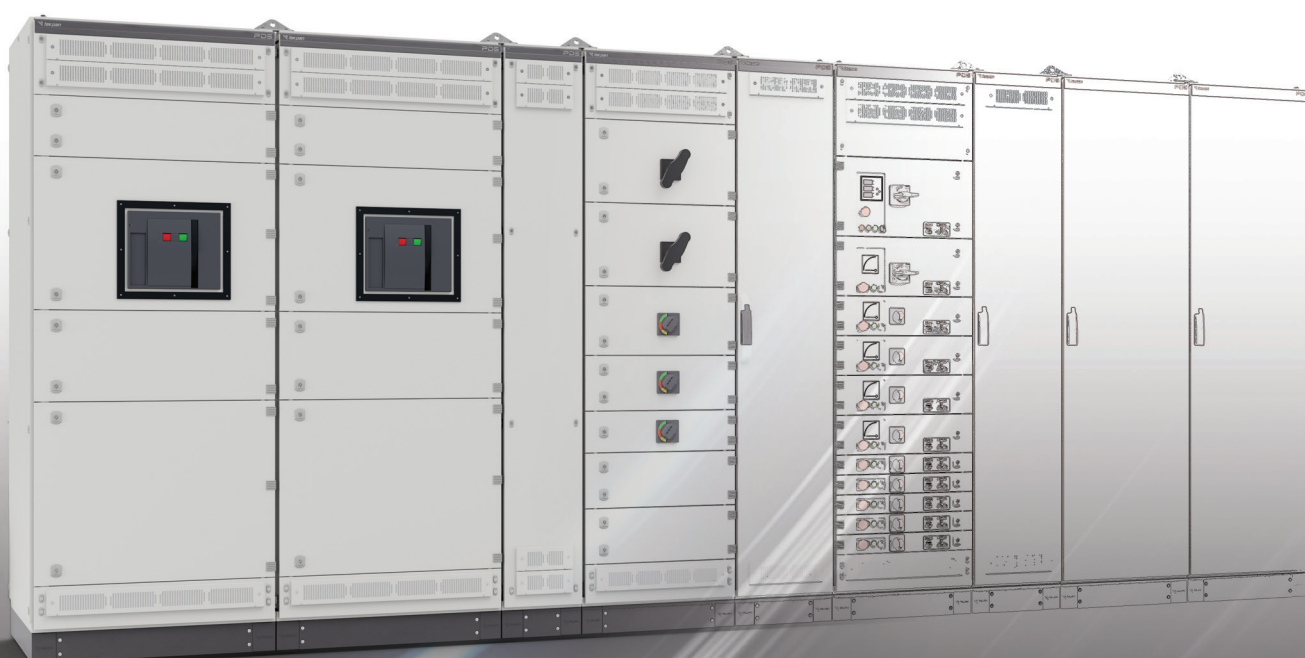




10/2021

INSTALLATION INSTRUCTIONS AT **WORKSHOP**



PDS
UPGRADE THE POWER

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

PDS
UPGRADE THE POWER

C1

GENERAL MECHANICAL and ELECTRICAL CHARACTERISTICS



■ 1.1. CONFIRMITY of IEC EN 61439 - 1&2 STANDARD

- The PDS switchboards have undergone the type tests IEC 61439-1&2 Standard at the international accredited type test laboratories such as Dekra , LVT and extc.
- The results of these tests guarantee the performances of the PDS switchboards and allow the end constructor of the switchboard using TEKPAN-PDS System.
- Metal structures, air, moulded-case and miniature circuit-breakers, not to carry out further type tests, respecting the selection criteria and the assembly instructions of the various components. These results, given below, can be referred to for drawing up the declaration of conformity of the electric switchboard.
- In the tables following, the thermal dissipation values are indicated, referring to all the dimensions of the PDS switchboards and to the type of installation, deriving from the type tests carried out. The dissipated power data (in Watts) are according to the admissible overtemperature inside the switchboard in the upper part, and must be compared with the sum of the powers dissipated by all the components installed inside the switchboard (taking appropriately into account the factor of contemporaneity).

■ SHORT-CIRCUIT WITHSTAND CURRENT - UP TO 4000A SYSTEM

- Rated short-time short-circuit current (I_{cw}) : **Up to 85kA (1s) , 65kA (3s)**
- Rated max. peak short-circuit current (I_{pk}) : **Up to 176kA**
- Rated short-time short-circuit current (I_{cw}) in withdrawble module : **Up to 60kA (1s) , Peak(I_{pk}) : 132kA**

■ DIELECTRIC PROPERTIES - UP TO 4000A SYSEYEM

- Rated service voltage (U_e) : **Up to 690V AC**
- Rated insulation voltage (U_i) : **Up to 1000V AC , Up to 800V AC in withdrawable module**
- Rated impulse withstand voltage(U_{imp}) : **Up to 12kV , Up to 8kV in withdrawable module**
- The insulation distances are guaranteed by following the PDS metalwork structure instructions and circuit-breaker assembly and mounting instructions of manufacturers.

■ EFFICIENCY OF THE PROTECTION CIRCUIT

- Following the assembly indications of the metal components, the effective electrical continuity between the exposed conductive parts is verified, with negligible resistance values.
- Protection circuit short-circuit withstand current : phase-earthing busbar : **I_{cw} :60kA (1s) , I_{pk}:132kA**

■ MECHANICAL OPERATION

- Mechanical operation is verified by following the assembly and mounting instructions for the PDS metalwork structures and instructions for the circuit-breaker manufacturers.

■ DEGREE OF PROTECTION(IP) ACCORDING TO IEC EN 60529 / MECHANICAL IMPACT (IK)

- Modules with ventilated door and rear panels in Internal Front protection : Up to IP53 , IK10 / IK08 (Glazed Doors)
- Modules with ventilated door and rear panels in External Front protection : Up to IP53 , IK10
- Modules with ventilated door and rear panels in Withdrawable Module : Up to IP40 , IK10
- Modules with ventilated rear panels in Internal Front protection without door : Up to IP30 , IK08

■ MECHANICAL CHARACTERISTICS

MATERIALS :

SHEET PARTS :

- Sheet steel Parts : 6112 grade EN 10130-99 DC01
- Galvanized steel Parts : 1311 grade DIN EN 10142-00 DX51 D+Z
- Frame : 1,50mm galvanized steel + RAL 7035 flat powder coated
- Full front doors : 2,00mm sheet steel + RAL 7035 ragged powder coated
- External Partial doors , Rear Panels : 1,50mm sheet steel + RAL 7035 ragged powder coated
- Top panels and Side panels : 1,50mm sheet steel + RAL 7035 ragged powder coated
- Internal Covers : 1,20mm sheet steel + RAL 7035 flat powder coated
- Base-Plinth Parts : 1,50-2,00-3,00mm Galvanized steel + RAL 7012 ragged Powder Co
- Mounting plates : 2,00mm galvanized steel
- Segregation plates : 1,50mm galvanized steel
- Assembly& Support Rails : 2,00 - 3,00mm sheet steel + zinc coated Cr+3 passivated

PLASTIC PARTS :

- Busbar holders : PolyamidPA (6.6) reinforced with fiberglass , V0 UL 94 (-40°C + 130°C)
- Segregation plates : 3mm Polycarbonat sheet , B-S1-d0 according to EN 13501-1
 - Dry Heat Tested according to IEC 60068-2-2 Test Bb
 - Glow Wire Tested according to IEC 60695-2-10/11

DIE CAST PARTS :

- Aluminum Joint Corner : Etial-160 AlSi9cu3 (A-380)
- Fixing parts : Zinc Zamak 5 (ZnAl4Cu1)

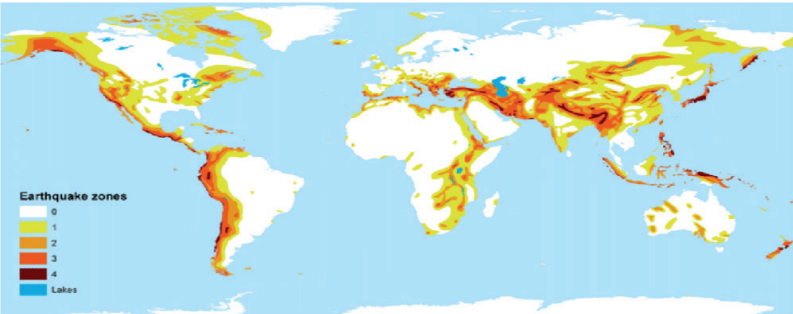
FASTENERS :

- Screws : 8.8 ISO 898-2
- Nuts : 8 ISO 898-2

GLASS on DOOR : 4,00mm Tempered Glass (IK08)

■ SIESMIC STRENGTH

Around the world can be found different zones with a specific seismic risk. These zones have been classified according to the Uniform Building Code (UBC).



DEFINATION of IEC 60068-3-3 STANDARDS

IEC 60068-3-3 Ground Acceleration		Siesmic Charactesitics		
References	General Description	Richter Scale Magnitude	UBC Zone	
AG2	Intensity from weak to average	< 5 .5	ZONE 0	
			ZONE 1	
AG3	Intensity from average to strong	5.5 to 7.0	ZONE 2	ZONE 3
AG5	Intensity from strong to very strong	> 7.0	ZONE 4	

PDS uses TEOS panels as main frame. TEOS Series are within the scope of Zone 3 seismic strength tests. Zone3 (AG3) test was covers all sizes and types of the Teos series.

TEOS ENCLOSURE SIESMIC STRENGTH (According to IEC 60068 3-3)

ZONE 3

All Teos series products are within the scope of Zone 3 seismic strength tests.

Zone3 (AG3) test was conducted for double-door enclosures of size 1200 width x 2000+100 height and 600mm depth, and covers all sizes and types of the Teos series.

The complete report can be discover on the company website.

ZONE 4

Zone 4 (AG5) seismic strength tests, an enclosure sized 800 width x 2000+100 height x 800 width an extra reinforced interior and welded plinth was used.

The abovementioned size and structure are required for needs within the scope of 'Zone 4'.

The complete report can be discover on the company website.

■ 1.2. CONFIRMITY of OTHERS STANDARDS

■ MECHANICAL CHARACTERISTICS

SURFACE FINISHING & CORROSION PROTECTION

PAINTING (COATING) PROCESS :

- Sheet washing
- Phosphating with iron salt base
- Drying in tunnel at 100°C
- External and internal painting with electrostatic application of thermosetting powder enamel with epoxy polyester binders. Total thickness: 70/80 micron.
- Polymerisation in oven at 180°C - 200°C

PAINTING (COATING) PERFORMANCE :

- Hardness : 1H - 2H
- DIN 53152 bending elasticity : unaltered on 1/4" spindle
- DIN 53151 reticular adherence : GT O (100%)
- Erichem elasticity: SEN DIN 53156 : > 6mm
- Gardner resistance to impact : 25 Kg. x cm.
- Foggy Salt Test Resistance EN ISO 9227 : Min 350 hours - Max. 400 hours
- Severity Test A according to IEC 61439-1 : Indoor
- Corrosion protection class EN ISO 12944-6 : C3 (Medium)

Corrosion durability time for first major maintenance as to Environments according to EN ISO 12944-6 :

Heated buildings/neutral atmosphere, Rural areas, low pollution : More than 15 years

Urban and industrial atmospheres Moderate sulfur dioxide levels, : 5 to 15 years

Production areas with high humidity

Industrial and coastal Chemical processing plants : 2 to 5 years

■ DECLARATION OF CONFIRMITY

When correctly selected and assembled, as per the indications given in the instruction manual, allow construction of switchgear complying with the IEC 61439-1&2 Standard, on the basis of what is foreseen by the Low Voltage Directive of the European Community Directives.

The above is valid if the switchgear is designed and constructed:

- Selecting and assembling the materials according to performances indicated in the PDS Ordering Guides and Instruction Manuel
- Sizing the conductors according to the prescriptions of the IEC 61439-1&2 Standards
- Carrying out the individual tests foreseen under the IEC 61439-1&2 Standards successfully.

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

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UPGRADE THE POWER

C2

CONDUCTORS SIZING, RIGIDITY and INSULATION



■ 2.1 MAIN BUSBAR

■ BUSBAR SIZING

The factors that must be taken into account in determining the size of busbars include:

a. Rated Diversity Factor:

Not all the loads supplied by a set of busbars are used at full rated load or at the same time. The diversity factor is the means to determine the maximum load current used to size the busbars.

Main busbar sizing is related with the currents summary of 'Distribution Vertical Busbars ' after rated diversity factor applied on functional units

For Example :

Distribution Vertical Busbar 1 : 510A

- FU1 : In : 800A , Inc : 750A , (510A) RDF: 0,68
- FU1 : In : 630A , Inc : 575A , (0A) As a spare

Distribution Vertical Busbar 2 : 204A

- FU3 : In : 100A , Inc : 100A , (68A) RDF: 0,68
- FU4 : In : 100A , Inc : 100A , (68A) RDF: 0,68
- FU5 : In : 100A , Inc : 100A , (68A) RDF: 0,68

Main Busbar : (510A+204A) ≥ **714A**

b. Degree of IP Protection:

IP protection which means to protection against solid and liquid objects in the environment is a necessity for a switchboard to survive the functions for a long time period and to protect against short circuits and harmful chemicals can be cause corrosion. For that reason PDS switchboards are designed according to IP 53. This protection limits the air circulation inside the switchboard and effects heating operational temperature of busbars. In case of removing the metal filter and metal case the IP protection decreases to IP2X. Then the operational temperature of busbar can be decrease.

Additionally there is another way to decrease operational temperature that using forced air with fan motors. For see the technics please go on Thermal Management Instructions.

In the sheets of current - rated current (In) - according to busbar sizes are values where tested in 25°C ambience temperature without any air circulation limits so called nominal. In the following pages there will be selection tables for currents in different IP protection selections.

c. Ambient Temperature around the switchboard:

The maximum load current for a set of busbars is a function of the thermal environment.

The type and the size of the conductors must be determined in view of carrying the required currents taking into account the temperatures reached in the switchboard. These conductors are subjected to additional heat rise caused by the flowing current (joule effect) and the connected devices.

The temperatures reached by the conductors and the insulating materials, etc. must not exceed the maximum temperatures for which the products were designed. PDS busbars are sized to operate without any particular constraints for the assemblies in switchboards operating under normal environmental conditions.

IEC 61439-1 permits higher overtemperature limits than 105 K, the absolute busbar temperature at an ambient temperature of 35°C and 105K over temperature limit is 140°C. Temperature 140°C is significantly below the thermal softening of copper material.

In the selection tables in below calculation of over temperature limits 105°C as a limit of PDS according to permissible temperature limits on insulated materials which is inside the IEC 61439-1 limit.

Type of Busbar	Nominal(In) 25°C +30K	Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
		Air Ventilation	IP Protection	Average Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40 / 10 x 2	1350A	Forced Air	IP2X	2000	2000	2000	2000	1910	1820	1710
		Standart	IP2X	1590	1540	1500	1430	1350	1300	1220
		Forced Air	IP 53	1820	1820	1820	1820	1730	1650	-
		Standart	IP53	1440	1400	1360	1300	1240	1180	-
50 / 10 x 2	1620A	Forced Air	IP2X	2990	2990	2990	2990	2850	2720	2570
		Standart	IP2X	2400	2310	2220	2140	1930	1810	1690
		Forced Air	IP53	2680	2680	2680	2680	2560	2440	-
		Standart	IP53	2170	2070	2000	1920	1740	1610	-
60 / 10 x 2	1860A	Forced Air	IP2X	3340	3340	3340	3340	3200	3040	2870
		Standart	IP2X	2600	2490	2390	2300	2170	2030	1900
		Forced Air	IP53	2940	2940	2940	2940	2800	2670	-
		Standart	IP53	2330	2220	2140	2060	1870	1720	-
80 / 10 x 2	2300A	Forced Air	IP2X	3700	3700	3700	3700	3530	3360	3180
		Standart	IP2X	2940	2850	2760	2640	2520	2400	2250
		Forced Air	IP53	3360	3360	3360	3360	3200	3060	-
		Standart	IP53	2650	2580	2520	2400	2280	2170	-

Type of Busbar	"Nominal(In) 25°C +30K"	Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
		"Air Ventilation"	"IP Protec-tion"	Average Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40 / 10 x 4	2500A	Forced Air	IP2X	3440	3440	3440	3440	3300	3130	2950
		Standart	IP2X	2950	2860	2780	2650	2530	2400	2270
		Forced Air	IP 53	3020	3020	3020	3020	2850	2750	-
		Standart	IP53	2780	2700	2620	2500	2380	2270	-
50 / 10 x 4	3000A	Forced Air	IP2X	4040	4040	4040	4040	3800	3670	3470
		Standart	IP2X	3170	3080	2990	2850	2720	2590	2450
		Forced Air	IP53	3500	3500	3500	3500	3300	3180	-
		Standart	IP53	2850	2810	2700	2600	2480	2350	-
60 / 10 x 4	3400A	Forced Air	IP2X	4220	4220	4220	4220	4000	3840	3620
		Standart	IP2X	3450	3350	3250	3100	2950	2820	2650
		Forced Air	IP53	3580	3580	3580	3580	3400	3250	-
		Standart	IP53	3230	3140	3050	2900	2770	2640	-
80 / 10 x 4	4000A	Forced Air	IP2X	4800	4800	4800	4800	4580	4370	4120
		Standart	IP2X	3880	3700	3570	3440	3090	2940	2780
		Forced Air	IP53	4280	4280	4280	4280	4080	3890	-
		Standart	IP53	3450	3300	3180	3060	2850	2710	-

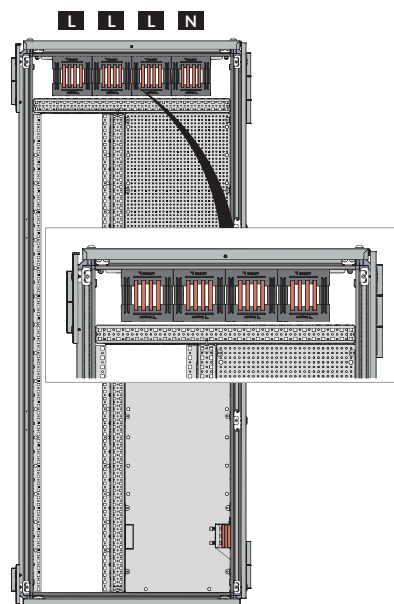
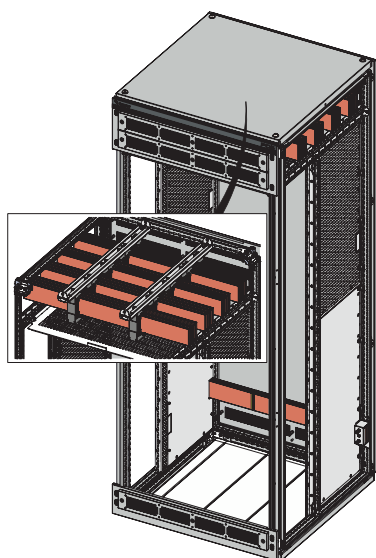
! NOTE: Tin plated busbar currents are the same as bare busbars. The tables can be use also in tin plated copper applications.

! NOTE: The tables show the currents on phases (L1,L2,L3). Sizing of Netural , PEN or PE bars partner have to follow the instructions in section C 3: EQUIPOTENTIALITY and ELECTRICAL CONTINUTY instruction pages.

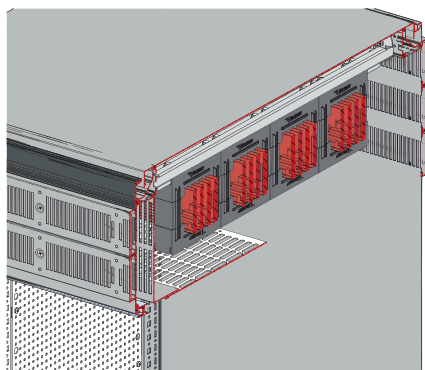
■ RIGIDITY & INSULATION OF MAIN BUSBAR

- **(a)** Main phases (L1,L2,L3), Neutral or PEN and PE busbar positions are fixed in PDS system.
The rigidity of busbars with busbar holders designed and tested together related to IEC 61439-1/2 standards with PDS declarations. Assembly manufacturer (PDS Partner) have to follow the fixing positions of busbars and holders which described at assembling specifications.
- Insulation air clearance distances set up related to 1000V (Ui) and 8kV / 12kV (Uimp)
 - **(b)** Main phases (L1,L2,L3) and Neutral bars have to fix to the frame by insulated busbar holders
 - **(c)** PEN bar is not a necessity to fix by insulated busbar holder but in PDS system PEN conductor is used with insulated busbar holder the same as Neutral Bar.
 - **(d)** PE conductor have to fix to the frame with a conductive holder. PE holder is designed with a conductive material in PDS system.
 - **(e)** At the end points of main busbar, ending insulated covers have to be used.
 - **(f)** In any case main busbar phases (L1,L2,L3) and Neutral bar have to protected against conductive parts with minimum air clearance distance 20mm.
- 2 positions of holders on the longitudinal of main busbar related to short circuit (Icw): 65kA and 85kA
Each module has a different adaptation on 2 positions that can be check from Modules descriptions.
But generally rule of positioning the holders on longitudinal of busbar are :
 - **(g)** Icw 65kA : 550 mm distance between holders
 - **(h)** Icw 85kA : 300 (272.5) mm distance between holders
- Fastening of holders and holder rails , partner have to follow asseby instructions for rigidity and protection against loosening.

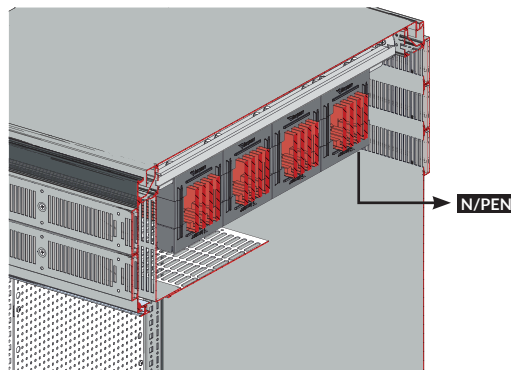
■ (a) Busbar Fix Positioning



■ (b) Insulated Busbar Holders

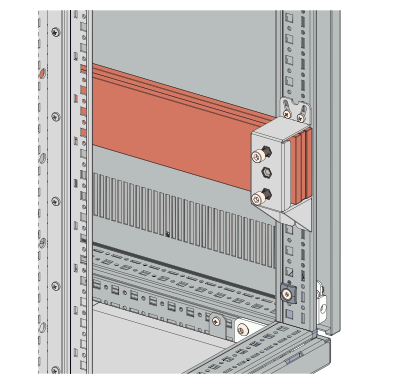


■ (c) PEN Busbar Holder

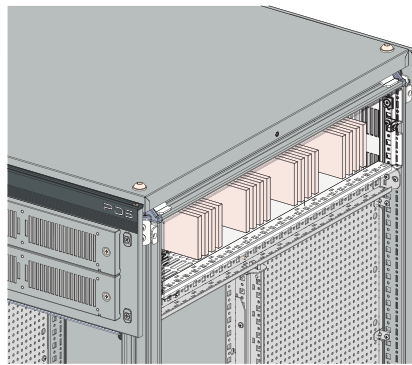


■ RIGIDITY & INSULATION OF MAIN BUSBAR

■ (d) Conductive PE Busbar holder

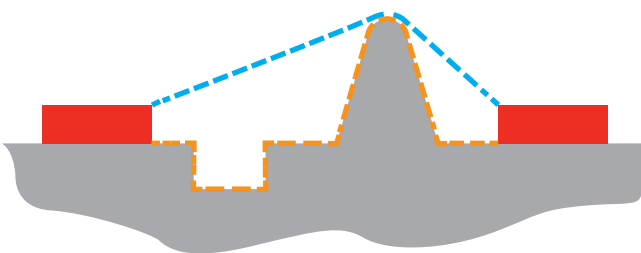


■ (e) Ending Insulated Cover



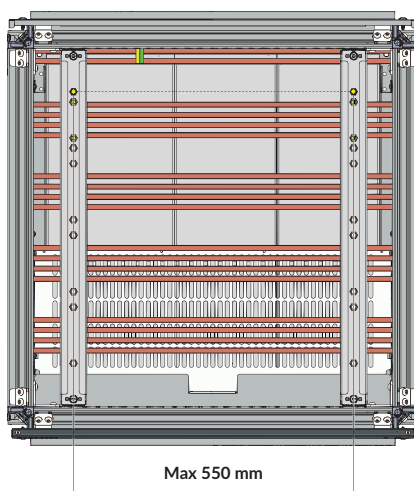
- It must be ordered optionally that can be found in Section A : 4.Accessories.

■ (f) Air clearance Distance : Min. 20mm

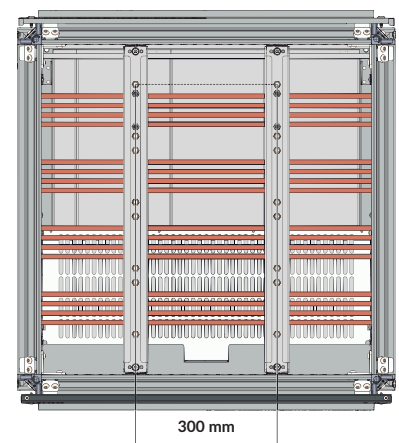
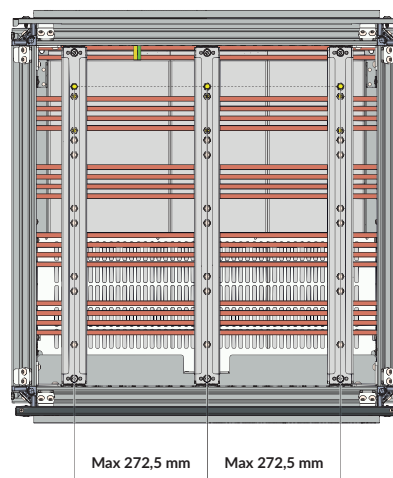


- Clearance
- Creepage distance
- Conductive part
- Solid insulated part

■ (g) Icw 65kA Holder Distance



■ (h) Icw 85kA Holder Distance



■ 2.2 DISTRIBUTION VERTICAL BUSBARS

■ BUSBAR SIZING

The factors that must be taken into account in determining the size of busbars include:

a. Diversity factor :

Not all the loads supplied by a set of busbars are used at full rated load or at the same time. The diversity factor is the means to determine the maximum load current used to size the busbars. Standard IEC 61439-1 and 2 specifies the table below.

Number of Cicuits	Diversity Factor
2 - 3	0,9 (%90)
4 - 5	0,8(%80)
6 - 9	0,7(%70)
10 and more	0,6(%60)

For example:

Total equipment circuit : 2700A

Equipment quantity : 22 ---> Diversity factor : 0,6

Requiring main busbar circuit : $2700 \times 0,6 = 1.620A$

b. Degree of IP Protection:

IP protection which means to protection against solid and liquid objects in the environment is a necessity for a switchboard to survive the functions for a long time period and to protect against short circuits and harmful chemicals can be cause corrosion. For that reason PDS switchboards are designed according to IP 53. This protection limits the air circulation inside the switchboard and effects heating operational temperature of busbars. In case of removing the metal filter and metal case the IP protection decreases to IP2X. Then the operational temperature of busbar can be decrease.

Additionally there is an another way to decrease operational temperature that using forced air with fan motors. For see the technics please go on Thermal Management Instructions.

In the sheets of current - rated current (In) - according to busbar sizes are values where tested in 25°C ambience temprature without any air circulation limits so called nominal. In the following pages there will be selection tables for currents in different IP protection selections.

c. Ambient Temperature around the switchboard:

The maximum load current for a set of busbars is a function of the thermal environment.

The type and the size of the conductors must be determined in view of carrying the required currents taking into account the temperatures reached in the switchboard. These conductors are subjected to additional heat rise caused by the flowing current (joule effect) and the connected devices.

The temperatures reached by the conductors and the insulating materials, etc. must not exceed the maximum temperatures for which the products were designed.

PDS busbars are sized to operate without any particular constraints for the assemblies in switchboards operating under normal environmental conditions.

IEC 61439-1 permits higher overtemperature limits than 105 K, the absolute busbar temperature at an ambient temperature of 35°C and 105K over temperature limitis 140°C. Temprature 140°C is significantly below the thermal softening of copper material.

In the selection tables in below calculation of over temperature limits 105°C as a limit of PDS according to permissible temprature limits on insulated materials which is inside the IEC 61439-1 limit.

Type of Busbar	Nominal (In) 25°C +30K"	Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
		Air Ventilation	IP Protection	Average Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
20 / 5 x 2	495A	Forced Air	IP2X	740	740	740	740	700	670	630
		Standart	IP2X	620	600	570	530	510	480	450
		Forced Air	IP 53	670	670	670	670	630	600	-
		Standart	IP53	570	540	520	480	450	420	-
30 / 5 x 2	700A	Forced Air	IP2X	1050	1050	1050	1050	990	940	890
		Standart	IP2X	880	850	800	750	720	670	630
		Forced Air	IP53	940	940	940	940	880	840	-
		Standart	IP53	790	760	720	670	630	580	-
40 / 5 x 2	900A	Forced Air	IP2X	1360	1360	1360	1360	1280	1220	1150
		Standart	IP2X	1140	1100	1040	970	940	870	820
		Forced Air	IP53	1220	1220	1220	1220	1140	1100	-
		Standart	IP53	1030	990	940	870	820	760	-
50 / 5 x 2	1100A	Forced Air	IP2X	1650	1650	1650	1650	1550	1490	1400
		Standart	IP2X	1390	1330	1260	1180	1140	1060	990
		Forced Air	IP53	1480	1480	1480	1480	1400	1340	-
		Standart	IP53	1250	1200	1150	1060	1000	920	-
60 / 5 x 2	1300A	Forced Air	IP2X	1960	1960	1960	1960	1840	1760	1670
		Standart	IP2X	1650	1580	1500	1400	1350	1260	1180
		Forced Air	IP53	1750	1750	1750	1750	1640	1570	-
		Standart	IP53	1480	1420	1350	1250	1180	1090	-

Type of Busbar	Nominal(In) 25°C +30K"	Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
		Air Ventilation	IP Protection	Average Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40 / 10 x 2	1350A	Forced Air	IP2X	2000	2000	2000	2000	1910	1820	1710
		Standart	IP2X	1590	1540	1500	1430	1350	1300	1220
		Forced Air	IP 53	1820	1820	1820	1820	1730	1650	-
		Standart	IP53	1440	1400	1360	1300	1240	1180	-
50 / 10 x 2	1620A	Forced Air	IP2X	2990	2990	2990	2990	2850	2720	2570
		Standart	IP2X	2400	2310	2220	2140	1930	1810	1690
		Forced Air	IP53	2680	2680	2680	2680	2560	2440	-
		Standart	IP53	2170	2070	2000	1920	1740	1610	-
60 / 10 x 2	1860A	Forced Air	IP2X	3340	3340	3340	3340	3200	3040	2870
		Standart	IP2X	2600	2490	2390	2300	2170	2030	1900
		Forced Air	IP53	2940	2940	2940	2940	2800	2670	-
		Standart	IP53	2330	2220	2140	2060	1870	1720	-
80 / 10 x 2	2300A	Forced Air	IP2X	3700	3700	3700	3700	3530	3360	3180
		Standart	IP2X	2940	2850	2760	2640	2520	2400	2250
		Forced Air	IP53	3360	3360	3360	3360	3200	3060	-
		Standart	IP53	2650	2580	2520	2400	2280	2170	-

! NOTE: Tin plated busbar currents are the same as bare busbars. The tables can be use also in tin plated copper applications.

! NOTE: The tables show the currents on phases (L1,L2,L3). Sizing of Netural , PEN or PE bars partner have to follow the instructions in section C 3: EQUIPOTENTIALITY and ELECTRICAL CONTINUTY instruction pages.

Type of Busbar	Nominal(In) 25°C +30K	Permissible current (A) at maximum 105°C Bare Busbar Temperature up to 60 Hz (E-Cu F30)								
		Air Ventilation	IP Protection	Maximum Ambient Temperature around the Switchboard						
				20°C	25°C	30°C	35°C	40°C	45°C	50°C
40 / 10 x 4	2500A	Forced Air	IP2X	3440	3440	3440	3300	3130	3130	2950
		Standart	IP2X	2860	2780	2650	2530	2400	2400	2270
		Forced Air	IP 53	3020	3020	3020	2850	2750	2750	-
		Standart	IP53	2700	2620	2500	2380	2270	2270	-
50 / 10 x 4	3000A	Forced Air	IP2X	4040	4040	4040	3800	3670	3670	3470
		Standart	IP2X	3080	2990	2850	2720	2590	2590	2450
		Forced Air	IP53	3500	3500	3500	3300	3180	3180	-
		Standart	IP53	2810	2700	2600	2480	2350	2350	-
60 / 10 x 4	3400A	Forced Air	IP2X	4220	4220	4220	4000	3840	3840	3620
		Standart	IP2X	3350	3250	3100	2950	2820	2820	2650
		Forced Air	IP53	3580	3580	3580	3400	3250	3250	-
		Standart	IP53	3140	3050	2900	2770	2640	2640	-
80 / 10 x 4	4000A	Forced Air	IP2X	4800	4800	4800	4580	4370	4370	4120
		Standart	IP2X	3700	3570	3440	3090	2940	2940	2780
		Forced Air	IP53	4280	4280	4280	4080	3890	3890	-
		Standart	IP53	3300	3180	3060	2850	2710	2710	-

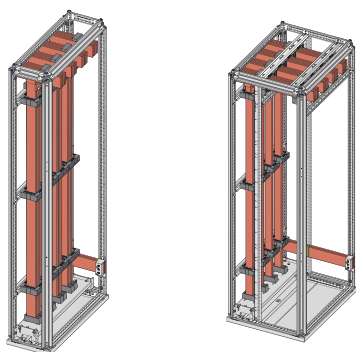
! NOTE : Tin plated busbar currents are the same as bare busbars. The tables can be use also in tin plated copper applications.

! NOTE : The tables show the currents on phases (L1,L2,L3) - 3 Poles - or with Neutral/PEN bar. -4 Poles-

■ RIGIDITY & INSULATION OF DISTRIBUTION VERTICAL BUSBARS

- (a) Phases (L1,L2,L3) , Neutral or PEN busbar positions are fixed in vertical distribution position in the same position of horizontal Main Busbars.

The rigidity of busbars with busbar holders designed and tested together related to IEC 61439-1/2 standards with PDS declarations. Assembly manufacturer (PDS Partner) have to follow the fixing positions of busbars and holders which described at assembling specifications.

