Medium voltage products

UniSec
Technical Guide

Power and productivity
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Contents

1. Introduction

1.1 Purpose of the technical guide

The purpose of this technical guide is to provide a schematic overview of the principle features of UniSec switchgear.
This guide contains technical information and can be freely consulted.
Please also consult the following documents for further details about UniSec switchgear:

- 1VFM2000003 “UniSec. Air-insulated medium-voltage secondary distribution switchgear” – Catalogue
- 1VFM200004 “UniSec. Installation manual” – Manual
- 1VFM200005 “UniSec. Operation and maintenance manual” – Manual

1.2 General aspects

UniSec is a family of air-insulated switchgear for indoor installation, designed for medium voltage distribution.
The switchgear is created by configuring standard units, positioned side by side in a coordinated way.

Safety, reliability, ease of use, simple installation and environmental sustainability are the criteria upon which the development of this switchgear has been based.
Attention to detail, internal arc resistance (IAC) and segregation among the different compartments (LCS) ensure continuity of service and help to make UniSec switchgear even more versatile.

1.3 Fields of use

UniSec switchgear is designed for the distribution of electricity. It can be used for monitoring the power supply and protecting lines and power transformers:

- in transformer substations
- in power production installations (e.g. cogeneration and photovoltaic systems)
- in medium voltage industrial installations
- in airports, shopping centres and hospitals
- in the shipbuilding sector.

1. Introduction

1.4 Reference Standards

The switchgear and the main equipment it contains comply with the following standards:

CEI EN / IEC standards	Titolo
IEC 62271-200	High voltage switchgear and controlgear Part 200: Metal-enclosed factory-built switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV
IEC 62271-1	High voltage switchgear and controlgear Part 1: Common specifications
IEC 62271-202	High voltage switchgear and controlgear Part 202: Factory-built high voltage/low voltage substations
IEC 61869-2	Instrument transformers Part 2: Additional requirements for current transformers
IEC 61869-3	Instrument transformers Part 3: Additional requirements for inductive voltage transformers
IEC 62271-100	High voltage switchgear and controlgear Part 100: Alternating current circuit-breakers
IEC 62271-102	High voltage switchgear and controlgear Part 102: Alternating current disconnectors and earthing switches
IEC 62271-105	High voltage switchgear and controlgear Part 105: Switch-fuse combinations for rated voltages above 1 kV up to and including 52 kV.
IEC 62271-103	High voltage switchgear and controlgear Part 103: Switches and switch-disconnectors for rated voltages above 1 kV up to and including 52 kV.
IEC EN 60529	Degrees of protection provided by enclosures (IP Code)
IEC 62271-206	High voltage switchgear and controlgear Part 206: Voltage presence indicating systems for rated voltages above 1 kV up to and including 52 kV.
IEC 60071-2	Insulation co-ordination Part 2: Application guide
IEC 62271-106	High voltage switchgear and controlgear Part 106: Alternating current contactors, contactor-based controllers and motor-starters
IEC TS 62271-2102013:	High-voltage switchgear and controlgear - Part 210: Seismic qualification for metal enclosed and solid-insulation enclosed switchgear and controlgear assemblies for rated voltages above 1 kV and up to and including 52 kV
IEC TS 62271-304:2008	High-voltage switchgear and controlgear - Part 304: Design classes for indoor enclosed switchgear and controlgear for rated voltages above 1 kV up to and including 52 kV to be used in severe climatic conditions
IEEE Standards	**Titolo**
693-2005	IEEE Recommended Practice for Seismic Design of Substations

1.5 Cubicles

1.5.1 Construction of the switchgear and main components

When the UniSec units were designed, particular attention was paid to the safety of personnel in the event of faults due to internal arcs.

To improve the conditions of safety for the personnel and for maintenance operations, the units have been divided into separate compartments. These compartments are designed to withstand very sharp temperature and pressure rises caused by internal arc faults.

1.5.2 Service continuity category (LSC)

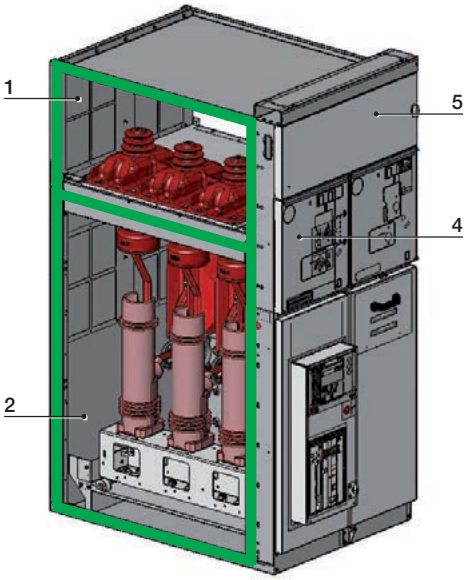
According to standard IEC 62271-200, the service continuity (LSC) category describes the method by which other compartments and/or functional units of the switchgear are able to remain in service when a main circuit compartment is opened.

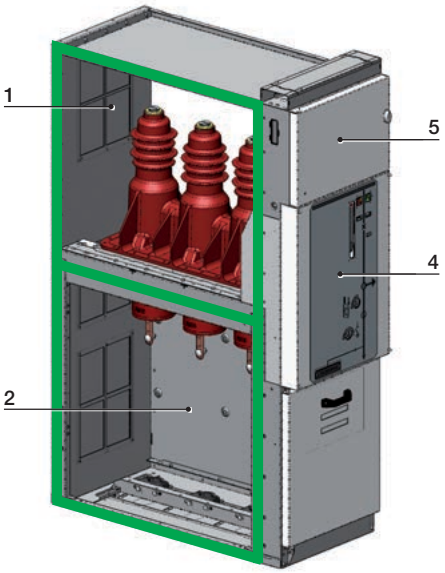
UniSec units on the basis of the type of enclosure	Segregation between live parts and open compartments
LSC2A	PM (metallic)
LSC2B	PM (metallic) for 12 and 17.5 kV versions PI (insulating) for 24 kV version

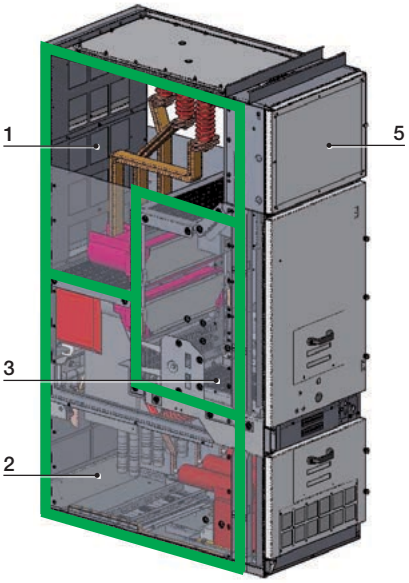
1.5.3 Compartments

The unit is divded into the following compartments:

1) Busbar compartment
2) Cable compartment
3) Apparatus compartment (only for LSC2B units)
4) Operating mechanism compartment
5) Auxiliary circuits compartment





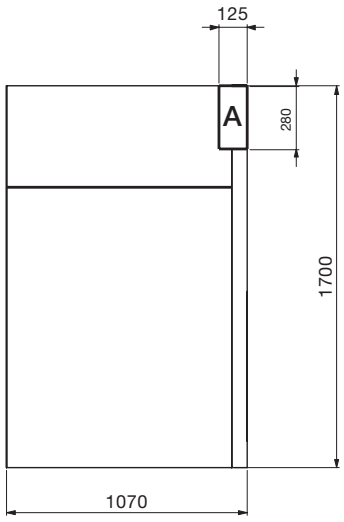


1. Introduction

1.5.4 LV compartments for auxiliary circuits

LV compartments available	Installable components
Standard	LV components, terminals, push-buttons, lamps and selectors
Wide	Protection relays, such as REF 601, REF 610, REF 615 or REF542plus with sensors
Big	Protection relays and measuring and remote management instruments or particularly large relays like REF620, REF630, REF542plus or REF 541

LSC2A



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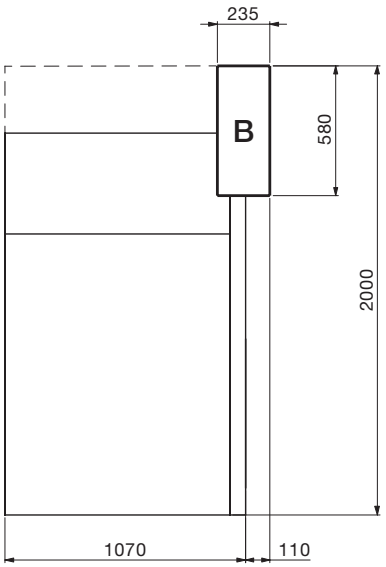
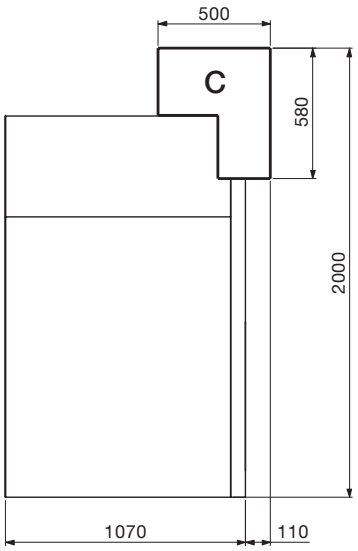


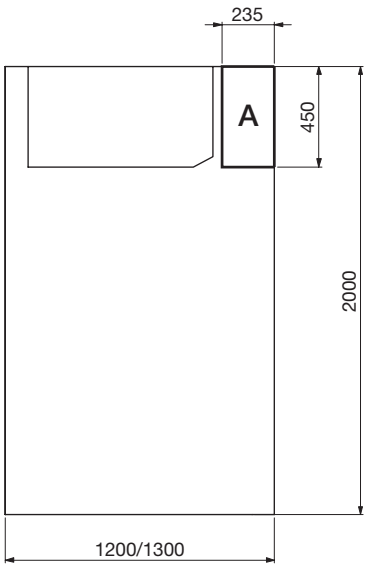
B = Wide



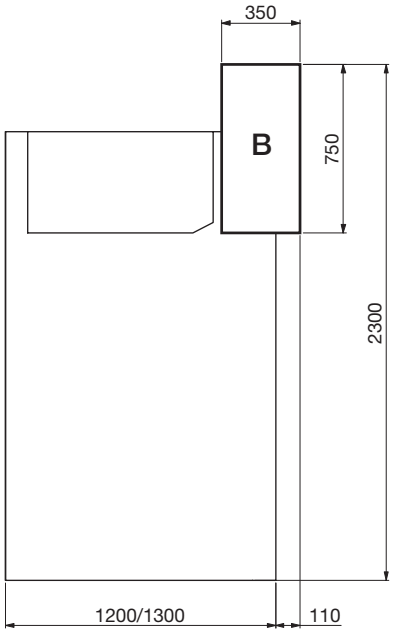
C = Big (*)

(*) Not available for panels with H = 2000 mm

LSC2B



A = Standard



B = Wide

1.6 Electrical characteristics

Rated voltage Ur	**kV**	**12**	**17.5**	**24**
Impulse withstand voltage Up	kV			
Rated value		75	95	125
On clearance		85	110	145
Power frequency withstand voltage for 1 min Ud	kV			
Rated value		28	38	50
On clearance		32	45	60
Rated frequency	Hz	50/60	50/60	50/60
Rated current Ir	A			
Busbar		630/800/1250	630/800/1250	630/1250
Line		630/800/1250	630/800/1250	630/1250
Rated current of switchgear:	A			
Circuit-breaker VD4/R-Sec - HD4/R-Sec - HD4/RE-Sec		630/800	630/800	630
Withdrawable circuit-breaker VD4/R-Sec - HD4/R-Sec		630	630	630
HySec multifunction apparatus		630	630	630
G-Sec gas-insulated switch-disconnector		630/800	630/800	630
Vmax/Sec withdrawable circuit-breaker		630/1250	630/1250	–
Withdrawable circuit-breaker VD4/Sec - HD4/Sec		–	–	630/1250
VSC/P withdrawable vacuum contactor		400	–	–
Admissible short-time withstand current	kA (3s)	16[4]/20[3]/25[1] [2]	16[4]/20[3]/25[2]	16[4]/20[3]
Rated peak current	kA	40[4]/50[3]/63	40[4]/50[3]/63	40[4]/50[3]

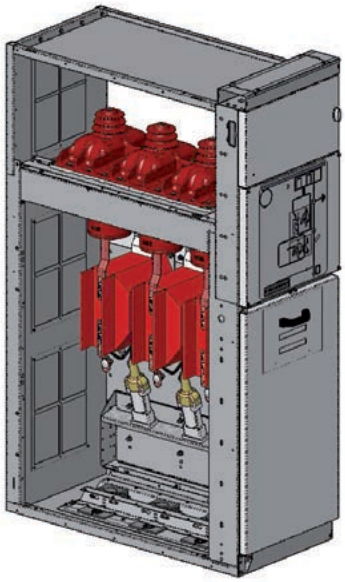
[1] 25 kA 2s for LSC2A classified units
[2] For LSC2B classified units
[3] Consult ABB for 21 kA/52.5 kAp
[4] For HySec 16 kA(1s)/40 kAp

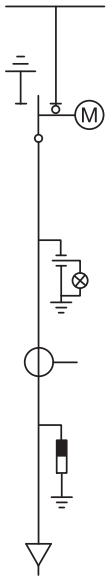
2. Typical UniSec units

2.1 List of available units

Letter code	Description	Width			
		190 mm	375 mm	500 mm	750 mm
SDC	Unit with switch-disconnector		•	•	•
SDS	Unit with switch-disconnector – disconnection		•	•	•
SDM	Disconnecting unit with measurements with switch-disconnector				•
SDD	Unit with double switch-disconnector				•
UMP	Universal measurement unit				•
SFC	Switch-disconnector with fuses		•	•	•
SFS	Switch-disconnector with fuses – disconnection		•	•	
SBC	Circuit-breaker unit with switch-disconnector				•
SBC-W	Withdrawable circuit-breaker unit with switch-disconnector				•
SBS	Circuit-breaker unit with switch-disconnector – disconnection				•
SBS-W	Withdrawable circuit-breaker unit with switch-disconnector – disconnection				•
SBM	Disconnecting unit with measurement and double switch-disconnector				•
SBR	Inverted circuit-breaker unit				•
HBC	Unit with integrated circuit-breaker and disconnector			•	
SFV	Switch-disconnector unit with fuse – measurements			•	
DRC	Direct incoming unit with measurements and busbar earthing		•	•	
DRS	Riser unit - measurements		•	•	
RLC/RRC	Lateral cable riser, right and left (for SBR units only)	•			

SDC – Unit with switch-disconnector





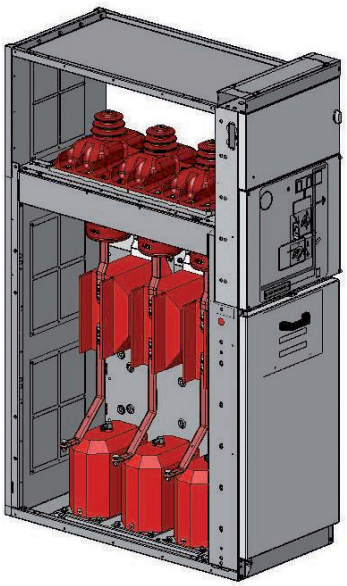
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	150 (1)	160 (1)
500	170 (1)	180 (1)
750	195 (2)	210 (2)

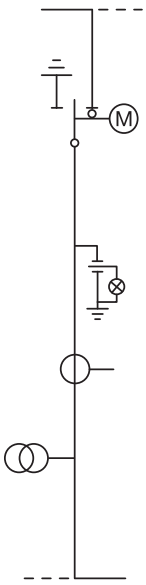
(1) Without CT
(2) Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630/800	12.5/16/20 (1)/25 (2) (3s)
17.5	630/800	12.5/16/20 (1) (3s)
24	630	12.5/16/20 (1) (3s)

(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SDS – Unit with switch-disconnector – disconnection





Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	155 (1)	165 (1)
500	175 (1)	185 (1)
750	200 (1)	215 (1)

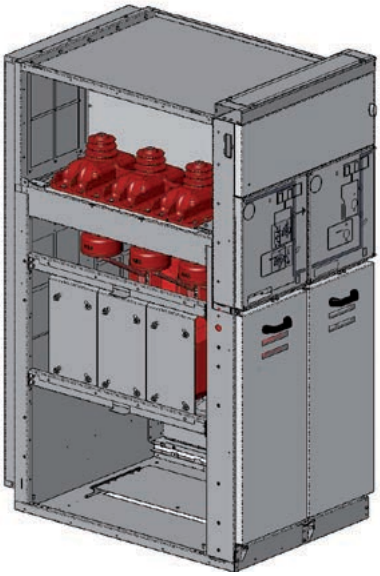
(1) Without CT or VT

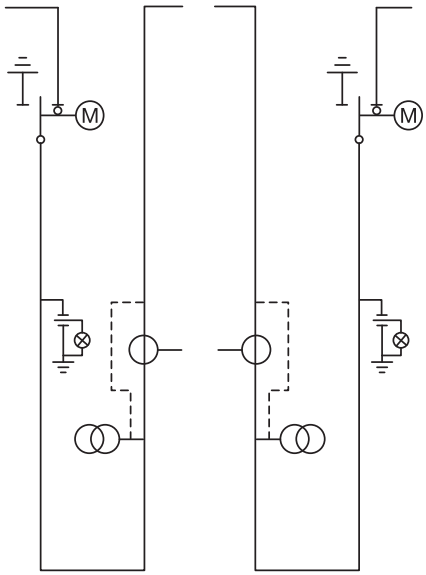
Un	Ir	Ik
kV	A	kA
12	630/800	12.5/16/20 (1)/25 (2) (3s)
17.5	630/800	12.5/16/20 (1) (3s)
24	630	12.5/16/20 (1) (3s)

(1) Consult ABB for 21 kA
(2) 25 kA (2s)

2. Typical UniSec units

SDM – Disconnecting unit with measurements with switch-disconnector





Disconnector on left Disconnector on right

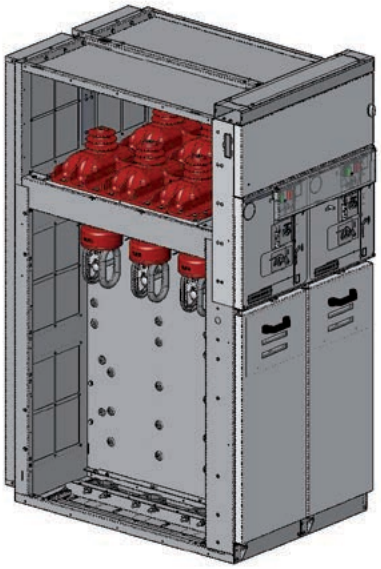
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	230 (1)	250 (1)

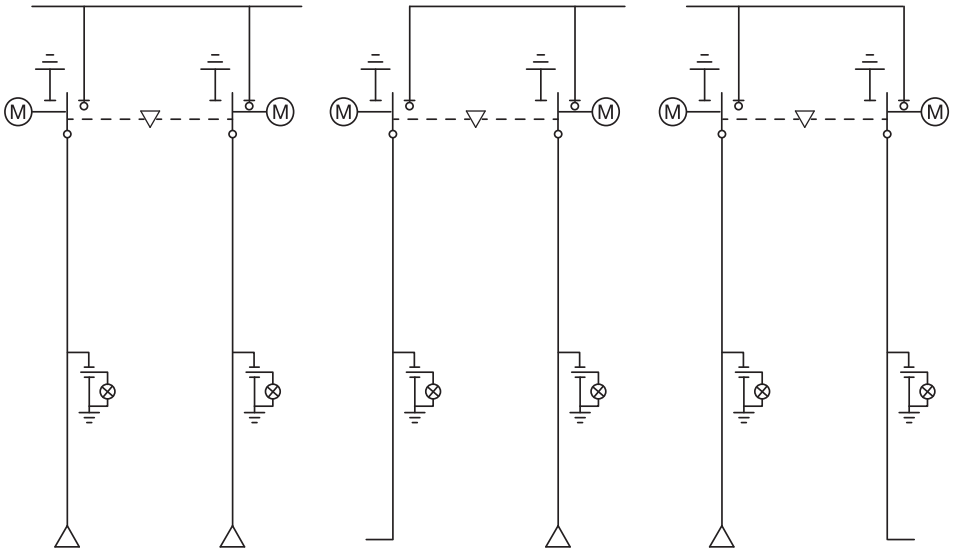
(1) Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630/800	12.5/16/20 (1)/25 (2) (3s)
17.5	630/800	12.5/16/20 (1) (3s)
24	630	12.5/16/20 (1) (3s)

(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SDD – Unit with double switch-disconnector





Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	270 (1)	290 (1)

(1) Without CT or VT

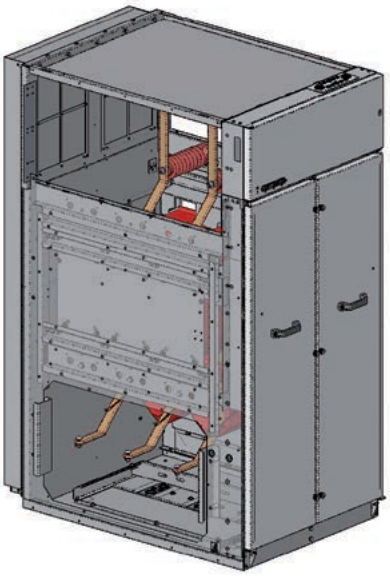
Un	Ir	Ik
kV	A	kA
12	630	12.5/16 (3s)
17.5	630	12.5/16 (3s)
24	630	12.5/16 (3s)

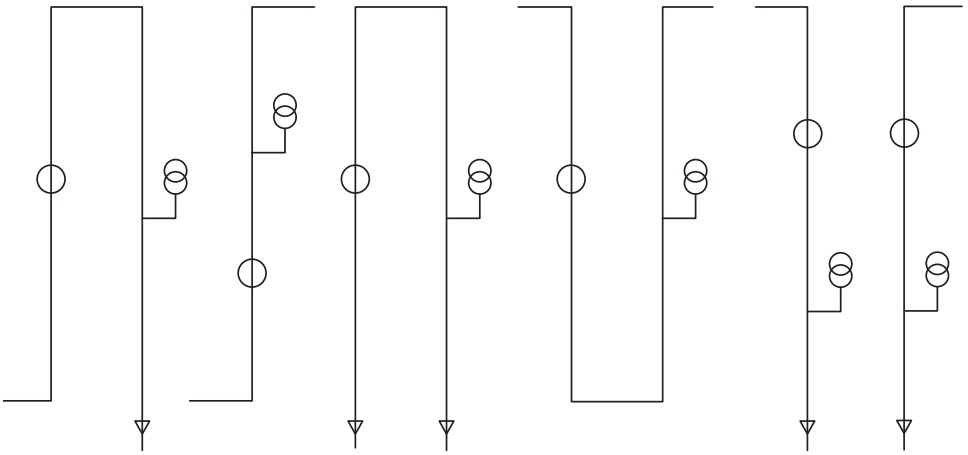
The logic of the interlock of the SDD unit is given in the table below.

Lh disconnector position (main line)			Rh disconnector position (secondary line)		
Closed	Open	Earth	Closed	Open	Earth
•				•	
	•		•		
	•			•	
	•				•
		•			•
		•		•	

2. Typical UniSec units

UMP – Universal measurement unit





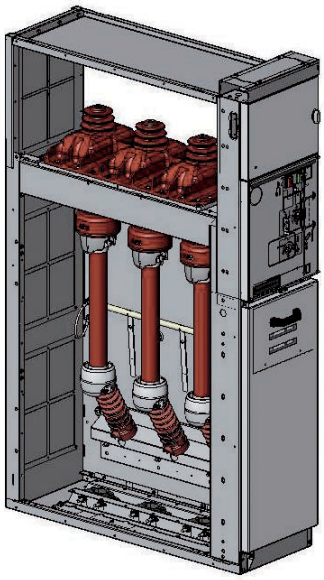
Panel width	Weight (kg)
mm	H = 1700 mm
750	200 [1]

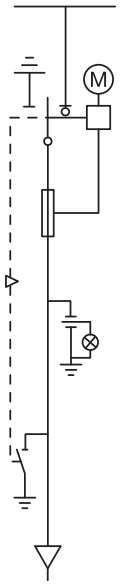
[1] Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630/800	12.5/16/20 [1]/25 [2] (3s)
17.5	630/800	12.5/16/20 [1] (3s)
24	630	12.5/16/20 [1] (3s)

[1] Consult ABB for 21 kA
[2] 25 kA (2s)

SFC – Switch-disconnector unit with fuses





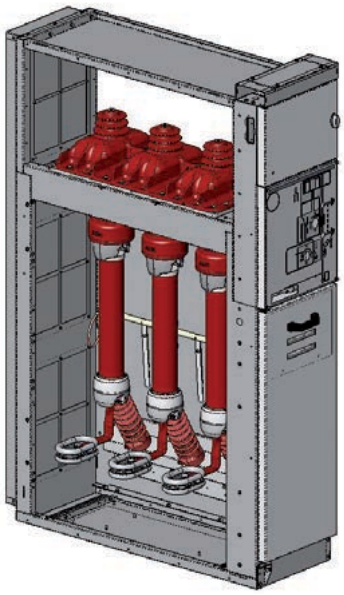
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	155 (1)	160 (1)
500	175 (1)	185 (1)
750	200 (1)	215 (1)

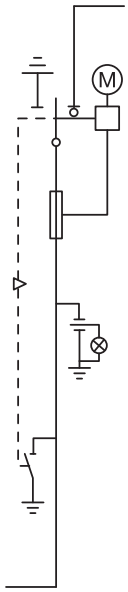
(1) Without fuses

Un	Ik	IkAp (*)	Fuses
kV	kA	kAp	A
12	12.5/16/20 (1)/25 (2) (3s)	5	125
17.5	12.5/16/20 (1) (3s)	5	80
24	12.5/16/20 (1) (3s)	5	80

(*) Making capacity of earthing switch on load side EF 230 (Ik = 2 kA)
(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SFS – Switch-disconnector with fuses – disconnection





Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	165 (1)	175 (1)
500	180 (1)	190 (1)

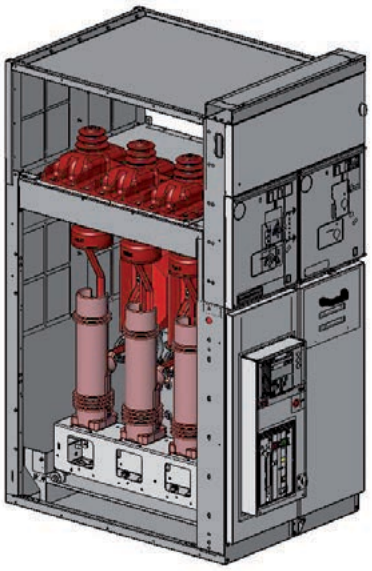
(1) Without fuses

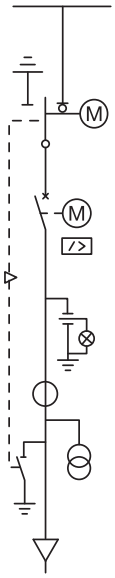
Un	Ik	IkAp (*)	Fuses
kV	kA	kAp	A
12	12.5/16/20 (1)/25 (2) (3s)	5	125
17.5	12.5/16/20 (1) (3s)	5	80
24	12.5/16/20 (1) (3s)	5	80

(*) Making capacity of earthing switch on load side EF 230 (Ik = 2 kA)
(1) Consult ABB for 21 kA
(2) 25 kA (2s)

2. Typical UniSec units

SBC – Circuit-breaker with switch-disconnector





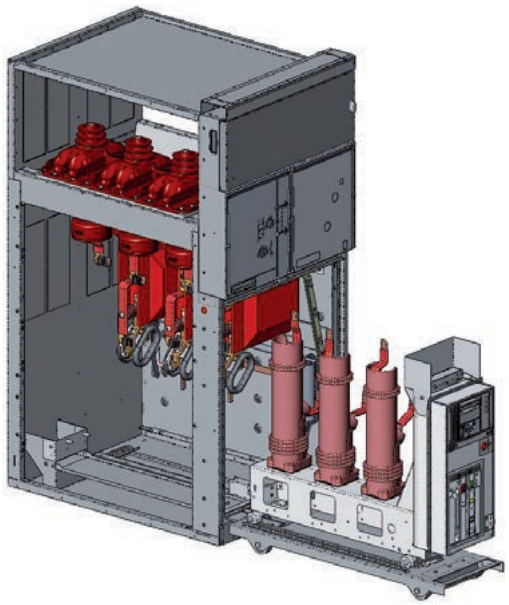
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	355 (1)	355 (1)

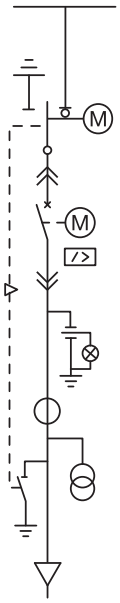
(1) Without CT or VT

Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	630/800	12.5/16/20 (1)/25 (2) (3s)	31.5/40/50 (1)/63
17.5	630/800	12.5/16/20 (1) (3s)	31.5/40/50 (1)
24	630	12.5/16/20 (1) (3s)	31.5/40/50 (1)

(*) Making capacity of earthing switch on load side EF 230
(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SBC-W – Withdrawable circuit-breaker unit with switch-disconnector





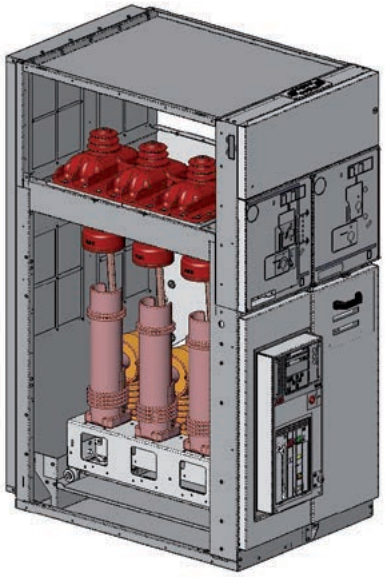
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	335 (1)	355 (1)

