

2023-12-14

UH-2023-204

Valid from, Date

Approved by, Date

Technical specification Switchgear 12 kV and 24 kV (RMU)

REVISION HISTORY

Revision	Date	Comment	Reviewed by
1.0	2023-12-14	Revision of TS from 2018-10-18. Integration with RTU added	Nätkommittén

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1 GENERAL

Technical specifications and details for the delivery of indoor medium voltage RMU switchgear 12 kV and 24 kV to Ellevio.

2 APPLICABLE STANDARDS AND REGULATIONS

The switchgear and its components shall be designed and tested according to the following list of priorities:

1. The Swedish National Electrical Safety Board's regulations (ELSÄK-FS)
2. This technical specification
3. High-voltage switchgear and controlgear
 - Part 1: Common specifications for alternating current switchgear and controlgear, SS-EN 62271-1
 - Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV, SS-EN IEC 62271-200
 - Part 100: Alternating-current circuit-breakers, SS-EN IEC 62271-100
 - Part 102: Alternating current disconnectors and earthing switches, SS-EN IEC 62271-102
 - Part 103: Switches for rated voltages above 1 kV up to and including 52 kV, SS-EN 62271-103

Measuring relays and protection equipment

- Part 151: Functional requirements for over/under current protection, SS-EN 60255-151

Insulated bushings for alternating voltages above 1000 V, SS-EN 60137

Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2,50 kA for equipment other than liquid filled transformers, SS-EN 50181

Live working - Voltage detectors

- Part 5: Voltage detecting systems (VDS), SS-EN 61243-5

4. Other applicable SS, EN and IEC standards

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3 MAIN TECHNICAL DATA

Main technical data in table below shall be fulfilled.

Nominal voltage	kV	11	22
Rated voltage (U_r)	kV	12	24
Rated insulation level: Rated short-duration power-frequency withstand voltage (U_d) and rated lightning impulse withstand voltage (U_p)	kV	28/75	50/125
Rated frequency (f_r)	Hz	50	50
Rated short-time withstand current (I_k), rated duration of short-circuit (t_k) = 1 s	kA	20	16
Rated peak withstand current (I_p)	kA	50	40
Rated continuous current main busbar (I_r)	A	630	400
Rated current switching devices (I_r)	A	400	400
Rated current circuit breaker (I_r) (transformer bay)	A	200	200
Breaking capacity circuit breaker (I_{sc}) (transformer bay)	kA	20	16
Making capacity switch-disconnector (I_{ma})	kA	50	40
Making capacity earthing switch (I_{ma})	kA	50	40
Degree of protection in service	IP3X		
Service ambient temperature range	-25°C to +40°C		

4 CONFIGURATIONS

In below C represents cable bay, T represents transformer bay and D represents dummy bay.

MV Type 1, 12 kV with automatic switchover functionality

The configurations shall be four (4) feeder bays divided into two (2) systems, two (2) switchover bays for switching between the systems and two (2) transformer bays.

A possible solution is CCD_CTTC_DCC.

The automatic switchover functionality is included in the RTU functionality and is not a part of the delivery.

The rated voltage is 12 kV.

Single-line diagram, see attachment 1.

MV Type 2, 12 kV with automatic switchover functionality

The configurations shall be four (4) feeder bays divided into two (2) systems, two (2) switchover bays for switching between the systems and one (1) transformer bay.

A possible solution is CCD_CTC_DCC.

The automatic switchover functionality is included in the RTU functionality and is not a part of the delivery.

The rated voltage is 12 kV.

Single-line diagram, see attachment 2.

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MV Type 3, 12 kV and 24 kV

The configurations shall be two (2) feeder bays and two (2) transformer bays.

A possible solution is CCTT.

The rated voltages are 12 kV or 24 kV.

Single-line diagram, see attachment 3.

MV Type 4, 12 kV and 24 kV

The configurations shall be two (2) feeder bays and one (1) transformer bay.

A possible solution is CCT.

The rated voltages are 12 kV or 24 kV.

Single-line diagram, see attachment 4.

MV Type 4 small, 12 kV and 24 kV

Same configuration as MV Type 4, but restricted in size

Option: Additional bays

- It shall be possible to add extra feeder bays and transformer bays to the different configurations.

Alternative configurations

Alternative configurations of feeder bays, switchover bays and transformer bays may occur.

5**GENERAL DESIGN**

The switchgear shall be of an approved design such that internal arcing cannot arise, or such that any arcing is extinguished so rapidly that dangerous excess pressure or dangerous gases are not emitted from the switchgear.

Switchgear containing SF₆ gas is not accepted.

Mechanical switch position indication of all switching devices shall be on the front of the switchgear.

The switchgear will be installed on an installation floor with normal height of 650-800 mm.

All earthing switches shall be equipped with hand-operated preloaded spring units for closing and opening. They shall have a lock mechanism.

If door blocking is used it shall be possible to bypass it independent of switching position.

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6 BAYS

Transformer bays

The transformer bays shall be provided with circuit breakers including relay protection and earthing switches. Current transformer to fulfil this task shall, if needed, be included in the tender.

Circuit breakers that have oil as extinguishing medium shall not be used.

The circuit breakers shall be provided with 24 VDC trip coil without delay to be used with arc guard, as described in Technical specification Switchgear 0.5 kV. Auxiliary contacts 2NO + 2NC to indicate circuit breaker position. The circuit breakers shall have a lock mechanism.

The relay protection function shall be constituted by reconnectable over-current protection characteristics that can be reconnected between NI, VI, EI (as specified by SS-EN 60255-151) and an instantaneous function. Setting of lower current start, tripping characteristic and instantaneous function shall be independent of each other. It shall be possible to carry out relay testing without interruption in service. Indication of function shall be included. An external auxiliary voltage shall not be required.