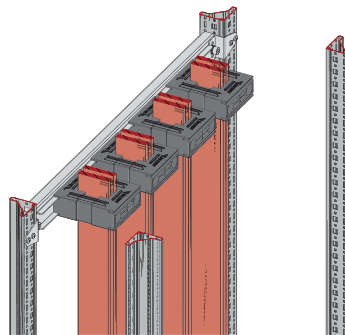
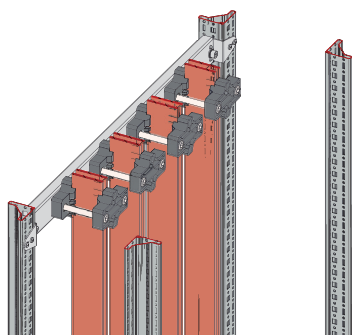


- (b) There are 4 type of busbars and holders are using :

- b1 : 5mm thickness x 2b from 495A to 1300A with insulated holder.
- b2 : 10mm thickness x 2b from 1350A to 2300A with insulated holder
- b3 : 10mm thickness x *4b from 2500A to 4200A with insulated holder
- * 4b flat busbars are usable in only 800mm depth enclosures!
- b4 : 5 or 10mm thickness ,2b or 4b for all currents with insulated bottom holder

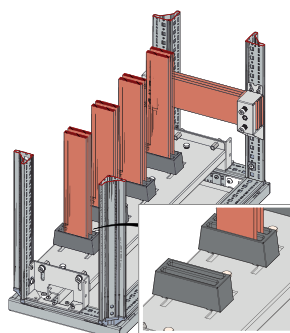
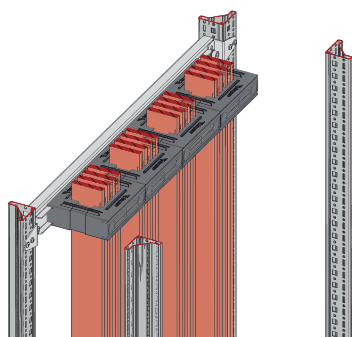
■ (b1) 5mm x 2b Insulated Holder

■ (b2) 10mm x 2b Insulated Holder

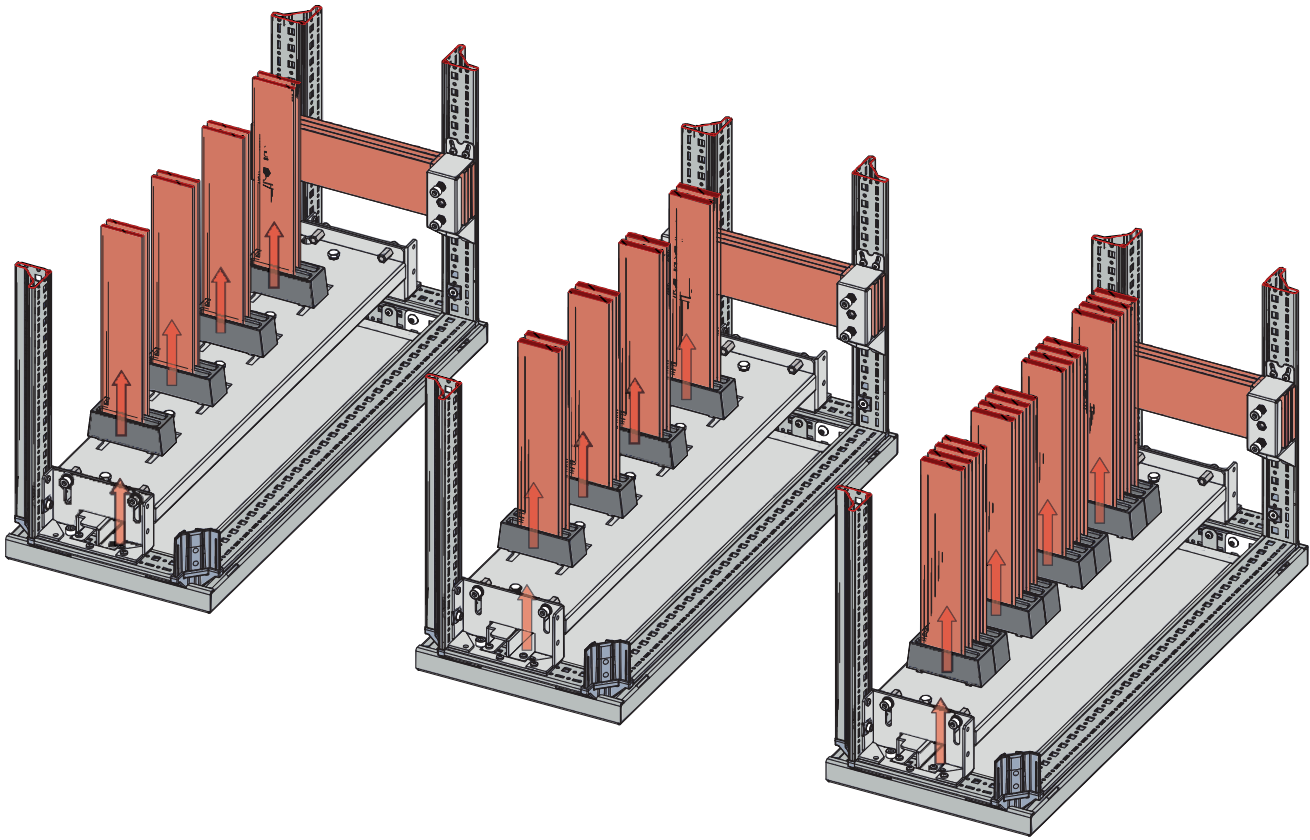


■ (b3) 10mm x 4b Insulated Holder

■ (b4) Insulated Bottom Holder

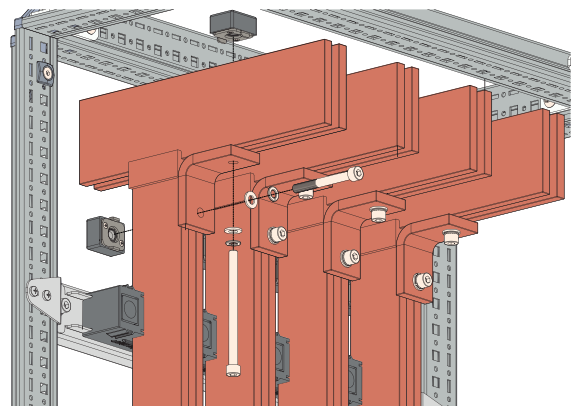
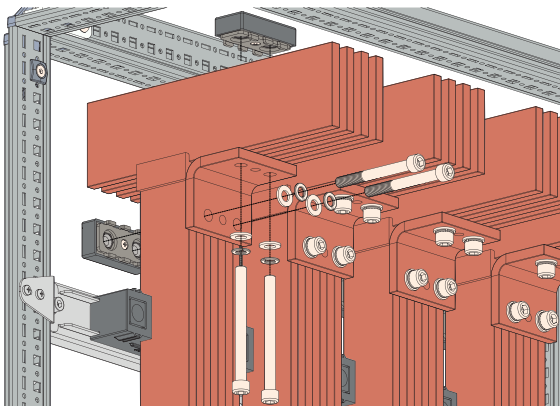


- (c) Vertical busbars are supporting from bottom up to main busbar thanks to bottom mounting kit.
This kit protects the vertical busbars against loosening of main busbar connection

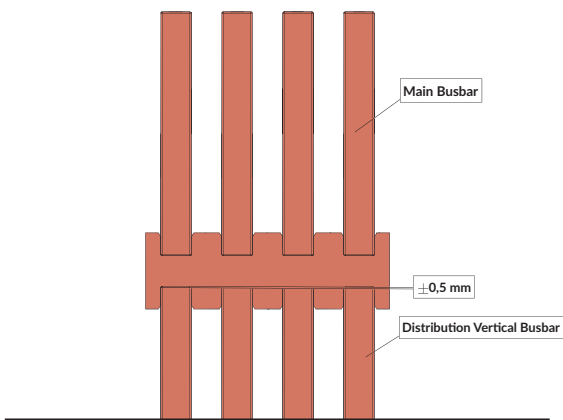


- (d) Vertical busbars are connecting and fixing to main busbar with an conductive adapter part thanks to connection kit without need drilling.

- d1** : The partner have to follow assembly instructions and be care that fits the adapter part into the busbar spaces. The length of the vertical busbars in each pole have to be in mininum $\pm 0,5\text{mm}$ cleareances.
- d2**: The connection kit needs a copper angle with 10mm thickness in 80mm width for x4b main busbar or in 40mm width for x2b main busbar.
- d3**: Screw lengths must be the fit accordig to busbar width sizes to be a suffceint fixig and keeping the insulated cover on nut.



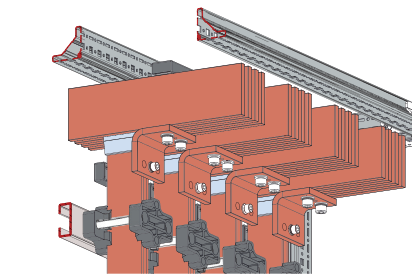
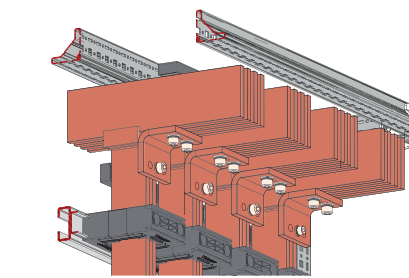
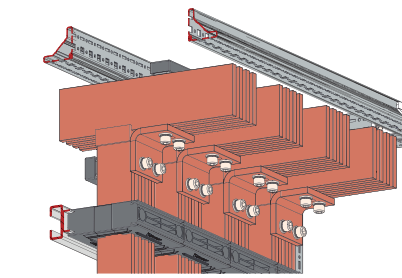
■ (d1) Busbar Length Clearance min : $\pm 0.5\text{mm}$



■ (d2) Copper Angle 80mm x4b to x4b

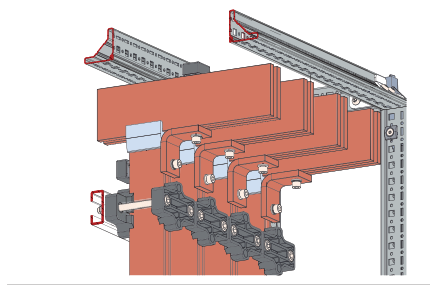
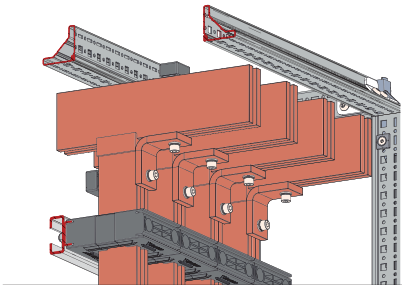
■ (d2) Copper Angle 80mm x4b to x2b

■ (d2) Copper Angle 80mm x4b to x2b(5mm)

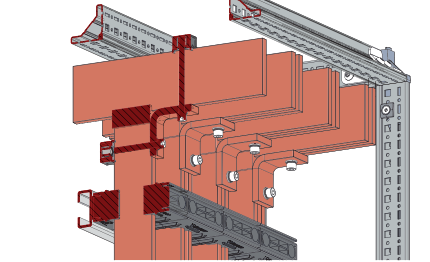
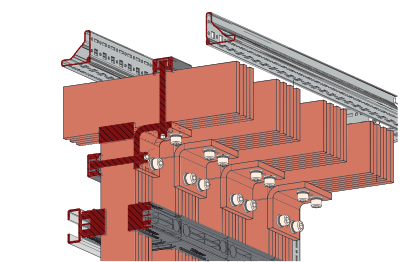


■ (d2) Copper Angle 40mm x2b to x2b

■ (d2) Copper Angle 40mm x2b to x2b (5mm)

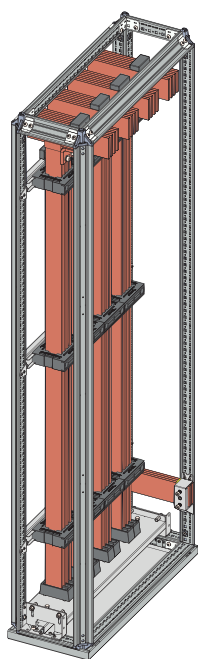


■ (d3) Fitting the Screw Lengths

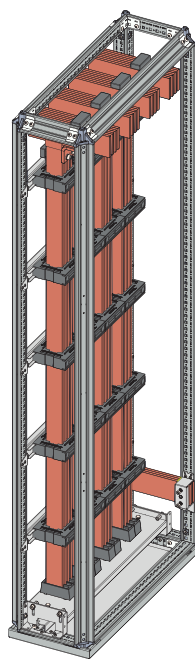


- (e) 2 positions of holders on the longitudinal of vertical busbar related to short circuit (Icw):
65kA and 85kA
Each module has a different adaptation on 2 positions that can be check from Modules descriptions.
But generally rule of positioning the holders on longitudinal of busbar are :
- e1 : Icw 65kA : 550mm distance between holders (4 holder sets on length)
 - e2 : Icw 85kA : 300mm distance between holders (6 holder sets on length)

■ (e1) Icw 65kA Holder Distance

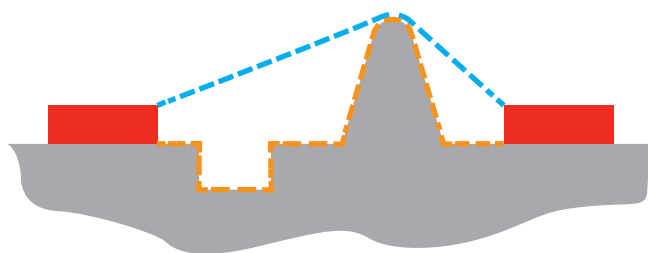


■ (e2) Icw 85kA Holder Distance



- (f) Insulation air clearance distances in vertical busbars set up related to 1000V (Ui) and 8kV (Uimp)
- Phases (L1,L2,L3) and Neutral bars have to fix to the frame by insulated busbar holders (see at items b1,b2,b3)
 - At the bottom points of vertical busbar , bottom insulated holders have to be used.(see at item b4)
 - In any case vertical busbar phases(L1,L2,L3) and Neutral bar have to protected against conductive parts with mininum air clearance distance 20mm.

■ Air clearance Distance : Min. 20mm

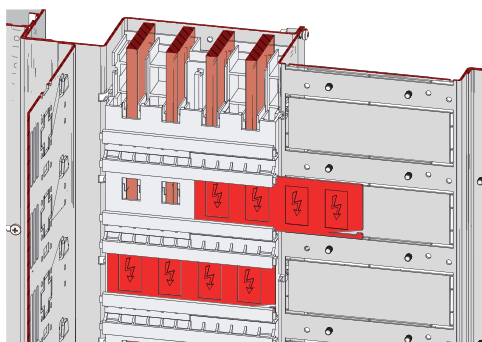


- Clearance
- Creepage distance
- Conductive part
- Solid insulated part

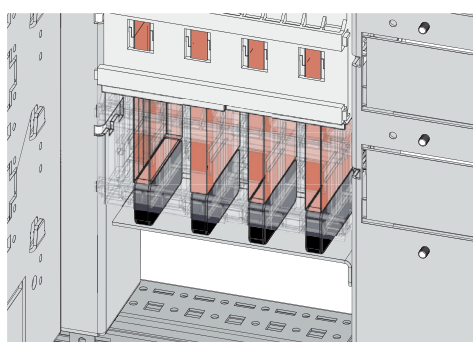
■ RIGIDITY & INSULATION OF DRAWABLE MODULE VERTICAL BUSBAR

- (a) Drawable module vertical busbar size is 60x10mm for all poles and calculated current is 1000A AC up to 60Hz.
- (b) Phases (L1,L2,L3), Neutral vertical busbar position are fixed in PDS system.
The rigidity of busbars with busbar holders designed and tested together related to IEC 61439-1/2 standards with PDS declarations. Assembly manufacturer (PDS Partner) have to follow the fixing positions of busbars and holders which described at assembling specifications.
- (c) Insulation air clearance distances set up related to 800V (Ui) and 8kV (Uimp)
 - c1: Phases (L1,L2,L3) and Neutral or PEN bars have to fix to the frame by insulated busbar holders
 - c2: At the bottom points of vertical busbar, ending insulated spacers have to be used.
 - In any case all busbar phases (L1,L2,L3) and Neutral bar have to protected against conductive parts with mininum air clearance distance 20mm.
- (d) Drawable module can give possibility to change the feeder with a draw while the module is under energy. Therefore partner have to be close all open areas according to IPXXB (12.5mm -as finger)
 - d1: Empty modules inside the draws have to be closed with closer cover.
 - d2: Contact modules inside the draws have to be used with close slider.
 - d3: Do not remove metal closers for empty zones in draw like outgoing and control connectors.
- (e) Vertical busbar related to short circuit (Icw): 60kA
 - e1: Insulated holder requires to fix the busbar on the top position close to main busbar connection
- (f) Fastening of holders busbars, partner have to follow assembly instructions for rigidity and protection against loosening.

■ (c1) Insulated Busbar Holders



■ (c2) Ending Insulated Spacers

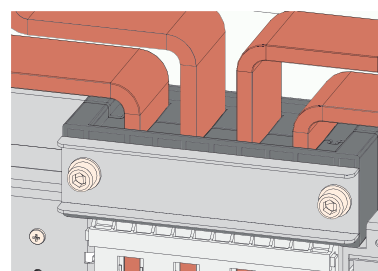
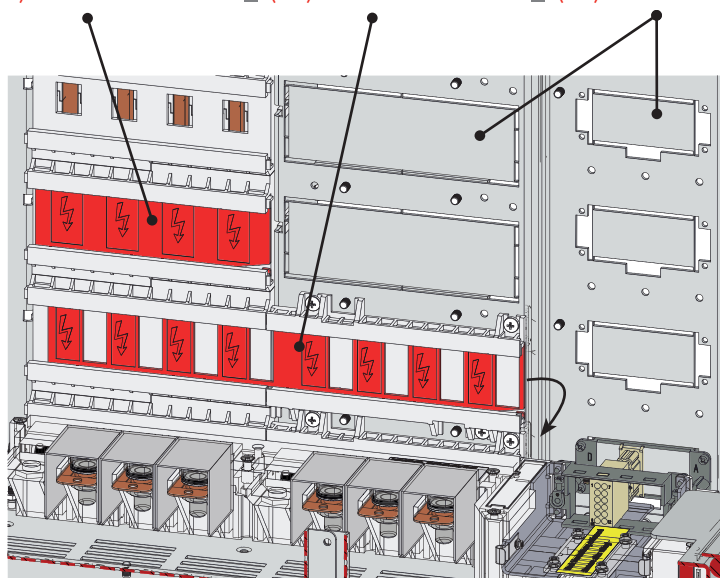


■ (d1) Closer Cover

■ (d2) Close Slider

■ (d3) Metal Closers

■ (e1) Insulated Holder For Top Of Busbar

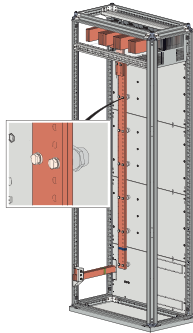


■ RIGIDITY & INSULATION OF OUTGOING VERTICAL BUSBARS (NEUTRAL AND EARTHING)

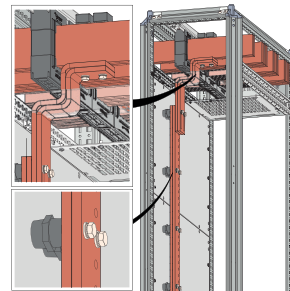
- (a) According to sizing of vertical neutral or PEN and Earthing busbars , the instructions must be followed in Equipotentiality and electrical continuity pages (Section C, Item 3)
- (b) Neutral or PEN and Earthing vertical busbar positions are fixed in cabling modules at PDS system.
The rigidity of busbars with busbar holders designed and tested together related to IEC 61439-1/2 standards with PDS declarations. Assembly manufacturer (PDS Partner) have to follow the fixing positions of busbars and holders which described at assembling specifications.
- (c) Insulation air clearance distances set up related to 1000V (Ui) and 8kV (Uimp) with 85kA Icw
 - c1:** Neutral bars have to fix to the frame by insulated busbar holders. ISO type insulators are using in PDS system for that.
 - c2:** PEN bars are not necessary to fix to the frame by insulated holders , but in PDS system , fixing system is the same as Neutral Bars.
 - c3:** Neutral or PEN bars are connecting to the main bar from top position and stretches to down.
 - c4:** Earthing bars should to fix to the frame with conductive spacers. Bars are connecting to the main bar from bottom position and stretches to upside.
 - c5:** Neuteral or PEN and Earthing bars thickneses are 5mm,10mm and 20mm. 20mm thickness bars are combined double adherent 10mm thickness bars.
 - c6:** The Neutral or PEN and Earthing bars should be perforated with diameter 10mm holes in each 25mm steps for fixing the cables with cable lugs.
 - c7:** 5mm and 10 mm thikness of Neutral or PEN and Earthing bars can be use without holes for fixing via the cable clamps.
- In any case all Neutral busbars have to protected against conductive parts with minimum air clearance distance 20mm.
- (d) Vertical busbar related to short circuit (Icw): up to 85kA
 - d1:** Holder positions on Neutral or PEN bars and on Earthing bars are 225mm between each other with 6 points.
- (e) Fastening of holders busbars, partner have to follow assembly instructions for rigidity and protection against loosening.

■ RIGIDITY & INSULATION OF OUTGOING VERTICAL BUSBARS (NEUTRAL AND EARTHING)

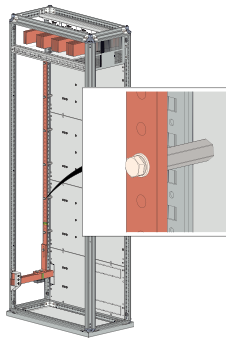
■ (c1) ISO Type Insulated Holders on Neutral Bar



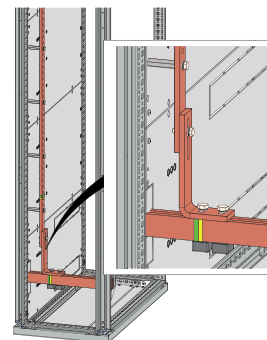
■ (c3) Main Neutral Bar Connection



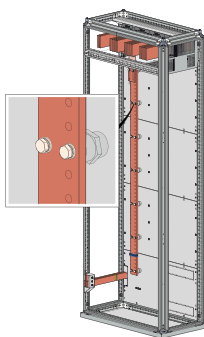
■ (c4) Conductive Spacers on Earthing Bar



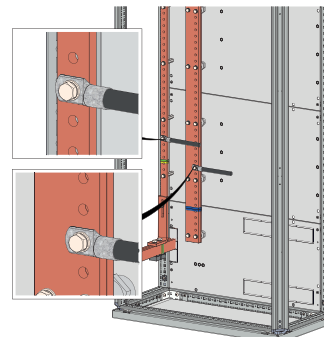
■ (c4) Main Earthing Bar Connection



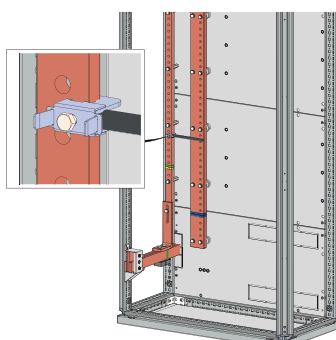
■ (c5) Single and Double Bars



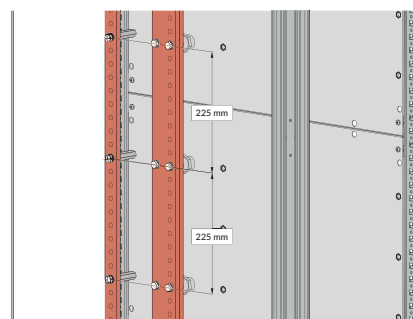
■ (c6) Perforation and fixing with cable Lugs



■ (c7) Fixing Cables Via the Cable Clamps



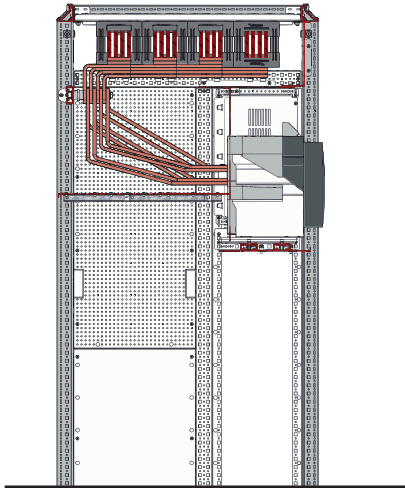
■ (d1) Holder Positions of Busbars



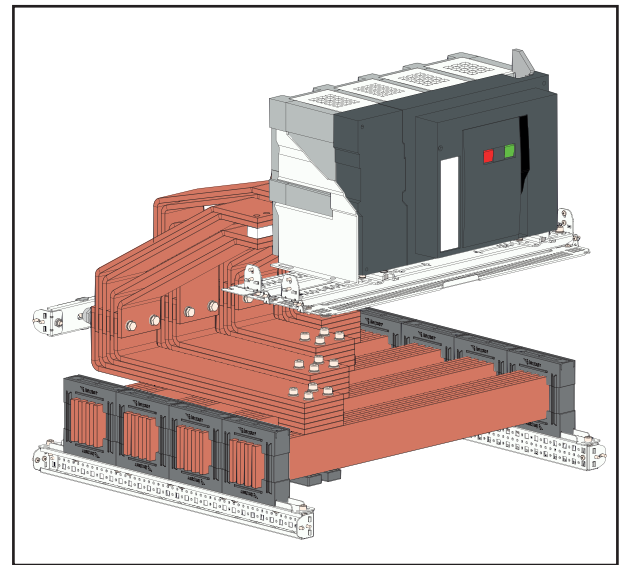
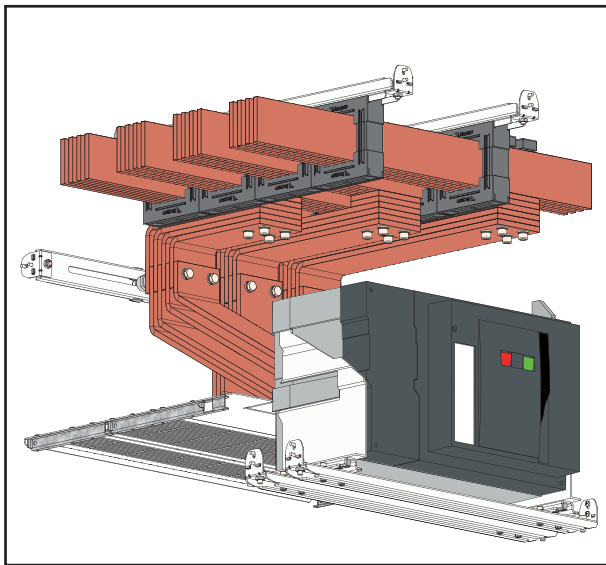
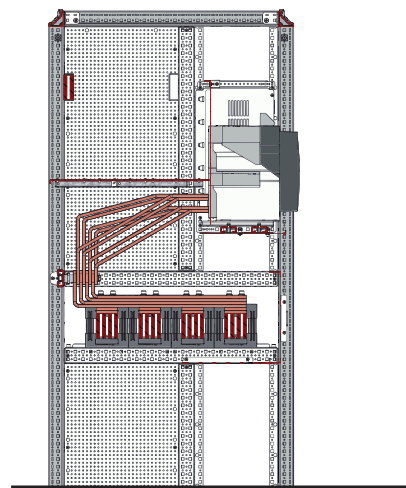
■ 2.3 ACB (AIR CIRCUIT BREAKER) CONDUCTORS and CONNECTION

■ MAIN BUSBAR CONNECTION

Top Busbar Position



Middle Busbar Position

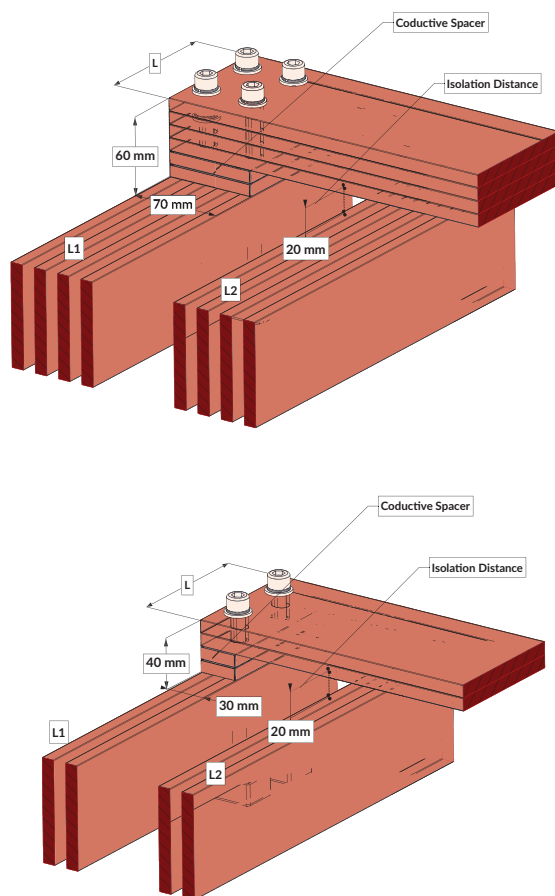


Designing connection bars to main busbars :

- Enclosure Depth 600mm : Main Busbar Power 1350A-2300A with 2 x (40,50,60,80)H/10 flat bars
Enclosure Depth 800mm : Main Busbar Power 2500A-4200A with 4 x (40,50,60,80)H/10 flat bars
- Neutral (N) or PEN conductor have to make connection to main busbar also in 3 pole applications.It connects and stretches to down(Top busbar position) or to upside(Middle busbar position) for connecting to incoming/outgoing terminal.
- Flat bar sections is changing to models by each brands. In PDS system flat bars' widths are 50/10, 60/10, 80/10, 100/10 with different quantities . In the following pages the selection tables can be found for each models.

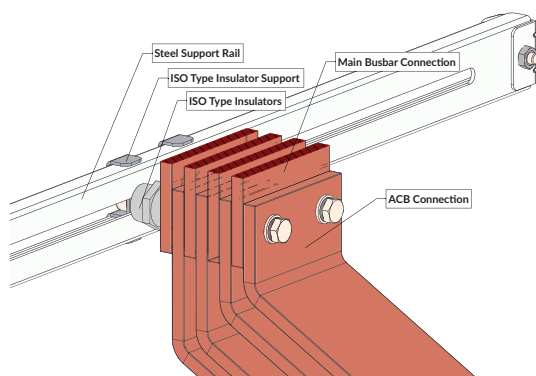
Critical Points of ACB connection bars to main busbar :

■ 1. Spacer for Isolation distance



- During the fixing ACB connection bars to main busbar minimum 20mm distance is required for isolation.
- When connection bars are stretching from front to back they are passing close to other main busbar poles. The partner have to be sure to kept minimum 20mm distance between connection bars and main busbars.
- The spacer have to be the same material as main busbar.
Two 10mm thickness rectangular parts can be used for this isolation distance.
- Width(w) of the spacer have to be the 40mm for 2 x sectioned main busbars, 80mm for 4 x sectioned main busbars for isolation between the poles of Main Busbar and to reach sufficient contacting.
- Length(L) of the spacer have to be minimum width of the connection bar to reach sufficient contacting.
- Fixing the connection bars to main busbar, the partner have to be follow assembling instructions which stated at the interested pages.

■ 2. Connection bar support holders for coming from Main Busbar

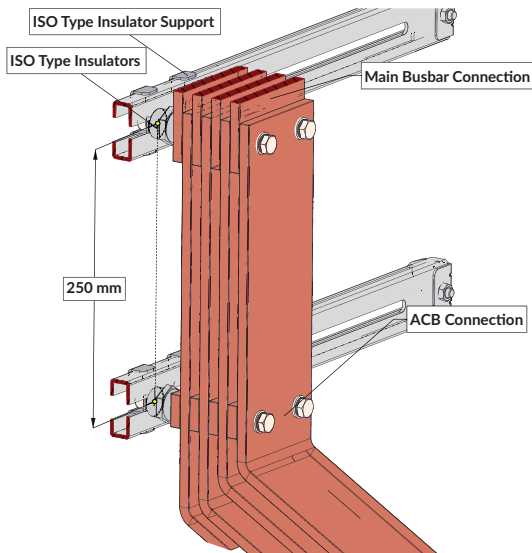


- Connection bars which coming from main busbar have to be fix to the enclosure frame on an exact point which stated at assembling instructions by an insulated holders for carrying weights and protection against short-circuits.
- ISO type metric insulators are using support with steel support rail in the rear of enclosure.

■ 2.3 ACB (AIR CIRCUIT BREAKER) CONDUCTORS and CONNECTION

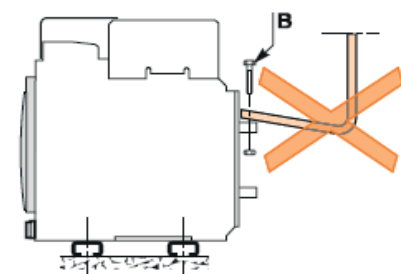
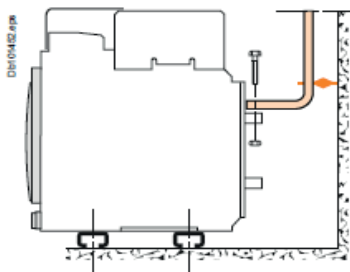
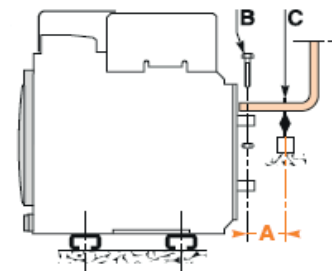
■ MAIN BUSBAR CONNECTION

■ 3. Connection bar support holders for coming from ACB Connection



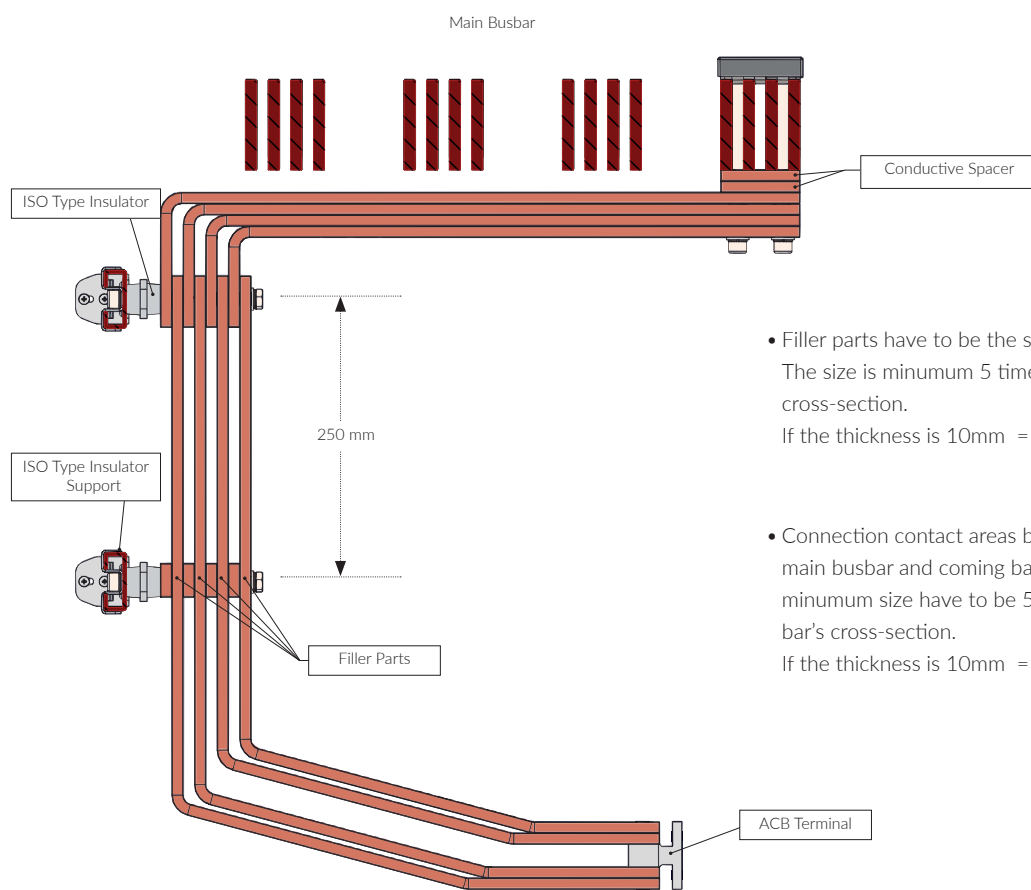
- Connection bars which coming from ACB terminals have to be fix to the enclosure frame on an exact point which stated at assembling instructions by an insulated holders for carrying weights and protection against short-circuits.
- ISO type metric insulators are using support with steel support rail in the rear of enclosure.
- Vertical position of connection bar on the rear , minimum busbar holder distances have to be 250mm.

■ 4. ACB Terminal Connections



- The busbars should be suitably adjusted to ensure that the connection points are positioned on the terminals before the bolts are inserted B.
The connections are held by the support which is solidly fixed to the framework of the switchboard, such that the circuit breaker terminals do not have to support its weight C (this support should be placed close to the terminals).
- Electrodynamic stresses
The first busbar support or spacer shall be situated within a maximum distance from the connection point of the breaker (see table below). This distance must be respected so that the connection can withstand the electrodynamic stresses between phases in the event of a short circuit. Maximum distance A between busbar to circuit breaker connection and the first busbar support or spacer with respect to the value of the prospective short-circuit current.

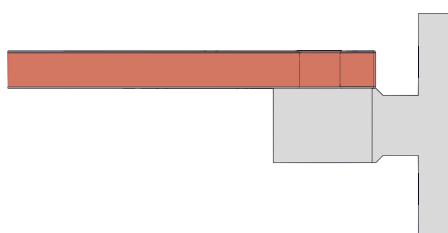
■ 5. Placing of flat Bars in side section



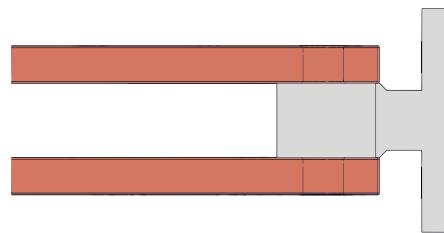
- Filler parts have to be the same material as connection bar.
The size is minimum 5 times larger than connection bar's cross-section.
If the thickness is 10mm = Minimum 50mm
- Connection contact areas between the coming bar from main busbar and coming bar from ACB terminal, the minimum size have to be 5 times larger than connection bar's cross-section.
If the thickness is 10mm = Min. 50mm / Width of Bar

■ Placing of connection bars on ACB Terminal

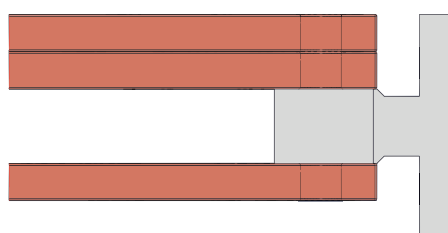
1 x Flat Bar



2 x Flat Bars



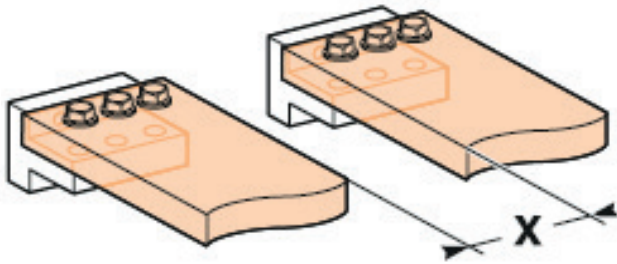
3 x Flat Bars



4 x Flat Bars

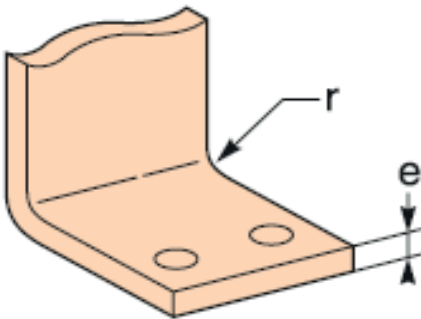


■ 6. Isolation of distances between Flat Bars



- X : Minimum 8mm in 600 V Ui
X : Minimum 14mm in 1000 V Ui
- Partners should keep the isolation distance as much more.