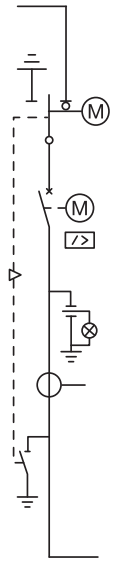
(1) Without CT or VT

Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	630	12.5/16/20 (1)/25 (2) (3s)	31.5/40/50 (1)/63
17.5	630	12.5/16/20 (1) (3s)	31.5/40/50 (1)
24	630	12.5/16/20 (1) (3s)	31.5/40/50 (1)

(*) Making capacity of earthing switch on load side EF 230
(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SBS – Circuit-breaker unit with switch-disconnector – disconnection





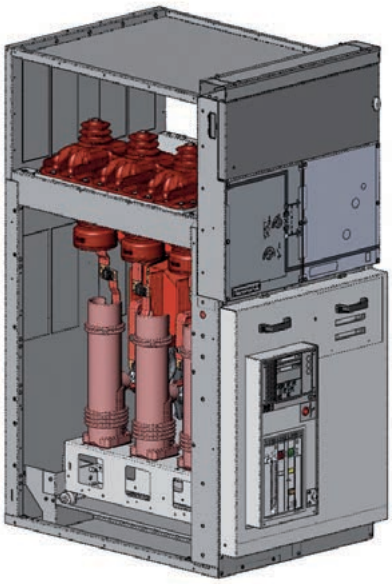
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	355 (1)	375 (1)

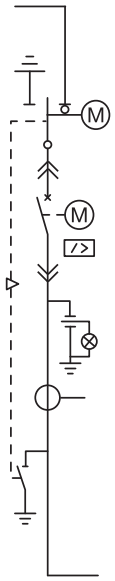
(1) Without CT or VT

Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	630/800	12.5/16/20 (1)/25 (2) (3s)	31.5/40/50 (1)/63
17.5	630/800	12.5/16/20 (1) (3s)	31.5/40/50 (1)
24	630	12.5/16/20 (1) (3s)	31.5/40/50 (1)

(*) Making capacity of earthing switch on load side EF 230
(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SBS-W – Withdrawable circuit-breaker unit with switch-disconnector – disconnection





Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	355 (1)	375 (1)

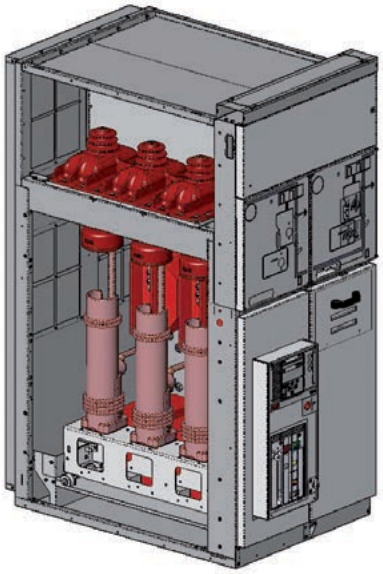
(1) Without CT or VT

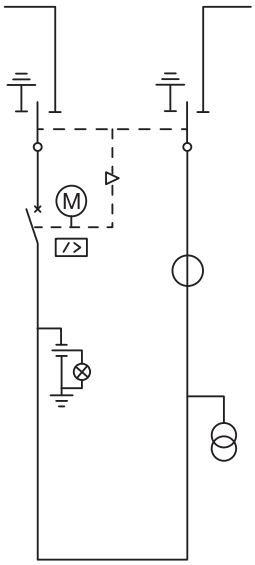
Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	630	12.5/16/20 (1)/25 (2) (3s)	31.5/40/50 (1)/63
17.5	630	12.5/16/20 (1) (3s)	31.5/40/50 (1)
24	630	12.5/16/20 (1) (3s)	31.5/40/50 (1)

(*) Making capacity of earthing switch on load side EF 230
(1) Consult ABB for 21 kA
(2) 25 kA (2s)

2. Typical UniSec units

SBM – Disconnecting unit with measurements and double switch-disconnector





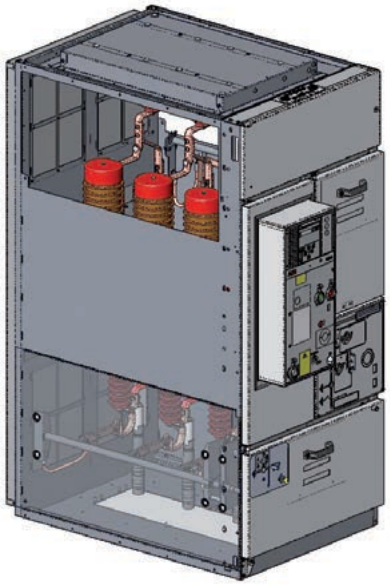
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
750	390 (1)	410 (1)

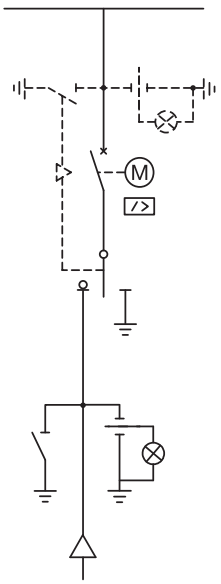
(1) Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630/800	12.5/16/20 (1)/25 (2) (3s)
17.5	630/800	12.5/16/20 (1) (3s)
24	630	12.5/16/20 (1) (3s)

(1) Consult ABB for 21 kA
(2) 25 kA (2s)

SBR – Inverted circuit-breaker unit





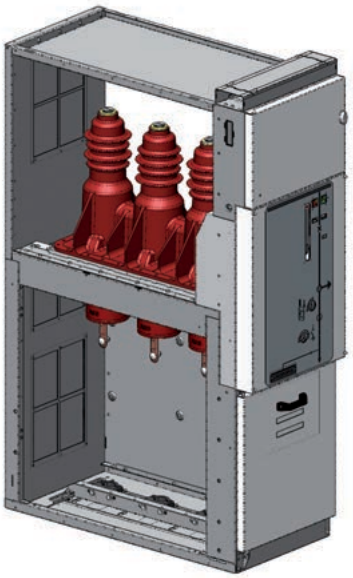
Panel width	Weight (kg)
mm	H = 1700 mm
750	335 (1)

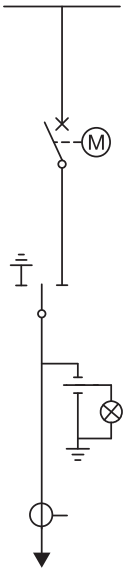
(1) Without CT or VT

Un	Ir	Ik	IkAp (*)	IkAp (**)
kV	A	kA	kAp	kAp
12	630	12.5/16 (1s)	31.5/40	5
17.5	630	12.5/16 (1s)	31.5/40	5
24	630	12.5/16 (1s)	31.5/40	5

(*) Making capacity of earthing switch on supply side ESBR230-U
(**) Making capacity of earthing switch on load side ESBR230-L

HBC – Unit with integrated circuit-breaker and switch-disconnector





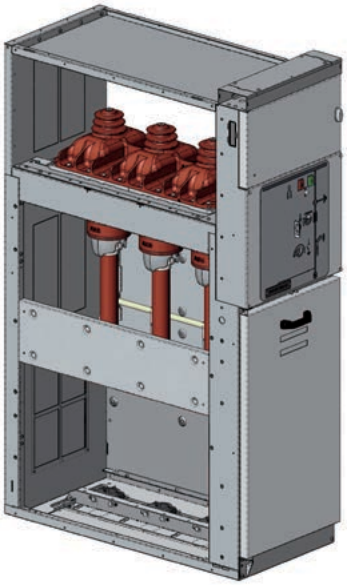
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
500	250 (1)	275 (1)

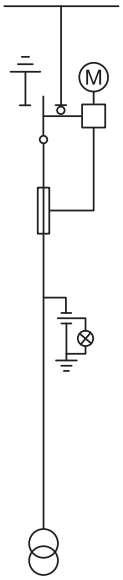
(1) Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630	12.5/16 (1 s)
17.5	630	12.5/16 (1 s)
24	630	12.5/16 (1 s)

HBC 24kV is available in the DY800 version, according to ENEL (Public Utility Company) specifications.

SFV – Switch-disconnector with fuses – measurements





Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
500	175 (1)	185 (1)

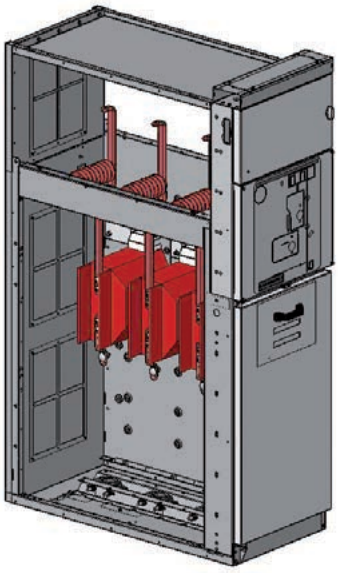
(1) Without CT or VT

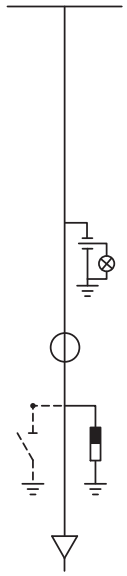
Un	Ik	Fuses
kV	kA	A
12	12.5/16/20 (1)/25 (2) (3s)	2 το 6
17.5	12.5/16/20 (1) (3s)	2 το 6
24	12.5/16/20 (1) (3s)	2 το 6

(1) Consult ABB for 21 kA
(2) 25 kA (2s)

2. Typical UniSec units

DRC – Direct incoming unit with measurements and busbar earthing





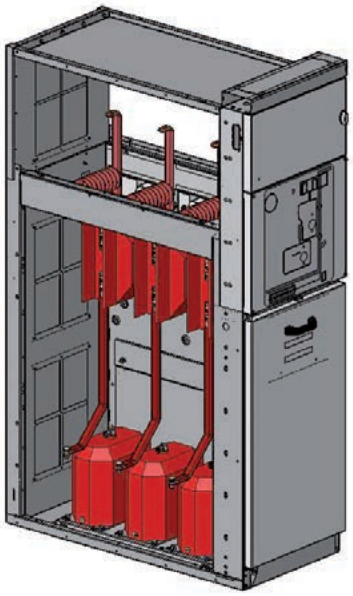
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	120 (1)	130 (1)
500	135 (1)	145 (1)

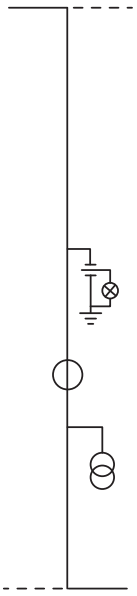
(1) Without CT or VT

Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	630/800/1250	12.5/16/20 (1)/25 (2) (3s)	31.5/40/50 (1)/63
17.5	630/800/1250	12.5/16/20 (1) (3s)	31.5/40/50 (1)
24	630/1250 (3)	12.5/16/20 (1) (3s)	31.5/40/50 (1)

(*) Making capacity ES-230 N
(1) Consult ABB for 21 kA
(2) 25 kA (2s)
(3) Only for H = 2000 mm

DRS – Riser unit - measurements





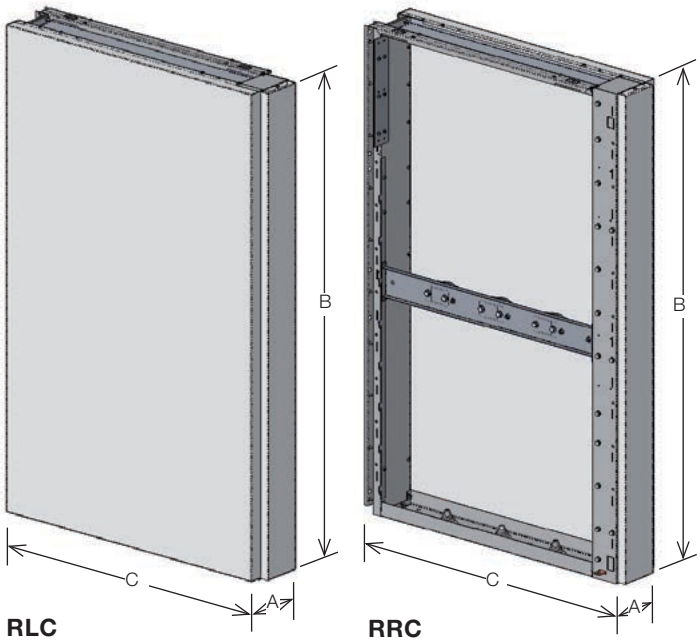
Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	120 (1)	130 (1)
500	135 (1)	145 (1)

(1) Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630/800/1250	12.5/16/20 (2)/25 (3) (3s) (4)
17.5	630/800/1250	12.5/16/20 (2) (3s) (4)
24	630/1250 (1)	12.5/16/20 (2) (3s) (4)

(1) Only for H = 2000 mm
(2) Consult ABB for 21 kA
(3) 25 kA (2s)
(4) 25 kA, 3s DRS coupled to WBC/WBS

RLC/RRC – Lateral cable riser, right and left



Panel dimensions	Weight
mm A x B x C	kg
190 x 1700 x 1070	80
190 x 2000 x 1070	90

Un	Ir	Ik
kV	A	kA
12	630	12/16 (1s)
17,5	630	12/16 (1s)
24	630	12/16 (1s)

Table of matches with RRC/RLC cable riser units

Unit	Cable riser H = 1700 mm		Cable riser H = 2000 mm	
	RLC	RRC	RLC	RRC
SDC 375	■	■	■	■
SDC 500	■	■	■	■
SDC 750	–	■	–	■
SDS 375 busbar outlet on left	–	–	–	■
SDS 375 busbar outlet on right	–	–	■	–
SDS 500 busbar outlet on left	–	–	–	■
SDS 500 busbar outlet on right	–	–	■	–
SFC 375	■	■	■	■
SFC 500	■	■	■	■
SFV 500	■	■	■	■
SFS 375 busbar outlet on left	–	–	–	■
SFS 500 busbar outlet on left	–	–	–	■
SBC 750 (SBC-W 750)	■	–	■	–
SBS 750 (SBS-W 750) busbar outlet on left	–	–	■	–
SDM 750 Gsec on left	–	–	■	–
SDM 750 Gsec on right	–	–	–	■
SDD 750 cable outlet	■	■	■	■
SDD 750 busbar outlet on left	–	■	–	■
SDD 750 busbar outlet on left	■	–	■	–
SBM 750	–	–	■	■
SBR 750	■	■	–	–

2. Typical UniSec units

2.2 Busbar applications

The following busbar applications are available for H = 2000 mm panels only (not adapter panels):

- Incoming cables
- Voltage transformers (*)
- Combisensors or current transformers (*)
- Earthing switch (*)

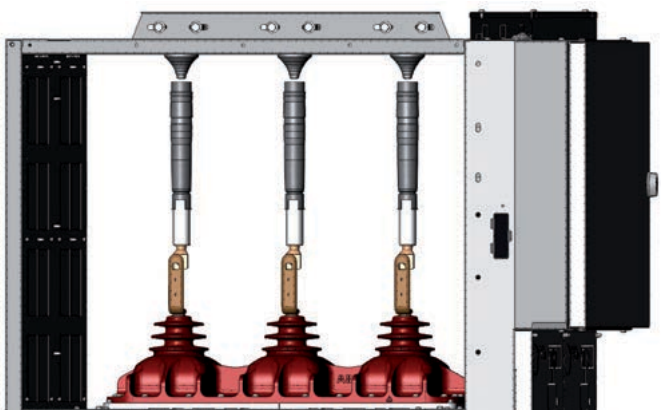
(*) the roof cannot be removed in this busbar application. Take care to position the units in sequence in the switchgear

2.2.1 Incoming cables

The solution is available for the following units:

Incoming cables from above
1 cable up to 400 mm² – 12-17.5 kV 800 A – 24 kV 630 A

Typical unit	Width	Position in switchgear	Rated voltage		
			12 kV	17.5 kV	24 kV
SDC-SFC DRS-SDS	375 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X
SDC-SFC SFV-SDS HBC-DRS	500 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X
SBC-SBS SFC - SBC-W SBS-W	750 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X
SDC	750 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X



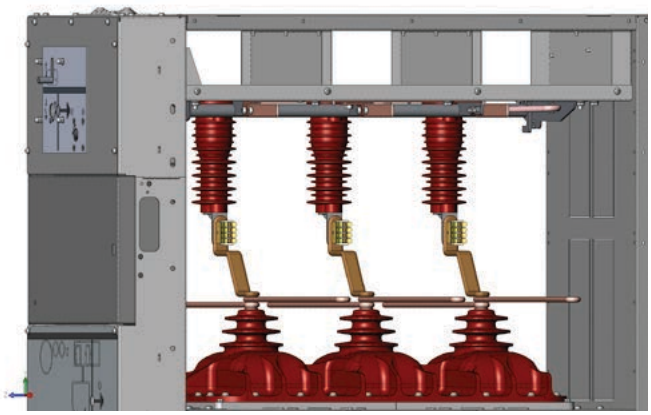
2.2.2 Earthing switch with making capacity [1]

The solution is available for the following units:

Busbar earthing switch (ES)

Typical unit	Width	Position in switchgear	Rated voltage		
			12 kV	17.5 kV	24 kV
SDC-SFC-SFV	500 mm	Left end	–	–	–
		Intermediate	X	X	X
		Right end	X	X	X
SBC SBC-W	750 mm	Left end	–	–	–
		Intermediate	X	X	X
		Right end	X	X	X
SDC-SFC	750 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X

[1] The procedure for safely earthing the apparatus is ensured by padlocks, keys or locking magnets installed on the earthing switch



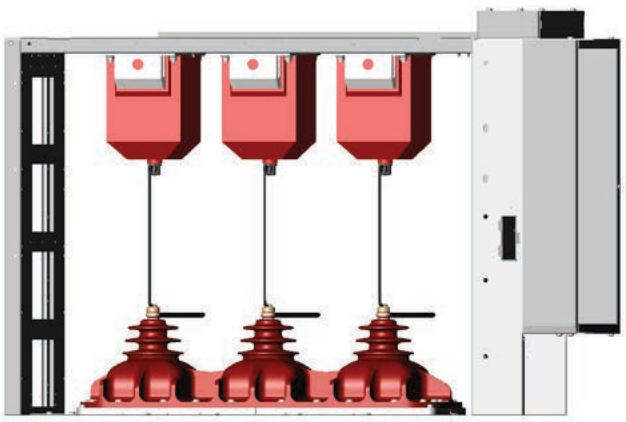
2.2.3 Voltage transformers [1]

The solution is available for the following units:

Busbar VT

Typical unit	Width	Position in switchgear	Rated voltage		
			12 kV	17.5 kV	24 kV
SDC-SFC SFV-SDS DRS-HBC	500 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X
SBC-SBS SFC - SBC-W SBS-W	750 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X
SDC	750 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	X

[1] VT without fuses



2. Typical UniSec units

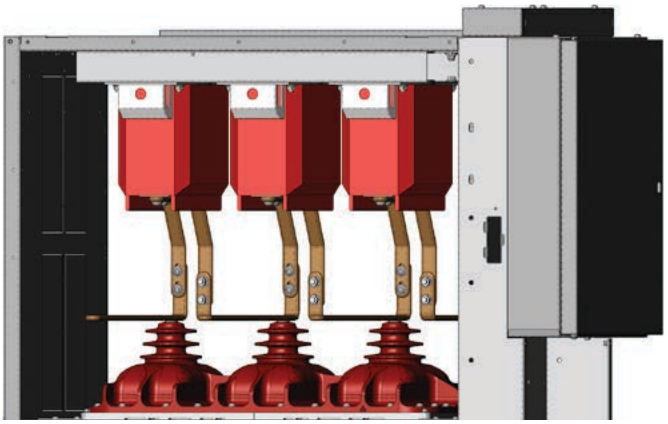
2.2.4 Current transformers [1]

The solution is available for the following units:

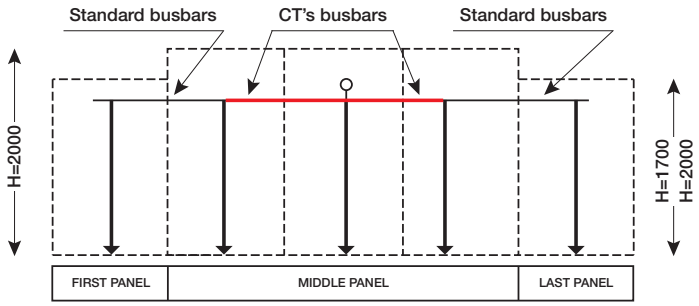
Busbar VT

Typical unit	Width	Position in switchgear	Rated voltage		
			12 kV	17.5 kV	24 kV
SDC-SFC SFV-HBC	500 mm	Left end	X	X	–
		Intermediate	X	X	X
		Right end	X	X	–
SBC SBC-W	750 mm	Left end	X	X	–
		Intermediate	X	X	X
		Right end	X	X	X
SDC-SFC	750 mm	Left end	X	X	X
		Intermediate	X	X	X
		Right end	X	X	–

[1] The procedure for safely earthing the apparatus is ensured by padlocks, keys or locking magnets installed on the earthing switch



The panel beside the one with the busbar CTs cannot be fitted with these latter. Refer to the example below:

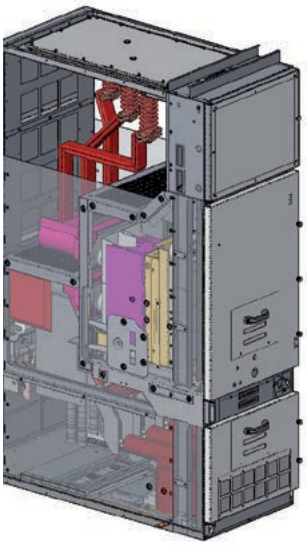


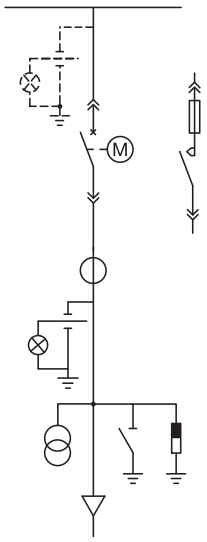
2.3 List of available units

Letter code	Description	Width		
		500 mm	600 mm	750 mm
WBC	Unit with withdrawable circuit-breaker		•(*)	•(**)
WBS	Unit with withdrawable circuit-breaker – disconnection		•(*)	•(**)
BME	Busbar earthing and measurement unit		•(*)	
DRS	Riser unit – measurements	•		

(*) 12-17.5 kV
(**) 24 kV

WBC – Unit with withdrawable circuit-breaker





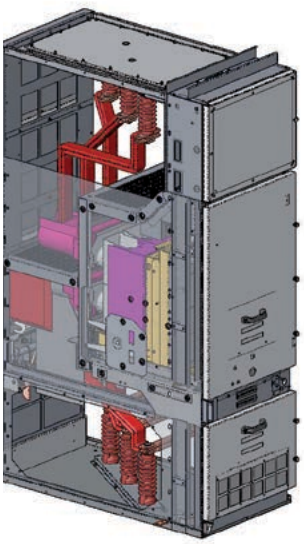
Panel width	Weight (kg)
mm	kg
600 (12-17.5 kV PM)	600 (1)
750 (24 kV PI)	750 (1)

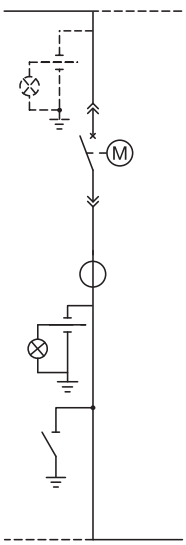
(1) Without CT or VT

Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	400 (1)/630/1250	16/20 (2)/25 (3s)	40/50 (2)/63
17.5	630/1250	16/20 (2)/25 (3s)	40/50 (2)/63
24	630/1250	16/20 (2)	40/50 (2)

(*) ESWB-150 making capacity
(1) Solution with VSC/P contactor
(2) Consult ABB for 21 kA

WBS – Unit with withdrawable circuit-breaker – disconnection





Panel width	Weight (kg)
mm	kg
600 (12-17.5 kV PM)	600 (1)
750 (24 kV PI)	750 (1)

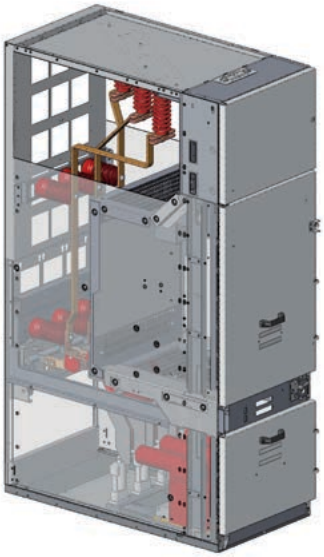
(1) Without CT or VT

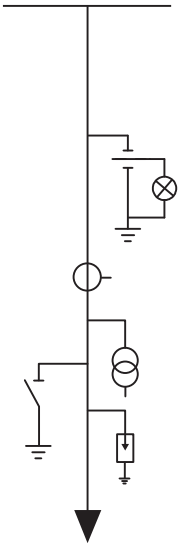
Un	Ir	Ik	IkAp (*)
kV	A	kA	kAp
12	630/1250	16/20 (1)/25 (3s)	40/50 (1)/63
17.5	630/1250	16/20 (1)/25 (3s)	40/50 (1)/63
24	630/1250	16/20 (1)	40/50 (1)

(*) ESWB-150 making capacity
(1) Consult ABB for 21 kA

2. Typical UniSec units

BME – Busbar earthing and measurement unit





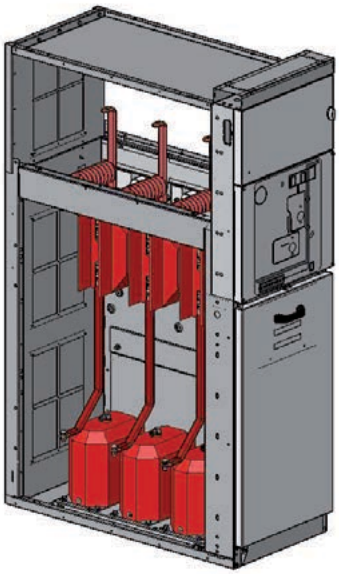
Panel width	Weight (kg)
mm	kg
600 (12-17.5 kV PM)	450 (1)

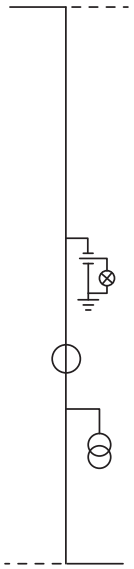
(1) Without CT or VT

Un	Ir (2)	Ik	Ikap (*)
kV	A	kA	kAp
12	630/1250	16/20 (1)/25 (3s)	40/50 (1)/63
17.5	630/1250	16/20 (1)/25 (3s)	40/50 (1)/63

(*) ESWB-150 making capacity
(1) Consult ABB for 21 kA
(2) Only for units used for direct incoming purposes

DRS – Riser unit – measurements





Panel width	Weight (kg)	
mm	H = 1700 mm	H = 2000 mm
375	120 (1)	130 (1)
500	135 (1)	145 (1)

(1) Without CT or VT

Un	Ir	Ik
kV	A	kA
12	630/800/1250	12.5/16/20 (2)/25 (3) (3s) (4)
17.5	630/800/1250	12.5/16/20 (2) (3s) (4)
24	630/1250 (1)	12.5/16/20 (2) (3s) (4)

(1) Only for H = 2000 mm
(2) Consult ABB for 21 kA
(3) 25 kA (2s)
(4) 25 kA, 3s DRS coupled to WBC/WBS

The units can be equipped with:

- a VSC/P series vacuum contactor up to 12 kV
- a Vmax/Sec series vacuum circuit-breaker up to 17.5 kV and VD4/Sec up to 24 kV
- a 24 kV HD4/Sec series gas circuit-breaker.

Withdrawable versions of the apparatus are installed on trucks allowing them to assume the following positions in relation to the compartment:

– CONNECTED: main circuits and auxiliary circuits connected;
– ISOLATED: partially isolated with the main circuits disconnected and the auxiliary circuits connected (plug connector plugged-in). fully isolated with the main and auxiliary circuits disconnected (plug connector unplugged).
– WITHDRAWN: main and auxiliary circuits disconnected and the apparatus withdrawn from the switchgear.

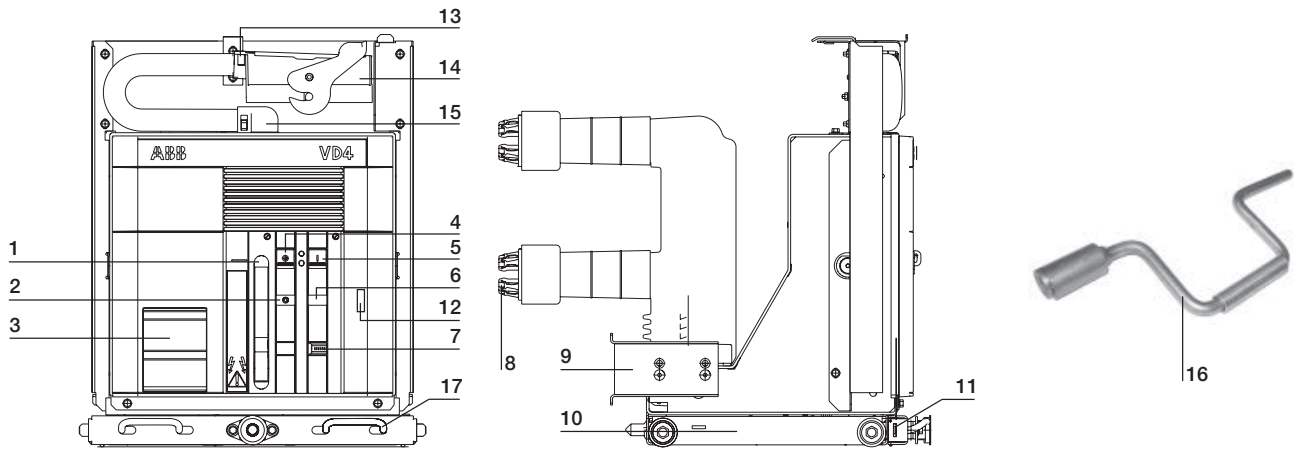
In the connected and isolated positions, the equipment remains inside the compartment with the door closed. The position can be seen from the inspection window of the switchgear. The front cross-beam allows the racking-in/isolating operation to be performed with the door closed by means of the dedicated lever.

The apparatus is complete with locks on the front cross-beam allowing it to be latched onto the corresponding slot-in joints in the compartment.

