MEDIUM VOLTAGE SWITCHGEAR PANELS CATALOGUE
About us

Acting focused year by year, as a unified team based on passion and confidence, we managed to show that beyond the efficient technical solutions we can develop the ideal performance to customer requests.

Our constant concern for quality has led us, year after year, to focus on updating the machinery, technical equipment and other specific kits for our domain.

Electroalfa is a leading provider of first class solutions for electric power distribution with over 20 years experience in the field. The company manufactures low and medium voltage electrical equipment, power distribution equipment and metallic enclosures. Electroalfa bids and manages contractor works. It provides ongoing technical support, maintenance and post warranty. Electroalfa develops projects aimed at providing and distributing clean energy from renewable sources.

Electroalfa signifies today 10 Business Units, 10 Sales Representatives, 4 workshops, 3 modern factories and a strong brand, based on strong experience, qualifications and enthusiasm of 350 professionals.
We are not just providers of quality equipment offering safety, peace of mind and ease of use, but we are long-term partners for our clients.

Out of the desire to create the highest quality products and to be up-to-date with the technological developments, Electroalfa has implemented and maintains an Integrated Management system pursuant to the requirements of the reference standards: SR EN 9001:2008, SR EN ISO 14001:2005, SR OHSAS 18001:2008, SR ISO/ CEI 27001:2006 and SA 8000:2008, system that was evaluated and certified by SRAC CERT Bucharest Awarding Body and IQNet (SA 8000:2008).

Backed by strong research, our products and services provide our clients all the best in terms of innovation, safety, quality, service.

The Electroalfa character animates every product.

We have also been awarded:

- Licence from the National Commission for Nuclear Activities Control (CNCAN), on the nuclear field of manufacturing;
- Certificate from the National Energy Regulatory Authority (ANRE) – A, B, C1B, C2B, E1, E2, F;
- Partnership approval on the lists of providers for Transelectrica, Electrica and E-on Moldova;
- Certification from the Romanian Railways Authority (AFER) and Romanian Naval Authority (ANR);
- Licence from the Ministry of Agriculture, Forests and Rural Development for land improvement activities (building and installation works);
- Agreements from the Permanent Technical Council for Constructions from the Ministry of Transports, Constructions and Tourism.
The Medium Voltage Business Unit holds a portfolio of primary, secondary distribution switchgear and transformer substations, product of highly complexity and high added value.

All these are the result of two decades of research and development in its own departments as confirmed by independent laboratories and the ever increasing demand of the market.

The high functionality of the equipment and the high operational safety lead are attributes that have made our medium voltage products to benefit of a top position in major customers’ preferences.

Both substation switchgear and transformer substation switchgear are products made by Electroalfa own solutions and they can cover a large range of apparatus are constantly tested in independent laboratories to ensure the reliability and durability.
Medium Voltage Switchgear Panels

Metal enclosed, indoor, simple busbar, air insulated, up to 24 kV and 4000A

The medium voltage switchgear panels metal enclosed, indoor, with simple busbar, air insulated, are modular assemblies of electric equipment, for AC, used in medium voltage networks, which represents the optimal solution in primary and secondary power distribution.

This type of medium voltage switchgear is broadly used in the energy sector, both on the power generation and distribution side, connection points and power points as well as on the secondary distribution for the MV / LV medium voltage transformer stations, and industrial or large individual consumers’ networks.

**Operation Conditions**

As per SR EN 62271-200:2003 and SR EN 62271-1:2009, with the following specifications:

**Climate zone:**
- WDr/CT (moderate: warm dry/ temperate/ cold), according to SR HD 478.21S1.

**Environment temperature:**
- min. -5°C;
- max. +40°C.

The average temperature:
- for 24 hours:
  - max. +35°C.

The relative air humidity:
- max. 80% at 20°C.

**Environment:**
- must be free of dust, no corrosive or flammable gases, vapours or salt beyond limits established by current regulations for indoors electrical installations;
- normal degree of atmosphere aggressiveness.

**Maximum altitude:**
- 1000 m;
- for altitudes above 1000 m refer to supplier.

The above conditions are also considered normal during transport, storage and installation, except that the minimum ambient temperature can fall to -25 ° C.
Classification

According to the location in the energy system the switchgear are classified as follows:
- electrical station switchgear used in medium voltage primary distribution;
- transformer substation switchgear, used in medium voltage secondary distribution, especially for the MV / LV medium voltage transformer substations.

According to the functional role the switchgear are classified as follows:
- line switchgear (incoming/outgoing);
- motor switchgear (with circuit breaker, with contactor);
- special purpose switchgear: coupling, metering, etc.

