



Technical information

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MAIN CHARACTERISTICS

- Type tested according IEC62271-200
- Construction of two (three - optionally) high voltage compartments with draw-out circuit breakers
- Make-type earthing switch
- One-sided maintenance
- Complete air insulation of all switchboard live parts
- IP4X degree of protection on the external housing
- Constructed to withstand the overpressures caused by the internal arc up to 25kA/1s
- Busbar segregation shutters activated automatically by circuit breaker movement inside the compartment. Optional lower contact segregation shutters to reach LSC2B category.
- HV door's mechanical interlock ensures secure maintenance
- Very small overall dimensions (minimal height – 1800mm with lowest dimension of LV compartment)

APPLICATION

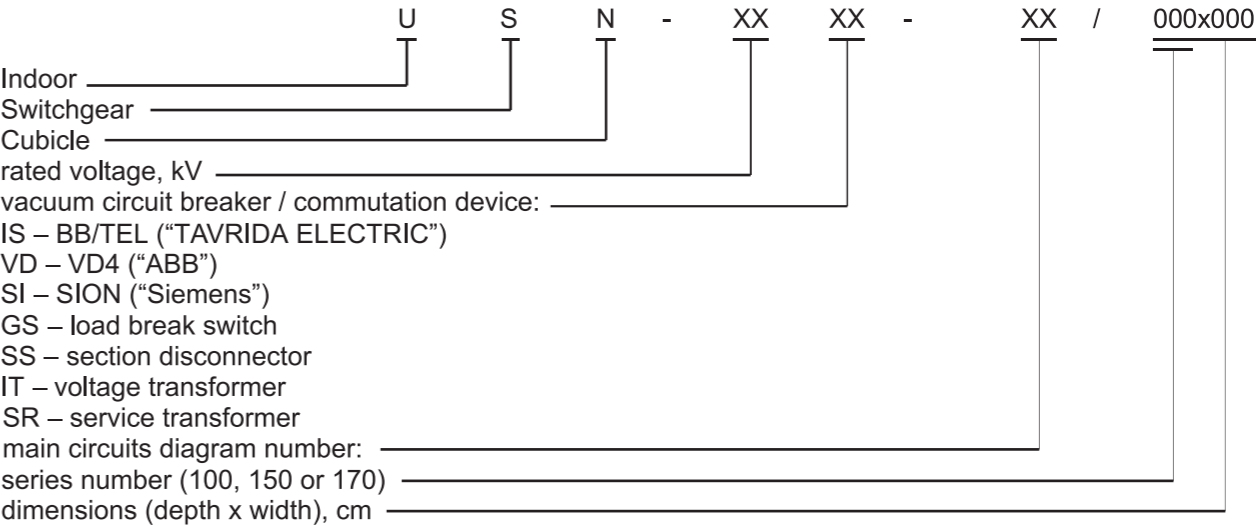
USN 100 series cubicles are used in indoor switchgears and distribution centers for 6(10) kV voltage 50/60 Hz frequency electrical power distribution, line overload and short circuit protection. Cubicles are equipped with vacuum circuit breakers of various manufacturers.

This document contains technical information about USN 100 series cubicles.



NOTATION

Conventional cubicle notation:



TYPE TESTS

Sophisticated tests are performed at accredited European power laboratories (IPH, IEL).



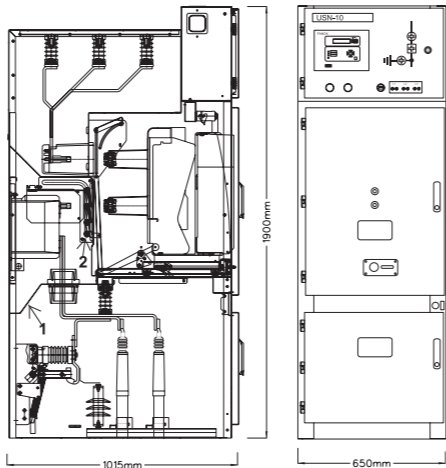
CUBICLE STRUCTURE

The torsionally rigid housings of the cubicles are made of 2.0...3.0 mm thickness galvanized steel sheets (Finland) folded at the edges and bolted together.

With the selection of high quality materials, special surface treatment and powder painting, the conditions for high impact and corrosion resistance are fulfilled.

Special labyrinth construction of panel's side elements and doors ensure personnel safety against arc faults.

Switchboards can be fixed to the special foundation, using anchoring bolts above cable ducts.



1) optional partition between draw-out element and cable compartments
2) optional lower contact segregation shutters

SERVICE CONDITIONS

Cubicles are designed for indoor use (on stationary premises or prefabricated substation buildings) and must be operating under normal conditions in accordance with the IEC 60694 standard.

The lower limit of operating ambient air temperature shall be not less - 30° C.

The upper limit of operating ambient air temperature shall not exceed + 40° C.

Cubicles can be used up to an altitude of 1000m. Beyond that (altitude up to 3000 m) it's necessary to take into account of a decrease in the dielectric strength.

In cubicle operation environment must be no dust particles, fumes or smoke, corrosive or flammable gases, vapors or salts.