A lock prevents the truck from advancing into the switchgear when the earthing switch is closed. When the truck is in the intermediate position between isolated and connected, another lock prevents the circuit-breaker from closing (both mechanically and electrically). The truck is fitted with a locking magnet (RL2) which, if de-energized, prevents truck operation.

The cord with connector (plug) for connecting the auxiliary circuits to the instrument compartment projects from the upper part of the control cover.

The auxiliary circuits of the circuit-breaker and the connected and isolated position contacts of the truck are available on the circuit-breaker itself. Metal slides for operating the segregation shutter of the medium voltage upper contacts are fixed to the sides of the apparatus.



Key

1 Lever for manual loading of the closing spring
2 Circuit-breaker open/closed signalling device
3 Rating plate
4 Opening pushbutton
5 Closing pushbutton
6 Signalling device for closing spring loaded/discharged
7 Operation counter
8 Disconnecting contacts
9 Chute for operating the switchgear shutters
10 Truck
11 Locks for latching in the fixed part
12 Mechanical override of the undervoltage release (on request)
13 Strikers for operating the contacts in the enclosure
14 Connector (plug)
15 Wiring connection
16 Operating lever for circuit-breaker racking-in/out
17 Lock operating handles (11)

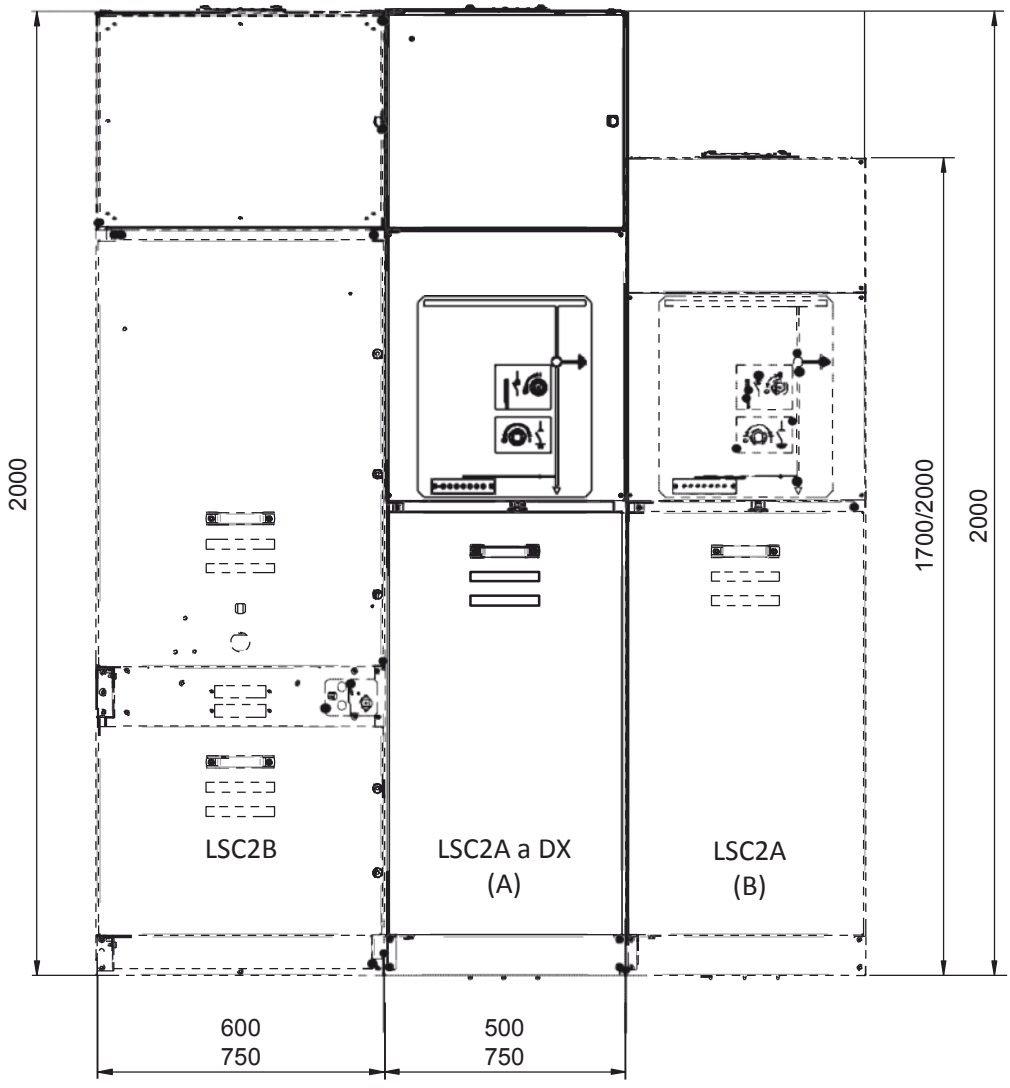
2. Typical UniSec units

2.4 Coupling typical units together

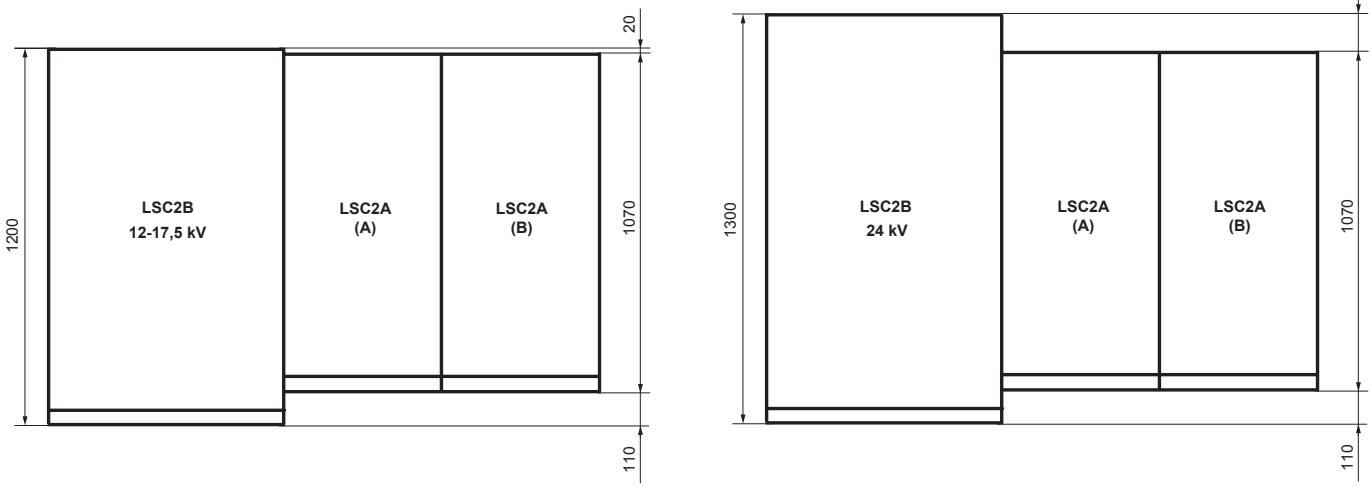
Direct coupling with LSC2A panels is not possible owing to the height of the omnibus busbars and the fact that LSC2B compartments are of a different type. An adapter panel that possesses all the characteristics of a standard panel and can therefore be used as an incoming/outgoing unit is required in this case.

2.4.1 Coupling layout

Front view



Plan view



2.4.2 Admissible coupling between units

With reference to the previous figure, coupling between LSC2B and LSC2A units is established on the basis of the configuration of the main busbars.
The table lists the admissible types of couplings:

LSC2A unit to be installed	Width (mm)	Unit in version with adapter panel (*) (A)		Standard unit (B). An additional adapter panel (A+B) is required for coupling purposes	
		LH(**)	RH(**)	LH(**)	RH(**)
SDC	375			•	•
	500	•	•		
	750			•	•
SDS	375			•	•
	500	•	•		
SDM	750			•	•
SDD	750			•	•
SFC	375			•	•
	500	•	•		
SFS	375			•	•
	500	•	•		
SBC / SBC-W	750	•			•
SBS / SBS-W	750				•
SBM	750			•	•
SBR	750			•	•
HBC	500			•	•
SFV	500	•	•		
DRC	375			•	•
	500	•	•		
DRS	375			•	•
	500	•	•		

(*) The adapter panel is only available in the H 2000 mm version

(**) Position in relation to the LSC2B unit

2.4.3 Coupling to other products

An adapter panel allowing UniSec switchgear to be coupled to the other ABB switchgear (UniMix, UniSwitch and UniAir) is available on request.

3. UniSec for Smart Grids

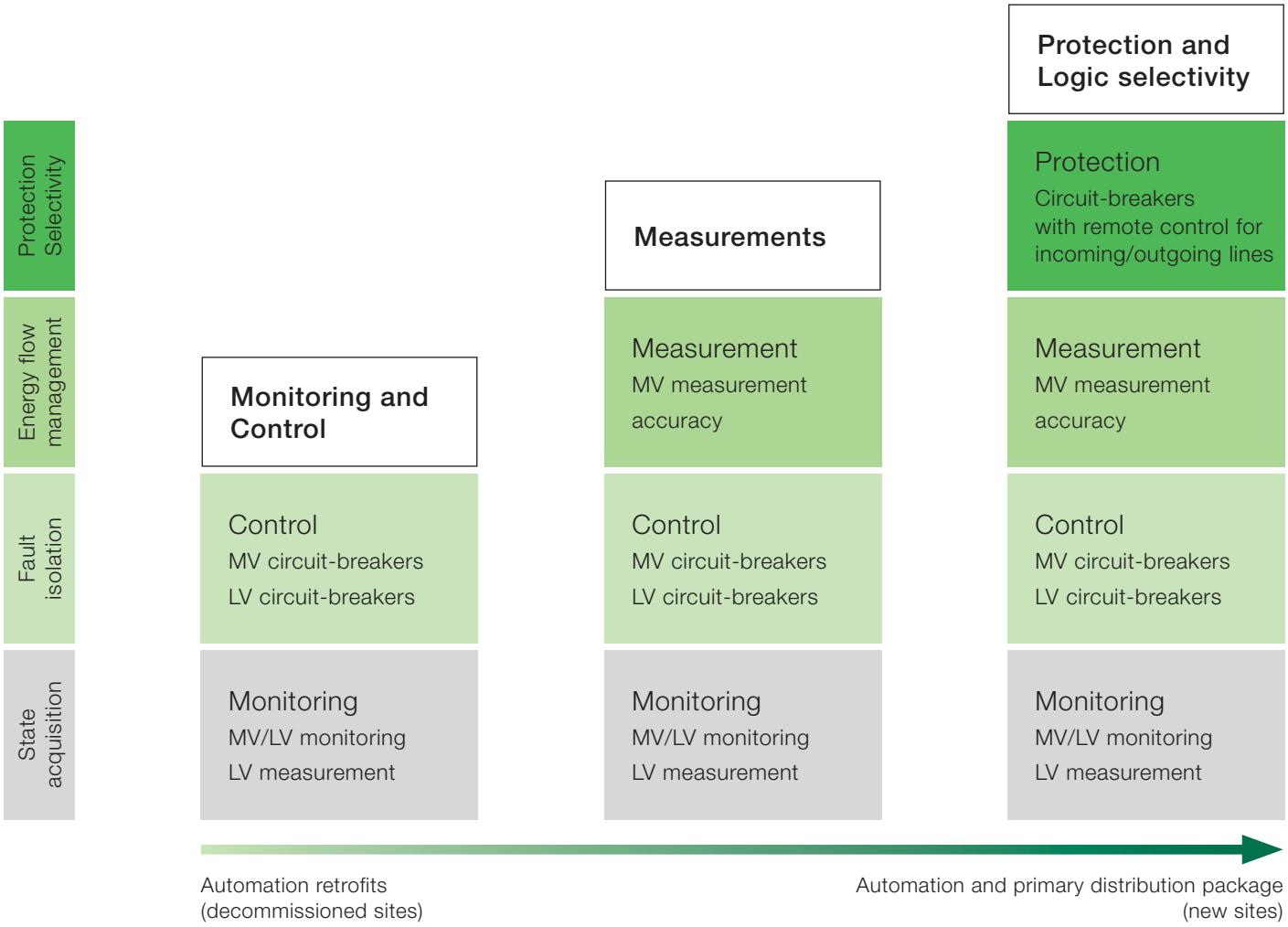
UniSec for Smart Grids (SG) is a medium voltage switchgear for 12, 17.5 and 24 kV systems equipped with an advanced line automation device (FA) which, when associated with other devices, e.g.: fault indicators (FPI), transmits various types of data to the remote control centers. This allows the main requirements of the electrical system to be met:

- Management of faults by reducing their duration and frequency
- Improvement of distributed power quality
- Handling of power flows on the basis of distributed generation.

Consult publication 1VCP000527 for further information.

3.1 Proposed levels

The UniSec for Smart Grids concept provides three pre-configured solutions depending on the degree of grid complexity and automation. They cover the most common grid configurations.

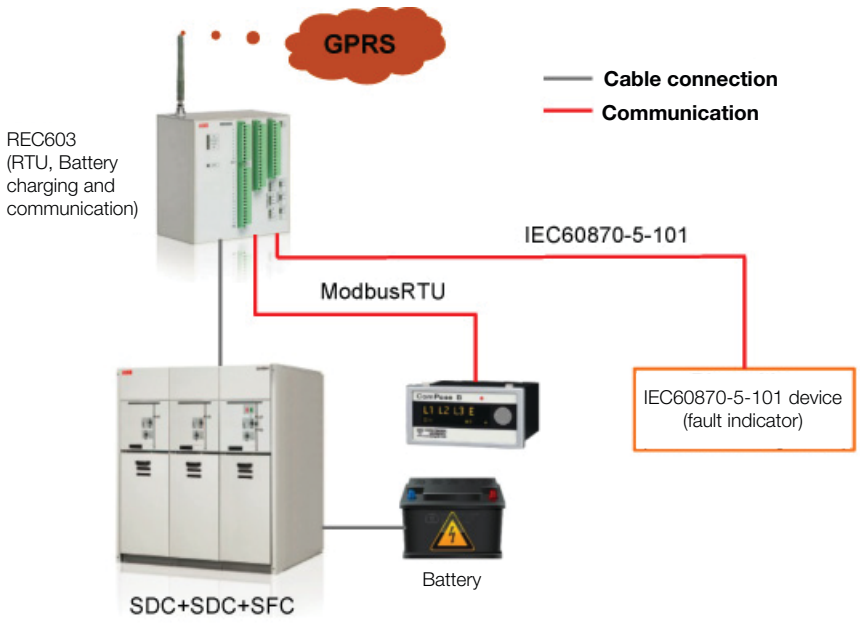


3.2 Monitoring and control

3.2.1 Functions

- Indication of the disconnector state
- Fault indication
- LV measurement
- Monitoring of substation conditions
- Remote control of disconnectors (motor-operated disconnectors)
- Remote configuration of the grid (motor-operated disconnectors)

3.2.2 Architecture

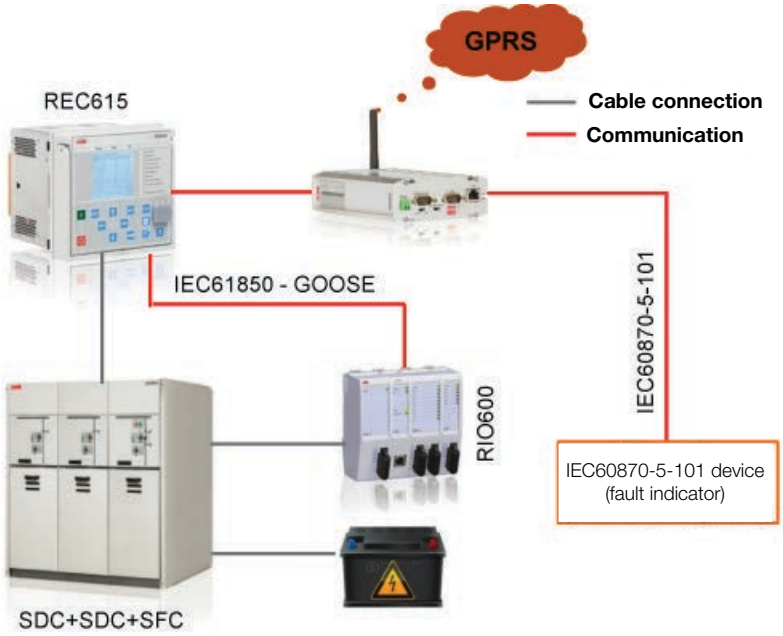


3.3 Measurements

3.3.1 Functions

- As monitoring and control unit
- High-precision MV measurement

3.3.2 Architecture



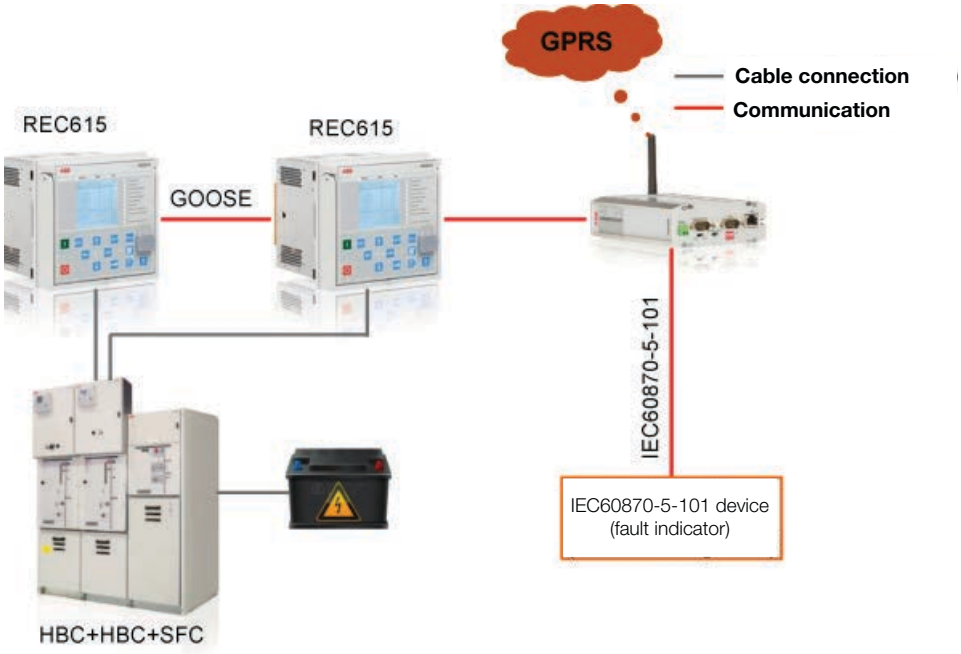
3. UniSec for Smart Grids

3.4 Protection and logic selectivity

3.4.1 Functions

- As measurement unit
- Protection
- Logic selectivity

3.4.2 Architecture



3.5 General information

3.5.1 Supervision of the LV side of the distribution transformer (optional)

- LV multimeters able to communicate via IEC 60870-5-101 protocol can be connected.

3.5.2 Power supply

All the secondary devices of the switchgear are energized by a 24 V DC battery. The battery is charged by its charger, which does not need an external power source:

- 90 to 264 V AC 50/60 Hz or 85 to 200 V DC in the case of “Monitoring and control” automation functions
- 115 V AC, 230-V AC- ±-20-% (48- to -62-Hz) in the case of higher level automation functions.

3.5.3 Battery life

The batteries installed in UniSec units last 10 years at 20°C ambient temperature. The batteries must be changed every 10 years after switchgear installation.

3.5.4 Environmental conditions

UniSec for Smart Grids is designed to operate at temperatures between -5 °C and +40 °C (consult ABB if the operating temperature is less than -25 °C). When installed in non-standard conditions, UniSec for Smart Grids requires regular inspections and maintenance operations to suit the type of environment.

4. UniSec for nautical applications

4.1 Description

The shipping market can be divided into four different segments:
- passenger ships (cruise liners and ferries)
- industrial vessels (tankers, drillships, oil tankers, freighters, etc.)
- platforms (oil platforms and rigs)
- navy.

In this sort of application, the temperature range, vibrations and buoyancy are particularly aggravating conditions that affect the functionality of the instruments on board, such as switchgear.
ABB is the leading manufacturer of air-insulated switchgear for applications installed by all the major shipyards (Brazil, China, Denmark, Finland, France, Germany, Japan, Korea, Italy, Norway, Singapore, Spain, United Kingdom and the United States). UniSec is suitable for 7.2-12 kV shipbuilding applications (option for 17.5 kV).
Over 10,000 ABB panels installed in vessels of all types, are in service throughout the world. Shipping registers and customers (shipyards or shipowners) need switchgear manufactured in compliance with the shipping register test requirements for the equipment on board.
This is why tests are performed to ensure compliance with the main provisions established by the shipping registers: DNV, LR, RINA, BV, GL and ABS.
To ensure the necessary structures and liveable conditions, large electric generating systems and monitoring equipment must be concentrated into very small spaces.

4.1.1 Main technical specifications

UniSec switchgear is the ideal technical solution for shipbuilding applications:
- the arc-proof structure, mechanical safety interlocks, automatic segregation shutters and closed-door apparatus control guarantee safe conditions for the personnel during installation, maintenance work and service
- metallic segregations between each cubicle are guaranteed and all components that can be accessed by the personnel are earthed: Apparatus, shutters, doors and the entire switchgear frame
- a high degree of fire resistance is ensured since plastic materials and resins are only used to a limited extent: the auxiliary apparatus and wiring are highly self-extinguishing
- the panels can operate at a permanent 25° inclination
- the outer enclosure features a high protection degree (up to IP42)
- Vibrations are in the 2…100 Hz frequency range at the following range of movement
  - 1 mm amplitude in the 2…13.2 Hz frequency range
  - 0.7 g acceleration amplitude in the 13.2…100 Hz frequency range.

4.1.2 IEC electrical specifications

Rated voltage Ur (*)	kV	7.2	12
Rated test voltage (at power frequency for 1 min) Ud	kV	20	28
Rated impulse withstand voltage Up	kV	60	75
Rated frequency	Hz	50/60	50/60
Admissible rated short-time withstand current	kA (3s)	16/21/25	16/21/25
Rated peak current	kA	40/50/62.5	40/50/62.5
Rated internal arc withstand current	kA (1s)	16/21/25	16/21/25
Rated busbar current	A	630/800/1250	630/800/1250
Rated current of circuit-breaker	A	630/800/1250	630/800/1250

(*) Consult ABB for 17.5 kV

Notes:
– The values indicated are also valid for vacuum circuit-breakers
– For panels with contactor, the rated current value is max 400 A for 12 kV

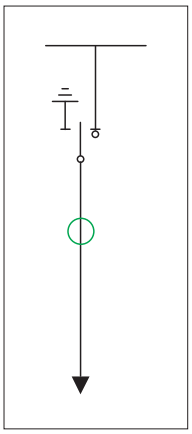
4. UniSec for nautical applications

4.2 Typical nautical units

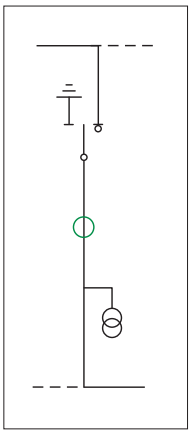
The typical units used in naval applications are a minimum 500 mm in width and are:

LSC2A

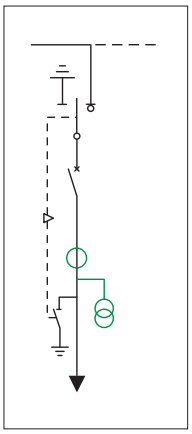
SDC



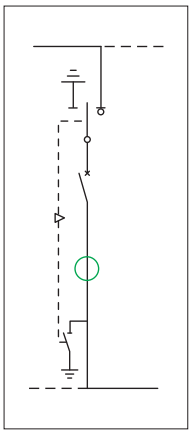
SDS



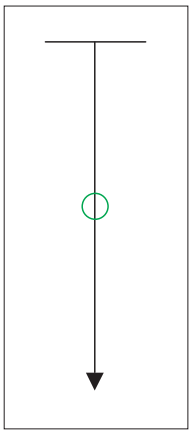
SBC



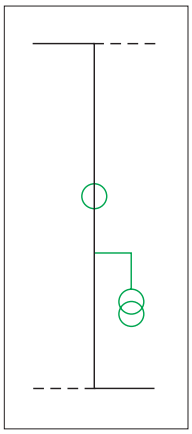
SBS



DRC

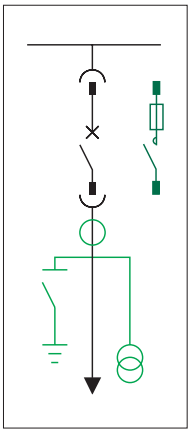


DRS

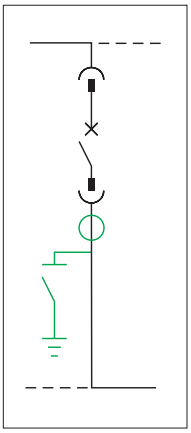


LSC2B

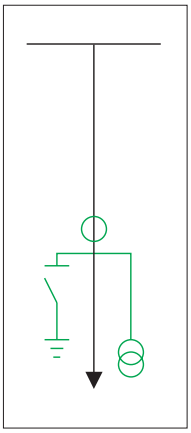
WBC



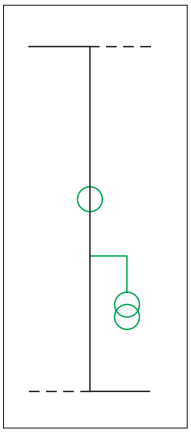
WBS



BME



DRS



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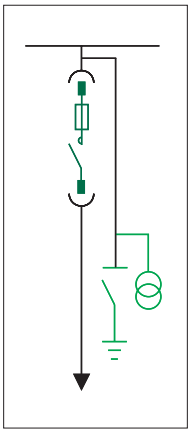


4.3 Certifications

The nautical version of the switchgear has passed the type-approval tests required by the Shipping registers, especially those concerning vibration and static inclination at 22.5°. The type-approval certificates are available on request.

5. Additional tests

5.1 Seismic test

In zones where the risk of earthquakes is high, the vibrations created by quakes affect the behaviour of the switchgear.
Standard IEC 62271-2102 establishes 3 stress tolerance levels.
Units WBC, WBS, SDC, SFC, SBC, SDS are guaranteed up to Severity Level 2, equivalent to the IEEE 693 high performance level.
Severity Level 2 is recommended for accelerations up to 1 g and for installations on the top floors of buildings.
During the test, the shape of the spectrum (Required Response Spectra, or RRS) is such as to simulate the various conditions of intensity, depth and distance from the epicenter of the earthquake.

5.2 Ageing test

The ageing test accelerates switchgear wear by means of a climatic chamber.
This allows the useful life of the switchgear to be assessed (30 years according to estimates), thereby ensuring that the operating mechanisms function correctly and the absence of electric discharge even when the humidity level is high.
In accordance with standard IEC 62271-304, some of the LSC2A units (SDC, SBS, DRS and SFC) have been tested up to level 2, corresponding to seven climatic cycles performed in seven days.

5.3 Type-approval for factory-made substations

Validation tests in accordance with standard IEC 62271-202 have been performed so as to allow UniSec switchgear to be installed in factory-made substations in safe conditions.
2 types of accessibility have been certified by means of internal arc tests: type A and type B, allowing work to be performed in complete safety near the units while they are in service conditions.

6. Technical specifications

6.1 Materials

Components of the units		Material and/or processes
Enclosure and internal segregations		Galvanized steel sheet (EN 10346-DX51D+Z275-N-A-C). Thickness of main structure: 2 mm
Doors and end panels		60 to 100 µm powder paint coating with anti-corrosion treatment [salt spray test 500 h (UNI 9862)(*)] Finish, RAL 7035 colour(**), smooth appearance
Busbars		
Main busbars	LSC2A	Flat electrolytic copper busbars with the following sections: 1 (one) 30x10 mm for 630 A 1 (one) 40x10 mm for 800 A 2 (two) 40x10 mm for 1250 A
	LSC2B	Flat electrolytic copper busbars with the following sections: 1 (one) 40x10 mm for 630 A 2 (two) 40x10 mm for 1250 A
Earthing busbars		Electrolytic copper, section 75 mm^2

(*) Resistance refers to paint coating only
(**) Special colours following agreement

6.2 Protection degree (IP code)

For enclosure and operating mechanism	Standard	IP 3X
	On request	IP 31/ IP 32/ IP 4X/ IP 41/ IP 42
For segregations between compartments		IP 2X

6.3 Operating conditions

6.3.1 Normal operating conditions

The switchgear is designed for use in normal operating conditions indoors, as indicated in the respective IEC standards. Any differences with respect to the normal conditions specified in the IEC standards (IEC 62271-1) must be defined separately with the manufacturer.

Ambient temperature	°C
Maximum value	+40°
Max. mean value in 24 hours	+35°
Min. mean value in 24 hours	-5° (1)
Recommended minimum value	+5
Storage temperature	-5 °C / +70 °C
Altitude above sea level	m
Maximum value	1000 (2)
Humidity conditions	%
Mean relative humidity value (24 hours)	≤95
Mean relative humidity value (1 month)	≤90

(1) Consult ABB for –25 °C operating temperatures and –40 °C storage temperatures
(2) Apply the relative derating value for altitudes above 1000 m

6.3.2 Special operating conditions

Voltage derating

Altitude effects

The effects of the reduction in the dielectric strength of the insulating air must be considered at altitudes exceeding 1000 m. Standard IEC 62271-1 has established correction factor K_a, which should be applied to the insulation voltage values depending on the altitude and which can be calculated by the following equation:

$$K_a = e^{m\,(H-1000)/8150}$$

where

H represents the altitude in meters

m is a constant worth 1 for the impulse withstand voltage and power-frequency test voltage

NOTE

Owing to the components installed inside it, UniSec switchgear can be used up to a maximum altitude of 3000 m above sea level by applying the appropriate correction factor. Consult ABB if the altitude is higher.

Several K_a values are given in the table below

Altitude H [m]	Ka
1500	1.06
2000	1.13
2500	1.20
3000	1.28

Example

As required by standard IEC 62271-1 (table 1a), the peak impulse withstand voltage value of switchgear with 17.5 kV rated voltage is 95 kV. When this switchgear is put into service at an altitude of 2500 m, the impulse withstand voltage value it must comply with becomes 95 kV x 1.13 = 107.35 kV. Owing to the effect of this altitude, the switchgear in question no longer meets the insulation requirements and, according to the provisions established by the standard, one with 24 kV rated voltage is required even though it is in service at 17.5 kV.

