

# UniGear

## Technical Guide





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## DESCRIPTION

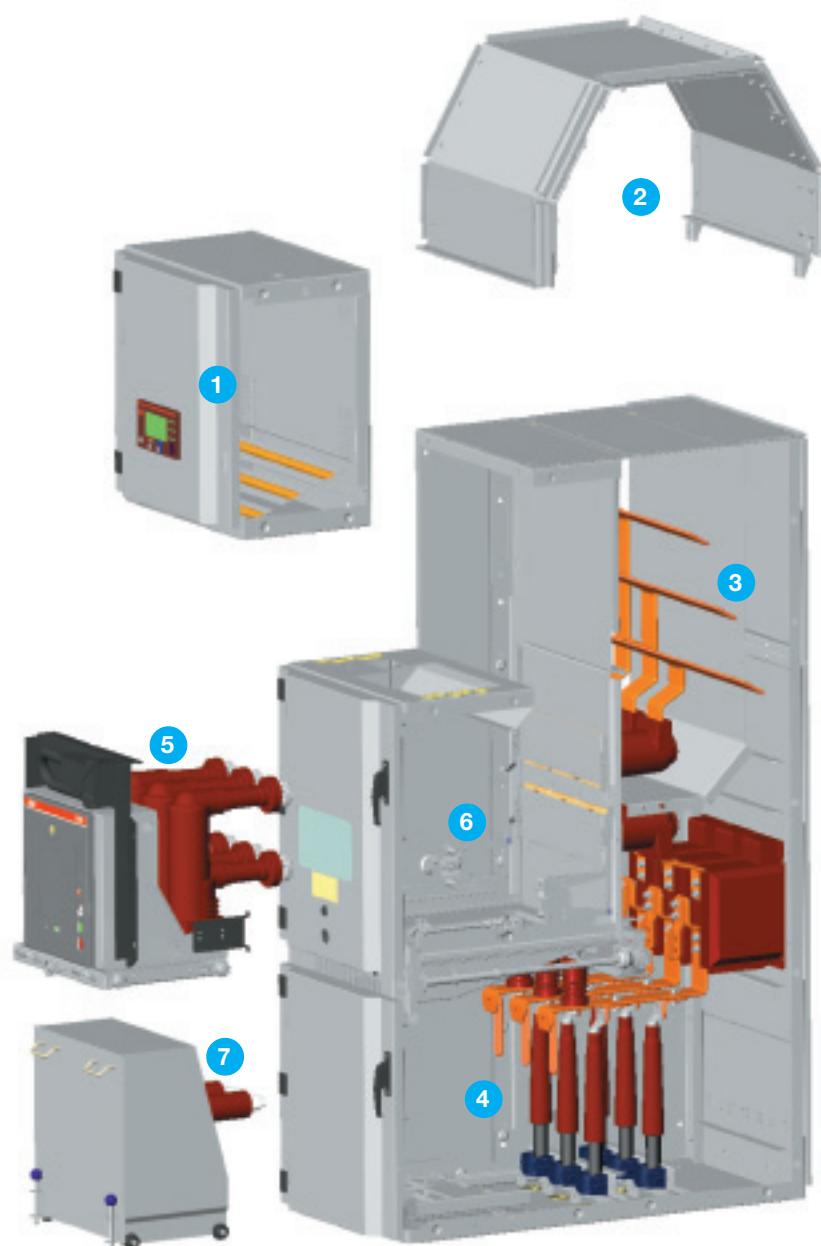
### 1.1.1 Compartments

The typical units of the UniGear switchboard consist of up to a maximum of five compartments segregated from each other by means of metal partitions (incoming/outgoing unit with measurements shown in the figure).

For details of the other units, please see chapter 2.

- 1 Low-voltage compartment
- 2 Gas exhaust duct
- 3 Busbar compartment
- 4 Feeder compartment
- 5 Circuit-breaker
- 6 Circuit-breaker compartment
- 7 Withdrawable voltage transformers with fuses

Separate compartment for VTs is available in deep version of Unigear panels only.





## UNIGEAR SINGLE BUSBAR SYSTEM

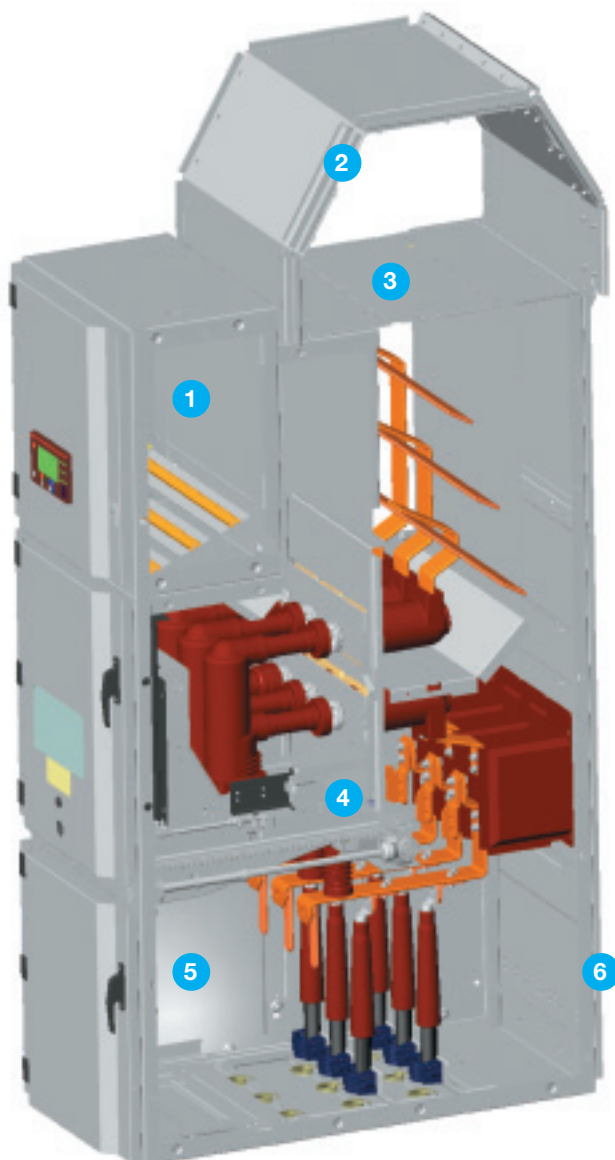
**1.1.2 Components of the structure****1.1.2.1 Hot-galvanized steel sheet**

Type: EN 10143 B500A/DX51D AZ 150 NACO

Thickness: 2 mm (some details 1 or 1.5 mm)

Weight (average): 310...450 Kg

Use: supporting structure, compartments, segregations, gas exhaust duct, gas exhaust flaps.



- 1 Low Voltage compartment
- 2 Gas exhaust duct
- 3 Gas exhaust flaps
- 4 Segregations
- 5 Side walls
- 6 Basic assembly

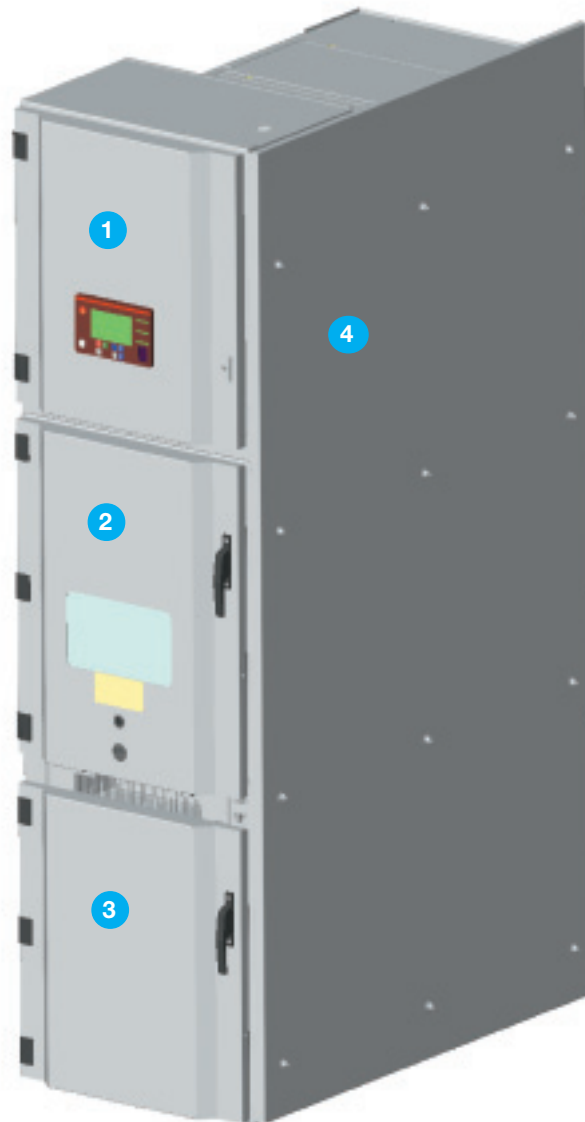
## DESCRIPTION

### 1.1.2.2 Painted steel sheet

Type: UNI EN 10130 Fe P01  
Standard colour: RAL7035 (doors and side covers)  
Thickness: 65 µm  
Use: auxiliary compartment doors,  
circuit-breaker and feeder doors,  
side covers.

### 1.1.2.2.1 Weight of the paint used

<b>12-17.5 kV</b>	<b>Kg</b>
550 mm wide units	0.3
600 mm wide units	0.3
800 mm wide units	0.4
1000 mm wide units	0.5
<b>24 kV</b>	<b>Kg</b>
800 mm wide units	0.4
1000 mm wide units	0.5



- 1 Low-voltage compartment door
- 2 Circuit-breaker compartment door
- 3 Feeder compartment door
- 4 side covers (closing panels of the right-hand and left-hand units of the switchboard).

## UNIGEAR SINGLE BUSBAR SYSTEM

**1.1.2.3 Copper**Type: UNI EN 5649 Cu ETP<sup>(1)</sup>

Weight: 52...150 Kg

Use: main busbars, top and bottom branches, branches for CT and VT, cable connections, earthing switch fixed contacts, earthing busbar.

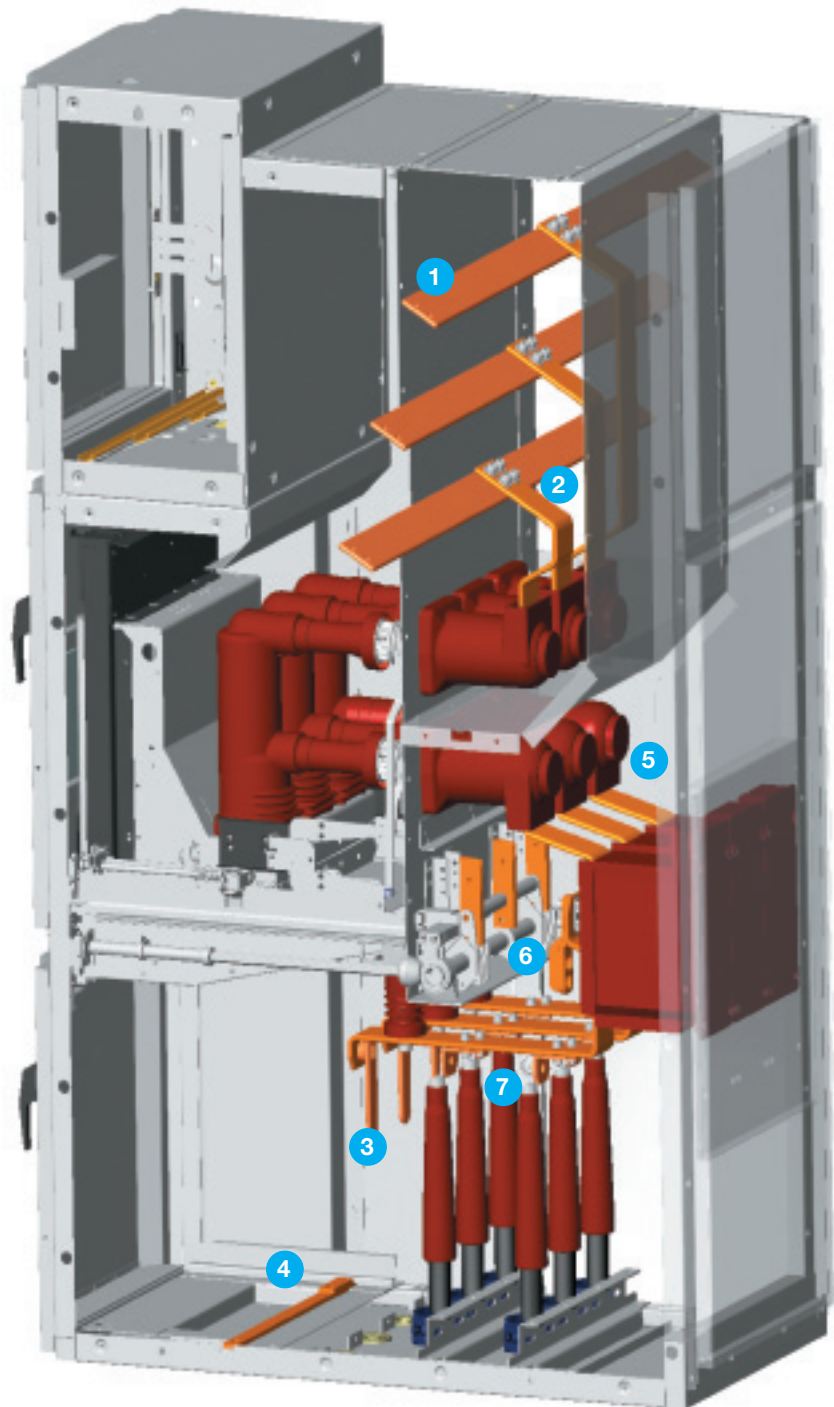
The main busbar system and the branches are supplied with insulating covering for 17.5 and 24kV level. On request insulation can be supplied for 12kV level.

Also on request, the main busbar system and the branches can be silver plated or tinned.

Earthing busbar dimensions: 30x8 mm standard, 40x10 mm on request.

<b>U<sub>n</sub> 12 kV</b>					
I <sub>n</sub> [A]	I <sub>th</sub> [kA]	panel width [mm]	Busbars dim. [mm]	Tee-offs dim [mm]	Insulation
630	31.5	650	1x80x10	1x60x10	no
1000	31.5	650	1x80x10	1x60x10	no
1250	31.5	650	1x80x10	1x80x10	no
1250	40	800	1x80x10	1x80x10	no
1600	31.5/40	800	2x80x10	2x80x10	no
2000	31.5/40	800	2x80x10	2x80x10	no
1600	31.5/40	1000	2x80x10	2x80x10	no
2000	31.5/40	1000	2x80x10	2x80x10	no
2500	31.5/40	1000	2x80x10	2x100x10	yes
3150	31.5/40	1000	2xD100/12	2x120x10	yes
3600	31.5/40	1000	2xD100/12	2x120x10	yes
4000	31.5/40	1000	2xD100/12	2x120x10	yes
<b>U<sub>n</sub> 17,5 kV</b>					
630	31.5	650	1x80x10	1x60x10	yes
1000	31.5	650	1x80x10	1x60x10	yes
1250	31.5	650	1x80x10	1x80x10	yes
1250	40	800	1x80x10	1x80x10	yes
1600	31.5/40	800	2x80x10	2x80x10	yes
2000	31.5/40	800	2x80x10	2x80x10	yes
1600	31.5/40	1000	2x80x10	2x80x10	yes
2000	31.5/40	1000	2x80x10	2x80x10	yes
2500	31.5/40	1000	2x80x10	2x100x10	yes
<b>U<sub>n</sub> 24 kV</b>					
1000	25	800	1x80x10	1x60x10	yes
1250	25	800	1x80x10	1x80x10	yes
1000	25	1000	1x80x10	1x60x10	yes
1250	25	1000	1x80x10	1x80x10	yes
1600	25	1000	2x80x10	2x80x10	yes
2000	25	1000	2x80x10	2x80x10	yes
2300	25	1000	2x80x10	2x100x10	yes
2500	25	1000	2x80x10	2x100x10	yes

## DESCRIPTION



- 1 Main busbars
- 2 Top branches
- 3 VT branches
- 4 Earthing busbar
- 5 Bottom branches
- 6 Earthing switch fixed contacts
- 7 Cable connections

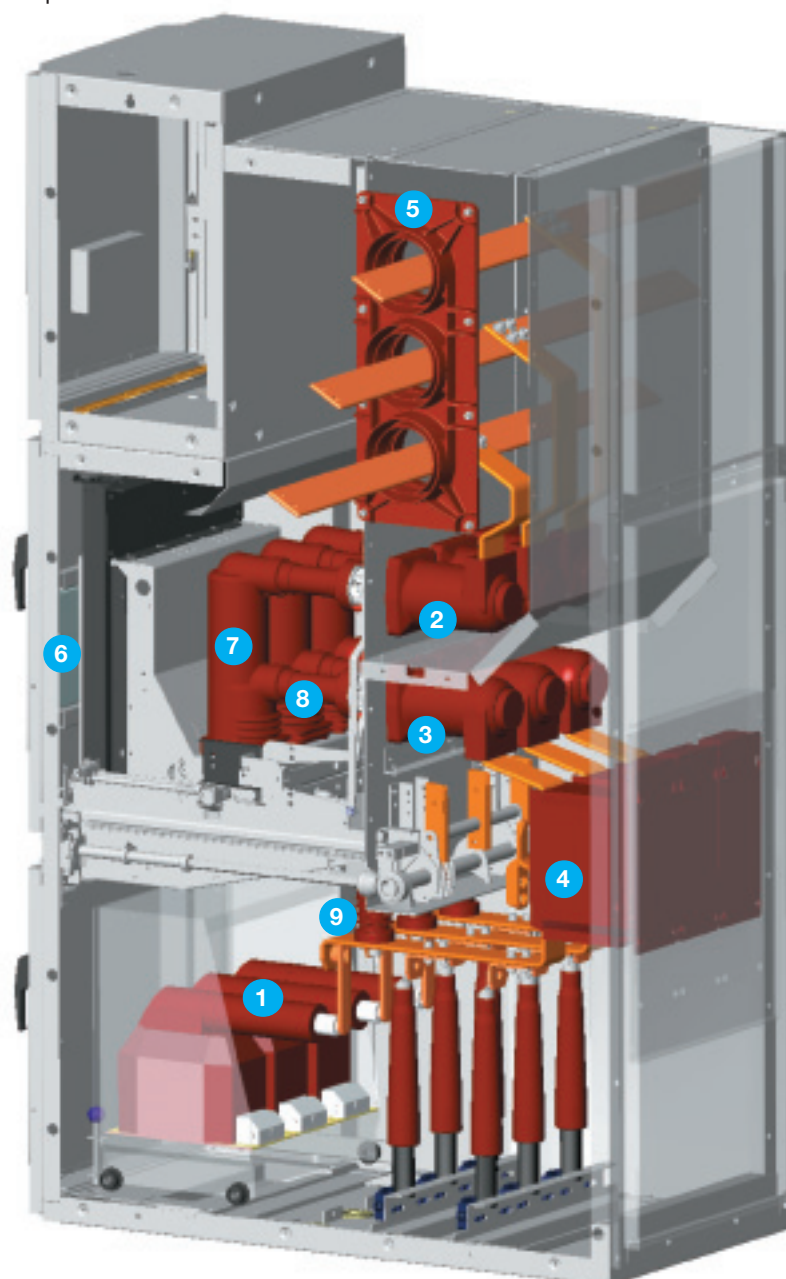
## UNIGEAR SINGLE BUSBAR SYSTEM

**1.1.2.4 Insulating materials**

Type: Epoxy resin  
 Weight: see chap. 7  
 Use: CTs, VTs, sensors, insulators (in variable quantities, see single units - chap. 2 and 3), chambers.

Type: BPTM thermoshrinking polymer  
 Weight (average): 2-5 Kg  
 Use: insulating covering of busbars and branches (if applied).

Type: Glass  
 Weight: 0.4 Kg  
 Use: Inspection windows.



- 1 Voltage transformers
- 2 Busbar side chambers
- 3 Cable side chambers
- 4 Current transformers
- 5 Busbar compartment segregation bushing
- 6 Inspection window (CB door)
- 7 CB poles
- 8 CB contact arms
- 9 Insulator

## DESCRIPTION

### 1.1.3 General electrical characteristics

Switchboard		12 kV	17.5 kV	24 kV
Rated voltage	kV	12	17.5	24
Rated insulation voltage	kV	12	17.5	24
Rated power frequency withstand voltage	kV (1 min)	28	38	50
Rated lightning impulse withstand voltage	kV	75	95	125
Rated short-time withstand current (max.)	kA (3s)	50	40	25
Peak current (max.)	kA	125	100	63
Internal arc withstand current (max.)	kA (1s)	40; 50 (0.5s)	40	25
Branch connectors rated currents	A	630	630	
		1000	1000	
		1250	1250	1250
		1600	1600	1600
		2000	2000	2000
		2500	2500	2500
		3150	3150	
		3600	3600	
Main busbars rated currents	A	630	630	630
		1250	1250	1250
		1600	1600	1600
		2000	2000	2000
		2500	2500	2500
		3150	3150	
		3600	3600	
		4000	4000	

Electrical characteristics of Double level units are listed in chapter 2.

Electrical characteristics of Double busbar system are listed in chapter 4.

#### 1.1.3.1 Earthing switch electrical characteristics

Earthing switch with making capacity		12 kV	17.5 kV	24 kV
Rated short-time withstand current [kA for 3s]	550mm	25	25	–
	650mm	31.5	31.5	–
	800, 1000mm	40, 50 <sup>1)</sup>	40	25
Making capacity	kAp	80, 120	100	63

<sup>1)</sup> For 1s

## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.1.4 Panels overview

## 12 kV

Units width	550mm		650mm				800mm				1000mm					
Panel \ Current	630	1250	400	630	1000	1250	1250	1600	2000	2500	1600	2000	2500	3150	3600	4000
IF	1	1	2	1, 3	1, 3	1, 3	3	3	3		3	3	3	3	4	4
BR		0			0	0	0	0	0	0			0			0
RM		5					5			5						
BC	1	1			1, 3		3	3					3	3	4	4
M		5			5			5					5			

## 17,5 kV

Units width	550mm		650mm			800mm				1000mm						
Panel \ Current	630	1250	630	1000	1250	1250	1600	2000	2500	1600	2000	2500	3150	3600	4000	
IF	1	1	1, 3	1, 3	1, 3	3	3	3		3	3	3	3	4	4	
BR		0			0	0		0	0				0		0	
RM		5				5			5						5	
BC	1	1			1, 3		3	3					3	3	4	4
M		5			5				5				5			

## 24 kV

Units width	800mm				1000mm		
Panel \ Current	1250	1600	2000	2500	1600	2000	2500
IF	3	3	3		3	3	3
BR	0		0				0
RM	5			5			
BC		3	3				3
M				5			5

- 0 Available w/o an apparatus
- 1 Available with V-Max
- 2 Available with V-Contact
- 3 Available with HD4, VD4 and VM1
- 4 Available with VD4 and VM1
- 5 Metering truck available

Busbar applications		Voltage transformers	Earthing switch	Incoming duct
IF	Incoming feeder	■	■	■
IFM	Incoming feeder with measurement	■	■	■

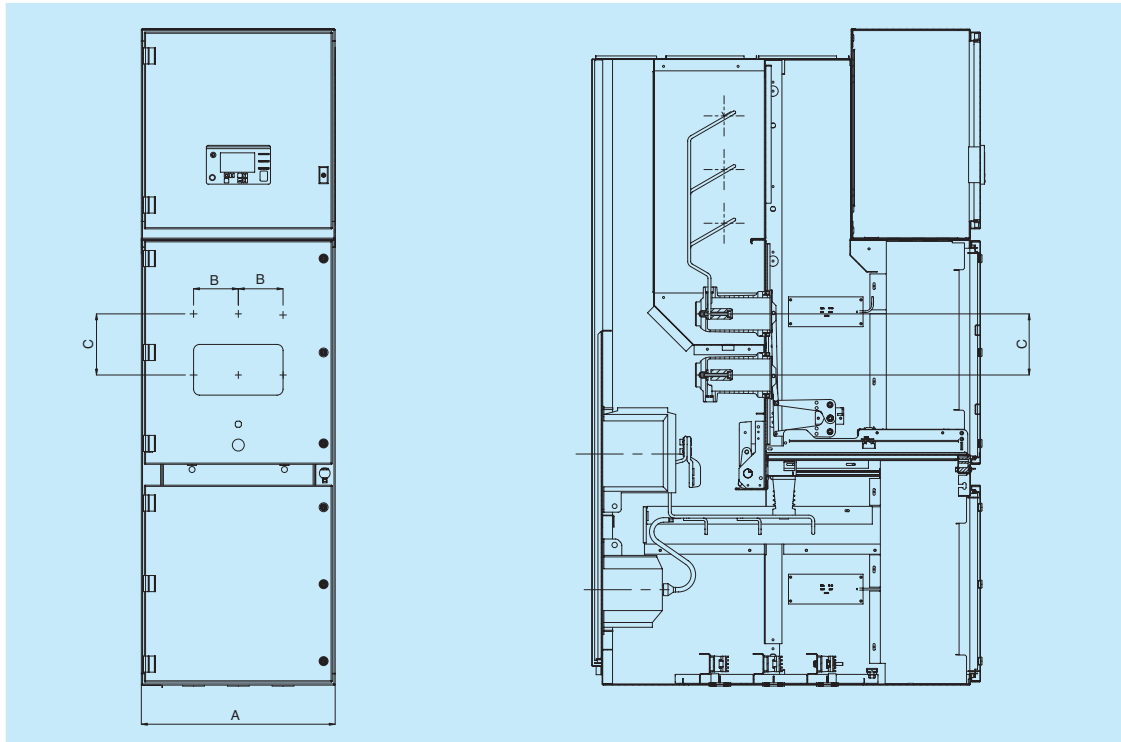
IF - Incoming feeder  
BR - Bus riser

RM - Bus riser with metering  
BC - Bus coupler (with a breaker)

M - Metering unit  
IFM - Incoming feeder with metering

## DESCRIPTION

### 1.1.5 Panels width and pole distances of apparatus



UniGear 12/17.5 kV			
A*)	B	C	Apparatus
550	150	195	V-max 630-1250A
650	150	205	HD4 630-1250A / VD4 630-1250A / V-Contact 400A / VM1 630-1250A
800	210	310	HD4 1250-2000A / VD4 1250-2000A / VM1 1250-2000A
1000	275	310	12 kV: HD4 1600-3150A / VD4 1600-4000A / VM1 1600-4000A 17,5 kV: VD4 1600-3150 A / VM1 1600-3150 A

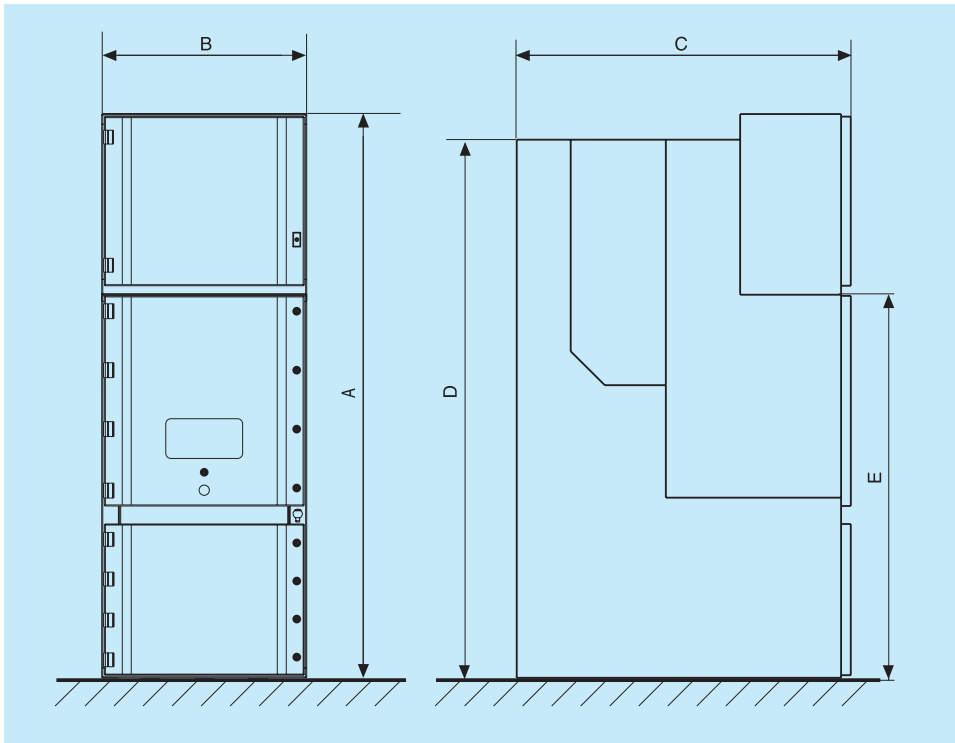
UniGear 24 kV			
A*)	B	C	Apparatus
800	210	310	HD4 630-1250A / VD4 630-1250A / VM1 630-1250A
1000	275	310	HD4 1000-2500A / VD4 1000-2500A / VM1 1000-2500A

\*) Side cover (painted - see chapter 1.2.2.) widens the switchgear by 40 mm on each side.



## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.1.6 Overall dimensions of panels



## 1.1.6.1 Dimensions of 12/17.5 kV units with circuit breaker or contactor

	Dimension	mm
Height	A	2100/2200/2595 <sup>1) 7)</sup>
Width	B <sup>*)</sup>	
- Feeder panels series 550		550
- Feeder panels up to 1250 A (up to 31.5 kA) <sup>6)</sup>		650
- Feeder panels up to 1250 A (above 31.5 kA)		800
- Feeder panels 1600 - 2000 A		800 <sup>2)</sup>
- Feeder panels above 2000 A		1000
Depth	C	1300/1340 <sup>3)</sup> or 1350/1390 <sup>4)</sup>
Height of the basic part of panel	D	2100
	E	1495

<sup>1)</sup> Height of the control cabinet is 580/705/1100 mm, except for the 3150/4000 A panels, where it is only available in heights 705/1100 mm.

<sup>2)</sup> 1000 mm request.

<sup>3)</sup> Up to 2500 A - panel depth with circuit breaker HD4 including combination with them is 1340 mm, in other cases A=1300 - however always consider annotation <sup>5)</sup>

<sup>4)</sup> For 3150 A and 4000 A - panel depth with circuit breaker HD4 including combination with them is 1390 mm, in other cases B=1350 mm - however always consider annotation <sup>5)</sup>

<sup>5)</sup> Dimension must be verified according to documentation of the relevant order.

<sup>6)</sup> Feeders equipped with contactor "V-Contact" are 650 mm wide up to the 50 kA short-time current.

<sup>7)</sup> Unigear type ZS1 series 550 is 2200 or 2595 mm high only.