According to equipment type:
- fixed equipment;
- withdrawable equipment;
- special equipment (e.g. fixed switchgear in withdrawable module).

According to the circuit breaker's switching environment:
- vacuum;
- SF6.

Design

A. The switchgear consist of a metal housing made of steel sheet, assembled by special rivets, fasteners or arc welding, in which the medium voltage equipment is located according to the operation demands, including the withdrawable trolley together with the low voltage, metering, control, protection and signaling equipment. The enclosure is provided with slotted lid and double wall (at the rear) for evacuation of gases resulted from an open arc, leading them to the top. The switchgear are resistant to the action of free electric arc, being tested in accredited laboratories.

B. The support insulators and the crossing insulators are made of mixed hardware based epoxy resin.

C. The switchgear panels are expandable and are designed so inserting new panels into a power station can be achieved easily. The panels are equipped with extensible general busbar and distribution busbar preferably made of copper, as well as general earthing copper busbar, with possibility of connecting to the ground electrode of the electrical substation.

D. The switchgear are provided with screw terminals for mounting medium voltage cables.

E. The trunking cables entry is via openings in the panel's base. These openings are blocked with aluminum caps and insulation boards cut according to the size of the connecting cables.

F. The connection to the medium voltage network can also be done via busbar, preferably copper, both through lower connection or upper connection, usually via enclosed busbar.

G. The secondary circuits are separated of the medium voltage side through metal screens or, on small areas, through insulating tubes. All panels are provided with the possibility of secondary circuits cables crossing to the secondary circuits’ compartment. The connections between the switchgear secondary circuits of the electric station are done via cable trunking located above the secondary circuits’ compartment.

H. A resistance connected through a thermostat is provided in the panel’s compartments eliminating condensation. The interior will be illuminated by lights mounted in the secondary circuit’s compartment.

I. The secondary circuits, which connect the fixed part (switchgear) and the trolley are of multiple contacts socket-plug type and flexible conductors, allowing movement of trolley “operation” and “test” positions.

J. The medium voltage switchgear are mounted in closed rooms, on a horizontal metal frame firmly fixed on the floor.
Primary Distribution Switchgear Panels
Called “Power Station Switchgear”

Technical Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage (Ur):</td>
<td>7,2 kV; 12 kV; 24 kV</td>
</tr>
<tr>
<td>Rated Current (Ir):</td>
<td>max. 4000 A</td>
</tr>
<tr>
<td>Breaking Current:</td>
<td>max. 50 kA</td>
</tr>
<tr>
<td>Rated admissible short-time Current (Ik):</td>
<td>max. 50 kA/1s</td>
</tr>
<tr>
<td>Rated admissible peak current (Ip):</td>
<td>max. 125 kA</td>
</tr>
<tr>
<td>Rated Frequency (Fr):</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Arc resistance:</td>
<td>max. 55 kA</td>
</tr>
<tr>
<td>Protection Class:</td>
<td>IP 3X</td>
</tr>
</tbody>
</table>

General Electric Features

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>U.M.</th>
<th>Values</th>
<th>NB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Voltage</td>
<td>kV</td>
<td>7,2</td>
<td>12</td>
</tr>
<tr>
<td>Lightning impulse withstand rated voltage (phase to earth, phase to phase)</td>
<td>kV</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>50Hz trial withstand rated voltage</td>
<td>kV</td>
<td>20</td>
<td>28</td>
</tr>
<tr>
<td>Rated Current (In):</td>
<td>A</td>
<td>max. 4000</td>
<td>max. 4000</td>
</tr>
<tr>
<td>Breaking Current</td>
<td>kA</td>
<td>max. 50</td>
<td>max. 50</td>
</tr>
<tr>
<td>Rated admissible peak current</td>
<td>kAmax</td>
<td>max. 125</td>
<td>max. 125</td>
</tr>
<tr>
<td>Rated admissible short-time Current</td>
<td>kAef</td>
<td>max. 50/1s</td>
<td>max. 50/1s</td>
</tr>
<tr>
<td>Rated Frequency</td>
<td>Hz</td>
<td>50 (60*)</td>
<td></td>
</tr>
<tr>
<td>Secondary Circuits and Control Circuits Voltage</td>
<td>V</td>
<td>DC</td>
<td>24; 48; 60; 110;220.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC</td>
<td>100; 110; 230.</td>
</tr>
<tr>
<td>Usual protection functions</td>
<td>ANSI code (***)</td>
<td>27; 37; 46; 50; 51; 59; 67N; 81.</td>
<td>**</td>
</tr>
<tr>
<td>Normal Protection Class</td>
<td>IP 3X, upon request IP4X IP 2X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main circuits busbars insulation</td>
<td>air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free arc resistance inside the panels</td>
<td>KA</td>
<td>max. 55 KA</td>
<td>max. 55 KA</td>
</tr>
</tbody>
</table>