6. Technical specifications

Current derating

Temperature effects

Environmental temperature rises must be compensated when the busbars, branches and components are re-designed, otherwise the current carrying capacity will appear limited when the following derating factor is applied.

Ambient temperature [°C]	Derating factor on Ir
45	0.95
50	0.91
55	0.83
60	0.79
65	0.76

Danger

Condensation could form if the switchgear is in service where the humidity level is high and/or there are considerable differences in temperature. However, the formation of condensation must be an exception to the rule in the normal operating conditions of indoor switchgear. Adequate preventive measures must be taken along with the manufacturer (e.g. installation of electric heaters) to avoid the formation of condensation and, consequently, corrosion or other adverse effects. The operating system of the heaters depends on the relative design, while the specifications must be taken from the order documents.

IP degree effects

Is applied to LSC2B units with Ir = 1250 A and Ur 12.5-17 kV in the non-internal arc version (IP3x) or internal arc with filters version.

IP degree	Derating factor on Ir
IPX1	1
IPX2	0.95

Example

LSC2B unit, Ir = 1250 A and Ur 17kV, installed at T = 45 °C for which the IP32 degree is required. Depending on various factors, the effective rated current of the switchgear is calculated in the following way:

$$k_T = 0.95 \text{ at } 45\ ^\circ\text{C}$$
$$k_{IP} = 0.95 \text{ for IP32}$$
$$I = 1250 \cdot 0.95 \cdot 0.95 \cong 1130 \text{ A}$$

6.4 Internal arc classification (IAC)

Standard IEC/EN 62271-200 establishes criteria for the safety of personnel against internal arcs by means of IAC classification.

High mechanical strength and devices that exhaust the gas produced by the arc provide a good level of safety against internal arcs. However, the safety level can be increased to a further extent by using active production methods so as to rapidly extinguish the arcs.

The electric arc protection system with integrated monitoring sensor offers extremely fast and selective protection for the busbars, depending on the zone.

The REF615 line protection relay also provides an optional arc fault protection function.

6.4.1 Available solutions

UniSec switchgear is available in the following versions(*).

(*) A panel without the internal arc-proof feature is available on request.

UniSec LSC2A

Arcing time and current	Accessible sides	Solutions			
		Wall-mounted	Filter	Duct with exhaust pointing downwards	Standard duct
12.5 kA (1s)	AFL/AFLR	•	•	•	•
16 kA (1) (1s)	AFLR		•	•	•
21 kA (1s)	AFLR		• (2)	•	•
25 kA (3) (1s)	AFLR				•

(1) For HySec 16 kA (1s)/40 kAp
(2) Only for H 2000 panel
(3) Only for 12 kV panel, height 2000 mm and width 750 mm (excluding units SBC-W, SBS-W, SDD, UMP and SBR)

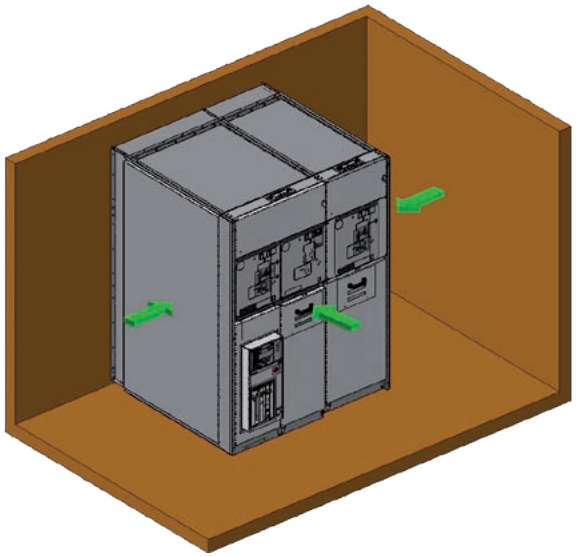
UniSec LSC2B

Arcing time and current	Accessible sides	Solutions			
		Wall-mounted	Filter	Duct with exhaust pointing downwards	Standard duct
21 kA (1s)	AFLR		•		•
25 kA (1) (1s)	AFLR		•		•

(1) Only for Ur up to 17.5 kV

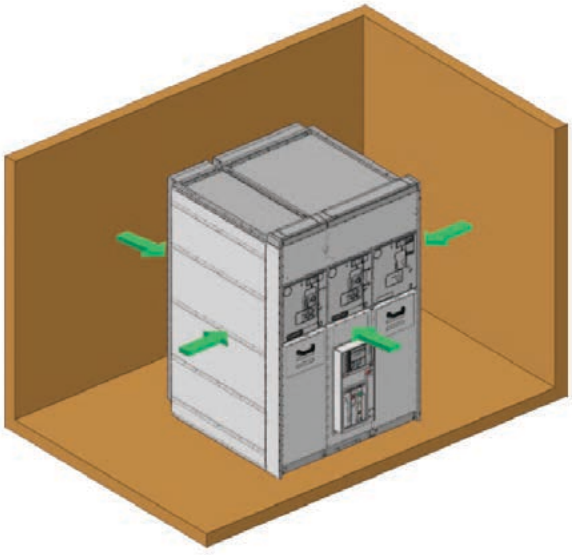
6.4.2 Switchgear completely against a wall (Ultralight)

Thanks to closing components on the top and sides of the switchgear, this version allows a single gas exhausting compartment to be created by using the rear of the switchgear and the wall. Internal arc protection is guaranteed on 3 sides of the switchgear, front and lateral. It is forbidden to access the rear of the switchgear during service.



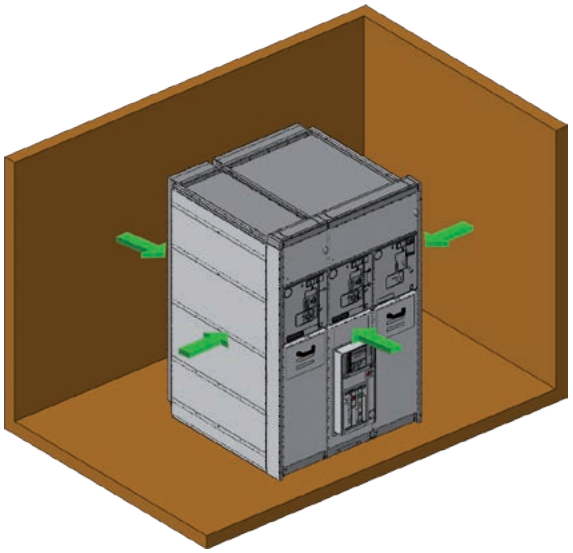
6.4.3 Filter

The switchgear can be positioned against a wall or in the middle of the room. Each individual unit is equipped with a single filter for arc-proofing purposes, thereby guaranteeing protection on 4 sides. In this case, the gas is conveyed into the filter, which cools it and lowers its pressure before it is relased into the switchgear room.



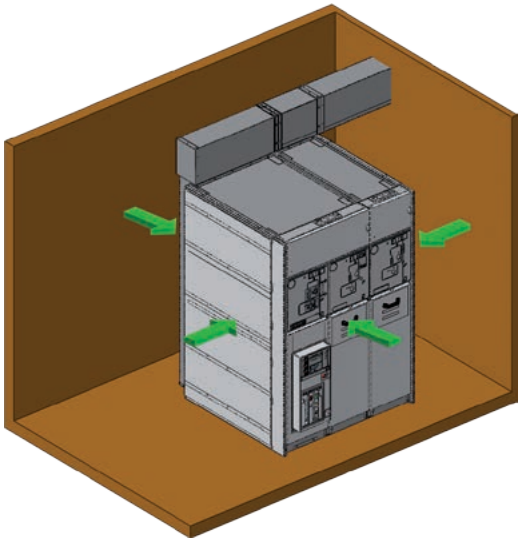
6.4.4 Duct with gas exhaust pointing downwards

The switchgear can be positioned against a wall or in the middle of the room. Each individual unit is equipped with a single filter for arc-proofing purposes, thereby guaranteeing protection on 4 sides. In this case, the gas produced by the internal arc is directed into the shaft. There is an exhaust for each panel. Additional work in the installation site is not required.



6.4.5 Standard duct (Upwards)

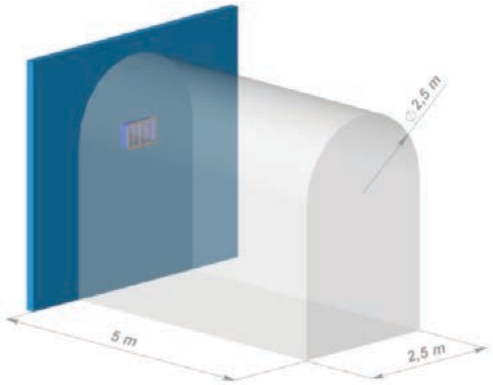
In this solution, the switchgear can be positioned against a wall or in the middle of the room. Internal arc fault protection is guaranteed on 4 sides.



6. Technical specifications

The switchgear is supplied with a duct at least 1-meter in length through which the gas is exhausted.
The recommended method for preventing overpressure and gas in the rooms is to route the duct outdoors and to close it with the end-piece to prevent water, dirt and small animals from entering. The excess part outside the building can be removed.

To guarantee safe conditions for persons and to preserve the integrity of the buildings, an inaccessible venting area must be provided at the duct outlet, sized as described below.

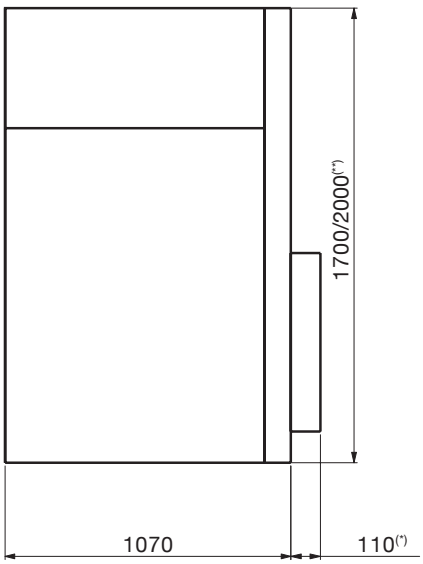


6.5 Overall dimensions of panels

The main dimensions of the units are illustrated in the following drawings.

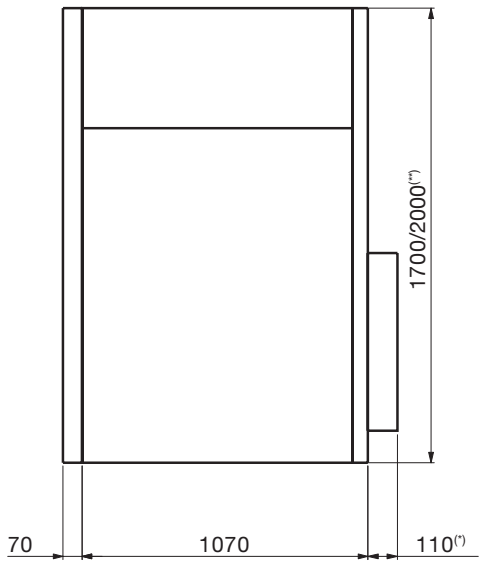
6.5.1 Side view of the units

UniSec LSC2A



(*) For panels with removable circuit-breaker
(**) Not available for SBR and UMP units

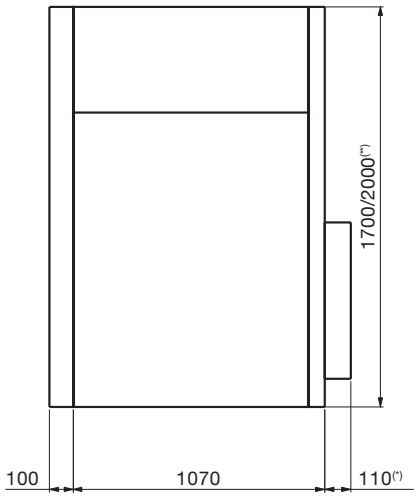
Side view of IAC and A-FL 12.5 kA 1s
(solution installed completely against a wall)



(*) For panels with removable circuit-breaker
(**) Not available for SBR and UMP units

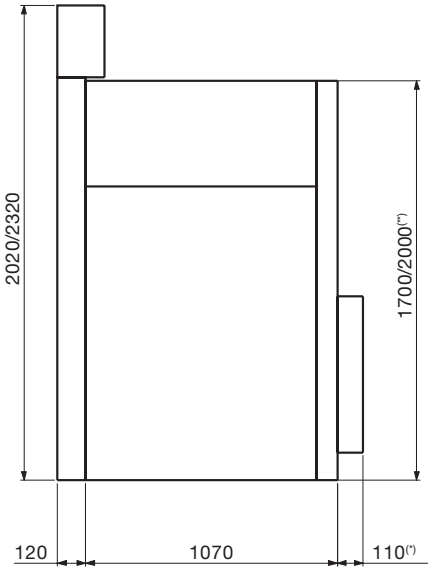
Side view of IAC A-FL 12.5 kA, with filters

UniSec LSC2A



(*) For panels with removable circuit-breaker
(**) Not available for SBR and UMP units

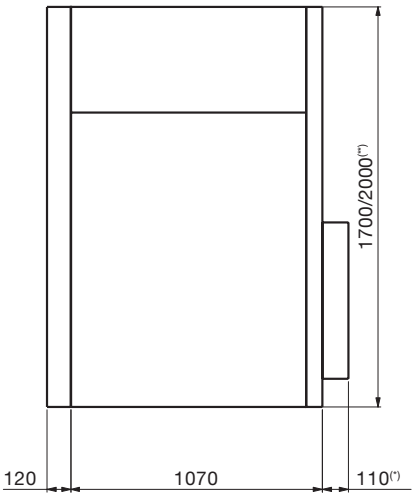
Side view of IAC A-FLR 16 kA, with filters



(*) For panels with removable circuit-breaker
(**) Not available for SBR and UMP units

Side view of IAC A-FLR 21 kA and 25 kA(1), with duct

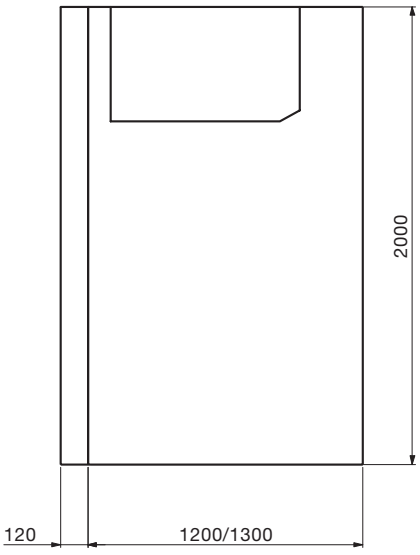
(1) only for 12 kV H2000 mm and 750 mm width (excluding units SBC-W, SBS-W, SDD, UMP and SBR)



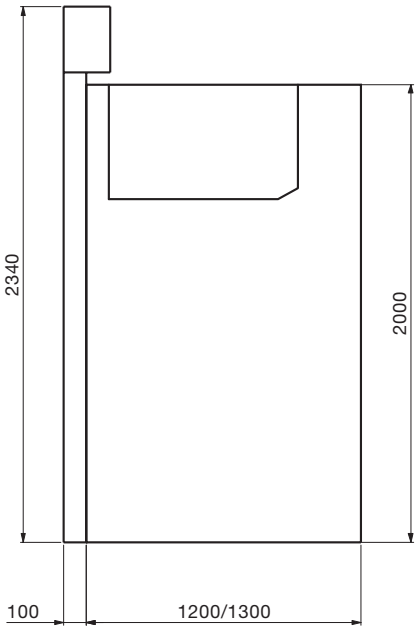
(*) For panels with removable circuit-breaker
(**) Not available for SBR and UMP units

Side view of IAC A-FLR 21 kA, with gas exhaust pointing downwards

UniSec LSC2B



Side view for panels with withdrawable circuit-breaker, IAC A-FLR 25 kA, 1s up to 17.5 kV and IAC A-FLR 16 kA, 1s at 24 kV with filters



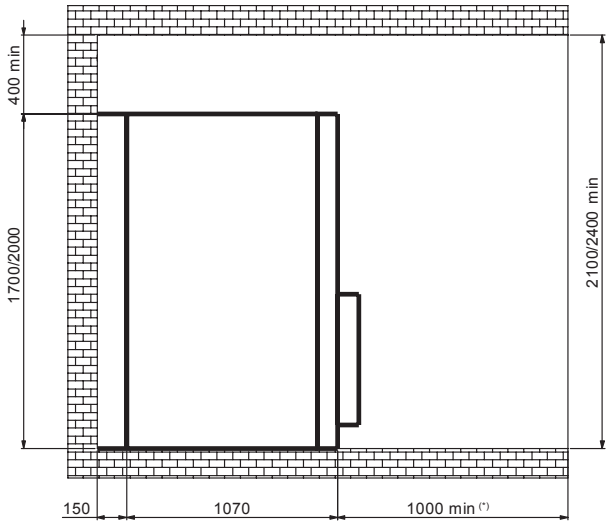
Side view for panels with withdrawable circuit-breaker, IAC A-FLR 25 kA, 1s up to 17.5 kV and IAC A-FLR 21 kA, 1s at 24 kV with duct

6. Technical specifications

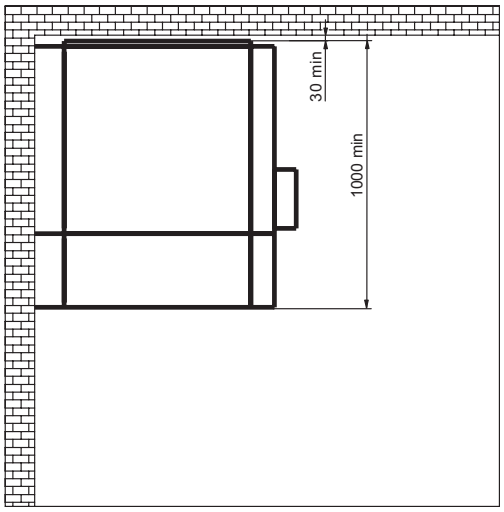
6.6 Installation instructions

6.6.1 Room layout for LSC2A units

Side view



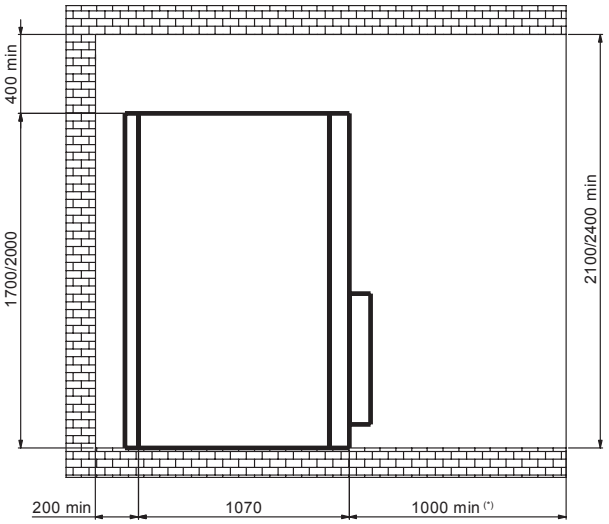
Plan view



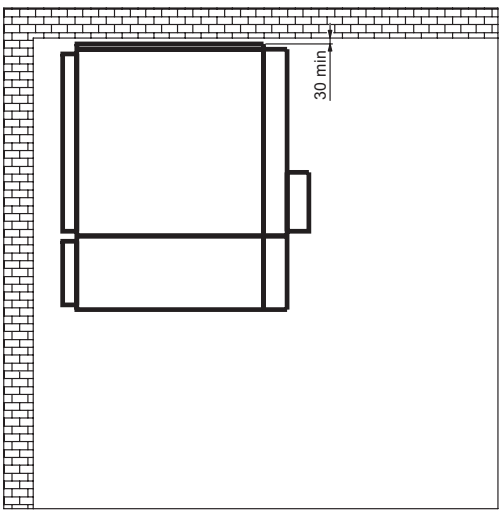
(*) 1300 mm at least for panels with circuit-breaker

Minimum distances from walls of installation room with gas venting compartment at rear, solution IAC A-FL 12.5 kA 1 s against wall

Side view



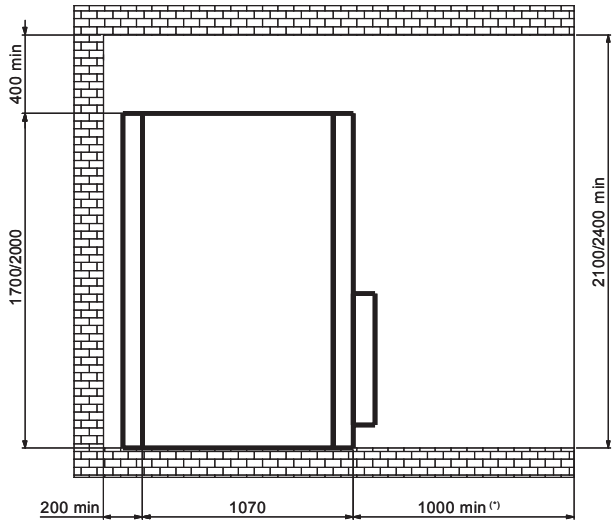
Plan view



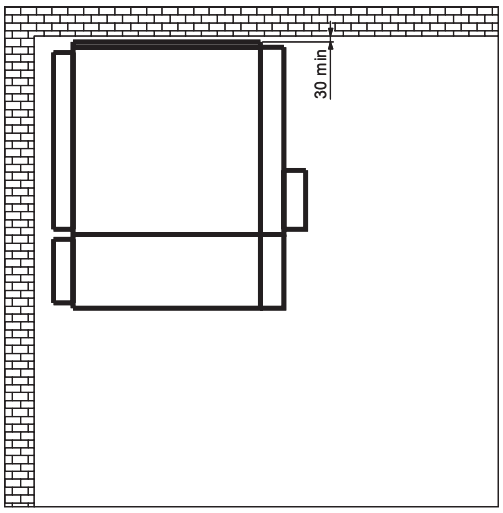
(*) 1300 mm at least for panels with circuit-breaker

Minimum distances from walls of installation room, solution IAC A-FL 12.5 kA 1s with filters installed on each individual unit

Side view



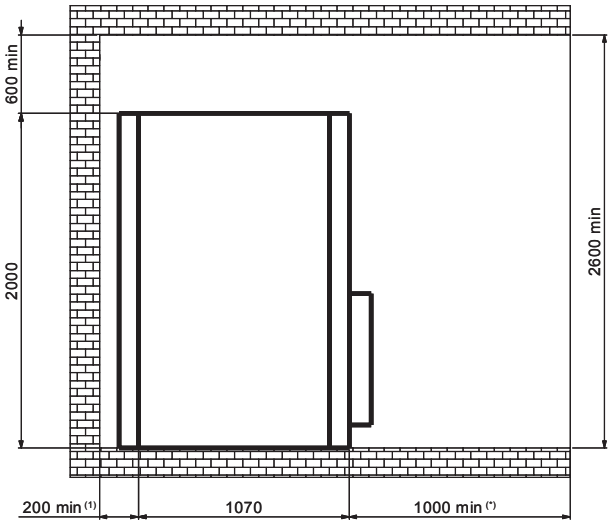
Plan view



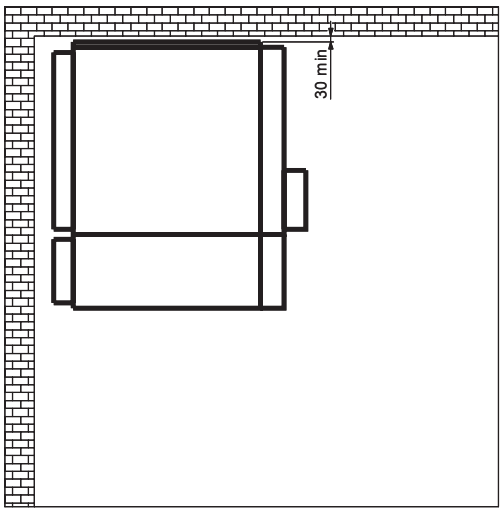
(*) 1300 mm at least for panels with circuit-breaker

Minimum distances from walls of installation room, solution IAC A-FLR 16 kA 1s with filters installed on each individual unit

Side view



Plan view

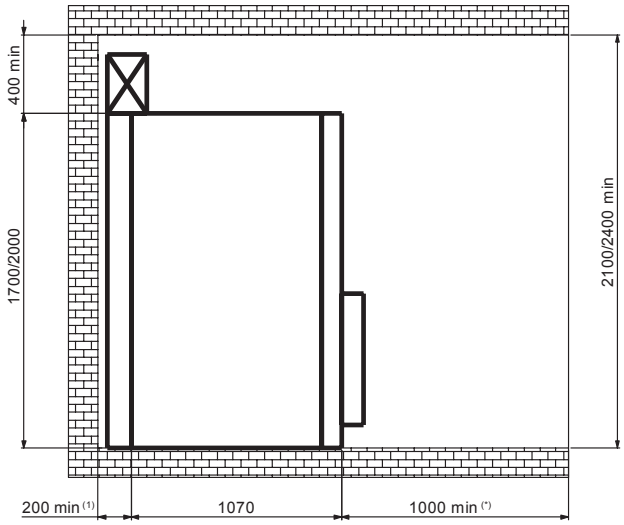


(*) 1300 mm at least for panels with circuit-breaker
(1) Consult ABB for special installation conditions

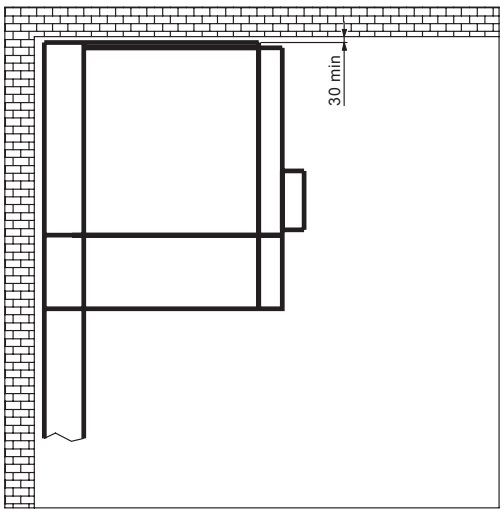
Minimum distances from walls of installation room, solution IAC A-FLR 21 kA 1s with filters installed on each individual unit

6. Technical specifications

Side view



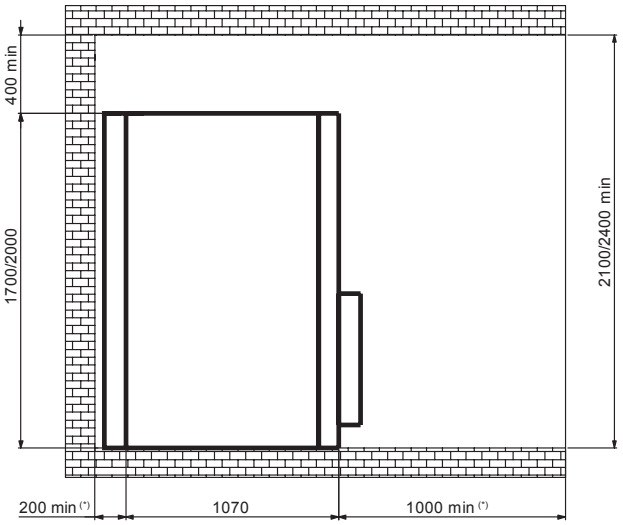
Plan view



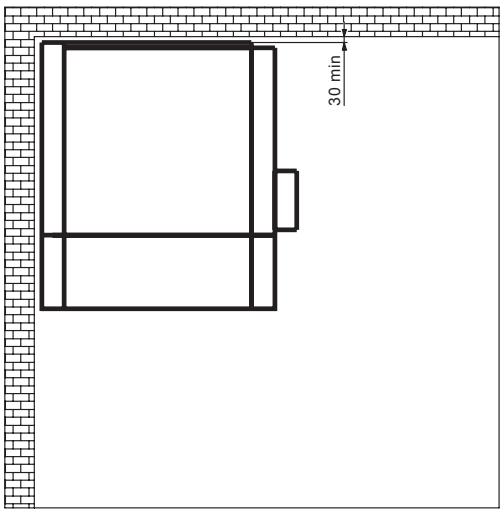
(*) 1300 mm at least for panels with circuit-breaker
(1) Consult ABB for special installation conditions

Minimum distances from walls of installation room, solution IAC A-FLR 25 kA 1 s with gas exhaust duct

Side view



Plan view

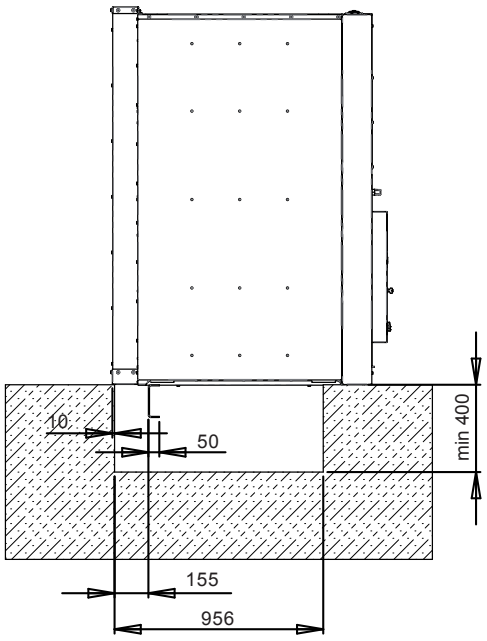


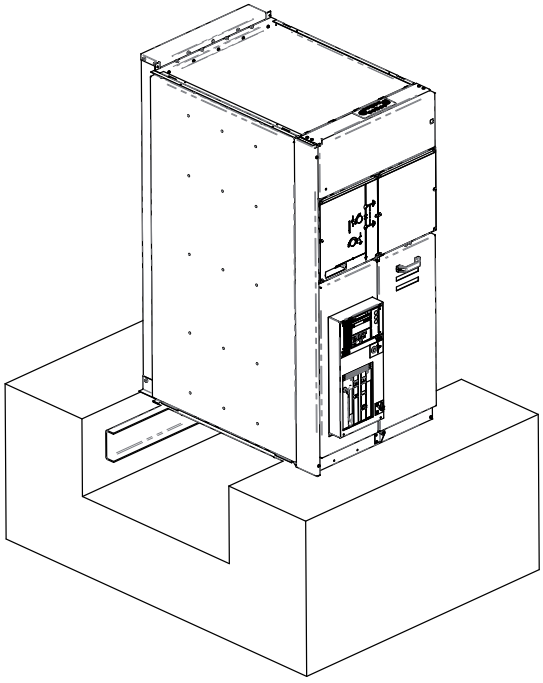
(*) 1300 mm at least for panels with circuit-breaker

Minimum distances from walls of installation room, solution IAC A-FLR 21 kA 1 s with gas exhaust duct pointing downwards

6.6.2 Gas exhaust pointing downwards

Installation example with shaft dimensions. The shaft is a civil engineering work and must be fit to bear the weight of the switchgear. Holes must be drilled in the bearing members to fix the switchgear in place.