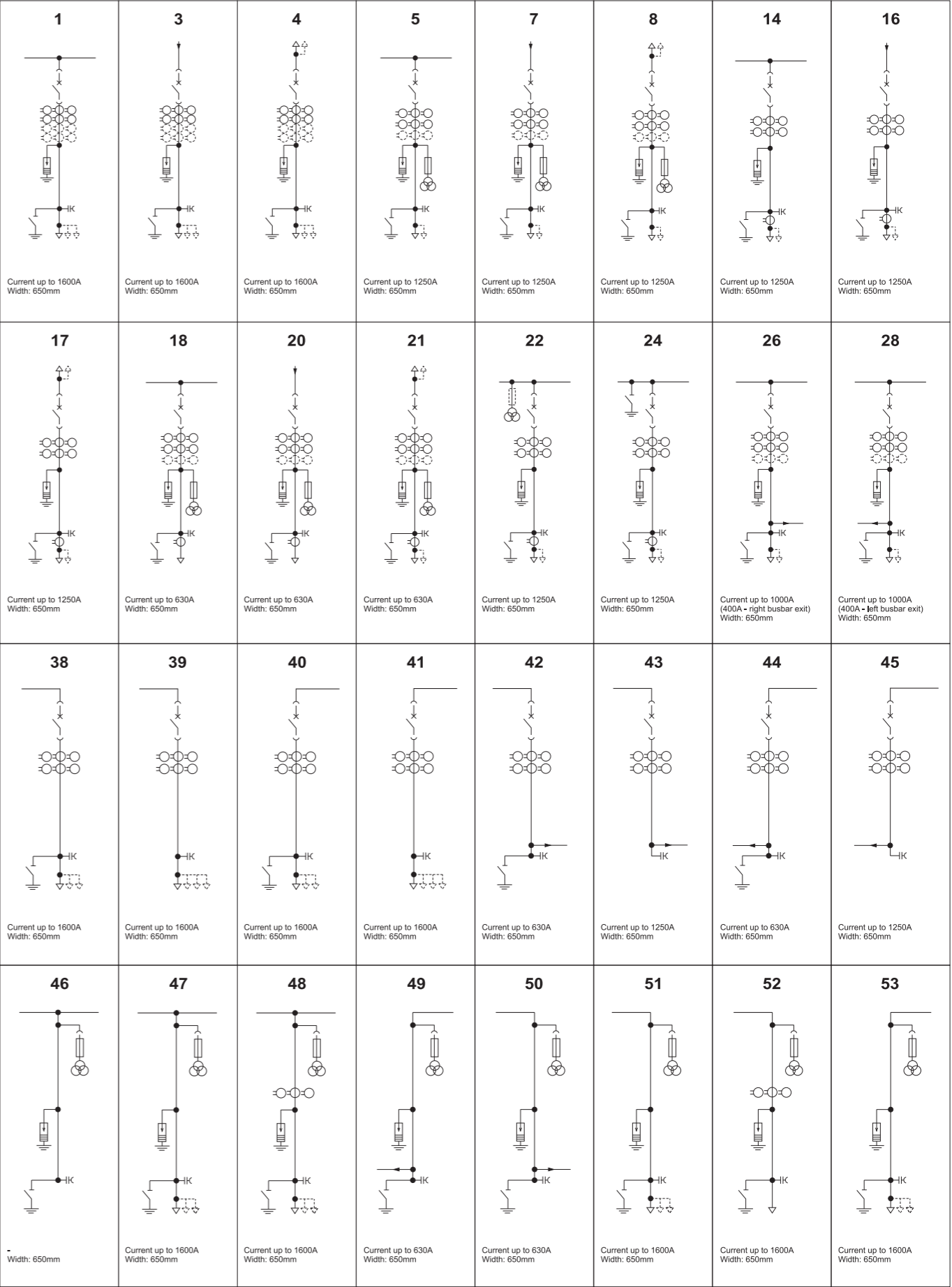
Seismic resistance of cubicles is up to 7 on Richter scale and up to 9 on MSK scale (according to IEC 60068-3-3 standard).

When commissioning and operating switchgear equipment under normal conditions, the general electrical safety instructions, as well as operation handling instructions should be respected. The sequent of disregarding given instruction is the loss of warranty repair.

TECHNICAL DATA

Rated voltage, kV	10 (6)
Maximum operating voltage, kV	12
Frequency, Hz	50/60
Rated branch connection current, A	630; 1000; 1250; 1600
Rated main busbar current, A	400...1600
Circuit breaker's making current, kA	16; 20; 25;
Rated short-time withstand current (3 s), kA	16; 20; 25;
Rated peak withstand current, kA	40; 50; 63;
Rated low voltage circuit connection voltage, V	
DC	48; 110; 220
AC	230
Circuit breaker	SION - "Siemens", VD4 - "ABB", BB/TEL - "TAVRIDA"
Insulation level	Normal insulation
Insulation type	Air
Classification according internal arc withstand (IEC62271-200)	AFLR 25kA/1s
Loss of service continuity category (IEC62271-200)	LSC2A (LSC2B - option)
Partition class (IEC62271-200)	PM
Degree of protection (with the cubicle door closed)	IP4X - for current up to 800A, IP3X - for 1000A, 1250A and 1600A
Busbar insulation	By request
Outgoing line connection	By cables
Maintenance version	One-sided
Control versions	Local and RTU
Height	1900...2200mm (depends on the height of LV compartment)
Width	500mm – load break switch cubicle 650mm – circuit breaker cubicle up to 1250A 800mm - circuit breaker cubicle up to 1600A
Depth	1015mm

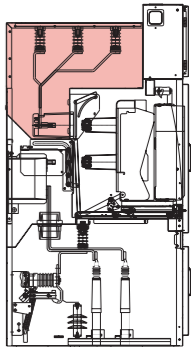
DIAGRAMS OF MAIN CIRCUITS (FOR 10 KV CUBICLES)



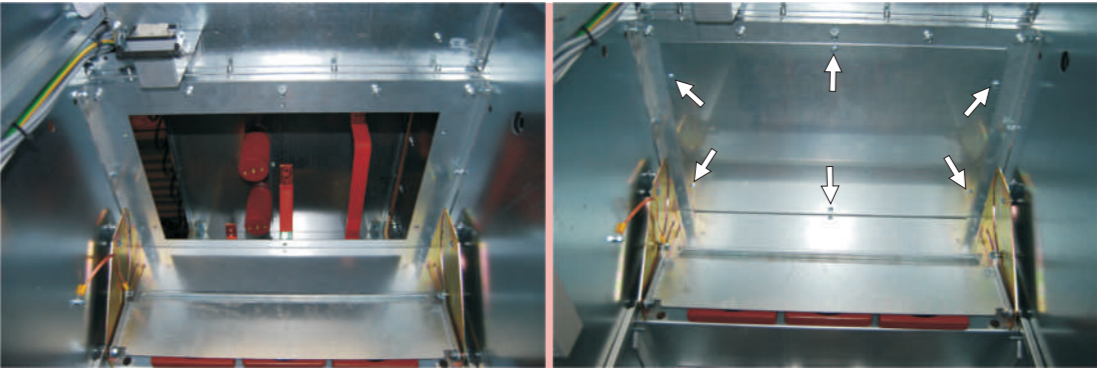
<div>54</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>55</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>57</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>58</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>59</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>60</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>61</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>61a</div> <div></div> <div>Current up to 630A Width: 650mm</div>
<div>62</div> <div></div> <div>Current up to 1600A Width: 650mm</div>	<div>63</div> <div></div> <div>Current up to 630A Width: 650mm</div>	<div>64</div> <div></div> <div>Current up to 630A Width: 650mm</div>	<div>65</div> <div></div> <div>Current up to 1250A Width: 650mm</div>	<div>66</div> <div></div> <div>Current up to 1250A Width: 650mm</div>	<div>67</div> <div></div> <div>Current up to 200A Width: 800mm</div>	<div>71</div> <div></div> <div>Current up to 200A Width: 800mm</div>	<div>72</div> <div></div> <div>Current up to 200A Width: 800mm</div>
<div>73</div> <div></div> <div>Current up to 1250A (400A - with fuses) Width: 500 x 650mm</div>	<div>74</div> <div></div> <div>Current up to 200A Width: 650mm</div>	<div>75</div> <div></div> <div>Current up to 200A Width: 650mm</div>	<div>76</div> <div></div> <div>Current up to 1250A (400A - with fuses) Width: 500 x 650mm</div>	<div>77</div> <div></div> <div>Current up to 1250A (400A - with fuses) Width: 500 x 650mm</div>	<div>78</div> <div></div> <div>Current up to 1250A (400A - with fuses) Width: 500 x 650mm</div>	<div>80</div> <div></div> <div>Current up to 400A Width: 650mm</div>	<div>81</div> <div></div> <div>Current up to 400A Width: 650mm</div>
<div>84</div> <div></div> <div>Current up to 1250A</div>							