■ 7. Busbar Bending



- When bending busbars maintain the radius indicated below (a smaller radius would cause cracks).
- In thickness(e) 5mm : Minimum radius(r) is 5mm, 7.5mm is recommended.
- In thickness(e) 10mm : Minimum radius(r) is 15mm, 18 to 20mm is recommended.

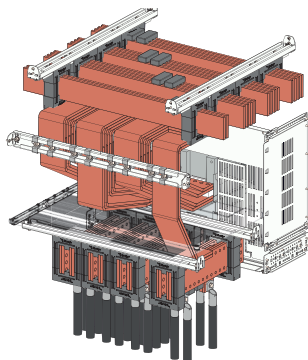
■ 8. Manufacturers' Instructions

- Partner must follow the ACB manufacturer instructions according to clamping, drilling and fastening conditions of terminal connections
- Partner must follow the ACB manufacturers' instructions and recommendations if there are conflicts between PDS instructions.

■ TERMINAL CONNECTION

Type of Terminal system for ACB connection incoming and outgoing :

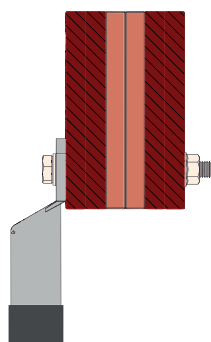
■ 1. General view of Terminal System



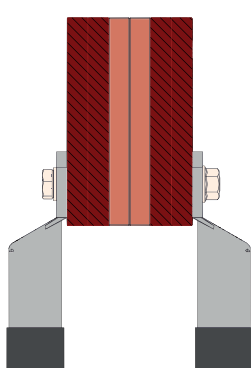
- The breaker terminals are using vertical position for creating stretched bar terminals. By this way cable connection points can be increase and can be safe for the wiegh loads.
- 2 busbar holders holds the terminal bar for each pole, 1 for the closest point to breaker terminal 1 for the end point of the terminal bar. Each holders are supporting by steel rail which fix directly the enclosure frame.
- In case of 3 poles ACB applicaitons , Neuteral or PEN terminal bar is also requiring for incoming or outgoing connections.

- For each pole terminal bar consists of 2 flat bars width of 80mm or 100mm according to current size of ACB.
- There are 3 types of cable connection :
 - (a) Using the single face of flat bars
 - (b) Using the double faces of flat bars
 - (c) Using the single or double faces of extended parts.
- Each type is requiring a conductive copper spacer between the flat bars.
- The selection of types are according with users' demand and secure isolation distances. Minumum secure distance is 14mm between two poles' conductive parts.

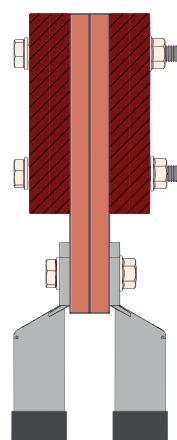
(a)



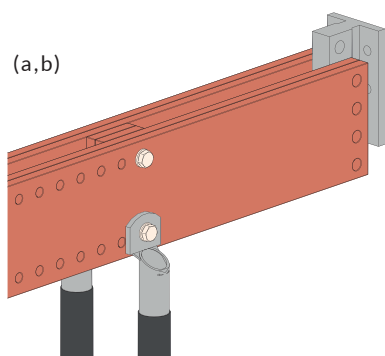
(b)



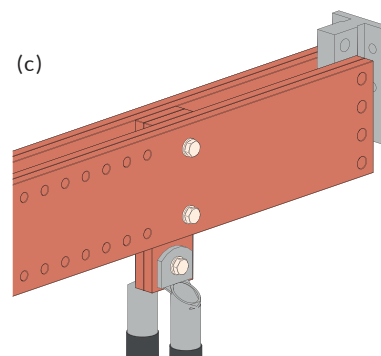
(c)



(a,b)



(c)



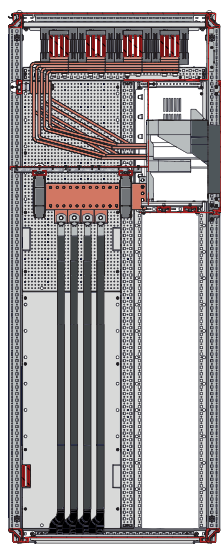
■ 2. Connection Points

■ Top position of Main Busbar

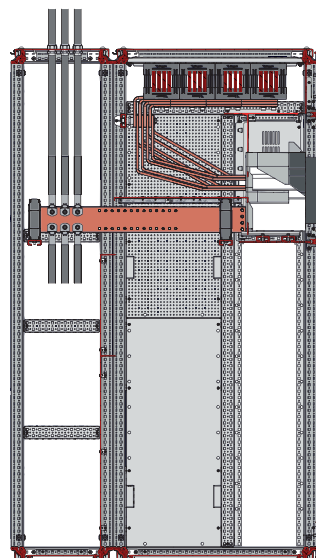
In case of using top main busbar there are two solutions for managing incoming cables directions.

- (a) Using without rear cabling module : The cables are coming in only from bottom position of enclosure.
 - (b) Using with rear cabling module : The cables are coming in from top or bottom position of enclosure.
- This solution is also permits to use busways.

(a) Without rear cabling module



(b) With rear cabling module

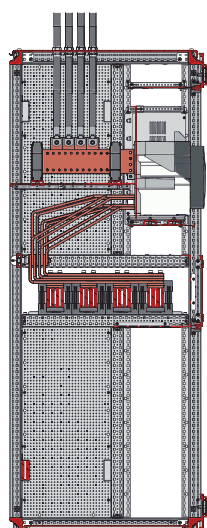


■ Middle position of Main Busbar

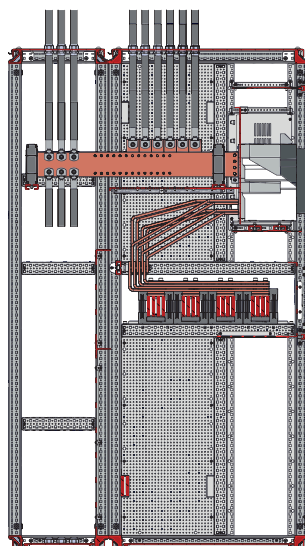
In case of using middle main busbar there are two solutions for managing incoming cables directions.

- (a) Using without rear cabling module : The cables are coming in only from top position of enclosure.
- This solution is also permits to use busways.
- (b) Using with rear cabling module : The cables are coming in from top or bottom position of enclosure.
- This solution is also permits to use busways.

(a) Without rear cabling module

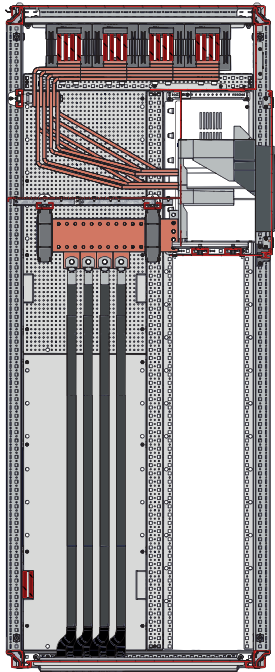


(b) With rear cabling module

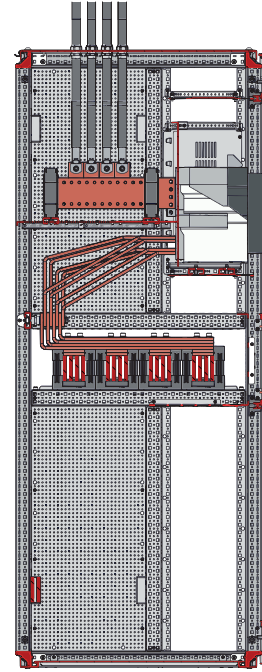


■ 3. Type of connection terminals

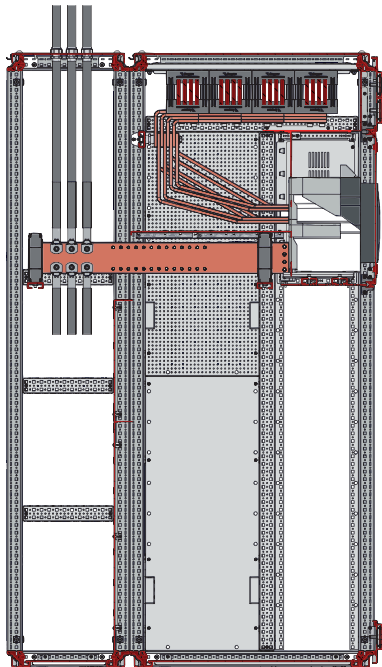
600mm depth ACB Module



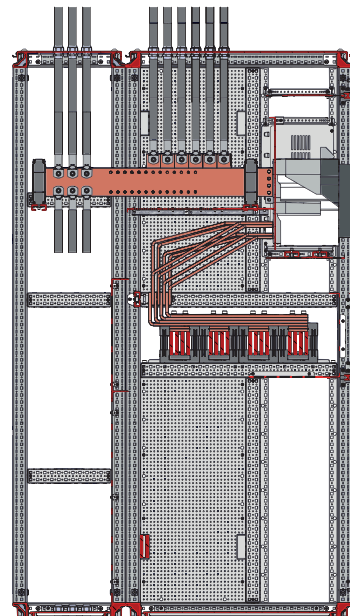
800mm depth ACB Module



400+600 depth with ACB rear cabling module

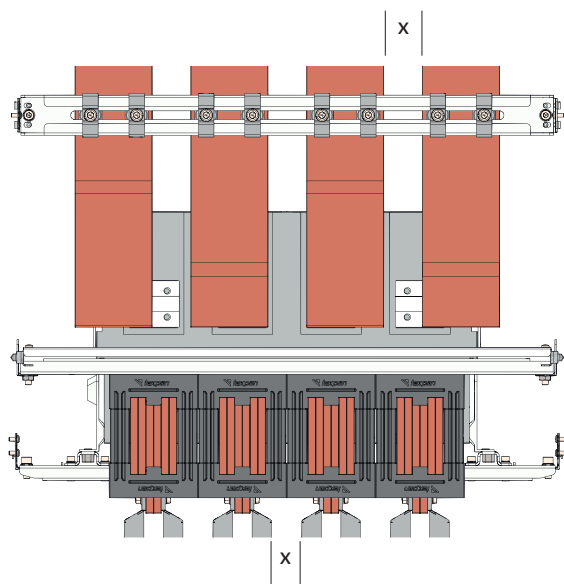


400+800 depth with ACB rear cabling module



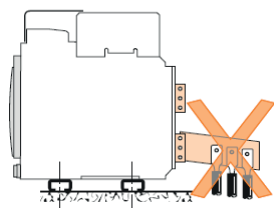
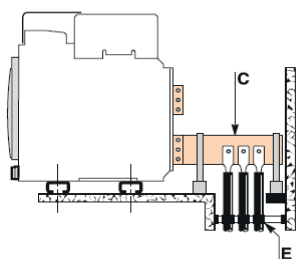
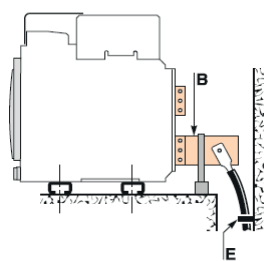
Critical Points of ACB terminal connection:

■ 1. Isolation distance between poles



- X : Minimum 8mm in 600 V Ui
X : Minimum 14mm in 1000 V Ui
- Partners should keep the isolation distance as much more.

■ 2. Cable connections



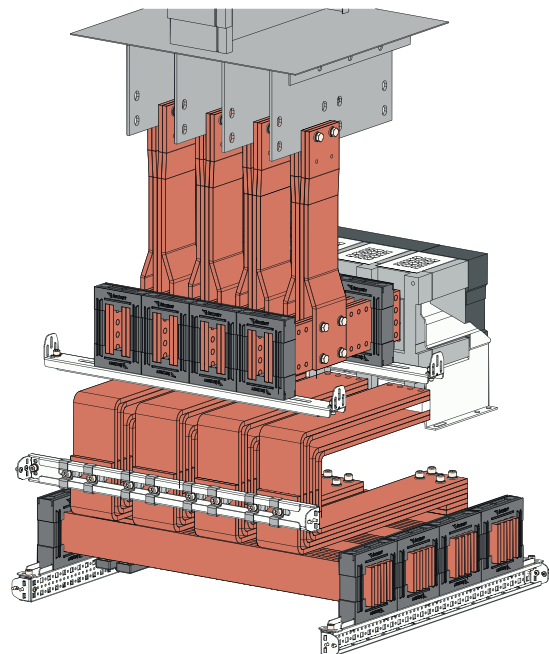
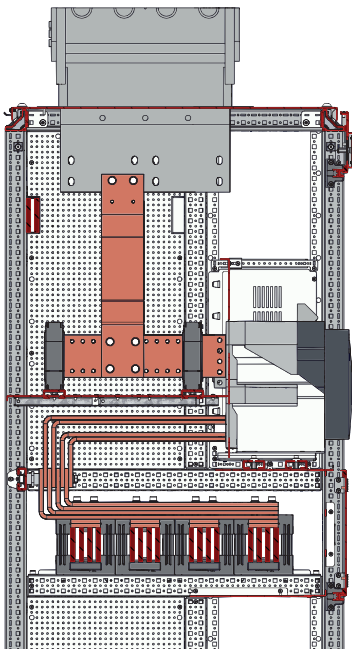
- If cables are used for the power connections, make sure that they do not apply excessive mechanical forces to the circuit breaker terminals.
- For this, make the connections as follows:
- extend the circuit breaker terminals using short bars designed and installed according to the recommendations for bar-type power connections:
- For a single cable, use solution B opposite
- For multiple cables, use solution C opposite
- In all cases, follow the general rules for connections to busbars:
- Position the cable lugs before inserting the bolts
- The cables should firmly secured to the framework by cable holders. See at cable management instructions

■ 3. Manufacturers' Instructions

- Partner must follow the ACB manufacturer instructions according to clamping , drilling and fastening conditions of terminal connections
- Partner must follow the ACB manufacturers' instructions and recommendations if there are conflicts between PDS instructions.

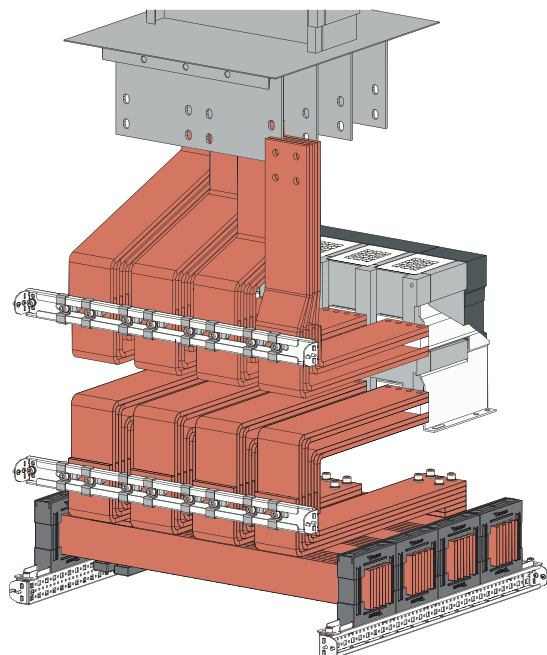
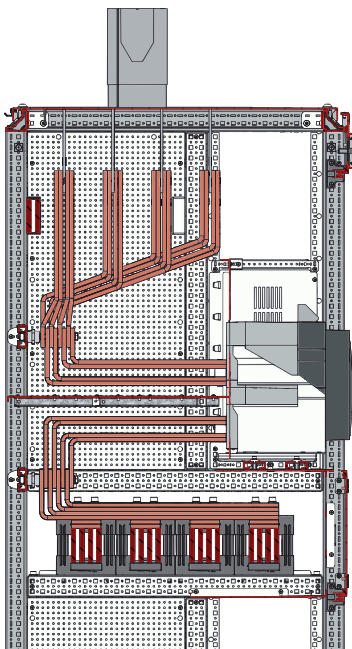
■ BUSBAR TRUNKING CONNECTION

Rear Vertical Connection:



- In case of busbar trunking connection system positioned with right angle use the vertical connection as the same as cable connection. Add a connection bar between terminal and busbar trunking

Rear Horizontal Connection:



- In case of busbar trunking connection system positioned with parallel angle use the horizontal connection as the same as connection type of main busbar connection.

■ SIZING OF ACB BUSBARS

SCHNEIDER ELECTRIC LV AIR CIRCUIT BREAKER NW/MTZ2 SERIE				
Type of ACB (Fixed&Drawable)	Nominal(In) 25°C +30K	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(l _{cw}) Up to 65 kA	(l _{cw}) Up to 85 kA	
NW/MTZ2	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2000	3 x 80/10	3 x 80/10	2 x 80/10
	2500	4 x 80/10	3 x 100/10 (4 x 80/10)	3 x 100/10
	3200	4 x 100/10	4 x 100/10	4 x 100/10

(b) Applications requires NW40 breaker terminals for spreading the flat rear horizontal bars.

It must be order saparetly.Manufacturer order no : 3 Poles: 47970 , 4 poles : 47971

(c) Applcation requires 800mm depth and Bubar with 4 flat bars selection.

! Note : All type of ACBs must to fix into 800mm width modules.

ABB ELECTRIC LV AIR CIRCUIT BREAKER Emax SERIE				
Type of ACB	Rated Current(A)	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(l _{cw}) Up to 65 kA	(l _{cw}) Up to 85 kA	
Emax E2.2	800	1 x 60/10	1 x 60/10	2 x 80/5
	1000	1 x 60/10 (2 x 50/10)	1 x 60/10 (2 x 50/10)	2 x 80/5
	1250	2 x 60/10	2 x 60/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	3 x 60/10	3 x 60/10	2 x 80/10
	2500	3 x 60/10	3 x 60/10	2 x 80/10
Emax E4.2	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2500	2 x 100/10	2 x 100/10	2 x 80/10
	3200	3 x 100/10 (4 x 80/10)	3 x 100/10 (4 x 80/10)	3 x 100/10
	4000	4 x 100/10	4 x 100/10	4 x 100/10

(b) Applications requires SHR Upper breaker terminals for spreading the flat rear horizontal bars.

It must be orders saparetly.Manufacturer order no :

- Up to 2000A 3 Poles: 1SDA074045R1, 4 poles : 1SDA074046R1

- 2500A 3 Poles: 1SDA074051R1, 4 poles : 1SDA074052R1

(c) Clamping the poles requires sliding to outer sides.

! Note : All type of ACBs must to fix into 800mm width modules .

SIEMENS LV AIR CIRCUIT BREAKER 3WL SERIE				
Type of ACB (Fixed&Drawable)	Rated Current(A)	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(Icw)Up to 65 kA	(Icw) Up to 85 kA	
3WL 12	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2500	3 x 80/10	3 x 80/10	3 x 80/10
	3200	3 x 100/10 (4 x 80/10)	4 x 80/10	3 x 100/10
	4000	4 x 100/10	4 x 100/10	4 x 100/10

(c) Clamping the poles requires sliding to outer sides

! Note : All type of ACBs must to fix into 800mm width modules.

● xxx

EATON LV AIR CIRCUIT BREAKER IZMX40 SERIE				
Type of ACB (Fixed&Drawable)	Rated Current(A)	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(Icw)Up to 65 kA	(Icw) Up to 85 kA	
IZMX40 (66 kA)	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10 (c)	2 x 80/10
	2500	3 x 80/10	3 x 80/10 (c)	3 x 80/10
	-	4 x 80 /10	4 x 80/10 (c)	3 x 100/10
	-	-	-	-
IZMX40 (85-105 kA)	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2500	3 x 80/10	3 x 80/10	3 x 80/10
	3200	3 x 100 /10	4 x 80/10	3 x 100/10
	4000	4 x 100 /10	4 x 100 /10 (c)	4 x 100/10

(c) Clamping the poles requires sliding to outer sides

! Note : All type of ACBs must to fix into 800mm width modules .

LEGRAND LV AIR CIRCUIT BREAKER DMX3 SERIE				
Type of ACB (Fixed&Drawable)	Rated Current(A)	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(lcw)Up to 65 kA	(lcw) Up to 85 kA	
DMX3 (Case 1) ! Only Withdrawable	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10 (c)	2 x 80/10
	2500	3 x 80/10	3 x 80/10 (c)	3 x 80/10
DMX3 (Case 2)	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2500	3 x 80/10	3 x 80/10	3 x 80/10
	3200	3 x 100 /10	4 x 80/10	3 x 100/10
	4000	4 x 100 /10	4 x 100 /10 (c)	4 x 100/10

(c) Clamping the poles requires sliding to outer sides

! Note : All type of ACBs must to fix into 800mm width modules .

GE LV AIR CIRCUIT BREAKER EntelliGuard SERIE				
Type of ACB (Fixed&Drawable)	Rated Current(A)	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(lcw)Up to 65 kA	(lcw) Up to 85 kA	
EntelliGuard (Case 2)	800	1 x 50/10	1 x 50/10	2 x 80/5
	1000	2 x 50/10	2 x 50/10	2 x 80/5
	1250	2 x 50/10	2 x 50/10	2 x 80/5
	1600	2 x 60/10	2 x 60/10	2 x 80/10
	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2500	3 x 80/10	3 x 80/10	3 x 80/10
	3200	3 x 100 /10	4 x 80/10	3 x 100/10
	4000	4 x 100 /10	4 x 100 /10 (c)	4 x 100/10

(c) Clamping the poles requires sliding to outer sides

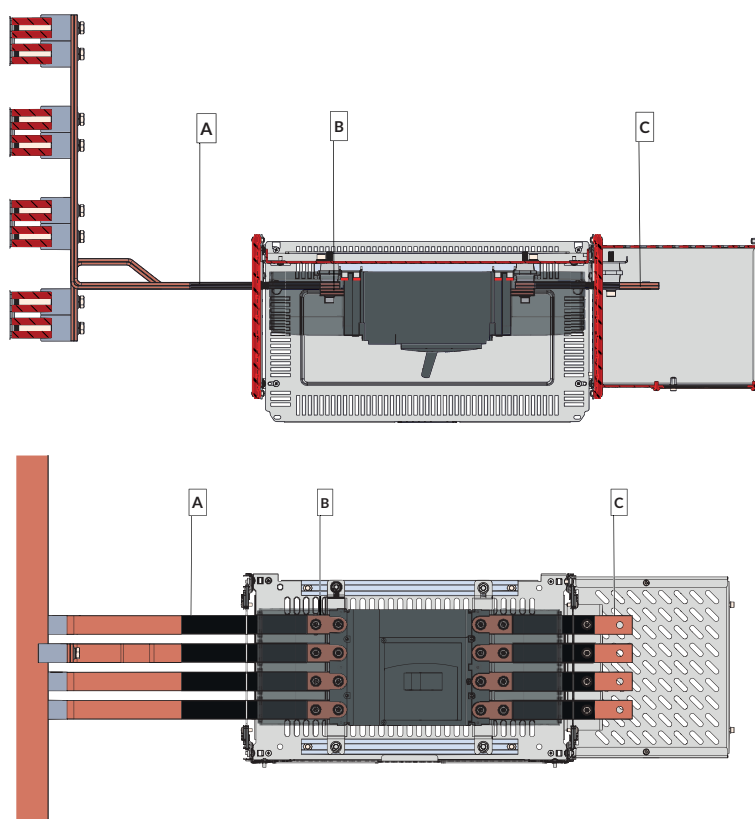
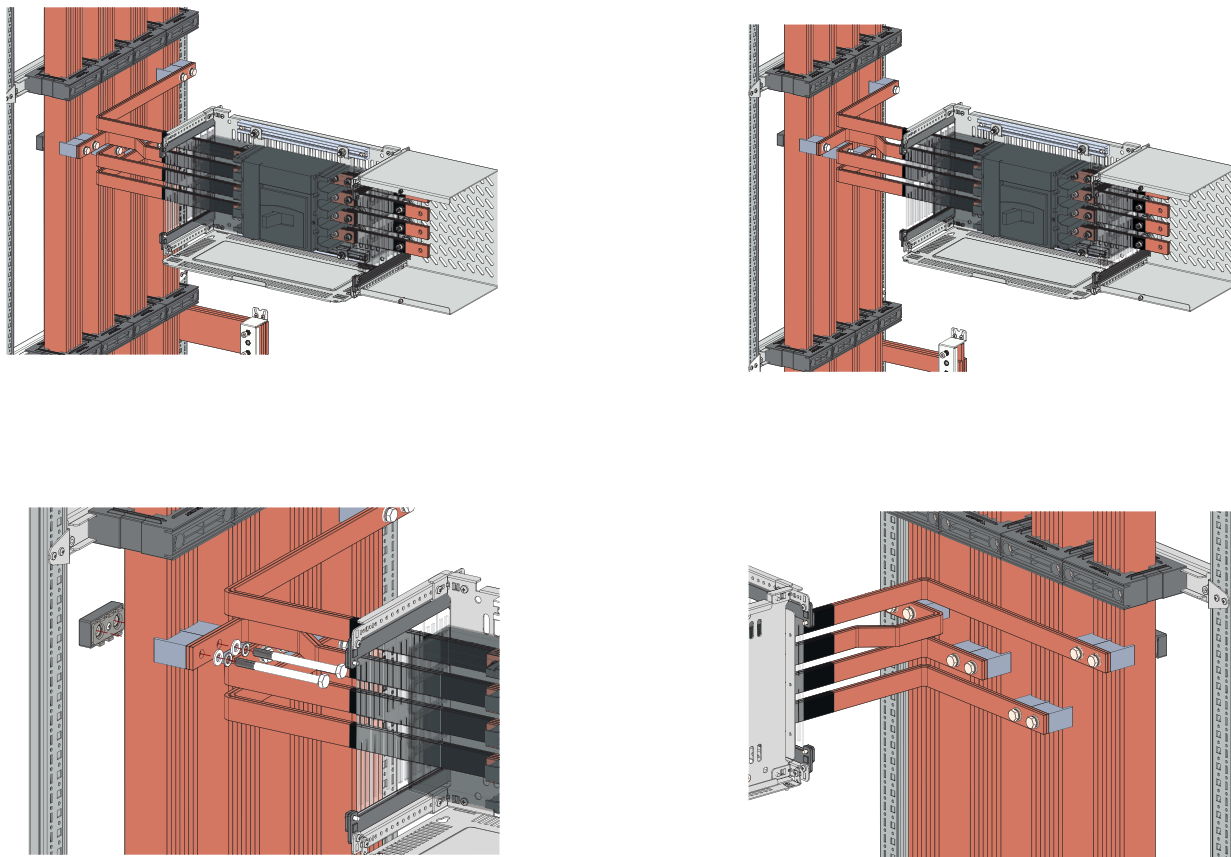
! Note : All type of ACBs must to fix into 800mm width modules.

MITSUBISHI LV AIR CIRCUIT BREAKER AE SERIE				
Type of ACB (Fixed&Drawable)	Rated Current(A)	Main Busbar Connection		
		Busbar Size quantity x width(mm) / thickness(mm)		Terminal Connection
		(Icw)Up to 65 kA	(Icw) Up to 85 kA	
AE 630-1600A	800	1 x 50/10	1 x 50/10 (c)	2 x 80/5
	1000	2 x 50/10	2 x 50/10 (c)	2 x 80/5
	1250	2 x 50/10	2 x 50/10 (c)	2 x 80/5
	1600	2 x 60/10	2 x 60/10 (c)	2 x 80/10
AE 2000-3200A	2000	2 x 80/10	2 x 80/10	2 x 80/10
	2500	3 x 80/10	3 x 80/10	3 x 80/10
	3200	3 x 100 /10	4 x 80/10	3 x 100/10

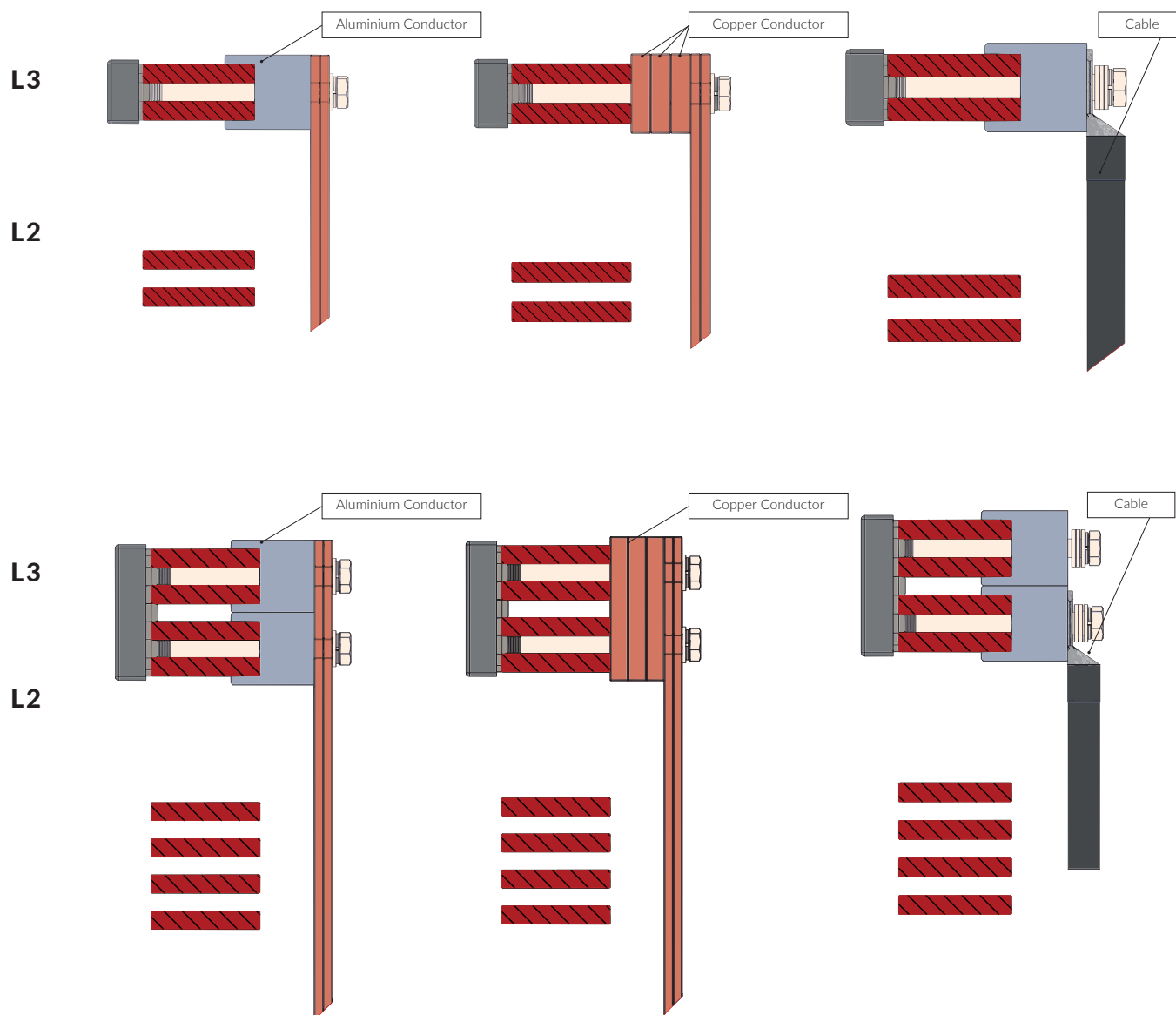
(c) Clamping the poles requires sliding to outer sides

! Note : All type of ACBs must to fix into 800mm width modules .

■ 2.4 MCCB (MOULDED CASE CIRCUIT BREAKER) CONDUCTORS and CONNECTION



■ A: Connection from Vertical Busbar

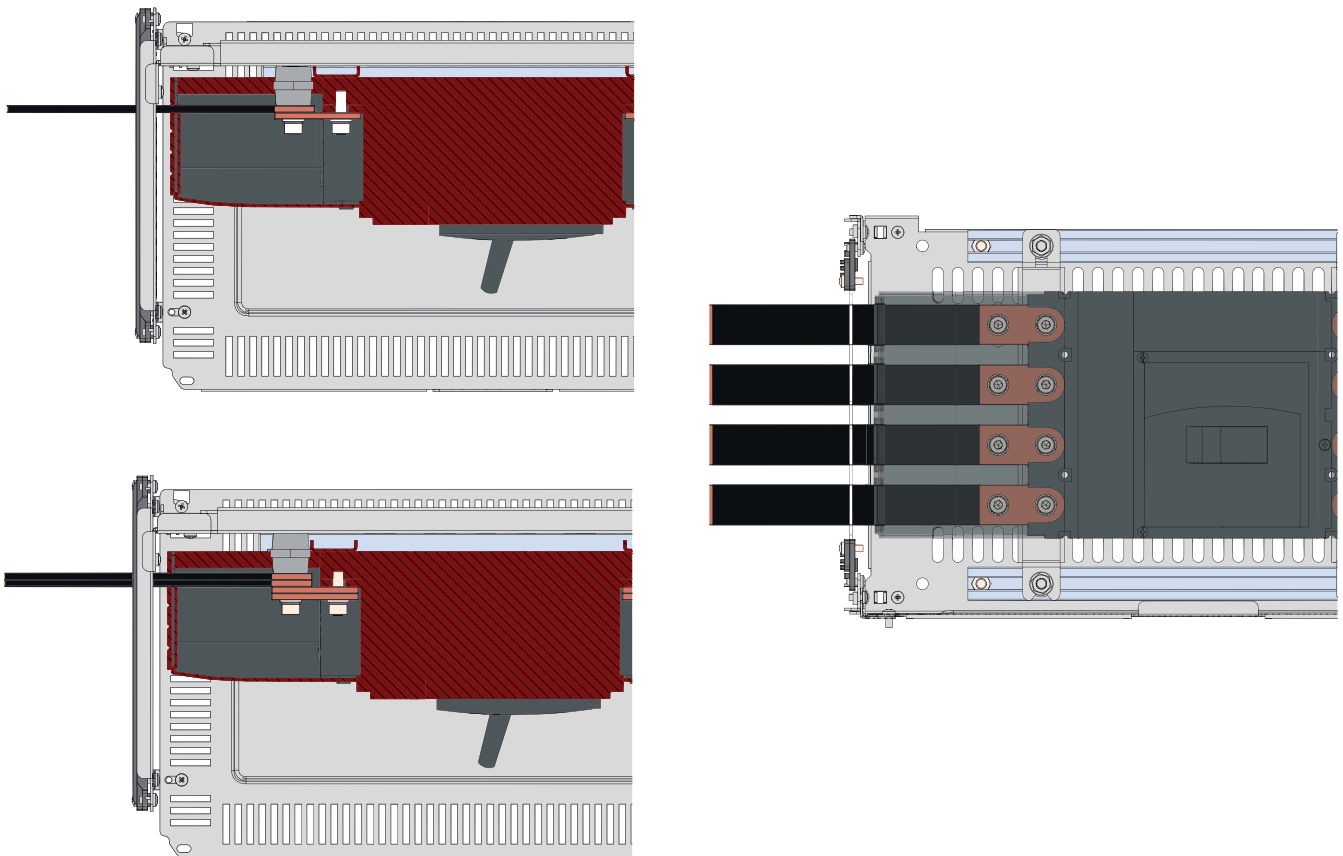


- A conductive spacer requires connecting between vertical busbar and connection bar or cable. There are two solutions:
 - Aluminium conductor spacer: It is standard part in PDS system, made by aluminium material with tin plate
 - Copper conductor spacer: It will make by partner.
- Spacer's height have to be minimum 20mm to occur isolation distance between the poles.
- Contact surface (mm^2) must be minimum 5 times or more than connection bar cross-section (mm^2) or must be use same width of connection bar and spacer width.
- In case of using 4 quantity vertical busbar, the spacer conductor must to connect on each bars that requires 2 pcs aluminium conductors. For copper version it must be 1 piece with double 10mm thickness coppers.
- In case of using cables for connection, fixing have to be done with cable lugs.