* upon special request
** according to the beneficiary’s order, upon request may agree on other values
*** ANSI codes corresponding protections are:

- 27. protection at minimum voltage level;
- 37. idle load protection;
- 46. the phase current unbalance protection;
- 50. instantaneous overcurrent protection (short circuit);
- 51. delayed overcurrent protection (overload);
- 59. maximum voltage protection level;
- 67N. directional earth fault protection;
- 81. network frequency variation protection.
The electrical single line diagrams can be basic, according to diagrams above, or derivatives thereof.
A.1. KV Primary Distribution Switchgear

A.1.1. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 12kV / max. 1250A/ max. 31,5 kA, equipped with Siemens gear

Basic switchgear outlook

S1201: 12kV/ 1250/ 31,5KA Line Switchgear, equipped with type 3AH Siemens circuit breaker

- The switchgear is withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by Siemens, type 3AH, code:
  1) 3AH5-131-1  6) 3AH5-134-1
  2) 3AH5-132-1  7) 3AH5-134-2
  3) 3AH5-132-2  8) 3AH5-135-2
  4) 3AH5-133-1  9) 3AH5-055-2
  5) 3AH5-133-2 10) 3AH5-115-2
12kV, max. 31,5kA, max. 1250 A, 210 mm polar pitch.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators, in the configuration shown in the diagram.
- The switchgear can be fitted with digital protection relays manufactured by Siemens (Siprotec), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 800;  A = 1.590;  H = 2.200.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment door
4) Support Insulator
5) Tube Insulator
6) Secondary circuit compartment
7) Withdrawable vacuum circuit breaker, type 3AH
8) Earthing Switch Disconnector
9) Medium voltage cable
10) Cable Input
11) Current metering transformer
12) Gas exhaust chimney
S1203: 12kV/ 1250/ max. 31,5KA
Metering Switchgear, equipped with withdrawable voltage metering transformers and included HRC fuses

- The metering switchgear is equipped with 3 withdrawable metering transformers, manufactured by Wattsud, EPR 10FS type, or similar, 10 (or 6)/ rad3// 0.1/ rad3// 0,1/ 3kV, with HRC fuse included.

- The switchgear can be fitted with digital protection relays manufactured by Siemens (Siprotec), or digital protection from other manufacturers, according to the technical and financial customers’ demands.

- Panel sizes, in mm:
  L = 600;  A = 1.590;  H= 2.200.

1) Electric diagram
2) Secondary circuit compartment door
3) Support Insulator
4) Tube Insulator
5) Secondary circuit compartment
6) Voltage metering transformer, with HRC fuse included
7) Gas exhaust chimney
A.1.2. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 12kV/ max. 1250A/ max. 31.5 kA, equipped with Schneider gear

Basic switchgear outlook

S1202: 12kV/ 1250/ 31.5KA Line Switchgear, equipped with Schneider, Evolis type, circuit breaker

• The switchgear is withdrawable vacuum circuit breaker.
• The circuit breaker is manufactured by Schneider, type Evolis, code:
  1) 7P1 630  5) 12P1 630
  2) 7P1 1250  6) 12P1 1250
  3) 7P2 630  7) 12P2 630
  4) 7P2 1250  8) 12P2 1250
12KV, max. 31.5KA, max. 1250 A, 210 mm polar pitch.
• The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators, in the configuration shown in the diagram.
• The switchgear can be fitted with digital protection relays manufactured by Schneider (Sepam), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
• Panel sizes, in mm:
  L = 800;  A = 1.590;  H = 2.200.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment door
4) Support Insulator
5) Tube Insulator
6) Secondary circuit compartment
7) Withdrawable vacuum circuit breaker, type Evolis
8) Earthing Switch Disconnector
9) Medium voltage cable
10) Cable Input
11) Current metering transformer
12) Gas exhaust chimney
A.1.3. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 12KV/ max. 2500A/ max. 31,5kA, equipped with vacuum ABB gear

Basic switchgear outlook

S1204: 12 KV/ 1250A/ 31,5KA Line Switchgear, equipped with ABB circuit breaker, type VD4