BUSBAR COMPARTMENT

The busbar system is made of flat copper or aluminum bars connected by bolted connection. Main busbars can be additionally covered with insulating material by special order. Busbar compartment, as well as draw-out element and cable compartments, has an exhaust channel to let out overpressured hot gases in the case of a fault. On request, busbar compartments between two adjacent cubicles can be separated by special cast resin bushings.



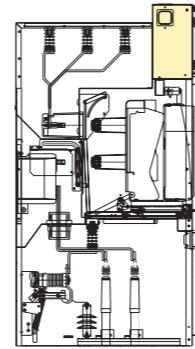
Main busbars



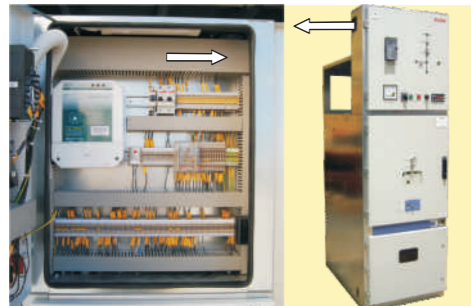
Removable access panel to main busbars in draw-out element compartment

LOW VOLTAGE COMPARTMENT

Low voltage compartment is positioned and manufactured in double steel plate system to have low voltage instruments well protected against the effects of short circuit currents from the primary compartments. The auxiliary circuits of the circuit breaker are connected by means of a specially designed multi-pole connector.



LV compartment door



The low voltage circuit connection between the cubicles

Relay-protection devices



VAMP



AREVA



ABB



SIEMENS



SCHNEIDER ELECTRIC

USN cubicles can be equipped with various digital protection and automation devices, electronic and multifunctional microprocessor-based energy meters. Typical diagrams realized using digital protection and automation devices, namely SEPAM, REF, SPAC, MICOM, SIPROTEC, F 650, БМРЗ, Сириус, УЗА. Other digital devices also can be utilized on request.

Diagrams of auxiliary circuits

Principal and wiring diagrams for auxiliary circuits are the part of USN switchgear documentation to be conveyed to a customer.

Diagrams are realized with direct, rectified and alternating operative current. At customer's request switchgear can be equipped with operative current panels.

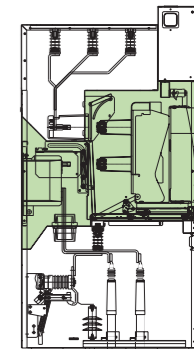
A complete set of diagrams is available for all typical USN switchgear cubicles: incoming, outgoing, section disconnector, metering, load break switch, voltage transformer, service transformer and etc.

Diagrams of auxiliary circuits for USN switchgears are realized through a range of typical schemes using various microprocessor-based protection, control, automation and signaling devices. Diagrams of an energy metering can be realized using electronic or multifunctional microprocessor-based energy meters.

Layout plans of switchgear cubicles and terminal panels, cable passages, control cable wiring and connection diagrams and cable list should be provided by design organizations.

DRAW-OUT ELEMENT COMPARTMENT

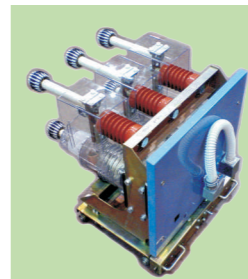
Standardized construction of draw-out element allows integration of voltage transformers, contactors, section disconnectors and vacuum circuit breakers from major worldwide suppliers.



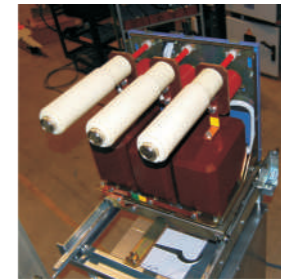
SION
Siemens



VD4
ABB



BB/TEL
Tavrida Electric



Voltage transformer
on draw-out element



Section
disconnecter on
draw-out element



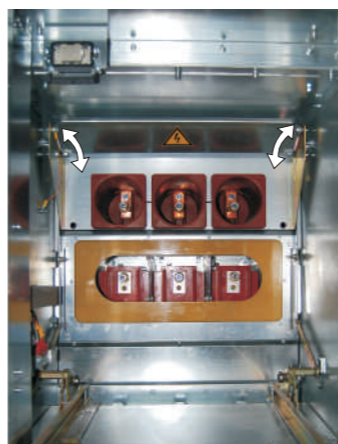
Opening draw-out
element
compartment door