<sup>\*)</sup> Side cover (painted see chapter 1.2.2) widens the switchgear by 40 mm on each side

## DESCRIPTION

### 1.1.6.2 Dimensions of 24 kV units with circuit breaker

	Dimension	mm
Height	A	2200/2325/2720 <sup>1)</sup>
Width	B	
- Feeder panels up to 1250 A		800 <sup>2)</sup>
- Feeder panels above 1250 A		1000
Depth	C	1520/1560 <sup>3)</sup>
Height of the basic part of panel	D	2200
	E	1620

<sup>1)</sup> Height of the control cabinet is 580/705/1100 mm.

<sup>2)</sup> 1000 mm on request.

<sup>3)</sup> Panel depth with circuit breaker HD4 including combination with them is 1560 mm, in other cases C=1520 mm - however always consider annotation <sup>4)</sup>

<sup>4)</sup> Dimension must be verified according to documentation of the relevant order.

### 1.1.6.3 Dimensions of panels with the switch-disconnector NALF 12 and 17.5 kV

	Dimension	mm
Height	A	2075/2200/2595 <sup>1)</sup>
Width	B	
- Outgoing and incoming panels with - switch-disconnector 630 A		800
Depth	C	1300/1340 <sup>2)</sup>
Height of basic part of panel	D	2100
	E	1495

<sup>1)</sup> Height of control cabinet is 580/705/1100 mm.

<sup>2)</sup> The depth of panel with the switch-disconnector in combination with HD4 circuit breaker panels is recommended to 1340 mm, in other cases 1300 mm – take always into account the note 3)

<sup>3)</sup> The dimensions must be verified according to the documentation of relevant order

### 1.1.6.4 Dimensions of panels with the switch-disconnector NALF 24 kV

	Dimension	mm
Height	A	2200/2325/2720 <sup>1)</sup>
Width	B	
- Outgoing and incoming panels with - switch-disconnector 630 A		1000
Depth	C	1520/1560 <sup>2)</sup>
Height of basic part of panel	D	2200
	E	1620

<sup>1)</sup> Height of control cabinet is 580/705 /1100mm

<sup>2)</sup> The depth of panel with the switch-disconnector in combination with HD4 circuit breaker panels is recommended to 1560 mm, in other cases 1520 mm – take always into account the note 3)

<sup>3)</sup> The dimensions must be verified according to the documentation of relevant order

## UNIGEAR SINGLE BUSBAR SYSTEM

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## TYPICAL CONVENTIONAL UNITS

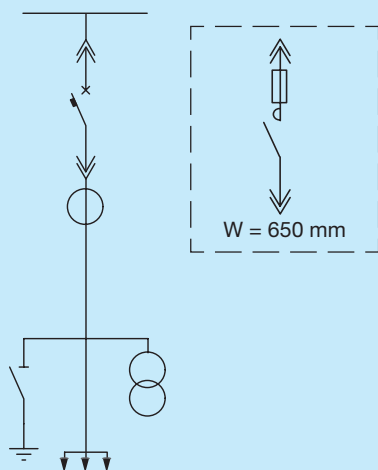
### 1.2.0 General notes

- Each medium size current transformer can be replaced by an ABB KEVCD sensor. The earthing switch is not a compulsory switchboard accessory.
- Voltage transformers in fixed version are not equipped with fuses.
- Low voltage compartment height is 705mm if not mentioned a different one. Other heights are 580mm and 1100mm.
- Total height of the unit is including low voltage compartment and without an exhaust duct.
- Indicated number of cables is maximal available. Voltage transformers occupy one position as well as surge arresters.
- Rating of panels with vacuum contactor is always 400A.
- Voltage transformers may not have a fuse status indication if they are located in the cable compartment.
- Dimensions of panels may vary depending on project requirements.

## UNIGEAR SINGLE BUSBAR SYSTEM

### 1.2.1 Incoming-outgoing unit (IF)

#### 1.2.1.1 Bottom cable entry



		12-17.5 kV				24 kV	
Width	mm	550	650	800	1000	800	1000
Height	mm	2200	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	2775
Depth	mm	1340	1340	1340	1340/1390	1560	1560
Rated current	A						
630		■ <sup>3)</sup>	■			■	■
1250		■ <sup>3)</sup>	■ <sup>1)</sup>			■	■
1600				■ <sup>2)</sup>			■
2000				■ <sup>1)</sup>			■
2500				■ <sup>1)</sup>			■
3150					■ <sup>2)</sup>		
3600					■ <sup>2)</sup>		
4000					■ <sup>2)</sup>		
Earthing switch		■	■	■	■	■	■
Number of cable connections (maximal)	nr.	2	3	6/3 <sup>2)</sup>	6	6	6
Number of CTs per phase (alternative combinations)							
1 medium size		■	■	■	■	■	■
1 long size		■	■	■	■	■	■
2 medium size							
1 medium and 1 long size							
1 ring type		■					
Number of VTs per phase (alternative combinations)							
1 fixed		■	■	■	■	■	■
2 fixed							
1 withdrawable with fuses							

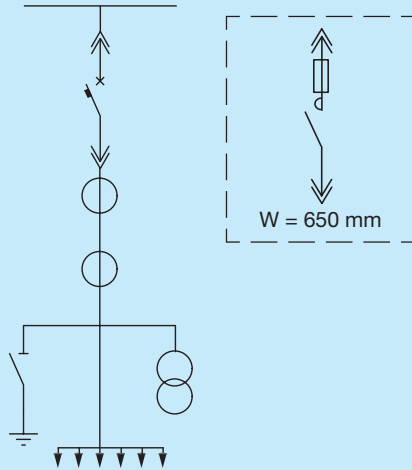
<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

<sup>3)</sup> ≤ 25 kA version

## TYPICAL CONVENTIONAL UNITS

### 1.2.1.2 Bottom cable entry - deep version



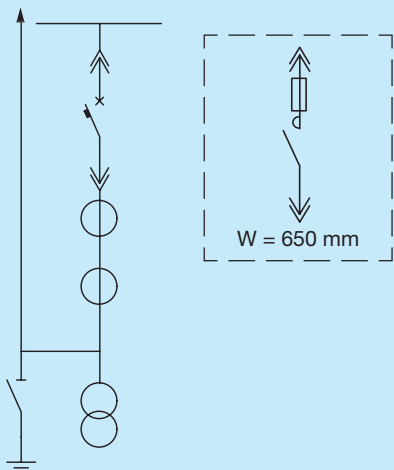
		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775
Depth	mm	1840	1840	1840	2170	2170
Rated current	A					
630		■ <sup>1)</sup>	■ <sup>2)</sup>		■	
1250			■			■
1600			■			■
2000			■			■
2500				■		
3150				■		
3600				■		
4000				■		
Earthing switch		■	■	■	■	
Number of cable connections (maximal)	nr.	4	6	6	6	6
Number of CTs per phase (alternative combinations)						
1 medium size		■	■	■	■	■
1 long size		■	■	■	■	■
2 medium size		■	■	■	■	■
1 medium and 1 long size		■	■	■	■	■
Number of VTs per phase (alternative combinations)						
1 fixed		■	■	■	■	■
2 fixed			■	■	■	■
1 withdrawable with fuses						

<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

## UNIGEAR SINGLE BUSBAR SYSTEM

### 1.2.1.3 Top cable entry - deep version



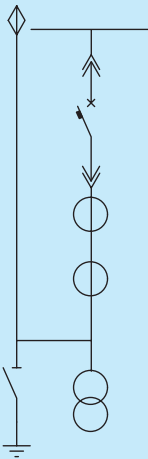
		12-17.5 kV			24 kV		
Width	mm	650	800	1000	800	1000	1000
Height	mm	2200	2200	2200	2325	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	2775
Depth	mm	1840	1840	1840	2170	2170	2170
Rated current	A						
630		■ <sup>1)</sup>	■ <sup>2)</sup>		■	■	
1250			■				
1600			■				■
2000			■				■
2500				■			
3150				■			
3600				■			
4000				■			
Earthing switch		■	■	■	■	■	■
Number of cable connections (maximal)	nr.	3	3	4	4	4	4
Number of CTs per phase (alternative combinations)							
1 medium size		■	■	■	■	■	■
1 long size		■	■	■	■	■	■
2 medium size		■	■	■	■	■	■
1 medium and 1 long size		■	■	■	■	■	■
Number of VTs per phase (alternative combinations)							
1 fixed		■	■	■	■	■	■
2 fixed			■	■	■	■	■
1 withdrawable with fuses							

<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

## TYPICAL CONVENTIONAL UNITS

### 1.2.1.4 Top busbar entry - deep version



		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775
Depth	mm	1840	1840	1840/1890	2170	2170
Rated current	A					
630		■ <sup>1)</sup>	■ <sup>2)</sup>		■	■
1250			■			■
1600			■			■
2000			■	■		■
2500			■	■		■
3150				■		
Earthing switch		■	■	■	■	■
Number of cable connections (maximal)		-	-	-	-	-
Number of CTs per phase (alternative combinations)						
1 medium size		■	■	■	■	■
1 long size		■	■	■	■	■
2 medium size		■	■	■	■	■
1 medium and 1 long size		■	■	■	■	■
Number of VTs per phase (alternative combinations)						
1 fixed		■	■	■	■	■
2 fixed			■	■	■	■
1 withdrawable with fuses						

<sup>1)</sup> ≤ 31.5 kA version

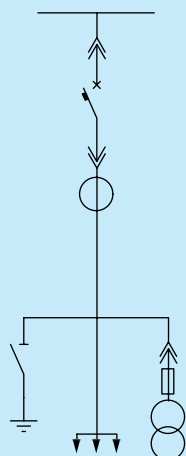
<sup>2)</sup> ≥ 40 kA version



## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.2.2 Incoming-outgoing unit with measurement (IFM)

## 1.2.2.1 Bottom cable entry



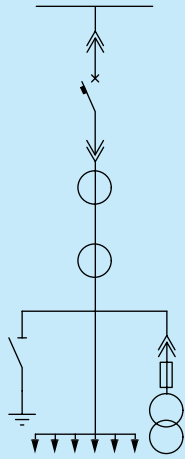
		12-17.5 kV			24 kV		
Width	mm	650	800	1000	800	1000	1000
Height	mm	2200	2200	2200	2325	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	2775
Depth	mm	1340	1340	1340	1560	1560	1560
Rated current	A						
630		■			■	■	
1250		■ <sup>1)</sup>	■ <sup>2)</sup>		■	■	
1600			■				■
2000			■ <sup>1)</sup>	■ <sup>2)</sup>			■
2500				■			■
3150				■			
3600				■			
4000				■			
Earthing switch		■	■	■	■	■	■
Number of cable connections (maximal)	nr.	2	4	4	4	4	4
Number of CTs per phase (alternative combinations)							
1 medium size		■	■	■	■	■	■
1 long size		■	■	■	■	■	■
2 medium size							
1 medium and 1 long size							
Number of VTs per phase (alternative combinations)							
1 fixed							
2 fixed							
1 withdrawable with fuses		■	■	■	■	■	■

<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

## TYPICAL CONVENTIONAL UNITS

### 1.2.2.2 Bottom cable entry - deep version



		12-17.5 kV		24 kV			
Width	mm		800	1000	800	1000	1000
Height	mm		2200	2200	2325	2325	2325
Height with gas exhaust duct	mm		2675	2675	2775	2775	2775
Depth	mm		1840/1890	1840/1890	2170	2170	2170
Rated current	A						
630			■		■	■	
1250			■				■
1600			■ <sup>1)</sup>	■ <sup>2)</sup>			■
2000				■			■
2500				■			■
3150				■			■
3600				■			■
4000				■			■
Earthing switch			■	■	■	■	■
Number of cable connections (maximal)	nr.		4	4	4	4	4
Number of CTs per phase (alternative combinations)							
1 medium size			■	■	■	■	■
1 long size			■	■	■	■	■
2 medium size			■	■	■	■	■
1 medium and 1 long size			■	■	■	■	■
Number of VTs per phase (alternative combinations)							
1 fixed							
2 fixed							
1 withdrawable with fuses <sup>®)</sup>			■	■	■	■	■

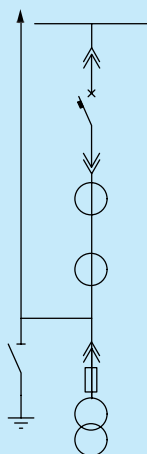
<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

<sup>®)</sup> Transformers may be in a segregated compartment.

## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.2.2.3 Top cable entry - deep unit

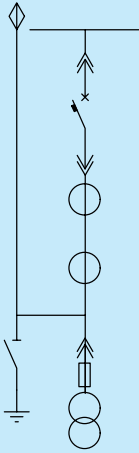


		12-17.5 kV			24 kV		
Width	mm	650	800	1000	800	1000	1000
Height	mm	2200	2200	2200	2325	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	2775
Depth	mm	1840	1840	1840/1890	2170	2170	2170
Rated current	A						
630		■			■	■	
1250		■					
1600			■				■
2000			■				■
2500				■			■
3150				■			
3600				■			
4000				■			
Earthing switch		■	■	■	■	■	■
Number of cable connections (maximal)	nr.	3	4	4	4	4	4
Number of CTs per phase (alternative combinations)							
1 medium size		■	■	■	■	■	■
1 long size		■	■	■	■	■	■
2 medium size		■	■	■	■	■	■
1 medium and 1 long size		■	■	■	■	■	■
Number of VTs per phase (alternative combinations)							
1 fixed							
2 fixed							
1 withdrawable with fuses			■	■	■	■	■

<sup>8)</sup> Transformers may be in a segregated compartment.

## TYPICAL CONVENTIONAL UNITS

### 1.2.2.4 Top busbar entry - deep unit

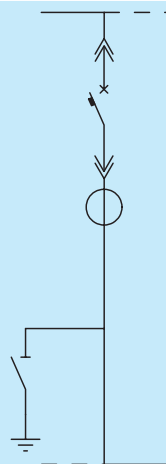


		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775
Depth	mm	1840	1840/1890	1840/1890	2170	2170
Rated current	A					
630		■			■	■
1250		■				
1600			■			■
2000			■			
2500				■		
3150				■		
3600				■		
4000				■		
Earthing switch		■	■	■	■	■
Number of cable connections (maximal)		-	-	-	-	-
Number of CTs per phase (alternative combinations)						
1 medium size			■	■	■	■
1 long size			■	■	■	■
2 medium size			■	■	■	■
1 medium and 1 long size			■	■	■	■
Number of VTs per phase (alternative combinations)						
1 fixed						
2 fixed						
1 withdrawable with fuses			■	■	■	■

<sup>8)</sup> Transformers may be in a segregated compartment.

## UNIGEAR SINGLE BUSBAR SYSTEM

### 1.2.3 Bus tie (BT)

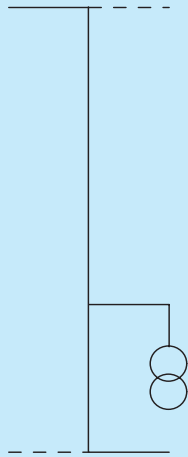


		12-17.5 kV			24 kV		
Width	mm	550	650	800	1000	800	1000
Height	mm	2200	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2675	2775	2775
Depth	mm	1340	1340	1340/1390	1340/1390	1560	1560
Rated current	A						
630		■	■	■ <sup>1)</sup>		■	
1250				■			■
1600				■			■
2000				■	■		■
2500					■		
3150					■		
3600					■		
4000					■		
Earthing switch							
Number of cable connections (maximal)		-	-	-	-	-	-
Number of CTs per phase (alternative combinations)							
1 medium size		■	■	■	■	■	■
1 long size		■	■	■	■	■	■
2 medium size							
1 medium and 1 long size							
Number of VTs per phase (alternative combinations)							
1 fixed							
2 fixed							
1 withdrawable with fuses							

<sup>1)</sup> ≥ 40 kA version

## TYPICAL CONVENTIONAL UNITS

### 1.2.4 Bus rise (R)



		12-17.5 kV			24 kV		
Width	mm	650	800	1000	800	1000	
Height	mm	2200	2200	2200	2325	2325	
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	
Depth	mm	1340	1340	1340	1560	1560	
Rated current	A						
630							
1250		■ <sup>1)</sup>	■ <sup>2)</sup>		■	■	
1600		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
2000		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
2500		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
3150			■				
3600			■				
4000			■ <sup>1)</sup>	■ <sup>2)</sup>			
Earthing switch		-	-	-	-	-	-
Number of cable connections (maximal)		-	-	-	-	-	-
Number of CTs per phase (alternative combinations)							
1 medium size							
1 long size							
2 medium size							
1 medium and 1 long size							
Number of VTs per phase (alternative combinations)							
1 fixed *)		■	■	■	■	■	■
2 fixed							
1 withdrawable with fuses							

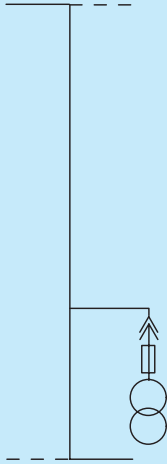
<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

\*) Available only as a DTO (Design to order).

## UNIGEAR SINGLE BUSBAR SYSTEM

### 1.2.5 Bus rise with measurement (RM)



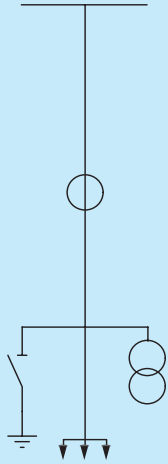
		12-17.5 kV			24 kV		
Width	mm	650	800	1000	800	1000	
Height	mm	2200	2200	2200	2325	2325	
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	
Depth	mm	1340	1340	1340	1560	1560	
Rated current	A						
630			■ <sup>2)</sup>		■	■	
1250		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
1600		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
2000		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
2500		■ <sup>1)</sup>	■ <sup>2)</sup>			■	
3150			■				
3600			■				
4000			■ <sup>1)</sup>	■ <sup>2)</sup>			
Earthing switch		-	-	-	-	-	-
Number of cable connections (maximal)		-	-	-	-	-	-
Number of CTs per phase (alternative combinations)							
1 medium size							
1 long size							
2 medium size							
1 medium and 1 long size							
Number of VTs per phase (alternative combinations)							
1 fixed							
2 fixed							
1 withdrawable with fuses		■	■	■	■	■	■

<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version

## TYPICAL CONVENTIONAL UNITS

### 1.2.6 Incoming-outgoing unit direct (IFD)



		12-17.5 kV			24 kV		
Width	mm	650	800		800	1000	
Height	mm	2200	2160		2325	2325	
Height with gas exhaust duct	mm	2675	2675		2775	2775	
Depth	mm	1340	1340		1560	1560	
Rated current	A						
630		■ <sup>1)</sup>					
1250		■ <sup>1)</sup>	■ <sup>2)</sup>		■		
1600							
2000			■ <sup>1)</sup>				
2500						■	
Earthing switch		■	■		■	■	
Number of cable connections (maximal)	nr.	3	4		4	4	
Number of CTs per phase (alternative combinations)							
1 medium size		■	■		■	■	
1 long size		■	■		■	■	
2 medium size							
1 medium and 1 long size							
Number of VTs per phase (alternative combinations)							
1 fixed		■	■		■	■	
2 fixed							
1 withdrawable with fuses							

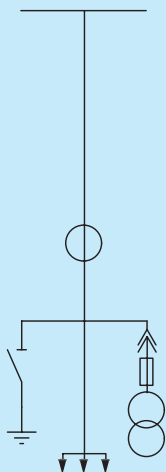
<sup>1)</sup> ≤ 31.5 kA version

<sup>2)</sup> ≥ 40 kA version



## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.2.7 Incoming-outgoing unit direct with measurement (IFDM)



		12-17.5 kV			24 kV		
Width	mm	650	800		800	1000	
Height	mm	2200	2200		2325	2325	
Height with gas exhaust duct	mm	2675	2675		2775	2775	
Depth	mm	1340	1340		1560	1560	
Rated current	A						
630		■ <sup>1)</sup>	■ <sup>2)</sup>		■	■	
1250						■	
1600						■	
2000						■	
2500						■	
Earthing switch		■	■		■	■	
Number of cable connections (maximal)	nr.	3	4		4	4	
Number of CTs per phase (alternative combinations)							
1 medium size		■	■		■	■	
1 long size		■	■		■	■	
2 medium size							
1 medium and 1 long size							
Number of VTs per phase (alternative combinations)							
1 fixed		■	■		■	■	
2 fixed							
1 withdrawable with fuses							

<sup>1)</sup> ≤ 31.5 kA version

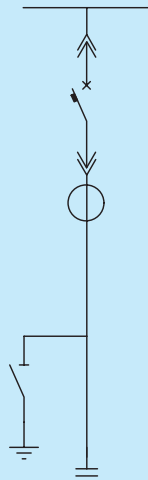
<sup>2)</sup> ≥ 40 kA version

## TYPICAL CONVENTIONAL UNITS

### 1.2.8 Incoming unit with capacitors (IFC)

This solution is treated as a DTO (Design To Order) every time. Please contact producer for this type of panel.

The characteristics and number of CTs can be different from the ones described according to the type of capacitors used, the installed power and the use of damping reactances and surge arresters.



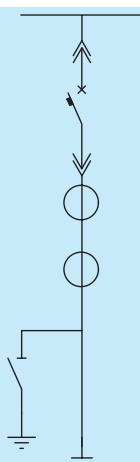
		12-17.5 kV				24 kV	
Width	mm	550	650	800	1000	800	1000
Height	mm	2200	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2675	2775	2775	2775
Depth	mm	1300	1340	1340	1340	1560	1560
Rated current	A						
	630						
	1250						
	1600						
	2000						
	2500						
	3150						
Earthing switch		■	■	■	■	■	■
Number of cable connections (maximal)		-	-	-	-	-	-
Number of CTs per phase (alternative combinations)							
	1 medium size	■	■	■	■	■	■
	1 long size	■	■	■	■	■	■
	2 medium size						
	1 medium and 1 long size						
Number of VTs per phase (alternative combinations)							
	1 fixed						
	2 fixed						
	1 fixed with fuses						
	1 withdrawable with fuses						
	1 fixed and 1 withdrawable with fuses						

## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.2.8.1 Deep version

This solution is treated as a DTO (Design To Order) every time. Please contact producer for this type of panel.

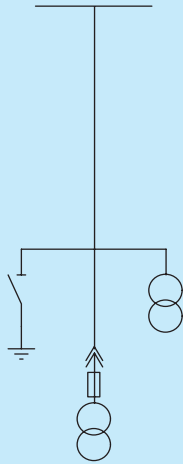
The characteristics and number of CTs can be different from the ones described according to the type of capacitors used, the installed power and the use of damping reactances and surge arresters.



		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200	2200	2200	2325	2325
Height with gas exhaust duct	mm	2675	2675	2775	2775	2775
Depth	mm	1840	1840	2170	2170	2170
Rated current	A					
	630					
	1250					
	1600					
	2000					
	2500					
	3150					
Earthing switch		■	■	■	■	■
Number of cable connections (maximal)		-	-	-	-	-
Number of CTs per phase (alternative combinations)						
	1 medium size	■	■	■	■	■
	1 long size	■	■	■	■	■
	2 medium size					
	1 medium and 1 long size					
Number of VTs per phase (alternative combinations)						
	1 fixed					
	2 fixed					
	1 fixed with fuses					
	1 withdrawable with fuses					
	1 fixed and 1 withdrawable with fuses					

## TYPICAL CONVENTIONAL UNITS

### 1.2.9 Measurement unit (M)



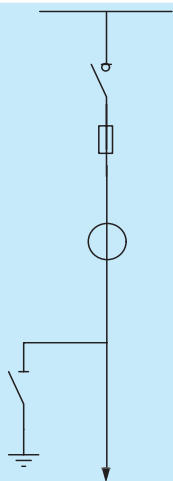
		12-17.5 kV			24 kV	
Width	mm	550 <sup>5)</sup>	650	800	800	
Height	mm	2200	2200	2200	2325	
Height with gas exhaust duct	mm	2675	2675	2675	2775	
Depth	mm	1340	1340	1340	1560	
Fault current (max.)	kA	25	31.5	50	25	
Rated current	A					
	630	■	■	■	■	
	1250	■	■	■	■	
	1600		■	■	■	
	2000		■	■	■	
	2500		■	■	■	
	3150		■	■		
	3600		■	■		
	4000		■	■		
Earthing switch		■	■		■	
Number of cable connections (maximal)		-	-	-	-	
Number of CTs per phase (alternative combinations)						
	1 medium size					
	1 long size					
	2 medium size					
	1 medium and 1 long size					
Number of VTs per phase (alternative combinations)						
	1 fixed					
	2 fixed					
	1 withdrawable with fuses		■	■	■	
	1 fixed and 1 withdrawable with fuses		■	■	■	

Voltage transformers are located in CB compartment.  
Transformers may be equipped with fuse status indication in 12 and 24kV panels.

<sup>5)</sup> 12 kV only, available from 2006

## UNIGEAR SINGLE BUSBAR SYSTEM

## 1.2.10 Disconnecter feeder (DF)



		12-17.5 kV	24 kV
Width	mm	800	1000
Height	mm	2200	2325
Height with gas exhaust duct	mm	2675	2775
Depth	mm	1340	1560
Rated current	A		
630		■ <sup>(6)</sup>	■ <sup>(6)</sup>
Earthing switch		■	■
Number of cable connections (maximal)	nr.	1	1
Number of CTs per phase			
1 medium size		■	■
1 long size			
2 medium size			
1 medium and 1 long size			
Number of VTs per phase (alternative combinations)			
1 fixed			
2 fixed			
1 withdrawable with fuses			

<sup>(6)</sup> The rated current depends on the fuses used.




## UNIGEAR SINGLE BUSBAR SYSTEM

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1.3.1	Current transformers	1/34
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1.3.3	Earthing switch	1/34
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## BUSBAR APPLICATIONS

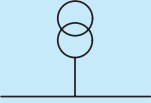
### 1.3.1 Current transformers



Width	mm	12-17.5 kV				24 kV	
		550	650	800	1000	800	1000
Busbars rated current	A						
1000							
1250			■	■	■	■	
1600				■			
2000				■	■		
2500							■
3150					■		

Transformers are installed in busbar compartment inside a bus-riser panel. This feature is available up to 31.5 kA. Depth of the panel may increase.

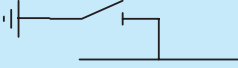
### 1.3.2 Voltage transformers



Width	mm	12-17.5 kV				24 kV	
		550	650	800	1000	800	1000
Without bushings			■	■	■	■	
With bushings						■	■

Transformers are installed in an additional box on the top of the switchgear. This feature is available up to 50 kA. The box can be combined with LV Compartment 705 mm high. If fault current of switchgear is 31.5 kA or higher please contact manufacturer

### 1.3.3 Earthing switch




Width	mm	12-17.5 kV				24 kV	
		550	650	800	1000	800	1000
Short circuit current	kA						
25							
31.5			■	■	■	■	■
40				■	■		

Earthing switch is installed in an additional box on the the top of the switchgear. This feature is available up to 31.5 kA. The box can be combined with LV Compartment 705 mm high.



## UNIGEAR SINGLE BUSBAR SYSTEM

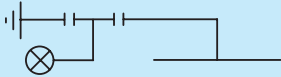
## 1.3.4 Incoming duct



Width	mm	12-17.5 kV				24 kV	
		550	650	800	1000	800	1000
Busbars rated current	A						
1250			■			■	■
1600			■				
2000							
2500				■			■
3150				■	■		

A busbar duct is available either in fixed or modular (telescopic) version.  
For details please see the instruction manual for modular busbar ducts (document number 1VLM000021)

## 1.3.5 Voltage indication



Width	mm	12-17.5 kV				24 kV	
		550	650	800	1000	800	1000
Short circuit current	kA						
25						■	■
31.5			■				
40				■	■		

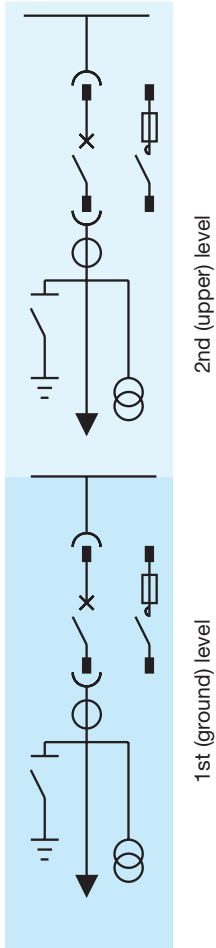


## UNIGEAR DOUBLE LEVEL

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## TYPICAL CONVENTIONAL UNITS

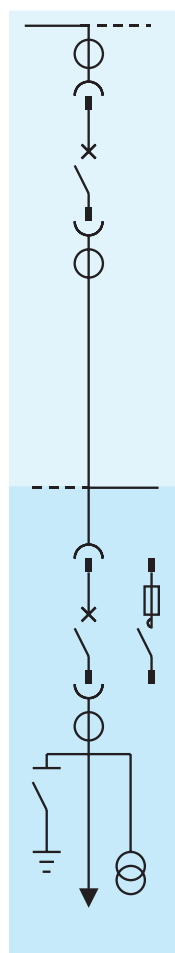
### 2.1 Double incoming feeder



		12 , 17.5 kV			
Width	mm	750	750	900	900
Height	mm	2698	2698	2698	2698
Height with gas exhaust duct	mm	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>
Depth	mm	1976	1976	1976	1976
Rated current	A				
	630	■	■		
	1000	■	■		
	1250			■	■
	1600			■	■
Earthing switch	1st level	■	■	■	■
	2nd level	■	■	■	■
Number of cable connections	1st level	3	3	3	3
For each phase	2nd level	3	3	3	3
Number of CTs per phase (alternative combinations) - 1st level					
	1 medium size		■	■	■
	1 long size		■	■	■
	2 medium size				
	1 medium and 1 long size				
Number of CTs per phase (alternative combinations) - 2nd level					
	1 medium size		■	■	■
	1 long size		■	■	■
	2 medium size				
	1 medium and 1 long size				
Number of VTs per phase (alternative combinations) - 1st level					
	1 fixed	■	■	■	■
	1 withdrawabel with fuses				
Number of VTs per phase (alternative combinations) - 2nd level					
	1 fixed	■	■	■	■
	1 withdrawabel with fuses				

<sup>1)</sup> The height of the switchgear in the compound configuration with simple and double level is the same as that of the double level unit.

