Secondary Distribution Switchgear

FBX

SF6 Gas-insulated switchboards

Instructions Guide for Civil Engineering Structures

Schneider Electric

Contents

1 Schneider Electric at your service

Operations and maintenance may only be carried out by personnel who have received suitable authorization for the operations and manœuvres they are responsible for performing.

If this is not the case, please refer to our Service Unit or Training Centre.

All locking-out operations must be performed according to the ”General Safety Instructions booklet for Electrical Applications” UTE C 18 510 (or its equivalent outside FRANCE).

1.1 Our Service Unit: our specialists, and suitably adapted services...

- Guarantee extension contracts in relation to the selling of new equipment,
- Supervision of HVA switchgear installations,
- Technical advice, diagnoses of the facilities, expertise,
- Maintenance contracts adapted to operational constraints,
- Systematic or conditional preventive maintenance,
- Corrective maintenance in case of partial or complete failure,
- Supply of spare parts,
- Overhauling of equipment and requalification of installations in order to benefit from new technologies and extend the life of your switchgear by limited investments.

Contact the Schneider Electric Service Unit for diagnoses and advice:
Working hours

33 (0)3 85 29 35 00
33 (0)3 85 29 36 30
or 33 (0)3 85 29 36 43

1.2 Schneider Electric Training: Together, let us develop our skills...

We can place at your disposal all of our trainers’ expertise, our teams’ pedagogical experience and the wealth of our equipment, to help you face the challenge of encouraging the personal development of each individual through the optimization of their skills.

From a few hours up to several weeks, Schneider Electric Training has the control over all of the teaching processes in order to meet the needs of each customer.

- Specific training, directly operational with practical work on real machines.
- Small groups to facilitate communication.
- Balance between theory and practice.
- Evaluation and management of the skills: Measurement and optimization of the trainees’ knowledge.

Faced with the direct and indirect training costs of the operational stoppages and shutdown, training is a real investment

Schneider Electric France
Training Centre

35 rue Joseph Monier - CS 30323 - F-92506 Rueil-Malmaison Cedex

www.schneider-electric.fr/formation

2 With regards to this User Manual

2.1 Use of this User Manual

This User Manual describes the works or arrangements necessary for the installation of a HVA switchboard of the FBX type.

2.2 Responsibilities

Our devices are quality controlled and tested at the factory in accordance with the standards and the regulations currently in force.

Apparatus efficiency and apparatus life depend on the compliance with the installation, commissioning and operation instructions described in this user manual.

Non respect of these instructions is likely to invalidate any guarantee.

The texts in this User Manual refer to international regulations.

Local requirements especially about safety and which are in accordance with the indications given in this document, must be observed.

2.3 Definition of the substations

Amongst substations that are prefabricated or built outdoors, walk-in substations can reach, or even exceed 2.5 m in height. They allow operating personnel to penetrate into the substation and work in them sheltered from bad weather.

The indoor substations with “prefabricated metal-clad bays” are installed in areas that the User reserves in one of the buildings in the factory, or in a building specially built for this purpose for the case of transformer substations for HVA distribution networks.

The recommended minimum volume for the room is: **12 m^3**

2.4 Access to the substation

Substation access must remain free at all times and under any circumstances. It is therefore generally installed on the side of the road.

Passages must be designed to permit easy maintenance for all of the substation’s elements (circuit breaker, transformer, etc.).

2.5 Other technical notices to be consulted

- AMTNoT131-02 FBX Installation - Commissioning
- AMTNoT132-02 FBX Operation - Maintenance
- AMTNoT170-02 FBX Function CB Installation - Commissioning - Operation - Maintenance
- AMTNoT174-02 FBX Assembly a 1250A busbar

3 Dimensions of the FBX switchboards

3.1 Description of the functions

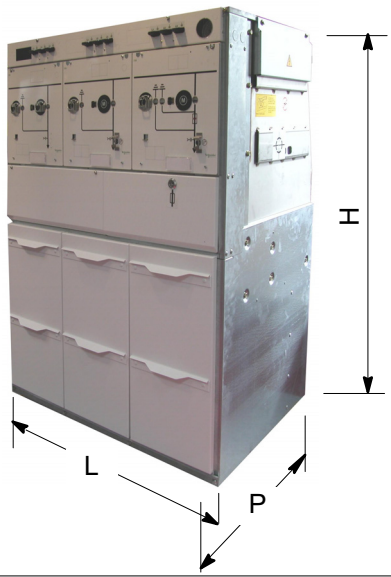
C = Load break switch
T1 = Combined or associated fused interrupter switch
T2 = Transformer protection circuit breaker
CB = Cables protection circuit breaker
CBb = Busbar protection circuit breaker
R = Direct linkage
RE = Direct incoming feeder with earthing switch

M1 = Measurement with cable connections
M2 = Measurement with RHS extension
M3 = Measurement for LHS extension
M4 = Measurement for extension (right or left)
Sb = Busbar isolator

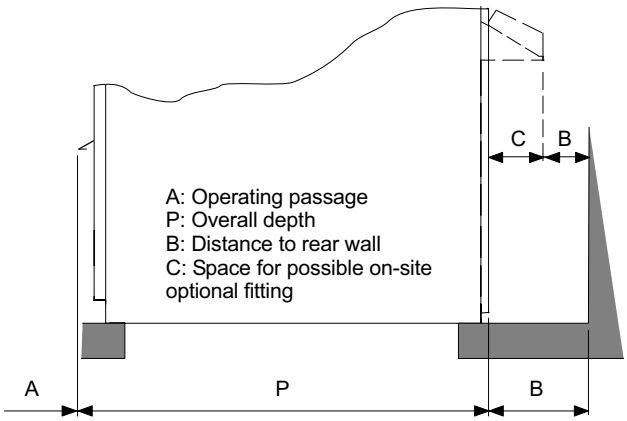
3.2 Overall dimensions

These are used to position the switchboard within the room.

The dimensions for the total switchboard volume (excluding optional extras) are:
- Width
- Depth
- Height.



Example for the depth of a switchboard



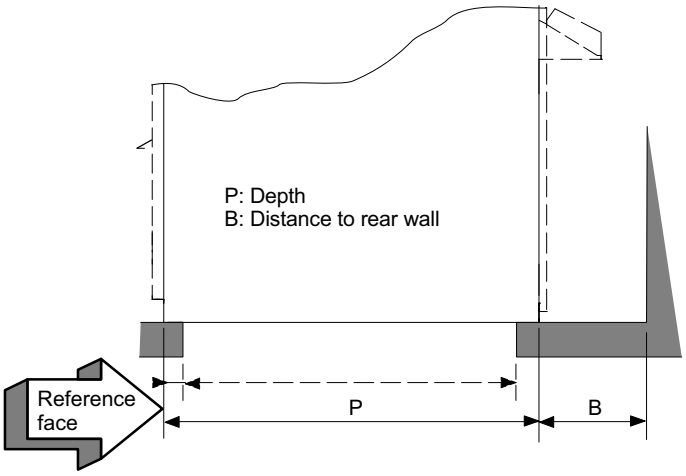
3.3 Ground plan dimensions

These are used for the civil engineering work relating to the switchboard.

In this case, the dimensions of the surfaces touching the ground are given.

The reference face is the front panel as it touches the ground. The sizes are taken from this reference.

Example for the depth of a switchboard



3.4 Dimensions and weights of the FBX-C switchboards (non-extendable model)

Switchboard	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height[1)]	Depth[2)]	Width	Depth	Width	
C-C	2	1380/1040	752	680	691	680	200
RE-T1	2	1380/1040	752	680	691	680	210
RE-T2	2	1380	752	680	691	680	240
C-T1	2	1380/1040	752	680	691	680	200
C-T2	2	1380	752	680	691	680	230
C-C-T1	3	1380/1040	752	1000	691	1000	330
C-C-T2	3	1380	752	1000	691	1000	360
C-C-C	3	1380/1040	752	1000	691	1000	320
C-RE-T1	3	1380/1040	752	1000	691	1000	320
C-RE-T2	3	1380	752	1000	691	1000	360
R-RE-T1	3	1380/1040	752	1000	691	1000	320
R-RE-T2	3	1380	752	1000	691	1000	350
C-C-C-T1	4	1380/1040	752	1320	691	1320	450
C-C-C-T2	4	1380	752	1320	691	1320	480
C-T1-C-T1	4	1380/1040	752	1320	691	1320	470
C-T2-C-T2	4	1380	752	1320	691	1320	500
C-C-C-C	4	1380/1040	752	1320	691	1320	440
C-C-C-C-C	5	1380	752	1675	691	1675	540
C-C-C-C-T1	5	1380	752	1675	691	1675	550
C-C-T1-C-T1	5	1380	752	1675	691	1675	580
C-T1-C-T1-T1	5	1380	752	1805	691	1805	570

1) Add 200 or 600 mm depending on the height of the box
2) Without a cooler at the rear. In the case of a cooler, add 38.5 mm

3.5 Dimensions and weights of the FBX-M switchboards

Module	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height	Depth[1)]	Width[2)]	Depth	Width	
M1	1	1380	720	1000	691	1000	490
M2	1	1380	720	1005	691	1000	490
M3	1	1380	720	1005	691	1000	490
M4	1	1380	720	1010	691	1000	490

1) Without a cooler at the rear. In the case of a cooler, add 38.5 mm
2) Plus 17.5 mm for the busbar cover (on the right or left-hand side) at the far end of the switchboard

3.6 Dimensions and weights of the FBX-E switchboards (extendable model)

Extendable switchboards

Module	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height[1)]	Depth[2)]	Width[3)]	Depth	Width	
C-C	2	1380	752	690	691	690	210
C-T1	2	1380	752	690	691	690	210
C-T2	2	1380	752	690	691	690	240
RE-T1	2	1380	752	690	691	690	220
RE-T2	2	1380	752	690	691	690	250
C-C-T1	3	1380	752	1010	691	1010	340
C-C-T2	3	1380	752	1010	691	1010	370
C-C-C	3	1380	752	1010	691	1010	330
C-RE-T1	3	1380	752	1010	691	1010	330
C-RE-T2	3	1380	752	1010	691	1010	360
R-RE-T1	3	1380	752	1010	691	1010	330
R-RE-T2	3	1380	752	1010	691	1010	360
C-C-C-T1	4	1380	752	1330	691	1330	460
C-C-C-T2	4	1380	752	1330	691	1330	490
C-T1-C-T1	4	1380	752	1330	691	1330	480
C-T2-C-T2	4	1380	752	1330	691	1330	510
C-C-C-C	4	1380	752	1330	691	1330	450

1) - Add 200 or 600 mm depending on the height of the box
2) - Without a cooler at the rear. In the case of a cooler, add 38.5 mm
3) - Plus 17.5 mm for the busbar cover (on the right or left-hand side) at the far end of the switchboard
   - To calculate the total width of several connected FBX-E switchboards, add 9 mm between each extension

Functional Unit - Extension

Module	Number of modules	Overall Depth (mm)			Floor dimensions (mm)		Weights approximate (kg)
		Height[1)]	Depth[2)]	Width[3)]	Depth	Width	
C	1	1380	752	370	691	360	135
R	1	1380	752	370	691	360	125
RE	1	1380	752	370	691	360	135
T1	1	1380	752	500	691	490	160
T2	1	1380	752	500	691	490	190
CB	1	1380	873	500	691	490	220
CBb	1	1380	873	635	691	625	250
Sb	1	1380	752	690	691	680	200
T1-T1	2	1380	752	1010	691	1000	310
T2-T2	2	1380	752	1010	691	1000	370

1) - Add 200 or 600 mm depending on the height of the box
   - With a 1250 A busbar on the top, add 217 mm
2) - Without a cooler at the rear. In the case of a cooler, add 38.5 mm
3) - Plus 17.5 mm for the busbar cover (on the right or left-hand side) at the far end of the switchboard
   - To calculate the total width of several connected FBX-E switchboards, add 9 mm between each extension

4 General rules for the installation of FBX switchboards

4.1 Reminder concerning normal installation and service conditions (in accordance with IEC62271-1)

* Permissible ambient temperature

The ambient air temperature should be comprised between - 5°C (on option -15 or -25°C) and + 40°C.

The mean measured value for a 24 hour period must not exceed 35°C.

* Installation altitude

HV equipment is defined in accordance with European Standards and can be used up to an altitude of 1,000 m.

Beyond this, account must be taken of the decrease in dielectric withstand.

For these specific cases, contact the Schneider Electric Sales Department.

* Atmospheric pollution

The ambient air must not contain any dust particles, fumes or smoke, corrosive or flammable gases, vapours or salts.

* Permissible atmospheric humidity level

The average atmospheric relative humidity level measured over a 24-hour period must not exceed 95%.

The average water vapour pressure over a period of 24 hours must not exceed 22 mbar.

The average atmospheric relative humidity value measured over a period of one month must not exceed 90 %.

The average water vapour pressure over a period of one month must not exceed 18 mbar.

Condensation may appear in case of any sharp variation in temperature, due to excessive ventilation, a high atmospheric humidity level or the presence of hot air. This condensation can be avoided by an appropriate lay-out of the room or of the building (suitably adapted ventilation, air driers, heating etc.).

Whenever the humidity level is higher than 90 %, we recommend that you take appropriate corrective measures. For any assistance or advice, contact the Schneider Electric After-Sales department (See § 1.1).

