



27.5 kV AC SWITCHGEARS

■ RAILWAYS ■

BUILDING FUTURE **TOGETHER!**

27.5 kV AC Switchgears

27.5 kV Switchgears are designed to deliver and distribute 50 Hz alternating current (AC) for the supply of AC railway electrification systems at a nominal voltage of 27.5 kV.

«AVL Reach Limited» provides a full range of services: starting from recommendations of the optimal choice of 27.5 kV switchgear components and design, up to installation and commissioning of the delivered equipment on site.

Our range of services is listed but not limited to the following:

- Personnel training for safe operation methods and maintenance;
- Warranty maintenance;
- Post warranty maintenance;
- Spare parts supply;
- Troubleshooting and repair works.

Safety

- Maximum protection against exposure of life components to personnel.
- Fixed power contacts and busbars are protected for safe maintenance.
- Enhanced interlocking system and safeguards eliminate human error.
- Cubicles tested at the independent testing facility.
- Electrocution hazard avoided by keeping all exposed conductive components of 27.5 kV switchgear at earth potential.
- Cubicle is resistant to environmental influence.

Correspondence to International Standards

27.5 kV AC Switchgears were type tested and comply with EN 62271-200 and EN 60694 standards.

Innovation and Design

Switchgear design allows single sided maintenance. Vacuum circuit-breaker is installed on the trolley. Trolley can be positioned in any of three positions: service, control and repair.

Switchgear frame has assembled metal structure. Switchgears are equipped with single door made of solid steel sheet with right or left fixture option.

Inspection window, made of multi-layered polycarbonate, is inbuilt into circuit-breaker compartment door. Power busbars are divided by panes and mounted on insulators. Cable connections are provisioned from the bottom of the switchgear allowing direct connection to the busbars.

One of the most important advantages of the switchgear is its high level of short-circuit resistance.

Switchgear ingress protection level is IP3X.



Maintainability

- Ergonomic industrial design.
- Ease of accessibility to all functional groups.
- Remote and local equipment control options.

Control Panel



▲ Feeder Cubicle

1 Mnemonic diagram

Convenient mnemonic diagrams with LED indication of condition and position of vacuum circuit-breaker and earthing switch

2 Measuring Tools

Ampere meter for load currents indication

3 Circuit-Breaker Manual Control

Circuit-Breaker ON/OFF buttons for local mode operation

4 Inspection Window

Inspection window allows to visually define circuit-breaker position

5 Door Interlocking

Door opening interlocking when vacuum circuit-breaker is closed

6 Handlebar

For manual vacuum circuit-breaker opening/closing in service position

7 Trolley Position

Indicator of trolley drive position

8 Earthing Switch Drive

Manual opening/closing of earthing switch

9 Trolley Manual Control

For trolley manual control (with handlebar)

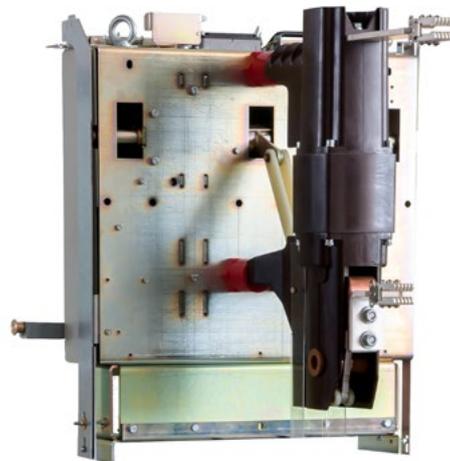
10 Manual Spring Setting

For vacuum circuit-breaker drive spring setting

11 Control Mode Selection

Control modes switching: local/ remote

Main Components of Switchgear



Vacuum Circuit-Breaker

Indoor vacuum circuit-breakers are designed for 27.5 kV rated voltage and 1250 A rated current.

Circuit-breaker is a maintenance free component. It is only recommended to make visual inspection and periodic cleaning of insulation parts and greasing of drive mechanism.

Circuit-breaker has both manual (by push button) and remote (release mechanism) control options.

In addition to release mechanisms switching module comprehensive interlocking system remain last switching operation to be always off.

High quality vacuum tube is placed into molded case made of insulating material.

Advantages:

- vacuum tube is protected against aging and damage by polymer encasement;
- circuit-breaker can be dismantled as an individual unit.

Earthing Switch

Three-pole earthing switches are optimized for zero-current switching on 27.5 kV networks and rated for 20 kA short-time current.

Control and protection units

27.5 kV switchgears control and protection functions are provided by panel type programmable logic controller (PLC) from world's leading manufacturers.

PLC driven unit provides control and protection functions in accordance with IEC61850 standard.