## UNIGEAR DOUBLE LEVEL



## 2.2 Bus Tie &amp; Incoming/outgoing feeder

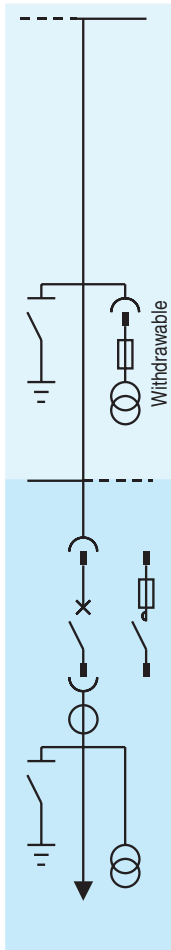
		12 , 17.5 kV			
Width	mm	750	750	900	900
Height	mm	2698	2698	2698	2698
Height with gas exhaust duct	mm	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>
Depth	mm	1976	1976	1976	1976
Rated current	A				
	630 *)	■	■		
	1000	■	■		
	1250			■	■
	1600			■	■
Earthing switch	1st level	■	■	■	■
	2nd level	-	-	-	-
Number of cable connections	1st level	3	3	3	3
For each phase	2nd level	0	0	0	0
Number of CTs per phase (alternative combinations) - 1st level					
	1 medium size		■	■	■
	1 long size		■	■	■
	2 medium size				
	1 medium and 1 long size				
Number of CTs per phase (alternative combinations) - 2nd level					
	1 medium size		■	■	■
	1 long size		■	■	■
	2 medium size		■	■	■
	1 medium and 1 long size		■	■	■
Number of VTs per phase (alternative combinations) - 1st level					
	1 fixed	■	■	■	■
	1 withdrawabel with fuses				
Number of VTs per phase (alternative combinations) - 2nd level					
	1 fixed	-	-	-	-
	1 withdrawabel with fuses	-	-	-	-

\*) Not applicable for second level

1) see note on page 4/2

## TYPICAL CONVENTIONAL UNITS

### 2.3 Riser with metering & Incoming/outgoing feeder



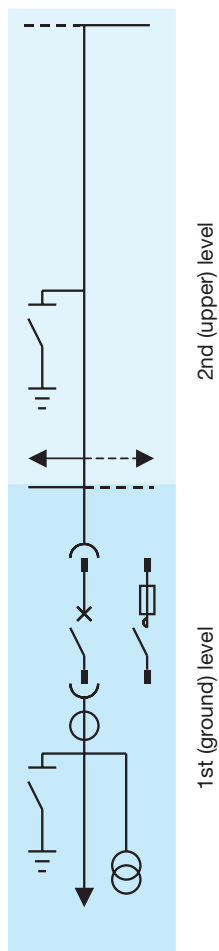
		12 , 17.5 kV			
Width	mm	750	750	900	900
Height	mm	2698	2698	2698	2698
Height with gas exhaust duct	mm	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>
Depth	mm	1976	1976	1976	1976
Rated current	A				
	630 *)	■	■		
	1000	■	■		
	1250			■	■
	1600			■	■
Earthing switch	1st level	■	■	■	■
	2nd level	■	■	■	■
Number of cable connections	1st level	3	3	3	3
For each phase	2nd level	0	0	0	0
Number of CTs per phase (alternative combinations) - 1st level					
	1 medium size		■	■	■
	1 long size		■	■	■
	2 medium size				
	1 medium and 1 long size				
Number of CTs per phase (alternative combinations) - 2nd level					
	1 medium size	-	-	-	-
	1 long size				
	2 medium size				
	1 medium and 1 long size				
Number of VTs per phase (alternative combinations) - 1st level					
	1 fixed	■	■	■	■
	1 withdrawabel with fuses				
Number of VTs per phase (alternative combinations) - 2nd level					
	1 fixed	■	■	■	■
	1 withdrawabel with fuses				

\*) Not applicable for second level

<sup>1)</sup> see note on page 4/2

## UNIGEAR DOUBLE LEVEL

## 2.4 Connection unit &amp; Incoming/outgoing feeder



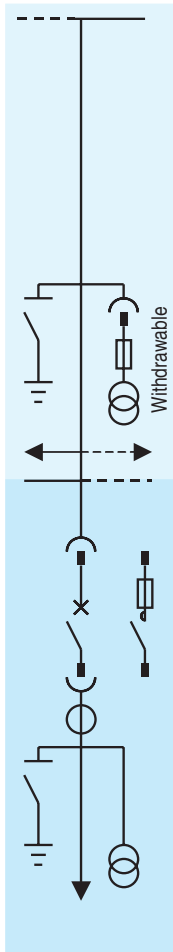
		12 , 17.5 kV			
Width	mm	750	750	900	900
Height	mm	2698	2698	2698	2698
Height with gas exhaust duct	mm	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>
Depth	mm	1976	1976	1976	1976
Rated current	A				
	630 *)	■	■		
	1000	■	■		
	1250			■	■
	1600			■	■
Earthing switch	1st level	■	■	■	■
	2nd level	■	■	■	■
Number of cable connections	1st level	3	3	3	3
For each phase	2nd level	0	0	0	0
Number of CTs per phase (alternative combinations) - 1st level					
	1 medium size		■	■	■
	1 long size		■	■	■
	2 medium size				
	1 medium and 1 long size				
Number of CTs per phase (alternative combinations) - 2nd level					
	1 medium size	-	-	-	-
	1 long size				
	2 medium size				
	1 medium and 1 long size				
Number of VTs per phase (alternative combinations) - 1st level					
	1 fixed	■	■	■	■
	1 withdrawabel with fuses				
Number of VTs per phase (alternative combinations) - 2nd level					
	1 fixed	-	-	-	-
	1 withdrawabel with fuses				

\*) Not applicable for second level

<sup>1)</sup> see note on page 4/2

## TYPICAL CONVENTIONAL UNITS

### 2.5 Connection unit with metering & Incoming/outgoing feeder



			12 , 17.5 kV			
Width	mm		750	750	900	900
Height	mm		2698	2698	2698	2698
Height with gas exhaust duct	mm		2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>	2698 <sup>1)</sup>
Depth	mm		1976	1976	1976	1976
Rated current	A					
	630 *)		■	■		
	1000		■	■		
	1250				■	■
	1600				■	■
Earthing switch	1st level		■	■	■	■
	2nd level		■	■	■	■
Number of cable connections	1st level	nr.	3	3	3	3
For each phase	2nd level		0	0	0	0
Number of CTs per phase (alternative combinations) - 1st level						
	1 medium size			■	■	■
	1 long size			■	■	■
	2 medium size					
	1 medium and 1 long size					
Number of CTs per phase (alternative combinations) - 2nd level						
	1 medium size		-	-	-	-
	1 long size					
	2 medium size					
	1 medium and 1 long size					
Number of VTs per phase (alternative combinations) - 1st level						
	1 fixed		■	■	■	■
	1 withdrawabel with fuses					
Number of VTs per phase (alternative combinations) - 2nd level						
	1 fixed		■	■	■	■
	1 withdrawabel with fuses					

\*) Not applicable for second level

<sup>1)</sup> see note on page 4/2



## UNIGEAR DOUBLE LEVEL

## 2.5.1 Electrical characteristics - Double level units

Rated voltage	kV	12	17.5
Rated insulation voltage	kV	12	17.5
Rated power frequency withstand voltage	kV 1min.	28	38
Rated lightning impulse withstand voltage	kV	75	95
Rated frequency	Hz	50-60	50-60
Rated short-time withstand current (max.)	kA 3s	50	40
Peak current (max.)	kA	125	100
Internal arc withstand current (max.)	kA 1s	40	40
	kA 0.5s	50	n/a
Main busbar rated current (max.)	A	1600	1600
Branch connection rated current	A	630	630
		1000	1000
		1250	1250
		1600	1600



## MARINE APPLICATIONS

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## TYPICAL UNITS

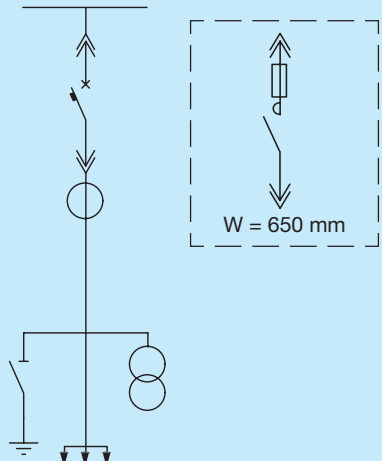
### 3.0 General notes

- This chapter describes typical units dedicated to marine applications;
- The value of the rated current is referred to 45°C; in the following pages, inside the parenthesis, it is indicated the value of the rated current at this value of temperature;
- Each medium size current transformer can be replaced by an ABB KEVCD sensor;
- The earthing switch is not a compulsory switchboard accessory;
- Voltage transformers in fixed version are not equipped with fuses;
- Low voltage compartment height is 705 mm if not mentioned a different one. Other heights are 580mm and 1100 mm;
- Total height of the unit is including low voltage compartment (705 mm) and without the exhaust duct;
- Indicated number of cables is the maximum admissible. Removable voltage transformers occupies one position as well as surge arresters;
- Rating of the panels with vacuum contactor is always 400 A;
- Voltage transformers may not have a fuse status indication if they are located in the cable compartment;
- Dimensions of panels may have variation depending on project requirements.

## MARINE APPLICATIONS

## 3.1 Incoming-Outgoing unit (IF)

## 3.1.1 Bottom cable entry – standard version



		12 kV		
Width	mm	650	800	1000
Height	mm	2200	2200	2200
Height with gas exhaust duct	mm	2530	2530	2530
Depth	mm	1340	1340	1340/1390
Rated current	A			
630 (630)*		■ <sup>(1)</sup>		
1250 (1200)		■ <sup>(2)</sup>	■ <sup>(3)</sup>	
1600 (1530)			■	
2000 (1910)			■	
2500 (2390)				■
3150 (3010)				■
Earthing switch		■	■	■
Number of cable connections (maximum)	Nr.	3	6	6
Number of CT's per phase (alternative combinations)		■	■	■
1 medium size		■	■	■
1 long size				
2 medium size				
1 medium and 1 long size				
1 homopolar toroidal CT (nr.1 for the three phases)		■	■	■
Number of VT's per phase (alternative combinations)				
1 fixed		■	■	■
2 fixed				

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

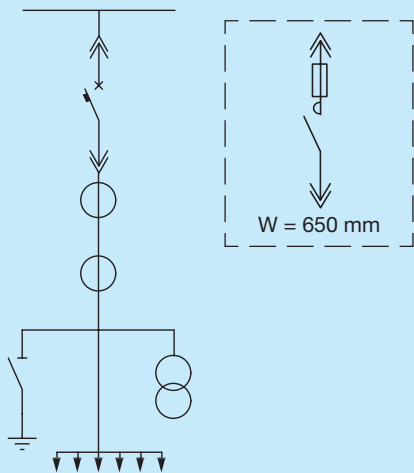
(1) Up to 50 kA with V-Contact

(2) <= 31,5 kA

(3) >= 40 kA

## TYPICAL UNITS

### 3.1.2 Bottom cable entry – deeper version



		12 kV			
Width	mm	650	800	1000	
Height	mm	2200	2200	2200	
Height with gas exhaust duct	mm	2530	2530	2530	
Depth	mm	1840	1840	1840	1890
Rated current	A				
630 (630)*		■ <sup>(1)</sup>			
1250 (1200)		■ <sup>(2)</sup>			
1600 (1530)			■ <sup>(3)</sup>		
2000 (1910)			■		
2500 (2390)				■	
3150 (3010)					■
Earthing switch		■	■	■	■
Number of cable connections (maximum)	Nr.	3/6	6	6	6
Number of CT's per phase (alternative combinations)					
1 medium size		■	■	■	■
1 long size		■	■	■	■
2 medium size		■	■	■	■
1 medium and 1 long size		■	■	■	■
1 homopolar toroidal CT (nr.1 for the three phases)		■	■	■	■
Number of VT's per phase (alternative combinations)					
1 fixed		■	■	■	■
2 fixed		■	■	■	■

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

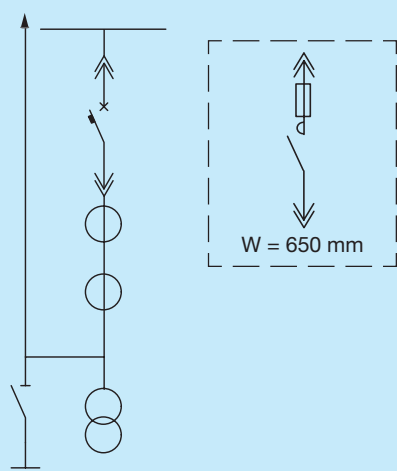
(1) Up to 50 kA with V-Contact

(2) < = 31,5 kA

(3) > = 40 kA

## MARINE APPLICATIONS

## 3.1.3 Top cable entry – deeper version



12 kV

		650	800	1000	1890
Width	mm	650	800	1000	
Height	mm	2200	2200	2200	
Height with gas exhaust duct	mm	2530	2530	2530	
Depth	mm	1840	1840	1840	1890
Rated current	A				
630 (630)*		■ <sup>(1)</sup>			
1250 (1200)		■ <sup>(2)</sup>			
1600 (1530)			■ <sup>(3)</sup>		
2000 (1910)			■		
2500 (2390)				■	
3150 (3010)					■
Earthing switch		■	■	■	■
Number of cable connections (maximum)	Nr.	4	4	4	4
Number of CT's per phase (alternative combinations)					
1 medium size		■	■	■	■
1 long size		■	■	■	■
2 medium size		■	■	■	■
1 medium and 1 long size		■	■	■	■
1 homopolar toroidal CT (nr.1 for the three phases)		■	■	■	■
Number of VT's per phase (alternative combinations)					
1 fixed		■	■	■	■
2 fixed					

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

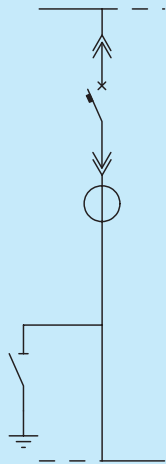
(1) Up to 50 kA with V-Contact

(2) < = 31,5 kA

(3) > = 40 kA

## TYPICAL UNITS

### 3.2 Bus Tie unit (BT)



		12 kV		
Width	mm	650	800	1000
Height	mm	2200	2200	2200
Height with gas exhaust duct	mm	2530	2530	2530
Depth	mm	1340	1340	1340/1390
Rated current	A			
630 (630)*				
1250 (1200)		■ <sup>(1)</sup>	■ <sup>(2)</sup>	
1600 (1530)			■	
2000 (1910)			■	
2500 (2390)				■
3150 (3010)				■
Earthing switch		■	■	■
Number of cable connections (maximum)	Nr.			
Number of CT's per phase (alternative combinations)		■	■	■
1 medium size		■	■	■
1 long size				
2 medium size				
1 medium and 1 long size				
1 homopolar toroidal CT (nr.1 for the three phases)				
Number of VT's per phase (alternative combinations)				
1 fixed				
2 fixed				

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

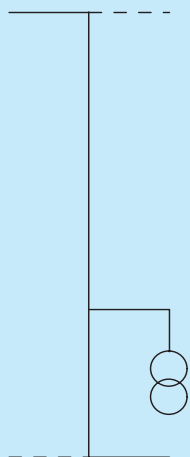
(1) <= 31,5 kA

(2) >= 40 kA



## MARINE APPLICATIONS

## 3.3 Bus Riser unit (R)



12 kV

		12 kV	
Width	mm	650	800
Height	mm	2200	2200
Height with gas exhaust duct	mm	2530	2530
Depth	mm	1340	1340/1390
Rated current	A		
630 (630)*		■ <sup>(1)</sup>	■ <sup>(2)</sup>
1250 (1200)			■
1600 (1530)			■
2000 (1910)			■ <sup>(2)</sup>
2500 (2390)		■ <sup>(1)</sup>	■
3150 (3010)			■
Earthing switch			
Number of cable connections (maximum)	Nr.		
Number of CT's per phase (alternative combinations)			
1 medium size			
1 long size			
2 medium size			
1 medium and 1 long size			
1 homopolar toroidal CT (nr.1 for the three phases)			
Number of VT's per phase (alternative combinations)			
1 fixed		■	■
2 fixed			

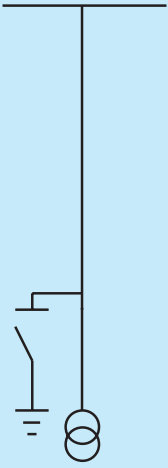
(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) <= 31,5 kA

(2) >= 40 kA

## TYPICAL UNITS

### 3.4 Measurement unit (M)



		12 kV	
Width	mm	650	800
Height	mm	2200	2200
Height with gas exhaust duct	mm	2530	2530
Depth	mm	1340	1340
Rated current	A	■ <sup>(1)</sup>	■ <sup>(2)</sup>
630 (630)*			
1250 (1200)			
1600 (1530)			
2000 (1910)			
2500 (2390)			
3150 (3010)			
Earthing switch		■	■
Number of cable connections (maximum)	Nr.		
Number of CT's per phase (alternative combinations)			
1 medium size			
1 long size			
2 medium size			
1 medium and 1 long size			
1 homopolar toroidal CT (nr.1 for the three phases)			
Number of VT's per phase (alternative combinations)		■	■
1 fixed			
2 fixed			

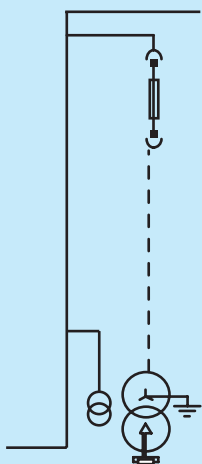
(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) < = 31,5 kA

(2) > = 40 kA

## MARINE APPLICATIONS

## 3.5 Riser unit with earthing transformer (RE)



12 kV

		12 kV	
Width	mm	650	800
Height	mm	2200	2200
Height with gas exhaust duct	mm	2530	2530
Depth	mm	1340	1340/1390
Rated current	A		
630 (630)*			
1250 (1200)		■ <sup>(1)</sup>	■ <sup>(2)</sup>
1600 (1530)			
2000 (1910)			
2500 (2390)		■ <sup>(1)</sup>	■ <sup>(2)</sup>
3150 (3010)			■
Earthing switch			
Number of cable connections (maximum)	Nr.		
Number of CT's per phase (alternative combinations)			
1 medium size			
1 long size			
2 medium size			
1 medium and 1 long size			
1 homopolar toroidal CT (nr.1 for the three phases)			
Number of VT's per phase (alternative combinations)			
1 fixed		■	■
2 fixed			

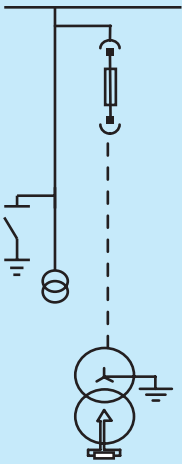
(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) <= 31,5 kA

(2) >= 40 kA

## TYPICAL UNITS

### 3.6 Measurement unit with earthing transformer (ME)



		12 kV	
Width	mm	650	800
Height	mm	2200	2200
Height with gas exhaust duct	mm	2530	2530
Depth	mm	1340	1340
Rated current	A	■ <sup>(1)</sup>	■ <sup>(2)</sup>
	630 (630)* 1250 (1200) 1600 (1530) 2000 (1910) 2500 (2390) 3150 (3010)		
Earthing switch		■	■
Number of cable connections (maximum)	Nr.		
Number of CT's per phase (alternative combinations)			
	1 medium size 1 long size 2 medium size 1 medium and 1 long size 1 homopolar toroidal CT (nr.1 for the three phases)		
Number of VT's per phase (alternative combinations)		■	■
	1 fixed 2 fixed		

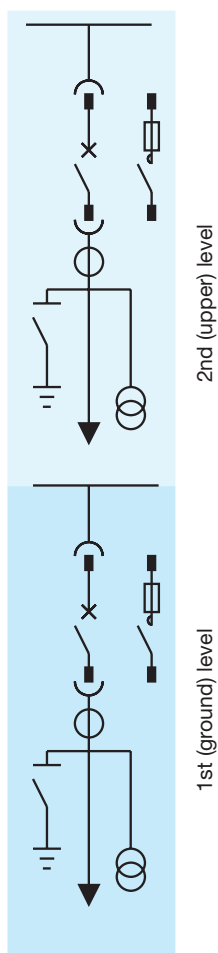
(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) < = 31,5 kA

(2) > = 40 kA

## MARINE APPLICATIONS

## 3.7 Double incoming feeder unit (bottom or top cable entry)



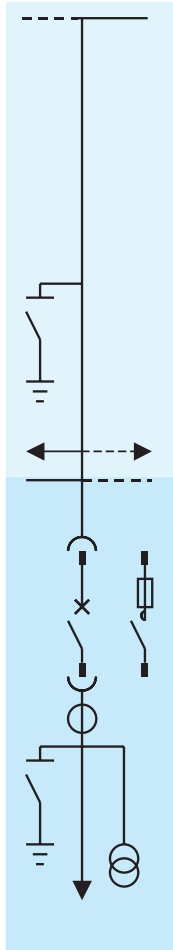
		12 kV	
Width	mm	750	900
Height	mm	2698	2698
Height with gas exhaust duct	mm	2698 <sup>(1)</sup>	2698 <sup>(1)</sup>
Depth	mm	1976	1976
Rated current	A		
	630 (630)*	■	
	1000 (960)	■	
	1250 (1200)		■
Earthing switch	1st level	■	■
	2nd level	■	■
Number of cable connections for each phase (maximum)	1st level	Nr. 3	3
	2nd level	3	3
Number of CT's per phase (alternative combinations) 1st level			
	1 medium size	■	■
	1 long size	■	■
	2 medium size		
	1 medium and 1 long size		
	1 homopolar toroidal CT (nr.1 for the three phases)	■	■
Number of CT's per phase (alternative combinations) 2nd level			
	1 medium size	■	■
	1 long size	■	■
	2 medium size		
	1 medium and 1 long size		
	1 homopolar toroidal CT (nr.1 for the three phases)	■	■
Number of VT's per phase (alternative combinations) 1st level			
	1 fixed	■	■
Number of VT's per phase (alternative combinations) 2nd level			
	1 fixed	■	■

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) The height of the switchboard in the compound configuration with simple and double level is the same as that of the double level unit.

## TYPICAL UNITS

### 3.8 Connection unit and incoming/outgoing feeder



		12 kV		
2nd (upper) level	Width	mm	750      900	
	Height	mm	2698      2698	
	Height with gas exhaust duct	mm	2698 <sup>(1)</sup> 2698 <sup>(1)</sup>	
	Depth	mm	1976      1976	
1st (ground) level	Rated current	A	■ <sup>(2)</sup> ■	
		630 (630)*	■      ■	
		1250 (1200)	■      ■	
		1600 (1530)	■      ■	
	Earthing switch	1st level	■      ■	
		2nd level	■      ■	
	Number of cable connections for each phase (maximum)	1st level	Nr. 3	3
		2nd level		
	Number of CT's per phase (alternative combinations) 1st level	1 medium size	■      ■	
		1 long size	■      ■	
2 medium size		■      ■		
1 medium and 1 long size		■      ■		
1 homopolar toroidal CT (nr.1 for the three phases)		■      ■		
Number of CT's per phase (alternative combinations) 2nd level	1 medium size			
	1 long size			
	2 medium size			
	1 medium and 1 long size			
	1 homopolar toroidal CT (nr.1 for the three phases)			
Number of VT's per phase (alternative combinations) 1st level	1 fixed	■      ■		
Number of VT's per phase (alternative combinations) 2nd level	1 fixed			

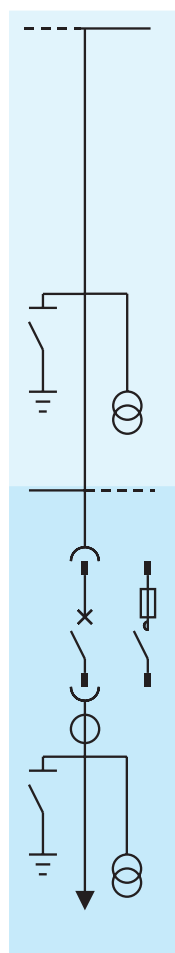
(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) The height of the switchboard in the compound configuration with simple and double level is the same as that of the double level unit.

(2) Not applicable for second level.

## MARINE APPLICATIONS

## 3.9 Connection unit with measurements and incoming/outgoing feeder



		12 kV	
Width	mm	750	900
Height	mm	2698	2698
Height with gas exhaust duct	mm	2698 <sup>(1)</sup>	2698 <sup>(1)</sup>
Depth	mm	1976	1976
Rated current	A	■ <sup>(2)</sup>	■
	630 (630)*		
	1250 (1200)		■
	1600 (1530)		■
Earthing switch	1st level	■	■
	2nd level	■	■
Number of cable connections for each phase (maximum)	1st level 2nd level	Nr. 3	3
Number of CT's per phase (alternative combinations)	1st level		
	1 medium size	■	■
	1 long size	■	■
	2 medium size		
	1 medium and 1 long size		
	1 homopolar toroidal CT (nr.1 for the three phases)	■	■
Number of CT's per phase (alternative combinations)	2nd level		
	1 medium size		
	1 long size		
	2 medium size		
	1 medium and 1 long size		
	1 homopolar toroidal CT (nr.1 for the three phases)		
Number of VT's per phase (alternative combinations)	1st level		
	1 fixed	■	■
Number of VT's per phase (alternative combinations)	2nd level		
	1 fixed	■	■

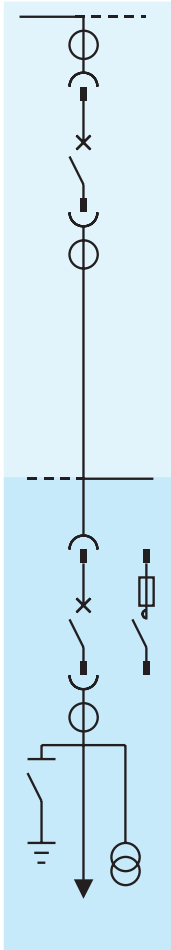
(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

(1) The height of the switchboard in the compound configuration with simple and double level is the same as that of the double level unit.

(2) Not applicable for second level.

## TYPICAL UNITS

### 3.10 Bus tie and incoming/outgoing feeder



		12 kV	
Width	mm	750	900
Height	mm	2698	2698
Height with gas exhaust duct	mm	2698 <sup>(1)</sup>	2698 <sup>(1)</sup>
Depth	mm	1976	1976
Rated current	A		
	630 (630)*	■ <sup>(2)</sup>	
	1000 (960)	■	
	1250 (1200)		■
Earthing switch	1st level	■	■
	2nd level		
Number of cable connections for each phase (maximum)	1st level	Nr. 3	3
	2nd level		
Number of CT's per phase (alternative combinations) 1st level			
	1 medium size	■	■
	1 long size	■	■
	2 medium size		
	1 medium and 1 long size		
	1 homopolar toroidal CT (nr.1 for the three phases)	■	■
Number of CT's per phase (alternative combinations) 2nd level			
	1 medium size	■	■
	1 long size	■	■
	2 medium size	■	■
	1 medium and 1 long size	■	■
	1 homopolar toroidal CT (nr.1 for the three phases)	■	■
Number of VT's per phase (alternative combinations) 1st level			
	1 fixed	■	■
Number of VT's per phase (alternative combinations) 2nd level			
	1 fixed		

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

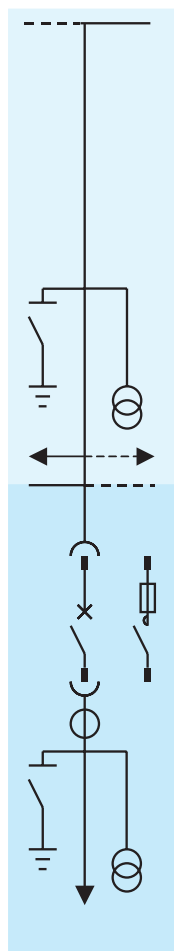
(1) The height of the switchboard in the compound configuration with simple and double level is the same as that of the double level unit.

(2) Not applicable for second level.



## MARINE APPLICATIONS

## 3.11 Bus riser unit with measurements and incoming/outgoing feeder



		12 kV	
Width	mm	750	900
Height	mm	2698	2698
Height with gas exhaust duct	mm	2698 <sup>(1)</sup>	2698 <sup>(1)</sup>
Depth	mm	1976	1976
Rated current	A		
	630 (630)*	■ <sup>(2)</sup>	
	1000 (960)	■	
	1250 (1200)		■
Earthing switch	1st level	■	■
	2nd level	■	■
Number of cable connections for each phase (maximum)	Nr.	3	3
Number of CT's per phase (alternative combinations) 1st level			
		■	■
		■	■
		■	■
Number of CT's per phase (alternative combinations) 2nd level			
Number of VT's per phase (alternative combinations) 1st level			
		■	■
Number of VT's per phase (alternative combinations) 2nd level			
		■	■

(\*) Inside the parenthesis it is indicated the value of rated current reported to 45°C

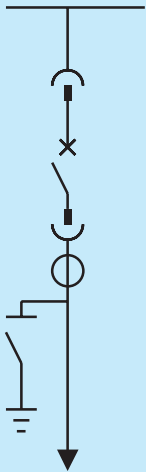
(1) The eight of the switchboard in the compound configuration with simple and double level is the same as that of the double level unit.

(2) Not applicable for second level.

## TYPICAL UNITS

### 3.12 Motor control center - UNIGEAR Type ZVC

#### 3.12.1 Bottom cable entry

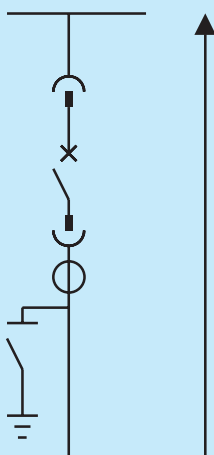


		7,2 kV
Width	mm	325
Height	mm	2200
Height with gas exhaust duct	mm	2530
Depth	mm	1304
Rated current	A	■
400		
Earthing switch		
Number of cable connections (maximum)	Nr.	1
Number of CT's per phase		■
1 medium size		
Number of VT's per phase (alternative combinations)		
1 fixed		
2 fixed		
1 removable with fuses		
1 withdrawable with fuses		

UniGear Type ZVC may be combined with Unigear Type ZS1, single busbar system.

## MARINE APPLICATIONS

## 3.12.2 Top cable entry



7,2 kV

Width	mm	325
Height	mm	2200
Height with gas exhaust duct	mm	2530
Depth	mm	1504
Rated current	A	
400		■
Earthing switch		■
Number of cable connections (maximum)	Nr.	1
Number of CT's per phase		
1 medium size		■
Number of VT's per phase (alternative combinations)		
1 fixed		
2 fixed		
1 removable with fuses		
1 withdrawable with fuses		

## TYPICAL UNITS

### 3.13 Circuit breakers homologation

Summary table related to the homologation of the Shipping Registers.

Circuit breaker / Contactor type	Shipping Registers			
	LR	DNV	GL	
HD4/P	12.06.32	■	■	■
	12.12.32	■	■	■
	12.16.32	■	■	■
	12.20.32	■	■	■
	12.25.32	■	■	■
	12.32.32	■	■	■
	12.12.40	■	■	■
	12.16.50	■	■	■
	12.25.50	■	■	■
	12.20.50	■	■	■
	12.32.50	■	■	■
VD4/P	12.06.32	■	■	■
	12.12.32	■	■	■
	12.16.32	■	■	■
	12.20.32	■	■	■
	12.25.32	■	■	■
V Contact	V7 P	■	■	■
	V12 P	■	■	■

LR: Lloyd's Register  
 DNV: Det Norske Veritas  
 GL: Germanischer Lloyd

RINA and BV (Bureau Veritas) homologation it is not required from the market.