Please consult Schneider Electric for any installation conditions which differ from the standard.

4.2 Substation installation requirements

The substation must be sheltered from flooding and any infiltrations of water. No ducts of any kind must pass through the substation's immediate environment without special protection (sheaths or ducts). Water, snow, or animal salts must not be able to penetrate.

Also prevent any penetration by small animals such as rodents, snakes, lizards, etc. especially in tropical areas.

The room must be equipped with standardised high level and low level ventilation.

Cable troughs and ducts must be blocked up to avoid:
- any draughts of air below the Functional Units,
- any rise in humidity or pollution coming from below ground.

4.3 Installation of the switchboard

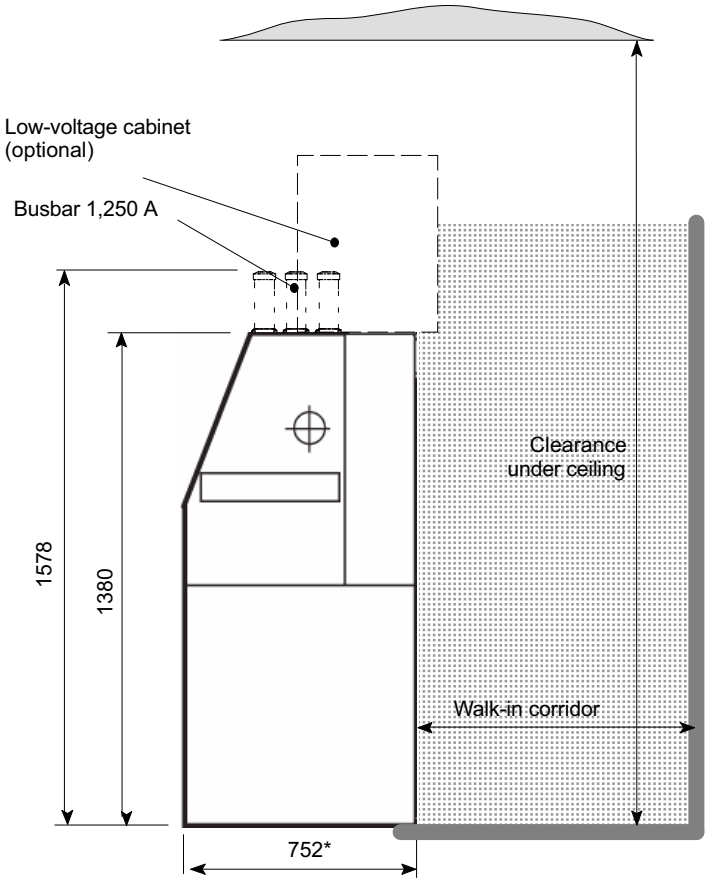
The positioning of the switchboard is paramount for:
- minimum spaces at the front (walk-in corridor for manoeuvering), at the rear and on each side of the switchboard. Certain passages must be sufficient for free movement and execution of operation and maintenance manoeuvres,
- leave the room's access door free,
- Take all measures to prevent all incidence of climatic conditions (humidity, pollution, etc.).

Respect the imposed distances (see following chapter).

Do not place the switchboard below any ventilation grilles, air vents, or air conditioning grilles or in the immediate proximity of glass tile panels in direct contact with the outside.

The switchboard must not be exposed to any solar radiation. A direct exposure can lead to excessive overheating of the low voltage racks.

4.4 Examples of the positioning of an FBX switchboard in a room



Side views

1) Free passages for installation:

Minimum width: 950 mm

Mimimum height: 1,800 mm

2) Walk-in corridor:

FBX-C: ≥ 800 mm for operations

FBX-E: ≥ 950 mm to facilitate the installation of extensible switchboards

3) Clearance under ceiling:

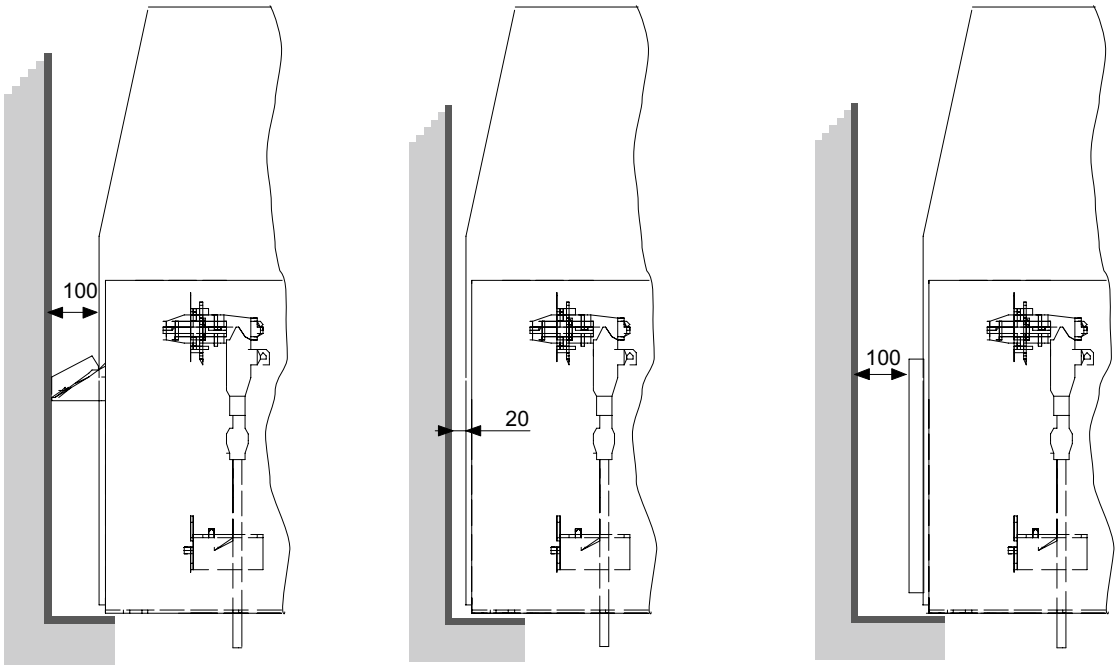
Without LV cabinet: ≥ 2,000 mm

With LV cabinet (200 mm): ≥ 2,000 mm

With LV cabinet (600 mm): ≥ 2,100 mm

With 1,250A busbar: ≥ 2,100 mm

* + 38,5 mm with cooler



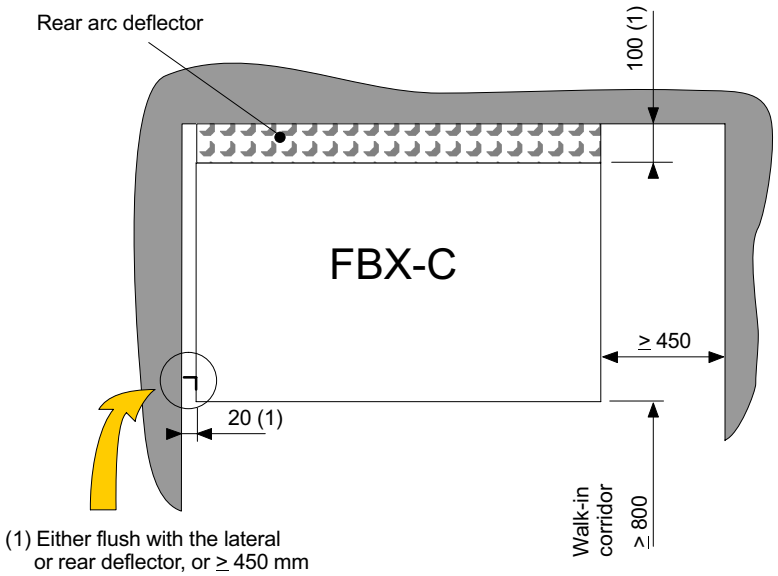
With rear deflector | Without rear deflector | With rear cooler

5 Installation of an FBX-C switchboard

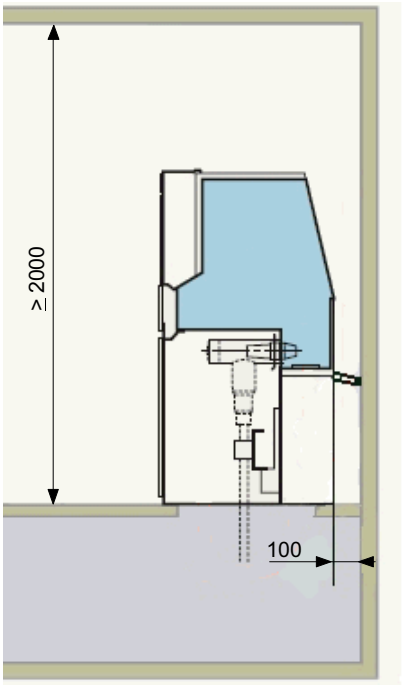
5.1 Switchboard up to 20 kA (AF - 1 s) - Rearward evacuation - Standard Installation

Top view (dimensions in mm)

N.B.: recommended configuration in compliance with type tests for the EDF HN64-S-52 specification.

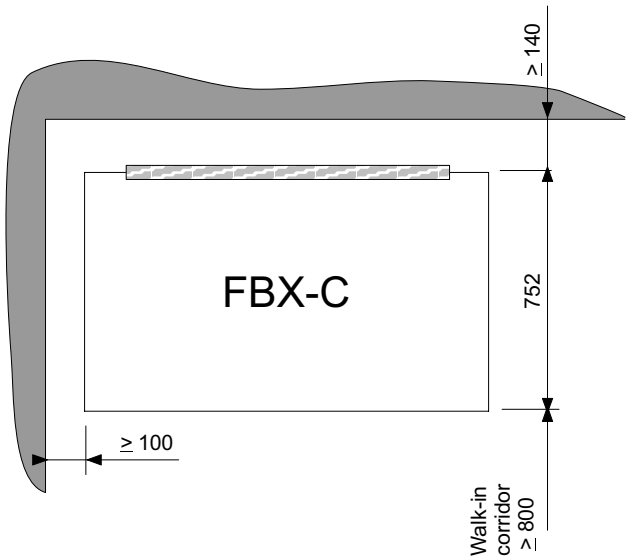


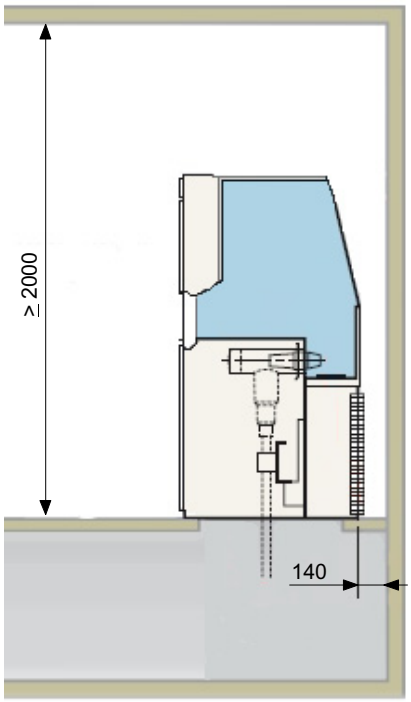
(1) Either flush with the lateral or rear deflector, or ≥ 450 mm



5.2 Switchboard up to 20 kA (AF - 1 s), with gas exhaust cooler towards the rear

Top view
(dimensions in mm)

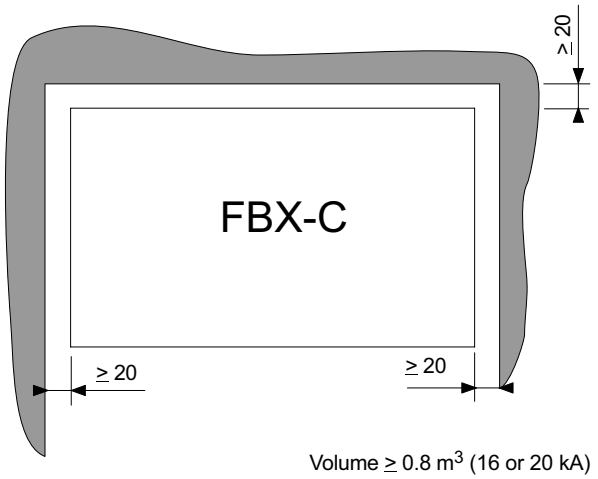


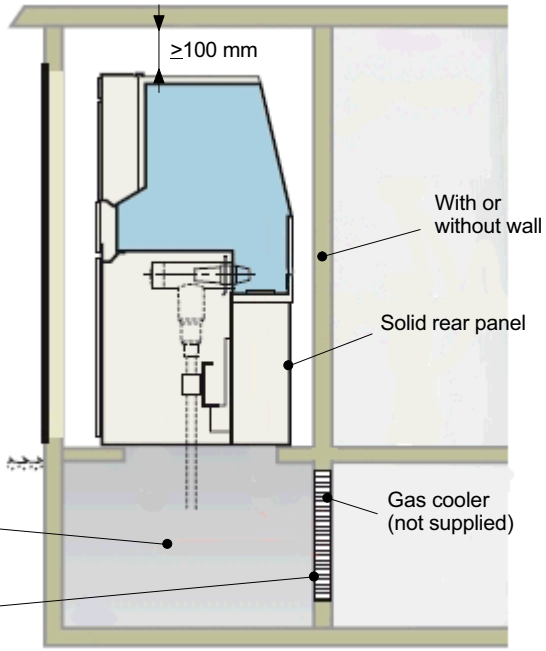


5.3 16, 20 and 25 kA Switchboards (AF/AFL - 1 s), with solid rear panel and gas exhaust towards the bottom

Top view
(dimensions in mm)

NB: This configuration is available for a FBX of height 1040 or 1380 mm.