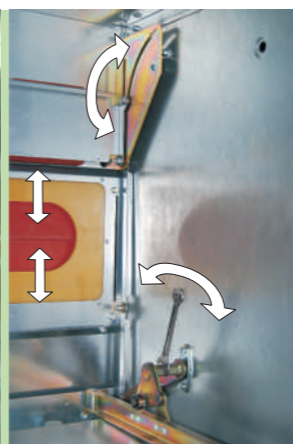
Handling draw-out
element



Electronic indicator of
draw-out element status



Handling segregation shutters

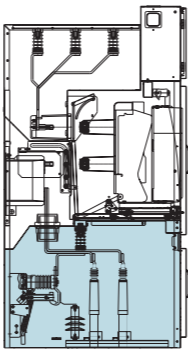


Locking shutter operating
mechanism

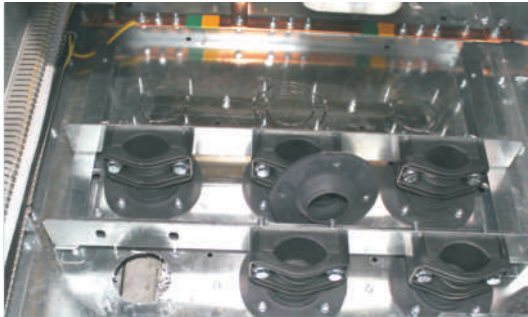
CABLE COMPARTMENT

Access to the cable compartment is from the front side. It is very easy to reach cable area, due to the compact design of busbar and circuit breaker compartments. Up to 40% of switchgear panel volume can be used as the cable termination compartment. A connection of 3 parallel cables up to 300 mm² per phase does not provide any problem, since two partitions between cable and draw-out element compartments can be removed (if they were installed by special order).

USN switchboards are fitted with a fault making earthing switch mounted in the cable compartment, to connect the busbar, incoming or outgoing cables to earth. The earthing switch is controlled from the front of the switchboard by means of manual operation. Electromechanical interlocks can link switch operation to other switching device in the substation or to lack of voltage in the cable.



In	Width, mm	Rated short-time withstand current	Max. number of cables per phase	The height of the cable connection point from the ground, mm
630A	650	up to 25kA	2	500
1000A, 1250A	650	up to 25kA	3	500
1600A	800	up to 25kA	3	500



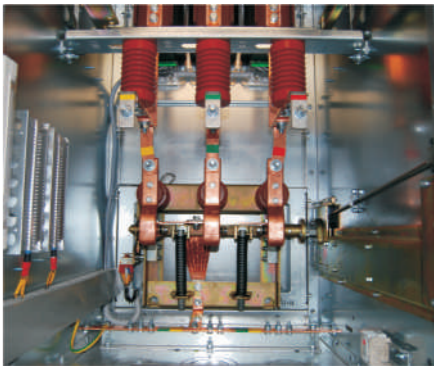
Bottom of cubicle hermetically sealed with cable entry sealing inserts



Locking earthing switch mechanism



Opening cable compartment door



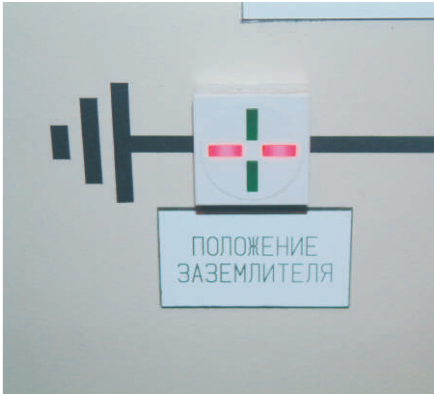
Earthing switch



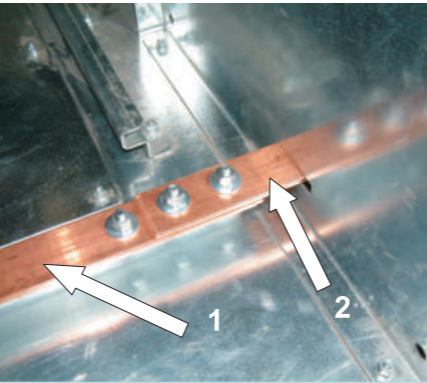
Handling earthing switch



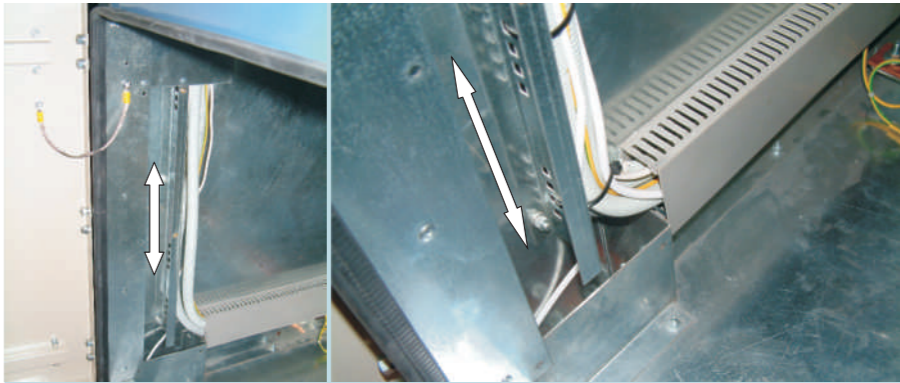
Mechanical indicator of earthing switch status



Electronic indicator of earthing switch status



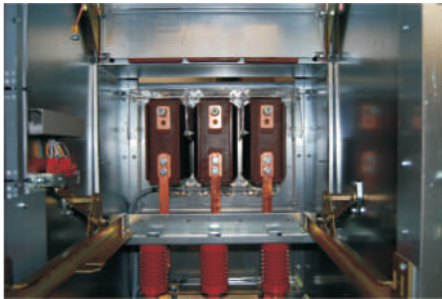
Earthing busbar connection between cubicles (connecting up the earthing circuit)



