



## 27.5 kV AC SWITCHGEARS

■ RAILWAYS ■

## ABOUT COMPANY

PLUTON is one of the largest manufacturers of electrical equipment on the territory of Europe. We supply our products to many countries of the world. PLUTON leads in electrical industry and successfully works for over 30 years implementing strategy of intensive growth, development, goods and services quality improvement.

Company proved correspondence of its management principles to the requirements of international standard of Quality Management System ISO 9001:2015, Environmental Management ISO 14001:2015, Occupational Health and Safety Management ISO 45001:2018.

Owing to accumulated experience and modern technologies we make power distribution reliable and effective. We build the future, creating the up-to-date products conforming to the international standards, innovative technologies, ensuring safety and comfort for people.

## 27.5 KV AC SWITCHGEARS

Taking into account market tendencies and Customer's needs, we constantly improve and expand product range of PLUTON company offering effective innovative products and solutions conforming to the international requirements and standards. We have created 27.5 kV switchgears which provide reliability and uninterrupted power supply, safety of operation and convenience of service.

27.5 kV Switchgears of manufactured by PLUTON are meant for reception and distribution of AC electric energy of 50 Hz power frequency, with rated voltage of 27.5 kV at AC railway traction substations.

PLUTON provides a full range of services: starting from recommendations on an optimum choice of 27.5 kV switchgear components and design, up to installation and commissioning of the delivered equipment on site.

After switchgears startup we provide:

- Personnel training on correct and safe operation methods and maintenance;
- Warranty maintenance;
- Post warranty maintenance;
- Spare parts delivery;
- Repair works.



## MAIN FEATURES

### Correspondence to International Standards

27.5 kV AC Switchgears were type tested and correspond to international standards EN 62271-200, EN 60694.

### Safety

- Maximum protection against accidental touch to live parts due to the fact that all switchgear components are located in metal enclosure.
- Fixed power contacts connected to the circuit-breaker are protected by moving shutter for safe maintenance.
- Optimal maintenance safety owing to interlocking system that prevent faulty actions of personnel.

### Ecological Compatibility

PLUTON Company uses in its production materials that have minimal influence to environment.

They are safe for people not only during operation, but also in the end of equipment life cycle.

### Maintainability

- Ergonomic industrial design.
- Easy access to all functional groups of equipment.
- Possibility of switchgear built-in equipment manual control when compartments doors are closed or remote control.

- Resistance to emergency arc owing to interlocks and protected enclosure.
- Cubicles were tested for the influence of arc in the independent testing facility.
- All the components of 27.5 kV switchgear enclosure are earthed for safe operation.
- Protected closed enclosure is resistant to environmental influence.
- Switchgear protection level is IP3X.



## DESIGN FEATURES

Switchgear design allows single sided maintenance. Vacuum circuit-breaker is installed on the truck. To make operation easier truck can be placed in 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.

Overview window made of multi-layered polymer glass is built in circuit-breaker compartment door. To connect switchgear cubicles busbars bushing isolators are applied. They are installed on partition panel. Cables connection in the switchgear is done from the bottom where they are fixed with fasteners.

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



## 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

Amperemeter for load current indication

### 3 Circuit-Breaker Manual Control

Circuit-Breaker ON/OFF buttons in local mode

### 4 Inspection Window

Inspection window allows to define visually 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 Truck Position

Indicator of truck drive position

### 8 Earthing Switch Drive

Manual opening/closing of earthing switch

### 9 Truck Manual Control

For truck manual control (with handlebar)

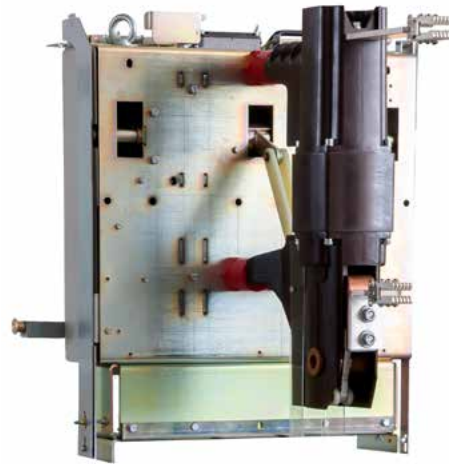
### 10 Manual Spring Setting

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-breakers require little maintenance. It is recommended to make visual inspection and periodic cleaning of insulation parts and greasing of drive mechanism.

It is possible to control circuit-breaker manually by pushing buttons, or electrically (release mechanism).

Actuator's drive reloads energy storage mechanism or coil spring after response.

In addition to release mechanisms switching module also includes interlocks. Last switching operation is always switching off.

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

Advantages:

- vacuum tube is protected against extreme environmental conditions and damage;
- circuit-breaker's pole can be dismantled as one unit.

### Earthing Switch

Three-pole earthing switches are meant for no-current switching off in 27.5 kV MV switchgears and used with 27.5 kV rated voltage and 20 kA rated current.

## Control and protection units

In 27.5 kV switchgears control and protection functions are provided by panel type microprocessor controllers of world-leading manufacturers.

Control and protection microprocessor units provide control and protection functions in accordance with ANSI and IEC standards.



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

### Technical Data of 27.5 kV AC Switchgears

Description	Unit	Value
Rated Service Voltage (Line)	kV	27.5
Maximum Service Voltage (Line)	kV	30
Current Rated Frequency	Hz	50
Main Circuit Rated Current	A	630; 1250
Busbars Rated Current	A	1250
Vacuum Circuit-Breaker Electrodynamic Stability Current	kA	50
Short-Time Thermal Current:		
• Vacuum circuit-breaker	kA/s	20/3
• Earthing Switch		20/1
Vacuum Circuit-Breaker Rated Opening Current	kA	20
Power Circuit-Breaker Total Break Time, max.	s	0.07
Test One Minute Power Frequency Voltage	kV	70
Lightning Impulse Voltage	kV	170
Poles Number		1/2/3

### Vacuum Circuit Breaker Technical Data

Description	Unit	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	Unit	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	kV	170
- Phase-to-Earth		
Rated Power Frequency Withstand Voltage	kV	70
- Phase-to-Earth		
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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