## MARINE APPLICATIONS

**3.14 General characteristics****3.14.1 Degree of protection**

The standard external protection degree of the marine switchboard is IP42 or IP43.

- IP42: protection against foreign bodies with diameter 1mm and against water at 15°;
- IP43: protection against foreign bodies with diameter 1mm and against water at 60°;

**3.14.2 Busbar partitioning**

On marine plants the units (busbars) need a mechanical support for fault current due to the high level of vibrations; thus the bushings are put to each unit.

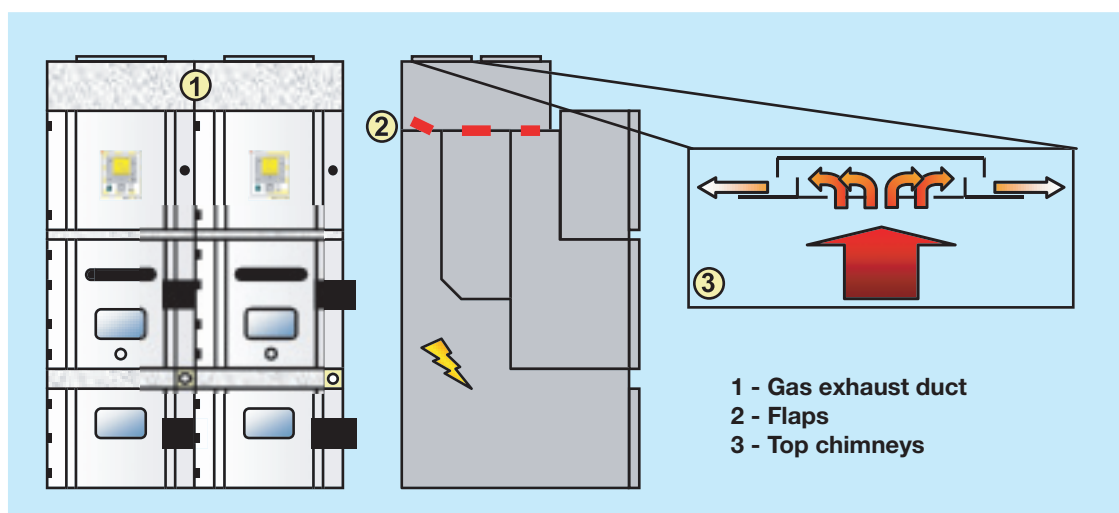
Unit Width	$I_{th}$	Bushings
mm	kA	
650, 750, 800, 900, 1000	all	Each unit

**3.14.3 Compact duct with top chimneys**

The duct is fixed on the top of the auxiliary compartment.

On marine plants, generally the exhaust gas cannot be evacuated out of the room and therefore the gas duct will be always closed on both the end-sides and equipped with top chimneys or an absorber.

If in some cases it is possible to evacuate hot gas out of the room; the standard gas duct can be supplied.





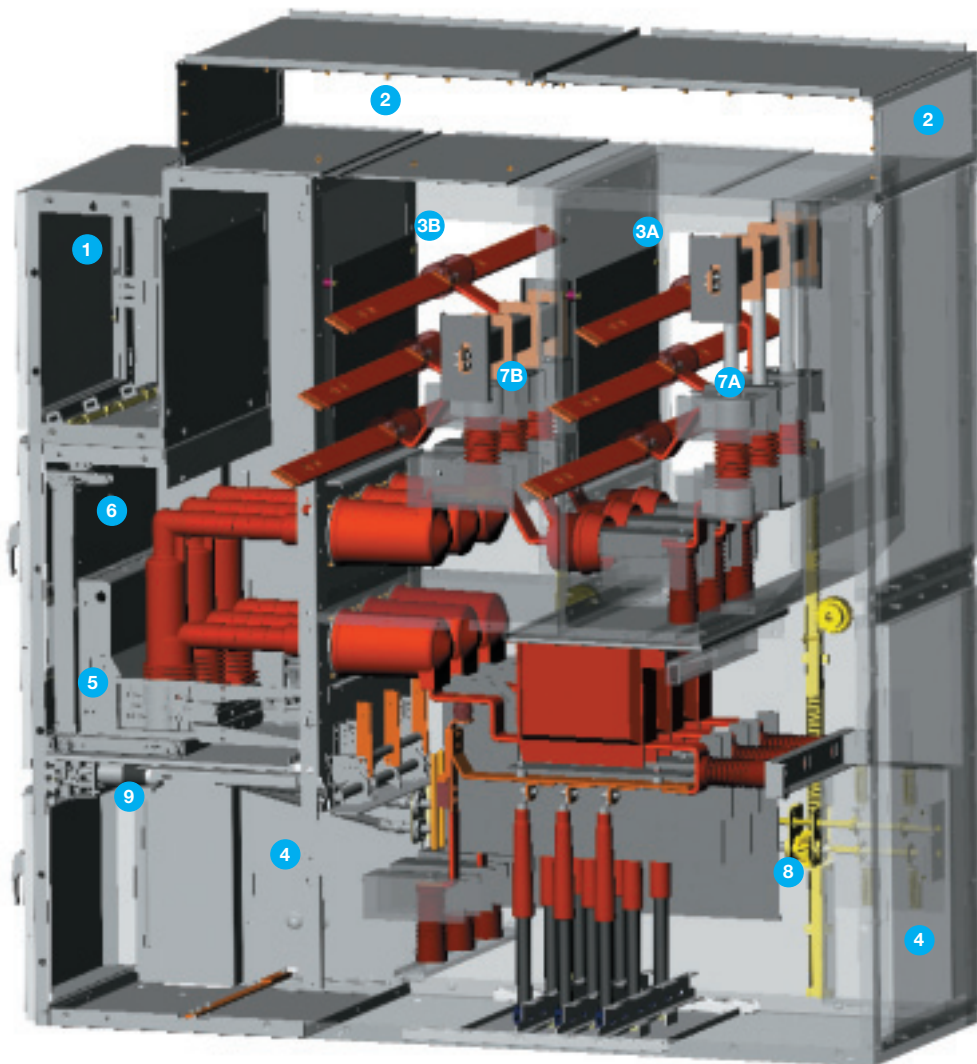
## UNIGEAR DOUBLE BUSBAR SYSTEM

4.1	Panel design and structure	4/2
4.1.1	Compartment	4/2
4.1.2	Insulating materials	4/3
4.2	General electrical characteristics	4/4
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## TYPICAL CONVENTIONAL UNITS

### 4.1 Panel design and structure

#### 4.1.1 Compartments



24kV panel is displayed  
Busbar system B is connected to the feeder  
For components of structure please see chapter 1.

- 1 Low-voltage compartment
- 2 Gas exhaust duct
- 3 Busbar compartments
- 4 Feeder compartment
- 5 Circuit-breaker
- 6 Circuit-breaker compartment
- 7 Line disconnectors
- 8 Gear and limit switches of line disconnectors
- 9 Motor drives for line disconnectors



## UNIGEAR DOUBLE BUSBAR SYSTEM

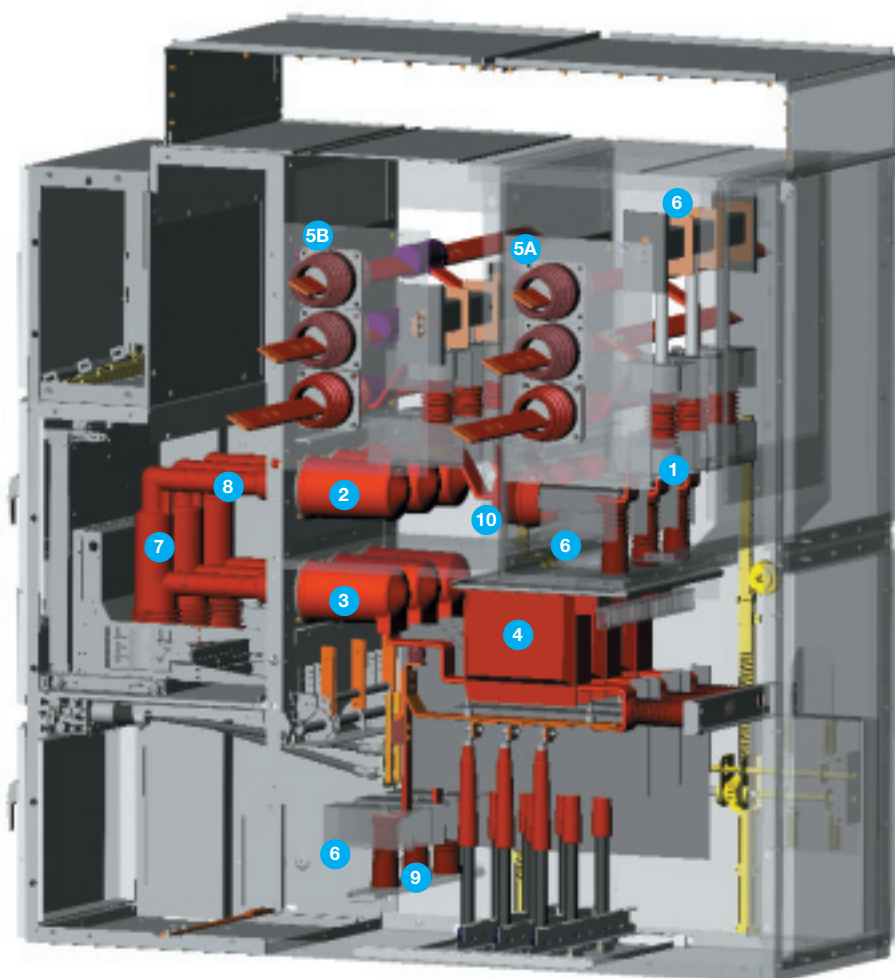
### 4.1.2 Insulating materials

Type: Epoxy resin  
 Weight: see chap. 7  
 Use: CTs, VTs, sensors, insulators (in variable quantities), chambers, bushings.

Type: BPTM thermoshrinking polymer  
 Weight: (average): 2-5 Kg  
 Use: Insulating covering of busbars and branches (if applied).

Type: Polyester  
 Weight: (average): 6 Kg  
 Use: Covers on line disconnectors (if applied), holding brackets for rods of the line disconnectors.

Type: **ABS** (Akrylonitril butadien styren)  
 Weight: (average): 1 Kg  
 Use: Busbar junction covers.



- 1 Line dsconnector covers
- 2 Busbar side chambers
- 3 Cable side chambers
- 4 Current transformers
- 5 Busbar compartment segregation bushings
- 6 Insulating covers
- 7 CB poles
- 8 CB contact arms
- 9 Insulators
- 10 Busbar systes bushings

24kV panel is displayed  
 Busbar junction covers displayed only on system B  
 For other components of structure please see chapter 1.

## TYPICAL CONVENTIONAL UNITS

### 4.2 General electrical characteristics

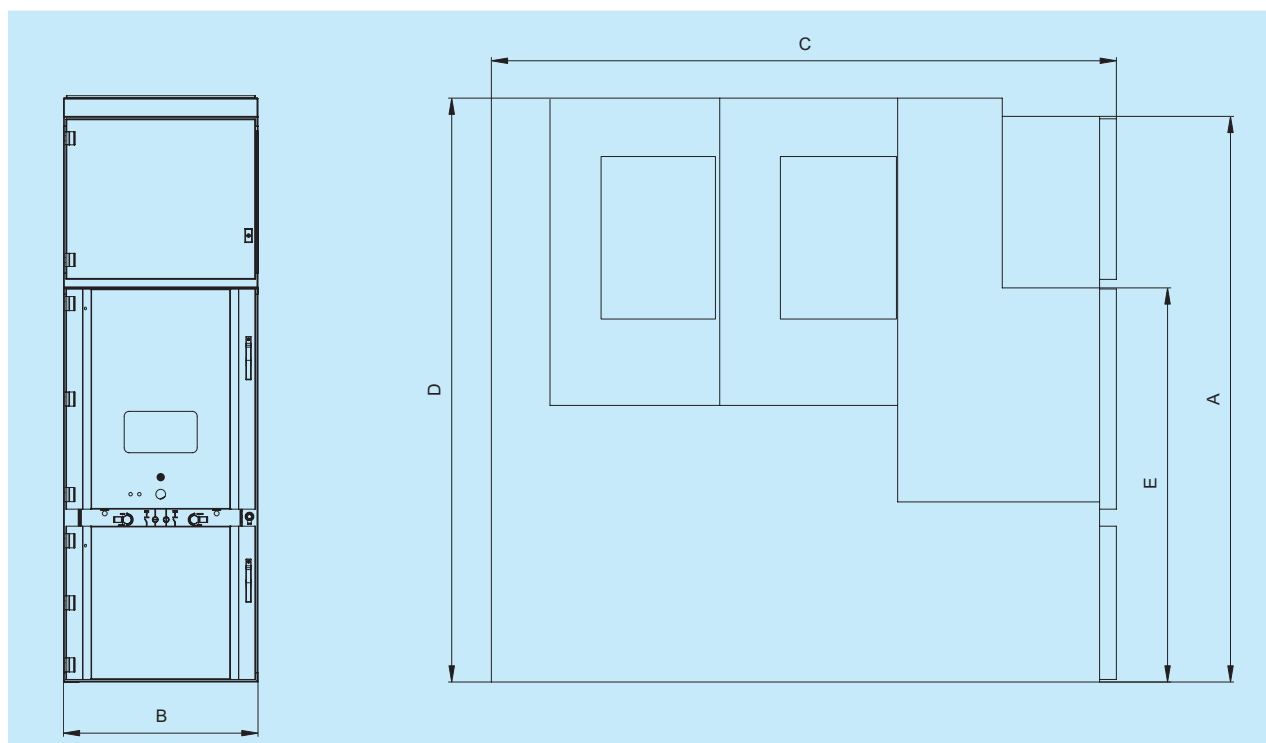
Switchboard		12 kV	17.5 kV	24 kV
Rated voltage	kV	12	17.5	24
Rated insulation voltage	kV	12	17.5	24
Rated power frequency withstand voltage	kV (1 min)	28	38	50
Rated lightning impulse withstand voltage	kV	75	95	125
Rated short-time withstand current (max.)	kA (3s)	31.5	31.5	25
Peak current (max.)	kA	125	100	63
Internal arc withstand current (max.)	kA (1s)	31.5	25	25
Branch connectors rated currents	A	630	630	630
		1250	1250	1250
		1600	1600	1600
		2000	2000	2000
		2500	2500	2500 <sup>7)</sup>
		3150 <sup>7)</sup>	3150 <sup>7)</sup>	
Main busbars rated currents	A	1250	1250	1250
		1600	1600	1600
		2000	2000	2000
		2500	2500	2500
		3150	3150	
		3600 <sup>8)</sup>	3600 <sup>8)</sup>	
		4000 <sup>8)</sup>	4000 <sup>8)</sup>	

<sup>7)</sup> Separate feeders for A and B busbar system. See chapter 4.5.2

<sup>8)</sup> Planned

## UNIGEAR DOUBLE BUSBAR SYSTEM

## 4.3 Dimensions of panels



## 4.3.1 Dimensions of 12/17.5 kV units

	Dimension	mm
Height without a gas duct	A	2200/2595 <sup>1)</sup>
Height with a gas duct		2700
Width	B <sup>*)</sup>	
- Feeder panels up to 1250 A (up to 31.5 kA)		650
- Feeder panels 1600 - 2000 A		800
- Feeder panels above 2000 A		1000
Depth	C	2021
Height of the basic part of panel (without LV compartment)	D	2026
	E	2100

<sup>1)</sup> Height of the auxiliary compartment is 705/1100 mm.

<sup>\*)</sup> Side cover (painted parts see chapter 1.2.2) widens the switchgear by 40 mm on each side

## TYPICAL CONVENTIONAL UNITS

### 4.3.2 Dimensions of 24 kV units

	Dimension	mm
Height without a gas duct	A	2400/2720 <sup>1)</sup>
Height with a gas duct		2700/2720 <sup>1)</sup>
Width	B <sup>*)</sup>	
- Feeder panels up to 1250 A (up to 31.5 kA)		650
- Feeder panels 1600 - 2000 A		800
- Feeder panels above 2000 A		1000
Depth	C	2570
Height of the basic part of panel (without LV compartment)	D	2400
	E	1620

<sup>1)</sup> Height of the control cabinet is 705/1100 mm.

<sup>\*)</sup> Side cover (painted parts see chapter 1.2.2) widens the switchgear by 40 mm on each side

## UNIGEAR DOUBLE BUSBAR SYSTEM

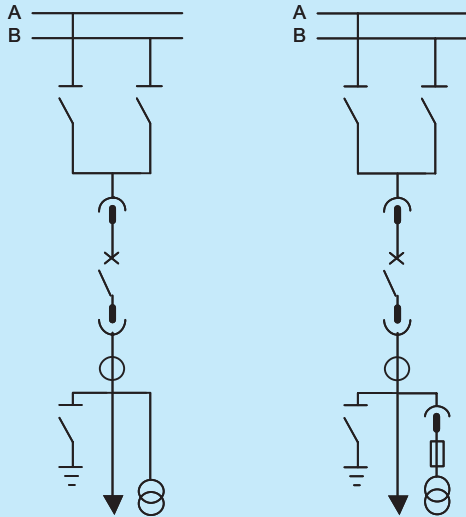
### 4.4 General notes

- Each medium size current transformer can be replaced by an ABB KEVCD sensor. The earthing switch is not a compulsory switchboard accessory.
- Voltage transformers in fixed version are not equipped with fuses.
- Low voltage compartment height is 705mm if not mentioned a different one. Another height is 1100mm. Height 580mm is not available for double busbar system.
- Total height of the unit including an exhaust duct may vary depending on the type of the duct. The height in the table is one of the options.
- Indicated number of cables is maximal available. Voltage transformers occupy one position as well as surge arresters.
- Rating of panels with vacuum contactor is always 400A.
- Voltage transformers may not have a fuse status indication if they are located in the cable compartment.
- Dimensions of panels may vary depending on project requirements if there is any DTO (Design To Order) modification.

## TYPICAL CONVENTIONAL UNITS

### 4.5 Incoming-outgoing unit (IF)

#### 4.5.1 Feeder up to 2500A



		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2400 <sup>5)</sup>	2400 <sup>5)</sup>
Height with gas exhaust duct	mm	2700	2700	2700	2700	2700
Depth	mm	2021	2021	2021	2570	2570
Rated current	A					
	630	■			■	
	1250	■			■	
	1600		■			■
	2000		■			■
2500			■			■
Maximal short-time withstand current	kA	31.5 <sup>6)</sup>	31.5 <sup>6)</sup>	31.5 <sup>6)</sup>	25	25
Earthing switch		■	■	■	■	■
Number of cable connections (maximal)	nr.	3	6	6	3	6
Number of CTs per phase (alternative combinations)	1 medium size	■	■	■	■	■
	1 long size	■	■	■	■	■
Number of VTs per phase (alternative combinations)	1 fixed	■	■	■	■	■
	2 fixed					
	1 withdrawable with fuses	■	■	■	■	■

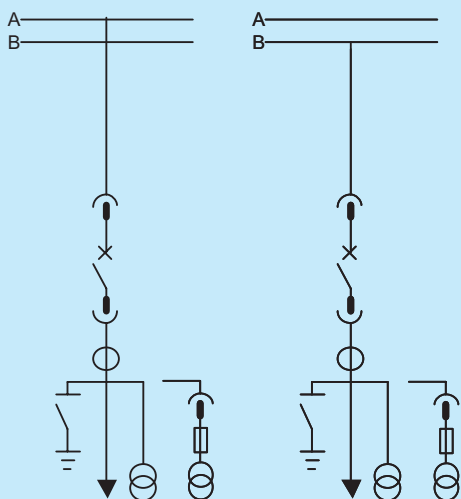
<sup>4)</sup> Height with low-voltage compartment 1100 mm high is 2595mm (12/17.5 kV)

<sup>5)</sup> Height with low-voltage compartment 1100 mm high is 2720mm (24 kV)

<sup>6)</sup> 31.5 kA @ 12 kV; 25 kA @ 17.5 kV

## UNIGEAR DOUBLE BUSBAR SYSTEM

## 4.5.2 Feeder over 2500A



Incomming feeder for currents above 2500A always consists of two panels. One panel for each busbar system.

		12-17.5 kV	24 kV
Width	mm	1000	1000
Height	mm	2200 <sup>4)</sup>	2200 <sup>5)</sup>
Height with gas exhaust duct	mm	2700	2700
Depth	mm	2021	2570
Rated current	A		
	2500		■ <sup>8)</sup>
	3150	■ <sup>8)</sup>	
	3600	■ <sup>8)</sup>	
	4000	■ <sup>8)</sup>	
Maximal short-time withstand current	kA	31.5 <sup>6)</sup>	25
Earthing switch		■	■
Number of cable connections (maximal)	nr.	6	6
Number of CTs per phase (alternative combinations)			
	1 medium size 1 long size	■ ■	■ ■
Number of VTs per phase (alternative combinations)			
	1 fixed 2 fixed	■ ■	■ ■
	1 withdrawable with fuses	■	■

<sup>4)</sup> Height with low-voltage compartment 1100 mm high is 2595mm

<sup>5)</sup> Height with low-voltage compartment 1100 mm high is 2720mm (24 kV)

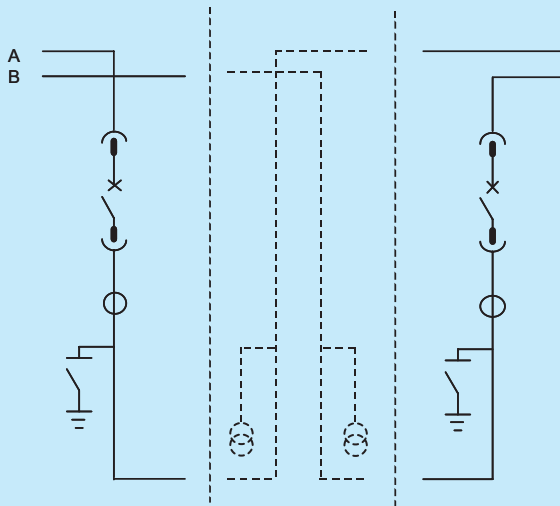
<sup>6)</sup> 31.5 kA @ 12 kV; 25 kA @ 17.5 kV

<sup>8)</sup> Planned

## TYPICAL CONVENTIONAL UNITS

### 4.6 Bus coupler

#### 4.6.1 Bus coupler longitudinal - bus tie part



Longitudinal bus coupler consists of 2 or 3 panels.  
Two bus ties and a bus riser in between  
**Here is described the bus tie.**

		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2400 <sup>5)</sup>	2400 <sup>5)</sup>
Height with gas exhaust duct	mm	2700	2700	2700	2700	2700
Depth	mm	2021	2021	2021	2570	2570
Rated current	A					
	630					
	1250	■			■	
	1600		■			■
	2000		■			■
	2500			■		■
	3150			■		
3600 <sup>8)</sup>			■			
4000 <sup>8)</sup>			■			
Maximal short-time withstand current	kA	31.5 <sup>6)</sup>	31.5 <sup>6)</sup>	31.5 <sup>6)</sup>	25	25
Earthing switch			■	■	■	■
Number of cable connections (maximal)	nr.	0	0	0	0	0
Number of CTs per phase (alternative combinations)	1 medium size		■	■	■	■
	1 long size		■	■	■	■
Number of VTs per phase (alternative combinations)	1 fixed					
	2 fixed					
	1 withdrawable with fuses					

<sup>4)</sup> Height with low-voltage compartment 1100 mm high is 2595mm (12/17.5 kV)

<sup>5)</sup> Height with low-voltage compartment 1100 mm high is 2720mm (24 kV)

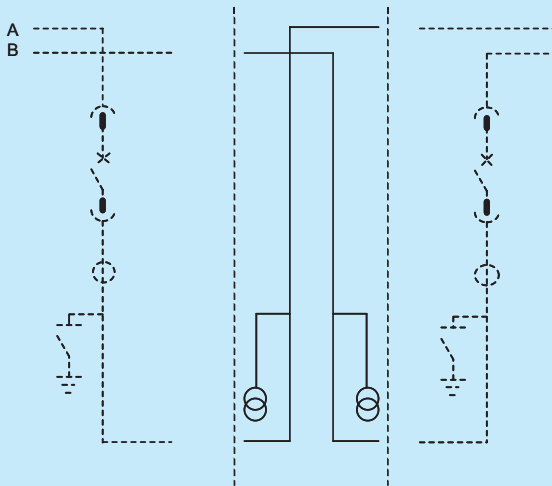
<sup>6)</sup> 31.5 kA @ 12 kV; 25 kA @ 17.5 kV

<sup>8)</sup> Planned



## UNIGEAR DOUBLE BUSBAR SYSTEM

## 4.6.2 Bus coupler longitudinal - combined bus riser part



Longitudinal bus coupler consisting of 3 panels.  
Two bus ties and a bus riser in between  
**Here is described the bus riser.**

		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2400 <sup>5)</sup>	2400 <sup>5)</sup>
Height with gas exhaust duct	mm	2700	2700	2700	2700	2700
Depth	mm	2021	2021	2021	2570	2570
Rated current	A					
	630					
	1250	■			■	
	1600	■			■	
	2000	■			■	
	2500	■			■	
	3150		■			
3600 <sup>8)</sup>		■				
4000 <sup>8)</sup>		■				
Maximal short-time withstand current	kA	31.5 <sup>6)</sup>	31.5 <sup>6)</sup>		25	
Earthing switch		-	-		-	
Number of cable connections (maximal)	nr.	0	0		0	
Number of CTs per phase (alternative combinations)						
	1 medium size	■	■		■	
	1 long size	■	■		■	
	2 medium size					
1 medium and 1 long size						
Number of VTs per phase (alternative combinations)						
	1 fixed	■	■		■	
	2 fixed					
	1 withdrawable with fuses					

<sup>4)</sup> Height with low-voltage compartment 1100 mm high is 2595mm (12/17.5 kV)

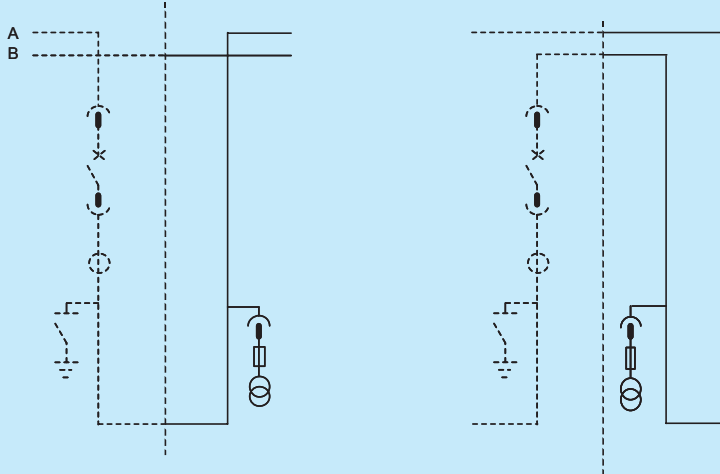
<sup>5)</sup> Height with low-voltage compartment 1100 mm high is 2720mm (24 kV)

<sup>6)</sup> 31.5 kA @ 12 kV; 25 kA @ 17.5 kV

<sup>8)</sup> Planned

## TYPICAL CONVENTIONAL UNITS

### 4.6.3 Bus coupler longitudinal - bus riser part with a metering truck



Longitudinal bus coupler consisting of 2 panels.  
Here is described the bus riser.