- The switchgear is withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by ABB, type VD4, code:
  1) VD4/W 12.06.16  5) VD4/W 12.12.16
  2) VD4/W 12.06.20  6) VD4/W 12.12.20
  3) VD4/W 12.06.25  7) VD4/W 12.12.25
  4) VD4/W 12.06.32  8) VD4/W 12.12.32
12KV, max. 31,5KA, max. 1250A, polar pitch of 210mm.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, included in the breaker’s accessories set.
- The switchgear can be fitted with digital protection relays manufactured by ABB (REF, REX, etc.), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 800;  A = 1.590;  H = 2.280.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment door
4) Support Insulator
5) Tube Insulator
6) Secondary circuit compartment
7) Withdrawable vacuum circuit breaker, type EVOLIS
8) Earthing Switch Disconnector
9) Medium voltage cable
10) Cable Input
11) Current metering transformer
12) Gas exhaust chimney
S1208: 12 KV/ 2500A/ 31,5KA Line Switchgear, equipped with ABB circuit breaker, type VD4

- The switchgear is withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by ABB, type VD4, code:
  1) VD4/P12.16.20  6) VD4/P12.20.32
  2) VD4/P12.16.25  7) VD4/P12.25.20
  3) VD4/P12.16.32  8) VD4/P12.25.25
  4) VD4/P12.20.20  9) VD4/P12.25.32
  5) VD4/P12.20.25
  12KV, max. 31,5KA, max. 2500A, polar pitch of 275mm.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, included in the breaker’s accessories set. The switchgear can be fitted with digital protection relays manufactured by ABB (REF, REX, etc.), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 1.000;  A = 1.590;  H = 2.280.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment door
4) Support Insulator
5) Tube Insulator
6) Secondary circuit compartment
7) Withdrawable vacuum circuit breaker, type VD4
8) Earthing Switch Disconnector
9) Medium voltage cable
10) Cable Input
11) Current metering transformer
12) Gas exhaust chimney
A.1.4. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 12KV/ max. 2500A/ max. 31,5kA, equipped with SF6 ABB gear

Basic switchgear outlook

S1205: 12 KV/ 1250A/ 31,5KA Line Switchgear, equipped with ABB circuit breaker, type HD4

- The switchgear is withdrawable circuit breaker, with switching in sulfur hexafluoride.
- The circuit breaker is manufactured by ABB, type HD4, code:
  1) HD4/W 12.06.16  5) HD4/W 12.12.16
  2) HD4/W 12.06.20  6) HD4/W 12.12.20
  3) HD4/W 12.06.25  7) HD4/W 12.12.25
  4) HD4/W 12.06.32  8) HD4/W 12.12.32

12KV, max. 31,5KA, max. 1250A, polar pitch of 210mm.

- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, included in the breaker’s accessories set.
- The switchgear can be fitted with digital protection relays manufactured by ABB (REF, REX, etc.), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  \[ L = 800; \quad A = 1.590; \quad H = 2.280. \]

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment door
4) Support Insulator
5) Tube Insulator
6) Secondary circuit compartment
7) Withdrawable SF6 Circuit Breaker, type HD4
8) Earthing Switch Disconnector
9) Cable Input
10) Medium voltage cable
11) Current metering transformer
12) Gas exhaust chimney
S1209 : 12 KV/ 2500A/ 31,5KA Line 
Switchgear, equipped with circuit breakerABB, type HD4

- The switchgear is withdrawable circuit breaker, with switching in sulfur hexafluoride.
- The circuit breaker is manufactured by ABB, type HD4, code:
  1) HD4/W 12.16.16  6) HD4/W 12.20.32
  2) HD4/W 12.16.25  7) HD4/W 12.25.16
  3) HD4/W 12.16.32  8) HD4/W 12.25.25
  4) HD4/W 12.20.16  9) HD4/W 12.25.32
  5) HD4/W 12.20.25
12KV, max. 31,5KA, max. 2500A, polar pitch of 210mm.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, included in the breaker’s accessories set.
- The switchgear can be fitted with digital protection relays manufactured by ABB (REF, REX, etc.), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 1.000;  A = 1.590;  H = 2.280.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment door
4) Support Insulator
5) Tube Insulator
6) Secondary circuit compartment
7) Withdrawable SF6 Circuit Breaker, type HD4
8) Earthing Switch Disconnector
9) Cable Input
10) Medium voltage cable
11) Current metering transformer
12) Gas exhaust chimney
S1217: 12 KV/ 2500A/ max.31,5KA
Metering Switchgear, equipped with withdrawable voltage transformers, with included HRC fuses

- The metering switchgear is equipped with 3 withdrawable metering transformers, manufactured by ABB, type UMZ, or similar, of 10 (sau 6) /rad3// 0,1/ rad3 // 0,1/3KV, with included HRC fuse.
- The switchgear can be fitted with digital protection relays manufactured by ABB (REF, REX, etc.), or digital protection from other manufacturers, according to the technical and financial customers' demands.
- Panel sizes, in mm:
  \[ L = 800; \quad A = 1.590; \quad H = 2.280. \]