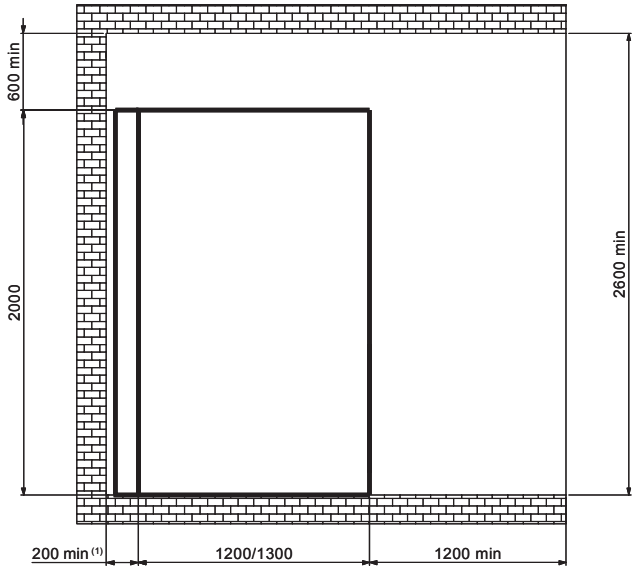




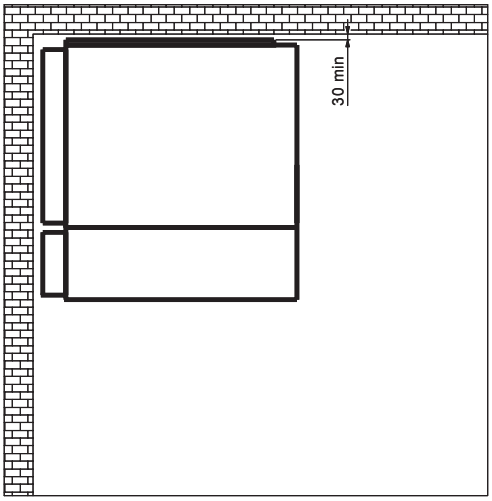
6. Technical specifications

6.6.3 Room layout for LSC2B units

Side view



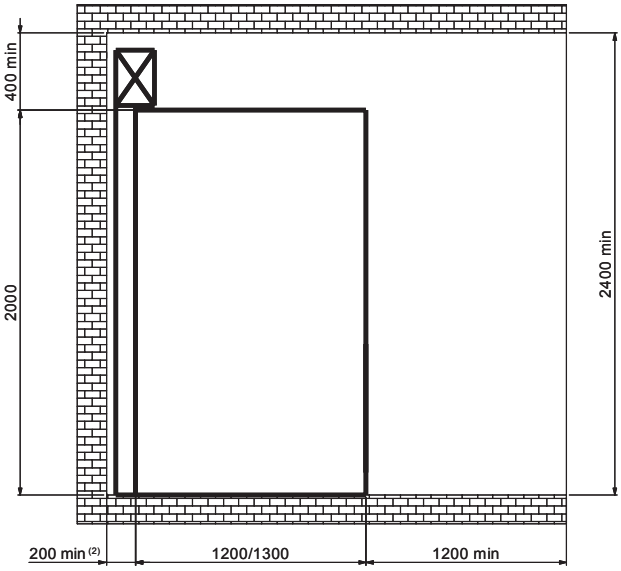
Plan view



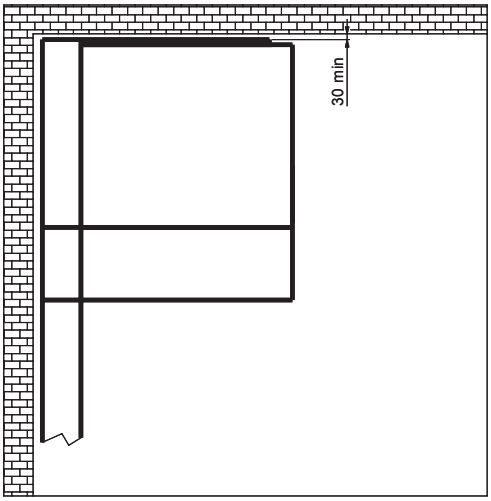
(1) Consult ABB for special installation conditions

Minimum distances from walls of installation room, solution IAC A-FLR 25 kA, 1s @ 12-17.5 and 16 kA, 1s @ 24 kV with filters installed on each individual unit

Side view



Plan view



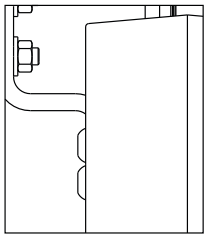
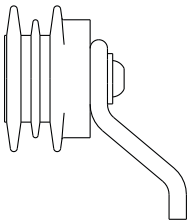
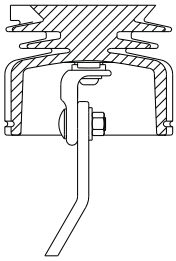
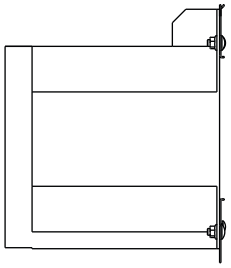
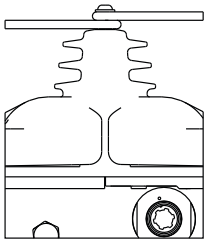
(1) Consult ABB for special installation conditions

Minimum distances from walls of installation room, solution IAC A-FLR 25 kA, 1s @ 12-17.5 and 21 kA, 1s @ 24 kV with gas exhaust duct

6.6.4 Tightening torque values for the joints

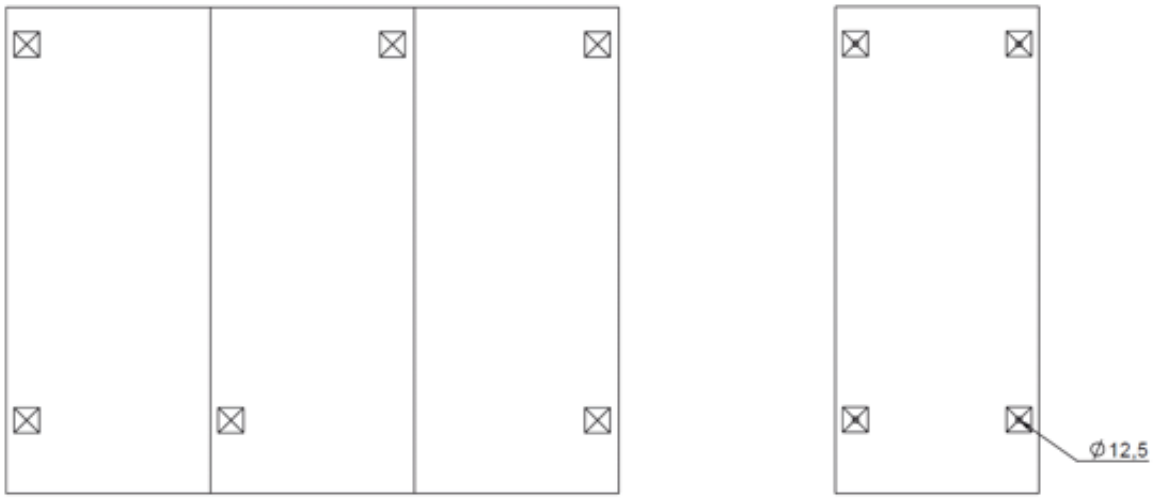
Type of joint			Tightening torque [Nm]					
			M5	M6	M8	M10	M12	M16
1	Bolts on the CT, TPU type	min.	2.8		16		56	
		nominal						
		max.	3.5		20		70	
2	Bolts on electrical jaw contacts	min.		8				
		nominal		9				
		max.		10				
3	Cable connection nut	min.			18	35	65	170
		nominal			20	40	70	180
		max.			22	45	75	190
4	Connections in busbar	min.			18	35	65	170
		nominal			20	40	70	180
		max.			22	45	75	190
5	Bolts on circuit-breaker	min.						
		nominal			30	40		
		max.						

6. Technical specifications

Type of joint			Tightening torque [Nm]					
			M5	M6	M8	M10	M12	M16
6	Bolts on the "Mandolino" CT 	min.						
		nominal				35		
		max.						
7	Bolts on post insulator 	min.					25	
		nominal			9	20	30	
		max.					31	
8	Bolts on connection and switching busbar 	min.					56	
		nominal				35	60	
		max.					70	
9	CT mounting bolts 	min.						
		nominal				40		
		max.						
10	GSec and busbar 	min.						
		nominal				35		
		max.						

6.7 Foundations

The switchgear must be built on a foundation that complies with the 2x1000 flatness requirement in relation fo switchgear length. Since it is difficult to built a concrete foundation that complies with this flatness requirement, adjustments are made by means of a metal frame or by installing steel plates under the corners of the units.
The bearing capacity of the floor and foundation must also be sufficient.
The switchgear must be fixed on a level with the holes in the bottom of the unit (2 welding seams/unit) or with two bolts/unit straight onto the floor.
The switchgear can be fixed to the concrete floor with jack bolts, on a metal frame and on a raised floor.
The switchgear must be fixed in place as shown in the figure.



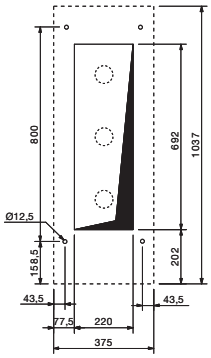
6. Technical specifications

6.8 Cables

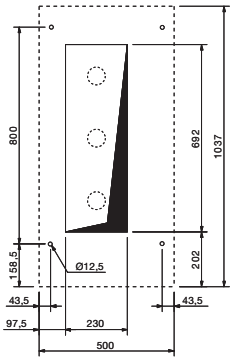
6.8.1 Cable routing and fixing points of the units

The following figures illustrate the positions and dimensions of the holes for routing the cables under the various units. These holes must be made before the switchgear is installed. The figures also show the switchgear fixing points.

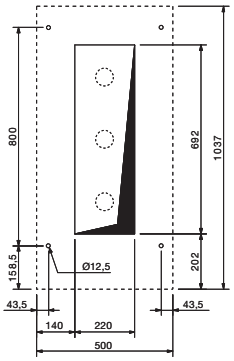
There is one fixing point in each corner of the unit (4 per unit). The dimensions and fixing points of units without cable entrance holes depend on the width of the units themselves. 10 mm anchoring bolts can be used for fixing.



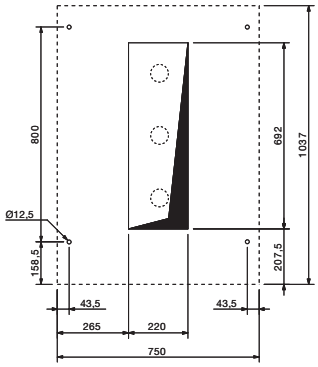
Units 375 mm in width



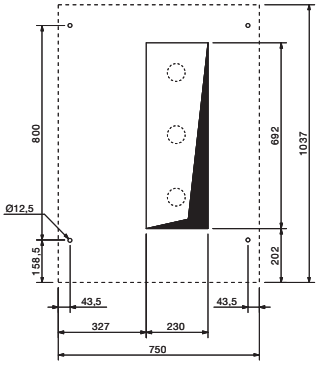
500 mm width for DRC unit



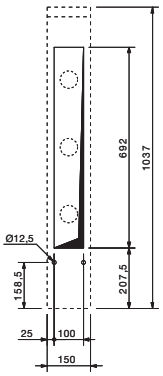
Units 500 mm in width



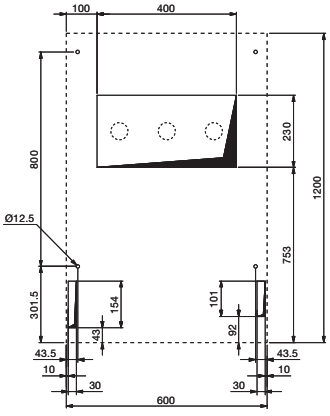
750 mm width for SBR unit



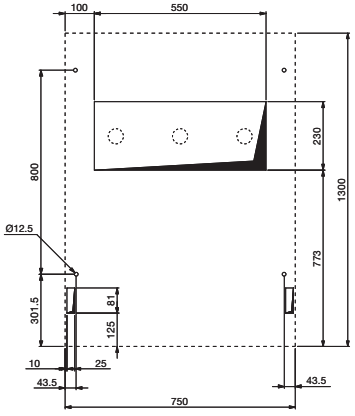
Units 750 mm in width



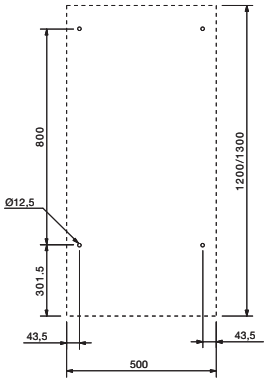
190 mm width for RLC/RRC units (only for SBR)



600 mm width for units with ithdrawable circuit-breakers up to 17.5 kV
WBS and BME without cable outlet



750 mm width for units with withdrawable circuit-breakers up to 24 kV
WBS without cable outlet



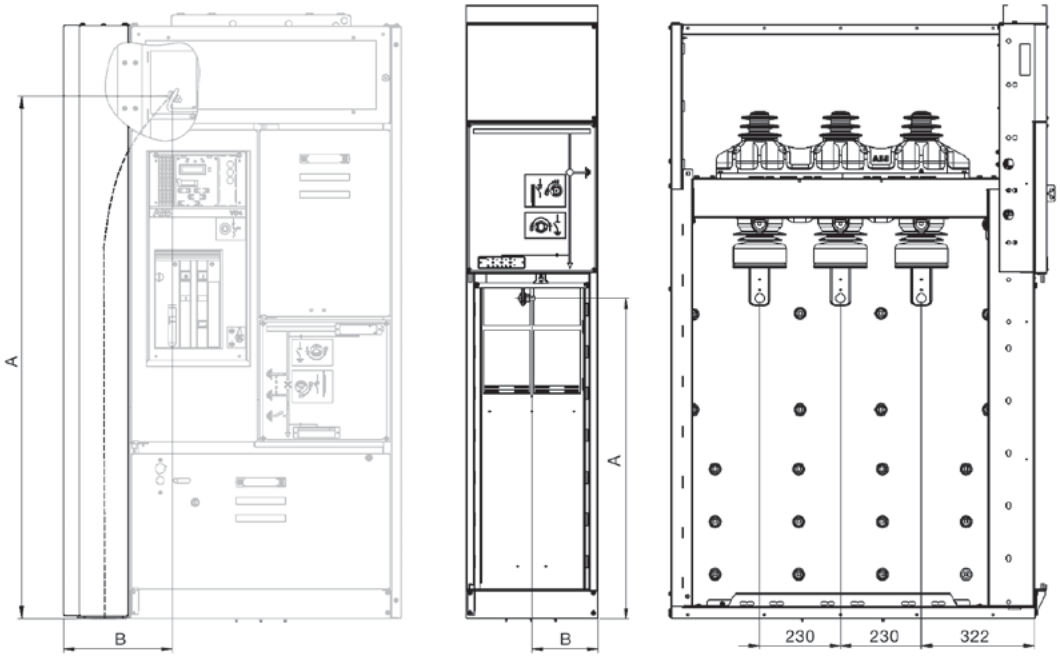
DRS for WBC/WBS/BME

6.8.2 Medium voltage cable positions and lengths

The lengths of the medium voltage cables used (distance between the cable connection point and the floor) depend on the units and accessories.

The figures and tables below show the lengths and positions of the cables for the different units.

LSC2A units



RLC/RRC units | LSC2A units (front) | LSC2A units (side)

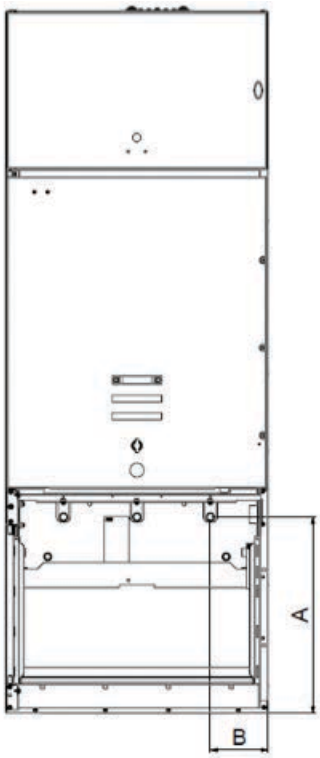
Medium voltage cable positions and lengths

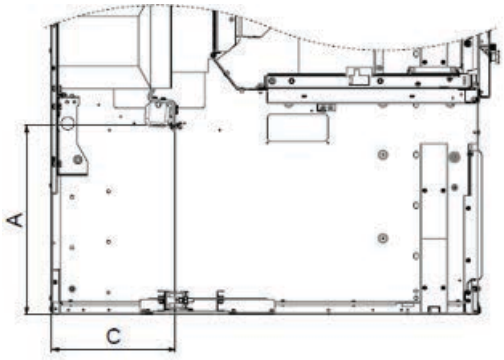
	Details	Width 190 mm		Width 375 mm		Width 500 mm		Width 750 mm	
		A (mm)	B (mm)	A (mm)	B (mm)	A (mm)	B (mm)	A (mm)	B (mm)
SDC	Base	–	–	920	210	920	275	–	–
	With CT	–	–	–	–	530	275	530	265
SDM	Base	–	–	–	–	–	–	525[1]	275[1]
SDD	Base	–	–	–	–	–	–	920	210
SFC	292 mm fuse	–	–	600	200	600	240	570	400
	442 mm fuse	–	–	450	200	450	240	570	400
SBC/ SBC-W	Base	–	–	–	–	–	–	610	355
	With CT	–	–	–	–	–	–	500	340
DRC	Base	–	–	870	180	670	240	–	–
	With CT	–	–	–	–	530	275	–	–
SBR	Base	–	–	–	–	–	–	400	390
UMP	With CT	–	–	–	–	–	–	550	270
HBC	Base	–	–	–	–	608	275	–	–
	With CT	–	–	–	–	460	325	–	–
	With Kevcr sensor	–	–	–	–	583/450[2]	275	–	–
RLC/RRC H1700	Base	1520	265	–	–	–	–	–	–
	With SBR	1495	310	–	–	–	–	–	–
	With HBC	1435	280	–	–	–	–	–	–
RLC/RRC H2000	Base	1645	305	–	–	–	–	–	–

[1] With optional cable terminal
[2] Central phase (L2)

6. Technical specifications

LSC2B units





Medium voltage cable positions and lengths

	Details	Width 600 mm			Width 750 mm		
		A (mm)	B (mm)	C (mm)	A (mm)	B (mm)	C (mm)
WBC/BME	Base or with CT	600	150[1]	332	600	165[1]	367

[1] Distance between side wall of panel and first cable connection

6.8.3 Cable terminations

- Applied cold
- Usable in confined spaces
- Special tools not required
- Factory-made for easy, safe installation
- Minimum cable stripping
- Active pressure
- Few components
- Long-life

General aspects

The power cables used for the switchgear need adequate terminations. The power cable has an aluminium or copper conductor, insulation made of polymeric material, an extruded insulating sheath, a metal braid, an armature (optional) and a protective external polymeric sheath.
Good mechanical connection between the cable conductor and busbar must be provided so as to ensure a safe and reliable current capacity. To do this, ABB offers specially designed mechanical terminals that are screwed on in order to adapt to the cable conductor.
It is also essential to guide the electric field produced by the cables in the proper way. ABB supplies rubber ends applied cold which provide active pressure around the cable. If the cable has a copper-free metallic braid, a special earthing kit must be used so that fault currents can be managed properly.

SOT type Kebledon cable terminations with bimetal cable terminal type SKSB

If applied, cable armatures must guarantee the same earthing-conductor voltage as the sheath. This means that it may be necessary to use additional connection material, which is also part of the ABB offer. Detailed information about the accessories for ABB cables is given in separate technical documentation.

Standards

The products conform to CENELEC HD 629.1 S1 standards.

Applications and characteristics

The correct type of cable accessories must be used. This will depend on the structure of the cable.
If a single-core screened cable with exclusively copper braid is used, just apply a cable terminal and a termination that suits the effective dimensions of the cable. Additional material must be used if the cable is the three-pole type, or screened with copper tape or aluminium sheet, or has an armature.
Correct preparation of the cable is as important as use of the right material. ABB offers a wide range of optimum tools for preparing cables.

Recommended products

ABB's pre-moulded SOT type termination can be used on any polymeric cable, regardless of the structure or dimensions of the conductor.
Just a few termination variants are suitable for a wide variety of cable dimensions. For values 12/17.5/24 kV, just four types of terminations can cover cable dimensions up to 800 mm^2.
The ABB product range includes extra materials such as earthing kits, bearing gaskets for three-pole cables and screening material for cable armatures. Please consult your ABB contact person for more details.

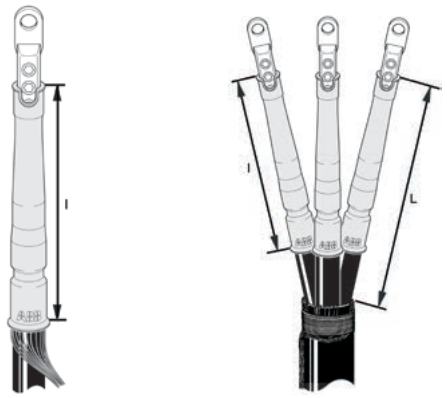
6. Technical specifications

Complete kits with screw-on cable terminals

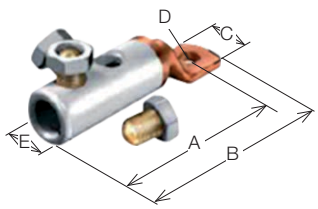
Cable termination, including bimetal screw-on cable terminal for conductors in Al and Cu.
The cable terminal is equipped with blind bolts.

Designation	Weight	Designation	Weight	Ø XLPE	Conduction (12 kV)	Conduction (24 kV)
Three-pole / 3 single-core termination for interiors	kg/kit	Termination for interiors - single-phase kit	kg/kit	mm	mm^2	mm^2
SOT 241 A-3	0.60	SOT 241 A	0.20	11-15	10-35	10
SOT 241-3	0.60	SOT 241	0.19	15-28	50-185	25-120
SOT 242-3	0.70	SOT 242	0.23	24-39	240-500	150-300
SOT 242 B-3	0.90	SOT 242 B	0.30	38-54	630	500-630

Designation	Weight	Designation	Weight	Conduction (12 kV)	Conduction (24 kV)
Single core / 1 single-core termination for interiors	kg/kit	Three-pole / 3 single-core for interiors	kg/kit	mm^2	mm^2
SOT 241A S1	0.35	SOT 241A-3 S1	1.05	16-35	16
SOT 241 S1	0.34	SOT 241-3 S1	1.02	50-70	25-70
SOT 241 S2	0.44	SOT 241-3 S2	1.32	95-150	95-120
SOT 241 S3	0.59	SOT 241-3 S3	1.50	185	–
SOT 242 S2	0.48	SOT 242-3 S2	1.44	–	150
SOT 242 S3	0.63	SOT 242-3 S3	1.89	240	185-240
SOT 242 S4	0.98	SOT 242-3 S4	2.94	300-400	300-400
SOT 242B S5	1.78	SOT 242B-3 S5	5.25	500-630	500-630



Designation	I	L
	mm	
SOT 241/242/242 B	235	min 300



Designation	Al or Cu conductor			Tightening torque	Dimensions					Weight kg/ article
	sector shaped	round	max Ø		A	B	C	D (Ø)	E (Ø)	
	mm^2	mm^2	mm		mm					
SKSB 70-12	25-70	16-70	11	15*	90	103	25	13	21.5	0.15
SKSB 150-12	95	95-150	16	20*	103	118	30	13	27	0.25
SKSB 240-12	120-185	185-240	20	30*	125	140	30	13	33.5	0.40
SKSB 400-16	240	300-400	25.5	40*	166	185	37	17	41.5	0.75
SKSB 630-16	–	500-630	33	45*	201	227	55	17	49	1.45

(*) The bolt must be tightened to the correct tightening torque value

6.8.4 Cable connections

The quantities and maximum sections of the cables that can be installed in the different units are given below.
Consult installation manual **1VFM200004** for information about how to install the cables and the components used.

Panels	Width	Maximum number of cables	Maximum cable section (mm²)
SDC	375	1 (*)	400
	500	2	300
		1	630
	750	2	300
		1	400
SDD	750	1	400
SFC	375	1	95
	500	1	95
	750	1	95
SBC/SBC-W	750	2	300
		1	630
SBR	750	1	300
HBC	500	2	300
		1	630
DRC	375	1 (*)	400
	500	2	300
		1	630
WBC/BME	600	4	300
		2	400
		1	630
	750	2	400
UMP	750	2	300
		1	400
RLC/RRC	190	1	400

(*) 2 (two) 300 mm² cables @ 12 kV

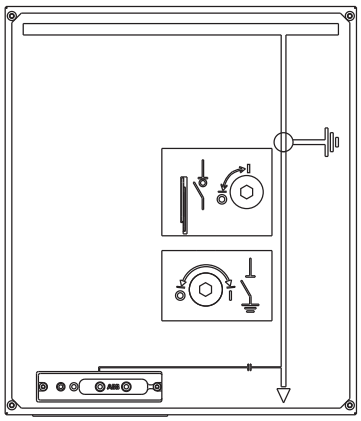
6. Technical specifications

6.9 Safety locks

Safety locks are designed to provide a higher level of safety for both personnel and installation.
There are two types of safety locks in the units:

- interlocks (standard equipment), required by the standards and therefore necessary if the correct operating sequence is to be guaranteed;
- locks available on request. Installation of these locks must suit the operating and maintenance procedures of the installation.

Consult operation and maintenance manual **1VFM200005** for further details about the available locks and switchgear operations that can be carried out.



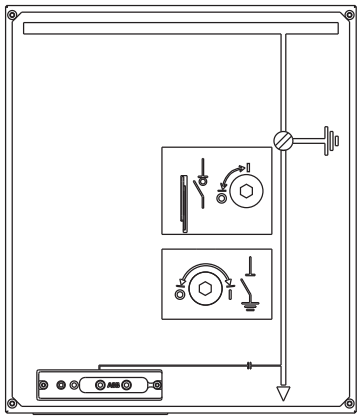
"Line closed" position

6.9.1 UniSec LSC2A locks

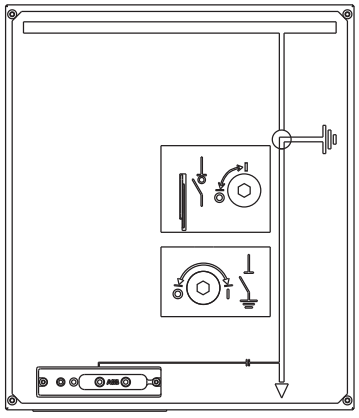
Positions

LSC2A units, with GSec switch-disconnectors or HySec multifunction apparatus, have two seats for operating the equipment and earthing switch if installed (interlocked with the switchgear).

- Line side: upper seat, for the "open" and "line closed" position
- Earth side: lower seat, for the "closed earthed" and "open" position



"Open" position



"Closed earthed" position

Standard interlocks [A] and relative functions [B]

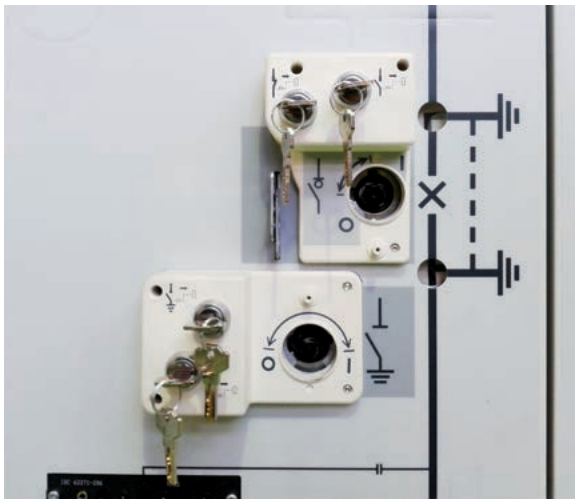
Type		Description	Condition
1	A	Insertion of GSec/HySec operating lever	Cable compartment door closed
	B	Opening of cable compartment door	GSec/HySec operating lever disengaged
2	A	Opening of cable compartment door	GSec/HySec in closed earthed position
	B	Opening of GSec/HySec from “closed earthed” position	Cable compartment door closed

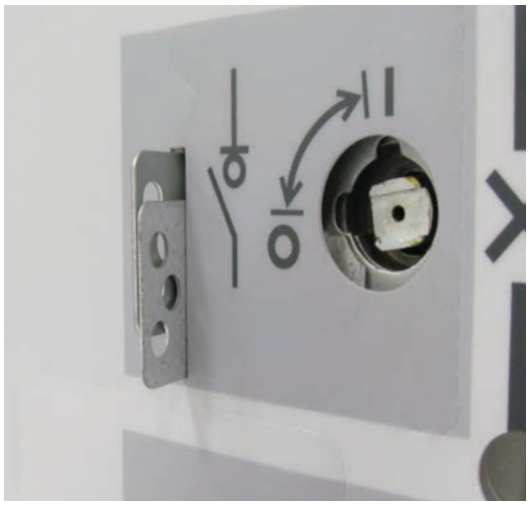
Key locks (on request)

Apparatus position for key removal	Description
Upper seat for GSec/HySec with single-spring operating mechanism	
Open	1 key free for preventing apparatus from closing in-line (operation to earth is possible)
Line-closed	1 key free for preventing apparatus from opening
Upper seat for GSec with double-spring operating mechanism (*)	
Open	1 key free for preventing apparatus from closing in-line (operation to earth is possible)
Lower seat for GSec with single- and double-spring operating mechanism and HySec	
Open	1 key free for preventing apparatus from closing to earth (closing in-line is possible)
Closing to earth	1 key free for preventing apparatus from opening
Combination between lower and upper seats	
Open	2 keys free for preventing apparatus from closing (line and earth)

(*) Line-closed key lock is not available for GSec with double-spring operating mechanism

Guissani, Ronic or Profalux keys can be used for the interlock.