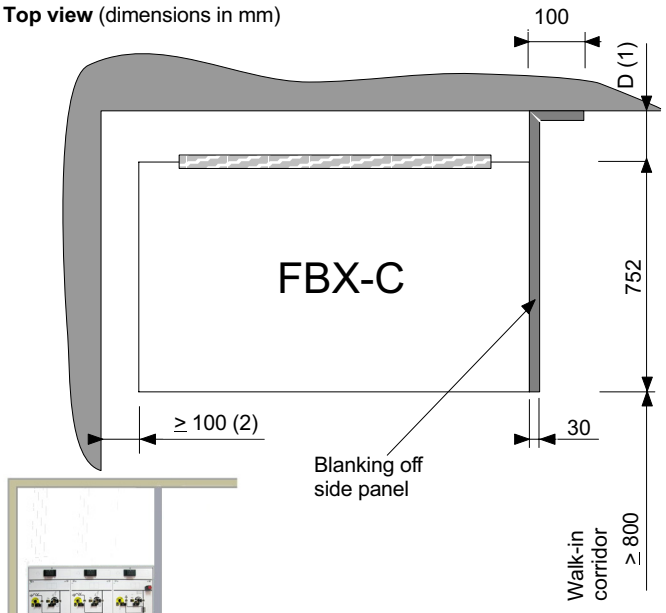


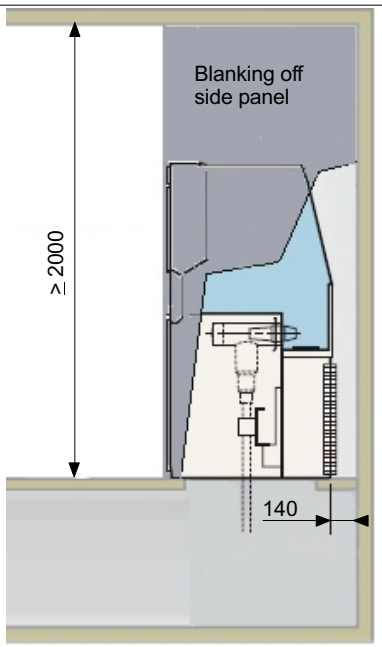
Volume ≥ 0.8 m^3 (16 or 20 kA)

Cross-section of duct > 0.3 m^2 (16 or 20 kA)
(with 5 layers of expanded metal, e.g. 6 x 3.4 x 0.5)

5.4 16 and 20 kA Switchboards (AFL - 1 s), with gas exhaust towards the rear

Top view (dimensions in mm)

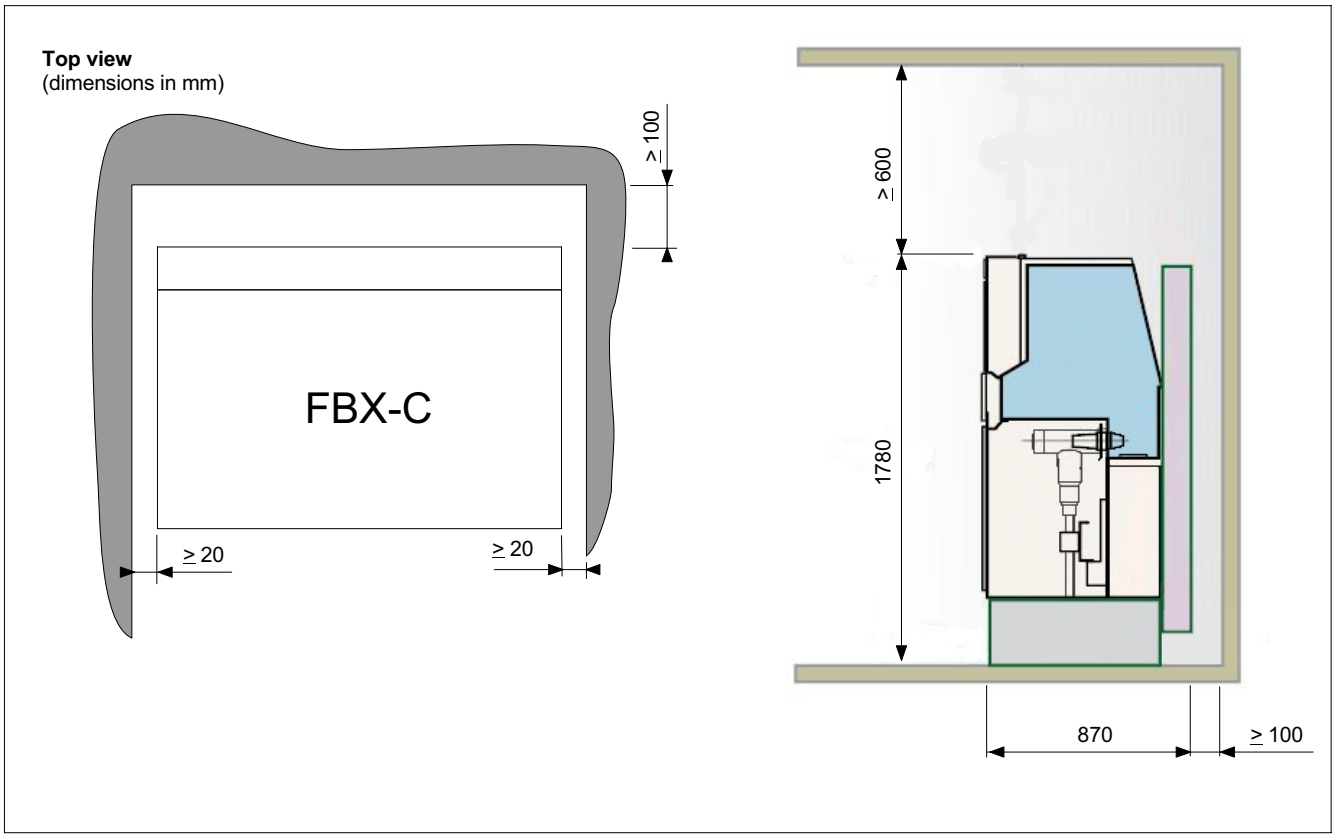




(1) D = 140
If D > 140, provide for additional blocking off (not supplied).

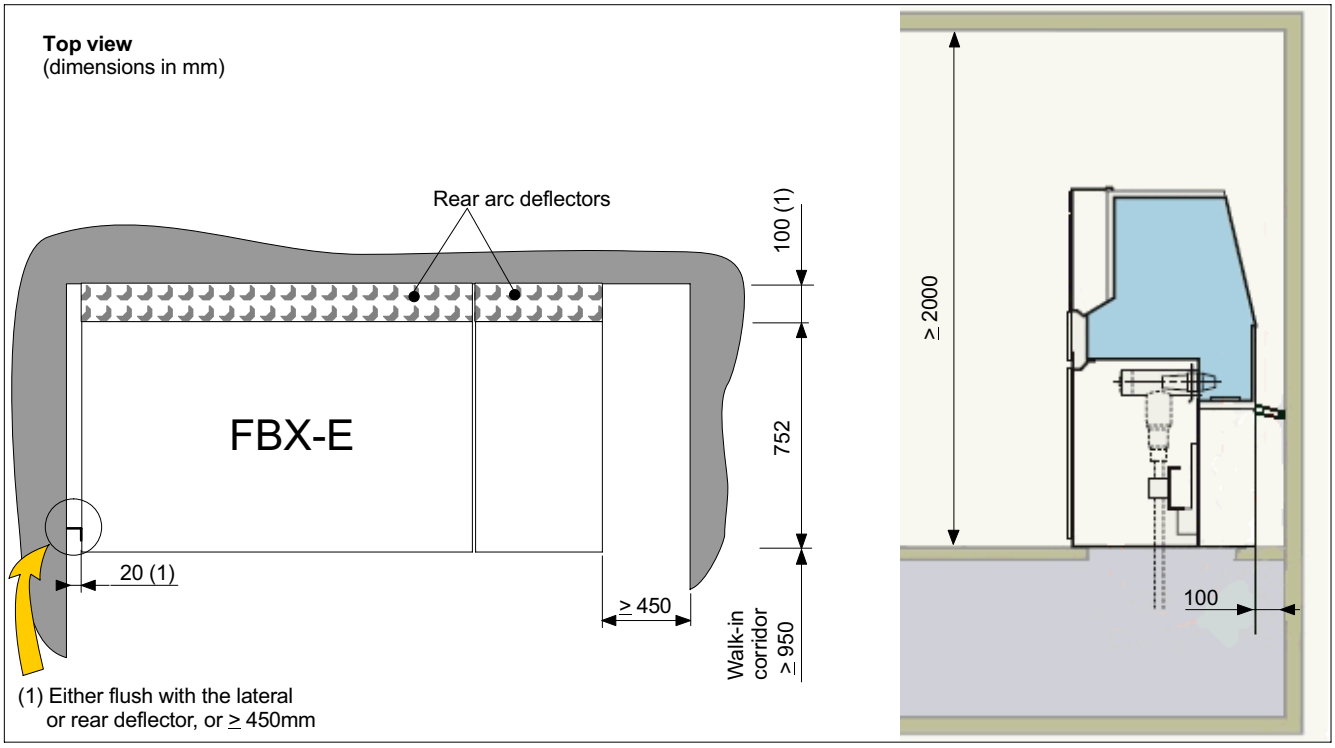
(2) If there is no left-hand wall, mount another side panel.