Passage of the LV cables in the cable compartment



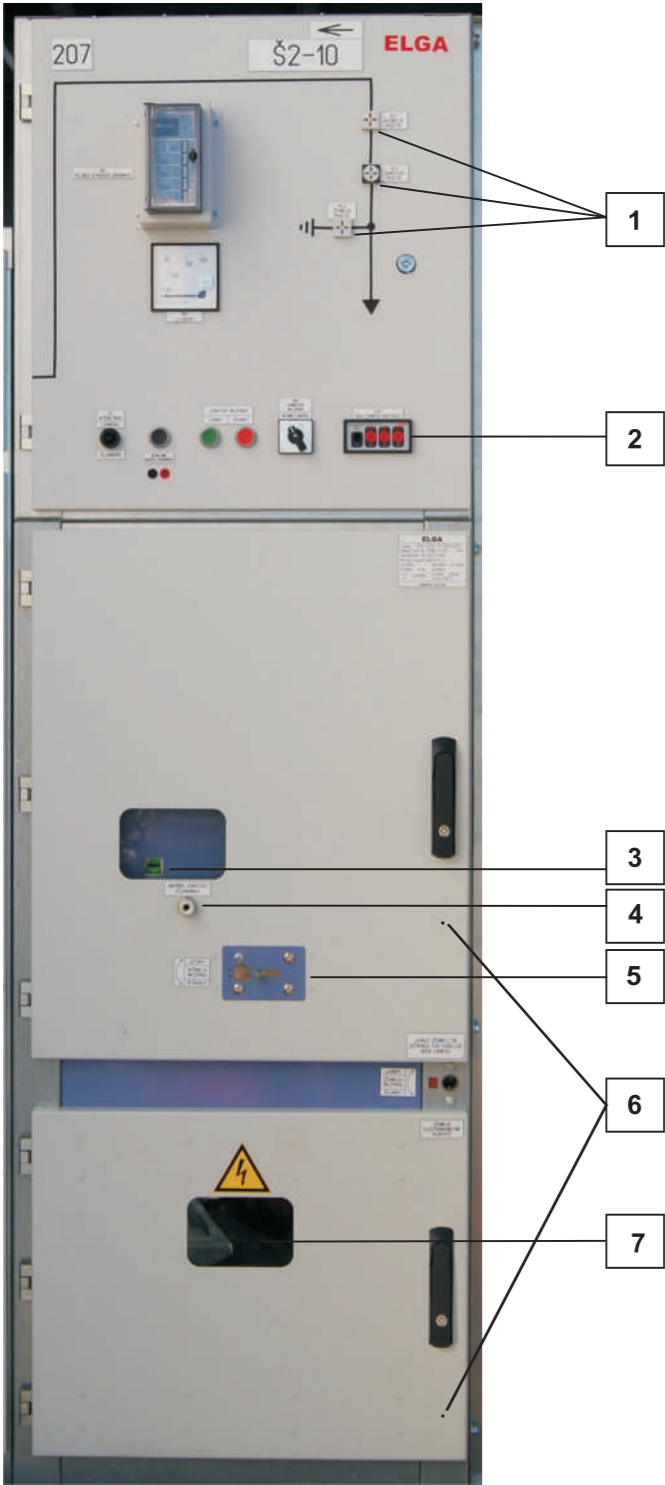
Fixing the cables and connecting cable earthing braid



Access to current transformers

OPERATING ELEMENTS OF CUBICLE WITH “SION-3AE1” (SIEMENS) CIRCUIT BREAKER

“SION-3AE1” circuit breaker is mounted on draw out element.
Operating elements of cubicle with other manufacturer's circuit breakers may differ (please refer to the appropriate manual).

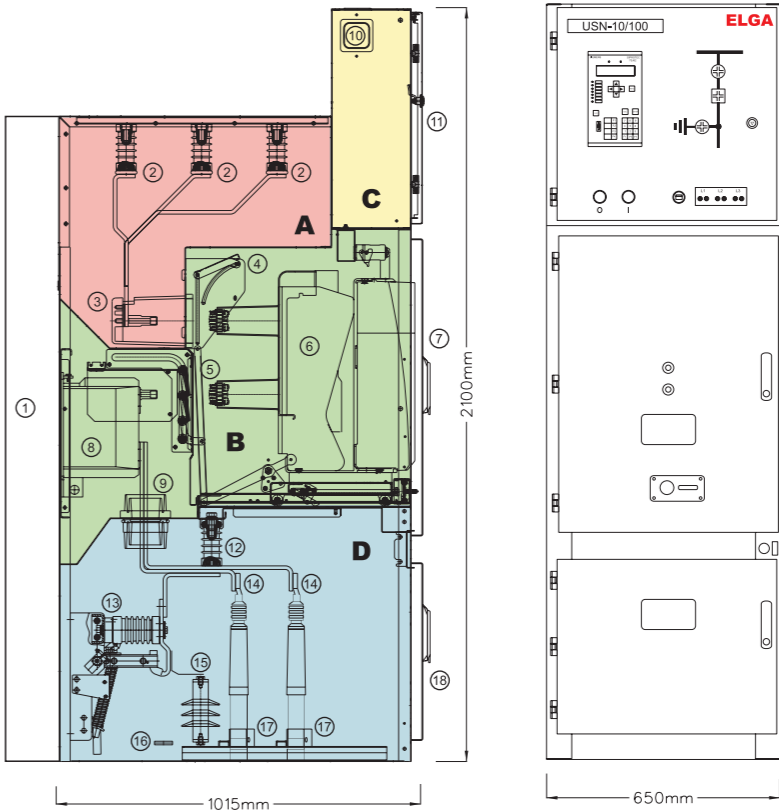


- 1 Mimic diagram with status indicators of commutation devices
- 2 Voltage indicator
- 3 Mechanical indicator of circuit breaker's position (CLOSED/OPEN)
- 4 Opening for circuit breaker's mechanical switch on/off handle
- 5 Opening for draw-out element control handle
- 6 Opening for overriding draw-out element and cable compartment doors mechanical interlock (using special handle)
- 7 Window for cable connection and earthing switch's position inspection

CUBICLE DESIGN AND EQUIPMENT

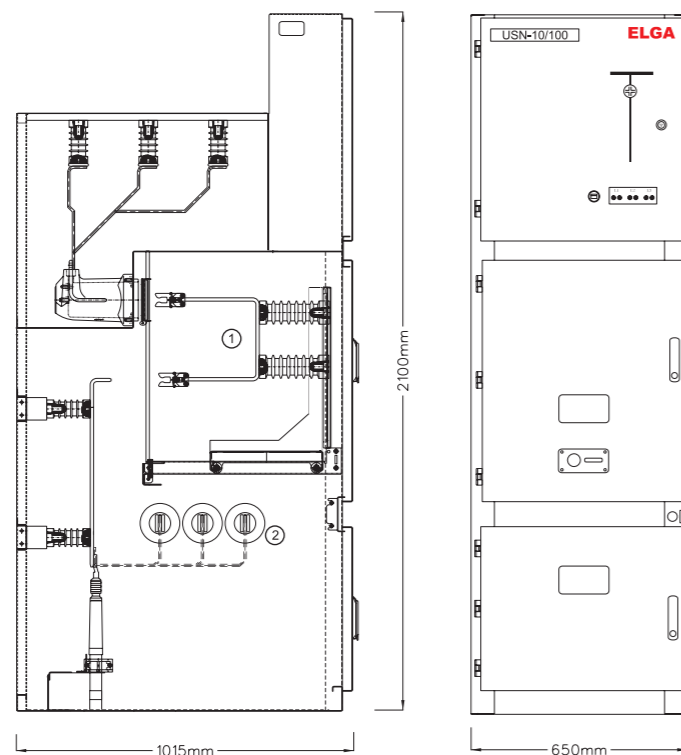
Indoor switchgear consists of different USN cubicles with commutation devices, control and protection relays, signaling and metering devices and other auxiliary equipment, which are interconnected by electrical diagram.