		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2400 <sup>5)</sup>	2400 <sup>5)</sup>
Height with gas exhaust duct	mm	2700	2700	2700	2700	2700
Depth	mm	2021	2021	2021	2570	2570
Rated current	A					
	630					
	1250		■		■	
	1600		■		■	
	2000		■		■	
	2500		■		■	
	3150		■			
	3600 <sup>6)</sup>		■			
	4000 <sup>6)</sup>		■			
Maximal short-time withstand current	kA	31.5	31.5		25	
Earthing switch		-	-		-	
Number of cable connections (maximal)	nr.	0	0		0	
Number of CTs per phase (alternative combinations)						
1 medium size		■	■		■	
1 long size		■	■		■	
2 medium size						
1 medium and 1 long size						
Number of VTs per phase (alternative combinations)						
1 fixed		■	■		■	
2 fixed						
1 withdrawable with fuses						

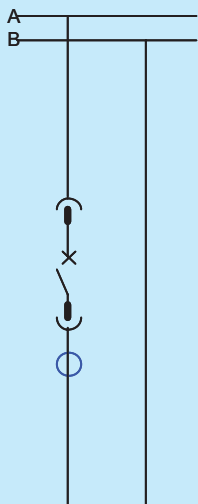
<sup>4)</sup> Height with low-voltage compartment 1100 mm high is 2595mm (12/17.5 kV)

<sup>5)</sup> Height with low-voltage compartment 1100 mm high is 2720mm (24 kV)

<sup>6)</sup> Planned

## UNIGEAR DOUBLE BUSBAR SYSTEM

## 4.6.4 Bus tie transverse



		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	1000
Height	mm	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2400 <sup>5)</sup>	2400 <sup>5)</sup>
Height with gas exhaust duct	mm	2700	2700	2700	2700	2700
Depth	mm	2021	2021	2021	2570	2570
Rated current	A					
	630					
	1250	■			■	
	1600		■			■
	2000		■			■
	2500			■		
	3150			■		
	3600 <sup>8)</sup>			■		
	4000 <sup>8)</sup>			■		
Maximal short-time withstand current	kA	31.5	31.5	31.5	25	25
Earthing switch		-	-	-	-	-
Number of cable connections (maximal)		0	0	0	0	0
Number of CTs per phase (alternative combinations)						
	1 medium size	■	■	■	■	■
	1 long size	■	■	■	■	■
	2 medium size					
	1 medium and 1 long size					
Number of VTs per phase (alternative combinations)						
	1 fixed					
	2 fixed					
	1 withdrawable with fuses					

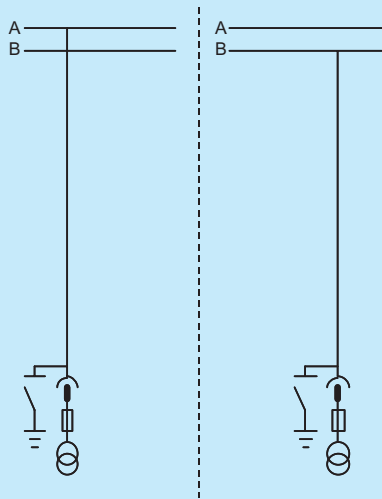
<sup>4)</sup> Height with low-voltage compartment 1100 mm high is 2595mm (12/17.5 kV)

<sup>5)</sup> Height with low-voltage compartment 1100 mm high is 2720mm (24 kV)

<sup>8)</sup> Planned

## TYPICAL CONVENTIONAL UNITS

### 4.7 Measurement unit (M)



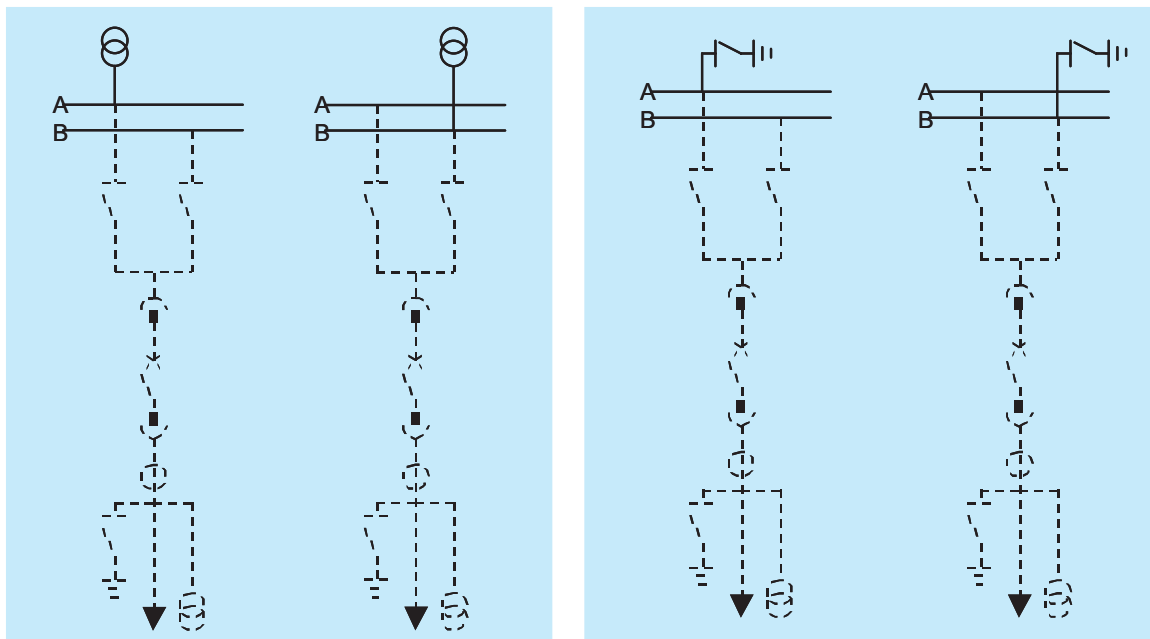
		12-17.5 kV			24 kV	
Width	mm	650	800	1000	800	
Height	mm	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2200 <sup>4)</sup>	2400 <sup>5)</sup>	
Height with gas exhaust duct	mm	2700	2700	2700	2700	
Depth	mm	2021	2021	2021	2570	
Rated current	A					
	630	■			■	
	1250	■			■	
	1600	■			■	
	2000	■			■	
	2500	■				
	3150	■				
	3600 <sup>8)</sup>	■				
	4000 <sup>8)</sup>	■				
Maximal short-time withstand current	kA	31.5	31.5	31.5	25	
Earthing switch		■			■	
Number of cable connections (maximal)		0	0	0	0	
Number of CTs per phase (alternative combinations)						
1 medium size						
1 long size						
2 medium size						
1 medium and 1 long size						
Number of VTs per phase (alternative combinations)						
1 fixed						
2 fixed						
1 withdrawable with fuses		■			■	
1 fixed and 1 withdrawable with fuses						

Voltage transformers are located in the CB compartment.  
Transformers may be equipped with fuse status indication in 12 and 24kV panels.

<sup>8)</sup> Planned

## UNIGEAR DOUBLE BUSBAR SYSTEM

## 4.8 Busbar applications



## 4.8.1 Voltage transformers

Width	mm	12-17.5 kV			24 kV	
		650	800	1000	800	1000
Without bushings		■	■	■	■	
With bushings				■	■	

Transformers are installed in an additional box on the top of the switchgear. The box can be combined with LV Compartment 705 mm high.

## 4.8.2 Earthing switch

Width	mm	12-17.5 kV			24 kV	
		650	800	1000	800	1000
Short circuit current	kA				■	■
25		■	■	■		
31.5						

Earthing switch is installed in an additional box on the top of the switchgear. This feature is available up to 31.5 kA / 12 kV; 25 kA / 17.5 and 24 kV. The box can be combined with LV Compartment 705 mm high.



## GENERAL CHARACTERISTICS

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## GENERAL CHARACTERISTICS

### 5.1 IEC reference Standards

Switchboard	62271-200
Switchboard and apparatus	60694
IEC 60271-200 Standard references of the tests the switchboard has been subjected to:	
– dielectric	6.1
– temperature	6.2
– impedance measurement	6.4
– rated short-time withstand current of the main circuits	6.5.101
– rated short-time withstand current of the earthing circuits	6.5.102
– removable mechanical parts	6.102.1
– mechanical interlocks	6.102.2
– degree of protection	6.103
– internal arc	6.108
Circuit-breakers	62271-100
Contactors	60470
Fuses	60282-1
Switch-disconnectors	60265-1 e 60420
SF6 gas	60376
Earthing switch	60129
Level of insulation (Co-ordination guide)	60071
Level of insulation (Values)	60694 Table 1a
Internal arc	62271-200 Annex A, criteria 1 to 5
Degrees of protection	60529
Current transformers	60044-1
Voltage transformers	60044-2
Current sensors	60044-8
Voltage sensors	60044-7

### 5.2 Operating conditions

The switchboard rated characteristics are guaranteed under the following ambient conditions:

- minimum ambient temperature      - 5 °C
- maximum ambient temperature      + 40 °C
- maximum relative humidity          95 %
- maximum altitude                      1000 m above sea level.
- presence of normal, non-corrosive and unpolluted atmosphere.

The switchboard must also be installed in ambients with the following characteristics:

- inside masonry or prefabricated structures;
- suitable for containing electrical apparatus;
- closed and not accessible to the public;
- only utilisable by personnel in charge of the electrical installation.



### 5.3 Level of insulation

#### 5.3.1 Reference Standards

IEC 60694.

#### 5.3.2 Rated degrees of insulation

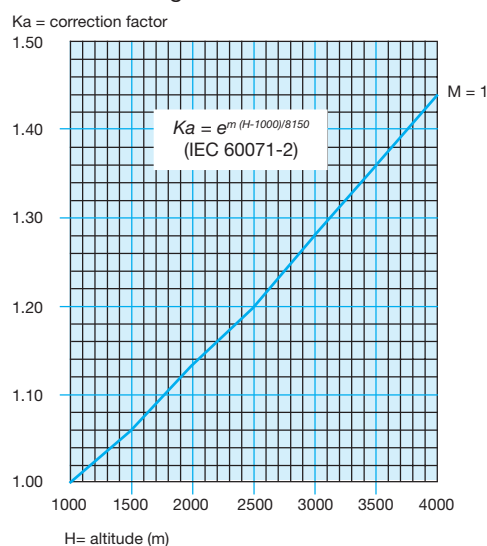
Rated and insulation voltage kV	Test voltage at industrial frequency		Impulse withstand voltage	
	For the insulation distance kV	For the phase-phase and phase-earth distance kV	For the insulation distance kV	For the phase-phase and phase-earth distance kV
3.6	12	10	46	40
7.2	23	20	70	60
12	32	28	85	75
17.5	45	38	110	95
24	60	50	145	125
36	80	70	190	170

The rated values are guaranteed at sea level and under normal atmospheric conditions (IEC 60071-2, pressure 1013 h Pa, temperature 20 °C, relative humidity 11 g/m<sup>3</sup>).

The degree of air insulation decreases progressively as the altitude increases; however, the rated values are guaranteed up to 1000 metres above sea level.

Above an altitude of 1000 m, a correction factor must be introduced which allows the required insulation levels to be guaranteed.

The graph below shows the correction factors according to the altitude.



Voltage test at industrial frequency (installation altitude) => Test voltage at industrial frequency (according to IEC 60694) x Ka

Impulse withstand voltage (installation altitude) => Impulse withstand voltage (according to IEC 60694) x Ka

## GENERAL CHARACTERISTICS

### 5.3.3 Example of calculation

Rated insulation voltage of the switchboard	12 kV
Test voltage at industrial frequency	28 kV
Impulse withstand voltage	75 kV
Altitude of the switchboard installation site	2000 metres
Correction factor (Ka)	1.13
Test voltage at industrial frequency (altitude of installation)	28x1.13
Impulse withstand voltage (altitude of installation)	75x1.13
Test voltage at industrial frequency	31.6 kV
Impulse withstand voltage	84.7 kV















The levels of insulation required are therefore guaranteed by the 17.5 kV (38 kV and 95 kV) switchboard.

## 5.4 Degrees of protection

### 5.4.1 Reference Standards

IEC 60529.

### 5.4.2 Identification table

IP	Protection against foreign bodies	Protection against water
0	No protection	No protection
1	 Foreign bodies with diameter 50 mm or more	 Vertical rain
2	 Foreign bodies with diameter 12 mm or more	 Rain at 15°
3	 Foreign bodies with diameter 2.5 mm or more	 Rain at 60°
4	 Foreign bodies with diameter 1 mm or more	 Spray from all directions
5	 Deposit of dust	 Jets from all directions
6	 Entry of dust	 Flood
7	–	 Immersion of limited duration
8	–	 Immersion of indefinite duration

### 5.4.3 Degrees of protection

UniGear switchboards are usually supplied with the following standard degrees of protection:

- External housing IP40
- Between the compartments IP20

On request, the external housing can be supplied with other degrees of protection up to IP53 maximum.

In case of higher degree than IP 41 please call the producer.

## GENERAL CHARACTERISTICS

### 5.5 Internal arc withstanding

#### 5.5.1 Reference Standards

IEC 62271-200 Annex A

Meaning of the criteria of the IEC 62271-200 Standard for carrying out the internal arc withstand tests:

Criteria	Description
1	The switchboard doors must remain closed and there must be no opening of the covering sheets
2	No part of the switchboard which is a possible source of danger for personnel must become detached
3	No drilling holes on the external housing of the switchboard must be made in the parts accessible to personnel
4	The vertical and horizontal fabric indicators on the outside of the switchboard must not catch fire
6	All the switchboard earthing connections must remain efficient

#### 5.5.2 Switchboard characteristics

The UniGear switchboard satisfies all the criteria from 1 to 5 for guaranteeing safety of the personnel in charge of the installation in the case of an internal arc.  
The criteria apply to the external switchboard housing.

#### 5.5.3 Switchgear classification

UniGear is classified as *IAC accessibility type B* acc. to IEC 62271-200

#### 5.5.4 Overlapping period of IEC 60298

There is an overlapping period within European Union. IEC 60298 is valid by 31st Dec. 2007

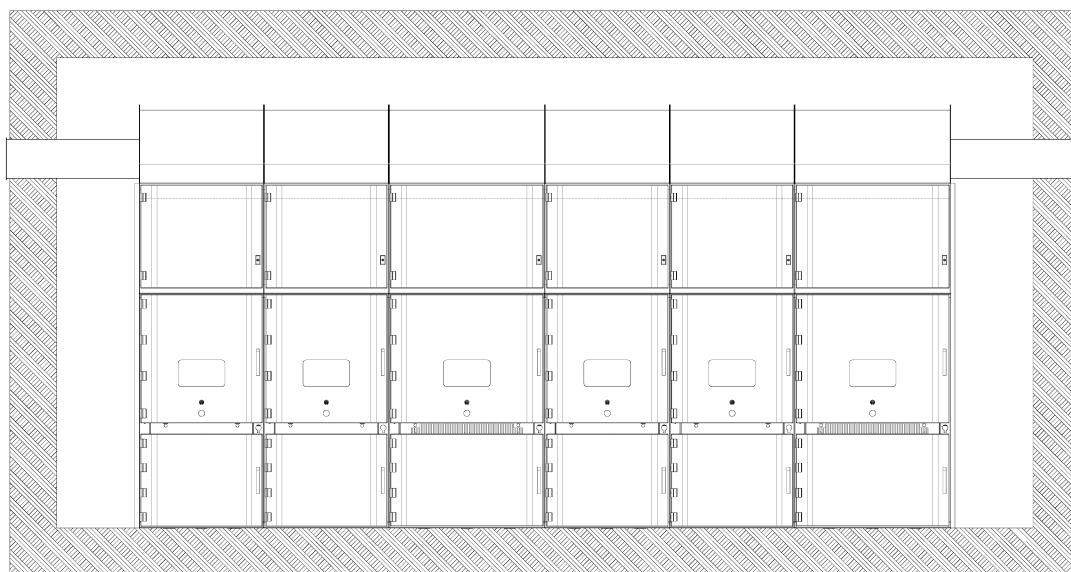
## 5.6 Installation of UniGear with gas ducts

### 5.6.1. Introduction

The event of internal arc inside of medium voltage switchgear occurs very rarely and generates overpressures inside the compartment affected by the arc, thus causing the exhaust of hot gases and material particles.

This exhausting must be carefully checked in order to guarantee the safety of the persons and avoid damages to the objects which are placed nearby the switchgear affected by the breakdown.

UniGear can be equipped with a metal sheet duct for collecting and exhausting the hot gases; this duct is mounted on the upper side of the switchboard and normally it is extended on both the right and left extremities (see Figure 5/1).



**Figure 5/1**

## GENERAL CHARACTERISTICS

The minimum height of the switchgear room is **3 metres** and the protection degree obtainable is up to **IP53**

This solution is capable to guarantee the safety for the persons that are standing in front of the switchgear, according to the Annex A of the IEC 62271-200 Standard (criteria 1 to 5).



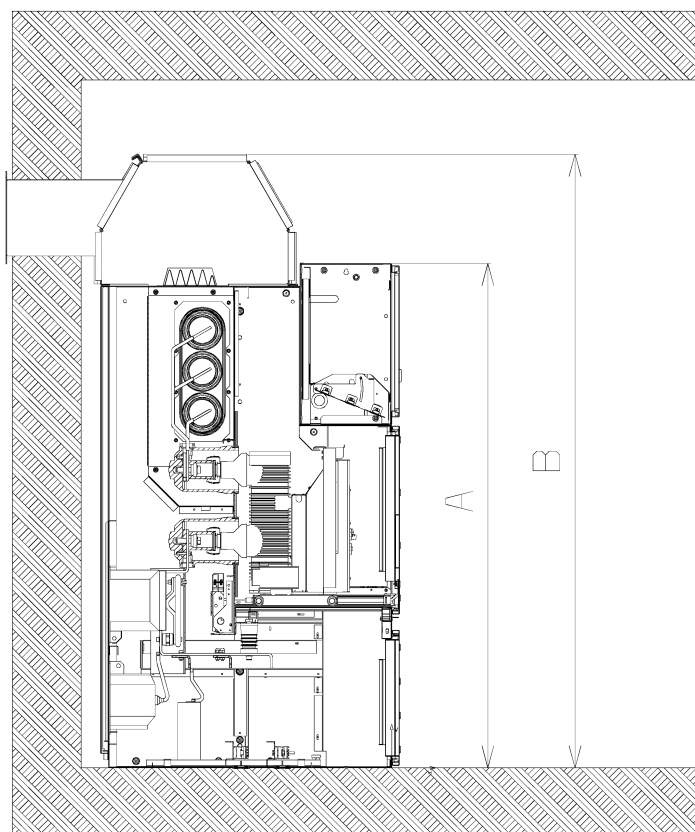
**If the extremities of the gas duct are directed towards areas of the installation building that are accessible for the personnel and/or dedicated to the installation of other equipment, machines and plants, these extremities must be prolonged in order to permit the exhaust of the hot gases in zones that are not dangerous for persons and machineries.**



**The extensions must be realised using metal sheet gas ducts with a cross section at least equal to the prolong sections already applied to the switchgear; the extensions must be capable of withstanding a minimum pressure value of 80kPa and must be properly sustained. The presence of bends and curves in the ducts must be accepted only if it is strictly necessary: in this case, the bend must be realised with the maximum applicable bending radius.**

The recommended solution in order to avoid the exhausting of the gases and the overpressures inside of the switchgear installation room is to prolong the exhaust duct outside of the substation (from left and right sides or front and rear sides). In this case, take care of the accessibility of the persons in the gas-exhausting zone and protect the gas exhaust channel extremity in order to avoid the entrance of water, dust, small animals and any foreign object.

Figures 1 and 2 show two real examples of gas ducts applications.



**Figure 5I2 - Rear exhaust arrangement**

The height B of the panel equipped with the standard gas duct arrangement (Figures 1 and 2) is 2675mm (12/17.5kV version) or 2775mm (24kV version). The switchgear height A is 2200mm (12/17.5kV version) or 2325mm (24kV version) if equipped with the 705mm LV compartment.

The figures contained in Section 2 show the standard arrangement (front and side view).

If the dimensions and the position of the switchgear room do not allow the installation of the switchboard according to the above-presented solutions, it is possible to arrange the gas exhausting according to the rules that are presented in Section 3.



**The test certification is not available for all the described solutions. Please contact ABB for more information.**

## GENERAL CHARACTERISTICS

### 5.6.2. Standard arrangement

Evacuation from the room of the exhausted gas produced by the internal arc fault must be normally carried out. The following solutions can be used when it is possible to exhaust the gases outside the switchgear room:

- **Standard duct**
- **Compact duct**



### 5.6.2.1 Standard duct

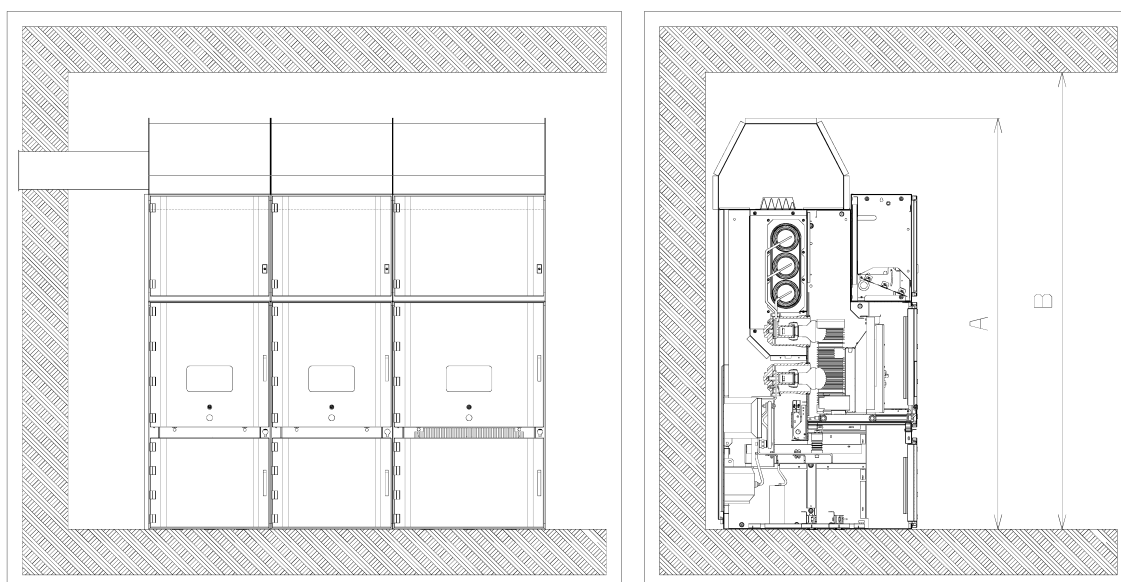


Figure 5/3 - Standard duct

2.1	Internal arc current [kA]	20		25		31.5		40		50
	Fault duration time [s]	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Ceiling height B	$B \geq 4m$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	$3.5m \leq B < 4m$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	$3m \leq B < 3.5m$	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	$2.8m \leq B < 3m$	No	No	No	No	No	No	No	No	No
	$2.5m \leq B < 2.8m$	No	No	No	No	No	No	No	No	No

Additional notes	Rated voltage [kV]	12/17.5	24
	Switchgear height A [mm] (705 and 1100mm height LV compartment)	2675	2775
	Max protection degree	IP43	
	Ceiling type	Concrete or false	
	Fault limiting devices	Optional	



Top mounted VTs (up to 50kA) and busbar earthing switch (up to 31.5kA) can be applied to this duct type. Those units equipped with such applications must be fitted with a dedicated duct type (see the relevant configuration document).

## GENERAL CHARACTERISTICS

### 5.6.2.2 Compact duct

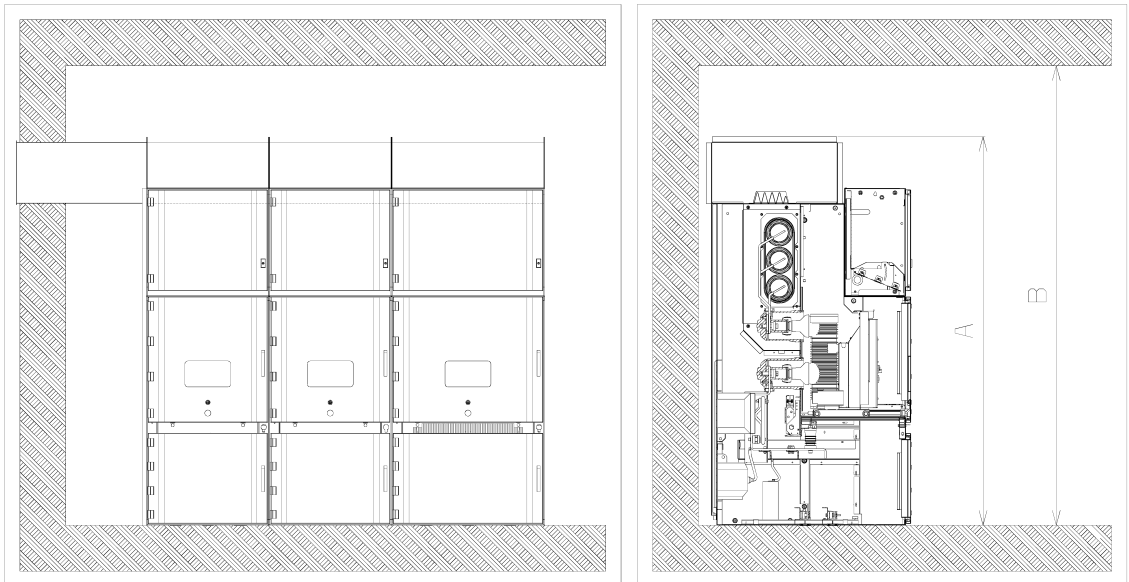


Figure 5/4 - Compact duct

2.2	Internal arc current [kA]	20		25		31.5		40		50
	Fault duration time [s]	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Ceiling height B	$B \geq 4m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$3.5m \leq B < 4m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$3m \leq B < 3.5m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$2.8m \leq B < 3m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$2.5m \leq B < 2.8m$	No	No	No	No	No	No	No	No	No

Additional notes	Rated voltage [kV]	12/17.5	24
	Switchgear height A [mm] (705mm height LV compartment)	2500	2500
	Max protection degree	IP43	
	Ceiling type	Concrete or false	
	Fault limiting devices	Mandatory for values marked with (*)	



Top mounted VTs and busbar earthing switch cannot be applied to this duct type.

### 5.6.3. Alternative solutions

The following solutions can be used when it is not possible to exhaust the gases outside the switchgear room:

- **Compact duct with top chimneys**
- **Application of partitions up to the ceiling top**
- **Without extra measures**

## GENERAL CHARACTERISTICS

### 5.6.3.1 Compact duct with top chimneys

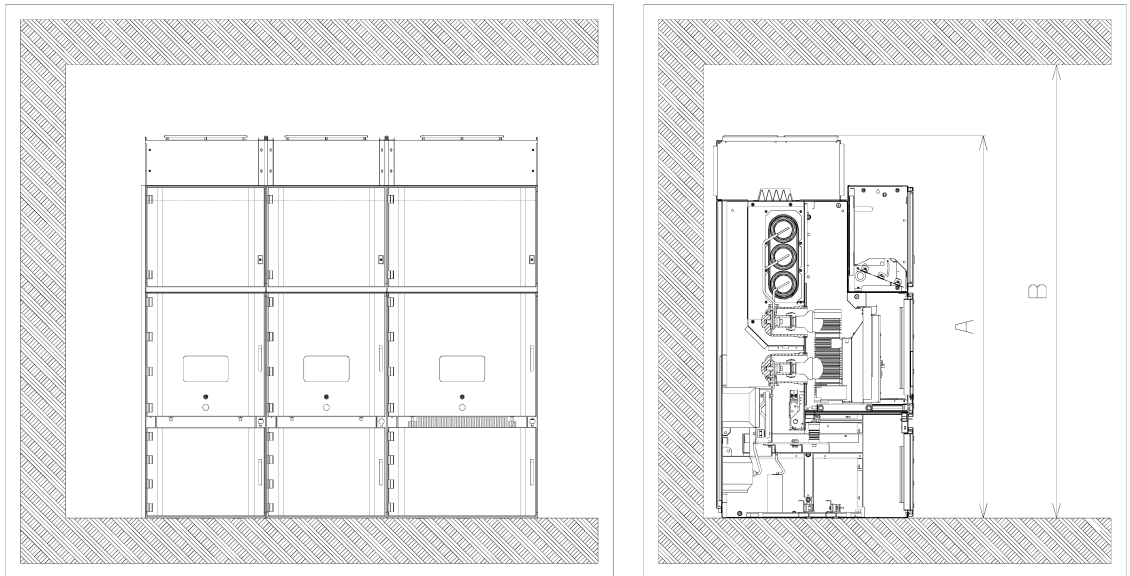


Figure 5/5 – Compact duct with top chimneys

3.1	Internal arc current [kA]	20		25		31.5		40		50
	Fault duration time [s]	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Ceiling height B	$B \geq 4m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$3.5m \leq B < 4m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$3m \leq B < 3.5m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$2.8m \leq B < 3m$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$2.5m \leq B < 2.8m$	No	No	No	No	No	No	No	No	No

Additional notes	Rated voltage [kV]	12/17.5	24
	Switchgear height A [mm] (705mm height LV compartment)	2530	2530
	Max protection degree	IP43	
	Ceiling type	Concrete or false	
	Fault limiting devices	Mandatory for values marked with (*)	



Top mounted VTs and busbar earthing switch cannot be applied to this duct type. Recommended solution is to mount at least one chimney every two panels.

### 5.6.3.2 Without extra measures

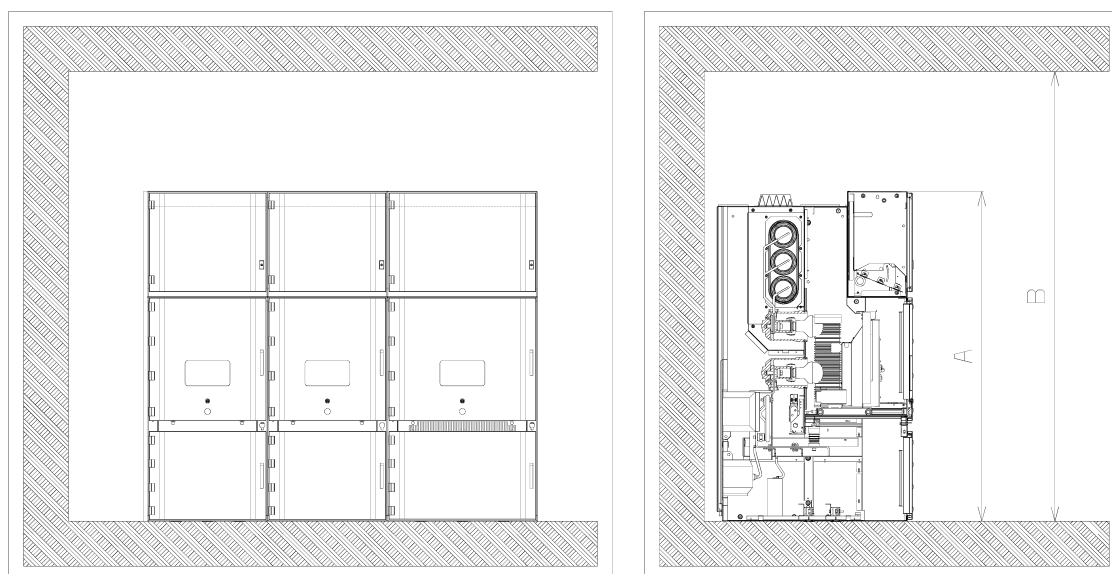


Figure 5/6 – Without extra measures

3.2	Internal arc current [kA]	20		25		31.5		40		50
	Fault duration time [s]	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Ceiling height B	$B \geq 4\text{m}$	Yes	(*)	Yes	(*)	(*)	(*)	No	No	No
	$3.5\text{m} \leq B < 4\text{m}$	Yes	(*)	Yes	(*)	No	No	No	No	No
	$3\text{m} \leq B < 3.5\text{m}$	Yes	(*)	No	No	No	No	No	No	No
	$2.8\text{m} \leq B < 3\text{m}$	No	No	No	No	No	No	No	No	No
	$2.5\text{m} \leq B < 2.8\text{m}$	No	No	No	No	No	No	No	No	No

Additional notes	Rated voltage [kV]	12/17.5	24
	Switchgear height A [mm] (705 and 1100mm height LV compartment)	2200 - 2595	2325 - 2720
	Max protection degree	IP4X	
	Ceiling type	Concrete	
	Fault limiting devices	Mandatory for values marked with (*)	



Top mounted VTs and busbar earthing switch can be applied to the switchboard.