5.5 16 and 20 kA switchboards (AFL - 1S) with rear-mounted chimney

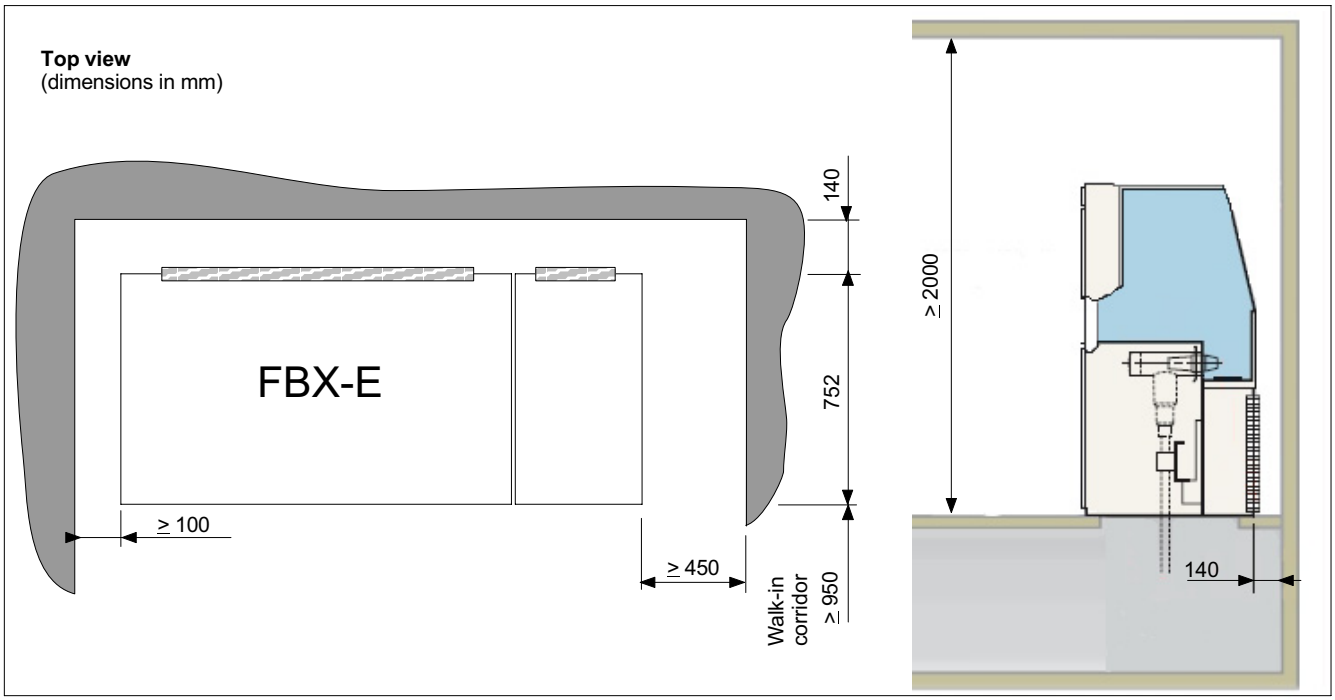


6 Installation of an FBX-E switchboard

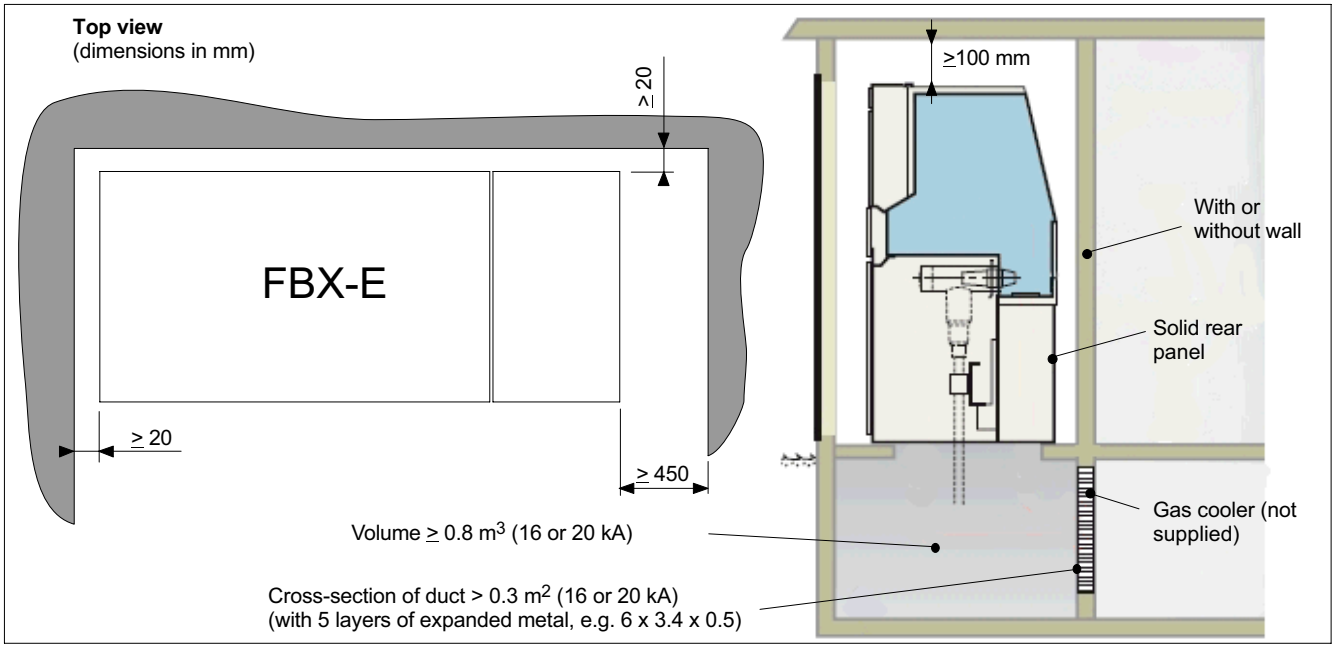
6.1 Switchboard up to 20 kA (AF – 1 s) [except if M or CBb function] - Rearward evacuation - Standard Installation



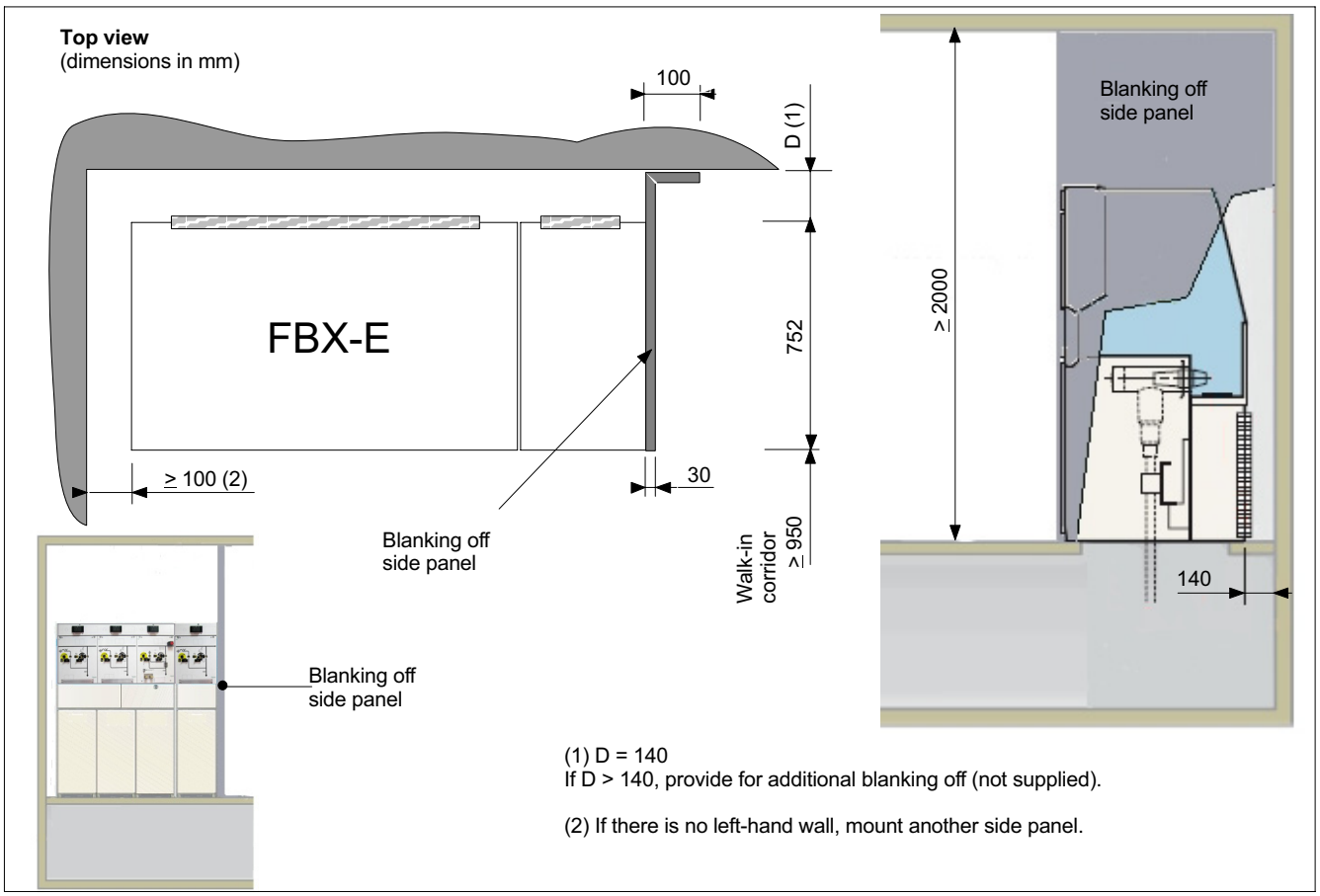
6.2 Switchboard up to 20 kA (AF - 1 s), with gas exhaust cooler towards the rear



6.3 16, 20 and 25 kA Switchboards (AF/AFL - 1 s), with solid rear panel and gas exhaust towards the bottom



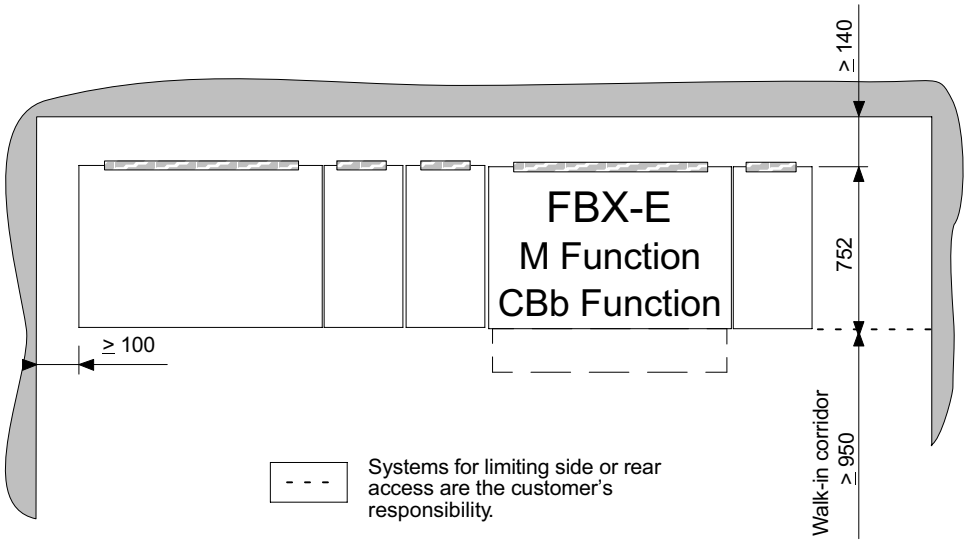
6.4 16 and 20 kA Switchboards (AFL - 1 s), with gas exhaust towards the rear



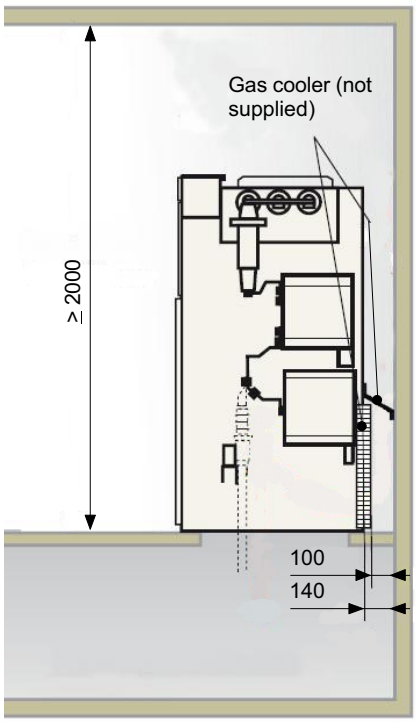
7 Installation of an FBX-E switchboard with M or CBb Function

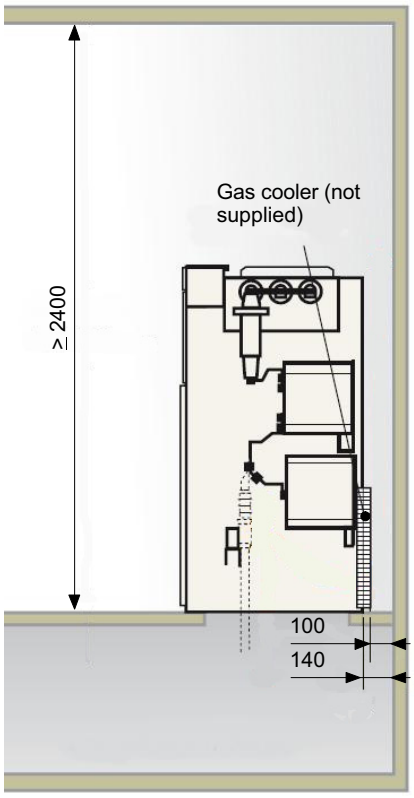
7.1 16 kA and 20 kA Switchboards (AF - 1 s), with gas exhaust towards the rear

Top view
(dimensions in mm)



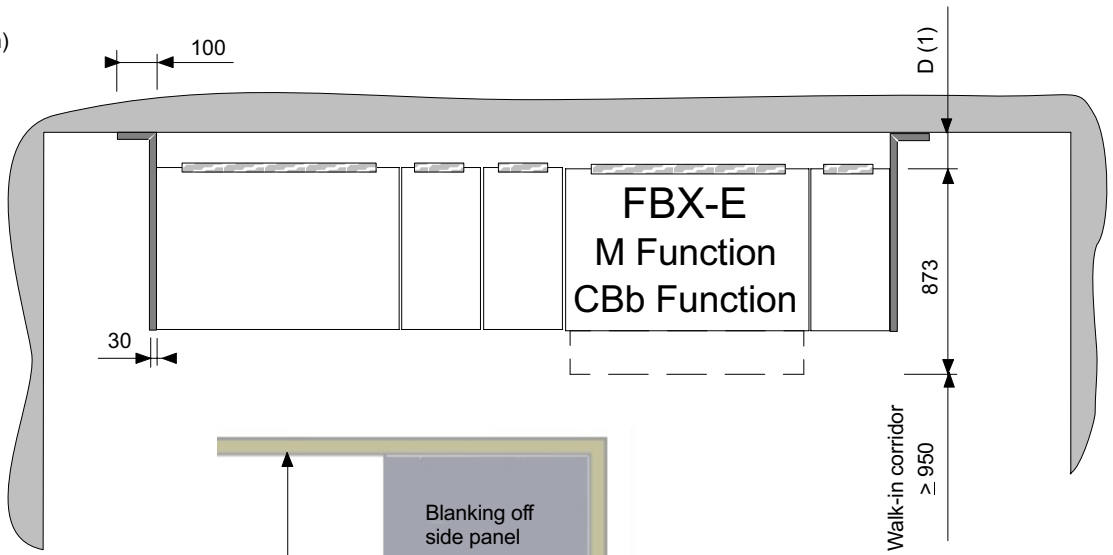
Side view
(dimensions in mm)



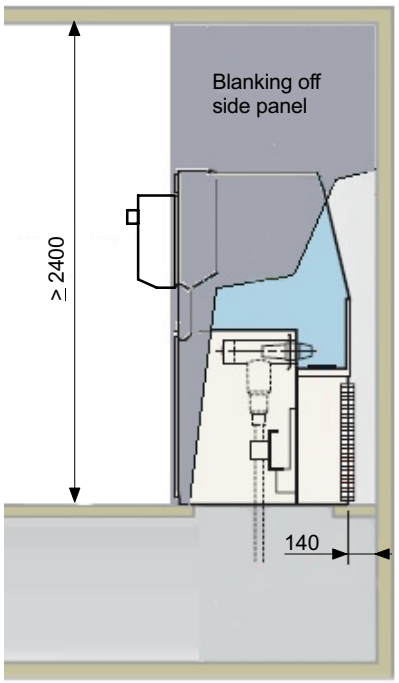


7.2 16 and 20 kA Switchboards (AFL - 1 s), with gas exhaust towards the rear

Top view
(dimensions in mm)