■ B: Incoming Connection to MCCB

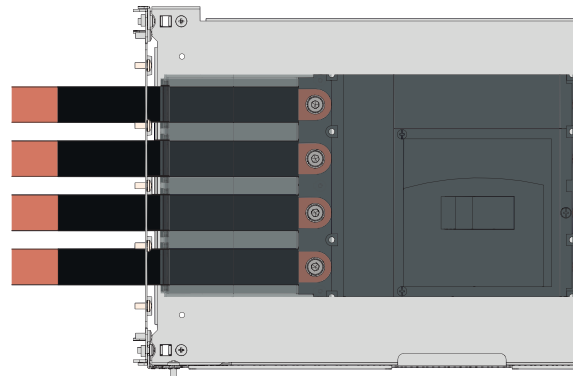
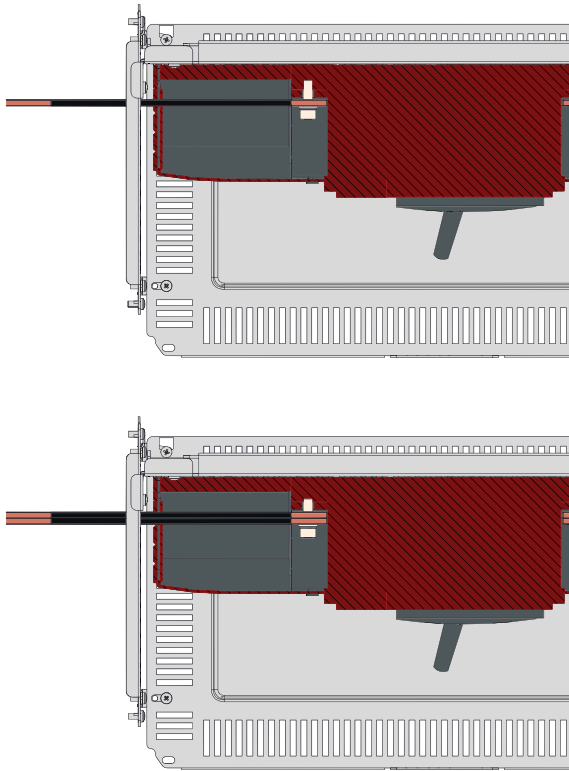
- Incoming connection can be done by 3 options :
 - Insulated cable : Up to 160A and connection via the cable lugs
 - Insulated Flexible Busbar : Up to 1600A
 - Bare flat busbar insulated with heat shrink tubing up to 1600A
- In case of direct connection type insulated flexible busbar is recommended. If bare bar with shrink tubing requires to using an insulation plate is requiring between busbar and mounting plate. Some of cases 'X' distance is risky of insulation.
- Terminal Shield must be use for closing the terminals of MCCB protection against IP2XB (Finger protection)
- Between compartment entrance point and terminal shield the conductor must be insulated. Bare points of the conductors must be kept inside the terminal shield and out of the compartment.
- The points of between cable insulation edge and cable lug must be also insulated with heat shrink tubes.

■ Connection via Easyfix

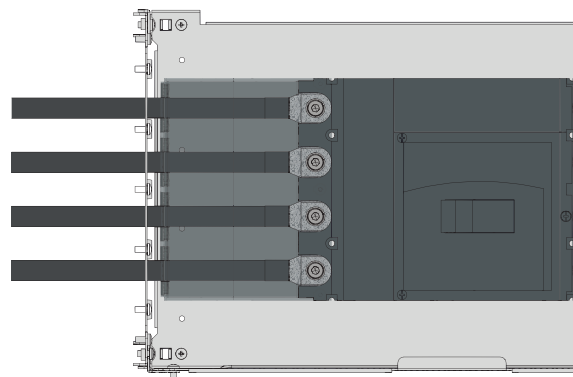
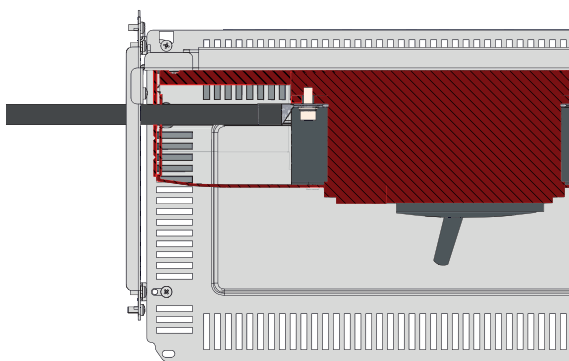


■ Direct connection

With Copper



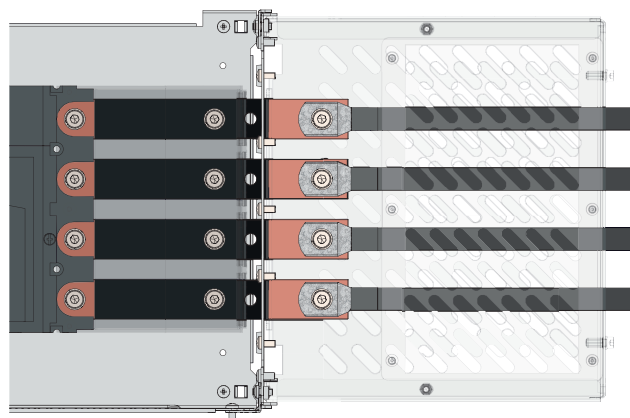
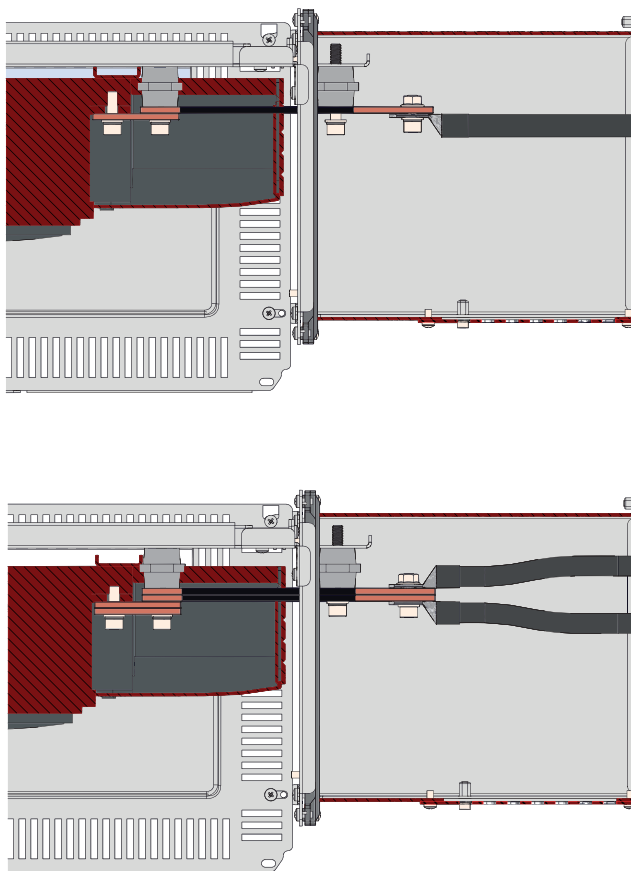
With Cable



■ C: Terminal Connection

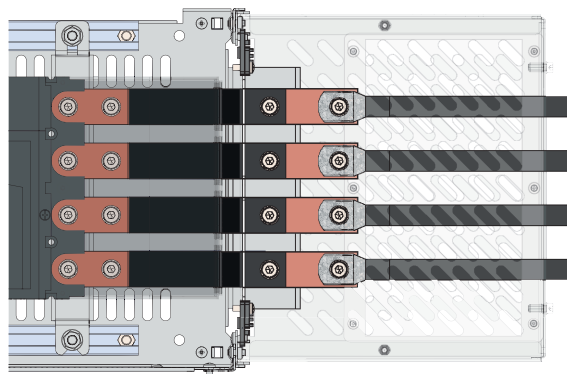
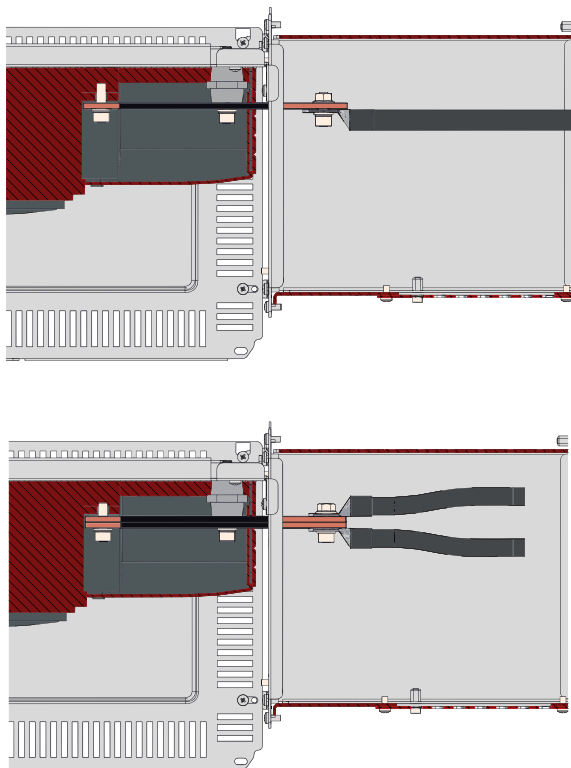
- Terminal connection can be done by 2 options :
 - Insulated cable : Up to 160A and connection via the cable lugs
 - Bare flat busbar insulated with heat shrink tubing up to 1600A
- Terminal Shield must be use for closing the terminals of MCCB protection against IPXXB (Finger protection)
- In case of cable using , the connection to MCCB , cable lugs must be used and covered with terminal shield in standard of IP2XB.
Connection to external terminal, an IPXXB terminal can be use in case of up to Form4b applications instead of Form4b metal box.
- Direct connection, an insulater holder must be used for supporting against cable weigth tension for each pole.
- Easyfix connection, 2 insulater holders must be used for supporting against cable weigth tension for each pole.

■ Connection via Easyfix

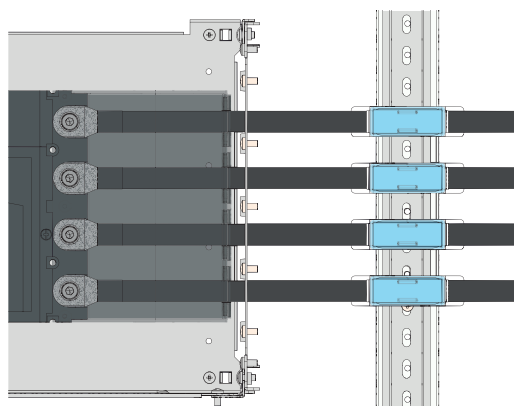
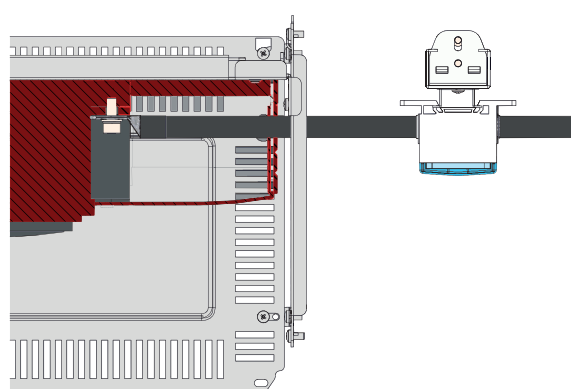


■ Direct connection

With Copper



With Cable



■ 2.5 MCB (MINIATURE CIRCUIT BREAKERS) CONDUCTORS and CONNECTION

Connection from Vertical Busbar

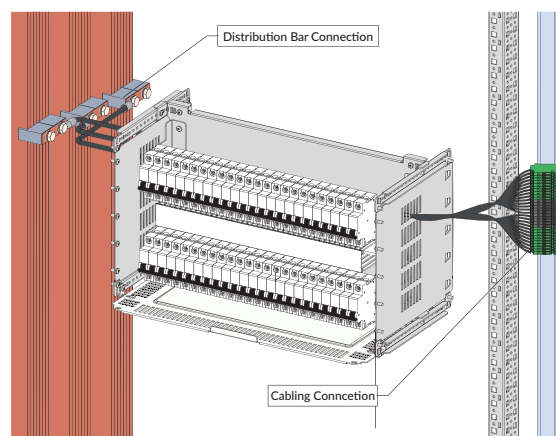
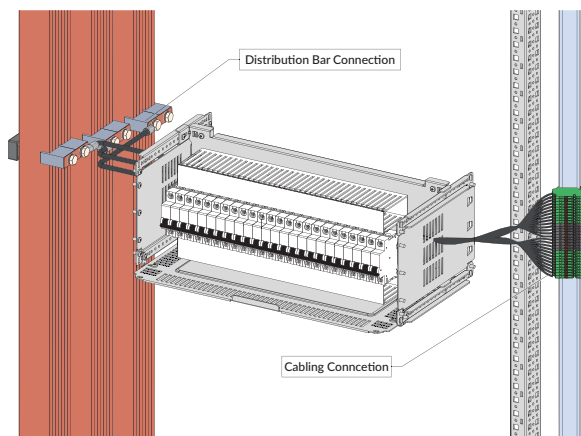
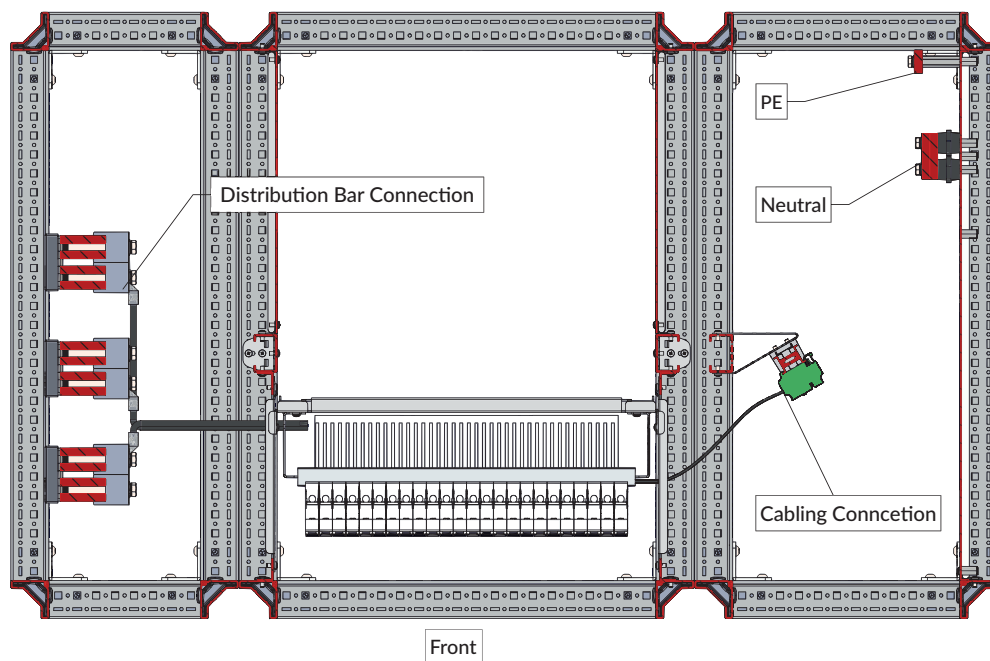
- A conductive spacer requires connecting between vertical busbar and cable. There are two solutions:
 - Aluminium conductor spacer : It is standard part in PDS system , made by aluminium material with tin plate
 - Copper conductor spacer : It will make by partner.
- Spacer's height have to be minimum 20mm to occur isolation distance between the poles.
- In case of using 4 quantity vertical busbar , the spacer conductor must to connect on each bars that requires 2 pcs aluminium conductors. For copper version it must be 1 piece with double 10mm thickness coppers.
- Fixing have to be done with cable lugs.

Incoming Connection to MCBs

- Cable connection must be done with horizontal Comb distribution busbar for an each pole. Selection of the size of Comb busbar, the section or the current(A) must be sufficient considered by diversity factor.

Terminal Connection

- Connection to external terminal, an IPXXB terminal can be use in case of up to Form4b applications instead of Form4b metal box.



■ SIZING OF MCB AND MCCB CONDUCTORS

With Cable	
Circuit Breaker Current (In)	Minumum Cross-Section of Cables
6A	1,5mm ²
8A	1,5mm ²
10A	1,5mm ²
13A	2,5mm ²
16A	2,5mm ²
20A	4mm ²
25A	4mm ²
32A	6mm ²
40A	10mm ²
63A	16mm ²
80A	25mm ²
100A	35mm ²
125A	50mm ²
160A	70mm ²

With Copper Bar		
Circuit Breaker Current (In)	Flat Busbar Size(mm)	Flexible Busbar Size(mm)
160A	15/3	20/1 x 2
200A	20/3	20/1 x 3
250A	20/5	20/1 x 3
400A	30/5	20/1 x 6
630A	30/5x2	32/1 x 6
800A	50/10	40/1 x 6
1000A	50/5x2	40/1 x 10
1250A	40/10x2	2 x 40/1 x 8
1600A	50/10x2	2 x 50/1 x 10

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

PDS
UPGRADE THE POWER

C3

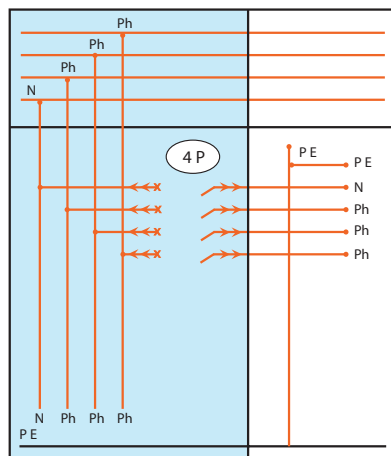
EQUIPOTENTIALITY and ELECTRICAL CONTINUITY



3.1 POWER SUPPLY FORMS and SIZING of THE PROTECTIVE CONDUCTORS

TN-S

TN-S : 1/1 Section



MAIN BUSBAR :

Phases = Size: A
Neutral (N) = A
Earthing (PE) = A/2

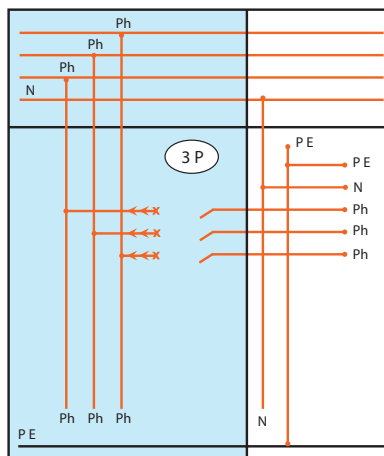
VERTICAL BUSBAR :

Phases = Size : B
Neutral (N) = B

CABLING MODULE :

Earthing (PE) = B/2

TN-S : 1/2 Section



MAIN BUSBAR :

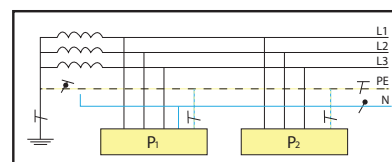
Phases = Size: A
Neutral (N) = A/2
Earthing (PE) = A/4

VERTICAL BUSBAR :

Phases = Size : B

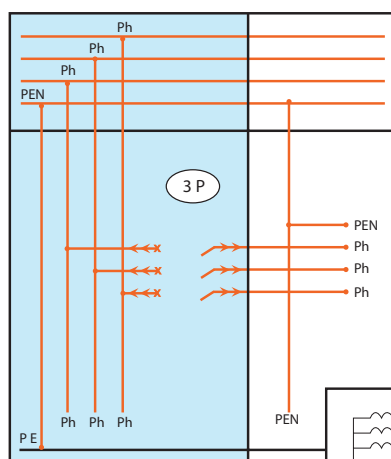
CABLING MODULE :

Neutral (N) = B/2
Earthing (PE) = B/4



TN-C (PEN)

TN-C : 1/2 Section



MAIN BUSBAR :

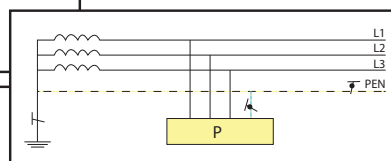
Phases = Size: A
PEN = A/2
Earthing (PE) = 1x50/10

VERTICAL BUSBAR :

Phases = Size : B

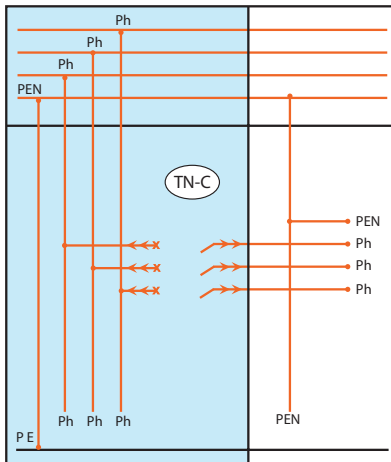
CABLING MODULE :

PEN = B/2



■ TN-C -S

TN-C-S : 1/2 Section



TN-C Section

MAIN BUSBAR :

Phases = Size: A

PEN = A/2

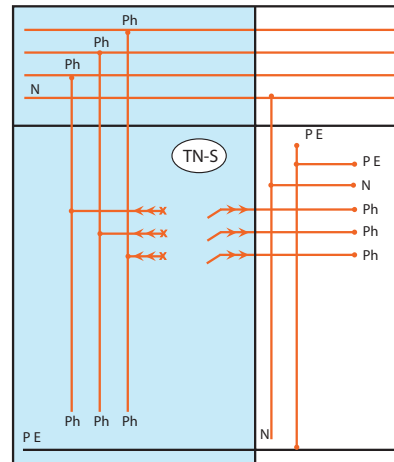
Earthing (PE) = A/4

VERTICAL BUSBAR :

Phases = Size : B

CABLING MODULE:

PEN = B/2



TN-S Section

MAIN BUSBAR :

Phases = Size: A

PEN = A/2

Earthing (PE) = A/4

VERTICAL BUSBAR :

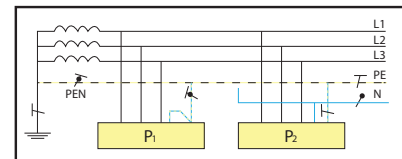
Phases = Size : C

CABLING MODULE:

Neutral (N) = C/2

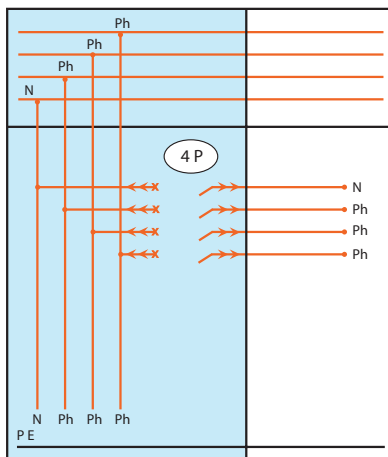
Earthing (PE) = C/4

- Mixing TN-C / TN-S is possible in a switchboard.
- The horizontal PEN replaces the Neutral (the horizontal busbar is in TN-C).
- PE runs horizontally for earthing of the columns and the vertical PE connection (TN-S).
- PEN / PE link on each incomer (TN-C).



■ TT

TT : 1/1 Section



MAIN BUSBAR :

Phases = Size: A

Neutral (N) = A

Earthing (PE) = 1x50/10

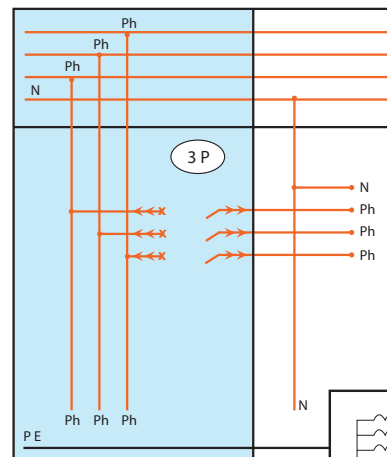
VERTICAL BUSBAR :

Phases = Size : B

Neutral (N) = B

CABLING MODULE:

TT : 1/2 Section



MAIN BUSBAR :

Phases = Size: A

Neutral (N) = A/2

Earthing (PE) = 1 x 50/10

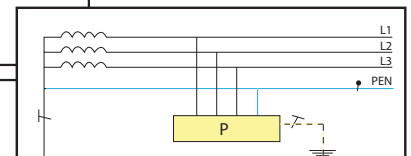
VERTICAL BUSBAR :

Phases = Size : B

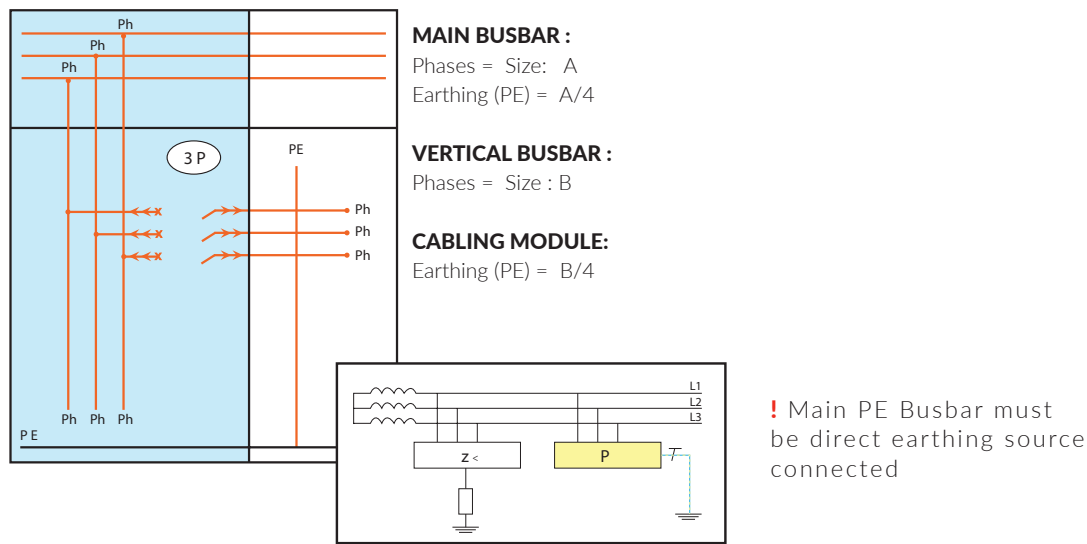
CABLING MODULE:

Neutral (N) = B/2

! Main PE Busbar must be direct earthing source connected



IT



NEUTRAL CONDUCTORS

- Dimensioning of the neutral conductor is described in IEC 61439-1, chapter 8.6. The following minimum requirements apply to the neutral conductor in 3-phase circuits.
- In circuits with a phase conductor cross-section up to and including 16 mm², the neutral conductor must correspond to 100% of the corresponding phase conductors.
- In circuits with a phase conductor cross-section of more than 16 mm², the neutral conductor must correspond to 50% of the corresponding phase conductors, but at least 16 mm².
- The current in the neutral conductor is assumed to be no more than 50% of a phase conductor current. The dimensioning of the neutral conductor should be agreed in advance with the end client.
- Additionally, when dimensioning the PEN conductor, it should be noted that the minimum cross-section must also satisfy the requirement for the N function.
- The PEN and N conductors should be fitted in accordance with the position shown in the PDS selection and assembly instructions.

PE (EARTHING) CONDUCTORS

- The cross-section of PE conductors that must withstand the thermal stresses of currents for a duration of 0.2s to 5s is calculated using the following equation related to IEC 60 364-5-54:

$$S_p = \frac{\sqrt{i^2 t}}{k}$$

S_p : the cross-section in mm²
i : is the value of the short-circuit AC current (rootmean-square value)
t : is the cut-out time of the disconnecting device in seconds
k : is the factor depending on the material of the PE conductor, the insulation and other parts, as well as on the starting and final temperature as in the following table:

	Insulation of the PE conductor or Cable cover		
	Thermoplastic (PVC)	VPE EPR Uncoated conductors	Butyl rubber
Final tempreture of conductor	160 °C	250 °C	220 °C
Conductor Material	Factor k		
Copper	143	176	166
Aluminium	95	116	110
Steel	52	64	60

The starting tempreture of the conductor has been assumed at 30 °C

- The IEC 61439-1 Standard indicates the methods of calculation for the cross-section of the PE protection conductor which must be suitably sized to withstand the thermal and dynamic components of the fault currents. For sizing the PE, Partner should use table :

Section of the Phase Conductors: S (mm ²)	Min. Section of PE Conductor : Sp(mm ²)
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S \leq 400$	S/2
$400 < S \leq 800$	200
$S > 800$	S/4

- Additionally, when dimensioning the PEN conductor, it should be noted that the minimum cross-section must also satisfy the requirement for the N function.

■ PEN CONDUCTORS

- The section of the PEN conductors of the apparatus must be determined using the same procedure followed for the neutral conductor (N).
- The minimum section of a copper conductor must be 10mm².
- The PEN conductor does not need to be insulated.
- The parts of the structure must not be used as a PEN conductor.
- However, the assembly tracks, made of copper or aluminium, can be used as PEN conductors.
- For conductors not made of copper, the sections above are replaced with equivalent conductivity sections, which may require larger sized terminals.

■ EQUIPOTENT

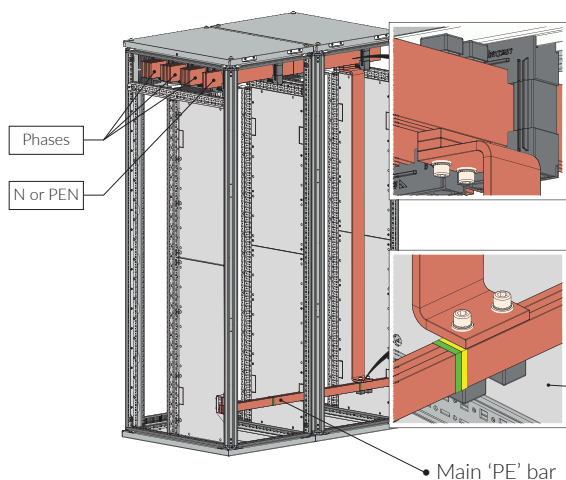
The accessible conductive parts of a device, which cannot be connected to the protection circuit by their own means of connection, must be connected to the protection circuit of the apparatus for equipotentiality of the protection by means of an equipotential conductor, whose section must be selected according to the table given below

Rated Service Current I _e (A)	Min. Section of EP Conductor (mm ²)
$I_e \leq 20$	S
$20 < I_e \leq 25$	2,5
$25 < I_e \leq 32$	4
$32 < I_e \leq 63$	6
$63 < I_e \leq 80$	10
$80 < I_e \leq 160$	16
$160 < I_e \leq 200$	25
$200 < I_e \leq 250$	35

S = section of the phase conductor (mm²)

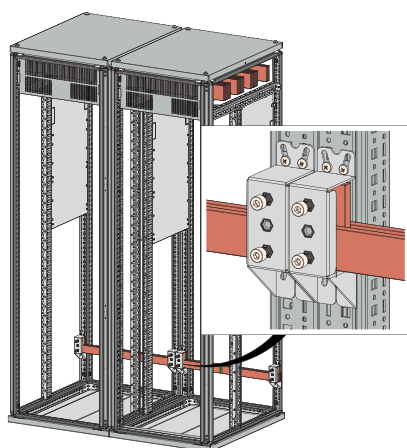
■ 3.2. PROTECTIVE NEUTRAL(N), EARTHING(PE) and PEN BAR AT MAIN BUSBAR SYSTEMS

NEUTRAL (N) BAR & PEN BAR



- Bar holder have to be an insulated material. Main busbar holders which using in the phases(L) are correct holders.
- Manufacturer must to follow instructions of assembling for correct positioning and insulation.
- Manufacturer must to use sizes of Neutral or PEN bars in tables which in the below of page.
- The section of Neutral full(1/1) size or half(1/2) size should be agreed in advance with the end client.
- Connection between 'N' bar and 'PE' Bar in case of 'PEN' system

EARTHING (PE) BAR



- Bar holder have to be a conductive material fixing by self tapping screw to the frame of modules. When the selection of modules steel holders deliveries with enough quantities.
- Manufacturer must to follow instructions of assembling for correct positioning.
- Manufacturer must to use sizes of earthing bars in tables which in the below of page.
- The size of bar should be minimum half(1/2) of Neutral bar or quarter (1/4) of phases (L1,L2,L3)
- In case of TN-C&TT power supply forms , there is PE bar is required for earthing of the cabinets conected to PEN bar or direct earthing connection.

AMBIANCE TEMP : 25°C , HEATING TEMP : 30°C ,50 Hz A.C.

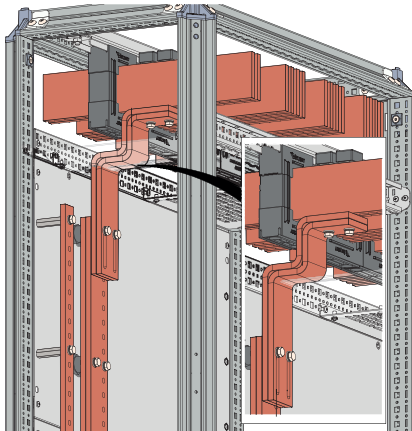
Neutral Section	Rated Current (In)	Flat Copper Size (mm) xQty		
		L1/L2/L3	Neutral(N)	PE
1/2 N	1350A	40/10x2	40/5x2	20/5x2
1/1 N	1350A	40/10x2	40/10x2	40/5x2
1/2 N	1620A	50/10x2	50/5x2	25/5x2
1/1 N	1620A	50/10x2	50/10x2	50/5x2
1/2 N	1860A	60/10x2	60/5x2	30/5x2
1/1 N	1860A	60/10x2	60/10x2	60/5x2
1/2 N	2300A	80/10x2	40/10x2	40/5x2
1/1 N	2300A	80/10x2	80/10x2	40/10x2

AMBIANCE TEMP : 25°C , HEATING TEMP : 30°C ,50 Hz A.C.

Neutral Section	Rated Current (In)	Flat Copper Size (mm) xQty		
		L1/L2/L3	Neutral(N)	PE
1/2 N	2500A	40/10x4	40/10x2	40/5x2
1/1 N	2500A	40/10x4	40/10x4	40/10x2
1/2 N	3000A	50/10x4	50/10x2	50/5x2
1/1 N	3000A	50/10x4	50/10x4	50/10x2
1/2 N	3400A	60/10x4	60/10x2	60/5x2
1/1 N	3400A	60/10x4	60/10x4	60/10x2
1/2 N	4000A	80/10x4	80/10x2	40/10x2
1/1 N	4000A	80/10x4	80/10x4	80/10x2

Selection Code	Power Supply Form (Size Scale of N)	Sections of Main Phases (L1/L2/L3) and Module Busbar Sizes		
		Main Busbar Size: A	Vertical Distribution Busbar Size : B	Cabling Module (Based from Vertical Busbar)
01	TN-S (1/1)	N(A/1) + PE(A/2)	L1+L2+L3+N(B/1)	PE(B/2)
02	TN-S (1/2)	N(A/2) + PE(A/4)	L1+L2+L3	N(B/2) + PE(B/4)
03	TN-C (PEN) (1/2)	PEN(A/2) + PE	L1+L2+L3	PEN(B/2)
04	TN-C-S (1/2)	PEN(A/2) + PE(A/4)	L1+L2+L3	(TN-C : PEN(B/2)) + (TN-S:N(B/2) + PE(B/4))
05	TT (1/1)	N(A/1) + PE	L1+L2+L3+N(B/1)	NONE
06	TT (1/2)	N(A/2) + PE	L1+L2+L3	N(B/2)
07	IT	PE(A/4)	L1+L2+L3	PE(B/4)

■ 3.3. PROTECTIVE NEUTRAL, EARTHING and PEN BAR IN CABLING MODULE FOR OUTGOING THE FEEDERS

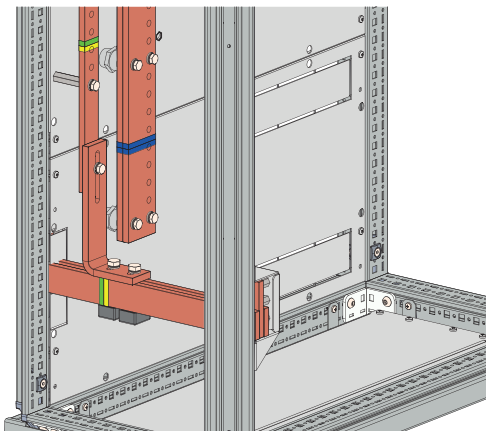


NEUTRAL (N) BAR

- Bar holder have to be an insulated material spaced with minimum 20mm distance from all directions of conductive parts all around. When the selection of modules with earthing configurations, ISO-TP insulators deliveries with enough quantities.
- Partner must to follow instructions of assembling for correct positioning and insulation.
- Partner must to use sizes of Neutral bars in tables which in the below of page.