1) Electric Diagram
2) Secondary circuit compartment door
3) Support Insulator
4) Tube Insulator
5) Secondary circuit compartment
6) Voltage metering transformer with fuse HRC
7) Earthing Switch Disconnector - optional
8) Gas exhaust chimney

12 kV Primary Distributions Switchgear Description

The switchgear consist of a metal housing made of steel sheet, assembled by special rivets, fasteners or arc welding, in which the medium voltage equipment is located according to the operation demands, including the withdrawable trolley together with the low voltage, metering, control, protection and signaling equipment. The Electroalfa panels are closed, compartmentalized and internal arc resistant.

The protection class with the doors closed is 3x IP and with the doors open is IP 20.

The enclosure is provided with slotted lid and double wall (at the rear) for evacuation of gases resulted from an open arc, leading them to the top.

The switchgear are manufactured with the following compartments:

1. General Busbar Compartment

It is located at the rear top of the panel and includes air insulated general busbars and the upper contact blocks. It is separated from other compartments by steel boards. Access within this section is not allowed during normal operation of the other substation switchgear panels. The access is achieved by removing the chimney behind the panel, then by removing the cover compartment corresponding to the busbar compartment, fastened with screws. After installing the switchgear, removing and dismantling the chimney behind the busbar compartment and the corresponding cover can be made only after the operator has ensured that there is no voltage in the busbar compartment and the busbars are grounded.
2. Circuit Breaker Compartment

For the switchgear with withdrawable circuit breaker the Circuit Breaker Compartment is located in front middle part of the panel, underneath the secondary circuit compartment and includes the withdrawable trolley where the breaker is set. The trolley moves slowly and smoothly and has three functional positions: operation, test and withdrawn. It is separated from other compartments by fixed and mobile boards. The movable boards (shutters) that provide the visible disconnection of the movable main contacts from the main, fixed contacts of the breaker in test position. The shutters are operated automatically by a joints system on moving the trolley on the rail system. When the trolley is set to test, the shutters obscure the holes in which the fixed contacts are mounted in the panel and are locked in position. Access to this section shall be made by opening the panels' front door. This compartment is accessible during normal operation of other substation switchgear panels. The door in front of the breaker is interlocked with special devices, operating it can only be done by following the sequence of maneuvers displayed on the door.

3. Connections and Fixed Equipment Compartment

The Connections and Fixed Equipment Compartment is located at the bottom of the panel and may include depending on switchgear type: the lower contact blocks, the current transformers, the cables connections, the capacitive dividers for controlling the voltage presence, homopolar current core and the cables’ earthing switch disconnector. The compartment is closed with metal panels fixed with special bolts and screws. The access to this section is allowed during substation normal operation only if special conditions are fulfilled, for example, if the circuit breaker is withdrawn and earthing switch disconnector is closed. To view the interior the door is opened by unscrewing the bolts and unlocking the door and the state of the components can be observed through the viewfinder found on the removable front panel. Removing this panel shall be done only after the operator has ensured that there is no voltage in the compartment and the earthing switch disconnector is closed and locked in this position with the lock type key. Access to this section may be made also by removing the back cover of the panel following the same protection measures that only after the operator has ensured that there is no voltage in the compartment and earthing switch disconnector is closed and locked in position with lock type key. The earthing switch disconnector is operated from the front of the panel, its position being properly indicated on the electric diagram. The medium voltage connections are made using single phase or three phase cables and ensuring conditions for achieving cable termination. For screened cables there is availability to connect the screen to the earthing busbar through a purpose-built screw.

4. Secondary Circuits Compartment

The Secondary Circuits Compartment is located in the upper front of the panel and is accessible during normal operation of the station. The access door is manageable by hand and closes with special locks. All equipment are easily identifiable and accessible after opening the door. The compartment door displays the electric circuit diagram of the station switchgear. The digital protection unit usually found in this compartment is mounted with the operation panel accessible on the compartment door. The metering and control equipment mounted on the compartment door are marked with visible and durable labels and are accessible without opening the door.
5. Withdrawable Voltage Metering Transformers Compartment

The Withdrawable Metering Voltage Transformers Compartment is situated in the metering panel in the middle area underneath the secondary circuits compartment and includes the withdrawable trolley on which are fixed the voltage metering transformers included with HRC Fuses. The withdrawable trolley has three operation positions: charged, discharged and withdrawn and is separated from other compartments by fixed and mobile boards. When the trolley is in “charged” position the holes in which the fixed contacts are mounted are blocked by movable shutters which are locked in this position as long as the cart is in “charged” position. Access to this section shall be by opening the door in front of the cell. This compartment is accessible during normal operation of the substation, and the door is interlocked so that it can only be operated observing the sequence maneuvers displayed on the outside of the door.