## GENERAL CHARACTERISTICS

### 5.6.4. Alternative solutions for ZS1 extensions

The following solutions can be used when it is not possible to exhaust the gases outside the switchgear room and should be preferably used for ZS1 extensions only:

- **Duct with top absorbers**
- **Diverted duct**

### 5.6.4.1 Duct with top absorbers

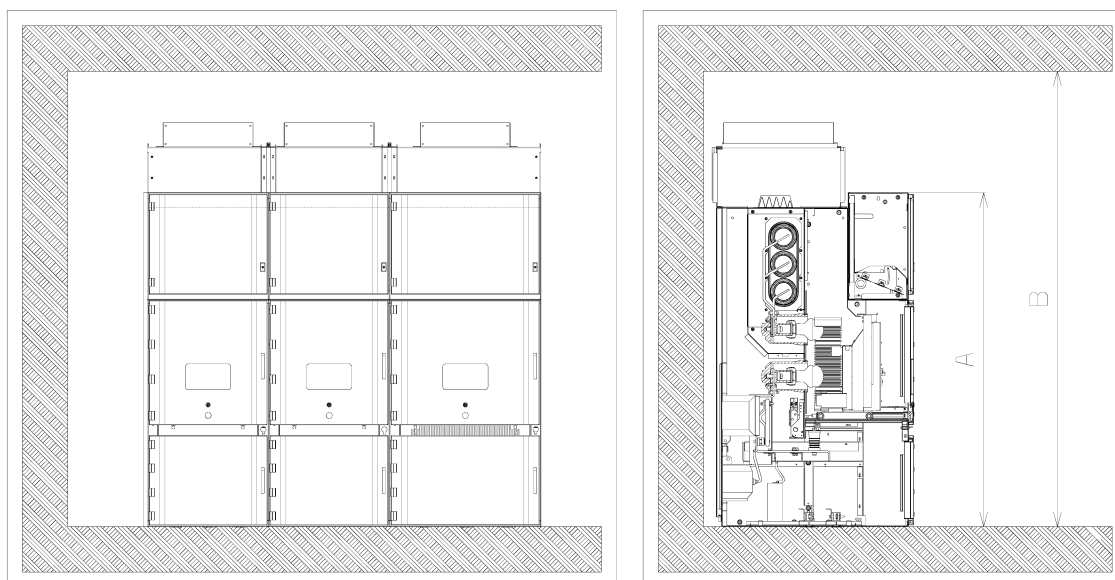


Figure 517 – Duct with top absorbers

4.1	Internal arc current [kA]	20		25		31.5		40		50
	Fault duration time [s]	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Ceiling height B	$B \geq 4\text{m}$	Yes	Yes	Yes	Yes	(*)	(*)	No	No	No
	$3.5\text{m} \leq B < 4\text{m}$	Yes	Yes	Yes	Yes	(*)	(*)	No	No	No
	$3\text{m} \leq B < 3.5\text{m}$	No	No	No	No	No	No	No	No	No
	$2.8\text{m} \leq B < 3\text{m}$	No	No	No	No	No	No	No	No	No
	$2.5\text{m} \leq B < 2.8\text{m}$	No	No	No	No	No	No	No	No	No

Additional notes	Rated voltage [kV]	12/17.5	24
	Switchgear height A [mm] (705mm height LV compartment)	2660	2660
	Max protection degree	IP4X	
	Ceiling type	Concrete	
	Fault limiting devices	Mandatory for values marked with (*)	



Top mounted VTs and busbar earthing switch cannot be applied with this duct type. Recommended solution is to mount at least one absorber every two panels.

## GENERAL CHARACTERISTICS

### 5.6.4.2 Diverted duct

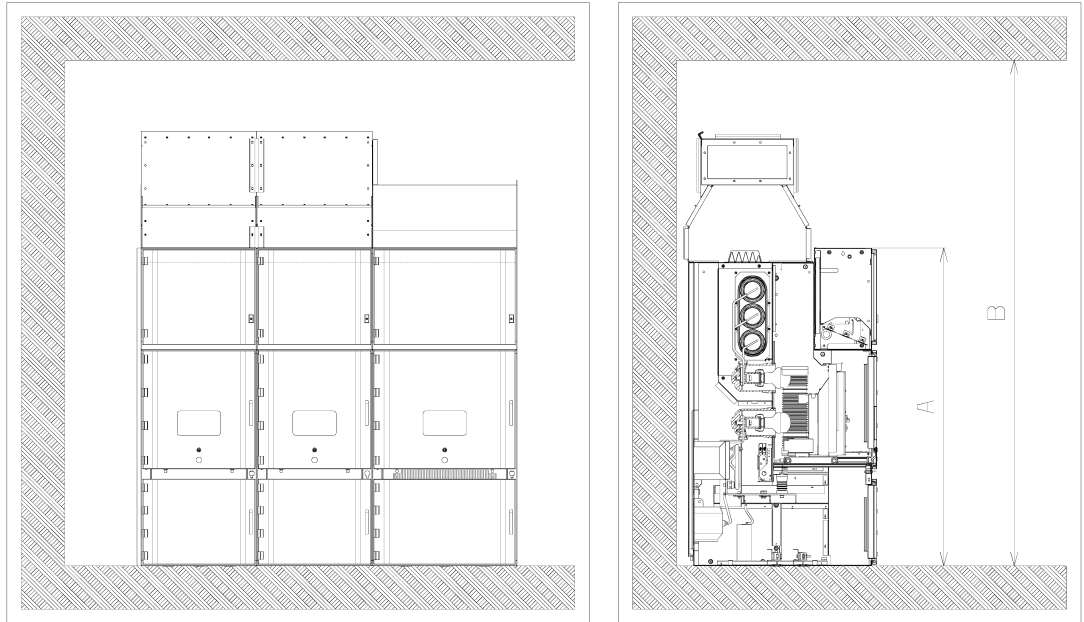


Figure 518 - Diverted duct

4.2	Internal arc current [kA]	20		25		31.5		40		50
	Fault duration time [s]	0.5	1	0.5	1	0.5	1	0.5	1	0.5
Ceiling height B	$B \geq 4\text{m}$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$3.5\text{m} \leq B < 4\text{m}$	Yes	Yes	Yes	Yes	Yes	Yes	(*)	(*)	(*)
	$3\text{m} \leq B < 3.5\text{m}$	No	No	No	No	No	No	No	No	No
	$2.8\text{m} \leq B < 3\text{m}$	No	No	No	No	No	No	No	No	No
	$2.5\text{m} \leq B < 2.8\text{m}$	No	No	No	No	No	No	No	No	No

Additional notes	Rated voltage [kV]	12/17.5	24
	Switchgear height A [mm] (705mm height LV compartment)	2960	3060
	Max protection degree	IP43	
	Ceiling type	Concrete or false	
	Fault limiting devices	Mandatory for values marked with (*)	



Top mounted VTs and busbar earthing switch cannot be applied to this duct type. The application must be used with at least 5 panels.



### 5.6.5. Rules for choosing the type of duct

The duct type to be applied to the switchboard must be chosen according to the following rules:

#### Exhaust outside of the switchgear room

Arc Fault Value	Ceiling Height B				
	$2.5\text{m} \leq B < 2.8\text{m}$	$2.8\text{m} \leq B < 3\text{m}$	$3\text{m} \leq B < 3.5\text{m}$	$3.5\text{m} \leq B < 4\text{m}$	$B \geq 4\text{m}$
20kA x 0.5"	-	2.2	2.1 - 2.2	2.1 - 2.2	2.1 - 2.2
20kA x 1"	-	2.2	2.1 - 2.2	2.1 - 2.2	2.1 - 2.2
25kA x 0.5"	-	2.2	2.1 - 2.2	2.1 - 2.2	2.1 - 2.2
25kA x 1"	-	2.2	2.1 - 2.2	2.1 - 2.2	2.1 - 2.2
31.5kA x 0.5"	-	2.2	2.1 - 2.2	2.1 - 2.2	2.1 - 2.2
31.5kA x 1"	-	2.2	2.1 - 2.2	2.1 - 2.2	2.1 - 2.2
40kA x 0.5"	-	<u>2.2</u>	2.1 - <u>2.2</u>	2.1 - <u>2.2</u>	2.1 - <u>2.2</u>
40kA x 1"	-	<u>2.2</u>	2.1 - <u>2.2</u>	2.1 - <u>2.2</u>	2.1 - <u>2.2</u>
50kA x 0.5"	-	<u>2.2</u>	2.1 - <u>2.2</u>	2.1 - <u>2.2</u>	2.1 - <u>2.2</u>

**Note:** if the indication of the solution is underlined, it means that the application of fault limiting devices is mandatory.

#### Exhaust inside the switchgear room

Arc Fault Value	Ceiling Height B				
	$2.5\text{m} \leq B < 2.8\text{m}$	$2.8\text{m} \leq B < 3\text{m}$	$3\text{m} \leq B < 3.5\text{m}$	$3.5\text{m} \leq B < 4\text{m}$	$B \geq 4\text{m}$
20kA x 0.5"	3.2	3.1 - 3.2	3.1 - 3.3	3.1 - 3.3	3.1 - 3.3
20kA x 1"	3.2	3.1 - 3.2	3.1 - <u>3.3</u>	3.1 - <u>3.3</u>	3.1 - <u>3.3</u>
25kA x 0.5"	3.2	3.1 - 3.2	3.1	3.1 - 3.3	3.1 - 3.3
25kA x 1"	3.2	3.1 - 3.2	3.1	3.1 - <u>3.3</u>	3.1 - <u>3.3</u>
31.5kA x 0.5"	3.2	3.1 - 3.2	3.1	3.1	3.1 - <u>3.3</u>
31.5kA x 1"	3.2	3.1 - 3.2	3.1	3.1	3.1 - <u>3.3</u>
40kA x 0.5"	-	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>
40kA x 1"	-	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>
50kA x 0.5"	-	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>

**Note:** if the indication of the solution is underlined, it means that the application of fault limiting devices is mandatory.

## GENERAL CHARACTERISTICS

### 5.7 Busbar partitioning

There are two key parameters defining when to use the bushings between switchgear units (cubicles).

It is width of the cubicle and fault current.

650 mm units (busbars) are short enough to be resistant against resonance and impact of dynamic current by themselves. Therefore there is not necessary to add any mechanical support.

800 mm and 1000 mm units (busbars) need a mechanical support for fault current 31.5 kA and above. Thus the bushings are put to every third unit for fault current 31.5 kA and to each unit for fault current 40 kA and 50 kA.

The rules above are summarized in the table:

<i>Unit width</i> [mm]	<i>I<sub>th</sub></i> [kA]	<i>Bushings</i>
650, 800, 1000	25	No
800, 1000	31.5	Every 3 <sup>rd</sup> unit
800, 1000	40/50	Each unit
Marine version	All ratings	Each unit

The bushings can be applied in each unit on customer request.

## APPARATUS

6.1	HD4 type SF6 circuit-breakers	6/2
6.1.1	Value of the rated currents	6/4
6.2	V-max type vacuum circuit-breakers	6/5
6.3	VD4 type vacuum circuit-breakers	6/6
6.4	VM1 Vacuum circuit-breakers	6/8
6.5	Value of the rated currents	6/10
6.6	V-Contact type vacuum contactors	6/10
6.7	NALF fuse switch disconnecter	6/12

## APPARATUS

### 6.1 HD4 type SF6 circuit-breakers



Circuit-breaker		
Standards		<b>IEC 62271-100</b> <b>CEI 17-1 (File 1375)</b>
Rated voltage		<b>Ur</b> [kV]
Rated insulation voltage		<b>Us</b> [kV]
Withstand voltage at 50 Hz		<b>Ud (1 min)</b> [kV]
Impulse withstand voltage		<b>Up</b> [kV]
Rated frequency		<b>fr</b> [Hz]
Rated normal current (40 °C) <sup>(1)</sup>		<b>Ir</b> [A]
Rated breaking capacity		<b>Isc</b> [kA]
Rated short-time withstand current (3 s)		<b>Ik</b> [kA]
Making capacity		<b>Ip</b> [kA]
Operation sequence		[O-0,3s-CO-15s-CO]
Opening time		[ms]
Arc time		[ms]
Total breaking time		[ms]
Closing time		[ms]
Absolute SF6 gas pressure <sup>(2)</sup>		[kPa]
Operating temperature		[°C]
Tropicalization		<b>IEC: 60068-2-30, 721-2-1</b>
Electromagnetic compatibility		

(1) Rated uninterrupted currents guaranteed with withdrawable circuit-breaker installed in a switchboard (40 °C).

(2) Rated service value.

(3) The circuit-breaker can reach rated currents higher than 3150 A with suitable forced ventilation of the switchboard (for further information, consult the UniGear type ZS1 switchboard technical catalogue).

(4) The locking electro-magnet in the truck (-RL2) to prevent the circuit-breaker being racked-in with the auxiliary circuits disconnected (plug not inserted in the socket) is included in the standard equipment.

(5) Rated current in a switchboard with forced ventilation. In a switchboard with natural ventilation, the rated current is 2300 A.

HD4/P 12								HD4/P 17							HD4/P 24						
■								■							■						
■								■							■						
12								17.5							24						
12								17.5							24						
28								38							50						
75								95							125						
50-60								50-60							50-60						
630	1250	1250	1600	2000	2500	3150 <sup>(3)</sup>		630	1250	1250	1600	2000	2500	3150 <sup>(3)</sup>		630	1250	1600	2000	2500 <sup>(5)</sup>	
16	16	-	-	-	-	-		16	16	-	-	-	-	-		16	16	16	16	16	
-	-	-	-	-	-	-		-	-	-	-	-	-	-		20	20	20	20	20	
25	25	-	25	25	25	25		25	25	-	25	25	25	25		25	25	25	25	25	
31.5	31.5	-	31.5	31.5	31.5	31.5		31.5	31.5	-	31.5	31.5	31.5	31.5		-	-	-	-	-	
-	-	40	40	40	40	40		-	-	40	40	40	40	40		-	-	-	-	-	
-	-	-	50	50	50	50		-	-	-	50	50	50	50		-	-	-	-	-	
16	16	-	-	-	-	-		16	16	-	-	-	-	-		16	16	16	16	16	
-	-	-	-	-	-	-		-	-	-	-	-	-	-		20	20	20	20	20	
25	25	-	25	25	25	25		25	25	-	25	25	25	25		25	25	25	25	25	
31.5	31.5	-	31.5	31.5	31.5	31.5		31.5	31.5	-	31.5	31.5	31.5	31.5		-	-	-	-	-	
-	-	40	40	40	40	40		-	-	40	40	40	40	40		-	-	-	-	-	
-	-	-	50	50	50	50		-	-	-	50	50	50	50		-	-	-	-	-	
40	40	-	-	-	-	-		40	40	-	-	-	-	-		40	40	40	40	40	
-	-	-	-	-	-	-		-	-	-	-	-	-	-		50	50	50	50	50	
63	63	-	-	63	63	63		63	63	-	63	63	63	63		63	63	63	63	63	
80	80	-	80	80	80	80		80	80	-	80	80	80	80		-	-	-	-	-	
-	-	100	100	100	100	100		-	-	100	100	100	100	100		-	-	-	-	-	
-	-	-	125	125	125	125		-	-	-	125	125	125	125		-	-	-	-	-	
■								■							■						
45								45							45						
10-15								10-15							10-15						
55-60								55-60							55-60						
80								80							80						
380								380							380						
- 5 ... + 40								- 5 ... + 40							- 5 ... + 40						
■								■							■						
■								■							■						

## APPARATUS

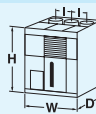
### 6.1.1 Value of the rated currents

Value of the rated currents according to the degree of protection of the external switchboard housing and ambient temperature.

Ambient temperature °C	IP4X					IP5X				
	630	1250	1600	2000	2500	630	1250	1600	2000	2500
40	630	1250	1600	2000	2500	440	880	1120	1400	1750
45	630	1200	1530	1910	2390	420	840	1070	1340	1670
50	600	1140	1460	1820	2280	400	800	1020	1280	1590
55	570	1080	1380	1730	2160	380	760	970	1210	1510
60	540	1020	1300	1630	2040	360	710	910	1140	1430
65	480	870	1110	1390	1740	310	610	780	980	1220

## 6.2 V-max type vacuum circuit-breakers



Circuit-breaker		Vmax/P 12		Vmax/P 17		
Standards	IEC 62271-100	■	■	■	■	
	CEI 17-1 (File 1375)	■	■	■	■	
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 normal current (40 °C)	(2) Ir [A]	630	1250	630	1250	
Rated breaking capacity	Isc [kA]	16	16	16	16	
(rated symmetrical short-circuit current)		20	20	20	20	
		25	25	25	25	
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	
Operation sequence	[O-0.3s-CO-15s-CO]	■	■	■	■	
Opening time	[ms]	40...60	40...60	40...60	40...60	
Arc duration	[ms]	10...15	10...15	10...15	10...15	
Total interruption time	[ms]	50...75	50...75	50...75	50...75	
Closing time	[ms]	60...80	60...80	60...80	60...80	
Maximum overall dimensions		H [mm]	665	665	665	665
		W [mm]	531	531	531	531
		D [mm]	662	662	662	662
		I [mm]	150	150	150	150
Pole centre distance						
Operating temperature	[°C]	-5...+40	-5...+40	-5...+40	-5...+40	
Tropicalization	IEC: 60068-2-30	■	■	■	■	
	721-2-1	■	■	■	■	
Electromagnetic compatibility	IEC 60694	■	■	■	■	

# APPARATUS

## 6.3 VD4 type vacuum circuit-breakers



Circuit-breaker		VD4/P 12									
Standards	IEC 62271-100	■									
	CEI 17-1 (File 1375)	■									
Rated voltage	Ur [kV]	12									
Rated insulation voltage	Us [kV]	12									
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28									
Impulse withstand voltage	Up [kV]	75									
Power frequency	fr [Hz]	50-60									
Rated normal current (40 °C)	(1) Ir [A]	630	1250	1600	1600	2000	2000	2500	3150	4000	
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16	16	–	–	–	–	–	–	–	
		20	20	20	20	20	20	20	–	–	
		25	25	25	25	25	25	25	25	25	
		31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	
		–	40	40	40	40	40	40	40	40	
		–	50	50	50	50	50	50	50	50	
Making capacity	Ip [kA]	40	40	–	–	–	–	–	–	–	
		50	50	50	50	50	50	50	–	–	
		63	63	63	63	63	63	63	63	63	
		80	80	80	80	80	80	80	80	80	
		–	100	100	100	100	100	100	100	100	
		–	125	125	125	125	125	125	125	125	
Operation sequence	[O-0,3s-CO-3min-CO]	■									
Opening time	[ms]	40...60									
Arc time	[ms]	10...15									
Total interruption time	[ms]	50...75									
Closing time	[ms]	60...80									
Mechanical operations (cycles)	Actuator	[No.]	... 30,000								
	Interrupters	[No.]	... 30,000								
Electrical operations (cycles)	Rated current	[No.]	... 30,000								
	In short-circuit	[No.]	... 100								
Pole centre distance	I [mm]	150	150	210	275	210	275	275	275	275	
Service temperature	[°C]	– 25 ... + 40									
Tropicalisation	IEC: 60068-2-30	■									
	721-2-1	■									
Electromagnetic compatibility	IEC 60694	■									

- (1) Rated uninterrupted currents guaranteed with withdrawable circuit-breaker installed in UniGear type ZS1 switchgear with 40°C air temperature
- (2) The 2300 A rated normal current is guaranteed with natural ventilation. The 2500 A rated normal current is guaranteed with forced ventilation.





VD4/P 17										VD4/P 24						
■										■						
■										■						
17.5										24						
17.5										24						
38										50						
95										125						
50-60										50-60						
630	1250	1600	1600	2000	2000	2500	3150	4000		630	630	1250	1250	1600	2000	2500 (2)
16	16	-	-	-	-	-	-	-	-	16	16	16	16	16	16	16
20	20	20	20	20	20	20	20	-	-	20	20	20	20	20	20	20
25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-	-	-	-	-	-	-
-	40	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	40	-	-	-	-	-	-	-	-	40	40	40	40	40	40	40
50	50	50	50	50	50	50	50	-	-	50	50	50	50	50	50	50
63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
80	80	80	80	80	80	80	80	80	80	-	-	-	-	-	-	-
-	100	100	100	100	100	100	100	100	100	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
■										■						
40...60										40...60						
10...15										10...15						
50...75										50...75						
60...80										60...80						
... 30,000										... 30,000						
... 30,000										... 30,000						
... 30,000										... 30,000						
... 100										... 100						
150	150	210	275	210	275	275	275	275	275	210	275	275	275	275	275	275
- 25 ... + 40										- 25 ... + 40						
■										■						
■										■						
■										■						

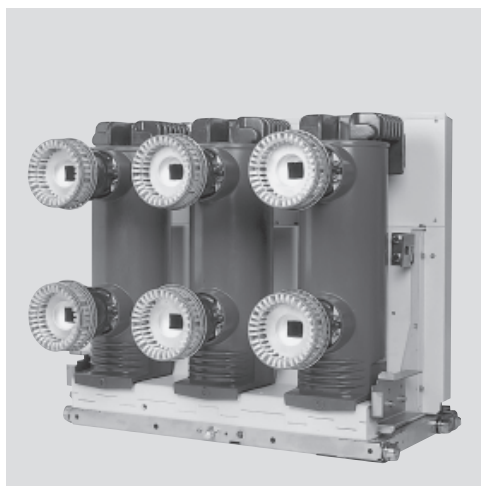
# APPARATUS

## 6.4 VM1 Vacuum circuit-breakers



Circuit-breaker		VM1/P 12								
Standards	IEC 62271-100 CEI 17-1 (File 1375)	■								
Rated voltage	Ur [kV]	12								
Rated insulation voltage	Us [kV]	12								
Withstand voltage at 50 Hz	Ud (1 min) [kV]	28								
Impulse withstand voltage	Up [kV]	75								
Power frequency	fr [Hz]	50-60								
Rated normal current (40 °C)	(1) Ir [A]	630	1250	1600	1600	2000	2000	2500	3150	4000
Rated breaking capacity (rated symmetrical short-circuit current)	Isc [kA]	16	16	–	–	–	–	–	–	–
		20	20	20	20	20	20	20	–	–
		25	25	25	25	25	25	25	25	25
		31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5
		–	40	40	40	40	40	40	40	40
Making capacity	Ip [kA]	–	50	50	50	50	50	50	50	50
		40	40	–	–	–	–	–	–	–
		50	50	50	50	50	50	50	–	–
		63	63	63	63	63	63	63	63	63
		80	80	80	80	80	80	80	80	80
–	100	100	100	100	100	100	100	100	100	
–	125	125	125	125	125	125	125	125	125	
Operation sequence	[O-0,3s-CO-3min-CO]	■								
Opening time	[ms]	35...45								
Arc time	[ms]	10...15								
Total interruption time	[ms]	45...60								
Closing time	[ms]	50...60								
Mechanical operations (cycles)	Actuator	[No.]	... 100,000							
	Interrupters	[No.]	... 30,000							
Electrical operations (cycles)	Rated current	[No.]	... 30,000							
	In short-circuit	[No.]	... 100							
Pole centre distance	I [mm]	150	150	210	275	210	275	275	275	275
Service temperature	[°C]	– 25 ... + 40								
Tropicalisation	IEC: 60068-2-30	■								
	721-2-1	■								
Electromagnetic compatibility	IEC 60694	■								

- (1) Rated uninterrupted currents guaranteed with withdrawable circuit-breaker installed in UniGear ZS1 type switchgear with 40 °C air temperature.
- (2) The 2300 A rated uninterrupted current is guaranteed with natural ventilation. The 2500 A rated uninterrupted current is guaranteed with forced ventilation.



VM1/P 17										VM1/P 24						
■										■						
■										■						
17.5										24						
17.5										24						
38										50						
95										125						
50-60										50-60						
630	1250	1600	1600	2000	2000	2500	3150	4000		630	630	1250	1250	1600	2000	2500 (2)
16	16	-	-	-	-	-	-	-	-	16	16	16	16	16	16	16
20	20	20	20	20	20	20	-	-	-	20	20	20	20	20	20	20
25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	-	-	-	-	-	-	-
-	40	40	40	40	40	40	40	40	40	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	40	-	-	-	-	-	-	-	-	40	40	40	40	40	40	40
50	50	50	50	50	50	50	-	-	-	50	50	50	50	50	50	50
63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63	63
80	80	80	80	80	80	80	80	80	80	-	-	-	-	-	-	-
-	100	100	100	100	100	100	100	100	100	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
■										■						
35...45										35...45						
10...15										10...15						
45...60										45...60						
50...60										50...60						
... 100,000										... 100,000						
... 30,000										... 30,000						
... 30,000										... 30,000						
... 100										... 100						
150	150	210	275	210	275	275	275	275	275	210	275	210	275	275	275	275
- 25 ... + 40										- 25 ... + 40						
■										■						
■										■						
■										■						

## APPARATUS

### 6.5 Value of the rated currents (VD4 and VM1) acc to higher IP degree

Value of the rated currents according to the degree of protection of the external switchboard housing and ambient temperature. The values in the table are maximal and may be lower under concrete circumstances

Ambient temperature °C	IP4_					IP5_				
	630	1250	1600	2000	2500	630	1250	1600	2000	2500
40	630	1250	1600	2000	2500	440	880	1120	1400	1750
45	630	1200	1530	1910	2390	420	840	1070	1340	1670
50	600	1140	1460	1820	2280	400	800	1020	1280	1590
55	570	1080	1380	1730	2160	380	760	970	1210	1510
60	540	1020	1300	1630	2040	360	710	910	1140	1430
65	480	870	1110	1390	1740	310	610	780	980	1220

### 6.6 V-Contact type vacuum contactors

Rated voltage	Rated breaking capacity	Rated current <sup>(3)</sup>	Contactors	Weights Kg
kV	kA <sup>(1)</sup>			
7.2	16	400	V7	55 <sup>(2)</sup>
	25			
	31.5			
12	16	400	V12	55 <sup>(2)</sup>
	25			
	31.5			

<sup>(1)</sup> Guaranteed by using suitable fuses.

<sup>(2)</sup> The weight of the fuses must be added (the largest size weighs 5.5. kg each).

<sup>(3)</sup> Rated service current in category AC4. For the largest fuse size which can be used with the contactor, at the different service voltages and the type of load to be protected, refer to the technical catalogue of the V-Contact contactor.

### Value of the rated currents

Value of the rated currents according to the degree of protection of the external switchboard housing and ambient temperature (without fuses).

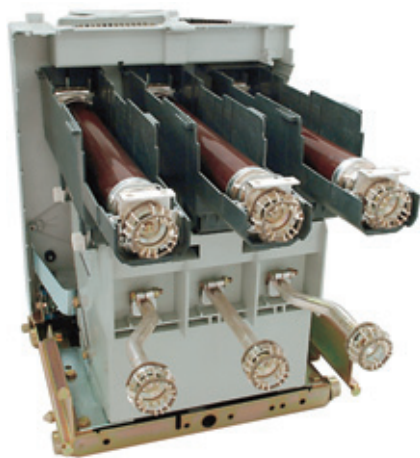
Ambient temperature °C	IP4X 400	IP5X 400
40	400	280
45	380	270
50	360	260
55	350	240
60	330	230
65	280	200

### Maximum performances of the contactor with fuses

Motors	kW	1500	3000	5000
Transformers	kVA	2000	4000	5000
Capacitors	kVAR	1500	3000	4800

### Maximum load currents of the fuses

Feeder	Transformers		Motors		Capacitors	
	Fuse	Maximum load	Fuse	Maximum load	Fuse	Maximum load
3.6 kV	200A	160A	315A	250A	450A	360A
7.2 kV	200A	160A	315A	250A	355A	285A
12 kV	200A	160A	200A	160A	200A	160A



### Standards

IEC 60470 and IEC 60632-1 for the contactor.  
IEC 60282-1 for the fuses.



Fuse according to DIN Standards



Fuse according to BS Standards

# APPARATUS

## 6.7 NALFE fuse switch disconnectors

Rated voltage	Rated breaking	Rated current <sup>(3)</sup>		Switch-disconnector
kV	kA <sup>(1)</sup>			
<b>12</b> <b>17.5</b>	<b>16</b>	630		NALFE 17-6A170R
	<b>25</b>			
<b>24</b>	<b>16</b>	630		NALFE 24-6A275R
	<b>20</b>			
	<b>25</b>			



The switch disconnector is always equipped with earthing switch.

<sup>(1)</sup> Guaranteed by using suitable fuses.

<sup>(2)</sup> The weight of the fuses must be added (the largest size weighs 5.5. kg each).

<sup>(3)</sup> The rated current depends on the fuse used.

### Value of the rated currents

Value of the rated currents according to the degree of protection of the external switchboard housing and ambient temperature (without fuses).

Ambient temperature °C	IP4X 630
40	630
45	600
50	570
55	540
60	510
65	440

### Selection table of the fuses for protection transformers

kV	Rated power of the transformer (kVA)																	
	25	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600
Rated normal current of the fuse (A)																		
<b>3</b>	10	16	25	25	40	40	63	63	100	100	100	100						
<b>5</b>	6	10	16	16	25	25	40	40	63	63	100	100	100	100				
<b>6</b>	6	6	10	10	16	16	25	25	25	40	40	63	63	100	100			
<b>10</b>	6	6	10	10	16	16	25	25	25	40	40	63	63	100	100			
<b>12</b>	6	6	6	10	10	16	16	25	25	40	40	40	63	63	100	100	100	100
<b>15</b>	6	6	6	10	10	16	16	25	25	25	40	40	40	63	63	100	100	100
<b>17</b>	6	6	6	6	6	10	16	16	25	25	25	40	40	63	63	63	100	100
<b>20</b>	6	6	6	6	6	10	16	16	16	25	25	40	40	40	63	63		
<b>24</b>	6	6	6	6	6	6	10	16	16	16	25	25	40	40	40	63	63	

## MEASURING INSTRUMENTS

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## MEASURING INSTRUMENTS

### 7.1 Current transformers

The primary current of the transformer must be selected from among the standard values closest to the measurement to be made (e.g. current to be measured = 1120 A - primary current of the transformer 1250 A).

The secondary current of the transformer is normally 1 or 5A and is a function of the instruments it is to be connected to and the distance between the transformer and the instruments themselves: 5A is used for distances under 10 metres, whereas 1A for higher ones. The losses due to connection wire resistance are 25 times higher at 5A than at 1A.

The VA power of the transformer must be calculated by summing the connection wire losses with the absorption of the connected instruments.

**Caution!** Never leave the secondary circuit of the transformer open with the primary terminals energised. High voltages could be produced in the secondary circuit causing damage to people or to the transformer itself.