PEN BAR

- Normally bar holders are not necessary to be an insulated material. But for systematizing PDS uses insulated holders for PEN bars in cabling module. When the selection of modules with earthing configuration, ISO-TP insulators deliveries with enough quantities.
- Partner must to follow instructions of assembling for correct positioning and insulation.
- Manufacturer must to use sizes of Neutural bars in tables which in the below of page.



EARTHING (PE) BAR

- Bar holder have to be a conductive material. When the selection of modules with earthing configuration steel holders deliveries with enough quantities.
- Manufacturer must to follow instructions of assembling for correct positioning.
- Manufacturer must to use sizes of earthing bars in tables which in the below of page.
- The size of bar should be minimum half(1/2) of Neutural bar.

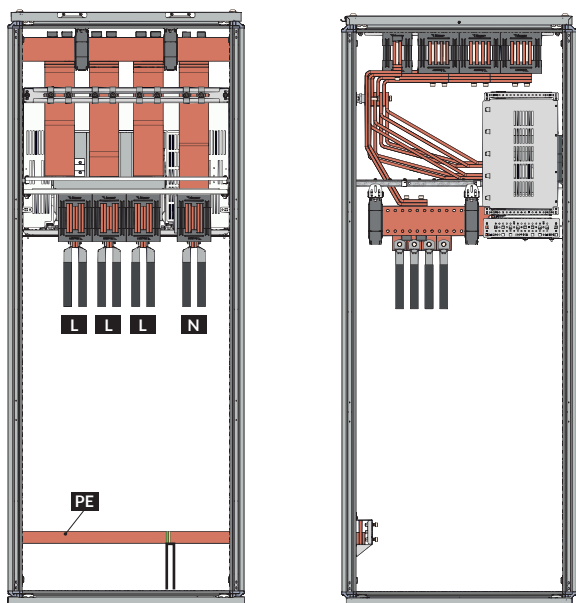
AMBIANCE TEMP : 25°C , HEATING TEMP : 30°C , 50 Hz A.C.					
Module Depth	Rated Current (In)	Flat Copper Size (mm) xQty			
		FULL SIZE (N)		HALF SIZE (N)	
		* Neutral(N)	PE	* Neutral(N)	PE
600D/800D	495A	20/5x2	20/5x1	20/5x1	20/3x1
600D/800D	700A	30/5x2	30/5x1	30/5x1	20/5x1
600D/800D	900A	40/5x2	40/5x1	40/5x1	20/5x1
600D/800D	1100A	50/5x2	50/5x1	50/5x1	25/5x1
600D/800D	1300A	60/5x2	60/5x1	60/5x1	30/5x1
600D/800D	1350A	40/10x2	40/5x2	40/5x2	20/5x2
600D/800D	1620A	50/10x2	50/5x2	50/5x2	25/5x2
600D/800D	1860A	60/10x2	60/5x2	60/5x2	30/5x2
600D/800D	2300A	80/10x2	40/10x2	40/10x2	40/5x2
800D	2500A	40/10x4	40/10x2	40/10x2	40/5x2
800D	3000A	50/10x4	50/10x2	50/10x2	50/5x2
800D	3400A	60/10x4	60/10x2	60/10x2	60/5x2
800D	4000A	80/10x4	80/10x2	80/10x2	40/10x2

* While 'N' Bar is located in vertical busbar position

3.4. CONNECTION OF INCOMING EARTHING AND NEUTRAL CONDUCTORS

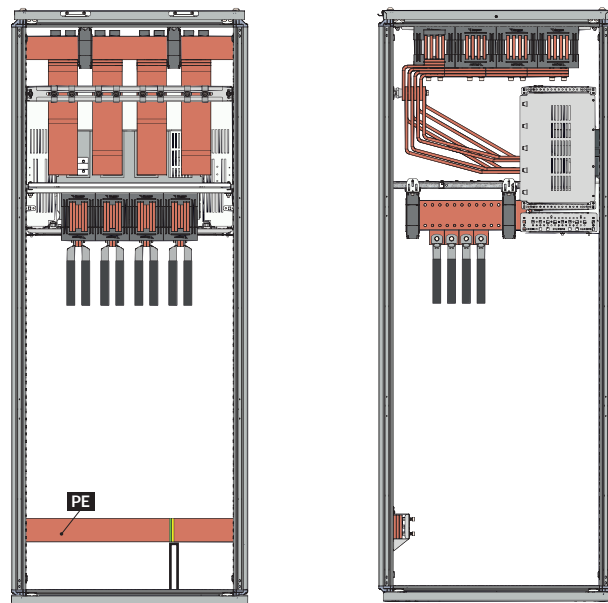
ACB MODULE (TOP BUSBAR)

3 POLES (L1+L2+L3)+N or PEN



Power Supply Forms 1/2 sections of 'N'

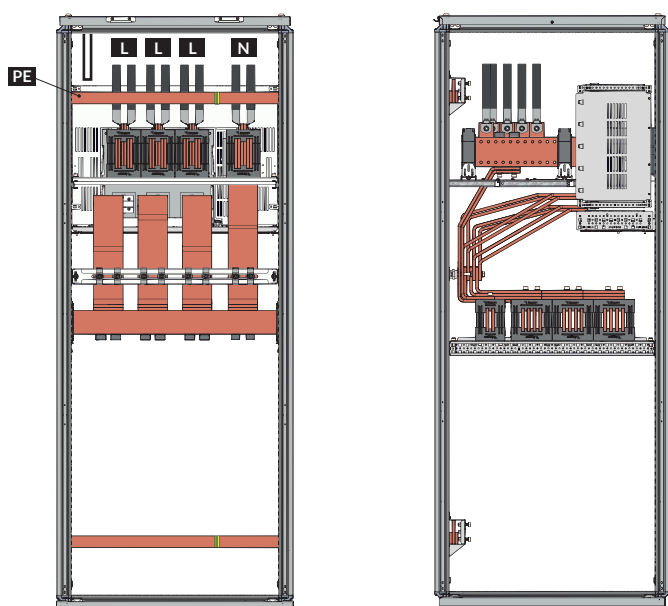
4 POLES (L1+L2+L3+N)



Power Supply Forms 1/1 sections

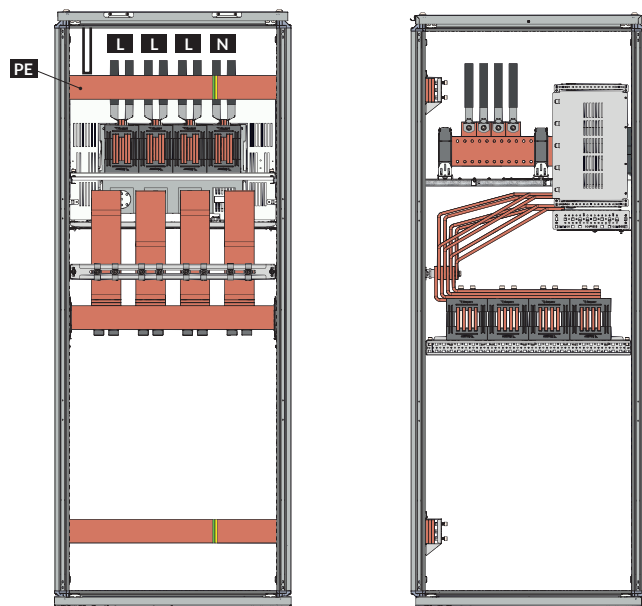
ACB MODULE (MID BUSBAR)

3 POLES (L1+L2+L3)+N



Power Supply Forms 1/2 sections

4 POLES (L1+L2+L3+N)



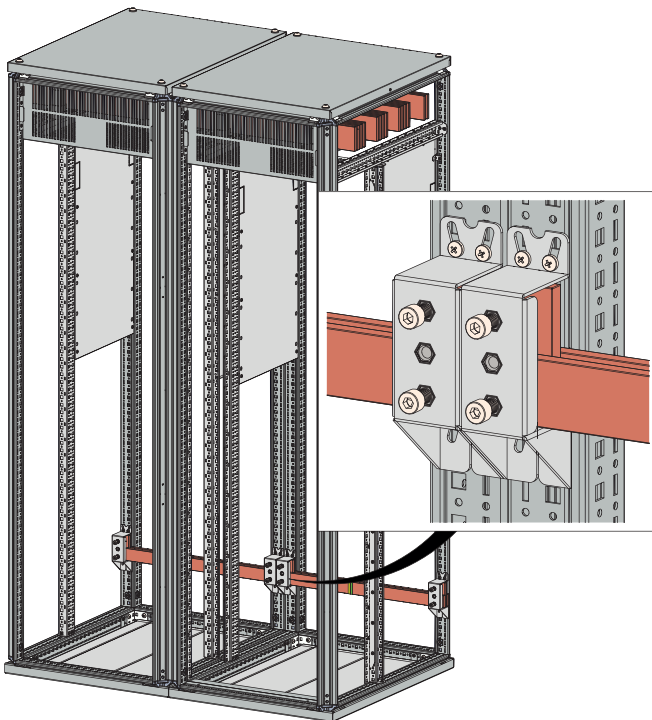
Power Supply Forms 1/1 sections

■ 3.6. ELECTRICAL CONTINUITY

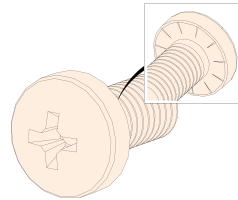
■ ELECTRICAL CONTINUITY OF THE STRUCTURE AND OF THE FIXED AND MOBILE PARTS

- Manufacturer have to make earthing connection of the structure and of the fixed and mobile parts as shown in below pictures and instructions.
- Other parts (painted to painted / painted to unpainted) have to be fixing by self tapping screws. (Part number : MP 12.0102). These screws also deliver with parts.
- Standard 61439-1 Part 8.4.2.2.2 Prescriptions for earth continuity for protection against the consequences of a fault within the switchgear for covers, doors, closing plates and similar, the ordinary connections with metal screws and metal hinges are considered sufficient for electrical continuity so long as electrical devices that exceed the low voltage limits (ELV) are not installed on them.

**Main Earthing Bar
connection to Structure**

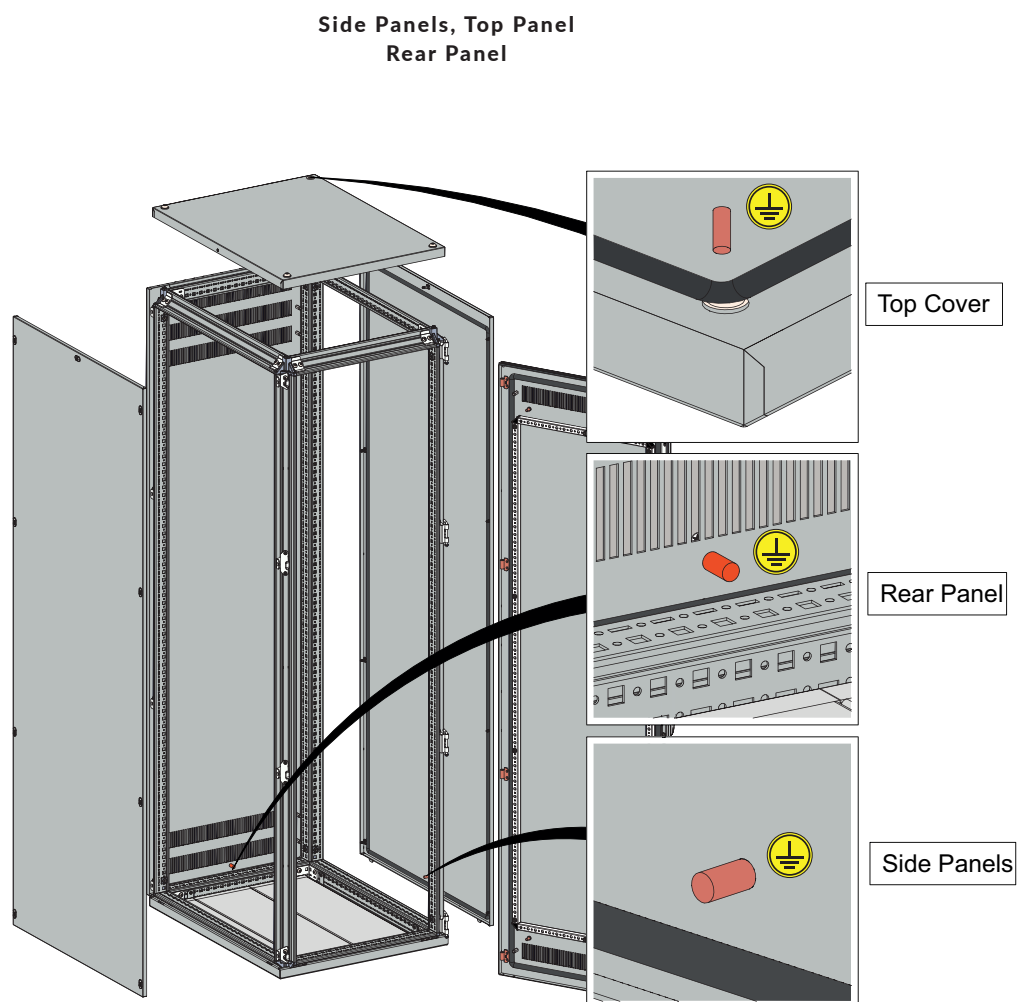


**MP 12.0102
Self Tapping Screw**



**Structure conductivity
with each other**



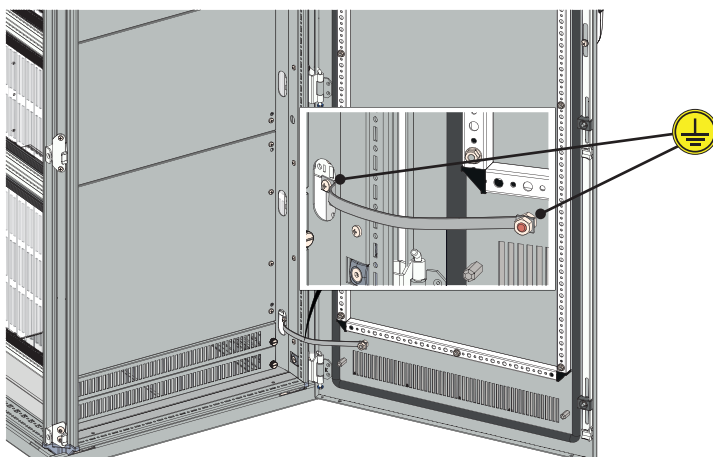


- Must be use with mininum 10mm² sectioned and 150mm length of green-yellow insulated copper cable with end sleeved M6
- One side of cable must to fix to M6 stud welded screw with M6 nut , other side of the cable must to fix to closest structure with self tapping screw (MP 12.0102)

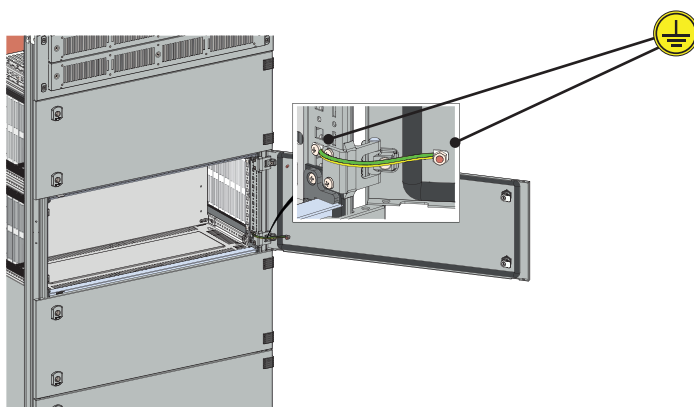
Front Door, Partial Doors, Internal Covers

- Must be use with mininum 10mm² sectioned and 150mm length of green-yellow insulated copper cable with end sleeved M8 (front door) , M6 (partial doors and internal covers)
- One side of cable must to fix to M8/M6 stud welded screw with double nut , other side of the cable must to fix to closest structure with self tapping screw (MP 12.0102)

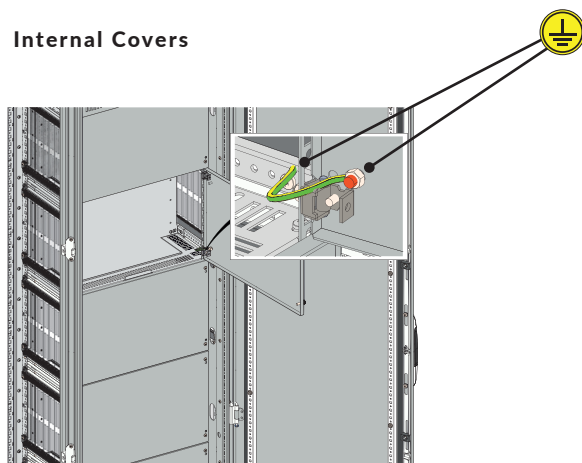
Front Door



Partial Doors



Internal Covers



INSTALLATION INSTRUCTIONS AT **WORKSHOP**

PDS
UPGRADE THE POWER

C4

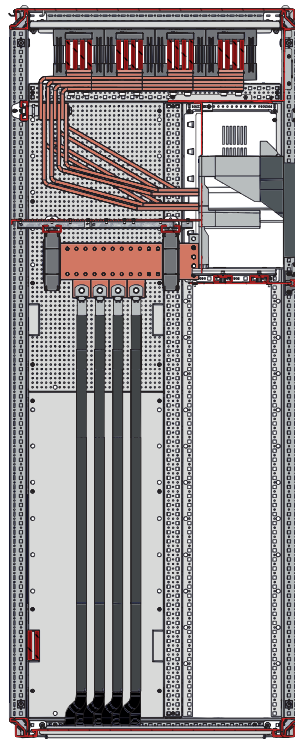
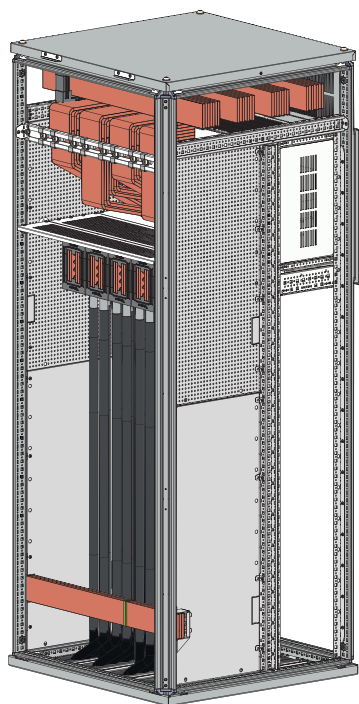
CABLE MANAGEMENT



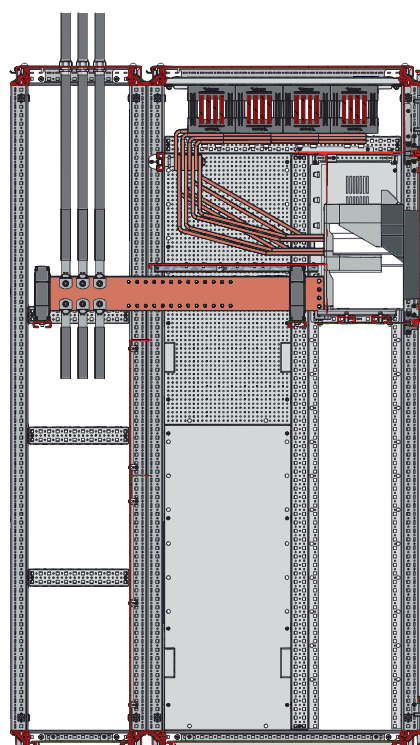
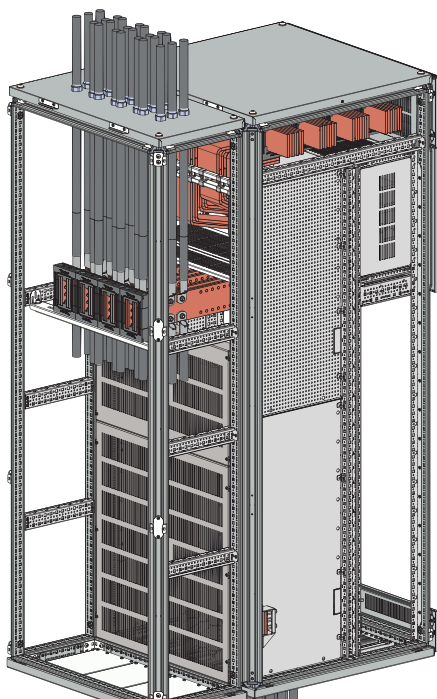
■ 4.1 CABLE INCOMING DIRECTIONS

■ ACB (TOP BUSBAR POSITION)

Cable Incoming from Bottom Direction



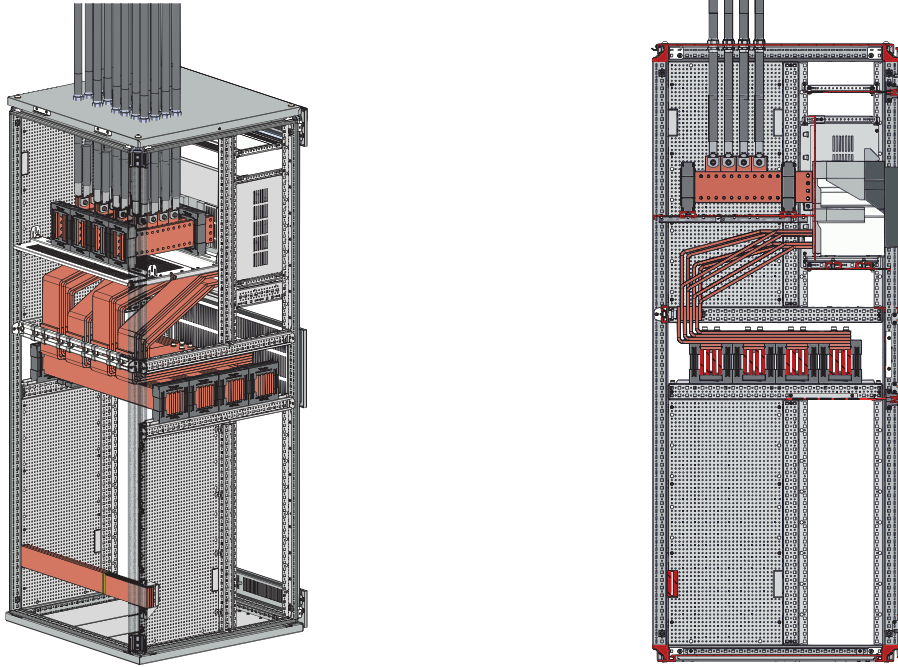
Cable Incoming from Top Direction



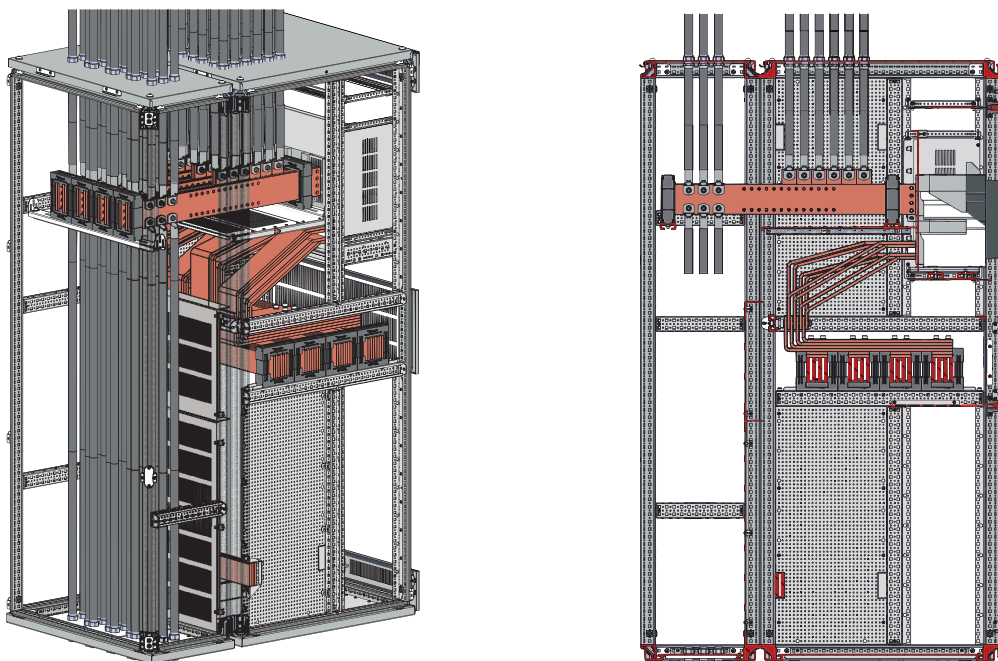
! Required : Rear Cabling Module for ACB must be ordered additionally

■ ACB (MIDDLE BUSBAR POSITION)

Cable Incoming from Top Direction



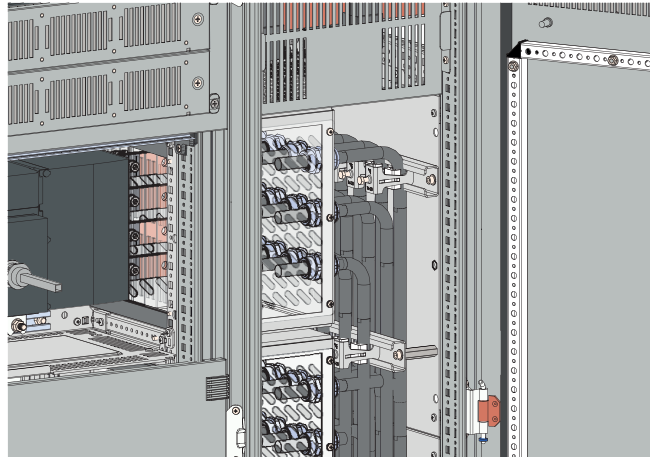
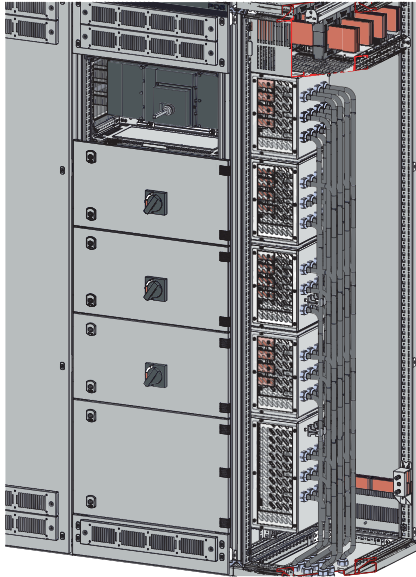
Cable Incoming from Top / Bottom Direction



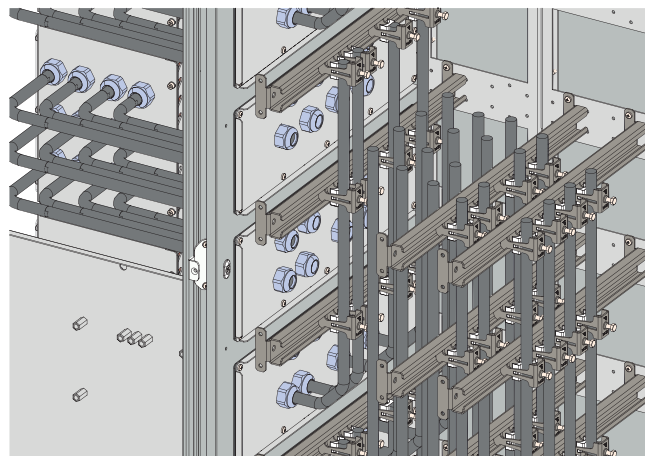
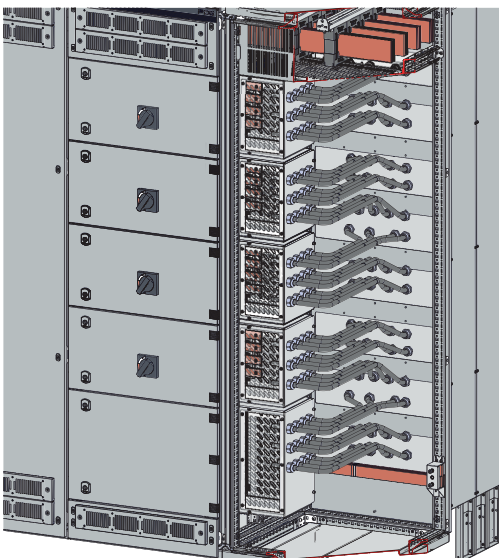
! Required : Rear Cabling Module for ACB must be ordered additionally

■ CABLING MODULE

Cable Incoming from Bottom Direction



Cable Incoming from Top Direction

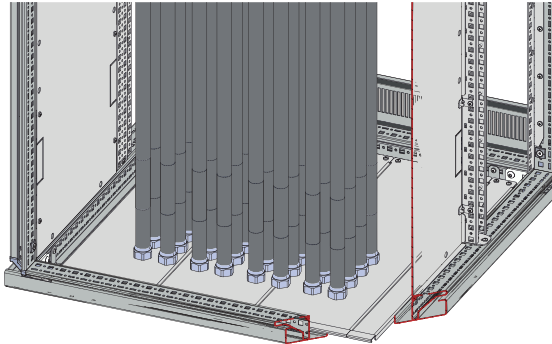


! Required : Top Rear Cabling Module for Feeders must be ordered additionally

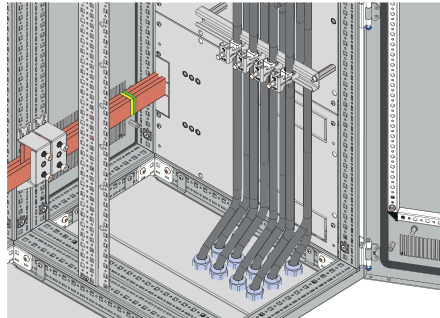
■ 4.2. CABLE GLANDING

■ CABLE ENTRY WITH CABLE GLANDS

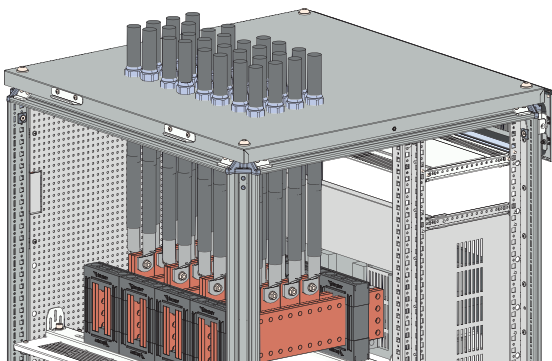
- If the switchgear's IP degree is stated IP53, the manufacturer must to use cable glands with minimum IP53 protected types during the cable entry.
- PDS sytem deliveries with solid gland plates for each module which consists IP 53 protection. These plates are useful for cable glanding.



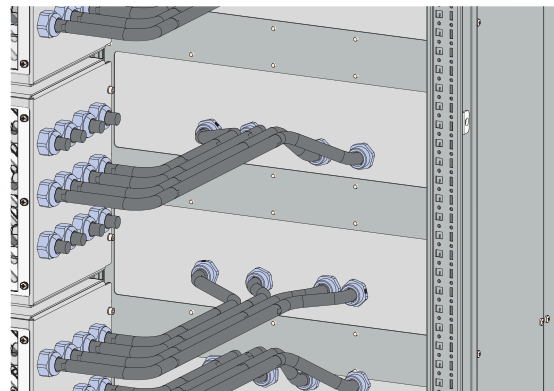
Entry from bottom gland plates to ACB Module



Entry from bottom gland plates to Cabling Module

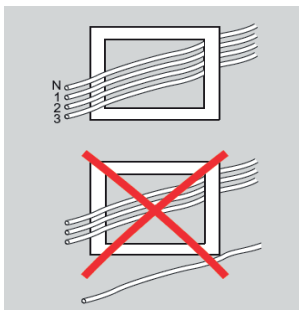


Entry from top cover to ACB Module



Entry from rear covers to Cabling Module via Rear Cabling Module

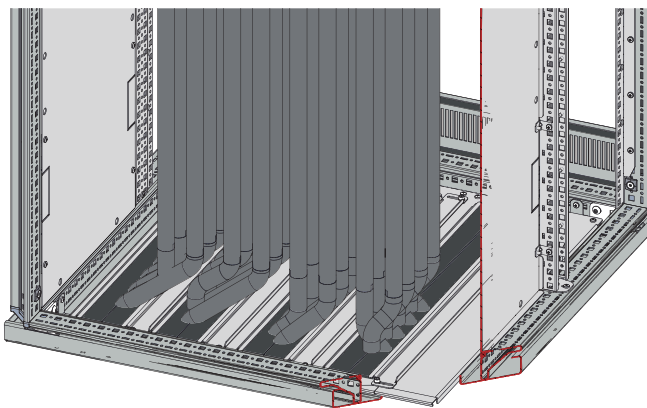
! ATTENTION



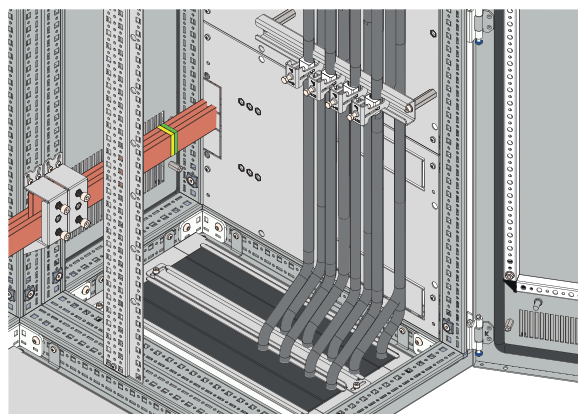
- All poles cables of a circuit must be entry from the same frame/hole to the switchboard protection against to magnetic effect.
- In case of separate entering the poles of a circuit, the manufacturer must use non-magnetic material plates like : aluminium, stainless steel or plastic.

■ CABLE ENTRY WITH FOAM RUBBER ENTRY

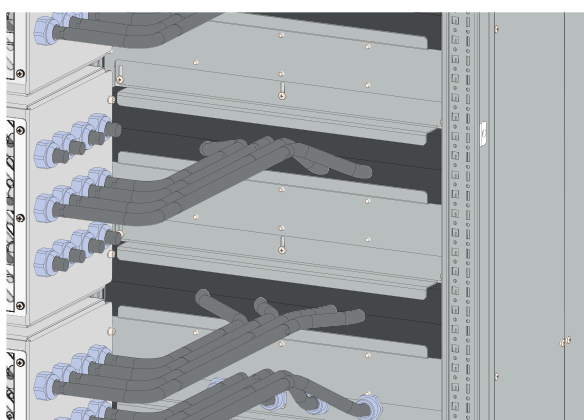
- If the switchgear's IP degree is stated IP53 and if there will be no possibility water jets from bottom, the manufacturer can use foam rubber gland plates instead of cable glands. IP2X version foam rubbered plates can also be useful.
- PDS system deliveries with blank gland plates for each module which consists IP 53 protection. Foam rubber gland plates must be ordered additionally instead of blank gland plates.



Entry from bottom via foam rubbered gland plates to ACB Module



Entry from bottom via foam rubbered gland plates to Cabling Module

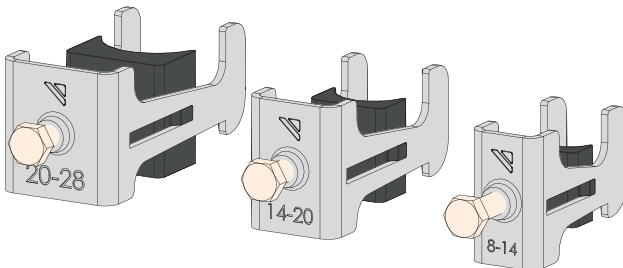
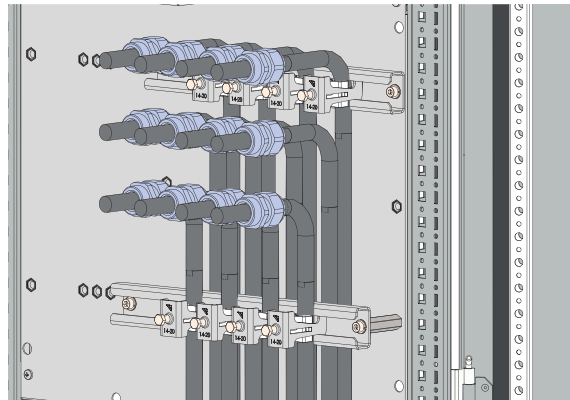
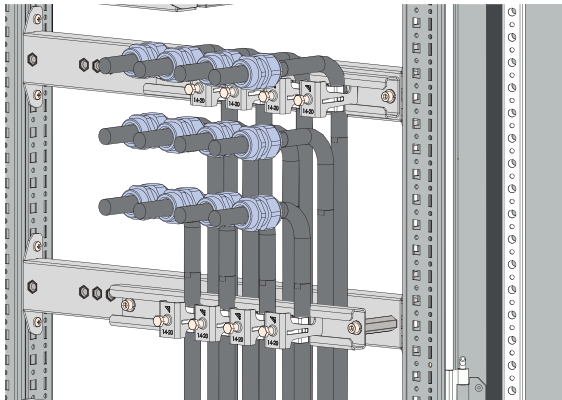


Entry from rear covers to Cabling Module via Rear Cabling Module plates

■ 4.3. CABLE CLAMPING

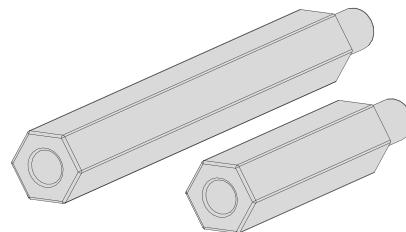
■ CABLE ENTRY WITH CABLE GLANDS

- Cable clamping is required for strain relief on the outgoing terminals. Cable clamps should be used via rails on side of cabling modules or inside the rear cabling modules.
- Thanks to spacers clamping can be done with various layers.