Padlocks

Description
GSec/HySec operating lever insertion lock

The switchgear is pre-engineered for use of up to 8 mm diameter padlocks.

6. Technical specifications

6.9.2 UniSec LSC2B locks

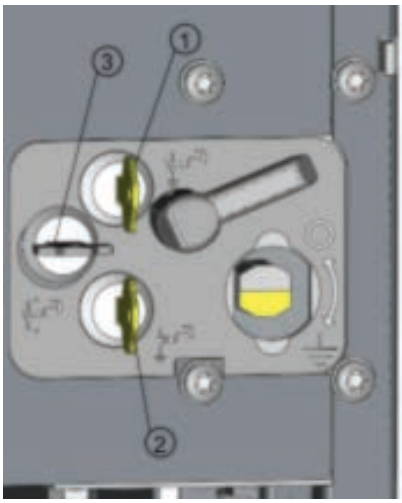
Standard interlocks [A] and relative functions [B]

Type		Description	Operation possible if...
1	A	Apparatus racking-in/out	Apparatus in “open” position and locking magnet truck energized
	B	Apparatus closing	Truck in defined position
2	A	Apparatus racking-in	Multi-contact plug of racked-in apparatus
	B	Removal of multi-contact switchgear plug	Truck in “isolated” position
3	A	Closing of earthing switch	Truck in “isolated” position
	B	Apparatus racking-in	Earthing switch in “open” position
4	A	Opening of apparatus compartment door	Truck in “isolated” position
	B	Apparatus racking-in	Apparatus compartment door closed
5	A	Opening of cable compartment door	Earthing switch in “closed” position
	B	Opening of earthing switch	Cable compartment door closed

Key locks (on request)

Type	Description	The lock key can only be removed if...
1	Earthing switch closing lock	the earthing switch is open
2	Earthing switch opening lock	the earthing switch is closed
3	Locking of apparatus racking-in	truck is in racked-out position

Guissani, Ronic or Profalux keys can be used for the interlock.

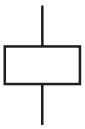


Padlocks

Type	Description
1	Lock preventing insertion of apparatus racking in/out lever
2	Shutter opening and closing lock
3	Lock preventing insertion of earthing switch operating lever (on request)

The switchgear is pre-engineered for use of up to 6 mm diameter padlocks.

Locking magnets (on request)



Type	Description
1	Earthing switch opening and closing lock
2	Lock to prevent opening of apparatus compartment door

Accessory devices

Fail-safe on shutters	Device locks shutters when apparatus is removed from compartment. Operator cannot open shutters in the manual mode. Shutters can only be operated by apparatus truck or service trucks.
Apparatus - switchgear unit compatibility matrix	The multi-contact plug of the apparatus and relative socket in the switchgear unit are equipped with a mechanical matrix. This means that it is impossible to rack the apparatus into a switchgear unit unless the rated current is suitable.
Mechanical operating mechanism of circuit-breakers	The apparatus compartment is equipped with a mechanical device that prevents the circuit-breakers from being closed and/or opened directly by the front control push-buttons, by keeping the door closed. Operations can be performed when circuit-breakers are in service and racked-out positions.

6.10 Maintenance intervals

It is advisable to perform maintenance operations at the following intervals:

Tasks performed	Interval in years	According to number of operations
Inspection	5[1]	
Maintenance	5[2]	[3]
Repairs	As required	As required

[1] These intervals should be reduced in more complex operating conditions.
[2] Depending on the results of the inspections.
[3] GSec

Electrical endurance:	100 breaking operations at 630 A 5 short-circuit making operations
Mechanical endurance:	5000 no-load operations
Circuit-breakers:	see the manuals
Earthing switch:	5 short-circuit making operations – 1000 no-load operations

7. Main components

7.1 Voltage signalling indicators

IEC 62271-206
IEC 61243-5 (VDS).

7.1.1 VPIS voltage presence indicating systems

The energized state of the unit is signalled by a light that flashes with at least 1 Hz repetition rate.

Operating temperature
The VPIS will operate reliably over a temperature range between –25 °C and +50 °C.

Phase comparison and testing of VPIS
Each phase of the integrated VPIS has a connection point on the front panel, which can be used to perform phase comparison and to test the voltage presence indicator.
Product type DXN-HXQ-01 by Fujian Nanping Anda Electrical Manufacture Co. Ltd. is recommended for phase comparison.

Threshold values for voltage presence indication
The indication corresponding to “voltage present” appears when the effective line-to-earth voltage is between 45% and 100% of the rated voltage value. The indication corresponding to “voltage present” does not appear when the effective line-to-earth voltage is less than 10% of the rated voltage.

7.1.2 VDS voltage presence indicators

VDS are used to detect the presence or absence of operating voltage in accordance with IEC 61243-5.
The VDS used are based on the HR system, comprising a fixed device installed on the switchgear coupled to a movable device. This is fitted with indicator lights that visually indicate the presence or absence of voltage and phase balance.
The state of the voltage is signalled by a light that flashes with at least 1 Hz repetition rate. The pulse rate of the flashing light must be between 1 Hz and 3 Hz with 4 to 1 pulse/pause ratio.
The recommended “voltage presence” indicators are the VM1 type (used as movable device) and the VM3 type (used as both fixed and movable device) by Maxeta.
The maximum operating threshold voltage of the “voltage presence” indicators is 90 V with 2.5 µA maximum threshold current at 50 Hz.

Operating temperature
VDS will operate reliably within a temperature range between –25 °C and + 50 °C.

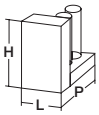
Phase comparator
The comparator detects balance or imbalance of phases between the interface and/or test points. Detection is performed by means of an indicator light.
The recommended VDS phase comparator is the PCM-HR type by Maxeta. It includes a 1.4 m test cable.

Threshold values for voltage presence indication
The “voltage present” indication must appear when the line-to-earth voltage is between 45% and 120% of the rated value. The “voltage present” indication must not appear when the line-earth voltage is 10% less than the rated voltage.

7.2 Components in LSC2A units

IEC 62271-100

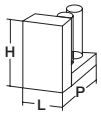
7.2.1 VD4/R-Sec vacuum circuit-breaker

Circuit-breaker		VD4/R-SEC 12		VD4/R-SEC 17		VD4/R-SEC 24
Rated voltage	Ur [kV]	12		17.5		24
Rated insulation voltage	Us [kV]	12		17.5		24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28		38		50
Impulse withstand voltage	Up [kV]	75		95		125
Rated frequency	fr [Hz]	50-60		50-60		50-60
Rated current (40 °C)	Ir [A]	630	800	630	800	630
Rated breaking capacity (symmetrical rated short-circuit current)	Isc [kA]	12.5	12.5	12.5	–	12.5
		16	16	16	16	16
		20	20	20[4]	20[4]	20
		25	25	–	–	–
Admissible rated short-time withstand current (3 s)	Ik [kA]	12.5	12.5	12.5	–	12.5
		16	16	16	16	16
		20	20	20[4]	20[4]	20
		25[5]	25[5]	–	–	–
Making capacity	Ip [kA]	31.5	31.5	31.5	–	31.5
		40	40	40	40	40
		50	50	50	50	50
		63	63	–	–	–
Operating sequence		[O - 0.3s - CO - 15s - CO]				
Opening time	[ms]	40…60		40…60		40…60
Arcing time	[ms]	10…15		10…15		10…15
Total break-time	[ms]	50…75		50…75		50…75
Closing time	[ms]	30…60		30…60		30…60
Overall dimensions (maximum) 	H [mm]	740		740		740
	L [mm]	315		315		315
	P [mm]	1005		1005		1005
	Pole center-distance [mm]	230		230		230
Weight[1]	[kg]	65		65		65
Application of PR521 protection device		Application not available				
Application of REF 601 protection device[3]		●[2]		●[2]		●[2]
Operating temperature	[°C]	- 5 ... + 40		- 5 ... + 40		- 5 ... + 40
General regulations	IEC 62271-100	●		●		●
Tropicalization	IEC: 60068-2-30, 60721-2-1	●		●		●
Electromagnetic compatibility	IEC 62271-1	●		●		●

[1] Increase the indicated weight by 20 kg for circuit-breakers with REF 601 devices and 3 current sensors
[2] The rated current of the REF 601 device must be set in the relay in accordance with the circuit-breaker's rated current
[3] "IEC" or "CEI 0-16" version. If the "CEI 0-16" version is required, the circuit-breaker is always supplied with 3 phase current sensors (Rogowsky coils) installed on the actual circuit-breaker, and a toroidal CT. In the "CEI 0-16" version, the REF 601 device opens the circuit-breaker by means of undervoltage release - MU
[4] Rated breaking capacity 21 kA at 17.5 kV. Admissible rated short-time withstand current 21 kA x 3 s
[5] Admissible rated short-time withstand current 25 kA x 2 s

7. Main components

7.2.2 HD4/R-Sec gas circuit-breaker

Circuit-breaker		HD4/R-SEC 12		HD4/R-SEC 17		HD4/R-SEC 24
Rated voltage	Ur [kV]	12		17.5		24
Rated insulation voltage	Us [kV]	12		17.5		24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28		38		50
Impulse withstand voltage	Up [kV]	75		95		125
Rated frequency	fr [Hz]	50-60		50-60		50-60
Rated thermal current (40°C)	Ir [A]	630	800	630	800	630
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	12.5	12.5	12.5	–	12.5
		16	16	16	16	16
		20	20	20[5]	20[5]	20
		25	25	–	–	–
Admissible rated short-time withstand current (3 s)	Ik [kA]	12.5	12.5	12.5	–	12.5
		16	16	16	16	16
		20[3]	20	20[5]	20[5]	20
		25[4]	25[4]	–	–	–
Making capacity	Ip [kA]	31.5	31.5	31.5	–	31.5
		40	40	40	40	40
		50	50	50	50	50
		63	63	–	–	–
Operating sequence		[O - 0.3s - CO - 15s - CO]				
Opening time	[ms]	45		45		45
Arcing time	[ms]	10...15		10...15		10...15
Total break-time	[ms]	55...60		55...60		55...60
Closing time	[ms]	80		80		80
Overall dimensions (maximum) 	H [mm]	740		740		740
	L [mm]	315		315		315
	D [mm]	1049		1049		1049
	Pole center-distance [mm]	230		230		230
Weight[1]	[kg]	103		103		103
Absolute pressure of gas (nominal duty value)	[kPa]	380		380		380
Application of PR521 protection device		application not available				
Application of REF 601 protection device		●[2]		●[2]		●[2]
Operating temperature	[°C]	- 5 ... + 40		- 5 ... + 40		- 5 ... + 40
General regulations	IEC 62271-100	●		●		●
Tropicalization	IEC: 60068-2-30, 60721-2-1	●		●		●
Electromagnetic compatibility	IEC 62271-1	●		●		●

[1] Increase the indicated weight by 20 kg for circuit-breakers with REF 601 device and 3 current sensors (15 kg only with 2 current sensors)

[2] the REF 601 device and the current sensors are available on request. The rated current of the REF 601 must be set in the relay and must be compatible with the rated current of the circuit-breaker. In the “CEI 0-16” version, the circuit-breaker is always supplied with 3 phase current sensors (Rogowsky coils) on the circuit-breaker itself and one 40/1 A closed-core toroidal CT. Circuit-breaker opening by the “CEI 0-16” version of the REF 601 is achieved by means of an -MU undervoltage release

[3] Admissible rated short-time withstand current 20 kA x 1 s

[4] Admissible rated short-time withstand current 25 kA x 2 s

[5] Rated breaking capacity 21 kA at 17.5 kV. Admissible rated short-time withstand current 21 kA x 3 s

7.2.3 GSec gas-insulated switch-disconnector

IEC 62271-102
IEC 62271-103
IEC 62271-105

Electrical characteristics				
Rated voltage	kV	12	17.5	24
Power-frequency withstand voltage (50-60 Hz, 1 min)				
– Line-to-line and line-to-earth	kV	28	38	50
– Between open contacts	kV	32	45	60
Lightning impulse withstand voltage (BIL 1.2/50 µs)				
– Line-to-line and line-to-earth	kVp	75	95	125
– Between open contacts	kVp	85	110	145
Rated frequency	Hz	50-60	50-60	50-60
Rated current (40 °C)	A	800 (1)	800 (1)	630
Admissible rated short-time withstand current	kA	25 (2s) (2)	20 (3s) (2)(3)	16 (3s) - 20 (3s) (2)(3)
Making capacity (peak current)	kAp	62.5	52.5	40-52.5
Breaking capacity:				
– Active load	A	800 (1)	800 (1)	630
– Vacuum transformers	A	16	16	16
– No-load lines	A	25	25	25
– No-load cables	A	50	50	50
– Loop circuits	A	800 (1)	800 (1)	630

(1) 630 A for SDC with 2S - Double-spring operating mechanism
(2) 16 kA (3s) for SDC with 2S - Double spring operating mechanism
(3) Consult ABB for 21 kA (3s)

Mechanical and electrical performance		
Electrical life of the line contact	class	E3 - up to 5 makings and 100 rated current interruptions
Electrical life of the earth contact	class	E2 - up to 5 makings
Mechanical life of the line contact with 1S - Single spring operating mechanism	class	M2 - 5000 mechanical operations
Mechanical life of the line contact with 2S - Double spring operating mechanism	class	M1 - 1000 mechanical operations
Mechanical life of the earth contact	class	M0 - 1000 mechanical operations

7. Main components

Actuators

GSec uses two types of actuator:

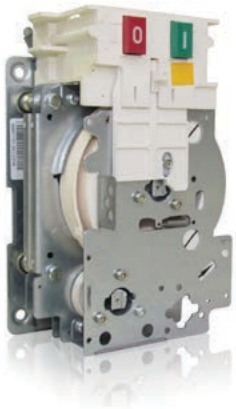
- 1S - Single spring: for the opening and closing operations. Can be operated by lever or motor.
- 2S - Double spring: for closing and opening operations. Can be operated by push-buttons (springs loaded by lever) or opening and closing shunt releases (springs loaded by motor).

In an emergency, both actuators can be operated manually by means of an operating lever (1S) or push-buttons (2S), even when equipped with a motor-operator.

Unit	Actuators	
	1S - Single spring	2S - Double spring
SDC, SDS	■	■
SFC, SFS	–	■
SDM	■	–
SDD	–	■
SBC, SBS	■	–
SBC-W, SBS-W	■	–
SBM	■	–
SBR	■	–
DRC, DRS	–	–
SFV	–	■

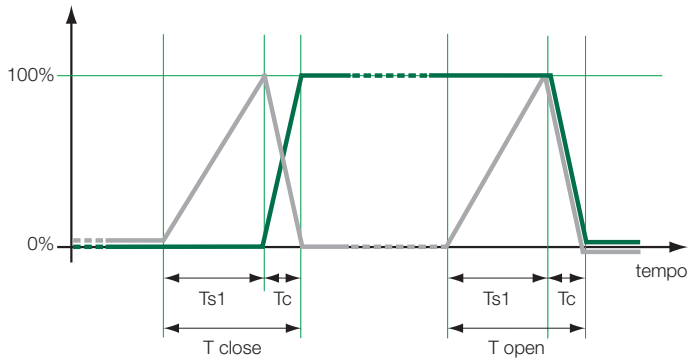
1S - Single spring

2S - Double spring



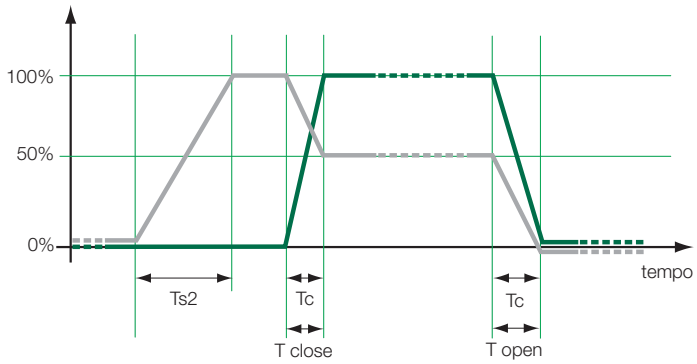
Trip time of GSec actuators

Diagram of 1S - Single spring operating mechanism operation



	Position of the line contact
	Spring load state
Ts1	Spring loading time
	– manual operation: depends on the operator
	– motor-driven operating mechanism = 3-4 s.
Tc	Contact opening or closing time < 0.3 s
Tclose	Total closing time < 5 s (motor-driven operating mechanism)
Topen	Total opening time < 5 s (motor-driven operating mechanism)

Diagram of 2S - Double spring operating mechanism operation



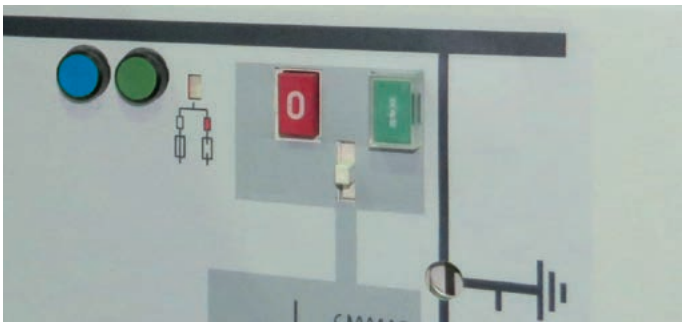
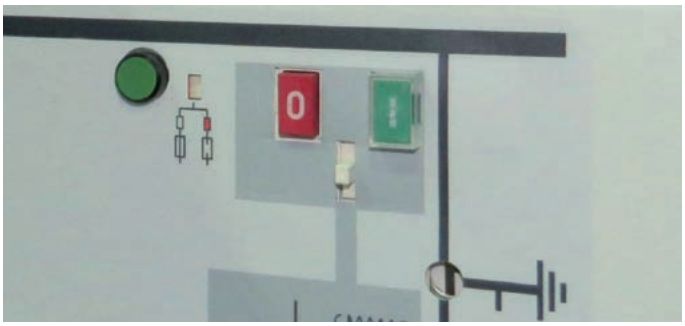
	Position of the line contact
	Spring load state
Ts2	Spring loading time
	– manual operation: depends on the operator
	– motor-driven operating mechanism = 3-4 s.
Tc	Contact opening or closing time < 0.3 s
Tclose	Total closing time < 0.3 s (motor-driven operating mechanism)
Topen	Total opening time < 0.3 s (motor-driven operating mechanism)

Motor for 1S - Single spring operating mechanism (-MAD)

The motor automatically loads the spring of the 1S – Single spring operating mechanism for line operations.
This allows the disconnector to be operated by remote control.
The disconnector's closing (Tclose) and opening (Topen) times are less than 5 seconds.

Motor for 2S - Double spring operating mechanism (-MAD)

The motor automatically loads the springs of the 2S – Double spring operating mechanism for line operations.
Thanks to this motor and the closing and opening shunt releases, the disconnector can be operated by remote control.
Spring loading with the motor takes less than 4 seconds.
The motor unit is available with the following operating modes.

Availability of the 2S motor operator	Image
CCO (Charge - Close - Open) Three phases: the motor loads the springs of the operating mechanism, then closing and successive opening are performed by means of two inputs (push-buttons or coils)	
CO (Charge and close - Open) Two phases: the motor loads the springs of the operating mechanism and closes the disconnector. Opening is performed by means of a successive input (push-button or coil).	

Remote control of the GSec

The opening, putting in line and earthing operations of all types of GSec disconnectors can be remote controlled.

7. Main components

7.2.4 HySec: multi-function apparatus (vacuum circuit-breaker and gas-insulated switch-disconnector)

IEC 62271-100
IEC 62271-102

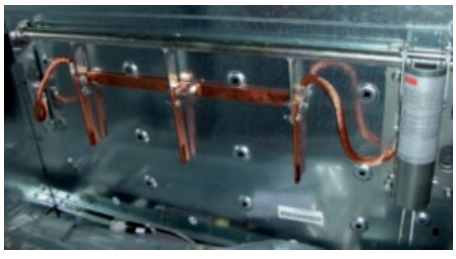
Electrical characteristics								
Rated voltage	Ur [kV]	12		17.5		24		
Rated insulation voltage	Us [kV]	12		17.5		24		
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28		38		50		
Impulse withstand voltage	Up (BIL 1.2/50 µs) [kV]	75		95		125		
Rated frequency	fr [Hz]	50/60	50/60	50/60	50/60	50/60	50/60	
Rated current	Ir [A]	630	630	630	630	630	630	
Admissible short-time withstand current (1 s)	Ik [kA]	12.5	16	12.5	16	12.5	16	
Performance of breaking part (IEC 62271-100)								
Breaking capacity								
– Short-circuit current	[kA]	12.5	16	12.5	16	12.5	16	
– Vacuum transformers	[A]	6.3	6.3	6.3	6.3	6.3	6.3	
– No-load lines	[A]	10	10	10	10	10	10	
– No-load cables	[A]	16	16	16	16	16	16	
– Capacitive currents	[A]	400	400	400	400	400	400	
Making capacity	[kAp]	31.5	40	31.5	40	31.5	40	
Operating sequence		[O – 0.3s – CO – 15s - CO]						
Opening time	[ms]	40...55	40...55	40...55	40...55	40...55	40...55	
Arcing time	[ms]	10...15	10...15	10...15	10...15	10...15	10...15	
Total break-time	[ms]	50...70	50...70	50...70	50...70	50...70	50...70	
Closing time	[ms]	40...55	40...55	40...55	40...55	40...55	40...55	
Electrical life	class	E2	E2	E2	E2	E2	E2	
Mechanical life	class	M2 - 10,000 mechanical operations						
Capacitive current breaking class	class	C2	C2	C2	C2	C2	C2	
Feeder disconnector performance (IEC 62271-102)								
Electrical life	class	E0	E0	E0	E0	E0	E0	
Mechanical life	class	M0 - 1,000 mechanical operations						
Earthing switch performance (IEC 62271-102)								
Electrical life	class	E2	E2	E2	E2	E2	E2	
Mechanical life	class	M0 - 1,000 mechanical operations						
Earthing switch making capacity	[kPa]	31.5	40	31.5	40	31.5	40	
Other characteristics								
Center-distance between phases	[mm]	230	230	230	230	230	230	
Operating temperature	[°C]	-15...+40	-15...+40	-15...+40	-15...+40	-15...+40	-15...+40	
Maximum installation altitude	[masl]	3000	3000	3000	3000	3000	3000	
SF_6 absolute pressure	[kPa]	142	142	142	142	142	142	
SF_6 weight	[g]	213	213	213	213	213	213	
Internal volume of SF_6	[l]	25	25	25	25	25	25	

7.2.5 Earthing switch

IEC 62271-102

Electrical characteristics				
Rated voltage	Ur [kV]	12	17.5	24
Impulse withstand voltage	Up [kV]	75	95	125
Admissible short-time withstand current (3 s)	Ik [kA]	25(*)	21	21
Electrical life class		E2		
Rated frequency	fr [Hz]	50-60		

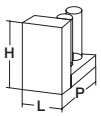
(*) 25 kA 2s



7.3 Components in LSC2B units

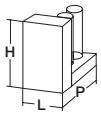
IEC 62271-100
IEC 62271-106
The circuit-breakers and contactors that can be installed in UniSec LSC2B switchgear are indicated in document 2RDA024474.
Approximate value of withdrawable circuit-breaker racking-in torque: 1250 A= 14 Nm.
The general characteristics of the main apparatuses are given below.

7.3.1 Vmax/Sec withdrawable vacuum circuit-breaker

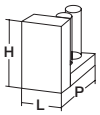
Circuit-breaker		Vmax/Sec 12		Vmax/Sec 17	
Rated voltage	Ur [kV]	12		17.5	
Rated insulation voltage	Us [kV]	12		17.5	
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28		38	
Impulse withstand voltage	Up [kV]	75		95	
Rated frequency	fr [Hz]	50-60		50-60	
Rated thermal current (40°C)	Ir [A]	630	1250	630	1250
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16	16	16	16
		20	20	20	20
		25	25	25	25
Admissible rated short-time withstand current (3 s)	Ik [kA]	16	16	16	16
		20	20	20	20
		25	25	25	25
Making capacity	Ip [kA]	40	40	40	40
		50	50	50	50
		63	63	63	63
Operating sequence		[O - 0.3s - CO - 15s - CO]			
Opening time	[ms]	33.5...60		33.5...60	
Arcing time	[ms]	10...15		10...15	
Total break-time	[ms]	43.5...75		43.5...75	
Closing time	[ms]	45...80		45...80	
Overall dimensions (maximum) 	H [mm]	665		665	
	L [mm]	503		503	
	D [mm]	662		662	
	Pole center-distance [mm]	150		150	
Weight[1]	[kg]	100		100	
Absolute pressure of gas (nominal duty value)	[kPa]	380		380	
Operating temperature	[°C]	-5...+40		-5...+40	
General regulations	IEC 62271-100	•		•	
Tropicalization	IEC: 60068-2-30, 60721-2-1	•		•	
Electromagnetic compatibility	IEC 60694	•		•	

7. Main components

7.3.2 VD4/Sec withdrawable vacuum circuit-breaker

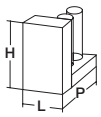
Circuit-breaker		VD4/SEC
Rated voltage	Ur [kV]	24
Rated insulation voltage	Us [kV]	24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	50
Impulse withstand voltage	Up [kV]	125
Rated frequency	fr [Hz]	50-60
Rated thermal current (40°C)	Ir [A]	630-1250
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16
		20
Admissible rated short-time withstand current (3 s)	Ik [kA]	16
		20
		25
Making capacity	Ip [kA]	40
		50
Operating sequence		[O - 0.3s - CO - 15s - CO]
Opening time	[ms]	33...60
Arcing time	[ms]	10...15
Total break-time	[ms]	43...75
Closing time	[ms]	60...80
Overall dimensions (maximum) 	H [mm]	743
	L [mm]	653
	D [mm]	742
	Pole center-distance [mm]	210
Weight(1)	[kg]	133
Absolute pressure of gas (nominal duty value)	[kPa]	380
Operating temperature	[°C]	-5...+40
General regulations	IEC 62271-100	•
Tropicalization	IEC: 60068-2-30, 60721-2-1	•
Electromagnetic compatibility	IEC 62271-1	•

7.3.3 HD4/Sec withdrawable gas circuit-breaker

Circuit-breaker		HD4/SEC
Rated voltage	Ur [kV]	24
Rated insulation voltage	Us [kV]	24
Withstand voltage at 50 Hz	Ud (1 min) [kV]	50
Impulse withstand voltage	Up [kV]	125
Rated frequency	fr [Hz]	50-60
Rated thermal current (40°C)	Ir [A]	630-1250
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16
		20
Admissible rated short-time withstand current (3 s)	Ik [kA]	16
		20
		25
Making capacity	Ip [kA]	40
		50
Operating sequence		[O - 0.3s - CO - 15s - CO]
Opening time	[ms]	33...60
Arcing time	[ms]	10...15
Total break-time	[ms]	43...75
Closing time	[ms]	60...80
Overall dimensions (maximum) 	H [mm]	743
	L [mm]	653
	D [mm]	742
	Pole center-distance [mm]	210
Weight[1]	[kg]	133
Absolute pressure of gas (nominal duty value)	[kPa]	380
Operating temperature	[°C]	-5...+40
General regulations	IEC 62271-100	•
Tropicalization	IEC: 60068-2-30, 60721-2-1	•
Electromagnetic compatibility	IEC 62271-1	•

7. Main components

7.3.4 VSC/P withdrawable vacuum contactor

Electrical characteristics		VSC/P 7			VSC/P 12		
		Contactor	Starter	In conjunction with fuses	Contactor	Starter	In conjunction with fuses
Rated voltage	Ur [kV]	7.2	7.2	7.2	12	12	12
Withstand voltage at 50 Hz	Ud (1 min) [kV]	32	32	32	42	42	42
Impulse withstand voltage	Up [kV]	60	60	60	75	75	75
Rated frequency	fr [Hz]	50/60	50/60	50/60	50/60	50/60	50/60
Rated current	Ir [A]	400	400	(1)	400	400	(1)
Admissible rated short-time withstand current (1s)	Ik [kA]	6	6	6	6	6	6
Rated peak current	Ip [kAp]	15	15	15	15	15	15
Short-circuit time	tk [s]	1	1	1	1	1	1
Breaking capacity	Isc [kAp]	–	–	50(2)	–	–	50(2)
Making capacity	Ima [kAp]	–	–	50(2)	–	–	50(2)
Number of operations							
SCO contactor	repeats/h	900	900	900	900	900	900
DCO contactor	repeats/h	900	900	900	900	900	900
Maximum admissible rated overcurrent for ½ cycle (peak value)	[kA]	55	–	–	55	–	–
Characteristic rated load and overload of class of use							
(Class AC4) 100 closing operations	[kA]	4	4	4	4	4	4
(Class AC4) 25 opening operations	[kA]	4	4	4	4	4	4
Feeder type 1 (24 to 60 DC)		•	•	•	•	•	•
Feeder type 2 (110 to 130 AC-DC)		•	•	•	•	•	•
Feeder type 3 (220 to 250 AC-DC)		•	•	•	•	•	•
Mechanical life	operations	1,000,000			1,000,000		
Electrical life (class AC3) (3)	operations	100,000			100,000		
Electrical life at rated current	operations	1,000,000			1,000,000		
Apparatus life (type)		C	C	C	C	C	–
Short-circuit breaking capacity	[kA]	6	6	–	4	4	–
Short-circuit making capacity	[kAp]	15	15	–	8	8	–
Fuse tripping upper limit	[kA]	–	–	5	–	–	5
Total break-time	[ms]	20...30	20...30	20...30	20...30	20...30	20...30
Closing time	[ms]	35...45	35...45	35...45	35...45	35...45	35...45
Overall dimensions (maximum) 	H [mm]	637	637	637	637	637	637
	L [mm]	531	531	531	531	531	531
	D [mm]	657	657	657	657	657	657
	Pole center-distance [mm]	150	150	150	150	150	150
Weight	[kg]	49	49	49	49	49	49
General regulations	IEC 62271-106						
Tropicalization	IEC 60721-2-1						

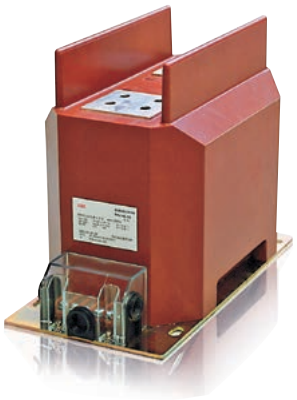
(1) Depends on fuse installed
(2) Value connected to fuse breaking capacity: consult fuse manufacturer's documentation
(3) Electrical life obtained by conforming to the maintenance schedule in the installation manual

To guarantee protection against short-circuit, the contactor must be installed in conjunction with the appropriate fuses on the basis of the load connected. Consult the relative section in this guide when choosing the fuses.