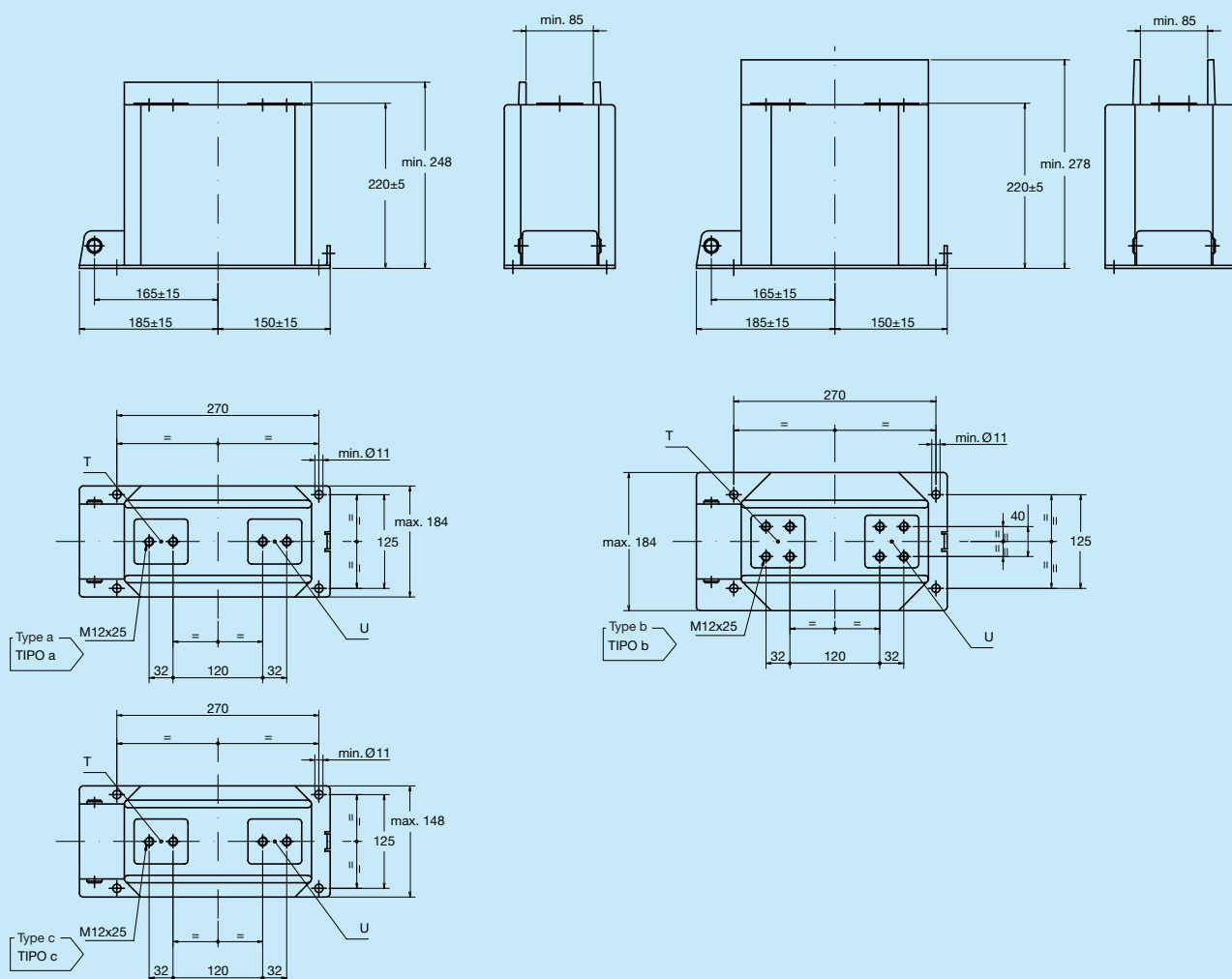
#### 7.1.1 Reference Standards

Electrical characteristics	60044-1
Dimensions	DIN 42600 Narrow type Medium and Long size



## 7.1.2 Dimensions

## 12-17.5 kV

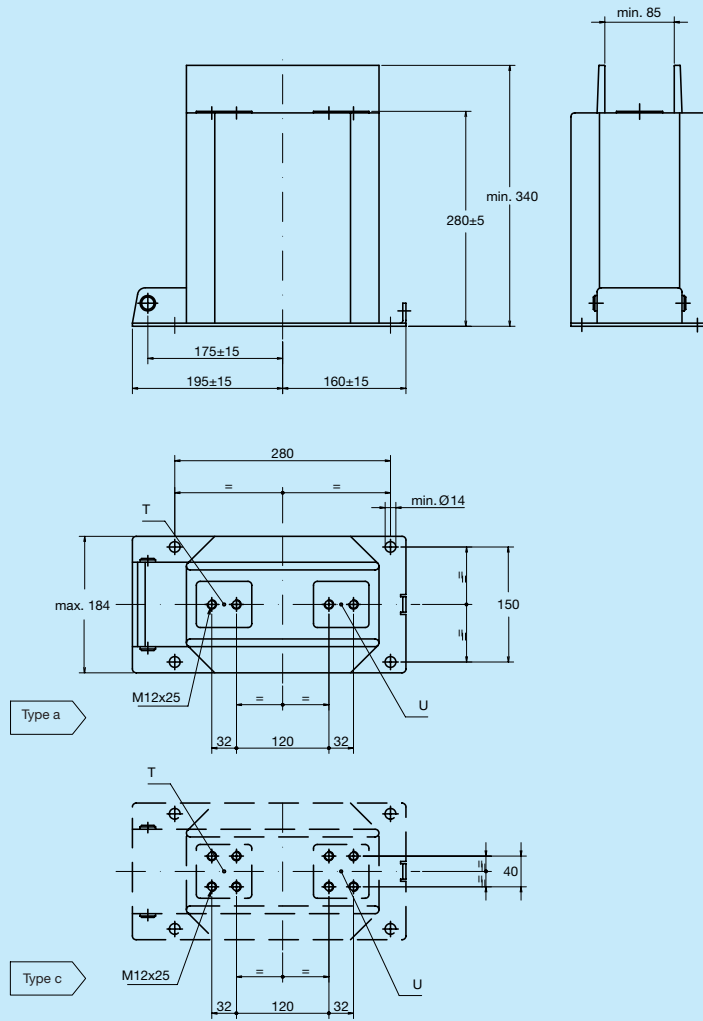


Type	Switchboard	Current
a	800/1000 mm	$I_n$ -1250 A
b		$I_n$ >1250 A
c	650 mm	$I_n$ -1250 A

Version	Connection coding	
	T	U
1	P1	P2
2	P2	P1
3	K	L
4	L	K

## MEASURING INSTRUMENTS

24 kV



Type	Switchboard	Current
a		In-1250 A
b	800/1000 mm	In>1250 A
		In-2000 A

Version	Connection coding	
	T	U
1	P1	P2
2	P2	P1
3	K	L
4	L	K

### 7.1.3 Weights

Rated voltage kV	Rated current A	Type	Weight Kg
12-17.5	1250	Medium size	20
		Long size	31
	2500	Medium size	26
		Long size	37
24	1250	Medium size	29
		Long size	42
	2500	Medium size	33
		Long size	46

### 7.1.4 Classes

IEC 60044-1.

Class	Error					Phase displacement			
	0.05 In	0.2 In	0.5 In	In	1.2 In	0.05 In	0.2 In	In	1.2 In
0.2	±0.75%	±0.35%	–	±0.2%	±0.2%	±30'	±15'	±10'	±10'
0.5	±1.5%	±0.75%	–	±0.5%	±0.5%	±90'	±45'	±30'	±30'
1	±3%	±1.5%	–	±1%	±1%	±180'	±90'	±60'	±60'
3	–	–	±3%	–	±3%	–	–	–	–

Class	Error					Phase displacement			
	0.05 In	0.2 In	0.5 In	In	1.2 In	0.05 In	0.2 In	In	1.2 In
0.2s	±0.75%	±0.35%	±0.2%	±0.2%	±0.2%	±30'	±15'	±10'	±10'
0.5s	±1.5%	±0.75%	±0.5%	±0.5%	±0.5%	±90'	±45'	±30'	±30'

Class	Error	Phase displacement	Composite error
	In	In	At rated accuracy limit current
5P	±1%	±60'	±5%
10P	±3%	–	±10%

## MEASURING INSTRUMENTS

### 7.1.5 Types

Some types of transformers which can be applied to UniGear switchboards are listed.

Manufacturer: ABB PTPM Brno (EJF, The Czech Republic)  
Name: TPU

### 7.2 Voltage transformers

The primary voltage of the transformer must be selected from among the standard values closest to the measurement to be made (e.g. voltage to be measured = 19 kV - primary voltage of the transformer 20 kV).

The secondary voltage of the transformer is normally 100 V or 110 V and is a function of the instruments to be supplied.

The VA power of the transformer must be calculated by summing the connection wire losses with the absorption of the connected instruments.

The voltage factor is determined by the maximum service voltage, by the type of neutral and by the earthing condition of the primary circuit of the transformer. For phase-phase type transformers, the factor is  $1.2 \times U_n$  continuous; for phase-neutral type transformers, it is as follows:

- $1.5 \times U_n$  for 30 s in installations with an effectively earthed neutral system;
- $1.9 \times U_n$  for 30 s in installations with a non-effectively earthed neutral system, with instantaneous earthfault tripping;
- $1.9 \times U_n$  for 8 hours in installations with an isolated or compensated neutral system, without instantaneous earthfault tripping.

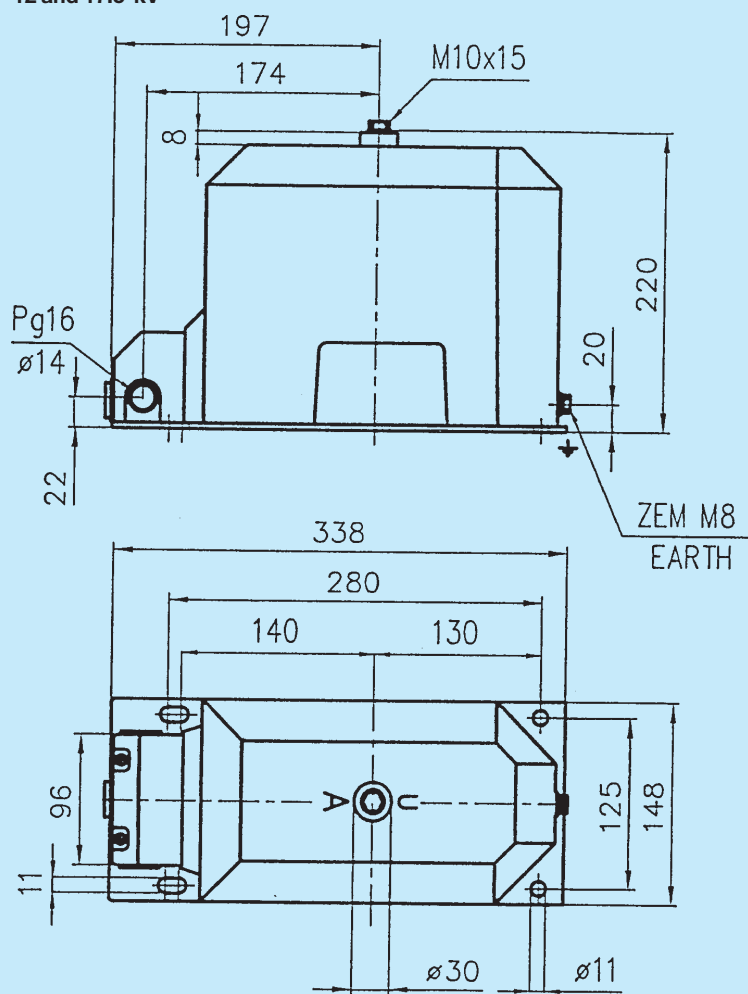
**Caution!** Never short-circuit the secondary of the transformer with the primary circuit energised to avoid it being damaged within a few seconds.

#### 7.2.1 Reference Standards

Electrical characteristics	60044-2
Dimensions	DIN 42600 Narrow type (in fixed version and fixed with fuses) Dedicated (see Chapter 2) (in withdrawable version with fuses)

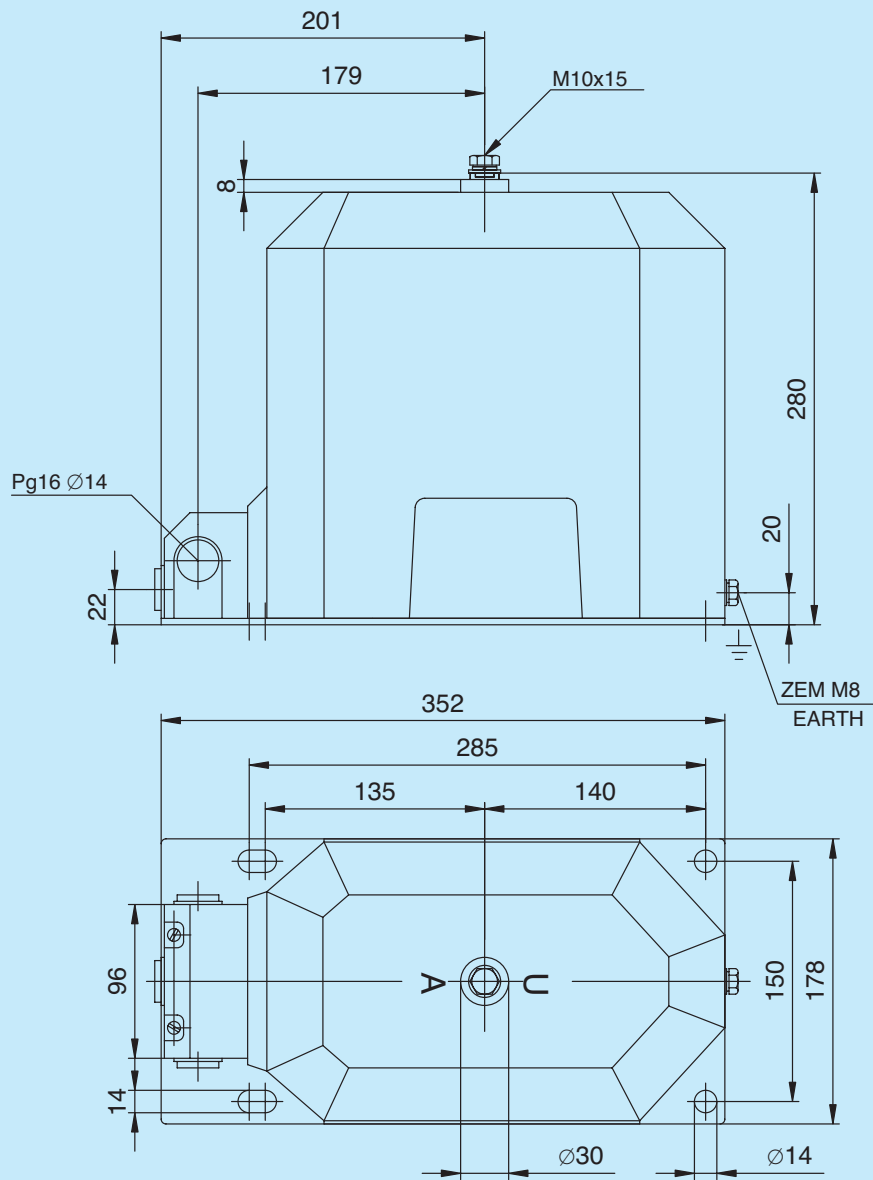
## 7.2.2 Dimensions

TJC 4, TJC 5 - 12 and 17.5 kV



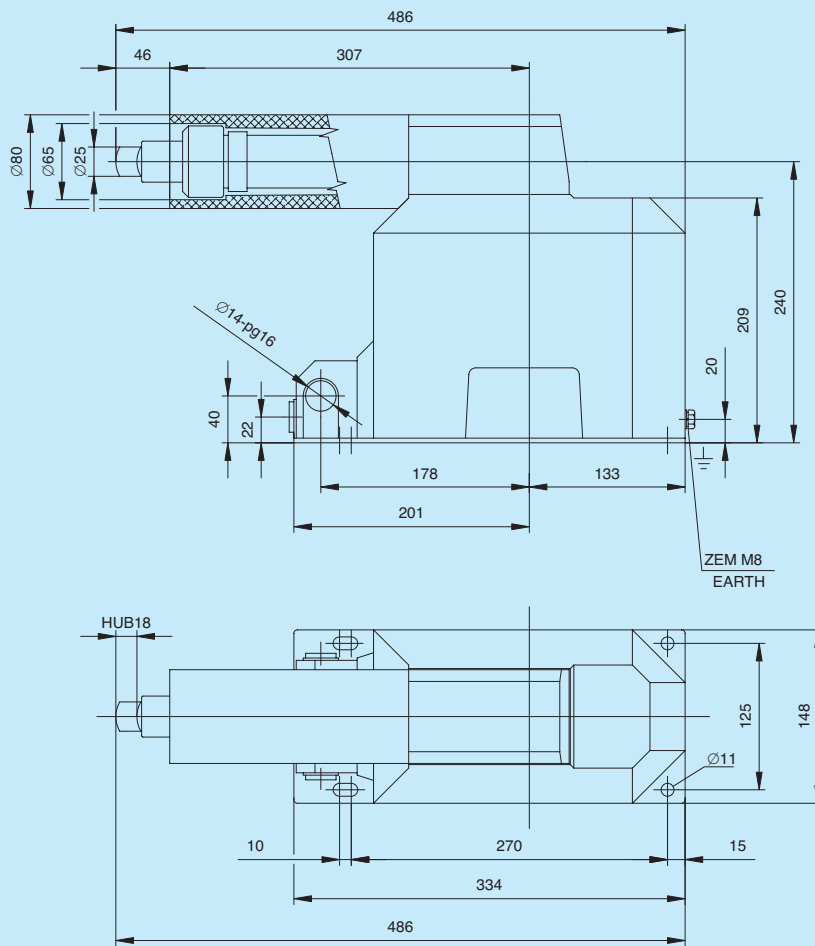
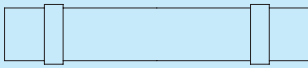
# MEASURING INSTRUMENTS

TJC 6 - 24 kV



12, 17.5 kV

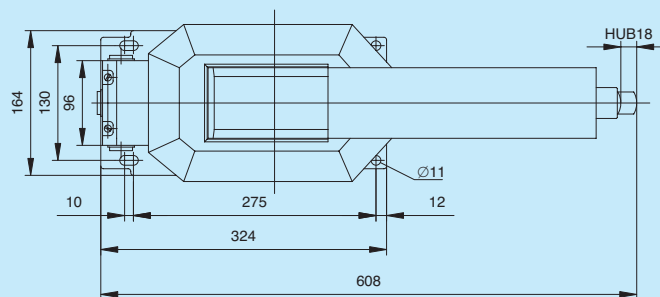
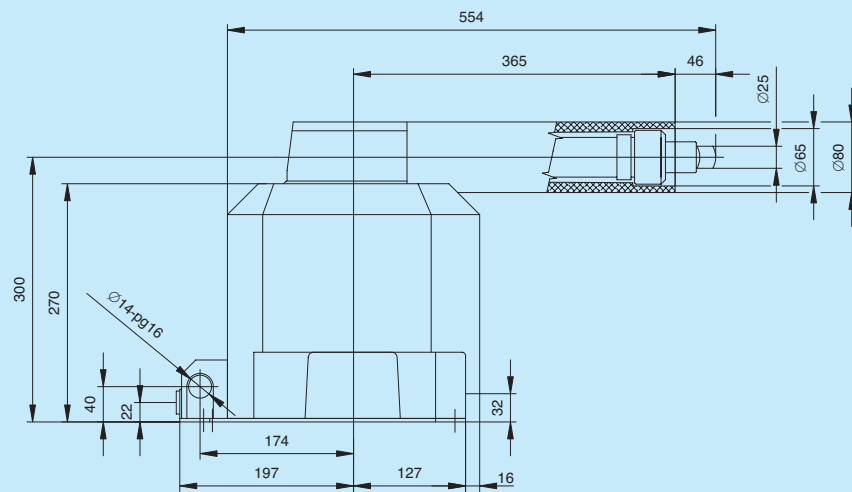
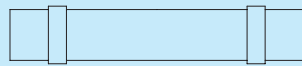
TJP4.0: fuse IEC 60282-1  
TJP5.0: fuse IEC 60282-1



## MEASURING INSTRUMENTS

24 kV

TJP6.0: fuse IEC 60282-1





### 7.2.3 Weights

Average weight of fixed transformers	
12-17.5 kV	22 kg
24 kV	30 kg

Average weights of withdrawable transformers with fuses (3 transformers, fuses and truck)	
12-17,5 kV	78 kg
24 kV	102 kg

### 7.2.4 Classes

IEC 60044-2.

Class	Error	Phase displacement
	0.8...1.2 Un	0.8...1.2 Un
0.2	±0.2%	±10'
0.5	±0.5%	±20'
1	±1%	±40'
3	±3%	–

Class	Error	Phase displacement
	0.05...voltage factor x Un	0.05...voltage factor x Un
3P	±3%	±120'
6P	±6%	±240'

### 7.2.5 Types

Some types of transformers which can be applied to UniGear switchboards are listed.

Fixed version:

Manufacturer: ABB PTPM Brno (EJF, The Czech Republic)  
Name: TJC

Fixed version is every time used without fuses.

Withdrawal version:

Manufacturer: ABB PTPM Brno (EJF, The Czech Republic)  
Name: TJP x.0

Withdrawal version is used every time with DIN type fuses.

## MEASURING INSTRUMENTS

### 7.3 Sensors

Sensors: ABB KEVCD Combi Sensor, Block type.  
 Manufacturer: ABB PTPM Brno (EJF, The Czech Republic)

The sensors are available in two versions:  
 – sensors for current measurement;  
 – combined sensors for current and voltage measurements.

#### 7.3.1 Current sensor

Rated brach current	Sensor type	Linearity limit for combination	Resulting transformation ratio at 50Hz (60Hz)
		<b>Max. rms A</b>	
A			
80-160	KEVCD_A_	4000	80A/0.150V (0.180V)
160-480	KEVCD_A_	12000	240A/0.150V (0.180V)
480-1250	KEVCD_A_	32000	640A/0.150V (0.180V)
1600-3200	KEVCD_B_	> 40000	1600A/0.150V (0.180V)

The KEVCD\_A\_ sensor is used for rated continuous currents up to 1250 A. Installation is carried out as follows:

- partialisation of the sensor by means of mobile bridges (1);
- setting the rated current in the REF54x, REX or REM unit software within the measuring range (2).

The KEVCD\_B\_ sensor is used for currents above the previous ones up to 3200 A.

Installation is carried out by setting the rated current in the REF54x, REX or REM unit software within the measuring range (2).

The voltage at the secondary circuit is 0.150 V (50 Hz) or 0.180 V (60 Hz).

The precision class for the whole measurement system (sensor+RE\_) is C11.

#### 7.3.2 Voltage sensor

Type	Rated primary voltage range	Rated transformation ratio
KEVCD 12_E_	6 kV / $\sqrt{3}$ -10 kV / $\sqrt{3}$	10000/1
KEVCD 17.5_E_	6 kV / $\sqrt{3}$ -15 kV / $\sqrt{3}$	10000/1
KEVCD 24_E_	6 kV / $\sqrt{3}$ -20 kV / $\sqrt{3}$	10000/1

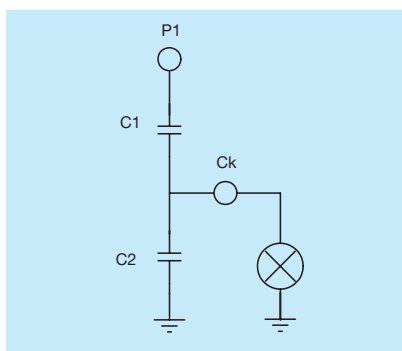
#### Caution!

Never cut or modify the secondary cable from the sensor! The cable is an integral part of the sensor. Any change or damage of the cable will influence accuracy and characteristics of the sensor.

### 7.3.3 Capacitive divider

The KEVCD sensor always includes the capacitive divider for connection to the voltage indicator lamp.

C1 ...20 pF  
C2 ...25 pF



### 7.3.4 Combi sensor

Support type Combi sesnsor including:

Rogovski coil current sensor	All versions
Resistive divider type voltage sensor	Versions <i>AE</i> and <i>BE</i>
Coupling electrode for voltage detecting system or voltage presence indicating systems	All vesrsions

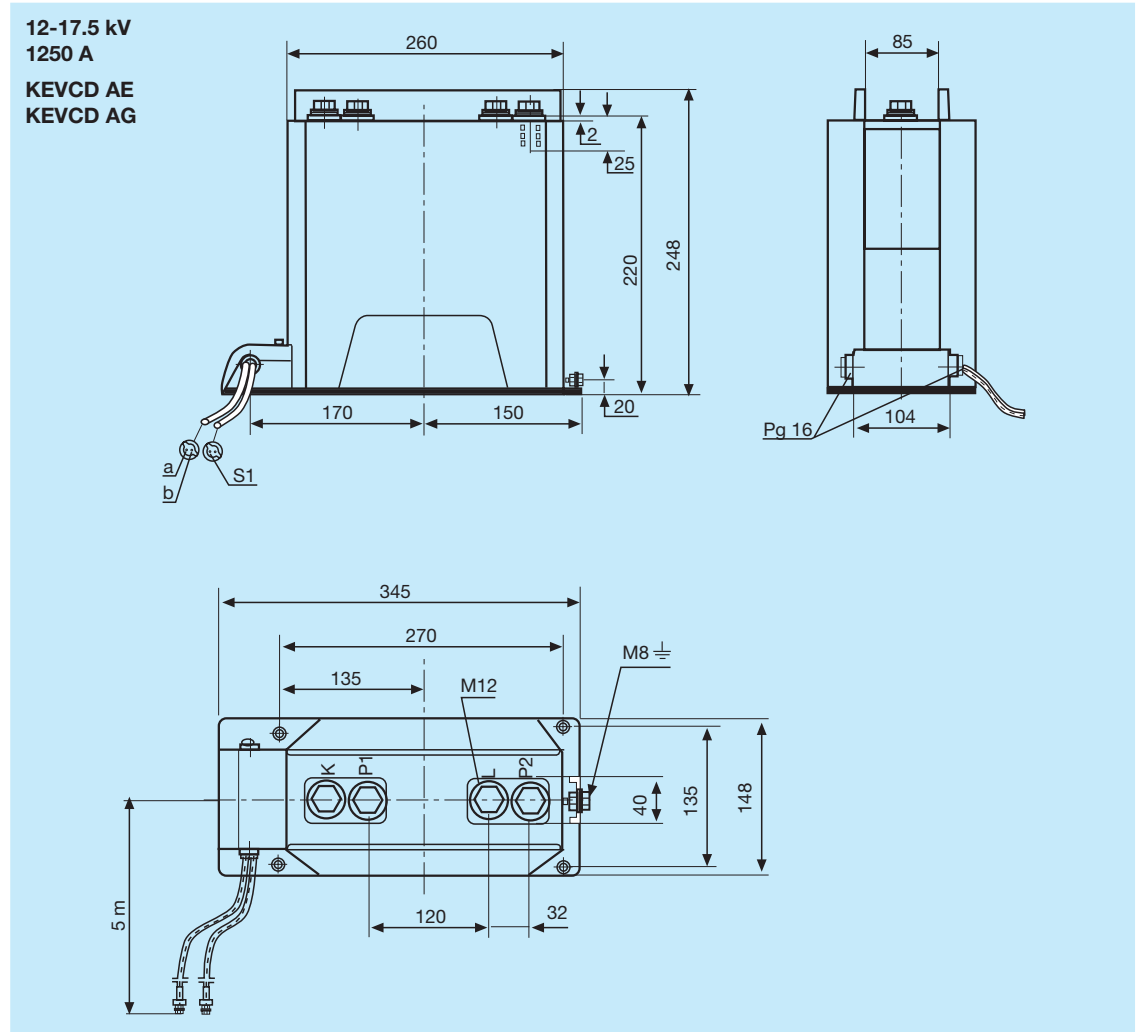
Rated primary currents				Capability			Remarks
80-1250 A		1600 - 3200 A		Voltage sensor	Current sensor	Voltage indication	
KEVCD 12	AE 3 AG 3	KEVCD 12	BE 3 BG 3	■	■	■	
KEVCD 12	AE 3C AG 3C	KEVCD 12	BE 3C BG 3C	■	■	■	Insulation level acc. to Chinese standards Insulation level acc. to Chinese standards
KEVCD 17.5	AE 3 AG 3	KEVCD 17.5	BE 3 BG 3	■	■	■	
KEVCD 24	AE 3 AG 3	KEVCD 24	BE 3 BG 3	■	■	■	

### 7.3.5 Reference Standards

Voltage sensors	IEC 60044-7 (1999-12) - Instrument transformers, Part 7: Electronic voltage transformers
Current sensors	IEC 60044-8 (2002-07) - Instrument transformers, Part 8: Electronic current transformers
Combi sensors	IEC 60044-3 (1980-01) - Instrument transformers, Part 3: Combined transformers
Dimensions	DIN 42600 Tail 8 - Narrow type, Medium size

## MEASURING INSTRUMENTS

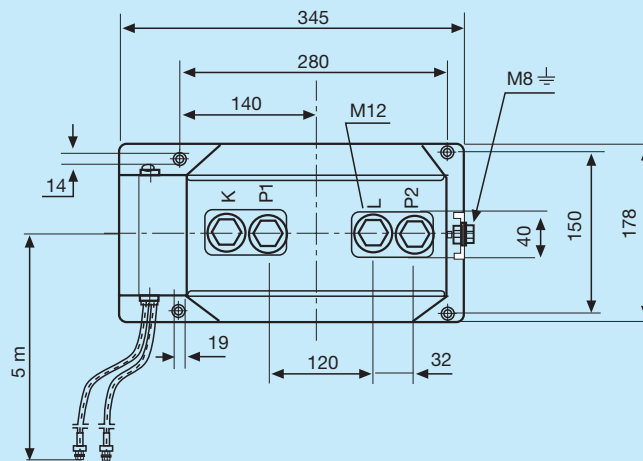
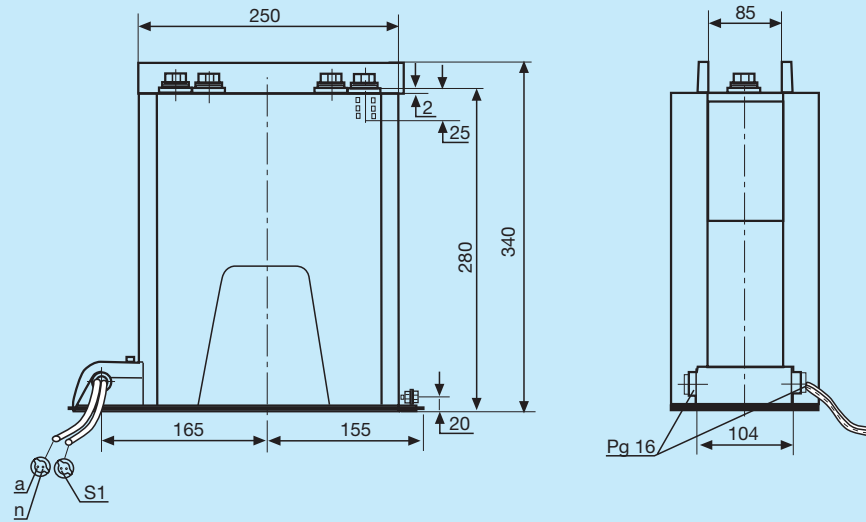
### 7.3.6 Dimensions



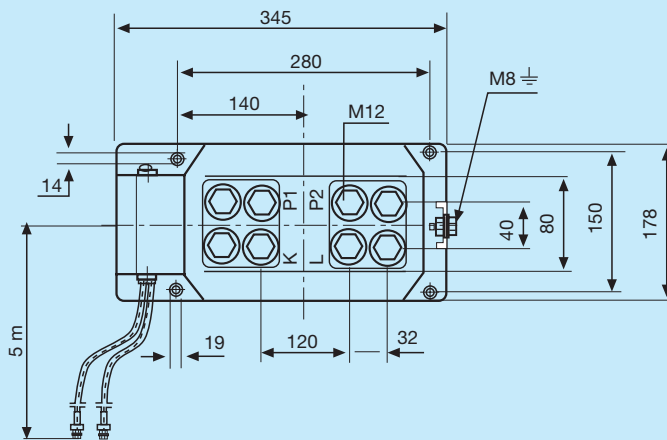
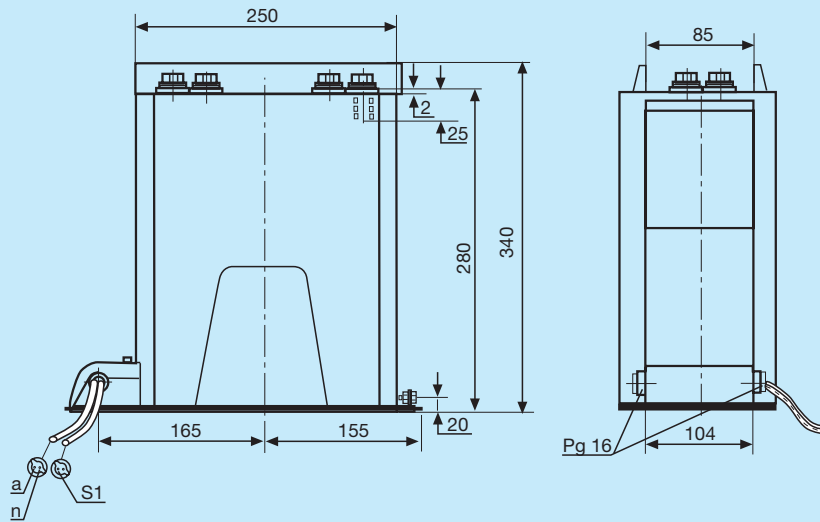


## MEASURING INSTRUMENTS

24 kV  
1250 A  
KEVCD AE  
KEVCD AG



24 kV  
2500 A  
KEVCD BE  
KEVCD BG







## DATA

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## DATA

### 8.1 Weight

#### 8.1.1 Units with circuit breaker or contactor

Rated voltage kV	Unit width mm	Rated current A		
		630-2000	2500-3150	4000
12 and 17.5 kV	550	700...800 kg	-	-
	650	800...900 kg	-	-
	800	900 kg	1200 kg	-
	1000	-	1200 kg	1400 kg

Rated voltage kV	Unit width mm	Rated current A	
		1250-1600	2000-2500
24	800	1000-1100 kg	1200 kg
	1000	1100-1200 kg	1200 kg

#### 8.1.2 Units with switch disconnecter NALFE

Rated voltage kV	Unit width mm	
12 and 17.5	800	750 kg
24	1000	950 kg

## 8.2 Cable connection

The cables are conveyed from below through floor covering, which is divided at the cable entry point. The cables go through rubber reducer rings 17.2, which can be adapted to the required cable diameter in a range from 27 to 62 mm. Cables are fastened in the panel by means of cable clamps mounted on cable strips, which are part of the panel floor covering. The clamps make it possible to fasten cables with diameters between 35 and 54 mm.