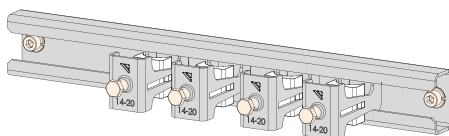
Cable Clamps :

Cable diameter : 8-14mm
Cable diameter : 14-20mm
Cable diameter : 20-28mm



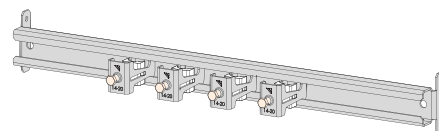
Spacers:

M8x50mm
M8x100mm



Clamp Fixing Rails in Cabling Module :

Module Depth : 600D
Module Depth : 800D



Clamp Fixing Rails in Rear Cabling Module :

Module Width : 400W
Module Width : 600W

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

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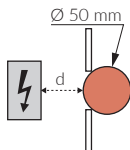
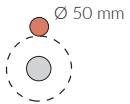
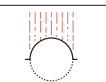

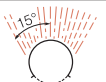
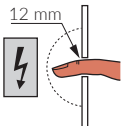
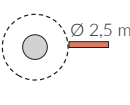
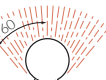
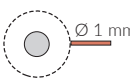

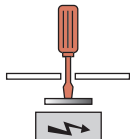
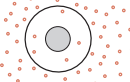
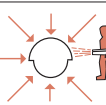
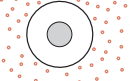
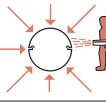
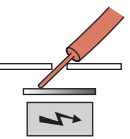
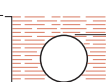
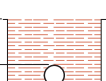
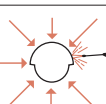
C5

DEGREES OF PROTECTION (IP)



5.1. IP DEGREES OF PROTECTION IN ACCORDANCE WITH STANDARDS IEC 60529 AND EN 60529

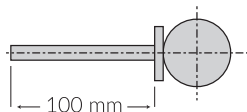
- The degree of protection of an assembly defines its capacity to protect people from direct contact with live parts and to prevent the entry of solid objects or liquids. It is specified by the IP code in accordance with the tests described in standard IEC 60529(see below).
- The IP code required for an assembly in an enclosure depends on its installation conditions and the external influences to which it is subjected. In all cases it must be at least IP 2X.The degree of protection of an open assembly must be at least IP XXB.
- The partner must carry out a visual inspection, once all the components have been assembled, to check that the enclosure and its components comply with the stated degree of protection.
- For example, if control and signalling auxiliaries are installed on doors or panels,their own IP and their installation must comply with the stated IP value.In this case, no additional testing is required.

1st number: protection against the penetration of solid objects			2nd number: protection against liquids			Additional letter IP XX (ABCD): protection against direct contact by access to hazardous live parts		
IP	tests		IP	tests		IP	tests	protection
0		No protection	0		No protection	A		The back of the hand is kept away from hazardous parts
1		Protected against solid objects larger than 50 mm	1		Protected against vertically falling drops of water (condensation)			
2		Protected against solid objects larger than 12.5 mm	2		Protected against dripping water up to 15° from the vertical	B		If a finger is inserted it cannot touch hazardous parts
3		Protected against solid objects larger than 2.5 mm	3		Protected against rainwater up to 60° from the vertical			
4		Protected against solid objects larger than 1 mm	4		Protected against water sprayed from all directions	C		If a tool is inserted (for example, a screwdriver) it cannot touch hazardous parts
5		Protected against dust (no harmful deposits)	5		Protected against water jets from all directions			
6		Totally protected against dust	6		Totally protected against powerful water jets similar to heavy seas	D		If a wire is inserted it cannot touch hazardous parts
			7		Protected against the effects of immersion			
			8		Protected against the effects of prolonged immersion under specified conditions			
			9		Protected against high-pressure and high-temperature water jets			

■ 5.2. MAXIMUM DISTANCES TO HAZARDOUS PARTS ON ADDITIONAL LETTERS (ABCD)

■ ACCESS TEST PROBES

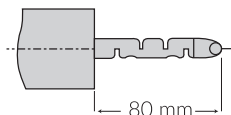
- Access probes for the tests for protection of person against access to hazardous parts.



A.

Metal test sphere, \varnothing 50 mm, on handle and guard of insulating material, \varnothing 10 mm, (L=100 mm).

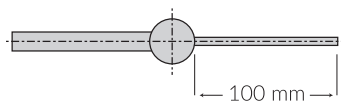
Test force = 50 N



B.

Jointed metal test finger, \varnothing 12 mm (L = 80 mm), fitted on handle of insulating material with stop face (\varnothing 50 x 20 mm).

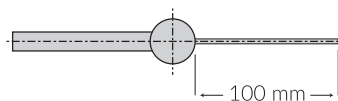
Test force 10 N.



C.

Metal test rod, \varnothing 2,5 mm, (L = 100 mm) with edges free from burrs. Mounted on stop face, \varnothing 35 mm of insulating material with insulated handle, \varnothing 10 mm (L = 100 mm).

Test force 3N.



D.

Metal test wire, \varnothing 1 mm, (L = 100 mm) with edges free from burrs. Mounted on stop face, \varnothing 35 mm of insulating material with insulated handle, \varnothing 10 mm (L = 100 mm).

Test force 1N.

■ 5.3. IP DEGREES AT PDS SYSTEM

- Standard delivery package in PDS system is IP 53D at Power distribution modules , IP 4XD at drawable module.
The partner can reduce IP protection level aiming to cooling purposes (see at 9.Thermal Management) till to below explanations.

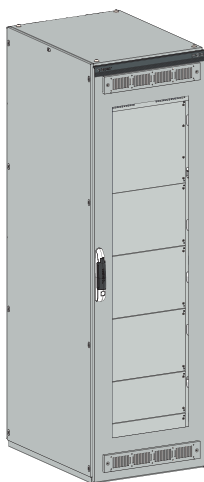
■ PROTECTION DEGREES WHILE THE DOORS ARE CLOSED ■

■ IP 53D DESIGN (IP 4XD AT DRAWABLE MODULE)

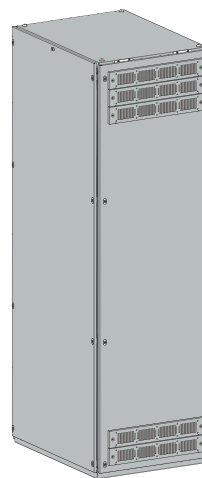
- Ventilation cutouts must be closed with metal filters with its' metal cases



External Door
Sapareted System



Internal Sapareted System with
External Single Door



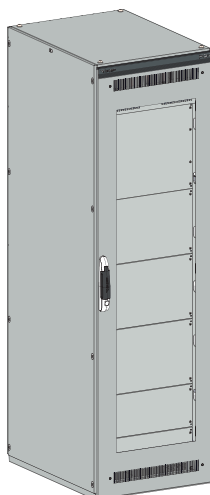
Rear Panel

■ IP 2XD DESIGN

- In case of IP 2XD protection metal cases and metal filters must be remove out from the panels.



External Door
Sapareted System



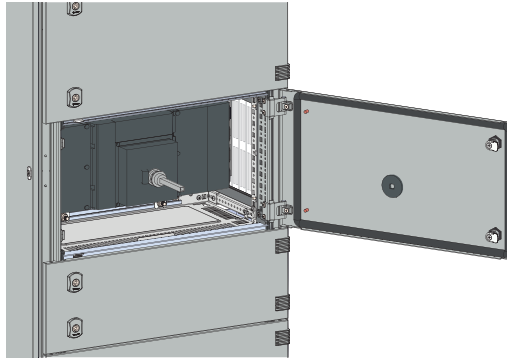
Internal Sapareted System with
External Single Door



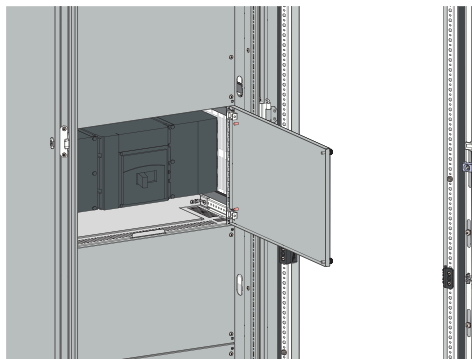
Rear Panel

■ PROTECTION DEGREES WHILE THE DOORS ARE OPENED

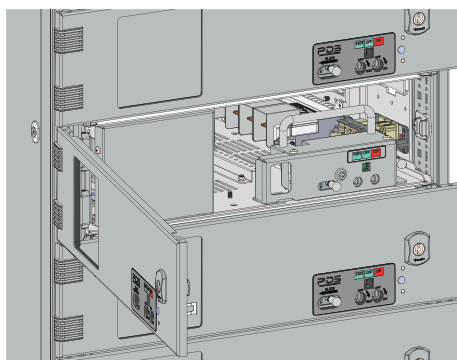
- While the doors are opened , the PDS system is protected IPXXD without any cutouts for the equipments.
- In case of making cutouts for equipments , partner must be sure the protection must be at least IP XXB.



External Door System



Internal Panel System



Drawable system

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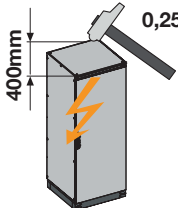
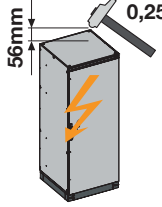
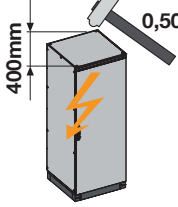
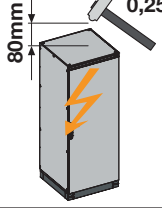
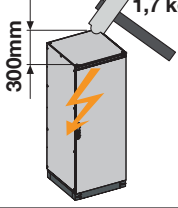
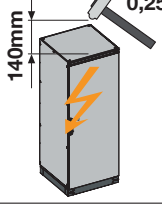
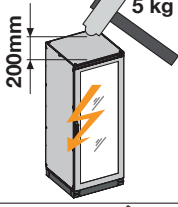
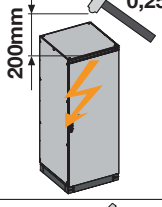
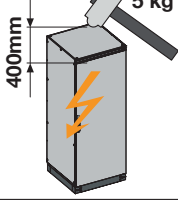
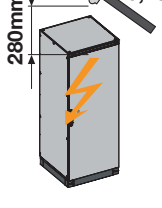
C6

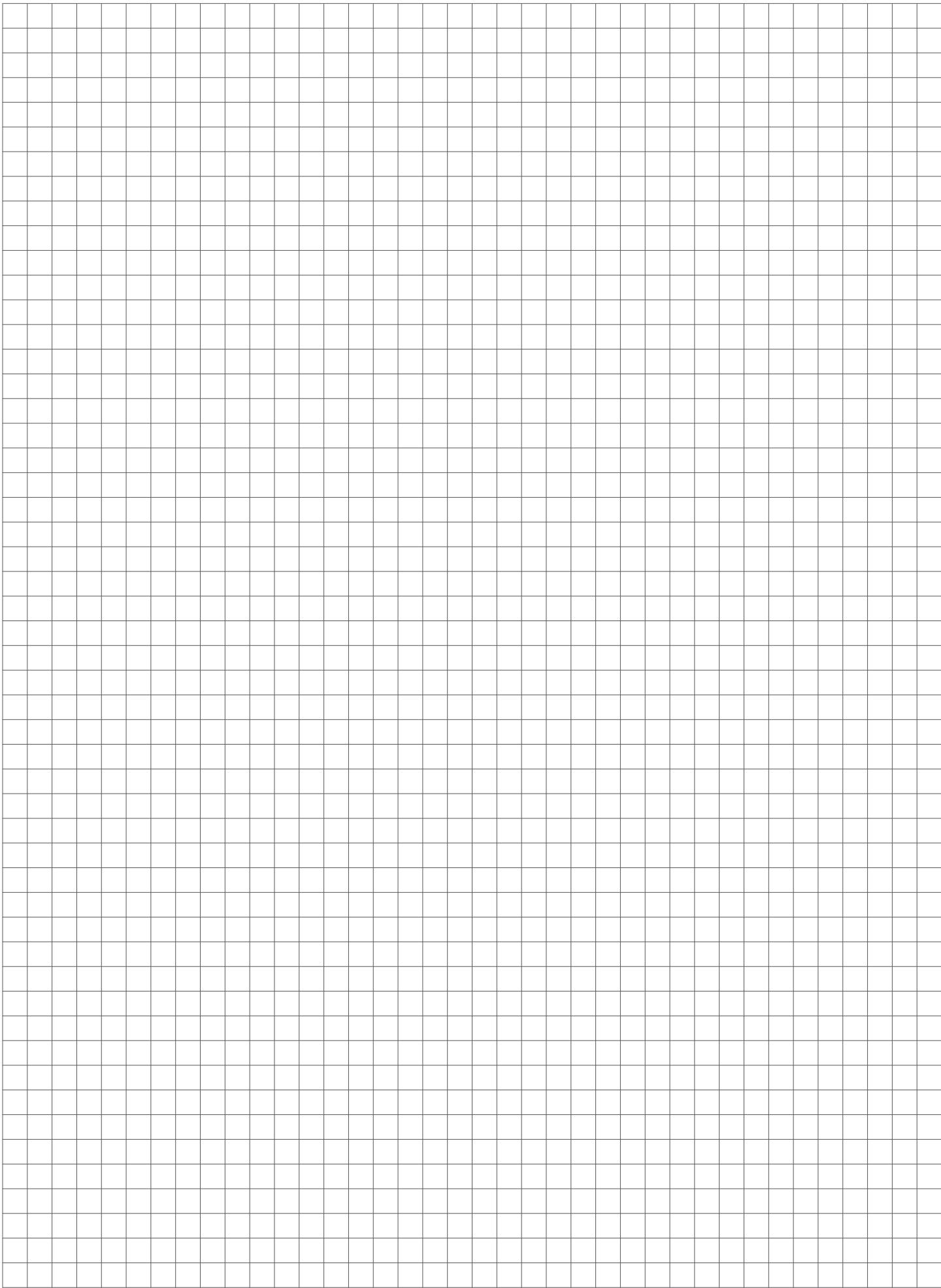
MECHANICAL RESISTANCE TO IMPACT (IK)



6.1. IK MECHANICAL RESISTANCE IN ACCORDANCE WITH STANDARDS IEC 62262

- IK resistances in PDS system are IK 09 at glazed doors and IK 10 at all modules' external parts. IP protections are valid which stated at ' 5. Degrees of Protection (IP)' by these IK resistances

<div>IK 0</div>  <div>No Protected</div>	<div>IK 06</div>  <div>Impact energy in Joule 1,00</div>
<div>IK 01</div>  <div>Impact energy in Joule 0,140</div>	<div>IK 07</div>  <div>Impact energy in Joule 2,00</div>
<div>IK 02</div>  <div>Impact energy in Joule 0,200</div>	<div>IK 08</div>  <div>With glazed door Impact energy in Joule 5,00</div>
<div>IK 03</div>  <div>Impact energy in Joule 0,350</div>	<div>IK 09</div>  <div>PDS GLAZED DOORS Impact energy in Joule 10,00</div>
<div>IK 04</div>  <div>Impact energy in Joule 0,500</div>	<div>IK 10</div>  <div>PDS SOLID DOORS PARTIAL DOORS - DRAWS Impact energy in Joule 20,00</div>
<div>IK 05</div>  <div>Impact energy in Joule 0,700</div>	



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SEGREGATION (FORMING)



■ 7.1. GENERAL RULES FOR FORMING ACCORDING TO IEC 61439-2

Standard IEC 61439-2 defines the separations inside an assembly according to 4 types of form, each form being divided into two groups, "a" and "b". These internal separations are created using barriers or screens made of metal or insulating material.

Their purpose is to divide the panel into closed protected areas to provide:

- Protection against direct contact with dangerous parts of neighbouring functional units.
The degree of protection must be at least IP XXB.
- Protection against the entry of solid objects. The degree of protection must be at least IP 2X (which covers IP XXB).

The main purpose is to maintain the availability of the power supply in the event of a fault or if work is being carried out on the panel.

Separations also limit the propagation of an electric arc and the risk of sparkover.

However, they limit the natural ventilation of the panel and can thus cause temperature rises. It is therefore advisable to check the thermal equilibrium. Separations will inevitably increase the size of the panel and its cost, both in terms of labour and components.

Functional Unit

Part of an ASSEMBLY comprising all the electrical and mechanical elements including switching devices that contribute to the fulfilment of the same function.

Conductors which are connected to a functional unit but which are external to its compartment or enclosed protected space (e.g. auxiliary cables connected to a common compartment) are not considered to form part of the functional unit. Comprises all parts necessary to form a complete incoming or outgoing circuit. It includes the load current carrying device(s) and associated equipment, cable terminals, and control devices within the assembly, that are necessary to form the complete circuit. It excludes the connections from the unit to the busbars (busbar connections) and any insulation or shrouding with which they may be provided. It may consist of more than one compartment or enclosed protected space.

Separation

Separation must be protected with IPXXB (Please see at Section C 5. Degree of protection)

Separation can be done insulated or metallic material. In case of metallic material using , penetration of live conductors from the separator , the air clearances must be kept in safety distances with the metallic parts.(Please see at Section C 2. Conductors sizing, rigidity and insulation)

Neutral and Earthing

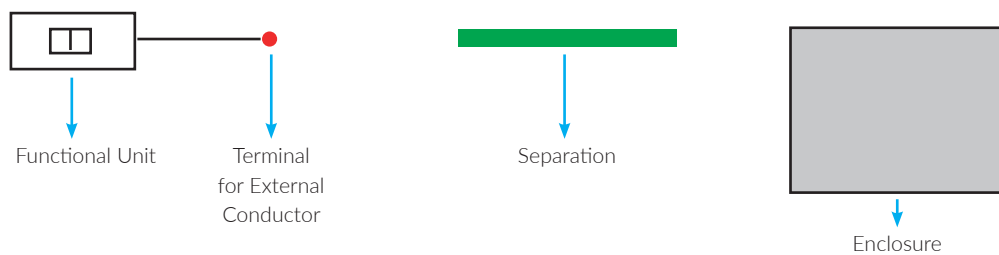
Main phases L1,L2,L3 must be kept into separation compartments. In case of using 4 pole applications ,Neutral pole must be kept into separation compartment too.

In case of 3 pole (L1,L2,L3) applications, Neutral connections do not necessary to kept into separation compartments.

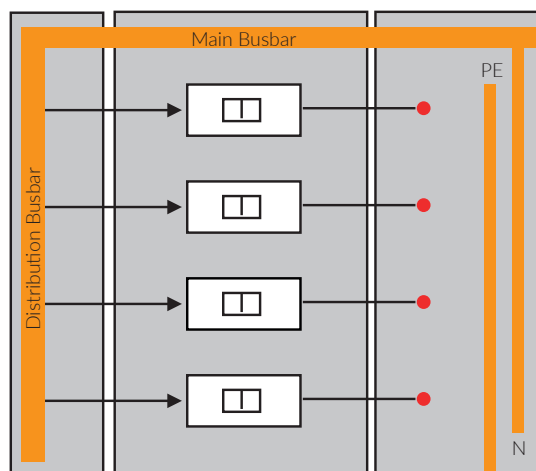
Incomer Breakers

PDS suggest to the user and partner to apply minimum Form 2b application for all incomers into the Switchgear which incoming terminals are live while the breaker shut down.

■ 7.2. FORMS OF SAPERATIONS

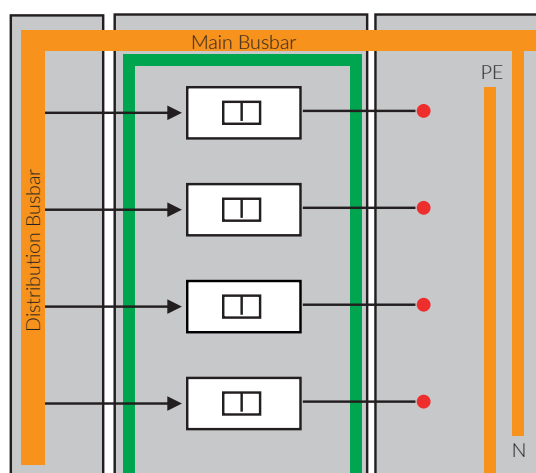


FORM 1



No Seperation

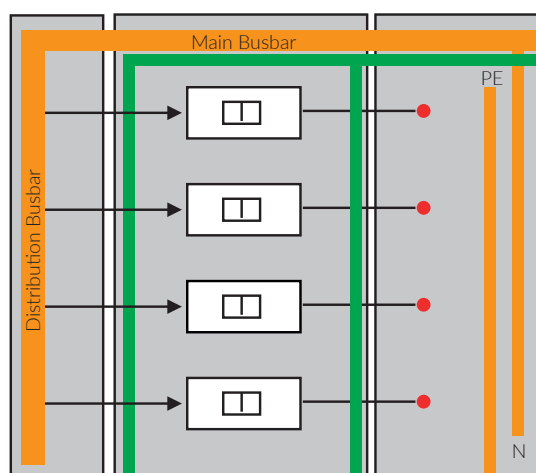
FORM 2a



Separation of busbars from functional units.

Terminals for external conductors do not need to be separated from busbars.

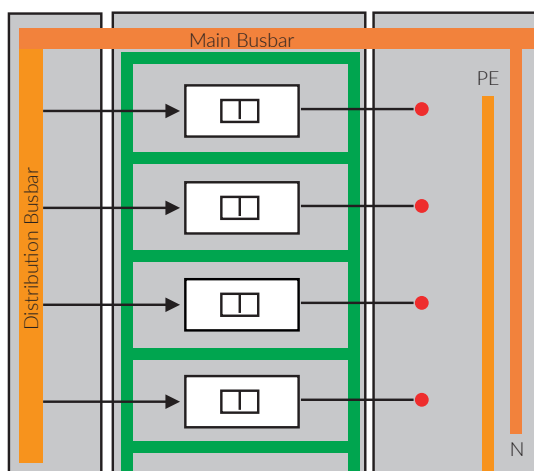
FORM 2b



Separation of busbars from functional units.

Terminals for external conductors are separated from busbars.

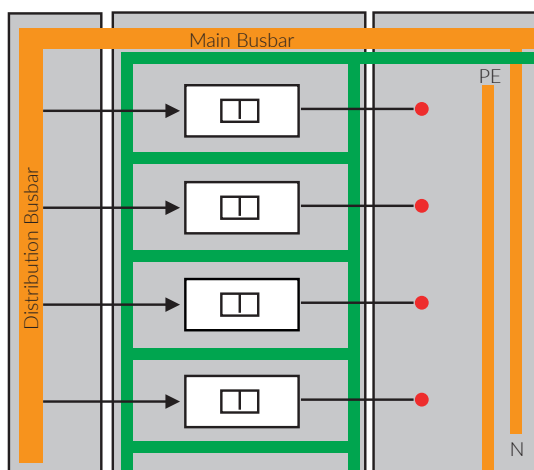
FORM 3a



Separation of busbars from functional units and separation of all functional units from each other.

Terminals for external conductors do not need to be separated from busbars.

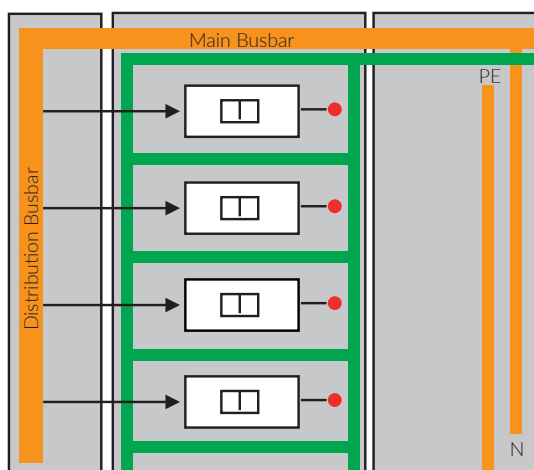
FORM 3b



Separation of busbars from functional units and separation of all functional units from each other.

Separation of terminals for external conductors from functional units but no separation between terminals.

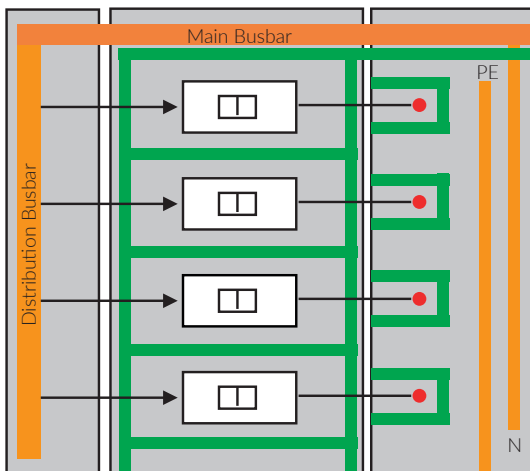
FORM 4a



Separation of busbars from functional units and separation of all functional units from each other, including the terminals for external conductors which are an integral part of the functional unit.

Terminals for external conductors are in the same compartment as the functional unit.

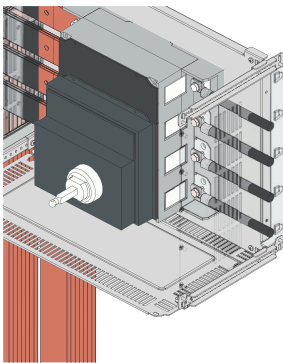
FORM 4b



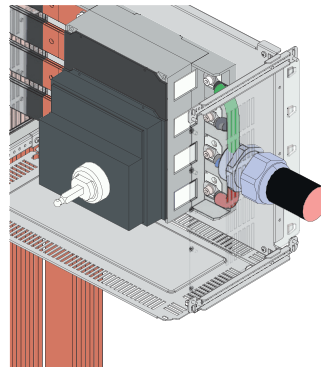
Separation of busbars from functional units and separation of all the functional units from each other including terminals for external conductors.

Terminals for external conductors are not in the same compartment as the functional unit but in separate individual compartments.

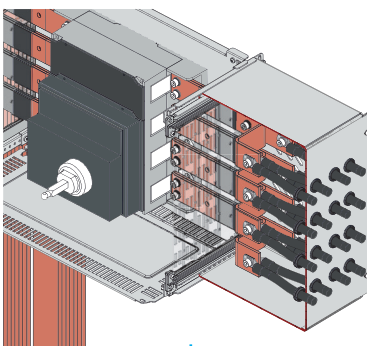
FORM 4a Type 2



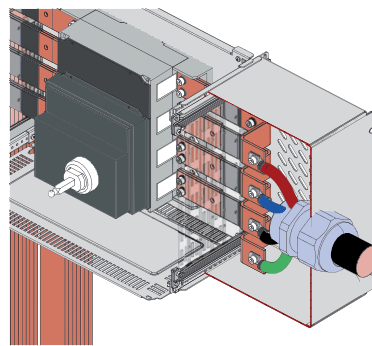
FORM 4a Type 3



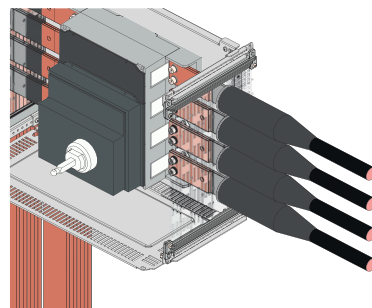
FORM 4b Type 6



FORM 4b Type 7



FORM 4b Type 5



IPXXB protected terminal connections are also an alternative instead of 4b metal box.

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THERMAL MANAGEMENT



■ 8.1 IEC 61439-2 TEMPERATURE RISING LIMITS

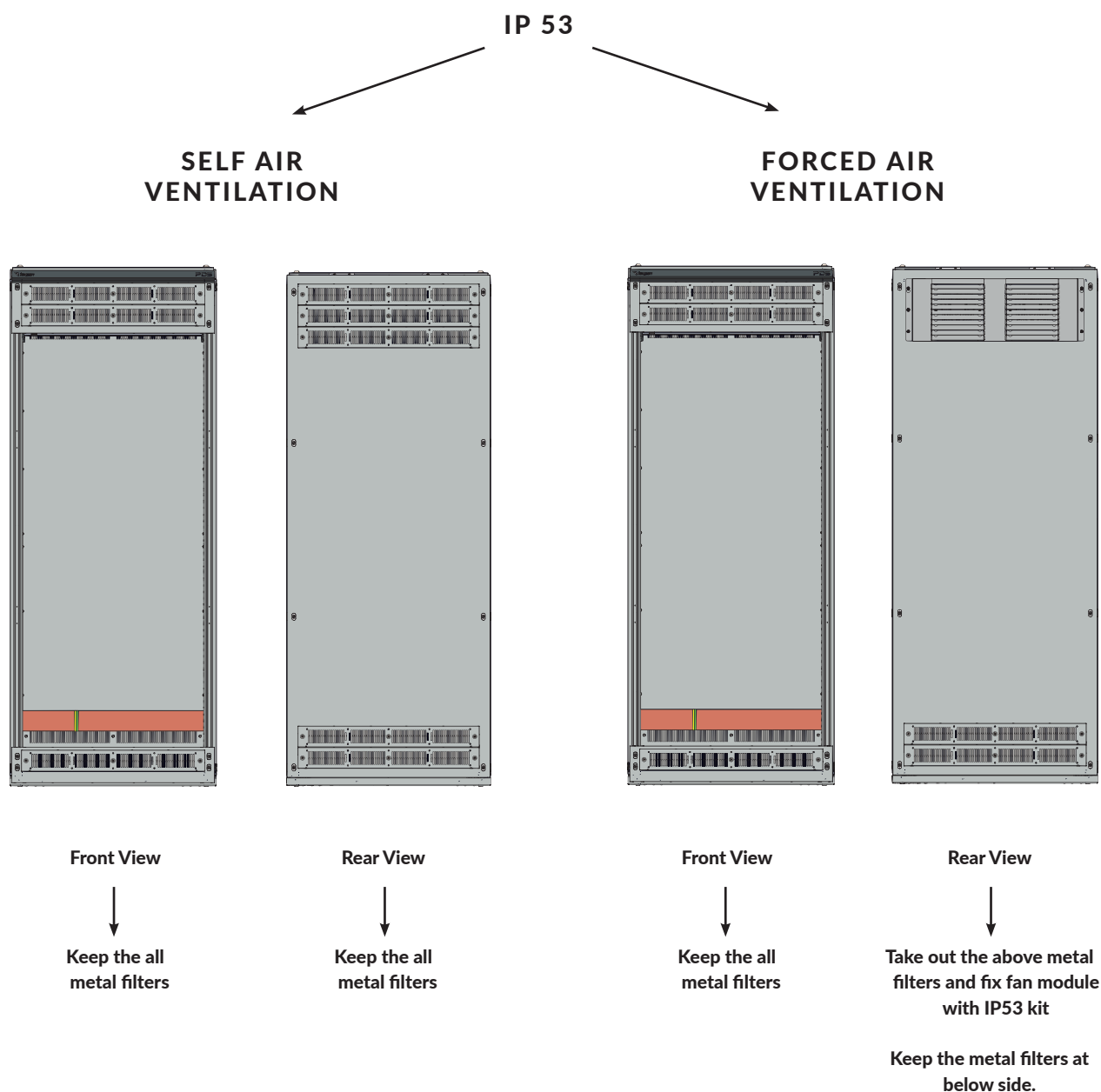
- Permissible Temperature Rise limits are the basic informations of thermal management at PDS switchboards according to IEC 61439-2 chapter 10.10 . These rising limits showed at below table :

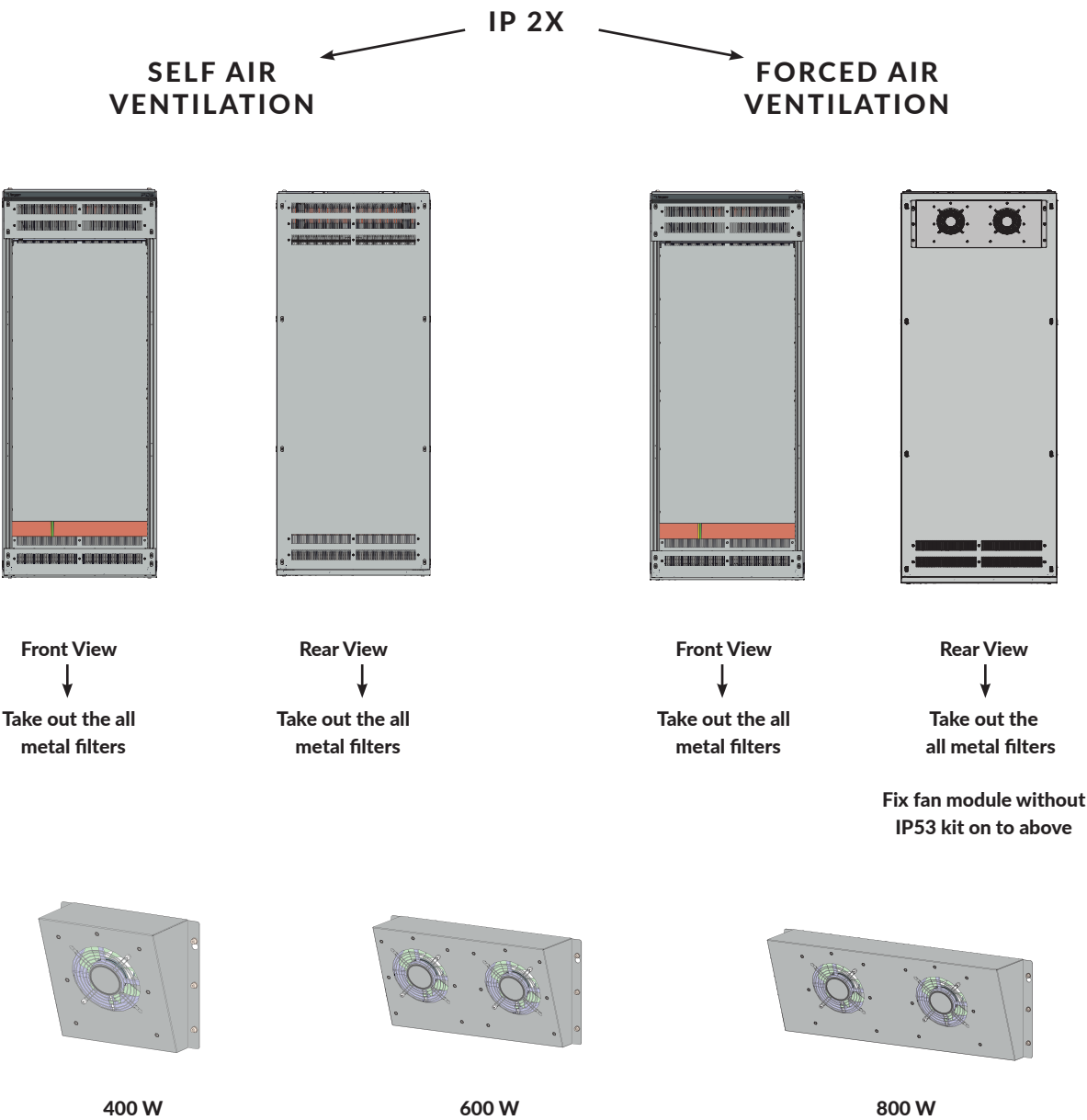
Permissible Temperature Rise $\Delta t : k^{\circ}$	Measurement Point
105k	Main and Distribution Busbars
80k	Incoming Conductor of Device
70k	Outgoing Terminal of Device
50k	Insulated Frame of Device
30k	External Surface of Switchgear
25k	Control Latches of Device

- These rising limits mean that the maximum temperature is permissible temp. rise + max.ambient temp. around the switchboard. For example if max. ambient temperature is $25^{\circ}C$, maximum temperature limit on the busbars is $130^{\circ}C$ ($25^{\circ}C + 105k$) .
- Only at Main and Distribution Busbars in PDS system , the maximum temperature limit is $105^{\circ}C$ because thermal capability of insulated holders. So the partner/user must to care to keep the temp. on busbars not more than $105^{\circ}C$. (Check on the busbar selection sheet table at ' Conductors Sizing instructions 2.1 and 2.2 ')
- Partner/ user must to be care to keep the maximum temperatures on devices according to rising limits between thermal capability of devices. The manufacturers' thermal instructions must be taken into consideration.

