disturbances;
- the output signal is a voltage (150 mV) proportional to the current variation over time. The current measurement is obtained by integrating the signal;
- two single coils cover the range from 0 to 3200 rated A;
- the winding can remain open even when the switchgear is under service conditions.

Voltage sensor

The voltage sensor consists of a resistive divider through which the signal is taken. This sensor is also the non-saturable type and gives a linear response for the entire measuring range.
The output signal is a voltage directly proportional to the primary voltage. The resistive element consists of a bar of ceramic material. Voltage sensors are used at the same time to make measurements and energize the protections.

Main features of the voltage sensors

- Linear response over the entire measuring range;
- no saturation;
- no ferroresonance;
- one single instrument for both protections and measurements;
- high accuracy class;
- high degree of immunity to electromagnetic disturbances;
- the output signal is a voltage directly proportional to the primary voltage;
- the division ratio is 10000/1;
- one single divider covers the range from 0 to 24 rated kV.

Microprocessor-based REF542*plus*

The REF542*plus* unit provides all the secondary functions of a unit of the switchgear in a single module with watchdog function.
Thanks to its flexible software, the unit is able to meet the requirements of a vast range of installations: protection, measuring, monitoring and signalling.
The user interface is simple and easy to use.

REF542*plus* in kits for OEM

The integrated protection and monitoring unit is based on the REF542*plus* platform, multifunction unit for medium voltage switchgear.
The REF542*plus* unit includes all the latest innovations in the microelectronics and information technology fields.
The main functions provided by the REF542*plus* unit are:

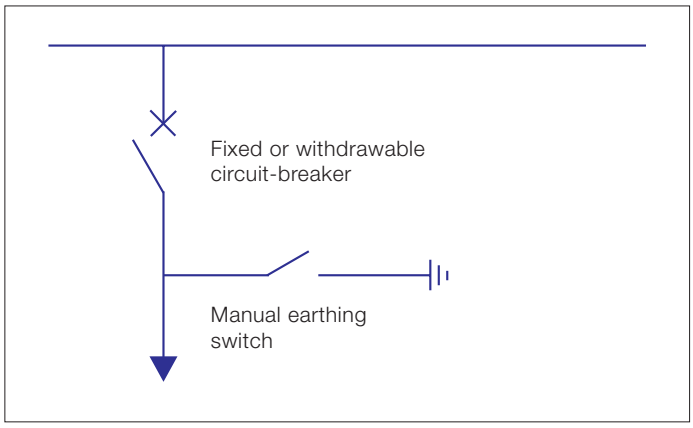
- protection
- control
- measuring
- monitoring
- energy quality
- communication.

Thanks to the exceptional flexibility and scalability of this modern unit, all the functions are integrated in a single configurable environment.
Thus dedicated and intelligent solutions can be created with a limited use of wiring in situations where a conventional approach would be costly and inefficient.

Pre-configured solutions based on REF542*plus*

Some already configured solutions for protecting and monitoring the majority of the common medium voltage applications are described below.
These solutions are based on the REF542*plus* unit and do not need to be programmed in any way.
The REF542*plus* unit is supplied already programmed and ready for installation.
All that needs to be done is to enter the parameters of the protections.
The already configured REF542*plus* unit can only be ordered as part of the medium voltage kit.
It cannot be sold separately.
The primary part is configured as indicated in the single-line diagram alongside.
The circuit-breaker can be the fixed or plug-in type. The earthing switch is manual. Configurations with a contactor instead of a circuit-breaker are available for motor switching.
A certified ATEX version for explosive environments, conforming to directive 94/9/EC, is also available. Please consult ABB.

Note
Specific and customized protection solutions are layouts can also be supplied. Please consult ABB.



Single-line diagram of the primary part

Fuses

Fuses can be supplied for use with the contactor, for protecting lines, motors, capacitors, voltage transformers for measuring functions, etc.
The fuses comply with DIN or BS standards.
Consult technical catalogue 1VCP000049 for the contactor-fuse matches and coordination.

Surge arresters

MWD

Over-voltage protective device:
- Transformers
- Motors
- Cables
- Cable sheath.

Medium voltage switchgear:
- Alternating current applications (AC)
- For indoor use.

Technical specifications

Surge arrester against over-voltage with metal oxide resistor without stark-gap (MO surge arresters), enclosure in moulded silicone rubber, grey colour, designed and tested in accordance with standard IEC 60099-4.

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