Rated voltage (kV)	Panel width (mm)	Max. number of parallel cables in phase	Max. cross section of cables (mm <sup>2</sup> )	Range of cable clamp (mm)	Range of reducer ring (mm)
12/17.5	550	3 <sup>3)</sup>	630	35 - 54	27 - 62
12/17.5	650	3 <sup>1)</sup>	630	35 - 54	27 - 62
12/17.5	800	6 <sup>2)</sup>	630	35 - 54	27 - 62
12/17.5	1000	6 <sup>2)</sup>	630	35 - 54	27 - 62
24	800	3 <sup>1)</sup>	500	35 - 54	27 - 62
24	1000	6 <sup>2)</sup>	500	35 - 54	27 - 62

<sup>1)</sup> In the case where there are removable voltage transformers on the truck, or surge arresters are used, the number of parallel cables is reduced to a max. of 2 per phase.

<sup>2)</sup> In the case where there are removable voltage transformers on the truck, or surge arresters are used, the number of parallel cables is reduced to a max. of 4 per phase.

<sup>3)</sup> If there are voltage transformers or surge arresters used, the number of parallel cables is reduced to a max 2 per phase.

Cable connection in the panel with switch-disconnector:

Rated voltage (kV)	Panel width (mm)	Max. number of parallel cables in phase	Max. cross section of cables (mm <sup>2</sup> )	Range of cable clamp (mm)	Range of reducer ring (mm)
12/17,5	800	1	240	35 - 54	27 - 62
24	1000	1	240	35 - 54	27 - 62



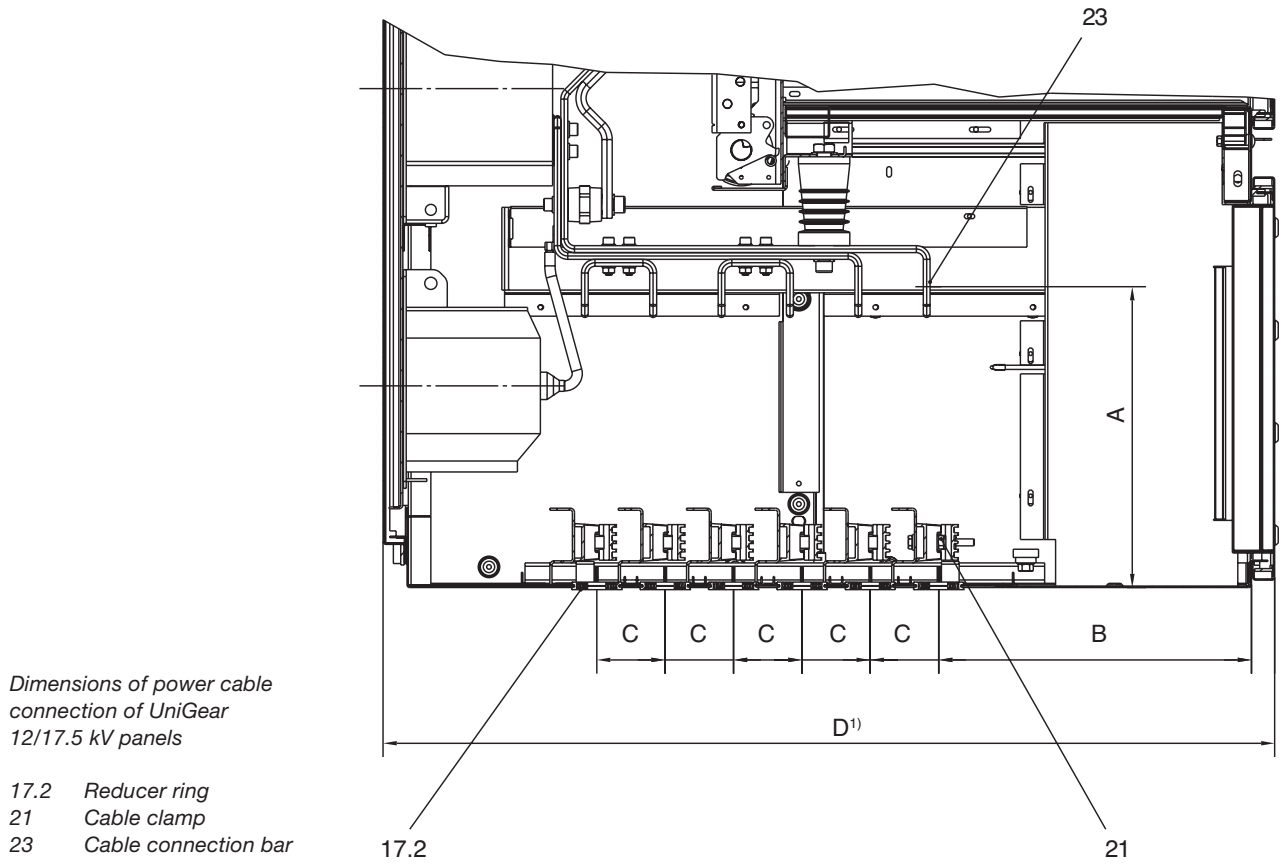
6 cables per phase 1000 mm wide unit



3 cables per phase 800 mm wide unit

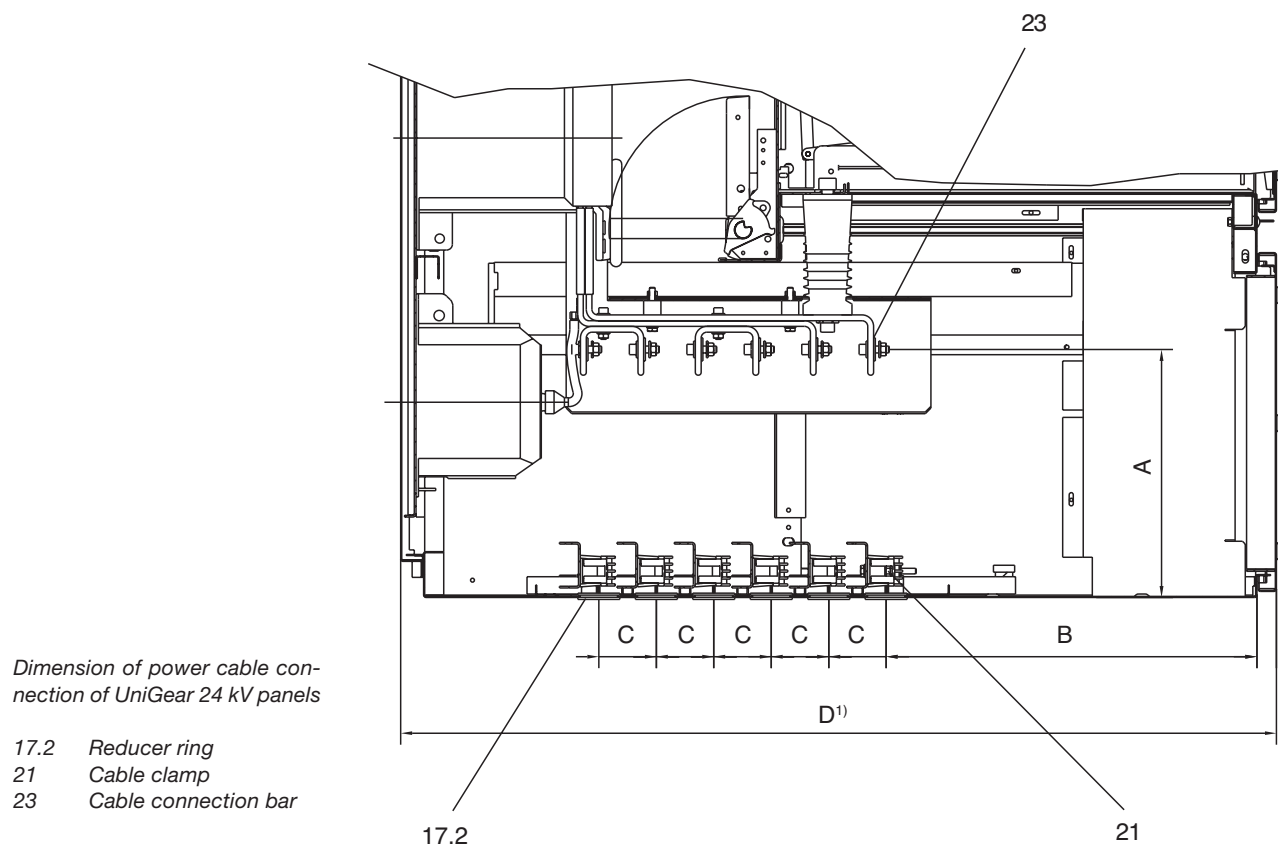
## DATA

### 8.2.1 Cable connection in 12 and 17.5kV Single busbar units



$I_n$	with	$I_{th}$	max. number of cables in one phase	A	B	C
A	mm	kA		mm	mm	mm
630	650	31.5	1	535	840	–
1000	650	31.5	3	535	480	180
1250	650	31.5	3	535	480	180
1250	800	40	3	465	480	180
1600	800	31.5/40	6	440	460	100
2000	800	31.5/40	6	440	460	100
1600	1000	31.5/40	6	440	460	100
2000	1000	31.5/40	6	440	460	100
2500	1000	31.5/40	6	440	460	100
3150	1000	40	6	455	460	100
4000	1000	40	6	455	460	100

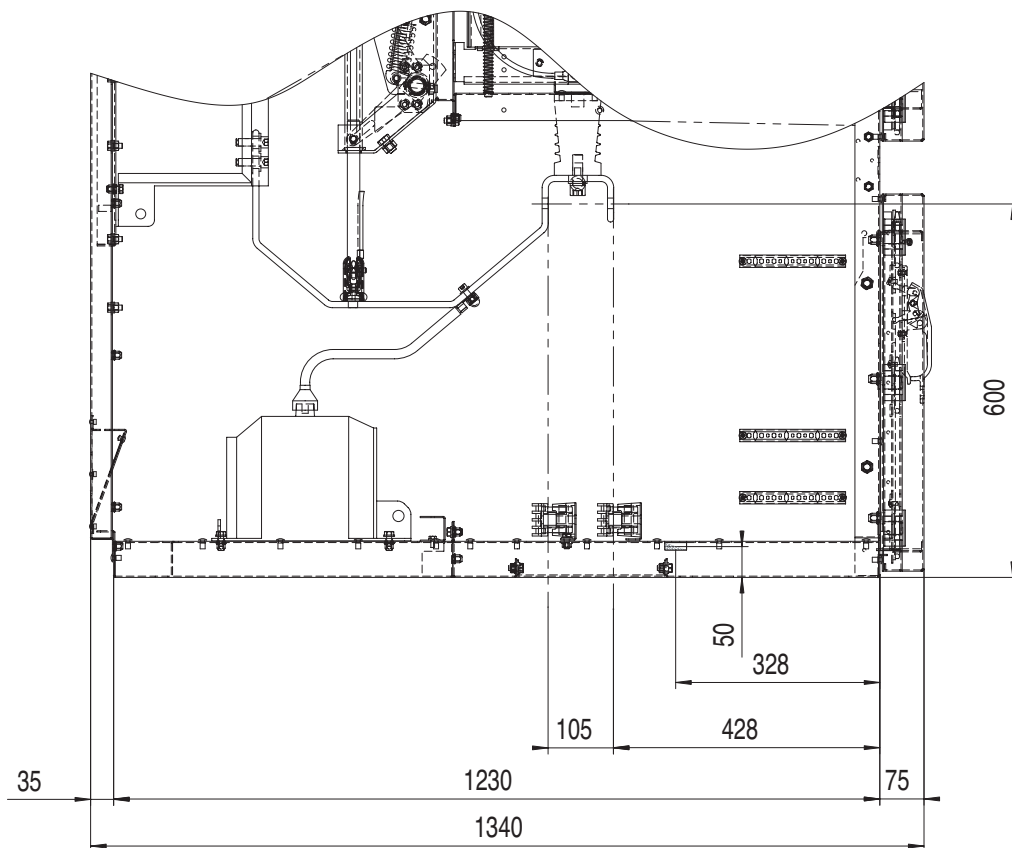
## 8.2.2 Cable connection in 24kV Single busbar units



$I_n$	with	$I_{th}$	max. number of cables in one phase	A	B	C
A	mm	kA		mm	mm	mm
1000	800	25	3	497	608	180
1250	800	25	3	497	608	180
1000	1000	25	3	497	608	180
1250	1000	25	3	497	608	180
1600	1000	25	6	432	645	100
2000	1000	25	6	432	645	100
2500	1000	25	6	432	645	100

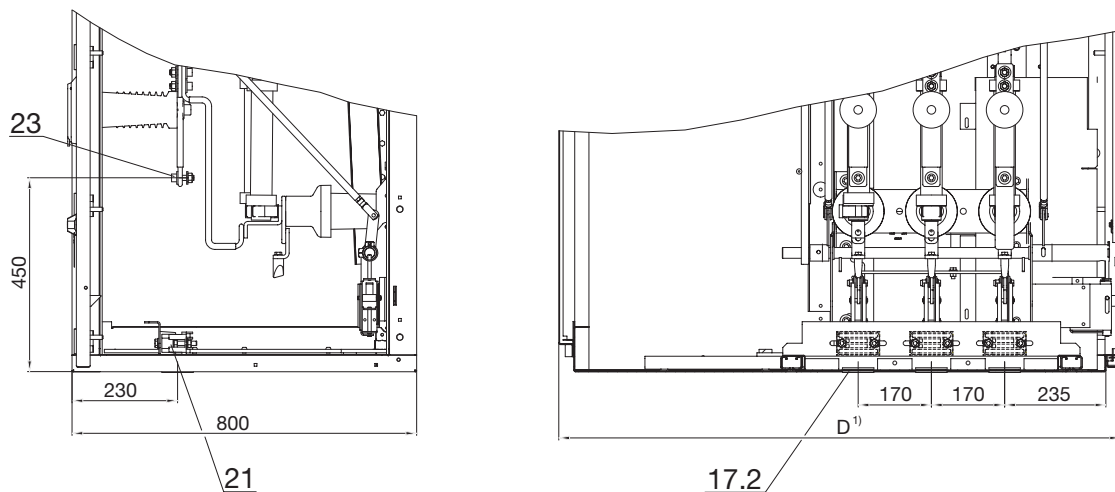
## DATA

### 8.2.3 Cable connection height in UniGear 550 series



$I_n$	width	$I_{th}$	max. number of cables in one phase	distance in one phase
A	mm	kA		mm
630	550	25	2	105
1250	550	25	2	105

### 8.2.4 Cable connection in switch-disconnector panels



#### Dimensions of cable connection in panels of switchgear UniGear with 12/17,5 kV switch-disconnector

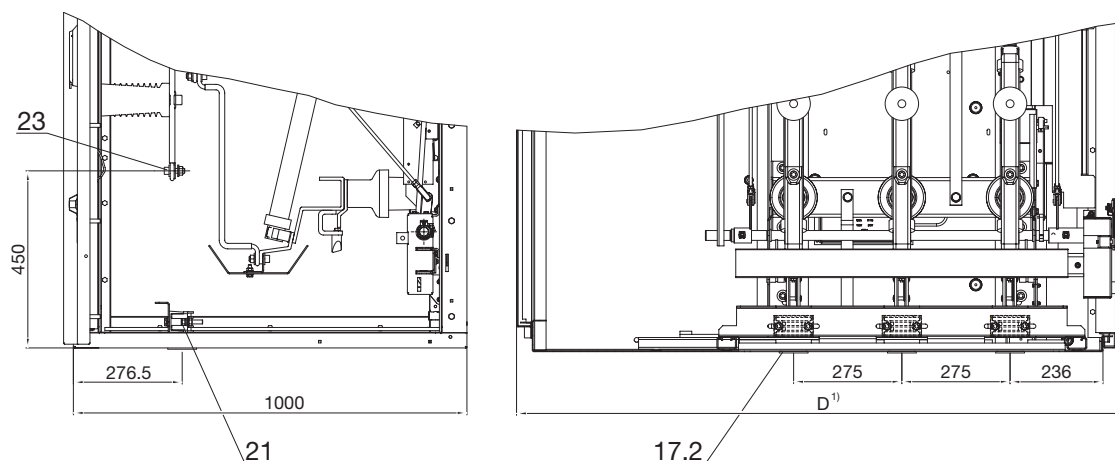
D The depth of panel with the switch-disconnector in combination with circuit breaker panels is recommended to 1340 mm, in other cases 1300 mm )

17.2 Reducer ring

21 Cable clamp

23 Cable connection bar

The dimension must be verified according to the documentation of relevant order



#### Dimensions of cable connection in panels of switchgear UniGear with 24 kV switch-disconnector

D The depth of panel with the switch-disconnector in combination with HD4 circuit breaker panels is recommended to 1560 mm, in other cases 1520 mm)

17.2 Reducer ring

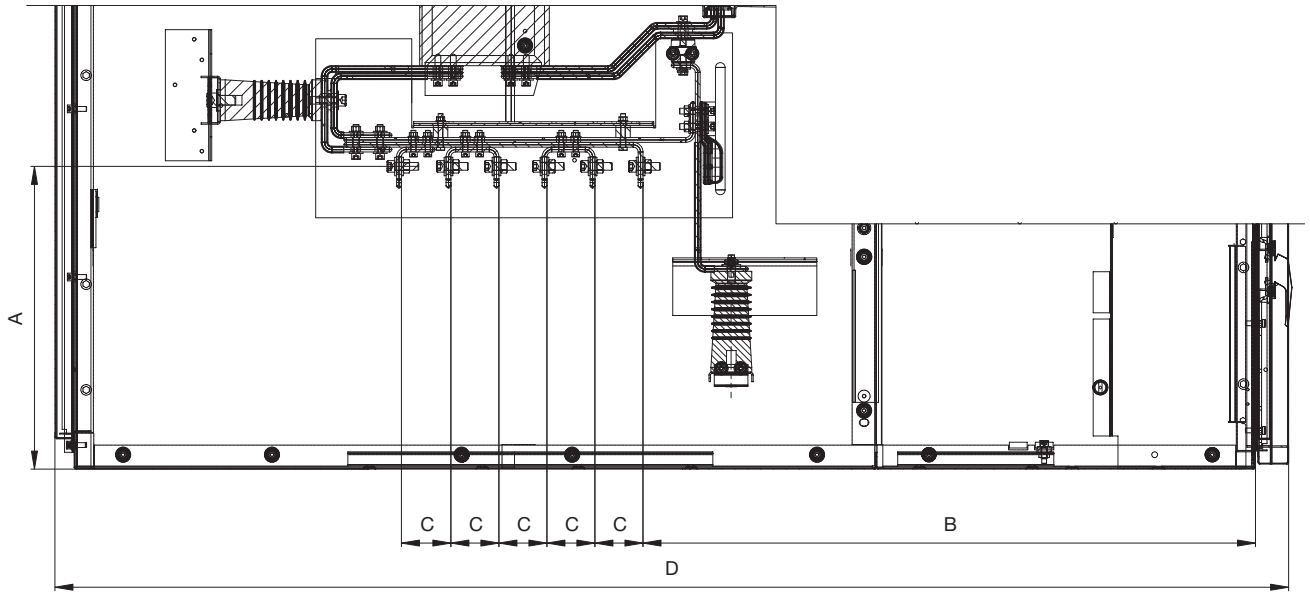
21 Cable clamp

23 Cable connection bar

The dimension must be verified according to the documentation of relevant order

## DATA

### 8.2.5 Cable connection in Double busbar units



$U_n$ kV	$I_n$ A	width mm	$I_{th}$ kA	max.number of cables in one phase	A mm	B mm	C mm	D mm
24	1000	800	25	3	690	1385	120	2570
24	1250	800	25	3	690	1385	120	2570
24	1600	1000	25	6	630	1275	100	2570
24	2000	1000	25	6	630	1275	100	2570
24	2500	1000	25	6	630	1275	100	2570
12/17,5	630	650	31,5/25	3	600	1152	130	2021
12/17,5	1000	650	31,5/25	3	600	1152	130	2021
12/17,5	1250	650	31,5/25	3	600	1152	130	2021
12/17,5	1600	800	31,5/25	6	497	993	100	2021
12/17,5	2000	800	31,5/25	6	497	993	100	2021
12/17,5	2500	1000	31,5/25	6	497	993	100	2021
12/17,5	3150	1000	31,5/25	6	760	1293	90	2021



## 8.5 Pressure relief flaps and covers

Panel type	Un [kV]	In [A]	Ith [kA]	Width [mm]	Cover beneath CB	Flap above CB	Flap above busbars up to 2000A	Flap above busbars over 2000A	Flap above cables	Rear CT holder
Feeder	12	1600	31,5	800	Closed	Closed	Closed	Ventilating	Closed	
Feeder	12	1250	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
Bus coupler (CB)	12	1250	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
Feeder	12	2000	31,5	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Bus coupler (CB)	12	2000	31,5	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	12	1600	50	800	Closed	Closed	Closed	Ventilating	Closed	
Feeder	12	2000	50	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Bus coupler (CB)	12	2000	50	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	12	1600	50	1000	Closed	Closed	Closed	Ventilating	Closed	
Feeder	12	2000	50	1000	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	12	2500	50	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Bus coupler (CB)	12	2500	50	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Feeder	12	1600	31,5	1000	Closed	Closed	Closed	Ventilating	Closed	
Feeder	12	2000	31,5	1000	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	12	2500	31,5	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Bus coupler (CB)	12	2500	31,5	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
bus riser	12	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
bus riser	12	2500	31,5	800	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser	12	2500	31,5	650	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser + metering	12	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
bus riser + metering	12	2500	31,5	650	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch	12	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch	12	2500	31,5	800	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch - metering	12	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch - metering	12	2500	31,5	800	Closed	Closed	Ventilating	Ventilating	Closed	
metering	12	N/A	31,5	650	Closed	Closed	Closed	Closed	Closed	
bus riser	12	1250	50	800	Closed	Closed	Closed	Closed	Closed	
bus riser	12	2000	50	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
bus riser	12	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser - metering	12	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch	12	1250	50	800	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch	12	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch - metering	12	1250	50	800	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch - metering	12	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
metering	12	N/A	50	800	Closed	Closed	Closed	Closed	Closed	
Feeder	12	1000	31,5	650	Closed	Closed	Closed	Ventilating	Closed	
Feeder	12	1250	31,5	650	Ventilating	Ventilating	Ventilating	Ventilating	Closed	
Bus coupler (CB)	12	1250	31,5	650	Ventilating	Ventilating	Ventilating	Ventilating	Closed	

# DATA

Panel type	Un	In	Ith	Width	Cover beneath CB	Flap above CB	Flap above busbars up to 2000A	Flap above busbars over 2000A	Flap above cables	Rear CT holder
	[kV]	[A]	[kA]	[mm]						
Feeder	17,5	1600	31,5	800	Closed	Closed	Closed	Ventilating	Closed	
Feeder	17,5	1250	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
Bus coupler (CB)	17,5	1250	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
Bus coupler (CB)	17,5	1600	31,5	800	Closed	Closed	Closed	Ventilating	Closed	
Feeder	17,5	2000	31,5	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Bus coupler (CB)	17,5	2000	31,5	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	17,5	1600	50	800	Closed	Closed	Closed	Ventilating	Closed	
Feeder	17,5	2000	50	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Bus coupler (CB)	17,5	2000	50	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	17,5	1600	50	1000	Closed	Closed	Closed	Ventilating	Closed	
Feeder	17,5	2000	50	1000	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	17,5	2500	50	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Bus coupler (CB)	17,5	2500	50	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Feeder	17,5	1600	31,5	1000	Closed	Closed	Closed	Ventilating	Closed	
Feeder	17,5	2000	31,5	1000	Ventilating	Ventilating	Closed	Ventilating	Closed	
Feeder	17,5	2500	31,5	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Bus coupler (CB)	17,5	2500	31,5	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	
Feeder	17,5	3150	50	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating
Feeder	17,5	4000	50	1000	<b>Cooler</b>	Ventilating	Ventilating	Ventilating	Ventilating	<b>Cooler</b>
Bus coupler (CB)	17,5	3150	50	1000	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating
Bus coupler (CB)	17,5	4000	50	1000	<b>Cooler</b>	Ventilating	Ventilating	Ventilating	Ventilating	<b>Cooler</b>
bus riser	17,5	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
bus riser	17,5	2500	31,5	800	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser	17,5	2500	31,5	650	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser - metering	17,5	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
bus riser - metering	17,5	2500	31,5	650	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch	17,5	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch	17,5	2500	31,5	800	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch - metering	17,5	1250	31,5	650	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch - metering	17,5	2500	31,5	800	Closed	Closed	Ventilating	Ventilating	Closed	
metering	17,5	N/A	31,5	650	Closed	Closed	Closed	Closed	Closed	
bus riser	17,5	1250	50	800	Closed	Closed	Closed	Closed	Closed	
bus riser	17,5	2000	50	800	Ventilating	Ventilating	Closed	Ventilating	Closed	
bus riser	17,5	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser	17,5	3150	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
bus riser - metering	17,5	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch	17,5	1250	50	800	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch	17,5	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	
direct feeder - earthing switch - metering	17,5	1250	50	800	Closed	Closed	Closed	Closed	Closed	
direct feeder - earthing switch - metering	17,5	2500	50	800	Closed	Closed	Ventilating	Ventilating	Closed	

Panel type	Un	In	Ith	Width	Cover beneath CB	Flap above CB	Flap above busbars up to 2000A	Flap above busbars over 2000A	Flap above cables	Rear CT holder
	[kV]	[A]	[kA]	[mm]						
Feeder	24	1000	25	800	25 kA	Closed	Closed	Closed	Ventilating	Closed
Feeder	24	1250	25	800	25 kA	Closed	Ventilating	Closed	Ventilating	Closed
Bus coupler (CB)	24	1250	25	800	25 kA	Closed	Ventilating	Closed	Ventilating	Closed
Feeder	24	1000	25	1000	25 kA	Closed	Closed	Closed	Ventilating	Closed
Feeder	24	1250	25	1000	25 kA	Closed	Ventilating	Closed	Ventilating	Closed
Bus coupler (CB)	24	1250	25	1000	25 kA	Closed	Ventilating	Closed	Ventilating	Closed
Feeder	24	1600	25	1000	25 kA	Closed	Closed	Closed	Ventilating	Closed
Feeder	24	2000	25	1000	25 kA	Ventilating	Ventilating	Closed	Ventilating	Closed
Feeder	24	2300	25	1000	25 kA	Ventilating	Ventilating	Ventilating	Ventilating	Ventilating
Feeder	24	2500	25	1000	25 kA	<b>Cooler</b>	Ventilating	Ventilating	Ventilating	Ventilating
Bus coupler (CB)	24	2000	25	1000	25 kA	Ventilating	Ventilating	Closed	Ventilating	Closed
Bus coupler (CB)	24	2500	25	1000	25 kA	<b>Cooler</b>	Ventilating	Ventilating	Ventilating	Ventilating
bus riser	24	1250	25	800	25 kA	Closed	Closed	Closed	Closed	Closed
bus riser	24	2500	25	1000	25 kA	Closed	Closed	Ventilating	Ventilating	Closed
bus riser - metering	24	1250	25	800	25 kA	Closed	Closed	Closed	Closed	Closed
bus riser - metering	24	2500	25	800	25 kA	Closed	Closed	Ventilating	Ventilating	Closed
direct feeder - earthing switch	24	1250	25	800	25 kA	Closed	Closed	Closed	Closed	Closed
direct feeder - earthing switch	24	2500	25	1000	25 kA	Closed	Closed	Ventilating	Ventilating	Closed
direct feeder - earthing switch - metering	24	1250	25	800	25 kA	Closed	Closed	Closed	Closed	Closed
metering	24	N/A	25	800	25 kA	Closed	Closed	Closed	Closed	Closed
bus riser	24	2500	25	800	25 kA	Closed	Closed	Ventilating	Ventilating	Closed
metering - earthing switch	24	N/A	31,5	650	31,5 kA	Closed	Closed	Closed	Closed	Closed
metering - earthing switch	24	N/A	50	800	40kA/1s or 50kA/0,5s	Closed	Closed	Closed	Closed	Closed



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