8.2 THERMAL MANAGEMENT AT PDS SYSTEM

- Managing of the thermal capacity at PDS sytem the partner/user must to follow these steps :
 - Determine the maximum ambient temperature around the switchborad.
 - Determine the IP protection (IP53 or IP2X) essential according to air pollution and liquid splashing around the switchboard.
 - !! The max. IP rate is IP 40 at drawable module, IP 53 at the rest of the modules.**
 - Choose the right main and distribution busbar sizes according to permissible current(A) tables from the 'Conductors Sizing instructions 2.1 and 2.2' considered with max ambient temp. , IP protection and air ventilation type.
 - If the conditions around the switchboard requires higher than permissible current(A) tables or air pollutions, partner/user must to build a switchboard room to take into convenient conditions for swithboards.
- PDS Switchboards are designed and deliver with IP53 equipments (metal filters). According to permissible current(A) sheet related with max. ambient temperature the partner/user can choose also IP 2X version without any order. IP 2X version switchboards can load more current (A) in the same type of busbar and ambeint temperature.
- Additionally partner/user can choose also forced air at IP53 or IP2X versions to increase current (A) capacity in the same size of busbar , ambient temperature .

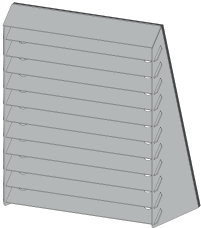




WIDTH(W)	FAN MODULE REF. NO	VAC	Hz	m³ / h *	Input W	dB(A)	Perm. Ambient Temperature	IP rate
400	1067.400	230V	50	325	45	49	- 25°C to 50°C	2X
			60	380	39	53	- 25°C to 70°C	2X
600	1067.600	230V	50	650	90	49	- 25°C to 50°C	2X
			60	760	78	53	- 25°C to 70°C	2X
800	1067.800	230V	50	650	90	49	- 25°C to 50°C	2X
			60	760	78	53	- 25°C to 70°C	2X

(*) : Empty Fan Capacity

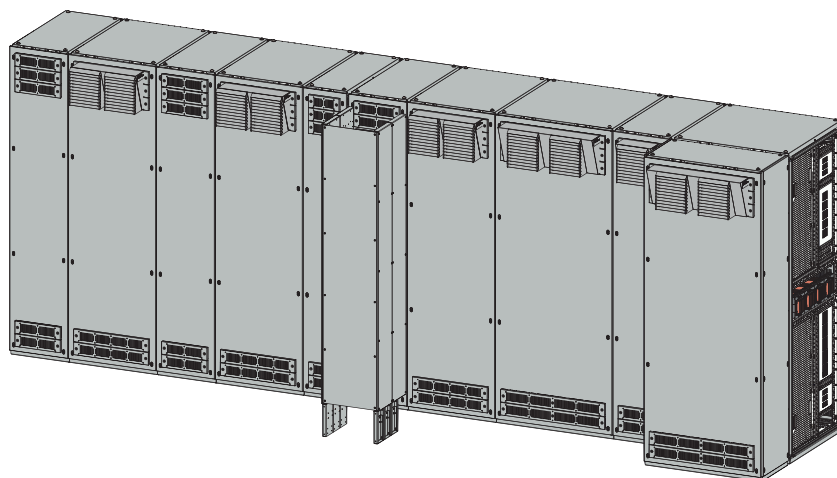
IP 53 KIT



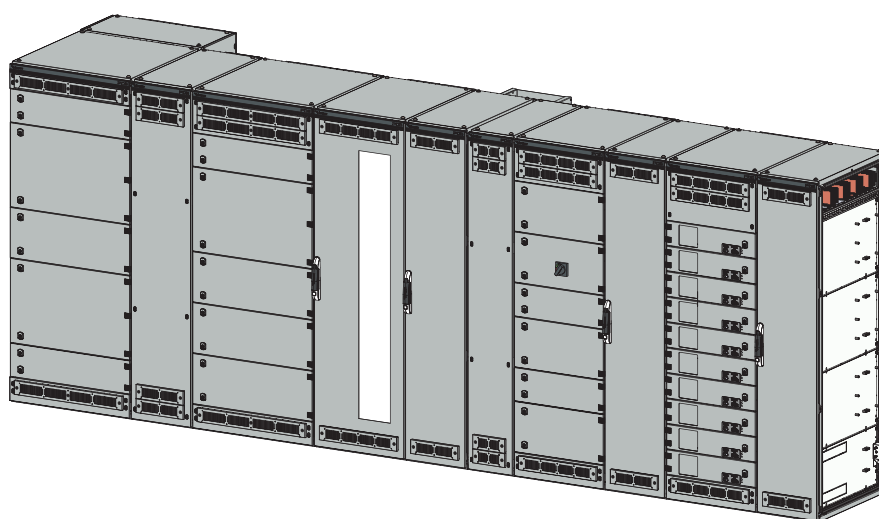
WIDTH (W)	REF. NO	REQUIRED QTY.
400	1067.400	1
600	1067.600	2
800	1067.800	2

■ 8.3 USING THE FAN MODULES

- Fan modules and IP53 Kits must be ordered separately from configurations
- Fan modules must be fixed to all PDS modules without Cable Modules in the same group of switchgear. Suitable width of fan module should be used for each module width.



- Minimum 2 meters space is required between the wall and rear side of the switchboard. That space is also required for without fan module applications



- The fan modules must be control with a fan thermostat set up with 35°C for each Fan Module. The thermostat must be placed at the top position of module in a suitable fixing point with safety.

FAN THERMOSTAT



Reference No : **983.011**
 Requires : IP 20
 CE Norms
 Suitable fixng on to 35mm DIN Rail
 0,75 - 1,50mm² connection
 Continous Open (NO) contact
 110 - 230V AC/DC 10 A

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

PDS
UPGRADE THE POWER

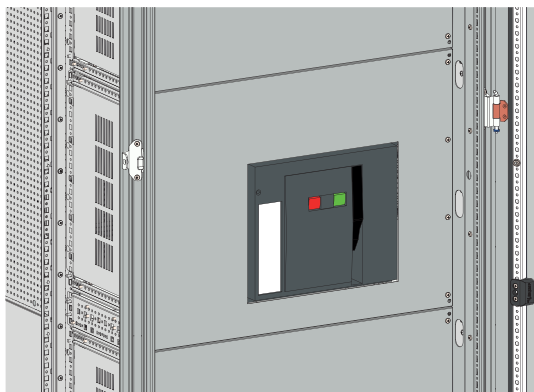
C9

CUTOUTS FOR ELECTRICAL EQUIPMENTS

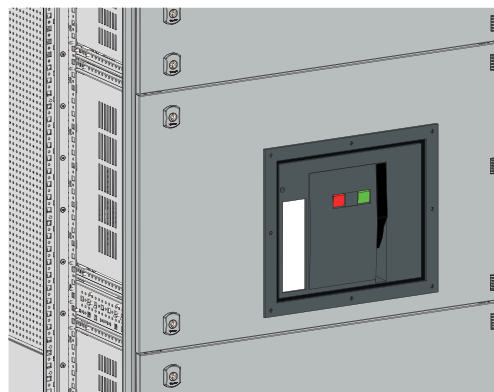


■ 9.1 CUTOUT METHODS

INTERNAL DOORS



EXTERNAL DOORS



METHOD A

Cutouts helping with drawings done by CNC Machines (Only in ACB available at ABB,Schneider and Siemens)

METHOD B

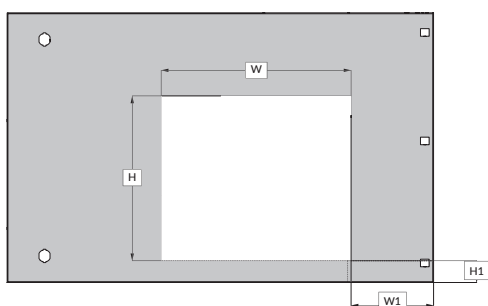
Cutouts helping with templates (Only in ACB available at ABB,Schneider and Siemens)

METHOD C

Cutouts helping with measuring frames

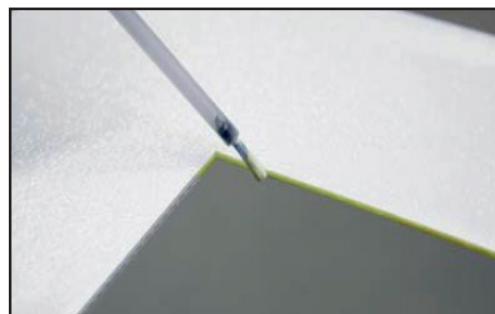
■ METHOD A :

1)



- Measures for Cutouts should take from the drawings shown at item 9.4
- The datas send to CNC machine via the CAD software

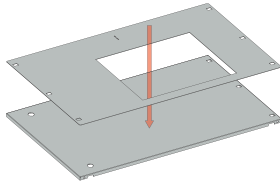
2)



- Cutouts are making by available CNC routers or Laser Cutting machines.
- The edges of cutting , must be close with corrosion protection primer.

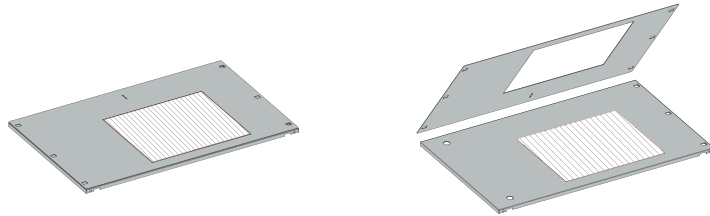
■ METHOD B :

1)



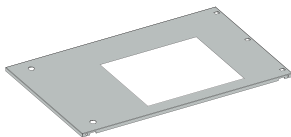
- The interested template is put on to the panel which will be cutted.

2)



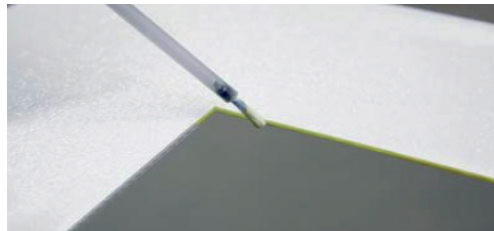
- The cutout size is drawn with a pencil.

3)



- Cutouts can be done via punches, cutters and trimmers guiding with pencil lines.

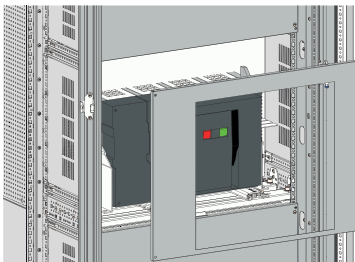
4)



- The edges of cutting , must be paint with corrosion protection primer.

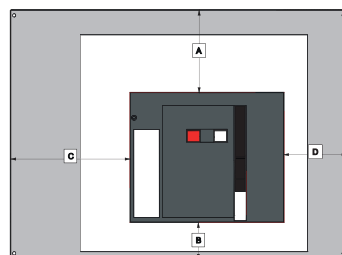
■ METHOD C :

1)

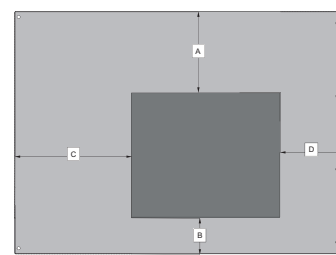


- Interested measuring Frame is fixing the place which is requiring measures.

2)

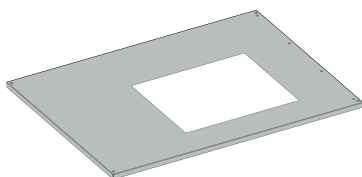


- Measure the sizes A,B,C and D
- Save the sizes.



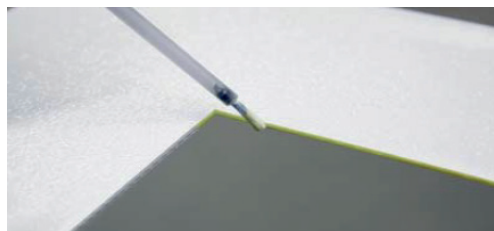
- Reduce the interested tolerances from the sizes A,B,C and D
- Draw the reduced sizes on panel.

3)



- Cutouts can be done via punches, cutters and trimmers guiding with pencil lines.

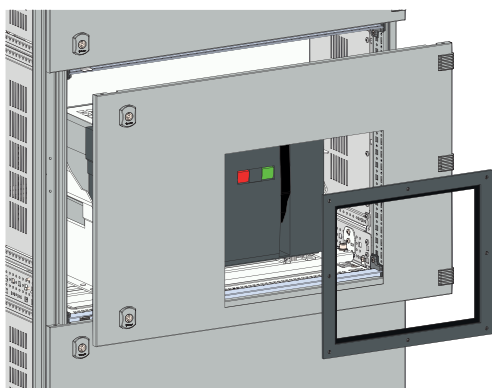
4)



- The edges of cutting, must be paint with corrosion protection primer.

■ 9.2 CUTTED EDGE CLOSING

■ CLOSING WITH ESCUTCHEONS



- In case of External door design , if the equipments touchable surface must be taken to out, the escutcheons or original closer frames must be used. The IP rate of the switchgear will be effect from the design of escutcheon. Partner/manufacturer have to be care of the escutcheon's IP rate is the same as declared and IPXXD.
- ACBs using in external door application : The escutcheons or closer frames must be used.
- ACBs using in internal door application : The escutcheons or closer frames does not necessary to use. Closing with U-gasket is also an alternative
- MCCBs using in internal door application : The escutcheons or closer frames does not necessary to use. Closing with U-gasket is also an alternative



- In case of while the Method C is applying for escutcheon size cutting, the manufacturer must to be consider the reducing tolerances from A,B,C and D sizes

Reducing tolerance for A and B = (Required Cutout size -Y)/2
Reducing tolerance for C and D = (Required Cutout size -X)/2

- For Example :

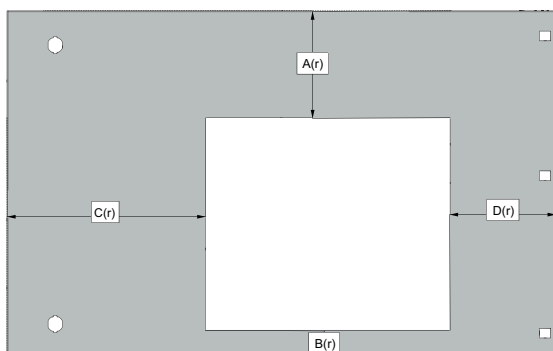
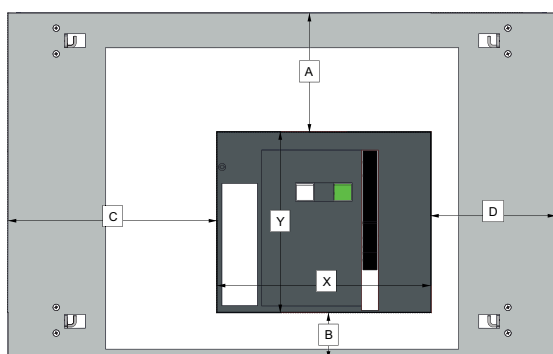
Required Cutout size : For X = 90 , For Y = 110

A : 60 , B: 40 , Y: 100

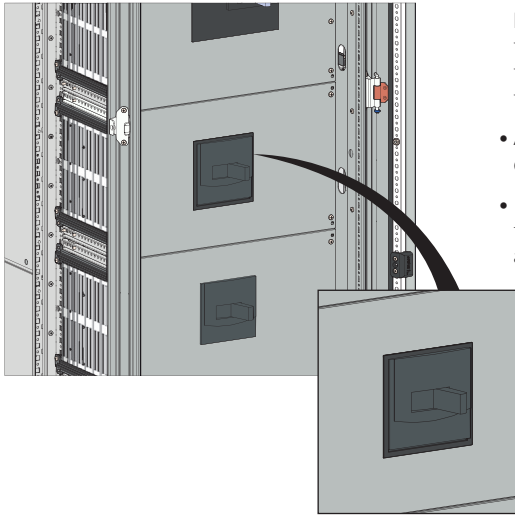
C: 230 , D: 190 , X: 80

Reducing A and B : $(110-100)/2 = 5$ A(r) : $60-5 = 55$, B(r) : $40-5 = 35$

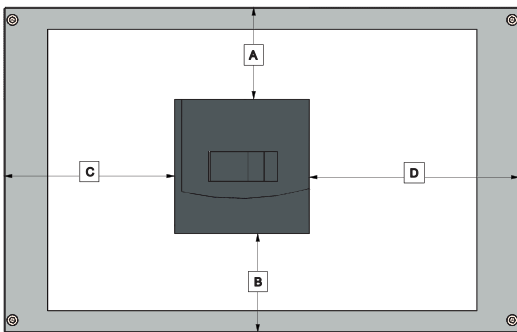
Reducing C and D : $(90-80)/2 = 5$ C(r) : $230-5 = 225$, D(r) : $190-5 = 185$



■ CLOSING with U-GASKET



- In case of internal door design , if the equipments touchable surface must be taken to out, the U-Gasket closer must be used if the escutcheon not to be preferred. The IP rate of the switchgear will be effect from the size tolerances of cutout size. Partner/manufacturer have to be care of the tolerances declared and IPXXB for internal doors.
- ACBs using in internal door application : The escutcheons or closer frames does not necessary to use. Closing with U-gasket is also an alternative
- MCCBs using in internal door application : The escutcheons or closer frames does not necessary to use. Closing with U-gasket is also an alternative



- In case of MCCB cutouts only Method C is available. In case of while the Method C is applying for U-Gasket size cutting , the manufacturer must to be consider the reducing tolerances from A,B,C and D sizes.

- Reducing tolerance for A, B, C and = 7,00mm

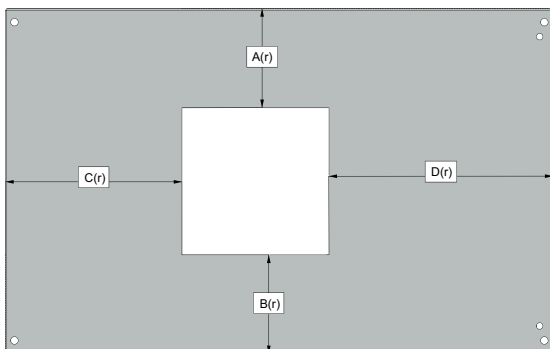
For Example :

A : 60mm , B: 40mm

C: 230mm , D: 190mm

Reducing A and B : $A(r) : 60-7 = 53$, $B(r) : 40-7 = 33$

Reducing C and D : $C(r) : 230-7 = 223$, $D(r) : 190-7 = 183$



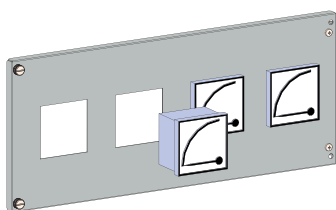
■ 9.3 OTHER CUTOUTS

■ MCCB FOR EXTERNAL DOORS



- In case of MCCB using with External door design , the extended rotary handles must be used.
- Method C is a way to determination of the hole positions.

■ MEASUREMENT & OTHER DEVICES

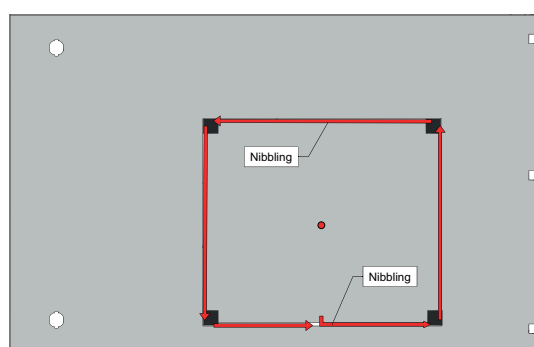
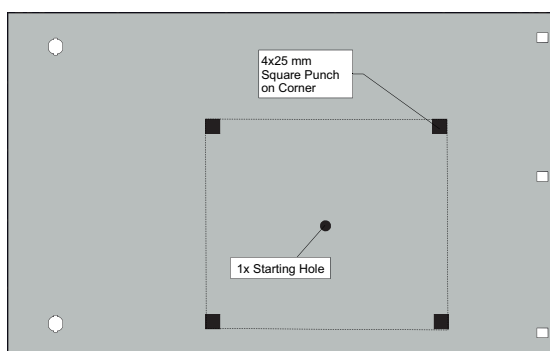


- For all small square, rectangle or diameter cutout types , hand hydraulic punches are the best solution for cutting edge quality.
- IP Rates of the equipments must be minimum as the switchboard IP's declared.
- The edges of cutting , must be paint with corrosion protection primer before the assemblies.

■ ONE OF RECOMENDED CUTOUTING METHOD



- Sheet Nibblers are the one of useful tools for making easy and correct cutouting. The Model Tru Tool N160 (www.trumpf.com) or equivalents are recommended
- In first step , the operator should punch via square tool on the corners, Second step , an sufficient starting hole should be punched. Third , the nibbling can start guided from inside drawn lines.



9.4 DRAWINGS FOR METHOD A

ABB E2.2

INTERNAL DOORS Size with 800mm Width

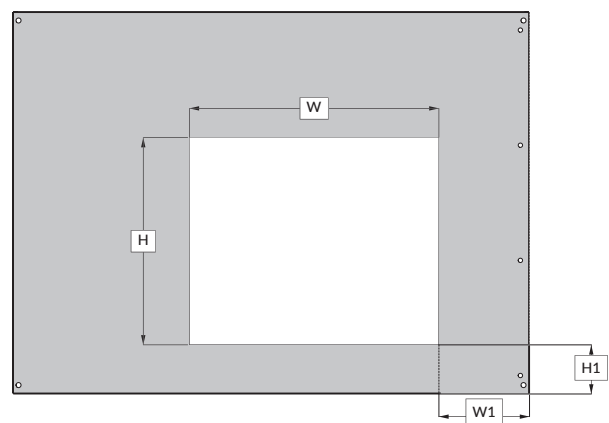


ABB E2.2 Internal Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x500	Fixed	W	32	138	350	308
800x500	Fixed	W/O	37	143	339	297
800x500	Drawout	W	33	138	376	308
800x500	Drawout	W/O	38	143	365	297

W1 and H1 measurements are fixed. You can change door direction but measurement always start same bottom right corner.

EXTERNAL DOORS Size with 800mm Width

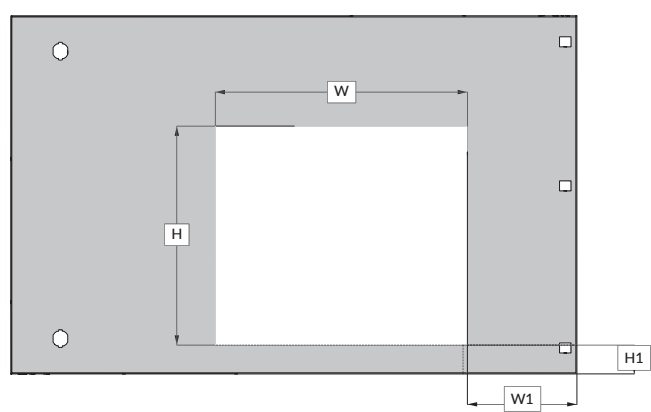


ABB E2.2 External Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x500	Fixed	W	31	194	350	308
800x500	Drawout	W	31	194	376	308

W1 and H1 measurements are fixed. You can change door direction but measurement always start same bottom right corner.

■ ABB E4.2

INTERNAL DOORS Size with 800mm Width

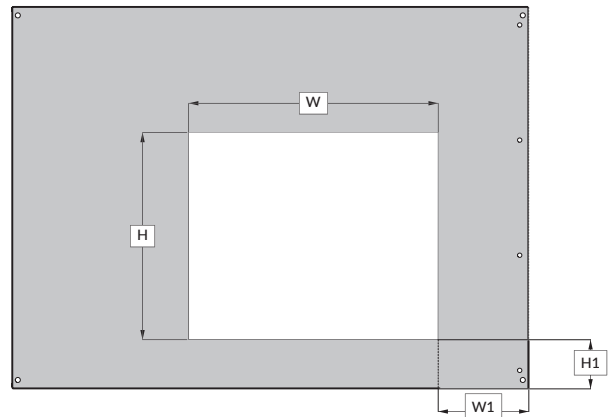


ABB E4.2 Internal Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x500	Fixed	W	32	120	350	308
800x500	Fixed	W/O	37	125	339	297
800x500	Drawout	W	31	120	376	308
800x500	Drawout	W/O	37	125	365	297

W1 and H1 measurements are fixed. You can change door direction but measurement always start same bottom right corner.

EXTERNAL DOORS Size with 800mm Width

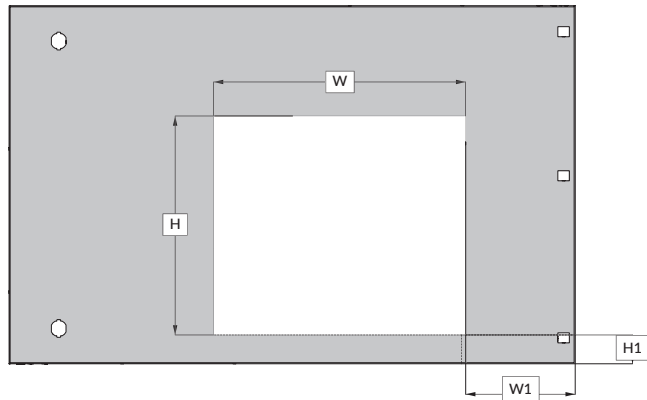
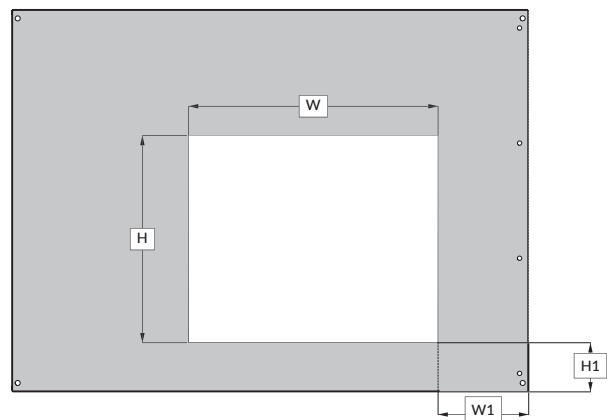


ABB E4.2 External Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x500	Fixed	W	31	175	350	308
800x500	Drawout	W	31	175	376	308

W1 and H1 measurements are fixed. You can change door direction but measurement always start same bottom right corner.

SCHNEIDER NW08-NW32 / NW40

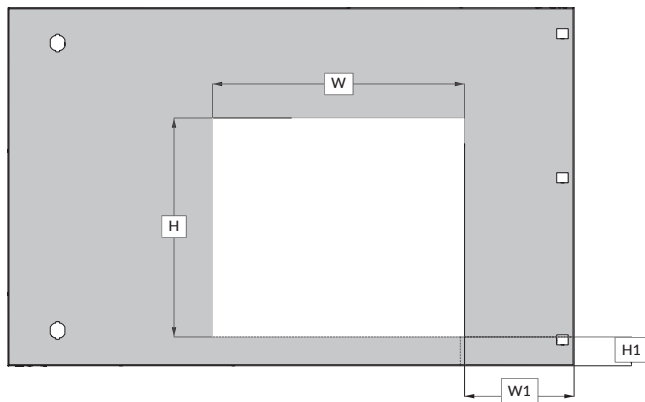
INTERNAL DOORS Size with 800mm Width



Schneider NW08-40/MTZ2 Internal Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x500	Fixed	W	41	96	318	366
800x500	Fixed	W/O	64	116	272	327
800x500	Drawout	W	20	96	381	366
800x500	Drawout	W/O	41	116	Check Breaker Manual	

W1 and H1 measurements are fixed. You can change door direction but measurement always start same bottom right corner.

EXTERNAL DOORS Size with 800mm Width

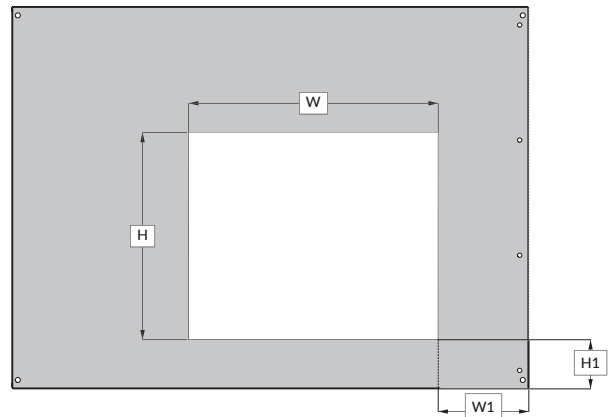


Schneider NW08-40/MTZ2 External Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x500	Fixed	W	40	152	318	366
800x500	Drawout	W	19	151	381	366

W1 and H1 measurements are fixed. You can change door direction but measurement always start same bottom right corner.

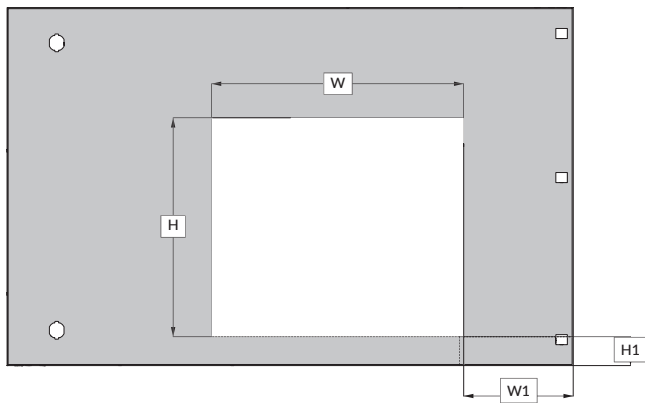
■ SIEMENS 3WL12

INTERNAL DOORS Size with 800mm Width



SIEMENS 3WL12 Internal Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x600	Fixed	W	103	121	352	302
800x600	Fixed	W/O	107	123	342	297
800x600	Drawout	W	103	121	352	302
800x600	Drawout	W/O	107	123	342	297

EXTERNAL DOORS Size with 800mm Width



SIEMENS 3WL12 External Door						
Dimension	ACB Type	Escutcheon	H1	W1	H	W
800x600	Fixed	W	103	175	352	302
800x600	Drawout	W	103	175	352	302

■ 9.5 TEMPLATES FOR METHOD B

ABB E2.2 PACKAGE : Reference No: 1068.002

2 x 800Wx500H Internal Door for ABB E2.2 Fixed-with Excutechon
 2 x 800Wx500H Internal Door for ABB E2.2 Drawable-with Excutechon
 2 x 800Wx500H Internal Door for ABB E2.2 Fixed-with U-Gaket Closed
 2 x 800Wx500H Internal Door for ABB E2.2 Drawable-with U-Gasket Closed
 2 x 800Wx500H External Door for ABB E2.2 Fixed-with Excutechon
 2 x 800Wx500H External Door for ABB E2.2 Drawable-with Excutechon

ABB E4.2 PACKAGE : Reference No: 1068.003

2 x 800Wx500H Internal Door for ABB E4.2 Fixed-with Excutechon
 2 x 800Wx500H Internal Door for ABB E4.2 Drawable-with Excutechon
 2 x 800Wx500H Internal Door for ABB E4.2 Fixed-with U-Gaket Closed
 2 x 800Wx500H Internal Door for ABB E4.2 Drawable-with U-Gasket Closed
 2 x 800Wx500H External Door for ABB E4.2 Fixed-with Excutechon
 2 x 800Wx500H External Door for ABB E4.2 Drawable-with Excutechon

SCHNEIDER NW08-40 PACKAGE : Reference No: 1068.001

2 x 800Wx500H Internal Door for SCHNEIDER NW08-40 Fixed-with Excutechon
 2 x 800Wx500H Internal Door for SCHNEIDER NW08-40 Drawable-with Excutechon
 2 x 800Wx500H Internal Door for SCHNEIDER NW08-40 Fixed-with U-Gaket Closed
 2 x 800Wx500H Internal Door for SCHNEIDER NW08-40 Drawable-with U-Gasket Closed
 2 x 800Wx500H External Door for SCHNEIDER NW08-40 Fixed-with Excutechon
 2 x 800Wx500H External Door for SCHNEIDER NW08-40 Drawable-with Excutechon

SIEMENS 3WL12 PACKAGE : Reference No: 1068.004

2 x 800Wx600H Internal Door for SIEMENS 3WL12 Fixed-with Excutechon
 2 x 800Wx600H Internal Door for SIEMENS 3WL12 Drawable-with Excutechon
 2 x 800Wx600H Internal Door for SIEMENS 3WL12 Fixed-with U-Gaket Closed
 2 x 800Wx600H Internal Door for SIEMENS 3WL12 Drawable-with U-Gasket Closed
 2 x 800Wx600H External Door for SIEMENS 3WL12 Fixed-with Excutechon
 2 x 800Wx600H External Door for SIEMENS 3WL12 Drawable-with Excutechon

■ 9.6 MEASURING FRAMES FOR METHOD C

EXTERNAL DOOR PACKAGE : Reference No: 1068.100

2 x 600Wx500H External Measuring Frame
 2 x 800Wx500H External Measuring Frame
 2 x 800Wx600H External Measuring Frame

INTERNAL DOOR PACKAGE : Reference No:1068.200

2 x 400Wx200H Internal Measuring Frame
 2 x 400Wx250H Internal Measuring Frame
 2 x 400Wx300H Internal Measuring Frame
 2 x 600Wx200H Internal Measuring Frame
 2 x 600Wx250H Internal Measuring Frame
 2 x 600Wx300H Internal Measuring Frame
 2 x 600Wx350H Internal Measuring Frame
 2 x 600Wx400H Internal Measuring Frame
 2 x 600Wx500H Internal Measuring Frame
 2 x 800Wx200H Internal Measuring Frame
 2 x 800Wx250H Internal Measuring Frame
 2 x 800Wx300H Internal Measuring Frame
 2 x 800Wx350H Internal Measuring Frame
 2 x 800Wx400H Internal Measuring Frame
 2 x 800Wx500H Internal Measuring Frame
 2 x 800Wx600H Internal Measuring Frame

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

PDS
UPGRADE THE POWER

C10

INSTALLATION of CURRENT TRANSFORMERS and METERS



10.1 GENERAL INFORMATION

Instrument Transformers : An instrument transformer is a piece of electrical equipment which converts primary electrical values current or voltage-into comparable secondary values which are suitable for the devices to which it is connected. They are defined in two kinds;

Current transformers convert primary rated current to a proper current level (1A...5A) which can be used by metering or protection devices. They can have several secondary windings with magnetically separated cores of the same or different characteristics.

Limits of current error and phase displacement for measuring current transformers

As described IEC 61869-2;

For classes 0.1 – 0.2 – 0.5 and 1, the current error and phase displacement at rated frequency shall not exceed the values given in table when the secondary burden is any value from 25 % to 100 % of the rated burden.