Design diagrams of USN switchgear cubicles are given below.



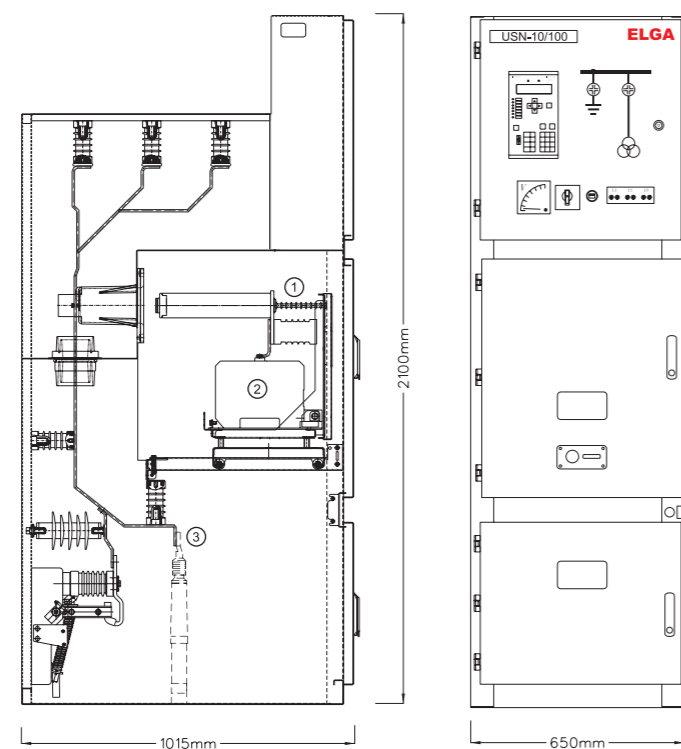
Circuit breaker cubicle (USN-10SI-01/100x065)

- 1 Internal arc channel for directing arc outside the building (in case the cubicles will be installed in prefabricated substation buildings made of sandwich panels)
- A Busbar compartment**
 - 2 Busbars
 - 3 Bushing insulator
- B Draw-out element compartment**
 - 4 Metallic segregation shutters of busbar compartment
 - 5 Metallic segregation shutters of current transformer compartment
 - 6 Circuit breaker on draw-out element
 - 7 Draw-out element compartment door
 - 8 Current transformer
 - 9 Bushing insulator (option)
- C Low voltage compartment**
 - 10 Control cable passage
 - 11 Low voltage compartment door
- D Cable compartment**
 - 12 Post insulator
 - 13 Earthing switch
 - 14 Cable connection lugs
 - 15 Surge arrester
 - 16 Earthing bar (neutral)
 - 17 Cable clamping parts
 - 18 Cable compartment door



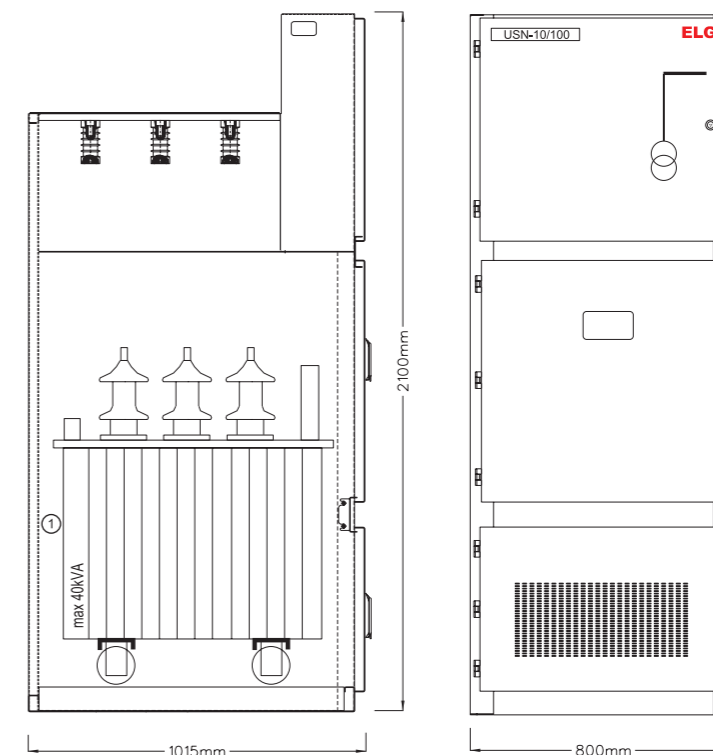
Section disconnecter cubicle (USN-10SS-61/100x065)

- 1 Section disconnecter on draw-out element
- 2 Bushing insulators (in diagrams of main circuits No.63...66)



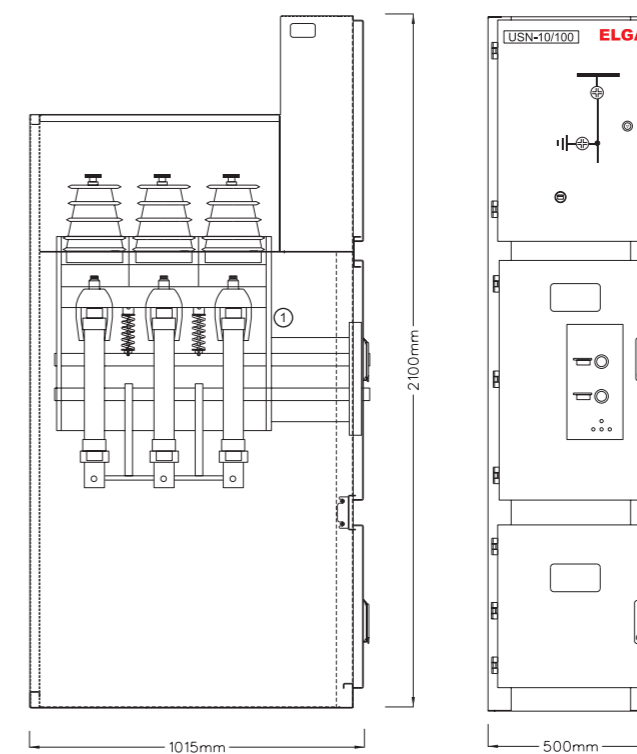
Voltage transformer cubicle (USN-10IT-47/100x065)