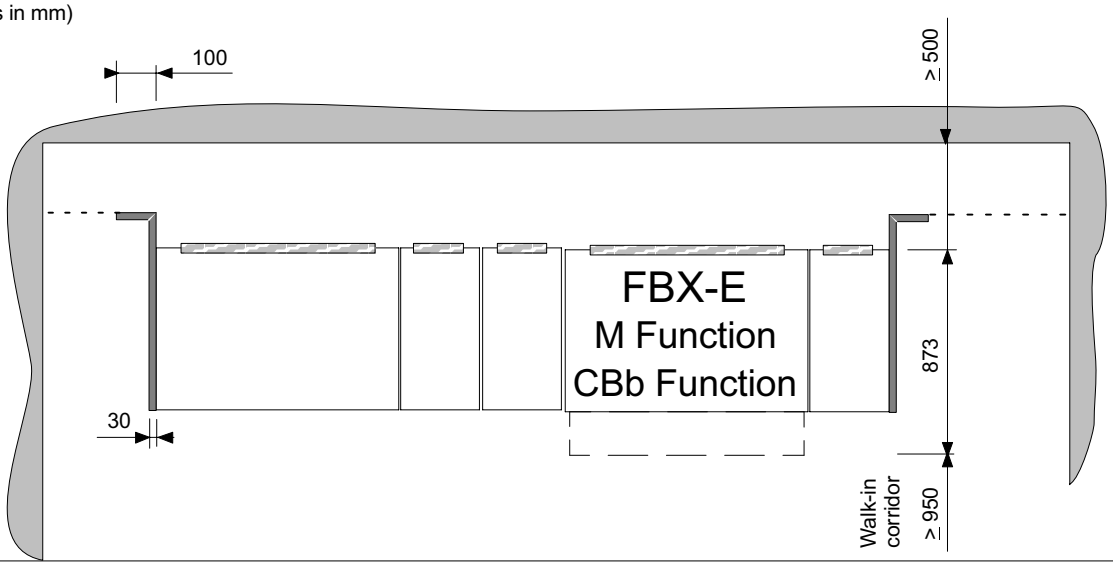
Side view
(dimensions in mm)



(1) D = 140
If D > 140, provide for additional blanking off (not supplied).

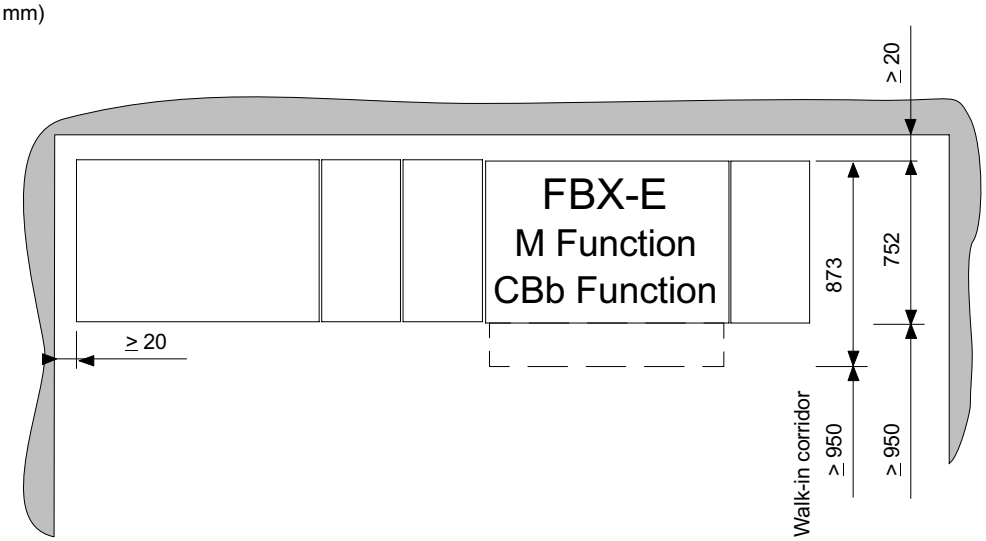
- - - Systems for limiting side or rear access are the customer's responsibility.

Top view
(dimensions in mm)

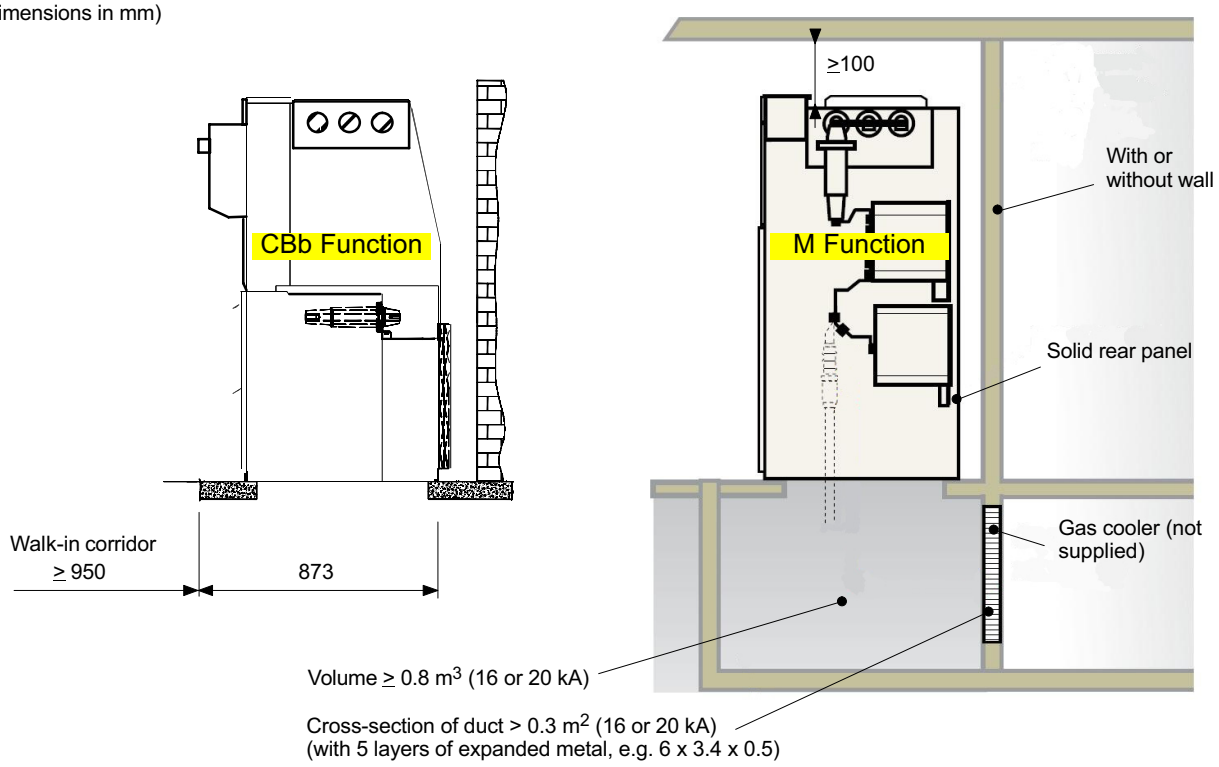


7.3 16 kA and 20 kA Switchboards (AF/AFL - 1 s), with gas exhaust towards the bottom

Top view
(dimensions in mm)



Side view
(dimensions in mm)



8 Installation of an FBX switchboard C or E

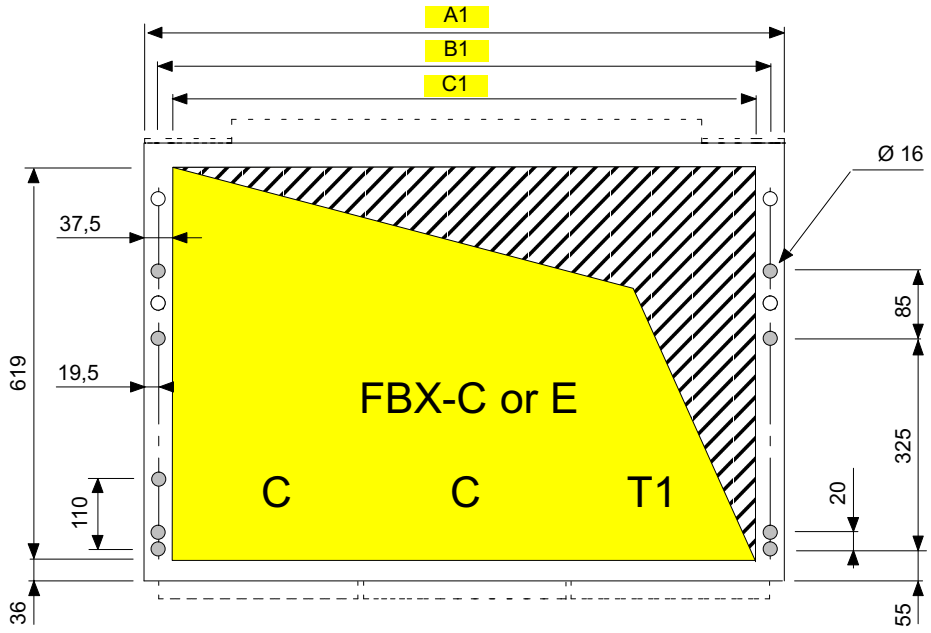
8.1 Dimensions for switchboards

FBX Widths (mm)	A1	B1	C1
C-C	680	641	605
RE-T1	680	641	605
RE-T2	680	641	605
C-C-T1	1000	961	925
C-C-T2	1000	961	925
C-C-C	1000	961	925
C-RE-T1	1000	961	925
C-RE-T2	1000	961	925
R-RE-T1	1000	961	925
R-RE-T2	1000	961	925
C-C-C-T1	1320	1281	1245
C-C-C-T2	1320	1281	1245
C-T1-C-T1	1320	1281	1245
C-T2-C-T2	1320	1281	1245
C-C-C-C	1320	1281	1245
C-C-C-C-C	1675	1636	1600
C-C-C-C-T1	1675	1636	1600
C-C-T1-C-T1	1675	1636	1600
C-T1-C-T1-T1	1805	1766	1730
C-T1-T1-T1-T1	2080	2041	2005

8.2 Geometry of the switchboard and civil engineering structure

Top view
(dimensions in mm)

The profiles, seen from the top, represent the surface of the switchboard borne on the floor.
All the fixing points (standard or optional) are located.



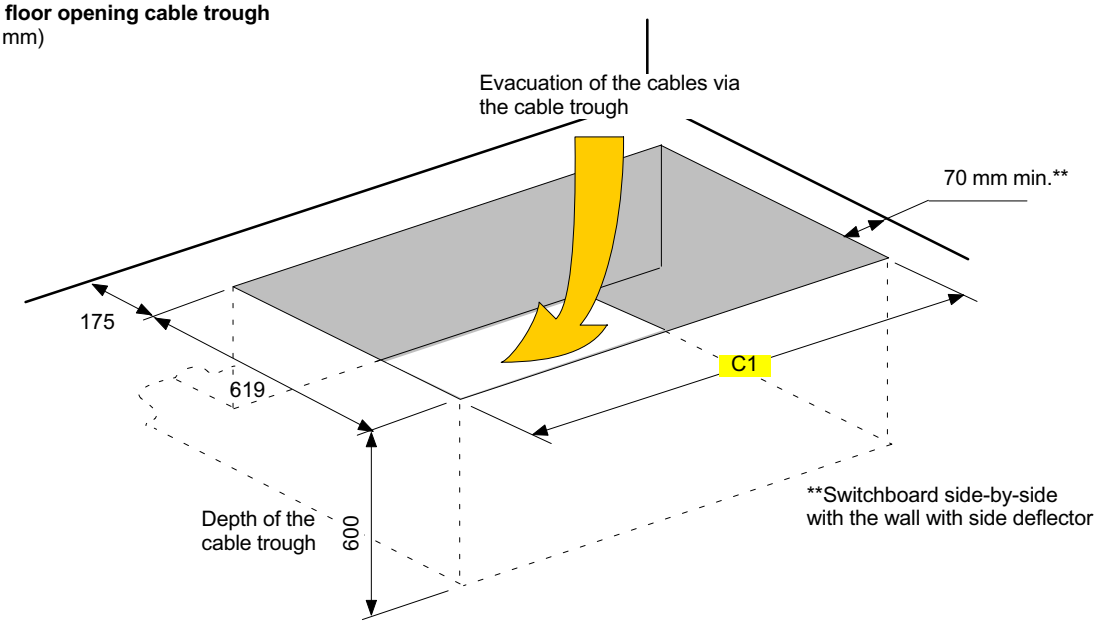
8.3 Installation on the floor (refer to table § 8.1)

The location of the cable trough is defined as a function of the type of FBX to be installed and the position of this switchboard in the room.