This type of medium voltage switchgear panels are fully tested (type tests), according to IEC 62271-200 standard, by accredited laboratories.
A.2. 24KV Primary Distribution Switchgear

A.2.1. Medium Voltage Switchgear Panels, metal enclosed, indoor, with simple busbar system, 24kV/ max.1250A/ max. 25kA, 800 mm width, equipped with Siemens gear.

Basic switchgear outlook

S2401: Line Switchgear 24KV/ 1250A/ 25KA, equipped with Siemens circuit breaker, vacuum, type Sion

- The Switchgear is equipped with withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by Siemens, type SION, code:
  1) 3AE1 321-1  5) 3AE1 323-1
  2) 3AE1 321-2  6) 3AE1 323-2
  3) 3AE1 322-1  7) 3AE1 324-1
  4) 3AE1 322-2  8) 3AE1 324-2
24KV, max. 25KA, max. 1250A, polar pitch of 210mm and distance between input-output terminals of same pole of 310mm.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by Siemens, supplied with the accessories set of each circuit breaker.
- The switchgear can be fitted with digital protection relays manufactured by Siemens (Siprotec), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 800;  A= 1.650;  H= 2.600.
A.2.2. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 24kV/ max. 1250A/ max. 25kA, width of 800 mm, equipped with ABB gear

Basic switchgear outlook

S2402 : Line Switchgear 24 KV/ 1250A/ 25KA, equipped with ABB circuit breaker, Vacuum, type VD4

- The Switchgear is equipped with withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by ABB, and can be one of the following types:
  1) VD4/P 24.06.16, code TN7413
  2) VD4/P 24.06.20, code TN7413
  3) VD4/P 24.06.25, code TN7413
  4) VD4/P 24.12.16, code TN7413
  5) VD4/P 24.12.20, code TN7413
  6) VD4/P 24.12.25, code TN7413
- 24KV, max. 25KA, max. 1250A, polar pitch of 210mm and distance between input-output terminals of same pole of 310mm.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, supplied with the accessories set of each circuit breaker.
- The switchgear can be fitted with digital protection relays manufactured by ABB, or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 800;  A= 1.650;  H= 2.600.

1) Electric diagram
2) Support Insulator
3) Tube Insulator
4) Secondary circuit compartment
5) Withdrawable Vacuum Circuit breaker
6) Connecting cable
7) Earthing Switch Disconnector
8) Current metering transformer
9) Connection Compartment
S2403 : Metering Switchgear 24 KV/ 1250A/ 25KA, equipped with withdrawable voltage metering transformer, with included HRC fuses

- The metering switchgear is equipped with 3 withdrawable metering transformers, manufactured by ABB, Siemens, Wattsud, or similar, of 20/rad3/0,1/ rad3/0,1/3KV, with included HRC fuses.
- The Switchgear can be fitted digital protection relays according to the technical and financial customers' demands.
- Panel sizes, in mm: L = 800; A= 1.650; H= 2.600.

1) Electric Diagram
2) Support Insulator
3) Tube Insulator
4) Secondary circuit compartment
5) Voltage metering transformer, withdrawable, with included HRC fuse
6) Earthing Switch Disconnector- optional
7) Gas exhaust chimney
8) Main Busbars

This type of medium voltage switchgear panels are tested (type tests), according to CEI 62271-200.
A.2.3. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 24kV/ max.1250A/ max. 31,5kA, equipped with ABB gear

Basic switchgear outlook

S2404: Line Switchgear 24 KV/ 1250A/ 25KA, equipped with ABB circuit breaker, vacuum, type VD4

- The Switchgear is equipped with withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by ABB, type VD4, code:
  1) VD4/P 24.06.16  
  2) VD4/P 24.06.20  
  3) VD4/P 24.06.25  
  4) VD4/P 24.12.16  
  5) VD4/P 24.12.20  
  6) VD4/P 24.12.25

- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, supplied with the accessories set of each circuit breaker.

- The switchgear can be fitted with digital protection relays manufactured by ABB (ex. REF542plus, REX), or digital protection from other manufacturers, according to the technical and financial customers’ demands.