Transformer bays shall be equipped with VDIS-LRM in accordance with 62271-213 or VDS-LRM in accordance with IEC 61243-5.

Feeder bays

Feeder bays shall be equipped with switch-disconnectors and earthing switches, or equivalent.

Motor operated switch-disconnectors shall be used to enable remote control.

Feeder bays shall be equipped with VDIS-LRM in accordance with 62271-213 or VDS-LRM in accordance with IEC 61243-5.

Switchover bays

Switchover bays shall be equipped with switch-disconnectors or equivalent and automatic switchover functionality.

Motor operated switch-disconnectors shall be used to enable remote control.

Switchover bays shall be equipped with VDIS-LRM in accordance with 62271-213 or VDS-LRM in accordance with IEC 61243-5.

7 DIVISION INTO SWITCHGEAR SECTIONS

Switchgear may be divided into independent sections. Cables or similar conductors shall be used to connect the sections. Cables or similar conductors with connection accessories (e.g. cable termination), for distances up to 5 m between sections, shall be included in the tender. The length is determined in order form. The equipment shall be dimensioned to fulfil the main electrical data. Control and indication cables for joining the sections shall be connected at one end.

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8 CABLE BUSHINGS AND CABLE INSTALLATION

Cable bushings

Switchgear connections shall be made by cable bushings, which shall be designed according to SS-EN 60137 and SS-EN 50181 that permit plug-in connection. Feeder bays and transformer bays shall be designed for bolt connection interface C (630 A, series 400).

Cable installation

It shall be possible to make connections in the feeder bays using connectors for both single core 1x3x240/25 Al and three core cables 3x240/50 Al.

Connection may take place using three core cables, installed with component screening after attachment at an anchor bar. Single core cables may also be used. One anchor bar or its equivalent for connection shall be placed at a suitable level. A test installation with three core cable 3x240/50 Al shall be performed at factory to decide the location of the anchor bar.

It shall be possible to carry out the cable assembly in a work environmentally sound manner. E.g. no cable assembly in transverse direction.

9 INTEGRATION WITH REMOTE TERMINAL UNIT (RTU)

The digital secondary substation play an important role in the Ellevio smartgrid. Measurements of voltages and currents give insights of loading levels and power quality. Fault indicators and automatic transfer switch (ATS) reduce time of interruptions and affected customers in case of fault.

This role result in the need for the switchgear to be able to interact with Remote terminal units (RTU:s) from 3rd parties through sensors measuring voltage and current. Motor drives enabling remote switching and indication of switching state are also important functionalities.

The supplier shall be able to integrate 3rd party RTU components and sensors into the switchgears to make the delivery as complete as possible to minimize installation time on site.

Note: This requires the switchgear supplier to be actively involved in creating a good solution together with one or several RTU providers and Ellevio. This involves the physical form of housing but also decisions which supplier is best suited to deliver auxiliary products like current transformers, low power voltage transformers etc. The procedures for this are determined after contract signing.

The supplier of the MV switchgear is responsible for the final assembly and test/verification of signals from switchgear and auxiliary sensors to terminal before shipping to Ellevio.

Position of all maneuverable objects such as disconnectors and earthing switches but also position of circuit breakers shall be indicated with double point information and connected to terminal an onwards to RTU.

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10 DIMENSIONS

Maximum dimensions according to table below.

Configuration	Maximum dimensions L x D x H (mm) (approximately)
MV Type 1	4500 x 800 x 1800
MV Type 2	4000 x 800 x 1800
MV Type 3	2000 x 800 x 1800
MV Type 4	1500 x 800 x 1800
MV Type 4 small *	1500 x 700 x 1500

* This type is purchased separately.

For practical reasons, the switchgear shall be delivered in parts that can easily be assembled on site.

General dimensions according to table below.

Assembled height (max)	mm	2250
Transport height (max)	mm	2000
Longest transport width (max)	mm	2000

11 LABELLING

Marking of switchgear (e.g. switching devices) shall be performed according to order form. E.g. switch-disconnector in first cable bay in Stockholm shall be labelled “1-11-LF”.

12 ACCESSORIES

The following items shall be included with the delivery of the switchgear:

- Operating handles, insulated and of each type required.
- Tools and signs required for operation and maintenance.
- Indicators for visual checks of insulator durability at gas-insulated switchgear, e.g. manometers.
- It shall be possible to disconnect all terminal blocks, and they shall have test terminals.
- Earthing connection through M12 bolts in both ends of PEN bar.
- Each encapsulation for feeder bays shall be equipped with one flat plastic component with the dimensions height x width = 80 mm x 130 mm, for cable address signs.

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13 DOCUMENTATION

- Type documentation (in PDF and drawings also in DWG format) for all configurations and options shall be delivered no later than three (3) months after contract signing. All updates shall also be delivered continuously.
- Documentation for the ordered switchgear (in DWG format) needed for the construction shall be provided no later than four (4) weeks before delivery.
- Documentation to be included with each delivery shall be sent to the person specified in the order form in three (3) copies in paper form and one (1) digital copy (in PDF format and drawings also in DWG format). Documentation to be sent with each delivery shall include:
 - layout drawings
 - single-line diagrams
 - circuit diagrams
 - list of apparatuses
 - list of signs
 - list of torques for screw connections
 - instructions and manuals which is required for installation, commissioning, operation, inspection, troubleshooting, maintenance and repair
 - functional description, manual and testing procedure of the automatic switchover functionality
 - type testing documentation carried out as specified by standards
- All above documents shall be in Swedish.