7.4 Instrument transformers

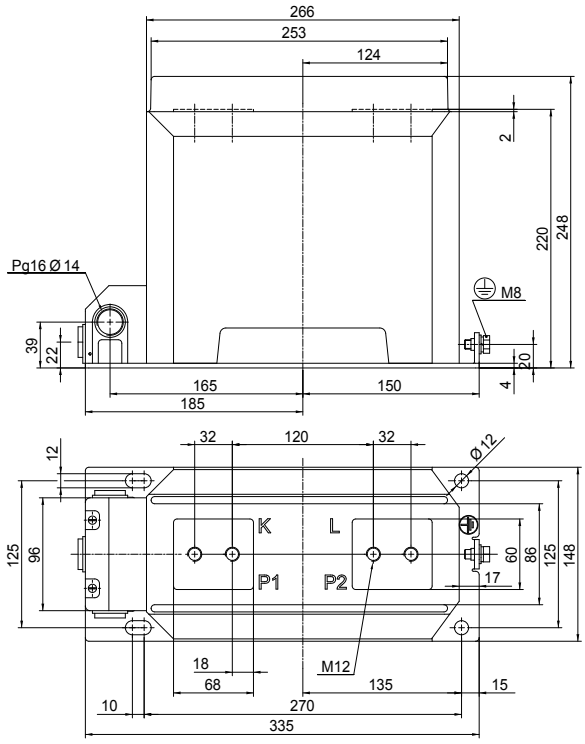
7.4.1 TA TPU

Used in LSC2A and LSC2B units

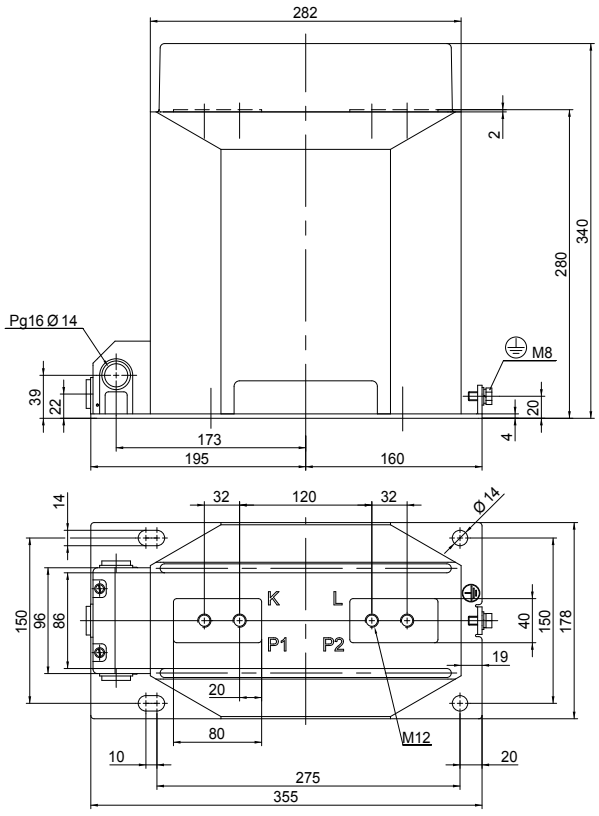


Rated voltage [kV]	12	17.5	24
Rated current [A]	1250	1250	1250
Weight [kg]	20	20	29
Model	ABB- TPU 40.13	ABB-TPU 50.13	ABB-TPU 60.15
	ABB- TPU 43.13	ABB-TPU 53.13	ABB-TPU 63.15
Dimensions	DIN 42600 standards		
Electrical characteristics	Standards IEC 60044-1 – IEC 61829-2		

TA 12 – 17.5 kV



TA 24 kV



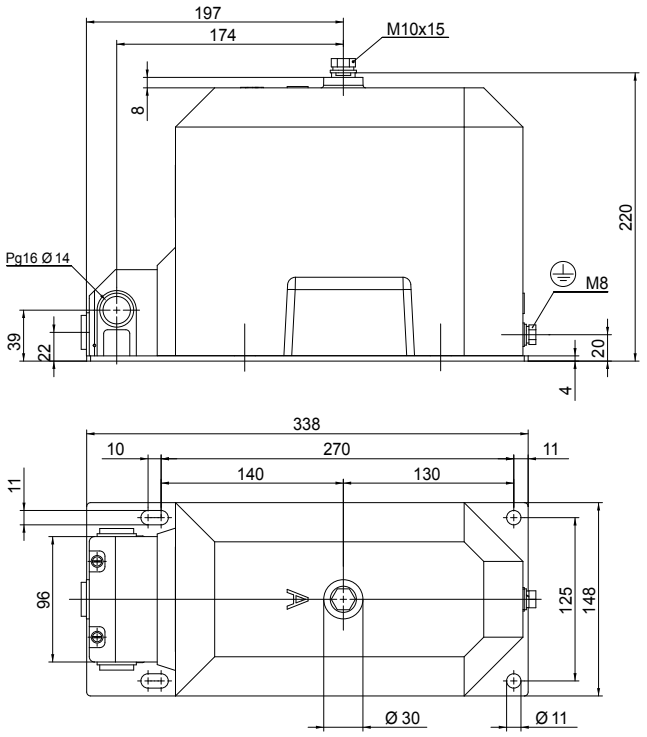
7. Main components

7.4.2 Line-to-earth VT type TJC

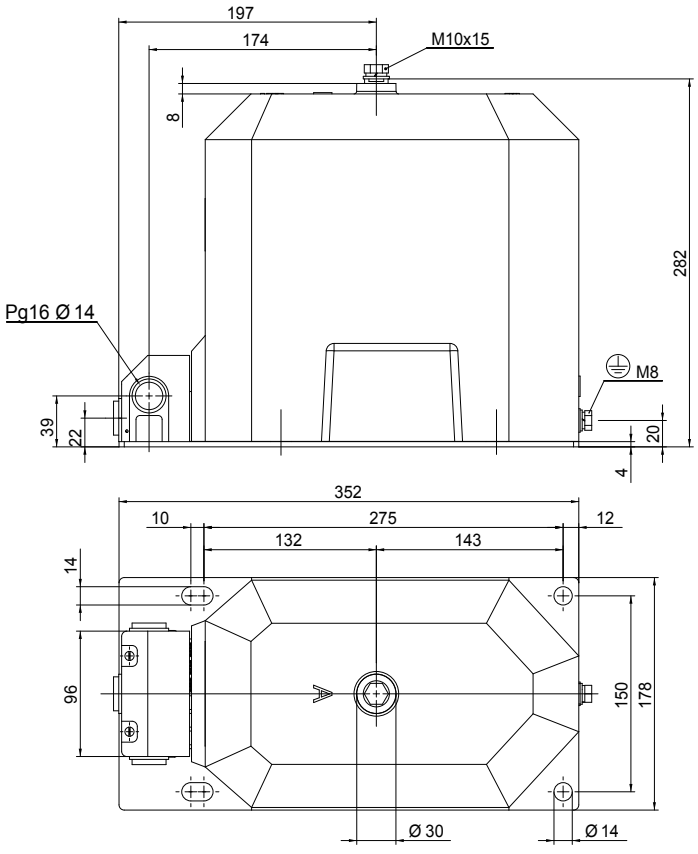
Used in LSC2A and LSC2B units

Rated voltage [kV]	12 - 17.5	24
Weight [kg]	22	30
Model	ABB-TJC4	ABB-TJC6
	ABB-TJC5	
Dimensions	DIN 42600 standards	
Electrical characteristics	IEC 61869-3 standards	

VT 12 – 17.5 kV



VT 24 kV

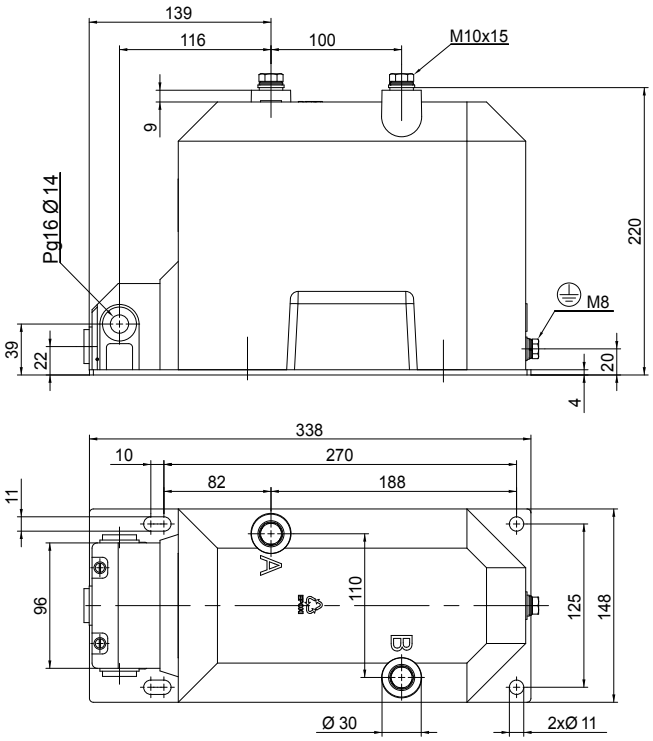


7.4.3 Line-to-line VT - type TDC

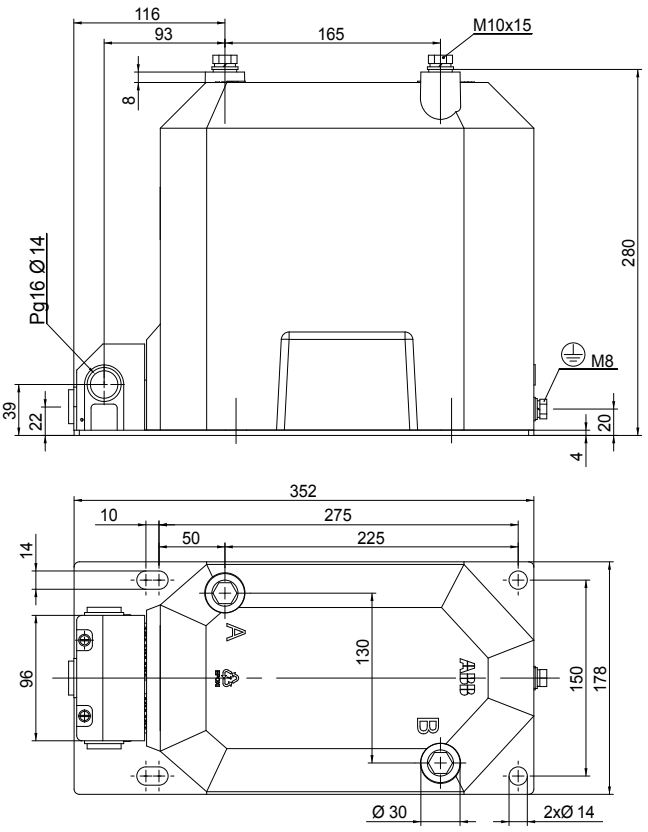
Used in LSC2A and LSC2B units

Rated voltage [kV]	12 - 17.5	24
Weight [kg]	22	30
Model	ABB-TDC4	ABB-TDC6
	ABB-TDC5	
Dimensions	DIN 42600 standards	
Electrical characteristics	IEC 61869-3 standards	

VT 12 – 17.5 kV



VT 24 kV



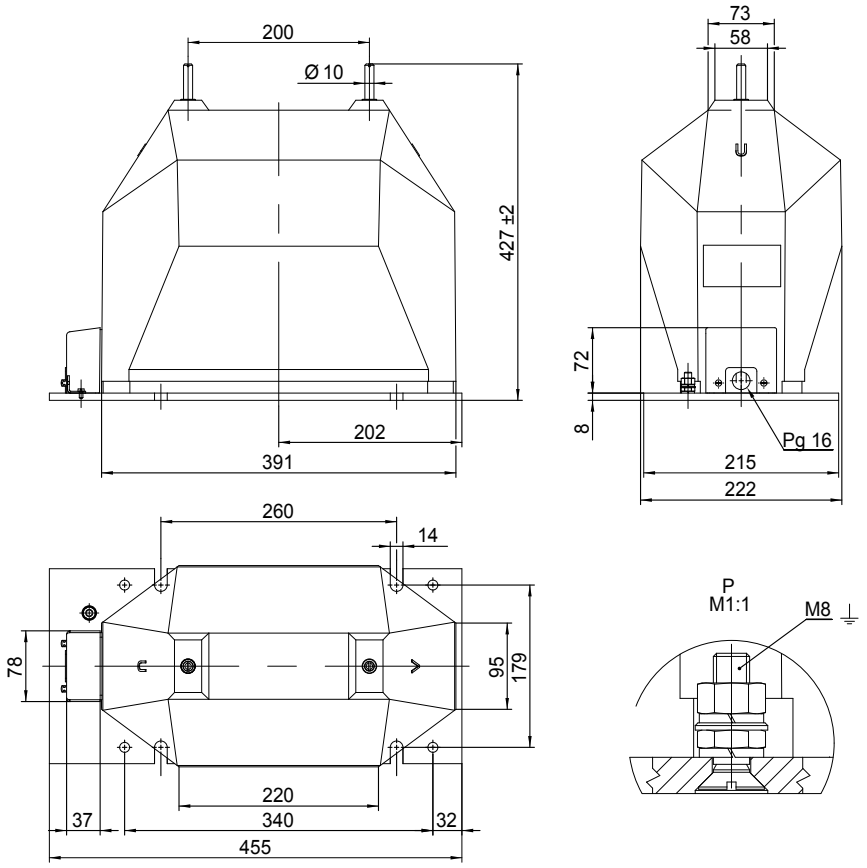
7. Main components

7.4.4 Line-to-line VT - type KGUG

Used in SFV units

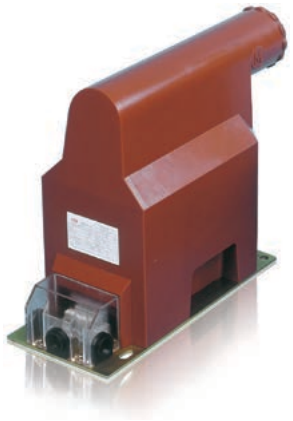
Rated voltage [kV]	24
Weight [kg]	60
Model	KGUG 24
Rated current [A]	1250
Admissible rated short-time withstand current (1s) [kA]	50
Rated peak current [kA]	125
Maximum thermal power [VA]	2000
Dimensions	DIN 42600 standards

VT 24 kV



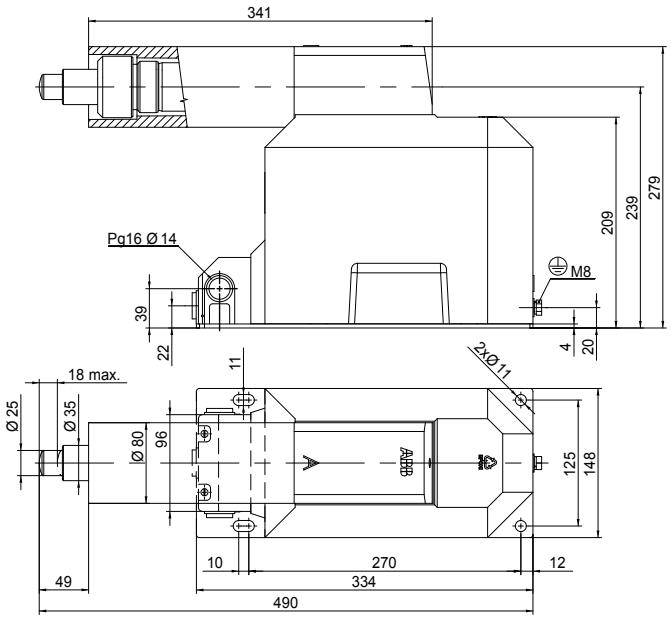
7.4.5 VT with TJP fuse

Used in LSC2B units

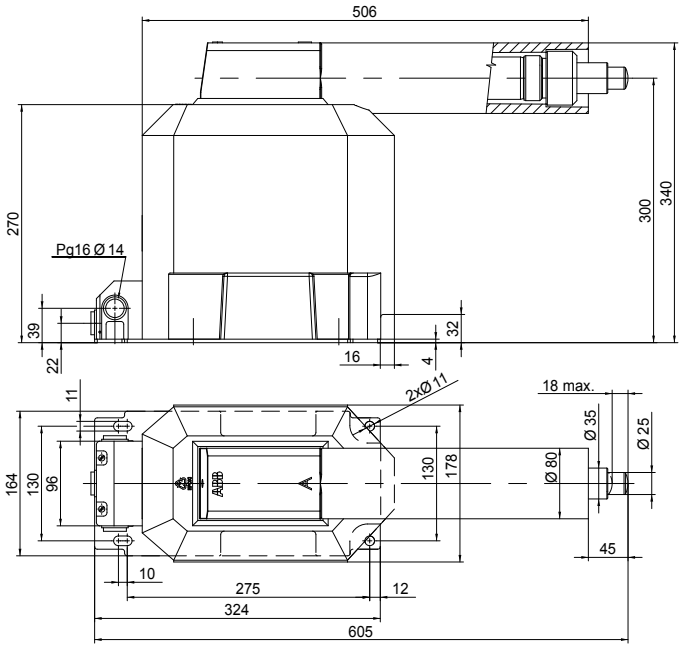


Rated voltage [kV]	12 - 17.5	24
Weight [kg]	27	42
Model	ABB-TJP4	ABB-TJP6
	ABB-TJP5	
Dimensions	DIN 42600 standards	
Electrical characteristics	Standards IEC 60282-1 – IEC 61829-2	

VT 12 – 17.5 kV



VT 24 kV



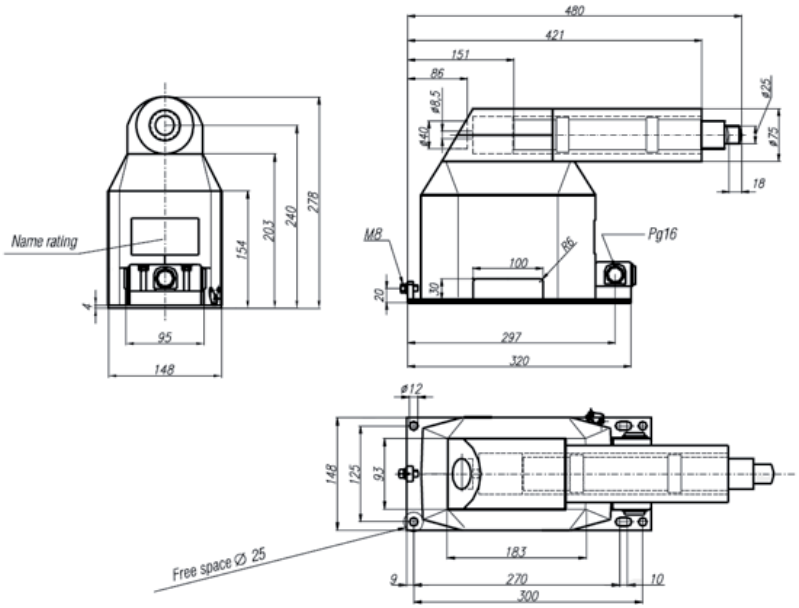
7. Main components

7.4.6 VT with UMZ fuse

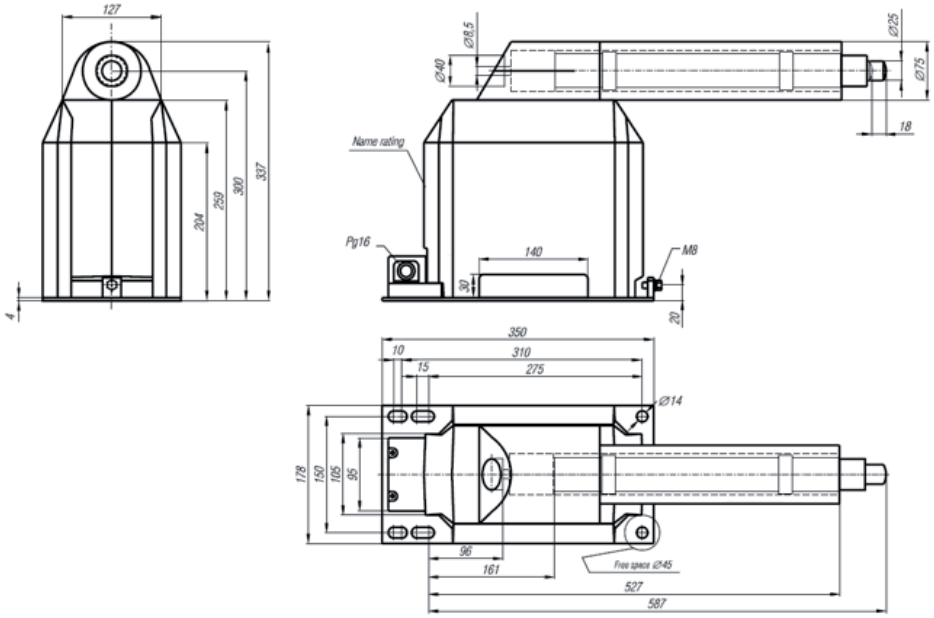
Used in LSC2B units

Rated voltage [kV]	12 - 17.5	24
Weight [kg]	19...23	31.5
Model	ABB-UMZ 12-1F	ABB-UMZ 24-1F
	ABB-UMZ 17-1F	
Dimensions	DIN 42600 standards	
Electrical characteristics	IEC 61869-3 standards	

VT 12 – 17.5 kV



VT 24 kV



7.4.7 Combined sensor KEVCD

Used in LSC2A and LSC2B units

Rated voltage [kV]	12 - 17.5	24
Weight [kg]	12.5	15.6
Model	KEVCD 12	KEVCD 24
	KEVCD 17.5	
Rated current [A]	1250	
Admissible rated short-time withstand current (1s) [kA]	50	
Rated peak current [kA]	125	
Dimensions	DIN 42600 standards	

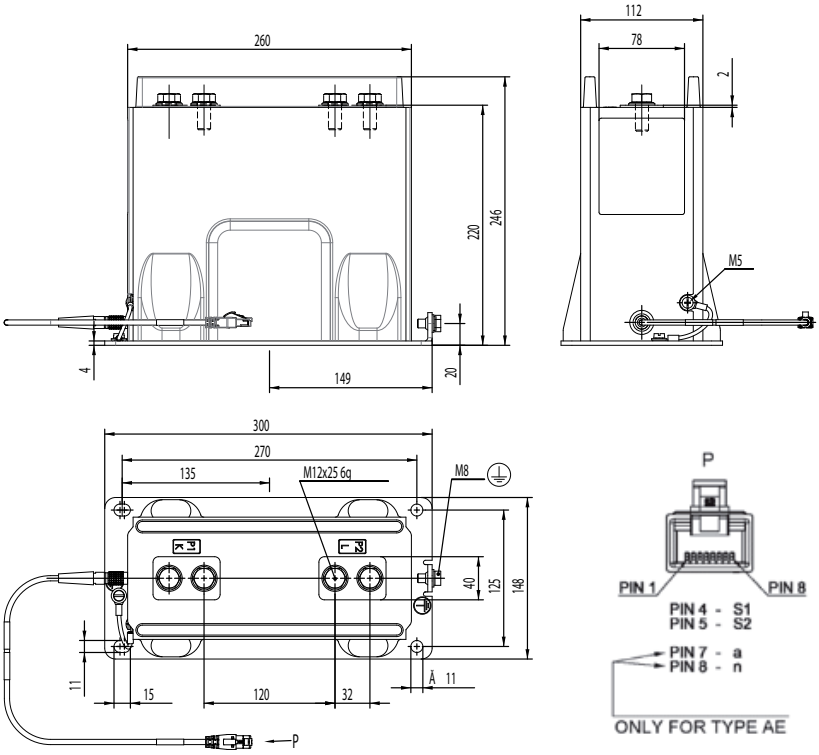
The dimensions of sensor KEVCD A comply with DIN 42600 standards.
It is available in two versions, depending on the type of measurement concerned:

- AG3: current measurement with voltage presence indicators
- AE3: current and voltage measurement

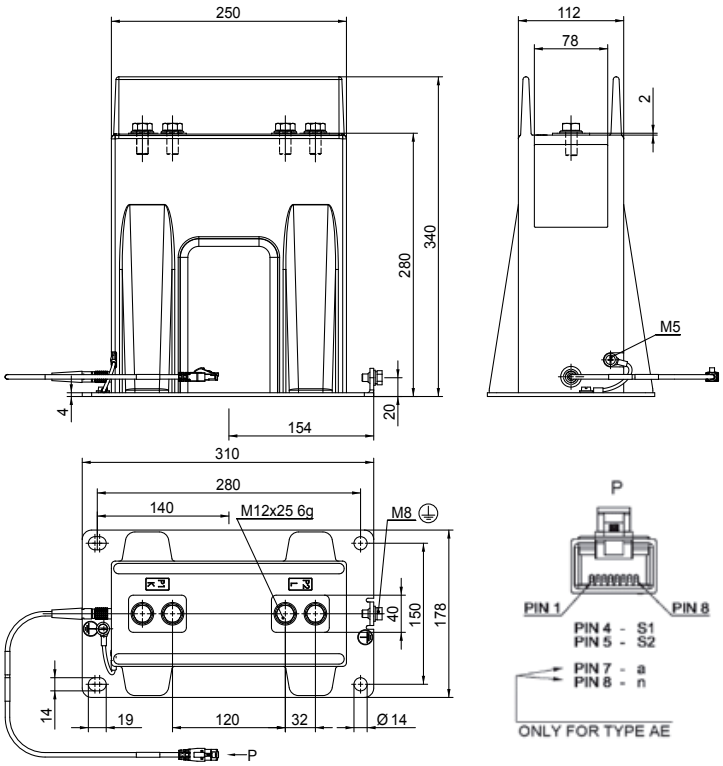
Sensor variants			
Type designation	Functions included		
	Voltage sensor	Current sensor	Voltage indication
KEVCD 12 AE3	•	•	•
KEVCD 12 AG3		•	•
KEVCD 17.5 AE3	•	•	•
KEVCD 17.5 AG3		•	•
KEVCD 24 AE3	•	•	•
KEVCD 24 AG3		•	•

7. Main components

KEVCD 12 – 17,5 kV



KEVCD 24 kV

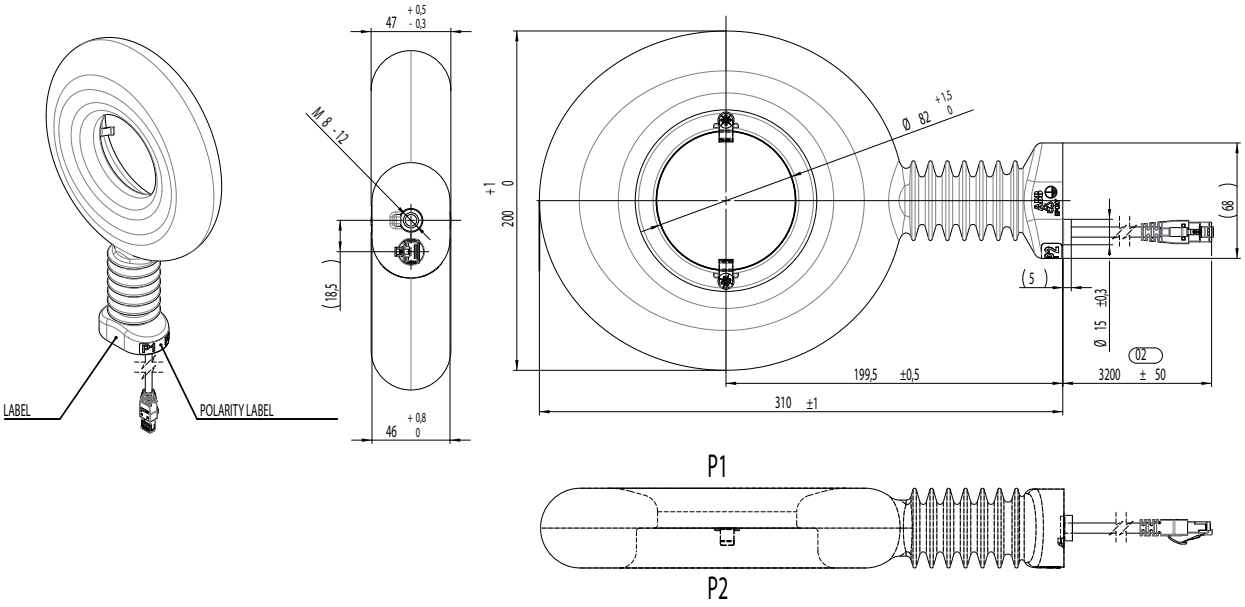


7.4.8 Combined sensor KEVCR BA2

Used in HBC 500 units

Sensor		KEVCR BA2
Rated voltage	Ur [kV]	12 – 17.5 - 24
Voltage accuracy class		1/3P (-5 at 40 °C)
		3/3P (-40 at 60 °C)
		With relay correction
Rated current (40 °C)	Ir [A]	2000
Admissible rated short-time withstand current (3s)	Ik [kA]	40
Rated peak current	[kA]	100
Current accuracy class		1/5P
		With relay correction