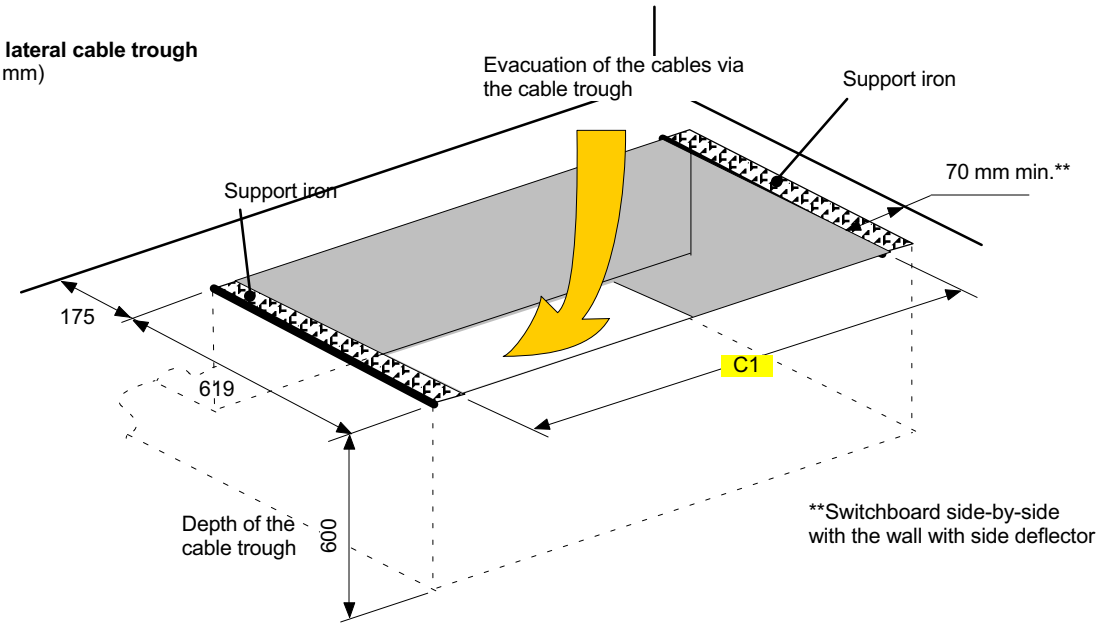
In case of a lateral cable trough, fit longitudinal irons to support the right and left-hand uprights of the switchboard.

The support irons to be used are of the 100 mm min. IPN type.

Example for a floor opening cable trough
(dimensions in mm)



Example for a lateral cable trough
(dimensions in mm)



8.4 Layout and fixing of the FBX-C or E to the floor

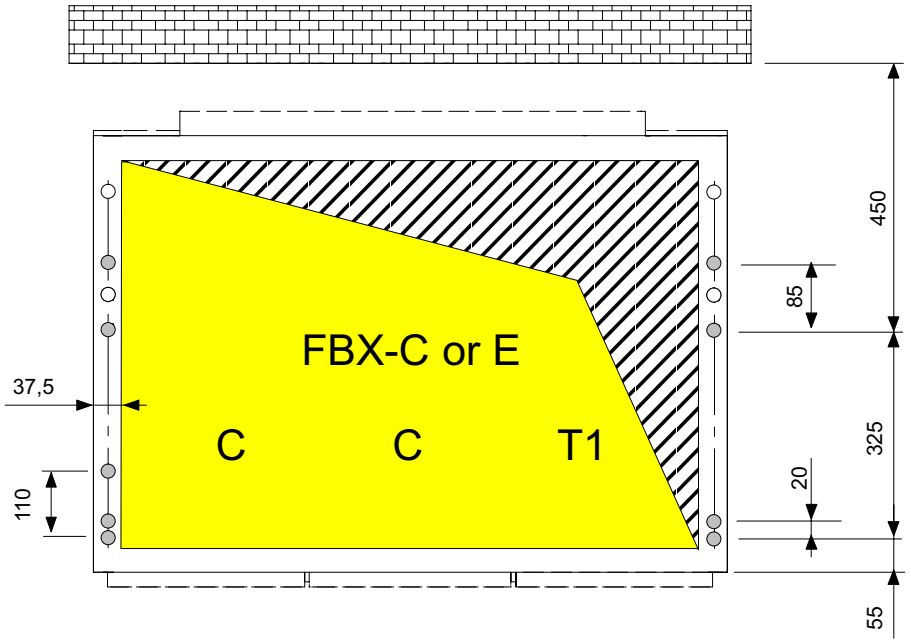
Before any installation of the FBX switchboard in the room in accordance with mounting instructions, check:
- the passages for HV cables, LV cables, and possibly the cable ducts,
- the load limit for the fixing points. It must be compatible with the weight of the switchboard (for indication of the weights, see § 3.4).

Check the evenness of the floor at the fixing points level. Any irregularities on the floor must not exceed 1 mm. If they are greater than that, install sheet metal shims just beside the fixing points.

8.5 Positioning of fixing points

Top view
(dimensions in mm)

Positioning of fixing points in relation to the rear wall



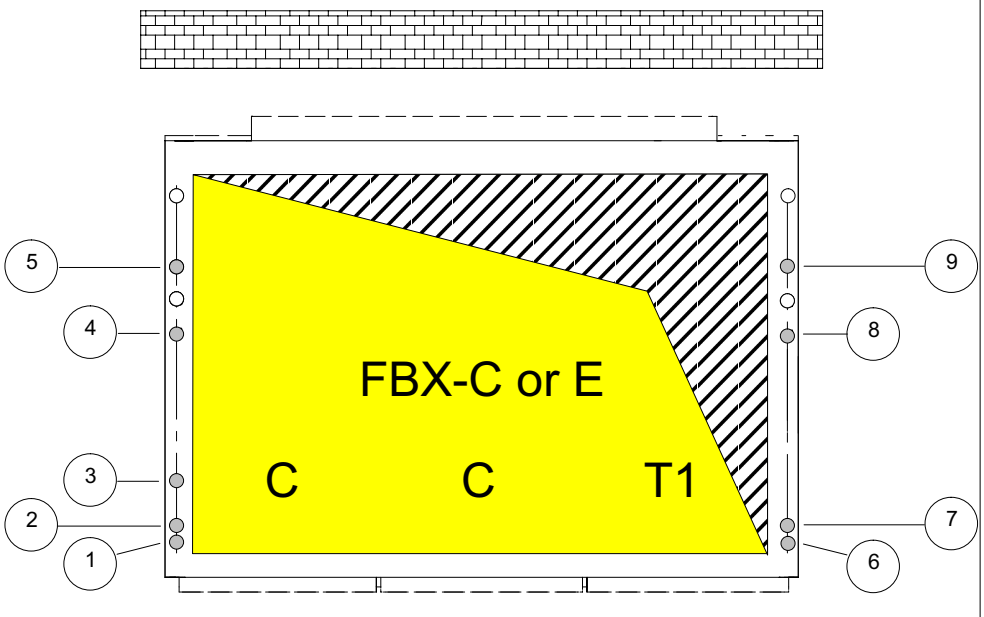
8.6 Fixing to the floor

Top view

1. Fixing to the floor by 4 points:

Fixing	Fixing point
Standard	1 or 3 ; 4 ; 6 ; 8
Option	2 ; 5 ; 7 ; 9
FBX-M	1 ; 4 ; 6 ; 8

2. Fasteners *(not supplied)*
4 H M10x30 bolts (class 8.8)
+ 4 flat washers Ø 30 mm on the exterior, 3 mm thick.



9 Installation of an extension function

9.1 Dimensions for extensions

Refer also to table § 8.1.

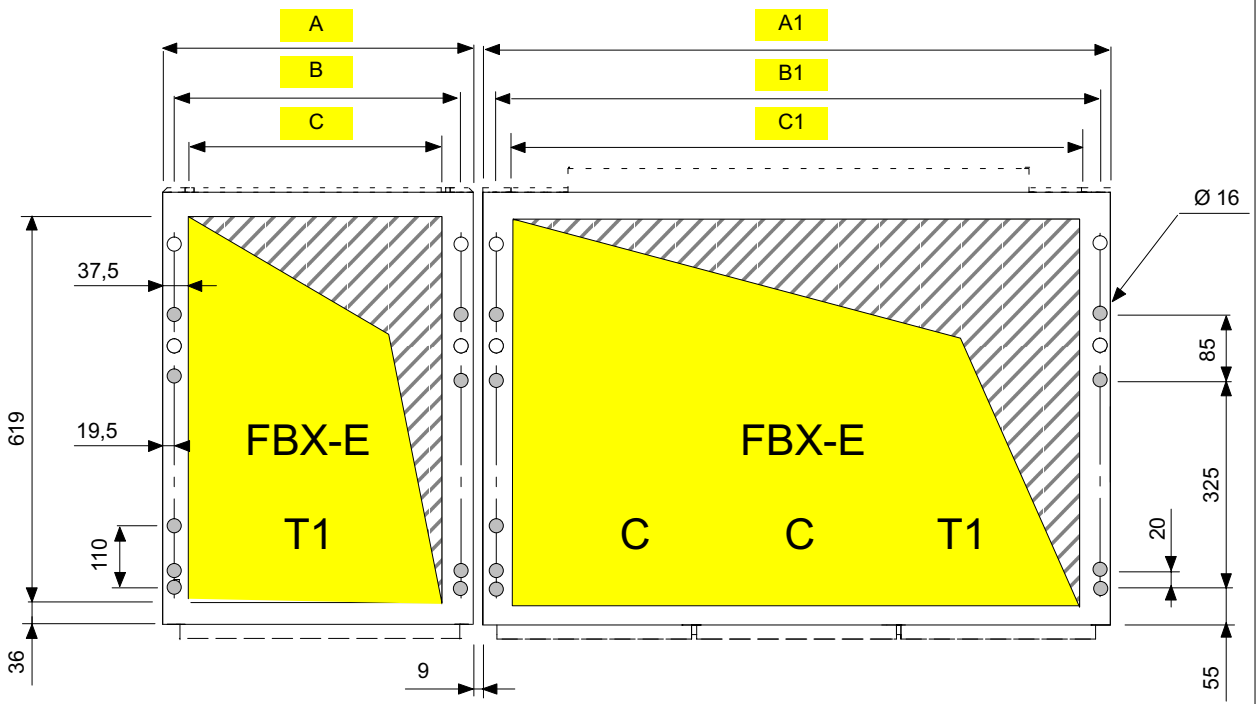
FBX Widths (mm)	A	B	C
Extension C	360	321	285
Extension T1	490	451	420
Extension T2	490	451	420
Extension CB	490	451	420
Extension CBb	625	586	550
Extension R	360	321	285
Extension RE	360	321	285

9.2 Geometry of the switchboard and civil engineering structure (see Tables § 8.1 & 9.1)

The profiles, seen from the top, represent the surface of the switchboard borne on the floor.

All the fixing points (standard or optional) are located.

Top view
(dimensions in mm)



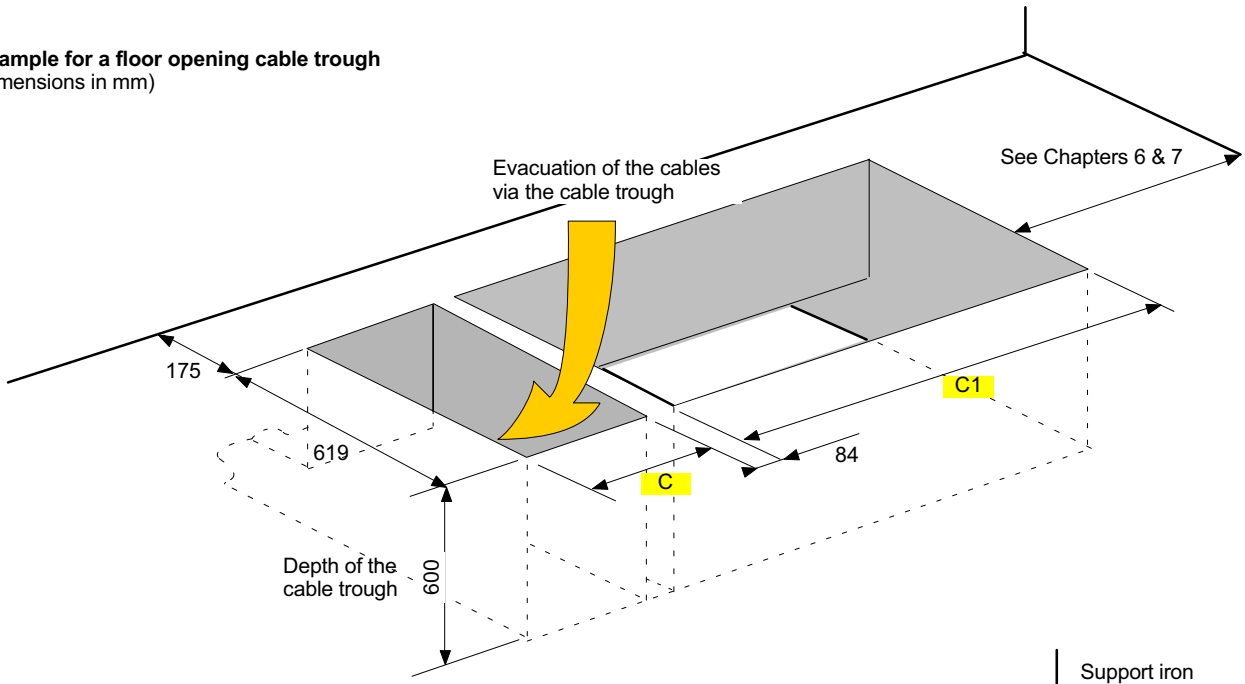
9.3 Installation on the floor (see Tables § 8.1 & 9.1)

The location of the cable trough is defined as a function of the position of the extension in the room.