- 1 Fuse with blowout indication
- 2 Voltage transformer on draw-out element
- 3 Surge arrester



Service transformer cubicle (USN-10SR-71/100x080)

- 1 Service transformer up to 40kVA

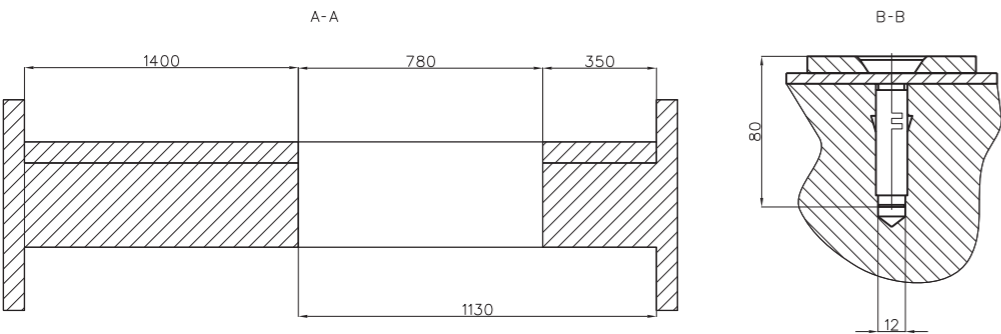
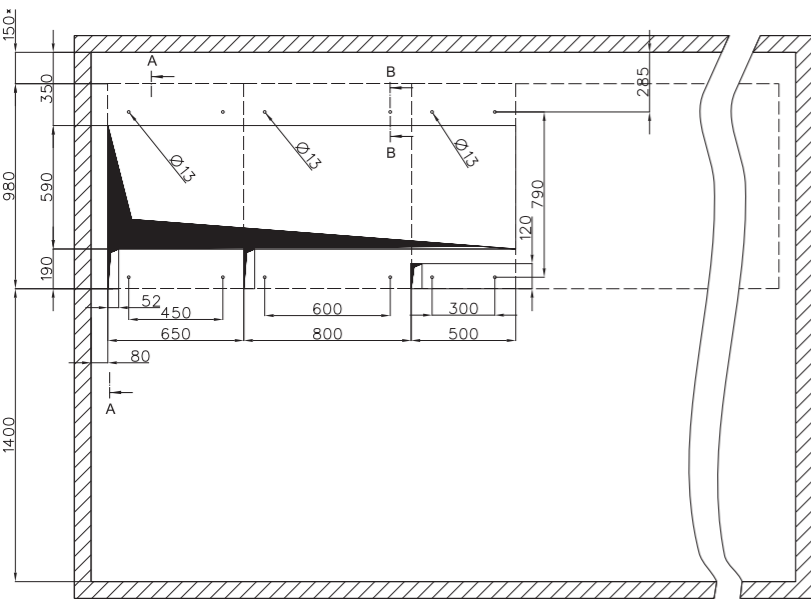
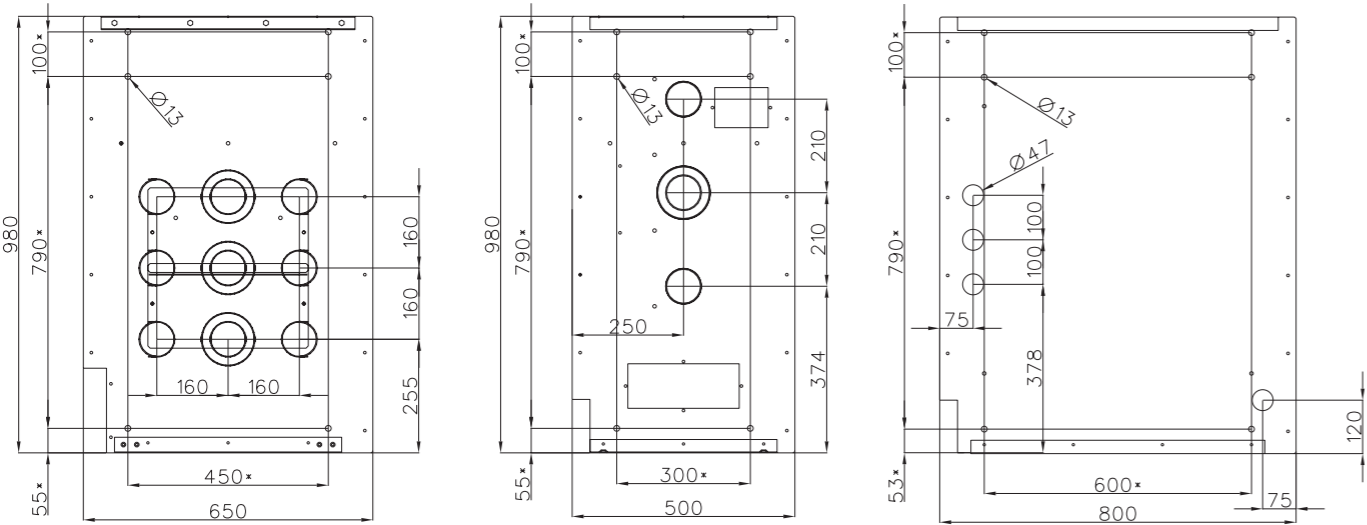


Load break switch cubicle (USN-10GS-73/100x050)

- 1 Load break switch with fuses

INSTALLATION ON THE GROUND

Cubicles must be positioned on installation site in accordance with certified project and electrical diagram. In the floor of the cubicle installation place over cable compartment of cubicle must be duct or opening for cable passing. The cubicle is fixed to the ground with 2 anchor bolts M12x110.



Installation of a back-to-wall switchboard (top view)

Positioning cubicles in switchgear

Cubicles must be positioned in the order of priority in accordance with the single-line diagram.