For classes 0,2 S and 0,5 S the current error and phase displacement at the rated frequency shall not exceed the values given in table when the secondary burden is any value from 25 % and 100 % of the rated burden

Limits of current Error and phase displacement according to IEC 618269-2										
Accuracy Class	± percentage of current error at percentage of rated current					± percentage of current error at percentage of rated current				
	1	5	20	100	120	1	5	20	100	120
Measuring Current Transformers										
0,1	-	0,4	0,2	0,1	0,1	-	15	8	5	5
0,2S	0,75	0,35	0,2	0,2	0,2	30	15	10	10	10
0,2	-	0,75	0,35	0,2	0,2	-	30	15	10	10
0,5S	1,5	0,75	0,5	0,5	0,5	90	45	30	30	30
0,5	-	1,5	0,75	0,5	0,5	-	90	45	30	30
1	-	3	1,5	1	1	-	180	90	60	60
Protective Current Transformers										
5P	-	-	-	1	-	-	-	-	60	-
10P	-	-	-	3	-	-	-	-	-	-

1. When the secondary terminals are connected to the measuring or protection devices, one of the terminals should be earthed for safety as seen in FIGURE CT-1
2. The secondary circuit of a current transformer must not be operated open-circuited
3. The secondary winding of a current transformer which will not be used must always be short-circuited and earthed as seen in FIGURE CT-2

FIGURE CT-1

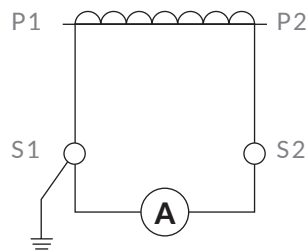
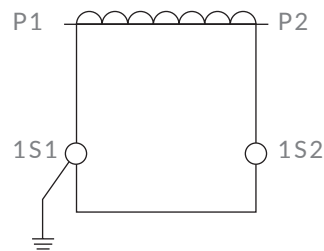
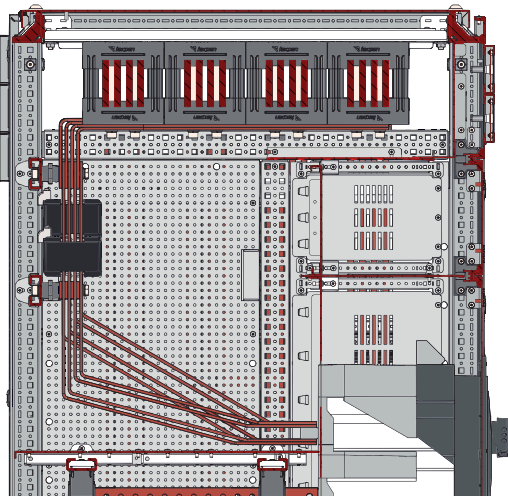
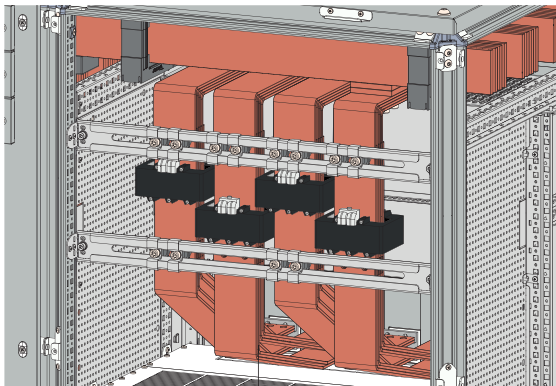


FIGURE CT-2



10.2 INSTALLATION OF CURRENT TRANSFORMERS AT INCOMER OR FEEDER ACB



Busbar	Conductor Size		Rated Current (In)
	W(mm)	X(mm)	
4x100/10	100	80	4000A
4x80/10	80	80	3200A
4x80/5	80	40	2500A
2x80/10	80	40	2000A
2x80/5	80	20	1200A
2x60/5	60	20	1200A
2x50/5	50	20	1000A
2x40/5	40	20	800A



Classic Current Tranformers
Available busbar sizes up to 85x125mm

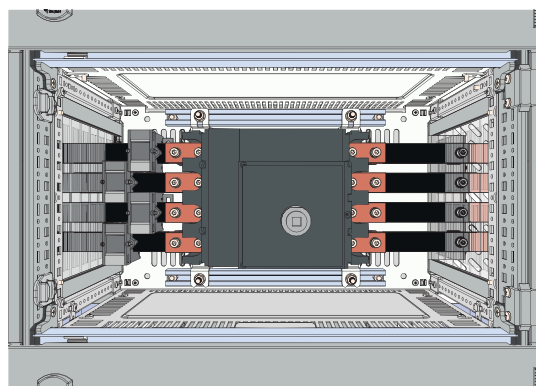
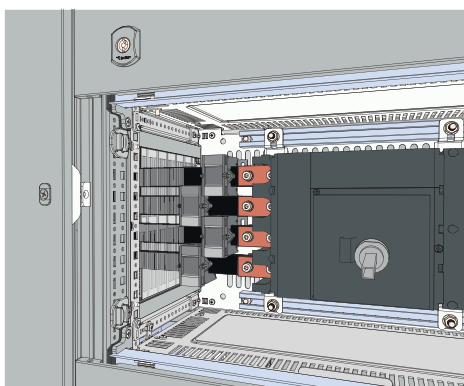
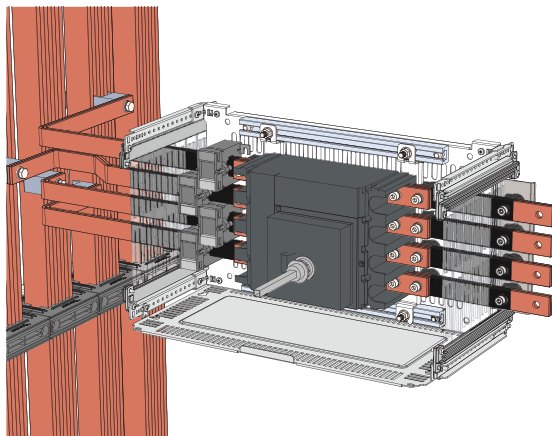


Flexible Current Transformers by Phoenix Contact
PACT RCP current transformers for retrofitting can be conveniently mounted where there is not enough space for split core current transformers



Rogowski Coil Flexible Current Transformers by Accuenergy
Current transformers for retrofitting can be conveniently mounted where there is not enough space for split core current transformers

■ 10.3 INSTALLATION OF CURRENT TRANSFORMERS AT FEEDER MCCB



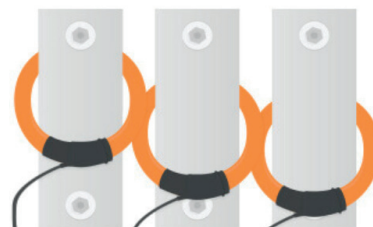
Combined Current Transformers

Available for cables



Classic Current Transformers

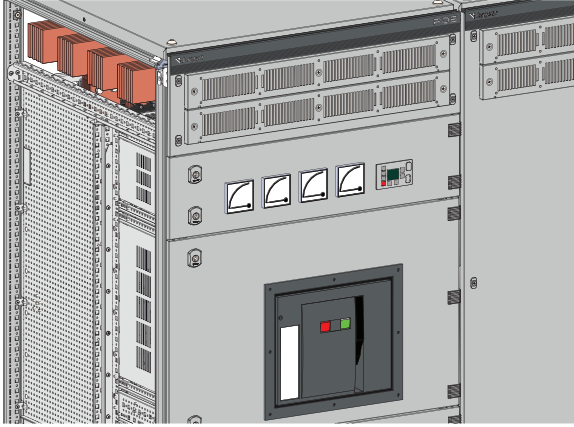
Available busbar sizes up to 85x125mm



Rogowski Coil Flexible Current Transformers by Accuenergy

Current transformers for retrofitting can be conveniently mounted where there is not enough space for split core current transformers

■ 10.4 INSTALLATION OF METER UNITS



- For ACB meter monitoring , an empty cassette can load into ACB module.
- Empty cassette provides up to Form-4b segregation.

INSTALLATION INSTRUCTIONS AT **WORKSHOP**

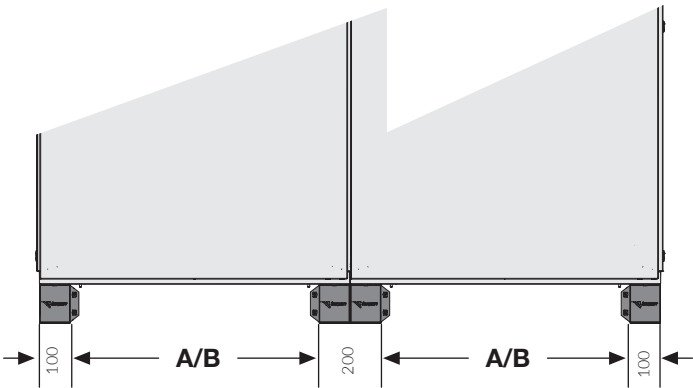
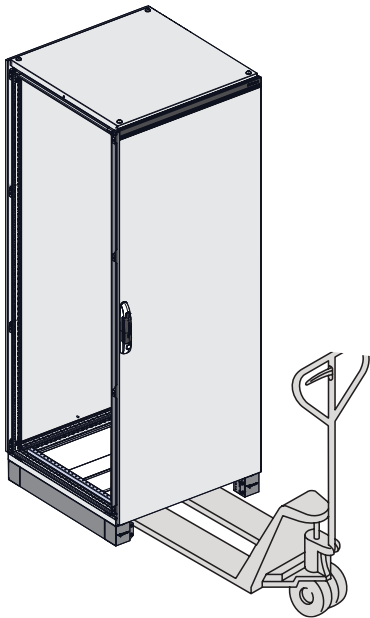
PDS
UPGRADE THE POWER

C11

HANDLING and TRANSPORT

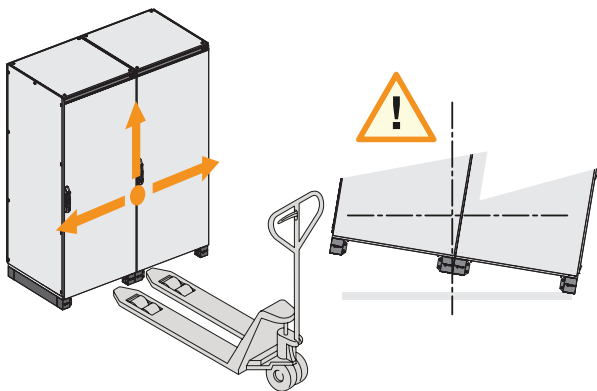


11.1 HANDLING WITH TRANSPALLET

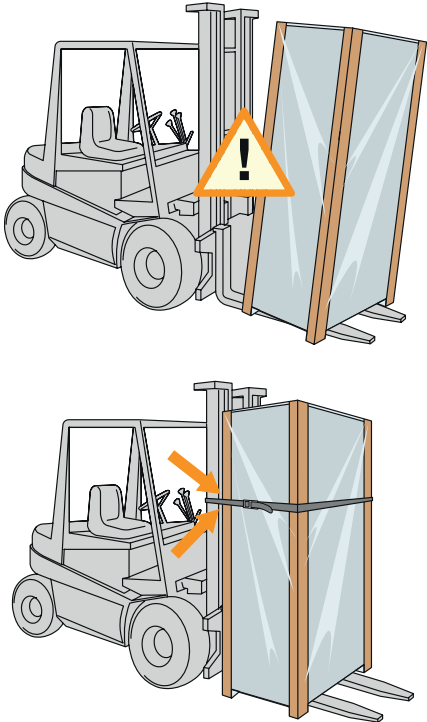


For greater safety during transport using a fork-lift truck, it is advisable to anchor the switchgear to the truck.

Enclosure Width (mm)		
Enclosure Sizes	A (front)	B (side)
300x600	96	396
300x800		596
400x600	196	396
400x800		596
600x400	396	196
600x600		396
600x800		596
800x400	596	196
800x600		596
800x800		596



In the case of structures W=800mm (with cabling module) containing busbar systems, check the centre of gravity before handling.



■ 11.2 HANDLING WITH OVERHEAD TRAVELLING CRANE

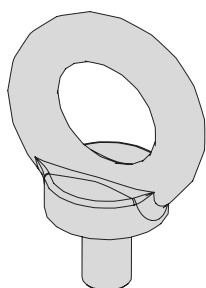
■ LIFTING BY TOP ELEMENTS



- Maksimum enclosure number is 3.
- The angle between lifting ropes and the enclosure roof must be $\geq 45^\circ$

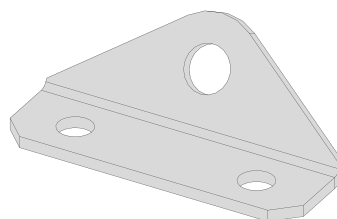
- To respect the conditions described above, a lifting beam with appropriate characteristics can be used when there are several columns side by side.
- The angle between lifting ropes and the enclosure roof must be $\geq 45^\circ$

M12 Eyebolts



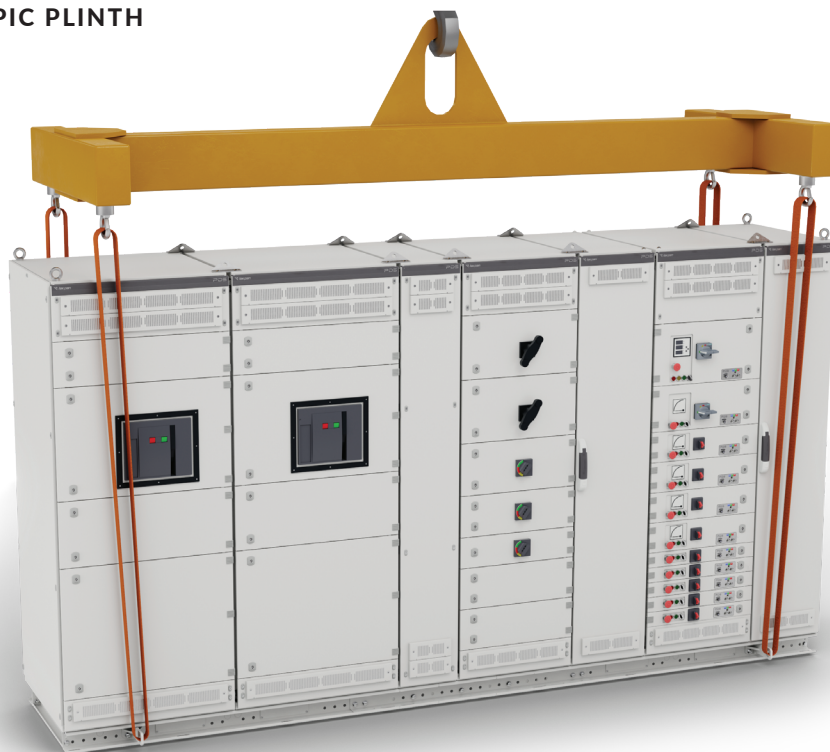
- Max. 340kg per eyebolt in 90° angle
- Max. 160kg per eyebolt in 60° angle
- Max. 120kg per eyebolt in 45° angle

Double Lifting Bracket

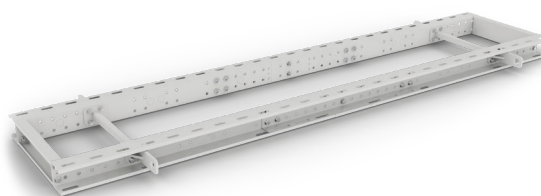


- Max. 510kg per bracket in 90° angle
- Max. 400kg per bracket in 60° angle
- Max. 350kg per bracket in 45° angle

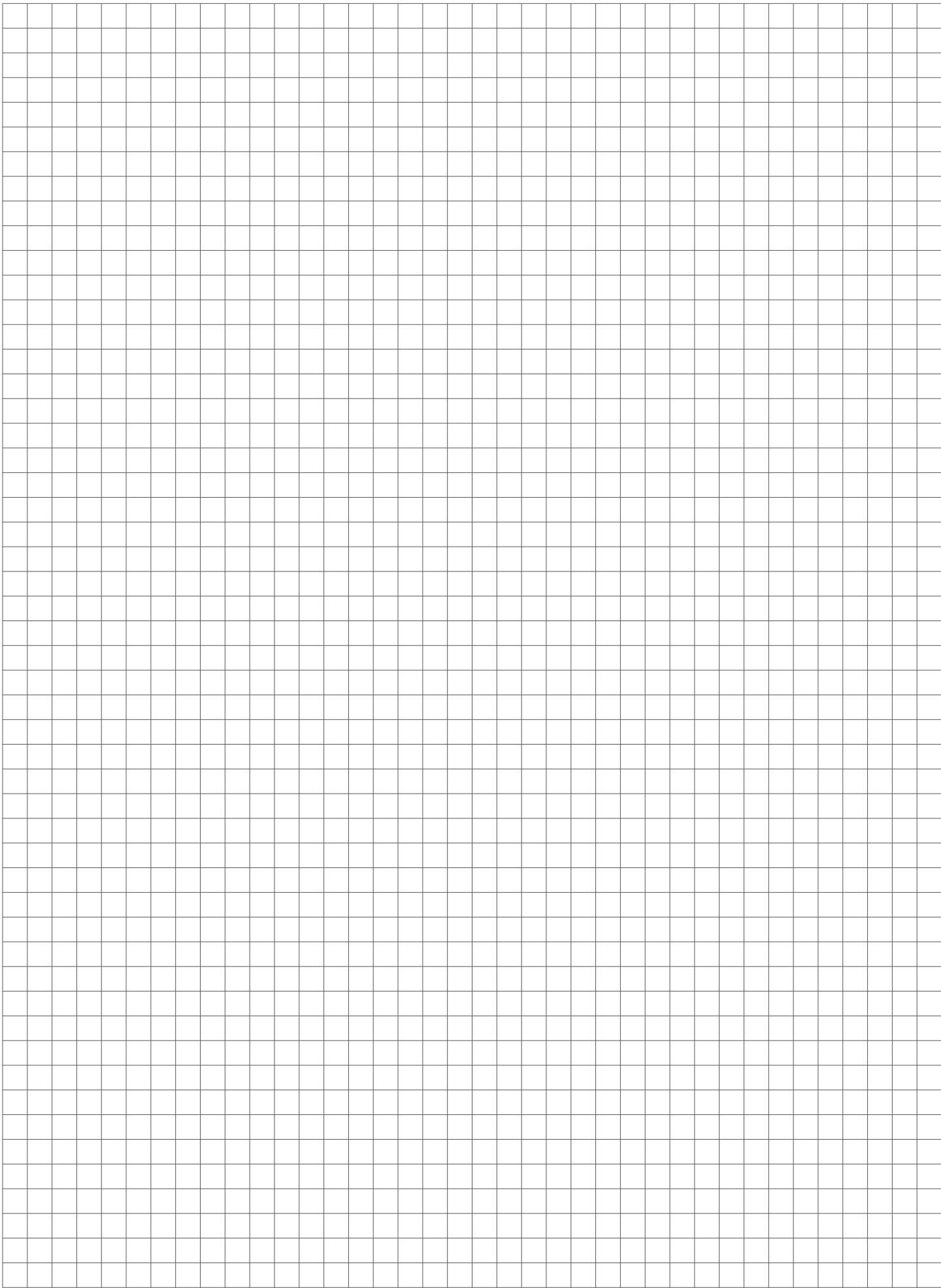
■ LIFTING BY TELESCOPIC PLINTH



- Max. 1000kg per lifting point in 90° angle
- Max. 800kg per lifting point in 60° angle
- Max. 700kg per lifting point in 45° angle



Transport by rollers is also possible with telescopic fixed plinth



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LABELLING



12.1 SWITCHGEAR IDENTIFICATION LABEL

PARTNER LOGO	PDS
ASSEMBLY MANUFACTURER	Partner-Assembly manufacturer name
SWITCHGEAR NAME	Stated by Partner
SWITCHGEAR NUMBER	Stated by Partner
PRODUCTION DATE	Stated by Partner
APPLICABLE STANDARD	IEC 61439 -1/2
RATED CURRENT FOR SWITCHGEAR (InA)	Stated by Partner : fe: 2000A
RATED OPERATIONAL VOLTAGE (Ue)	Stated by Partner : fe: 415V
RATED FREQUENCY (fn)	Stated by Partner : fe: 50Hz
DIELECTRICAL WITHSTAND TEST VOLTAGE	Stated by Partner : fe : 2.2 kV
RATED VOLTAGE OF AUXALIARY CIRCUITS	Stated by Partner : fe : 230V
RATED IMPULSE WITHSTAND VOLTAGE (Uimp)	Stated by Partner : fe : 8kV
RATED SHORT TIME WITHSTAND CURRENT (Icw)	Stated by Partner : fe: 100kA-1 sec.
IP PROTECTION LEVEL	Stated by Partner : fe : IP 53 D
SEGREGATION LEVEL	Stated by Partner : fe : Form 4b
Contact informations of Partner(Assembly Manufacturer) Company Name , Adresses , Phones , E-Mail and Web adresses	

- The partner-assembly manufacturer shall provide each assembly with one or more labels, marked in adurable manner and located in a place such that they are visible and legible when the assembly is installed and in operation. Compliance is checked according to the test of 10.2.7 IEC 61439-1 and by inspection.

Test 10.2.7

Marking made by moulding, pressing, engraving or similar, including labels with a laminated plastic covering, shall not be submitted to the following test.

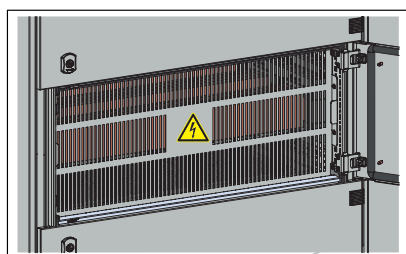
The test is made by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and then for 15 s with a piece of cloth soaked with petroleum spirit.After the test, the marking shall be legible to normal or corrected vision without additional magnification.

■ 12.2 ELECTRICAL SHOCK WARNING LABELS

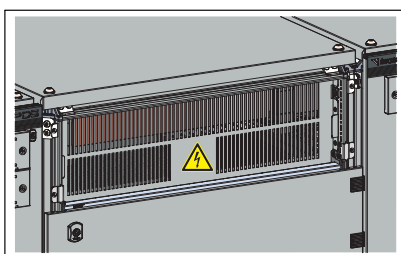


- The partner-assembly manufacturer shall paste one label on each individual compartment's cover-door which includes live conductors behind such as main or distribution busbar , feeding busbars and external terminal connection busbars.
- The labels must be paste on visible positions of the cover-door located on the center.
- There are two label options with different sizes :
 - Triangle label Size : 88x97mm
1 packs of with reference number : **1052.001**
5 packs of with reference number : **1052.002**
 - Triangle label Size : 178x196mm
1 packs of with reference number : **1052.003**
5 packs of with reference number : **1052.004**
- The labels do not deliver with the assembly parts that must be ordered saparely.

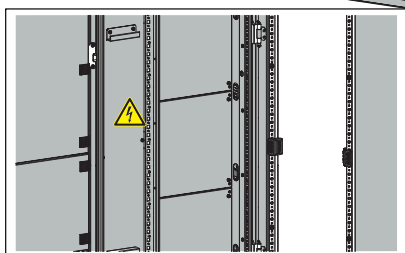
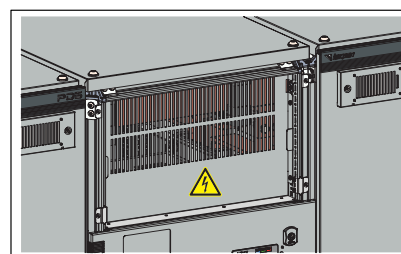
Main Busbar protector internal covers



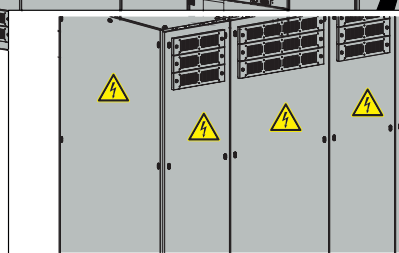
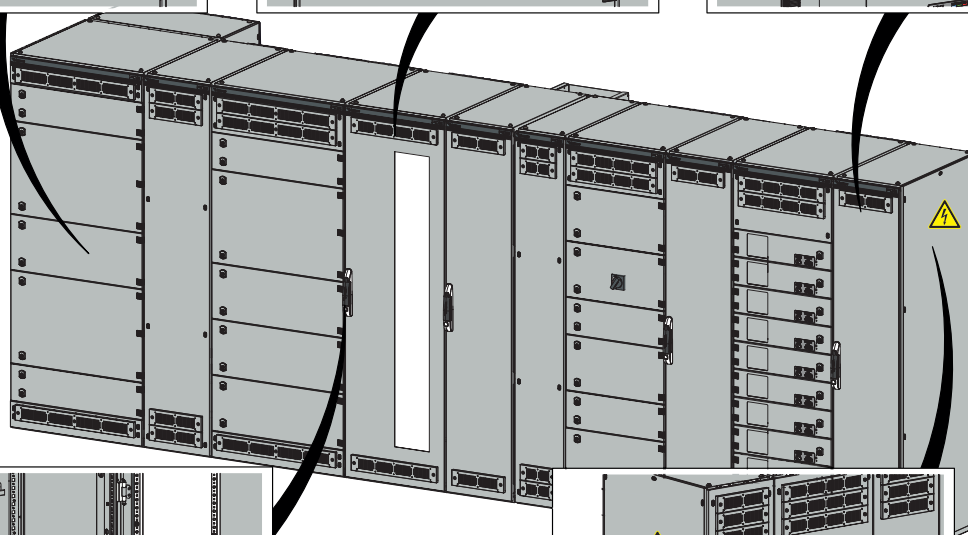
Distribution busbar protector internal cover of combined feeder module



Distribution busbar protector external cover of distribution module



Doors of Cabling Modules



Side panels
of all
Modules

Rear panels of all
Modules

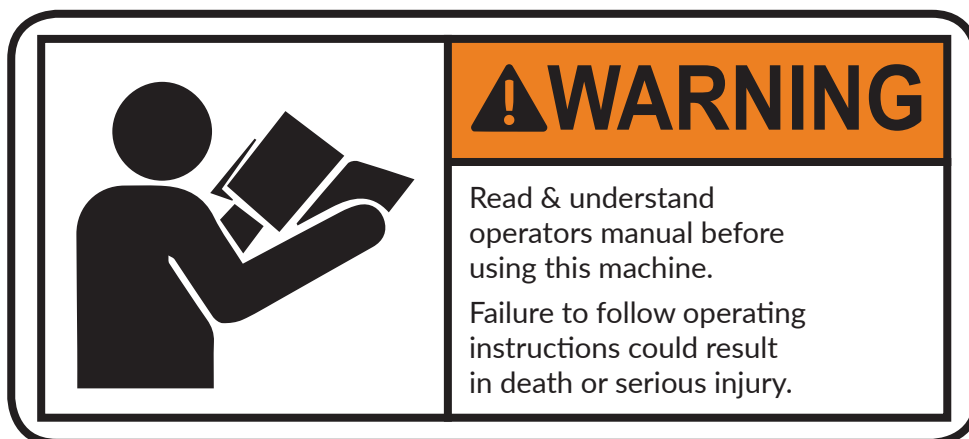
12.3 WARNING LABELS

ENCLOSURE WARNING LABEL



- The partner-assembly manufacturer shall paste one label on each door of cabling module.
- The labels must be paste on upside hinge position of the door.
- 1 packs of with reference number : **1052.005**
5 packs of with reference number : **1052.006**
- The labels do not deliver with the assembly parts that must be ordered saparetly.

USER MANUEL WARNING LABEL



- The partner-assembly manufacturer shall paste one label on each door of cabling module.
- The labels must be paste on center position of the door.
- 1 packs of with reference number : **1052.007**
5 packs of with reference number : **1052.008**
- The labels do not deliver with the assembly parts that must be ordered saparetly.

12.4 DRAWER USER INSTRUCTION LABEL

- The partner-assembly manufacturer shall paste one label on each door of drawable cabling module.
- The labels must be paste on center position of the door.
- 1 packs of with referance number : **1052.009**
5 packs of with referance number : **1052.010**
- The labels do not deliver with the assembly parts that must be ordered saparetly.



(a) Warning Label
Do Not Drill

REMOVING DRAWER

Switch Off the Breaker

To Disconnect the System Use On Hole

To Disconnect From Test Position Use Test Hole

Open Drawer Door's Lock

Open the Drawer's Door

Pull Up the Fixing Knob

Remove the Drawer

Close the Drawer's Door

Lock the Door

INSERTING DRAWER

Open the Drawer's Door

Insert&Push the Drawer

Pull Up the Fixing Knob

Close the Drawer's Door

Lock the Door

Be Aware the Breaker is Off

For Test Mode Use the Test Function

To Run the System Use the Power Function

The Panel is Ready to Operate

(b) MCC Drawers
Instruction Label

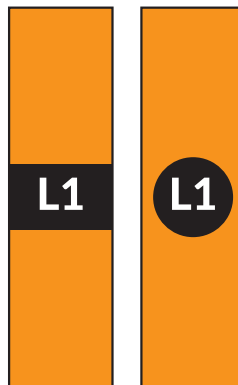
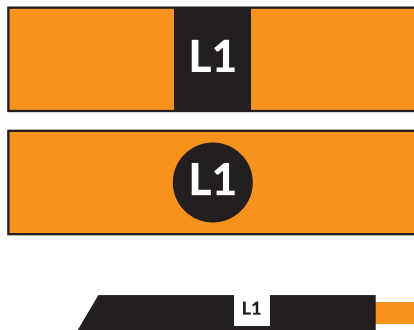
12.5 CONDUCTOR MARKING

- The partner-assembly manufacturer shall paste intersted marking on each conductor with a visiable position for all individual module-compartment. Conductors mean; main busbars , distribution busbars and external terminals.
- Marking types and colors are stated in the following pictures and explanations.
- Other definition markings like incomers' and feeders' conductors and compartments must be also defined with interseted names and/or numbers as the project specifications.
- Marking shall be strong and long life and shall be tested of 10.2.7 IEC 61439-1 and by inspection.

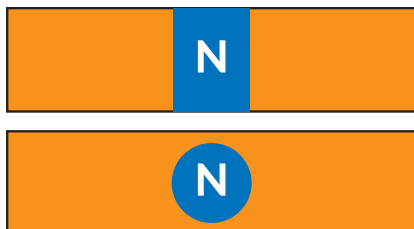
Test 10.2.7

Marking made by moulding, pressing, engraving or similar, including labels with a laminated plastic covering, shall not be submitted to the following test.

The test is made by rubbing the marking by hand for 15 s with a piece of cloth soaked in water and then for 15 s with a piece of cloth soaked with petroleum spirit. After the test, the marking shall be legible to normal or corrected vision without additional magnification.



- Phase Conductor (Line):
Line 1 (L1) : Black - Brown - R (Referance Phase)
Line 2 (L2) : Black - Black - S (Second Phase)
Line 3 (L3) : Black - Grey - T (Third Pahse)

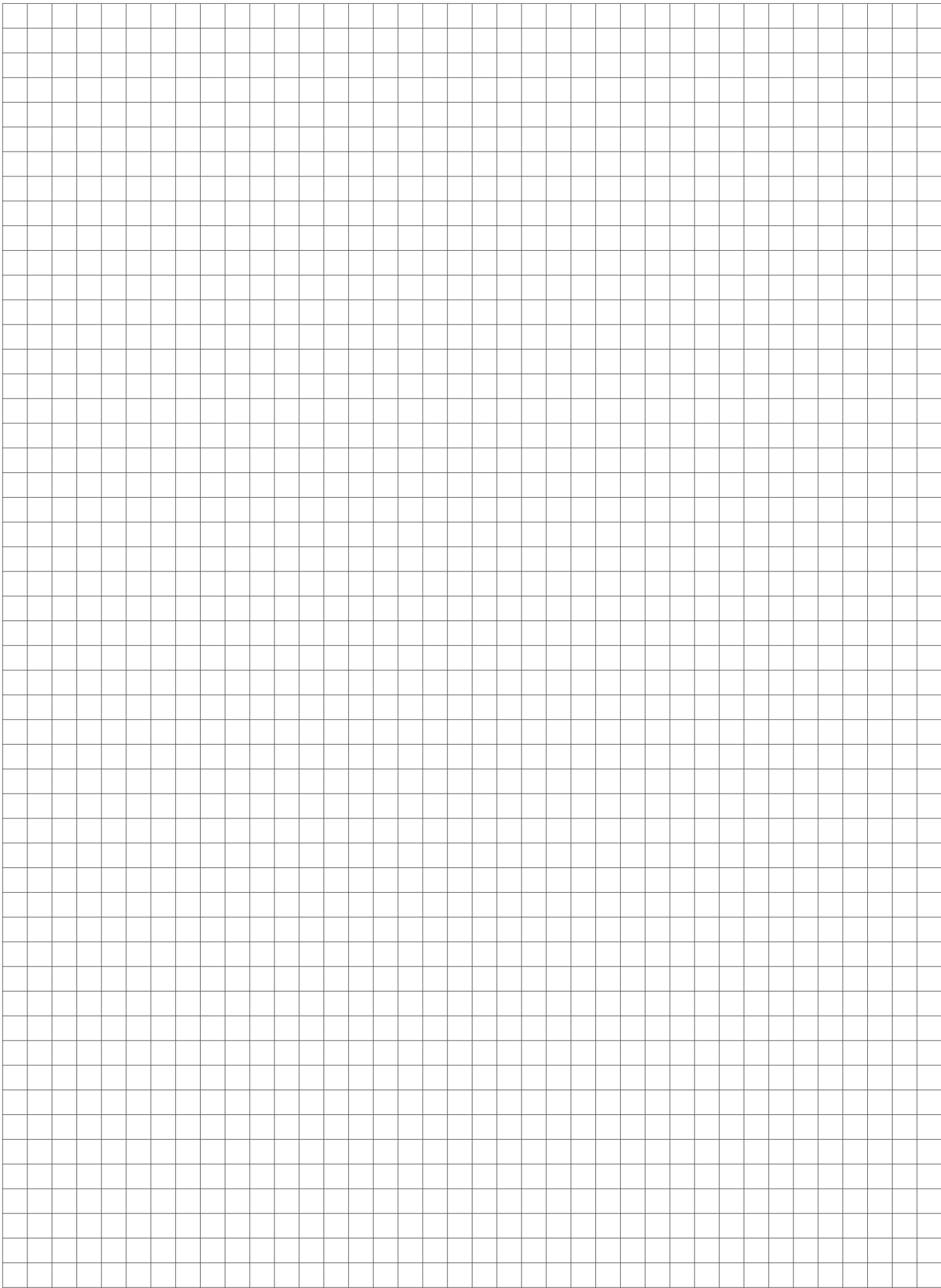


- Neutral Conductor (N) : Blue



- Protective Conductor(PE) : Green and Yellow





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STORAGE and PACKING



■ 13.1 RECEIVING CONTROLS AND STORAGE RECOMENDATIONS

RECEIVING THE PARTS

- On receipt of the equipments and before handling it, check that the cases and packing materials used for transportation have not been damaged and that all items on the packing list have been effectively delivered.
- Even if the packing appears to be in good condition, do not hesitate to unpack the equipment in the presence of an authorised transport agent.
- Check the contents and weights of the shipping units. Thoroughly check the equipment to make sure that no damage or shocks have occurred that could impair insulation or operation.
- If necessary, check that the information on the cases nameplate, located on the incoming cases, complies with the information indicated on the delivery slip.
- In case of damage or missing parts, inform the transport agent by registered mail.

STORAGE

- PDS parts before assembling must be stored with shrink packs and must be stored protective weight loads over. Shelf placed is recommended.
- Parts before assembling and modules after assembled must be stored in a dry and ventilated location, sheltered from rain, weather, dripping and running water, dust and chemical agents.
- Parts and modules, never store enclosures outdoors, even under an awning or tarp.
- Modules must be stored in upright position.
- The modules should if possible be left in their packing until they are installed. In this way they are protected against all risks that may be encountered on the site (impacts, splashes, etc.).
- Acceptable storage temperatures are -25 °C to +55 °C (or up to +70 °C for short periods not exceeding 24 hours).
- Given their heavy weight, cubicles should be stored on a stable, rigid and flat floor to avoid any risk of tipping during storage or handling.

■ 13.2 PACKING

STANDARD PACKING

- The modules must be protected by a plastic against water drops, humidity and dusting.
- Corners of the modules must be protected large carton angles or placed into a crate.
- The following accessories are attached inside the switchboard:
 - installation accessories (lifting/fixing cross-members and external fixing lugs)
 - preliminary installation accessories: plinth raisers
 - horizontal busbar joints (if required)
 - additional nuts and bolts and other mounting hardware
 - panels to be fitted after on-site connection: canopies, roof panels, gland plates
 - a set of drawings
 - device user manuals
- Large withdrawable or drawout circuit breakers installed at the top of the cubicle generally delivered separately.

SEA PACKING

The cubicles are protected by a heat-sealed plastic cover containing desiccant bags and are installed in a ventilated wooden or plywood crate.

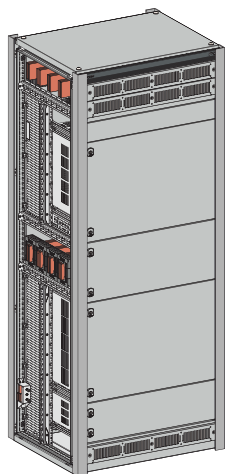
As a rule sea crates do not weight more than 5 tons.

PACKING DESCRIPTIONS

PDS switchboards are generally shipped as separate cubicles or in transport units comprising 2 or more cubicles side by side.

Each shipping unit is marked with:

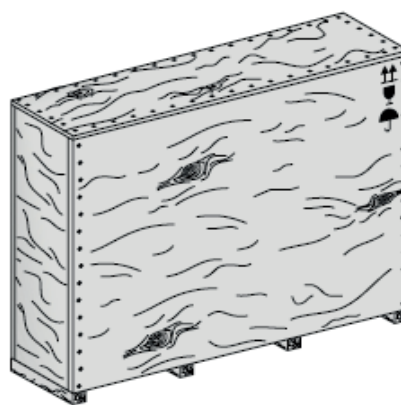
- project number
- weight
- packing unit information (packing unit number and total quantity)
- position of the centre of gravity
- storage and handling instructions.



Standard corner protection



Standard crate



Wooden or plywood crate for sea transportation



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