- Panel sizes, in mm:
  L = 1.000; A= 1.900; H= 2.150.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment
4) General busbars
5) Tube Insulator, with the fixed contact
6) Mobile Contact
7) Withdrawable Vacuum Circuit Breaker
8) Connecting cable
9) Earthing Switch Disconnector
10) Current metering transformer
11) Gas exhaust chimney
12) Cable connection passage PVC plate
S2406: Line Switchgear 24 KV/ 1250A/ max.31.5KA, ABB equipped with circuit breaker, SF6, type HD4

- The Switchgear is equipped with withdrawable SF6 circuit breaker.
- The circuit breaker is manufactured by ABB, type HD4, code:
  1) HD4/W 24.06.16      5) HD4/W (C) 24.12.16
  2) HD4/C 24.06.16      6) HD4/W (C) 24.12.20
  3) HD4/W (C) 24.06.20   7) HD4/W (C) 24.12.25
  4) HD4/W (C) 24.06.25
24KV, max. 25KA, max. 1250A and HD4/ C 24.12.32 de 24KV, 31,5KA, 1250A polar pitch of 210mm.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators manufactured by ABB, supplied with the accessories set of each circuit breaker.
- The switchgear can be fitted with digital protection relays manufactured by ABB (ex. REF, REX), or digital protection from other manufacturers, according to the technical and financial customers' demands.
- Panel sizes, in mm:
  L = 1.000;  A= 1.900;  H= 2.150.

1) Digital protection relay
2) Electric Diagram
3) Secondary circuit compartment
4) General Busbars
5) Tube Insulator with the fixed contact
6) Mobile contact
7) Withdrawable SF6 Circuit Breaker
8) Connecting cable
9) Cable Input
10) Earthing Switch Disconnector
11) Current metering transformer
12) Gas exhaust chimney
13) Cable passage PVC plate
S2407: Metering Switchgear 24
KV/1250A/ 25KA, equipped with withdrawable metering transformer, with included HRC fuses

- The metering switchgear is equipped with 3 withdrawable metering transformers, manufactured by ABB, type UMZ 24-1F, or similar, of 20/rad3/0,1/rad3/0,1/3KV, with included HRC fuses.
- The switchgear can be fitted with digital protection relays manufactured by ABB (ex. REF542 plus), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm
  L = 1.000;  A= 1.900;  H= 2.150.

1) Voltmeter with voltmeter switch
2) Electric Diagram
3) Electricity meter viewfinder
4) Main Busbars
5) Tube Insulator
6) Secondary circuit compartment
7) Voltage metering transformer with included HRC fuse
8) Gas exhaust chimney
A.2.4. Medium Voltage Switchgear Panels, metal enclosed, indoors, with simple busbars, 24kV/ max.1250A/ max. 25kA, 1000mm width, equipped with Siemens (3AH) gear

Basic switchgear outlook

S2408 : Line Switchgear 24 KV/ 1250A/ 25KA, equipped with Siemens circuit breaker, type 3AH

- The switchgear is withdrawable vacuum circuit breaker.
- The circuit breaker is manufactured by SIEMENS, type 3AH5, code:
  1) 3AH5-282-1…;  3) 3AH5-283-2…;
  2) 3AH5-282-2…;  4) 3AH5-284-2…;
  24KV, max. 25KA, max. 1250A, polar pitch of 275m.
- The withdrawable circuit breaker is equipped with fixed contacts, mobile contacts and tube insulators, in the configuration shown in the diagram.
- The switchgear can be fitted with digital protection relays manufactured by Siemens (Siprotec), or digital protection from other manufacturers, according to the technical and financial customers’ demands.
- Panel sizes, in mm:
  L = 1.000;  A= 2.200;  H= 2.150.

1) Digital protection relay
2) Electric diagram
3) Secondary circuit compartment
4) General Busbars
5) Tube Insulator
6) Contact mobile
7) Withdrawable vacuum circuit breaker, type 3AH
8) Earthing Switch Disconnector
9) Cable Input
10) Medium voltage cable
11) Current metering transformer
12) Contact fix
13) Gas exhaust chimney
S2411: Metering Switchgear 24
KV/ 1250A/ 25KA, equipped with withdrawable metering transformer, with included HRC fuses

- The metering switchgear is equipped with 3 withdrawable voltage metering transformers, manufactured by Wattsud, type EPR 20FS, or similar, of 20/kV/3/0, 1/ rad3/0, 1/3kV, with included HRC fuses.
- The switchgear can be fitted with digital protection relays manufactured by Siemens (Siprotec), or digital protection from other manufacturers, according to the technical and financial customers' demands.
- Panel sizes, in mm:
  L = 1.000;  A = 2.200;  H = 2.150.

1) Voltmeter with voltmeter switch
2) Electric Diagram
3) Electricity meter viewfinder
4) Main Busbars
5) Tube Insulators
6) Secondary circuit compartment
7) Voltage metering transformer with included HRC fuse
8) Gas exhaust chimney
This type of medium voltage switchgear panels are tested (type tests), according to CEI 62271-200, by accredited laboratories.