No. ANSI	Control and protection functions
2	Delay Time Starting or Closing Relay
12	Overspeed Device
14	Underspeed Device
15	Speed- or Frequency, Matching Device
24	Over-Excitation
25 /A	Automatic Synchronizing
27	Undervoltage
27B	Busbar undervoltage, set delay
32	Reverse Power
37	Undercurrent
40Q	Excitation Loss Relay
46	Reverse Phase Current
47	Phase Sequence or Phase Balance
49	Thermal
50BF	Breaker Failure
50	Instantaneous Overcurrent
50G/N	Instantaneous Earth Fault
51	Time Overcurrent, Set Delay, IDMT (6 curves)
51G/N	Earth Fault Current, Set Delay, IDMT (6 curves)
51LR	Locked Rotor Protection
51V	Voltage Restrained Overcurrent
59	Overvoltage

No. ANSI	Control and protection functions
59B	Busbar Maximum Voltage Relay, Set Delay
59N	Neutral Overvoltage
64	Ground Detector Relay
66	Starts per Hour
67	Directional Phase Overcurrent, Set Delay, IDMT
67GS/ GD	Directional Earth Fault, Set Delay
78	Out-of-Step / Pole Slip
78S	Out-of –Step Generator / Power Swings Relay
79	AC Reclosing Relay
81	Frequency Relay
81B	Busbar Frequency Relay
86	Lockout Relay
87M	Motor Differential Protection
87T	Transformer Differential Protection
87G	Generator Differential Protection
87LD	Line Differential Protection
87N	Restricted Earth Fault Protection
90	Voltage Regulating
94	Auxiliary Voltage Relay
95i	Harmonics Stabiliser (2nd Harmonic)
FF	Measuring Circuits Fuse Fault Relay

Technical Data of 27.5 kV AC Switchgears

Description		Value
Rated Voltage	kV	27.5
Rated Peak Voltage	kV	30
Rated Frequency	Hz	50
Rated Current	A	630; 1250
Busbars Rated Current	A	1250
Vacuum Circuit-Breaker Rated peak current	kA	50
Rated Short-Time Current:		
• Vacuum circuit-breaker	kA/s	20/3
• Earthing Switch		20/1
Rated Vacuum Circuit-Breaker Current	kA	20
Circuit-Breaker Opening Time, max.	s	0.07
Rated Lightning Pulse Withstand Voltage	kV	170
Poles Number		1/2/3

Vacuum Circuit Breaker Technical Data

Description		Value
Rated Voltage	kV	27.5
Rated Frequency	Hz	50
Rated Current	A	630; 1250
Rated Short Time Current	kA	20
Maximum Short-Circuit Current	s	3
Rated Peak Withstand Current	kA	50
Rated Impulse Withstand Voltage	kA	170
Rated Withstand Power Frequency Voltage	kV	70
Approx. Closing Time	ms	65
Arcing Time	ms	<17
Approx. Opening Time	ms	70
Rated Short-Circuit Opening Current	kA	20
Rated Short-Circuit Closing Current	kA	50
Rated Cable Charge Opening Current	A	50
Operating Cycles		
- vacuum tube at rated current		15.000
- vacuum tube at rated short-circuit breaking current		100
- circuit-breaker mechanism	-	10.000

Earthing Switch Technical Data

Description		Value
Rated Voltage	kV	27.5
Rated Frequency	Hz	50
Rated Short-Time Current	kA	20
Rated Duration of Short-Time Current	s	1
Rated Peak Withstand Current	kA	50
Rated Short-Circuit Closing Current	kA	50
Rated Impulse Withstand Voltage		
- Phase-to-Earth	kV	170
Rated Power Frequency Withstand Voltage		
- Phase-to-Earth	kV	70
Mechanical Life	-	M1 (2000 mechanical cycles)
Approx. Weight	kg	40

27.5 kV AC Switchgears Overall Dimensions



- Automatic and Control Equipment Compartment:
- ① Automatic and Control Equipment
- Busbars Compartment:
- ② Busbars
- Cable Compartment:
- ③ Current Transformer
- ④ Earthing Switch
- ⑤ Cable Clamp
- ⑥ Surge Arrester
- Vacuum Circuit-Breaker Compartment:
- ⑦ Vacuum Circuit-Breaker

Main Types of 27.5 kV AC Switchgears

Type	Description
Incomer Cubicle	Transformer winding connection with 27.5 kV busbars
Power Line Connection Cubicle	Power lines connection to 27.5 kV switchgear busbars
Feeder Cubicle	Traction network feeding line connection with 27.5 kV switchgear main busbar
Busbar Voltage Transformer Cubicle	Includes instrument voltage transformers providing 27.5 kV switchgear busbars voltage supervision
Section Switch Cubicle	Busbars sections interconnection at traction substations



Single-Line Diagrams of 27.5 kV AC Switchgears

Description	Incomer Cubicle	Power Line Connection Cubicle	Feeder Cubicle	Busbar Voltage Transformer Cubicle	Section Switch Cubicle
Single Line Diagram					
Load break / Switch	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Vacuum Circuit-Breaker	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthing Switch	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Current Transformer	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Voltage Transformer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

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