KEVCR BA2

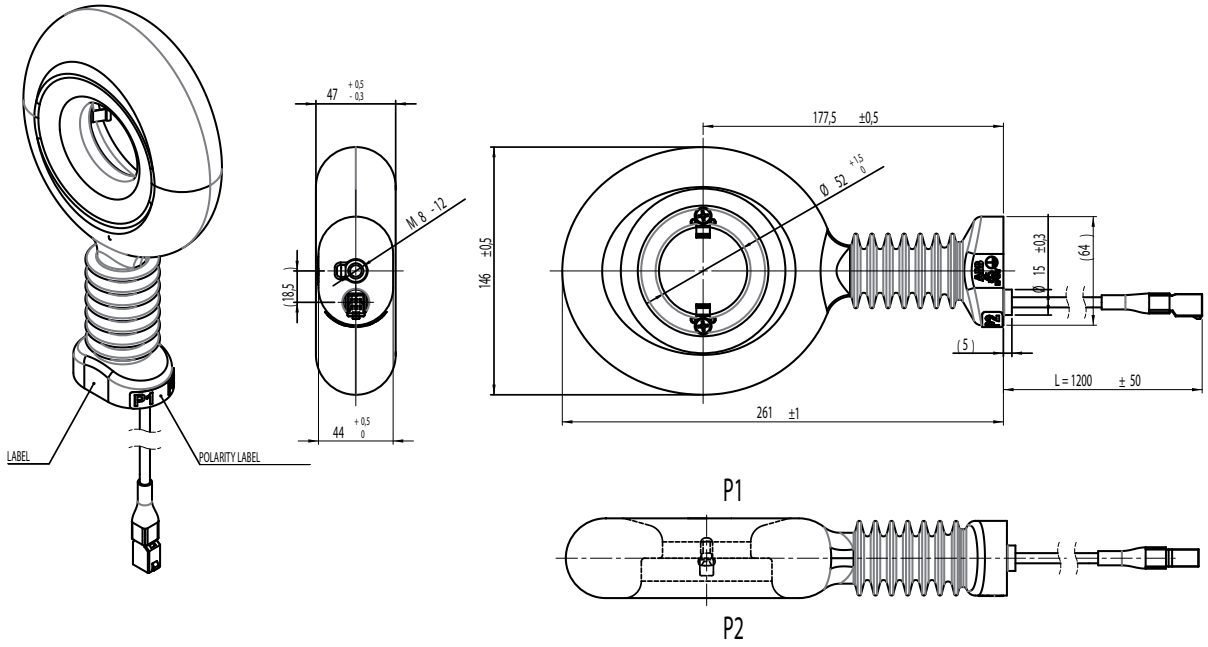


7. Main components

7.4.9 Combined sensor KEVCR AA1

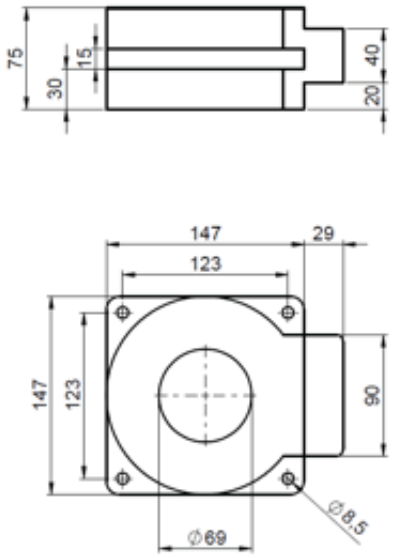
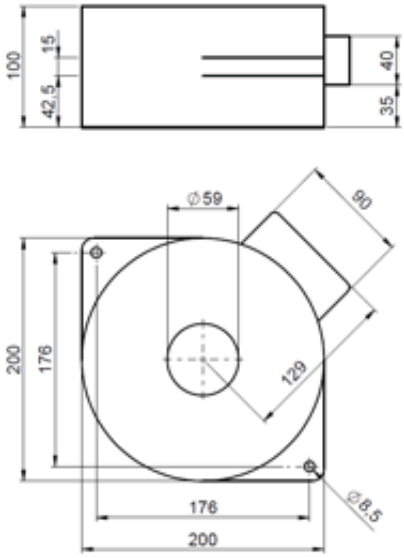
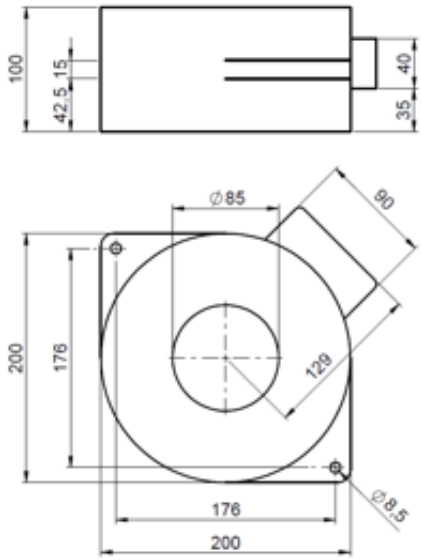
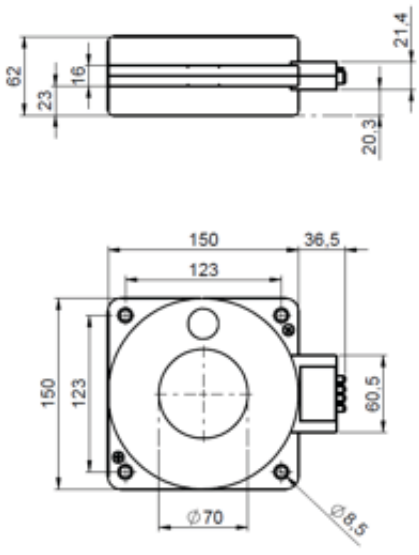
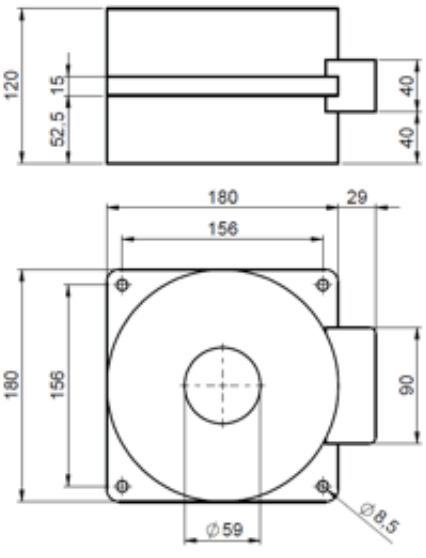
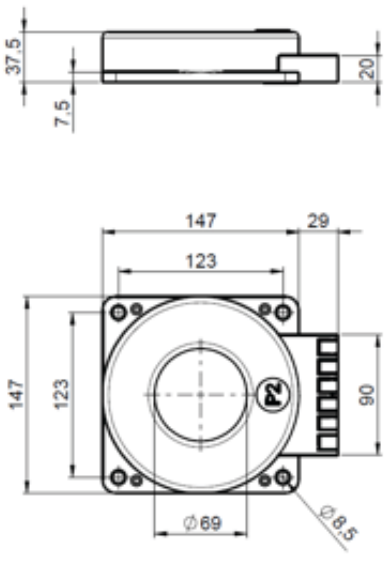
Used in WBC units

KEVCR AA1



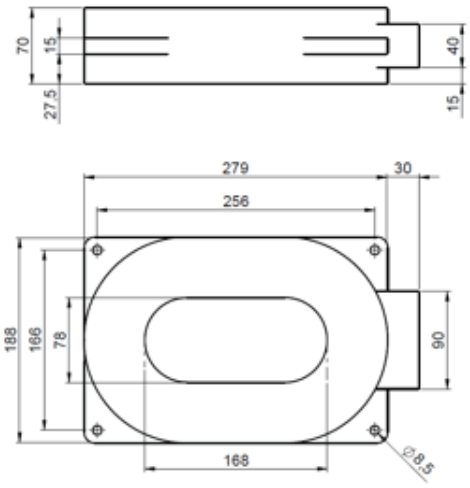
7.4.10 Toroidal current transformers (RCCT)

Used in LSC2A and LSC2B units

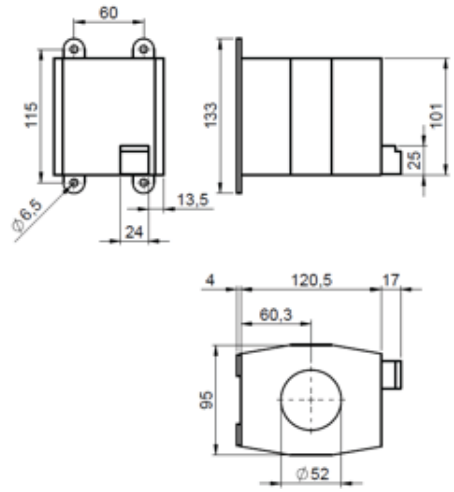
BD TF69 type A	BD TF59 type B	BD TF85 type C
		
KORI 072 EC 6	**KORI 072 DF 12**	**KECA 250 B1**
		

7. Main components

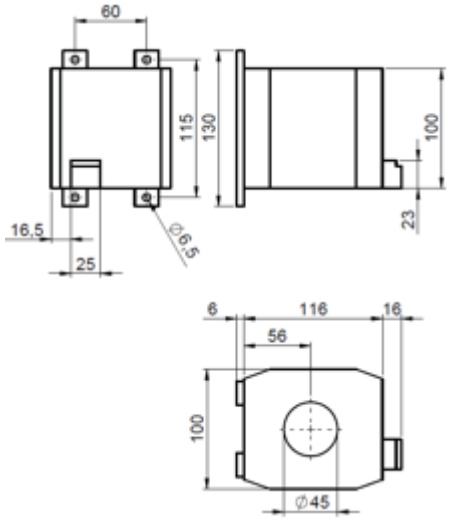
SIPIE TF 170 [1]



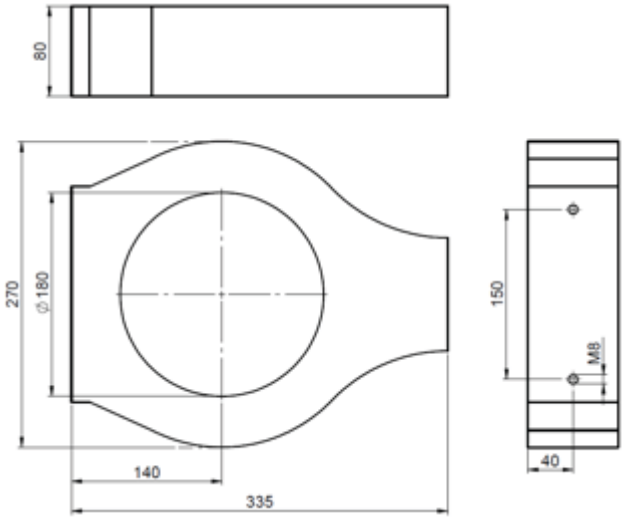
KOKM 072 CA



ELEQ SVA 100 [2]



KOLMA 06 D1-D2



[1] in the case of 2 cables per phase
[2] ELEQ GOST METROLOGICAL required

7.5 Fuses

IEC 60282-1
DIN 43625

The main function performed by current limiting fuses is to protect the connected components (e.g. transformers, motors and capacitor banks) against overcurrents due to overloads and short-circuits.

ABB fuses are equipped with a striker that causes the circuit to automatically open even if only one fuse trips.

Consider the following parameters when choosing fuses:

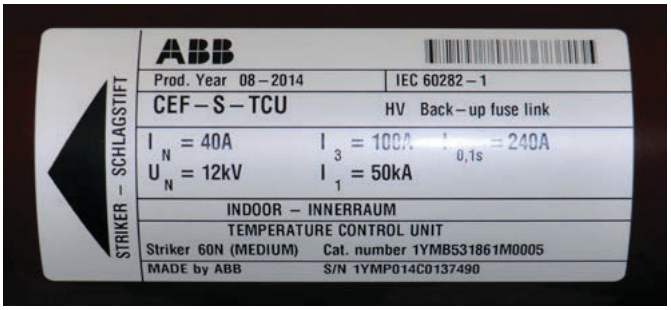
- **Rated voltage Un**: must be the same as the phase voltage of the system or higher. Make sure that the peak arc voltage during the break does not exceed the insulation level of the network.
- **Rated current In**: must be as low as possible, subject to the rated current of the component being protected.

7.5.1 Rating plate

The meanings of the symbols on the rating plate are as follows:

I_N = rated current
U_N = rated voltage
I_3 = minimum trip current
I_1 = maximum short-circuit current for which the cartridge has been tested.

The arrow on the rating plate indicates at which end of the cartridge the striker trip indicator and striker are located. The contact at this end of the fuse cartridge is marked differently.



7. Main components

7.5.2 ABB CEF for transformer protection

ABB CEF fuses are used in VSC/P contactors and in SFC units.
Three fuses (one for each phase) for transformer protection can be connected in series with the circuit.
In accordance with standard IEC 62271-105, refer to the table below for information about how to choose the fuses.

Choice of fuses for transformer protection (SFC units)

Rated voltage of the transformer [kV]	Transformer power rating [kVA]																Rated voltage of fuse U_N [kV]
	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	
	Rated current of fuse CEF I_N [A]																
3	16	25	25	40	40	50	63	80	100	125	–	–	–	–	–	–	3.6/7.2
5	10	16	25	25	25	40	40	50	63	80	100	125	–	–	–	–	
6	6	16	16	25	25	25	40	40	50	63	80	100	125	–	–	–	
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	–	12
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125	
15	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	80	17.5
20	6	6	6	10	10	16	16	16	20	20	25	31.5	40	50	63	80	24
24	6	6	6	6	10	10	16	16	16	20	20	25	40	40	50	63	

Choice of fuses for transformer protection (VSC/P contactors)

Rated voltage of the transformer [kV]	Transformer power rating [kVA]																Rated voltage of fuse U_N [kV]
	25	50	75	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	
	Rated current of fuse CEF I_N [A]																
3	16	25	25	40	40	50	63	80	100	125	160	200	250[(1)]	315[(1)]	–	–	3.6/7.2
5	10	16	25	25	25	40	40	50	63	80	100	125	160	200	250[(1)]	315[(1)]	
6	6	16	16	25	25	25	40	40	50	63	80	100	125	160	200	250[(1)]	
10	6	10	16	16	16	20	20	25	31.5	40	50	63	80	100	125	160	12
12	6	6	10	16	16	16	20	20	25	40	40	50	63	80	100	125	
15	6	6	10	10	16	16	16	20	20	25	40	40	50	63	80	100	17.5
20	6	6	6	10	10	16	16	16	20	20	25	31.5	40	50	63	80	24
24	6	6	6	6	10	10	16	16	16	20	20	25	40	40	50	63	

(1) Fuse CMF

ABB CEF-VT for VT protection

Used in SFV units

Availability of CEF-VT fuses

Rated voltage Un [kV]	Rated current In [A]	Striker	Length e [mm]	Diameter D [mm]	Maximum short-circuit current I_1 [kA]	Minimum trip current I_3 [A]	Weight [kg]
7.2/12	2	no	292	53	63	27	1.5
	2	yes	292	53	63	27	1.5
	6.3	yes	292	53	63	41	1.9
17.5/24	2	no	292	53	31.5	32	1.6
	2	no	442	53	31.5	32	2.4
	6.3	yes	292	53	31.5	46	1.9
	6.3	yes	442	53	31.5	46	2.5

7. Main components

7.5.3 ABB CMF for protecting motors and capacitor banks

Used in VSC/P contactors

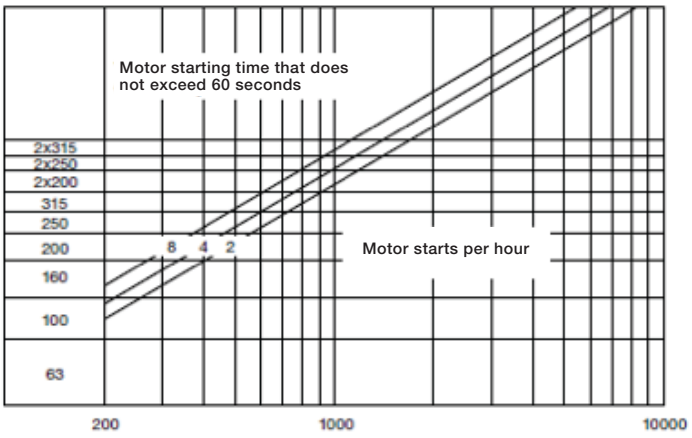
CMF fuses are able to withstand the repeated overcurrents that occur when motors are started up.

Limit performance of contactor with fuses

		3.6 kV	7.2 kV	12 kV
Motors	kW	1000	1800	3000
Capacitors	kvar	1000	1800	3000

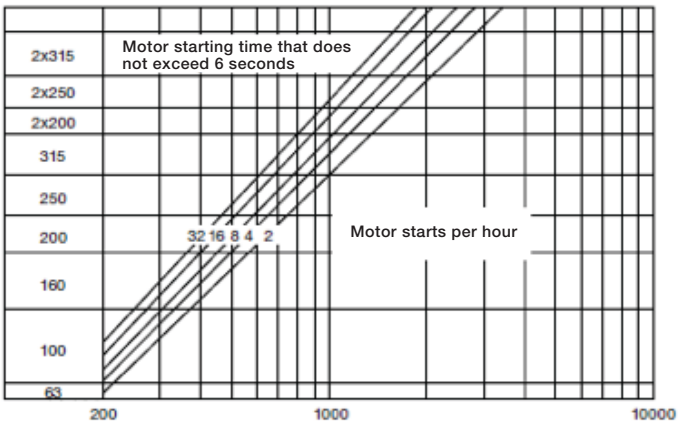
Choice of the fuses to use depends on the motor starting time, as indicated in the diagrams below.

Rated current of fuse cartridge [A]



Motor starting current [A]

Rated current of fuse cartridge [A]



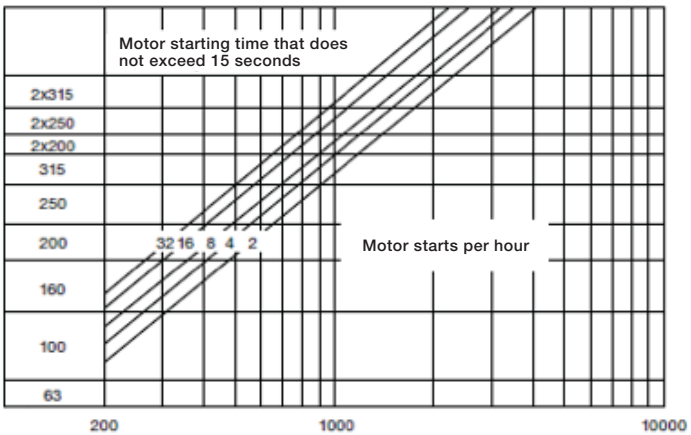
Motor starting current [A]

How to choose a fuse:

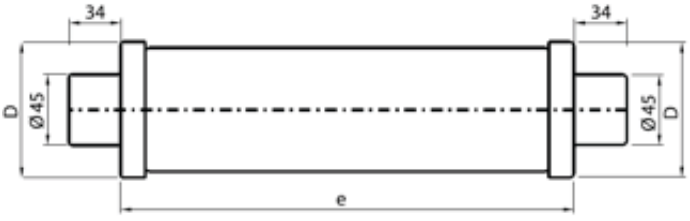
- Select the graph that corresponds to the starting time of the motor you need to protect.
- Select the value that corresponds to the motor starting current on the x-axis of the graph.
- Choose a correct curve on the graph depending on the number of starts per hour (2, 4, 8, 16 or 32 starts per hour).
- Read the rated current of the fuse cartridge corresponding to the required parameters on the y-axis of the graph.

Example	A	B
Starting current of a motor	820 A	250 A
Starting time	6 sec.	15 sec.
Number of starts/hour	2	16
Graph No.	1	2
Rated current of cartridge	250 A	160 A

Rated current of fuse cartridge [A]



Motor starting current [A]



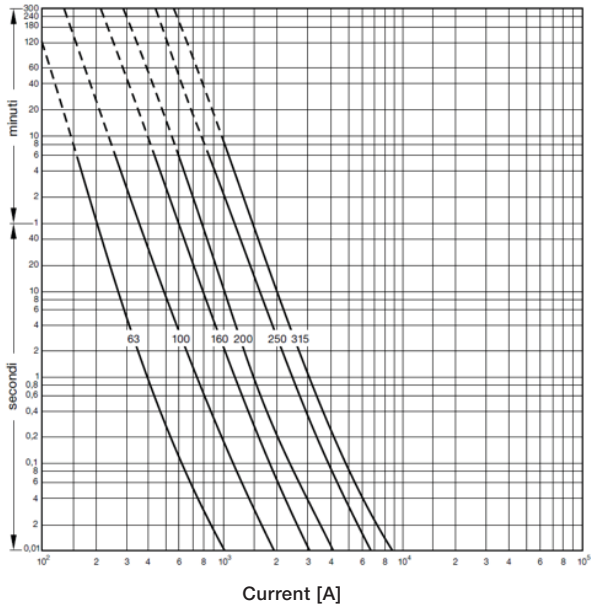
Availability of CMF fuses

Rated voltage Un [kV]	Rated current In [A]	Length e [mm]	Diameter D [mm]	Maximum short-circuit current I_1 [kA]	Minimum trip current I_3 [A]
3.6	100	292	65	50	275
	160	292	65	50	400
	200	292	87	50	500
	250	292	87	50	760
	315	292	87	50	900
7.2/12	63	442	65	50	175
	100	442	65	50	275
	160	442	65	50	400
	200	442	87	50	500
	250	442	87	50	800
	315	442	87	50	950
12	63	442	65	190	190
	100	442	87	275	275
	160	442	87	480	480
	200	442	87	560	560

Trip characteristics

The characteristics are identical for all rated voltage values and have been recorded from the cold state of the cartridge. The hatched parts of the curves indicate the uncertainty areas for tripping.

Pre-arcing times



7.6 Protection relays

ABB has a complete range of solutions for monitoring, controlling and protecting electrical installations.
These products can be integrated into the automation systems of substations and distribution switchgear, or they can also be used as multi-function stand-alone units. The relays are also equipped with communication, alarm and fault analysis functions.
The ABB range of relays includes the following versions, depending on the degree of protection provided:

- REF: protection of overhead and cable lines
- RET: protection of transformers
- REM: protection of motors
- REU: VT protection
- REJ: CT protection
- REB: protection of the main busbars
- RED line differential protection
- REG: protection of generators
- REC: protection of smart-grids

The Relion® relay range is made according to IEC 61850 standards.

7. Main components

Relion® relay selection table

In the table: X = function supported O = function available as option

	REF601	REJ603	REF610	REM610	REU610	REB611 IEC	REF611 IEC	REM611 IEC	REC615 IEC
Standard									
ANSI	X		X	X	X				
IEC	X	X	X	X	X	X	X	X	X
Application									
Arc fault protection application									X
Busbar application						X			
Back-up application	X		X				X		X
Capacitor bank application									
Feeder application	X	X	X		X		X		X
Generator									
Motor application				X		O		X	
Power management/load-shedding application									
Transformer application						O			
Grid application									X
Functionality									
Autorecloser	X		X				X		X
Circuit breaker controlability	X					X	X	X	X
Condition monitoring	X					X	X	X	X
Current-based protection	X	X	X	X		X	X	X	X
Distance protection									
Fault locator									X
Generator differential protection						X			
LCD display with Single Line Diagram (SLD)									X
Line differential protection (with in-zone transformer support)									
Load-shedding									
Motor differential protection						X			
On load tap changer control									
Power quality									X
Self-powered protection relay		X							
Synchro-check									X
Transformer differential protection						X			
Voltage based protection					X				X
Withdrawable release mechanism			X	X	X	X	X	X	X
Automatic transfer switch (ATS)									X
Hardware									
Analog inputs (CTs/VTs)	4/0	4/0	4/0	4/0	0/4	4/1	4/0	4/0	4/6
Analog inputs (sensor channels/CTs)	3/1	–	–	–	–	–	–	–	6/1
Binary inputs/outputs	4/6	0/2	5/8	5/8	5/8	10/9	4/7	4/7	14/13
RTD/mA inputs	–	–	–	–	–	–	–	–	–
mA outputs	–	–	–	–	–	–	–	–	–
Communication protocols									
DNP 3.0			X		X	X	X	X	X
IEC 60870-5-103	X		X	X	X	X	X	X	X
IEC 61850						X	X	X	X
Modbus	X		X	X	X	X	X	X	X
Profibus						X	X	X	X
Communication media									
Ethernet (RJ45)						X	X	X	X
Ethernet (LC)						X	X	X	X
Ethernet redundant solutions (HSR/PRP/RSTP)						X	X	X	X
Serial (RS 232/485, ST conn.)	X		X	X	X	X	X	X	X

The interactive selection guide for Relion relays (ISG) is available online at http://abb.relionisg.com

	REF615 IEC	RED615 IEC	REM615 IEC	RET615 IEC	REU615 IEC	REF620 IEC	REM620 IEC	RET620 IEC	REF630 IEC	REM630 IEC	RET630 IEC
	X	X	X	X	X	X	X	X	X	X	X
	X		X	X	X	X	X	X			
	X										
	X	X			X	X			X		
			X				X			X	
					X						
		X		X	X			X			X
	X	X				X			X		
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X		X	X	X	X	X	X
									X		
	X	X							X		
	X	X	X	X	X	X	X	X	X	X	X
					X				X		
							X			X	
					X			X			X
	X	X				X			X		
	X				X	X	X	X	X		X
				X				X			X
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X			
	4/5	4/5	4/5	7/5	4/5	4/5	7/5	8/9	4/5	8/4	8/3
	6/1	6/1	6/1	–	–	6/1	–	–	–	–	–
	18/13	18/13	16/12	14/12	14/12	32/18	20/14	16/17	50/45	50/45	50/45
	2/1	2/1	6/2	6/2	6/2	6/2	12/4	8/3	8	8	8
	–	–	–	–	–	–	–	–	4	4	4
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X			
	X	X	X	X	X	X	X	X			
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X			
	X	X	X	X	X	X	X	X	X	X	X

7. Main components

7.7 Use of SF_6 gas

SF_6 is a fluorinated greenhouse gas covered by the Kyoto Protocol, thus care must be taken not to cause emissions. At the end of its life, this greenhouse gas must be recovered. All these operations must be performed by authorized personnel.
Consult ABB for further details about SF_6.

Component	SF_6 pressure at 20 °C (*) [kPa]	Quantity of SF_6 at 20 °C [kg]
GSec switch-disconnector	148	0.210
HySec multifunction apparatus	142	0.210
HD4/R-Sec circuit-breaker (for LSC2A units)	381	0.285
HD4/R-Sec circuit-breaker (for LSC2B units)	381	0.285

(*) Absolute pressure, measured at atmospheric pressure 101.325 kPa ($p_{abs}=p_{rel}+p_{atm}$)

7.8 Information publications

Detailed information about the technical and application characteristics of the equipment used in UniSec switchgear is given in the following ABB publications.

Switchgear and controlgear	Publication code
GSec switch-disconnector	1VCP000470
VD4/R-Sec circuit-breakers	1VCP000263
HD4/R-Sec circuit-breaker	1VCP000028
HySec multifunction apparatus	1VCP000556
Vmax/Sec circuit-breaker	1VCP000408
VD4/Sec circuit-breaker	1VCP000001
VSC/P contactor	1VCP000165
CEF - CMF fuses	3405PL202
Earthing switch	–
Instrument transformers	1VLC000572
Relays REF 541, REF 543, REF 545	1MRS750443
Relay REF 542plus	1MRS756269
Relay REF 601	1MDB07212
Relay REF 610	1MRS756295
Relay REF 611	1MRS757468
Relay REF 615	1MRS756379
Relay REF 620	1MRS757844
Relay REF 630	1MRS756976
Relay REJ 603	1MDS07208
Relay RET 615	1MRS756891
Relay RET 620	1MRS757846
Relay RET 630	1MRS756978
Relay REM 610	1MRS756304
Relay REM 615	1MRS756890
Relay REM 620	1MRS757845
Relay REM 630	1MRS756977
Relay REG 630	1MRS757583
Relay REU 610	1MRS756305
Relay REU 615	1MRS757058
Relay REC 615	1MRS757811

8. Environment

8.1 Emissions

The emissions produced by an SDC 375 unit during its 30-year life cycle are given in the table below:

Emissions	Production	Operation	End of Life	Total
Acidification potential (AP) in equivalent mol H^+	301 (64%)	245 (52%)	-76 (-16%)	470 (100%)
Greenhouse effect potential (GWP) in equivalent kg CO_2	719 (30%)	1865 (79%)	-222 (-9%)	2362 (100%)
Eutrophication potential (EP) in equivalent kg O_2	12.9 (40%)	21.1 (65%)	-1.5 (-5%)	32.4 (100%)
Ozone depleting potential (ODP) in equivalent kg CFC_{11}	0	0	0	0
Photochemical oxidants (POCP) in equivalent kg C_2H_4	0.22 (46%)	0.28 (61%)	-0.03 (-7%)	0.47 (100%)

The energy required for assembling each SDC 375 unit is approximately 150 kWh, while the energy required during the assembly of GSec is about 6 kWh.
The calculation also includes transporting the finished and semi-finished products required in order to assemble the finished panel, which normally involves 1500 km road transport and 600 km via sea.

8.2 Thermal power dissipated

The thermal power dissipated (Watt) by a UniSec unit is given in the table below. The losses include the power dissipated by the power supply circuit, by the circuit-breaker and by the instrument transformers. The auxiliary circuit losses are excluded.
These data are mean values and can be used for sizing the air conditioning system in the room where the equipment is installed.

Unit	SDC-SDS 630-800 A	DRC-DRS 630-800 A	SBC-SBS 630-800 A	SFC 800 A	WBC-WBS 630 A	WBC-WBS 1250 A
Power dissipated	150 W	150 W	200 W	200 W	300 W	500 W

8. Environment

8.3 Recycling

8.3.1 General aspects

A UniSec switchgear lasts more than 30 years.
The instructions for recycling decommissioned UniSec products are given below. Recycling includes the materials used for packaging and for the product.
SDC units with switch-disconnector account for about half the requests for UniSec panels. The structures of the various units are fairly similar. For this reason, the SDC unit has been considered in the following description.
This section also includes instructions about the procedures required.

8.3.2 Materials

The following table gives examples of the materials used in SDC 375 units and how they can be recycled:

Recycling capability

Material	**Recyclable**	**kg**	**%**
Steel	Yes	106.5	69
Stainless steel	Yes	5.5	3.5
Copper	Yes	14	9
Brass	Yes	<0.5	<0.5
Aluminium	Yes	4	3
Zinc	Yes	1.5	1
Plastic	Yes	4.6	3
SF_6	Yes	<0.5	<0.5
Total recyclables		**132**	**87**
Rubber	No	<1	<0.5
Epoxy resin	No	18.5	12
Total non-recyclables		**19**	**13**

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