Switchgear Description

1. General Busbar Compartment

The General Busbar Compartment is located at the rear top of the panel and includes air insulated general busbars and the upper contact blocks. The general busbars are made of electrical copper bars, of rectangular section, corresponding to the rated current applied. The main bars are fixed on epoxy resin support insulators.

The General Busbar Compartment is separated from other compartments by steel boards. Access within this section is not allowed during normal operation of the other substations switchgear panels. The access is achieved by removing the corresponding flaps of this compartment, fastened with screws.

2. Circuit Breaker Compartment

The Circuit Breaker Compartment is located in front middle part of the withdrawable circuit breaker panel, underneath the secondary circuit compartment and includes the withdrawable trolley where the breaker is set. The trolley moves slowly and smoothly and has three functional positions: operation, test and withdrawn. It is separated from other compartments by fixed and mobile boards. The movable boards (shutters) that provide the visible disconnection of the movable main contacts from the main, fixed contacts of the breaker in test position. The shutters are operated automatically by a joints system on
moving the trolley on the rail system. When the trolley is set to test, the shutters obscure the holes in which the fixed contacts are mounted in the panel and are locked in position. Access to this section shall be made by opening the panels’ front door. This compartment is accessible during normal operation of other substation switchgear panels. The door in front of the breaker is interlocked with special devices, operating it can only be done by following the sequence of maneuvers displayed on the door.

3. Connections and Fixed Equipment Compartment

The Connections and Fixed Equipment Compartment is located at the bottom of the panel and may include depending on switchgear type: the lower contact blocks, the current transformers, the cables connections, the capacitive dividers for controlling the voltage presence, homopolar current core and the cables’ earthing switch disconnector. The medium voltage connections are made using single phase or three phase cables and ensuring conditions for achieving cable termination. For screened cables there is availability to connect the screen to the earthing busbar through a purpose-built screw.

4. Secondary Circuits Compartment

The Secondary Circuits Compartment is located in the upper front of the panel and is accessible during normal operation of the station. The access door is manageable by hand and closes with special locks. All equipment are easily identifiable and accessible after opening the door. The compartment door displays the electric circuit diagram of the station switchgear. The digital protection unit usually found in this compartment is mounted with the operation panel accessible on the compartment door. The metering and control equipment mounted on the compartment door are marked with visible and durable labels and are accessible without opening the door.

5. Withdrawable Voltage Metering Transformers Compartment

The Withdrawable Metering Voltage Transformers Compartment is situated in the metering panel is in the middle area underneath the secondary circuits compartment and includes the withdrawable trolley on which are fixed the voltage metering transformers included with HRC Fuses. Access to this section shall be by opening the door in front of the cell. This compartment is accessible during normal operation of the substation, and the door is interlocked so that it can only be operated observing the sequence maneuvers displayed on the outside of the door.
Operating Mechanical Interlockings

Withdrawable circuit breaker switchgear

A. interlocking between the breaker's charging and closing the door:
   • charging the breaker is not possible when the cell door is not closed and locked with the special key;
   • opening the panel door is not possible if the switch is not in the “discharged” position.

B. interlocking between the circuit breaker and the earthing switch disconnector:
   • charging the circuit breaker is possible only if the earthing switch disconnector is in “open” position, symbolized by the red status indicator of the earthing switch disconnector;
   • the earthing switch disconnector is locked in the “open” position when the circuit breaker is in operating position or in intermediate position, between the test position and operating. This blocking is achieved by filling the drive crank hole.

C. interlocking between the charge position and the “closed” position of the circuit breaker
   • both charging and discharging are only possible in the open position of the circuit breaker.

D. interlocking between the circuit breakers’s closing and charging, respectively discharging:
   • closing is impossible outside of the breaker’s charging or discharging positions.

E. interlocking between the medium voltage switchgear’s circuit breaker compartment and the circuit breaker:
   • in the test position of the breaker, the main fixed contacts are visible disconnected from the mobile contacts, by shutters covering the contacts. These shutters are operated by the breaker’s trolley during the move between the charge and discharge positions.

F. interlocking between the circuit breaker compartment door and the low voltage circuits plug:
   • the breaker compartment door cannot be closed if the low voltage circuit plug is not correctly inserted into the socket.

Metering Switchgear

• the switch disconnector can only be operated when no voltage is present or the medium voltage compartment doors are closed;

• the voltage transformer compartment door can be opened only if the switch disconnector is opened;

• the switch disconnector cannot be closed as long as the voltage transformer compartment door is open.