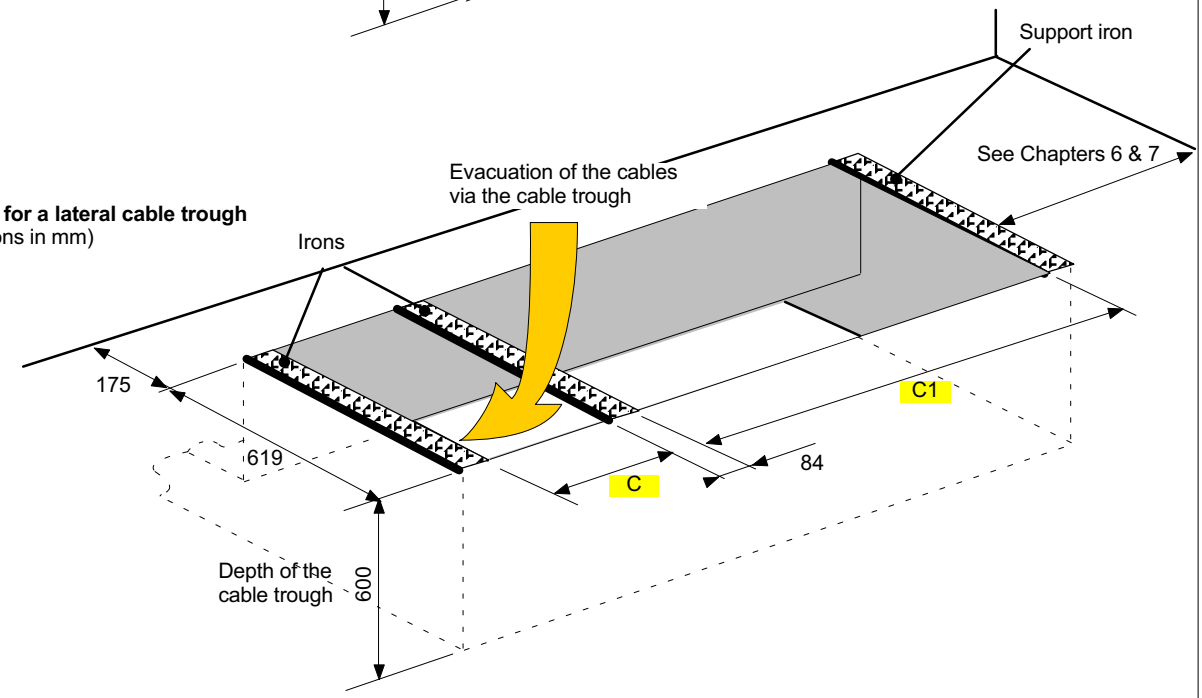
In case of a lateral cable trough, fit longitudinal irons to support the right and left-hand uprights of the extension.

The support irons to be used are of the 100 mm min. IPN type.

Example for a floor opening cable trough
(dimensions in mm)



Example for a lateral cable trough
(dimensions in mm)



9.4 Layout and fixing of the FBX-E to the floor

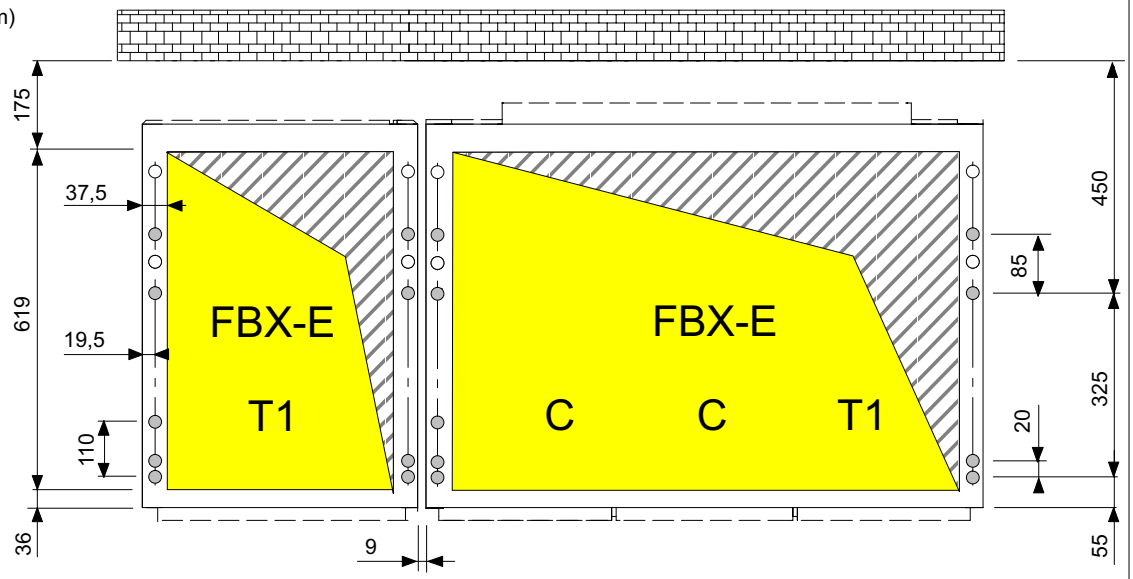
Check than the load limit for the fixing points is compatible with the weight of the extension (for indication of the weights, see § 3.6).

Check the evenness of the floor at the fixing points level. Any irregularities on the floor must not exceed 1 mm. If they are greater than that, install sheet metal shims just beside the fixing points.

9.5 Positioning of an extension and of its fixing points

Top view
(dimensions in mm)

Positioning of fixing points in relation to the rear wall



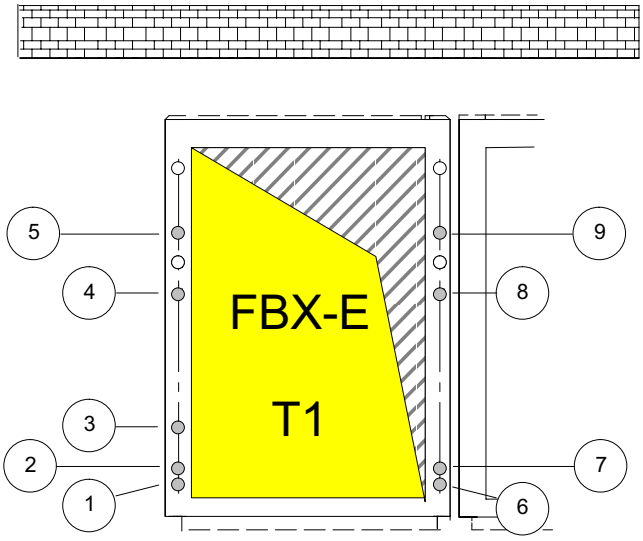
9.6 Fixing to the floor

Top view

1. Fixing to the floor of <u>each</u> extension, by 4 points:

Fixing	Fixing points
Standard	1 or 3 ; 4 ; 6 ; 8
Option	2 ; 5 ; 7 ; 9

2. Fasteners *(not supplied)*
4 H M10x30 bolts (class 8.8)
+ 4 flat washers Ø 30 mm on the exterior, 3 mm thick.



10 Work on the Civil Engineering structure

10.1 Characteristics of the work on the Civil Engineering structure

Overall evenness:
A 2 m rule, moved along the base should not highlight any irregularity of greater than 5 mm.

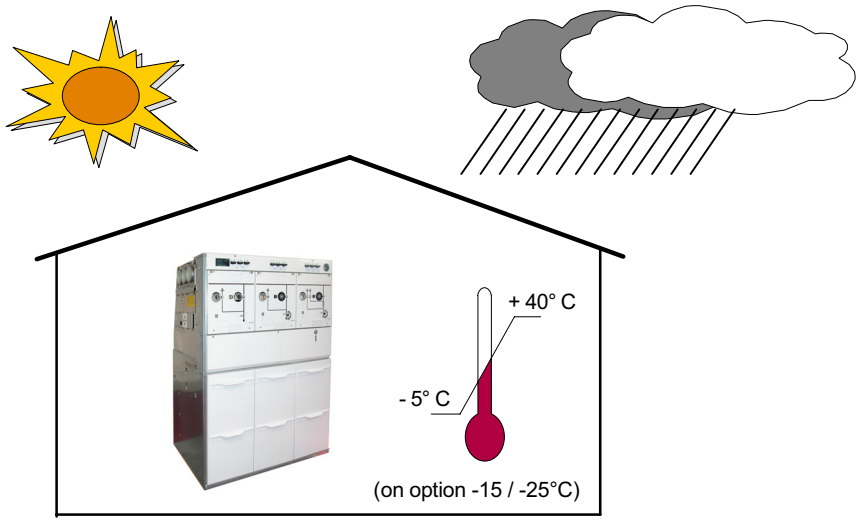
Local evenness:
A 20 cm rule, moved along the base should not highlight any irregularity or deflection of greater than 2 mm.

Any possible rabbets and closing slabs are the responsibility of the supplier of the Civil Engineering work.

10.2 Characteristics of the installation room

The room must be capable of protecting the equipment against any degradation agents such as:

- Water or water vapour.
- Salt-laden air.
- All types of pollution.
- Micro-organisms.



10.3 Characteristics of the storage area

The place of storage, before installation, must respect the same criteria as that for the installation room, with the exception of the temperature: + 50°C, - 25°C.

Contact Schneider Electric for any derogations to these criteria.

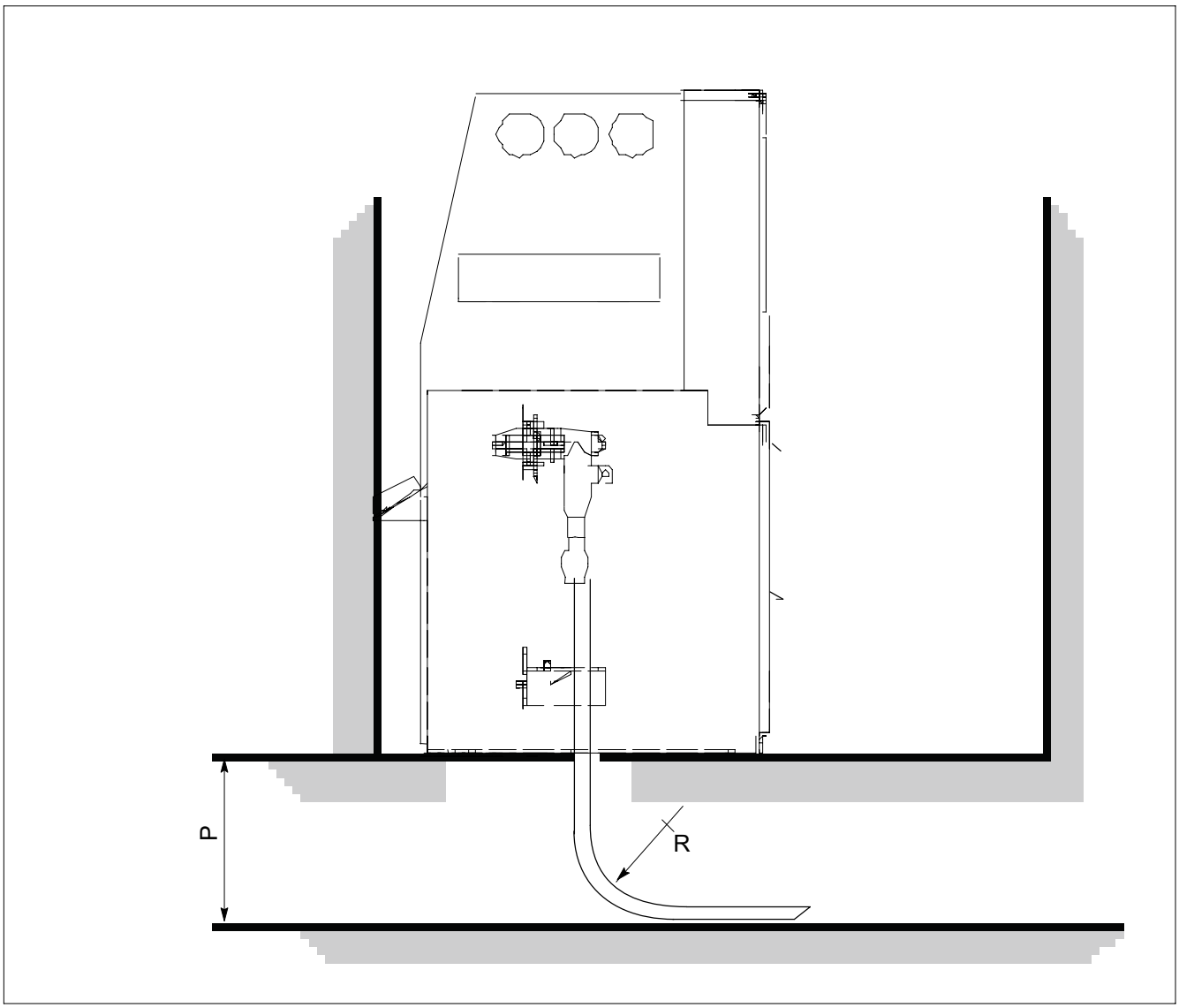
10.4 Geometry of the cable trough

The depth of the cable trough depends on the cross-section of the HV cables.
Generally, this depth [P] is at least equal to (generally higher) than the bend radius of the cables [R].