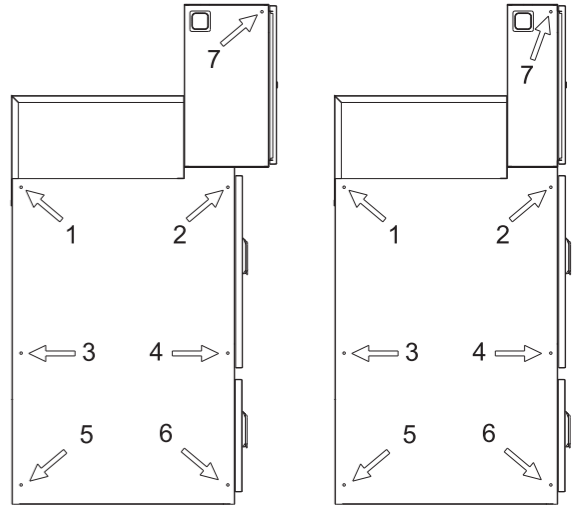
For a switchboard composed of 1 to 10 cubicles, it is recommended to begin installation from the first to the last cubicle on the side opposite the access to the premises. For a switchboard with more than 10 units, begin the installation of the equipment by the middle of the switchboard.

Connecting cubicles

Check the perpendicularity of each of them in relation to the ground. Align up the front facing panels.

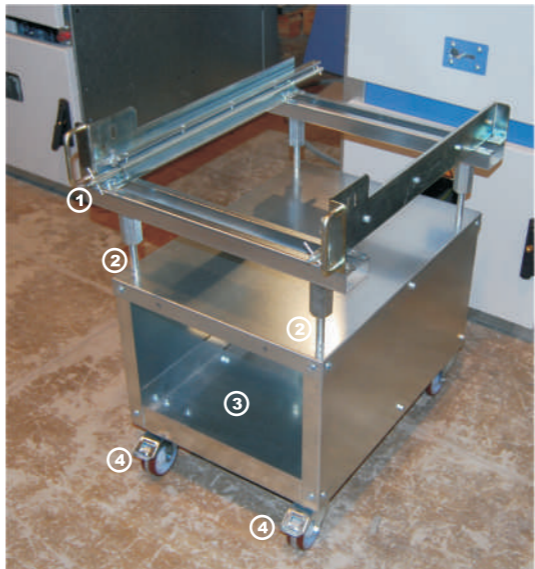
Proceed with the layout of the other cubicles by repeating the same checks each time.

Cubicles interconnected by M8 bolts in 7 fixing points (in accordance with the diagram).



OPERATING ACCESSORIES

Equipment handling table for the draw-out element



1. Handle for unlocking the draw-out element from its compartment
2. Adjusting the table height
3. Area for storing the accessories (operating handles, keys)
4. Blocking/unblocking the wheels

Operating handles and keys



Locking and unlocking key for cubicle doors



The handle for circuit breaker mechanical switch on/off

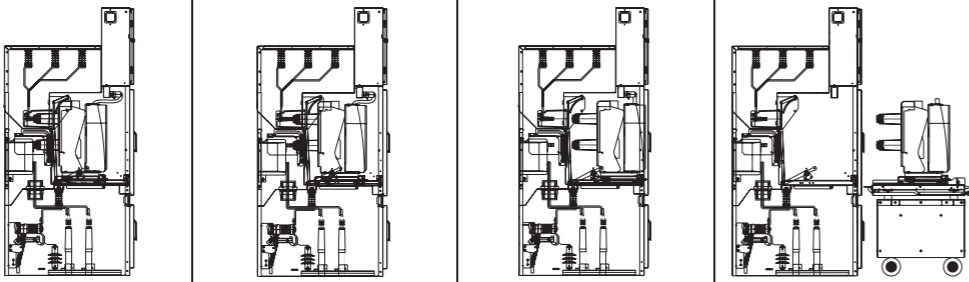


The crank-handle for the draw-out element control



The handle for earthing switch control

POSITION OF COMMUTATION DEVICES AND ITS OPERATION POSSIBILITY SUBJECT TO DRAW-OUT ELEMENT POSITION

Draw-out element position					
					
OperationIntermediateIsolatedService					
Circuit breaker	Operation possibility	YES	NO	YES	NO (YES - if auxiliary voltage connected through adapter cable)
	Position	ON/OFF	OFF	ON/OFF	ON/OFF
	Movement possibility (possibility to put in control handle)	NO (if circuit breaker is switched on); YES (if circuit breaker is switched off)	YES	YES (if earthing switch is opened); NO (if earthing switch is closed)	YES
Earthing switch	Possibility to put in control handle	NO	NO	YES	YES
	Position	OFF	OFF	ON/OFF	ON/OFF

ORDER BLANK

1	Object name									
2	Name and address of the customer									
3	Design organization and its address									
4	Main circuit rated voltage, kV									
5	Main busbar rated current, A									
6	Rated short-time withstand current, kA									
7	Serial number of the cubicle according to plan									
8	Main circuit scheme number									
9	Cubicle type (incoming, outgoing, voltage transformer, service transformer, circuit breaker, load break switch and etc.)									
10	Main circuit rated current, A (630, 1000, 1250, 1600)									
11	Circuit breaker (load break switch, contactor)	type								
		rated current, A								
		making current, kA								
12	Fuse-link rated current									
13	Current transformers	transformation rate								
		quantity								
		accuracy class								
		burden, VA								
14	Voltage transformers	1st winding	burden, VA							
			accuracy class							
		2nd winding	burden, VA							
			accuracy class							
		3rd winding	burden, VA							
			accuracy class							
15	Zero sequence current transformer, quantity									
16	Surge arresters, type									
17	Service transformer capacity, kVA									
18	Capacitor bank capacity, kVAr									
19	Microprocessor-based protection device	type								
		protection functions								
20	Energy meters	active								
		reactive								
21	Amperemeter									
22	Voltmeter									
23	Cubicle heating									
24	Internal arc channel for directing arc outside the building									
25	Tin or silver plated busbars									
26	Insulated busbars									
27	Other color									
28	Options (NOLA, KAMP)									

Annex to the order blank:

1. Single line diagram with specified types of protection.
Automatic Load Transfer (ALT) algorithm.
2. Layout plan of cubicles in switchgear and dimensions of installation place.
3. Other additional requirements.

Customer:

title

signature

date