The length of the cable is calculated as a function of the altitude of the connecting point [see chapter 11].

Refer to the cable manufacturer's recommendations (ambient temperature, etc.).

Cable sections (mm^2)	Depth for a single pole cable P (mm)	Depth for a three-pole cable P (mm)
50	450	600
95	450	700
150	600	800
240	600	900
300	600	-
400	600	-

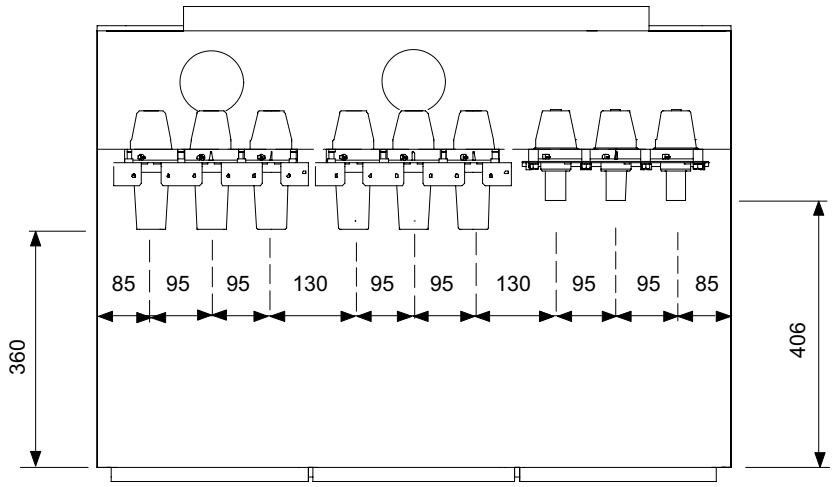


11 LV & HV connections for an FBX switchboard

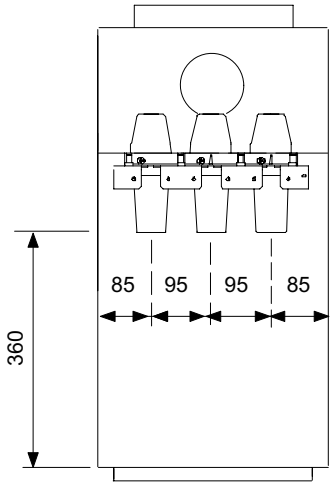
11.1 Distances between phases at HV connections level

Top views
(dimensions in mm)

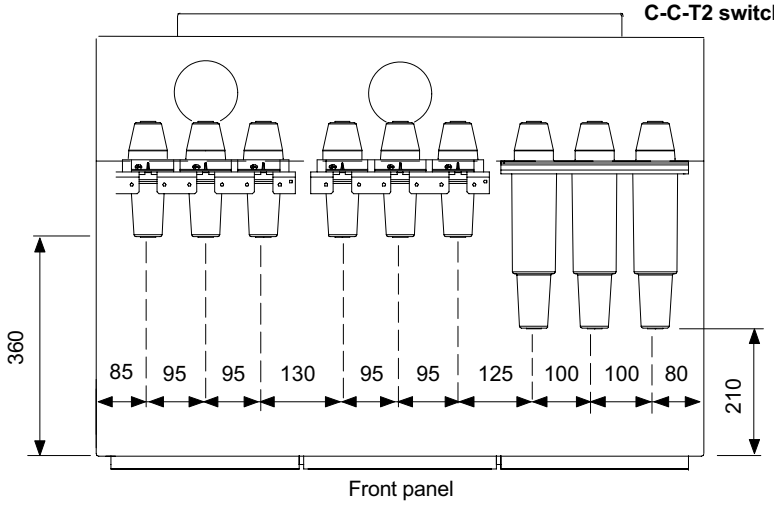
C-C-T1 switchboard



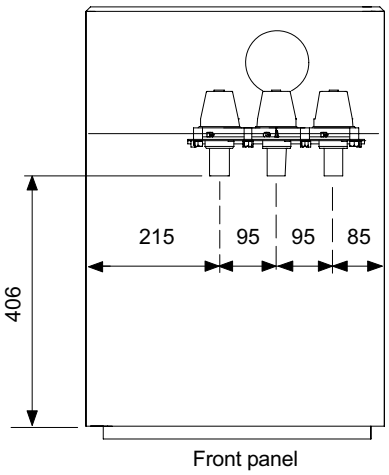
C or R or RE function



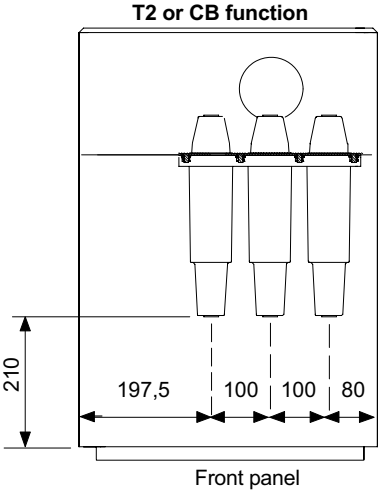
C-C-T2 switchboard



T1 function

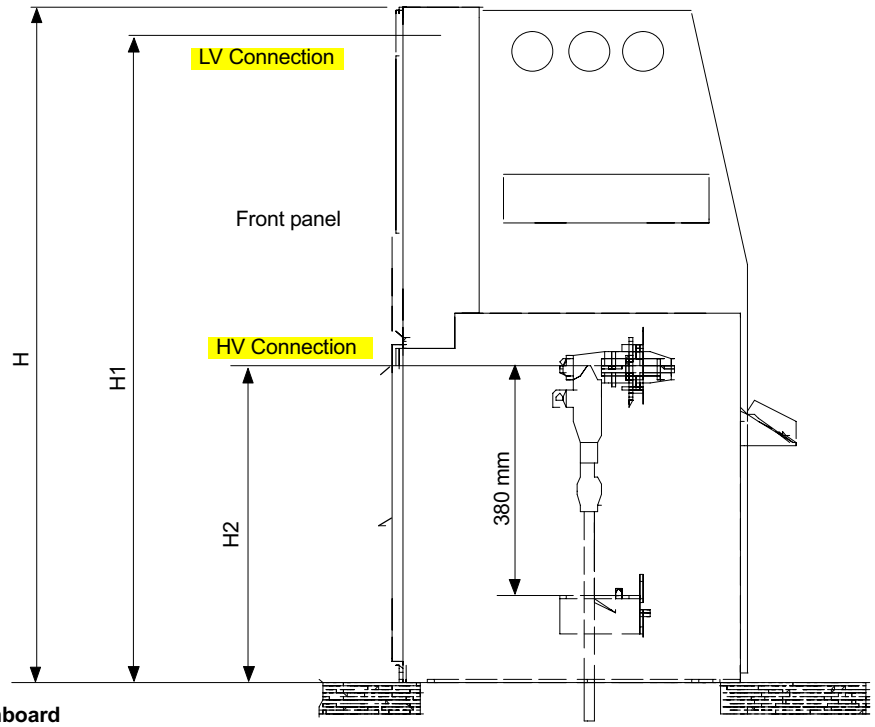


T2 or CB function



11.2 Altitudes for the LV & HV connection points

Distances	Functions C – R – RE with T1		Functions C – R – RE with T2 or CB	M1 Function	Functions M2 & M3
H (total height)	1040	1380	1380	1380	1380
H1 (LV connection)	965	1305	1305	1305	1305
H2 (HV connection)	303	643	593	648	580

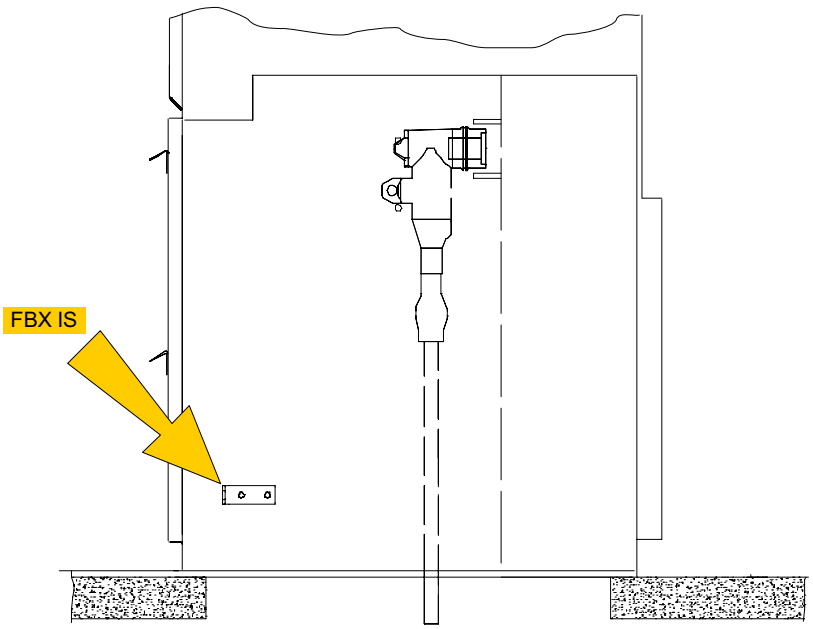


Side view of a C-C-T1 switchboard

11.3 Connection of the switchboard earthing circuit

1. FBX IS: The switchboard's general connection point is on the left, in the cables compartment for the function, located at the left-hand extremity of the switchboard.
2. FBX EDF: The connecting point is located in the upper, rear, right-hand part of he switchboard.

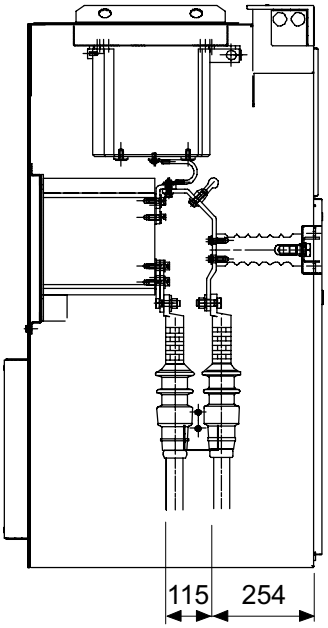
The connecting cable can be routed via the cables compartment. There is no specific reserve opening to be provided for.



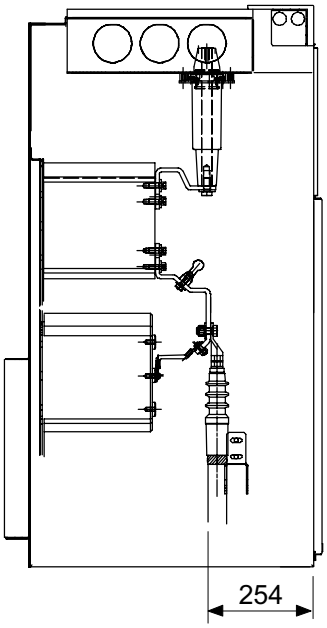
11.4 Disposition of connection point in M functions

Side views
(dimensions in mm)

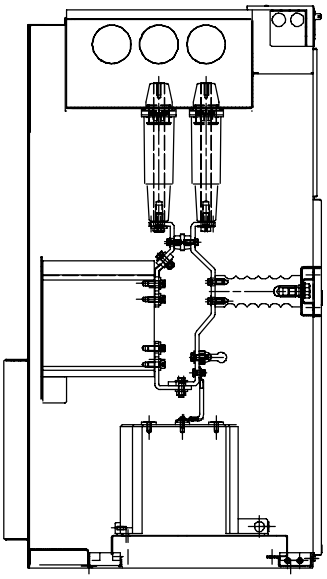
M1



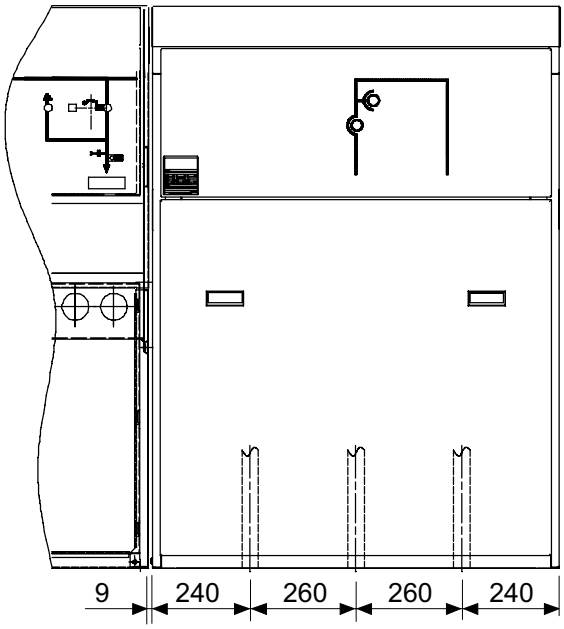
M2-M3



M4



Front view
(dimensions in mm)



12 Notes

If you have any comments on the use of this document or on the use of the equipment and services that are described in it, please send us your remarks, suggestions and wishes to:

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