PIX-36

Air Insulated Switchboard
Withdrawable Vacuum / Circuit-breaker up to 36kV
PIX-36
Reliability + Simplicity = Cost optimization!
Your requirements…

Safety

- Operating safety through protection against electrical, mechanical and thermal effects of a fault (insulation of each compartment)
- Most operations carried out from the front, door closed.
- Voltage Presence Indicator System located on the front panel/on rear side
- Position indicator linked to the device’s physical position
- Protection in the event of internal arcing
- Interlocking devices

Reliability

- Type-tested solution which complies with the IEC62271-200 standard
- Design by the most accurate three-dimensional computer techniques
- Manufacturing & Testing according to ISO 9001:2008 quality standard

Simplicity

- On-site information retrieval
- Possibility of remote management
- Maintenance with power on (LSC2B), very simple
- Compartmentalization of MV parts (earthed metallic partitions)
Our solutions

Schneider Electric has developed protection, monitoring and control solutions specifically dedicated to Medium Voltage networks for over 40 years. PIX-36 switchgear has been specifically designed on the basis of that extensive experience. It also incorporates some very new solutions, giving the best in terms of continuity of service and operators’ safety.

High-performance breaking devices

A comprehensive solution

PIX-36 switchgear is fully compatible with
- PowerMeter and Circuit Monitor metering units.
- Sepam multi-function protection relays
  - Protection
  - Measurements and diagnosis.
PIX-36 switchboards can thus be easily integrated into any monitoring and control system.
- Local & remote indication and operation.

Enclosures able to withstand internal arcing
- Internal Arc Classification: AFLR.
- Arc protection unit available, able to detect any arc flash in the installation and to trip the feeding breaker.

PIX-36 in MV networks

PIX-36, a truly professional solution!

PIX-36 can be used for all the segments in MV/MV substations, MV/LV substations in transmission & distribution, mine & metals, renewable energies (wind & solar), large infrastructure & industries.
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PIX-36 is suitable for all electrical power distribution requirements from 1 to 36kV

PIX-36 metal-enclosed switchgear consists of withdrawable units designed for indoor installation. PIX-36 is designed for the MV section of HV/MV substations and high-power MV/MV substations.

PIX-36 offers you:
- Pre-engineered solutions that can be adapted to your specific requirements
- Significantly reduced maintenance
- Local support centres throughout the world.

PIX-36 gives you the advantages of:
- Continuity of service for your networks
- Enhanced safety for your staff and operations
- Optimized investment throughout the life of your installation
- The possibility of incorporating your medium voltage switchboard in a monitoring and control system.

Applications
Power distribution
- Distribution substation
- Delivery substation
- Secondary transmission substation.

Industry
- Oil & gas
- Chemical industry
- Metallurgy
- Car industry
- Mining
- Cement plants

Infrastructures
- Airports
- Ports
- Water treatment
Continuity of service and complete safety

PIX-36 is solidly based on extensive experience acquired throughout the world and provides your networks with a high level of dependability and safety.

PIX-36 incorporates a host of innovative solutions designed around proven techniques: high-performance switchgear, digital protection, monitoring and control systems, enclosures capable of withstanding internal arcing.

From the design stage, PIX-36 allows for three key user requirements:

**Reliability**
- Type testing was carried out for each performance level.
- The design, manufacturing and testing of was carried out according to the ISO 9001:2008 quality standard.
- Three-dimensional computer modelling techniques were used to study electrical fields.

**Simplicity**
- A user interface which is easily understood by everybody.
- Interlocks and padlocks preventing operator errors.
- Sepam-type protection units enabling on-site information retrieval without any additional devices.
- Maintenance limited to simple, routine operating checks and cleaning and greasing every 5 to 10 years.
- Easy installation due to identical civil engineering dimensions for all cubicles.

**Safety**
- Most operations are performed from the front (Operation of earthing switch, line side voltage transformer and installation of medium voltage cable connections from the rear side).
- Racking in or out is only possible with the door closed.
- The power-on indicator is situated on the front of the functional unit.
- The earthing switch has making capacity.
- "Anti-reflex" mechanism in-built in mechanism for operation of earthing switches.
- Internal arc withstand developed for all functional units.
PIX-36, a comprehensive solution

PIX-36 provides the most efficient means to control and protect a wide range of applications. Due to the devices it comprises, PIX-36 can be easily integrated into a monitoring and control system.

Protection and control relays

Sepam

Sepam series 20, series 40, series 60 and series 80 digital protection relays take full advantage of Schneider Electric’s experience in electrical network protection.

They provide all the necessary functions:

- Effective fault diagnosis and protection planning
- Accurate measurements and detailed diagnosis
- Integral equipment control
- Local or remote indication and operation.
- Easy upgrading: addition of communication, digital I/O’s, analog output, or temperature acquisition systems can be added due to its modular design.

MiCOM

MiCOM protection provides the user with a choice of cost-optimised solutions for specific protection requirements within the distribution network.

The MiCOM relay series offers comprehensive protective function solutions for all power supply systems as well as for various functional and hardware project stages.

PowerMeter and Circuit Monitor metering units

The PowerLogic PowerMeter replaces a whole set of basic analogue meters.

This cost-effective, high-performance meter provides a full range of accurate true-rms metering values.

The PowerLogic series 3000/4000 Circuit Monitor is designed for critical power users and large energy consumers, to provide the information needed to confidently enter the evolving world of deregulation.

It can be adapted to meter almost any time-of-use or real-time rate.

Vamp arc flash protection

The arc protection unit detects an arc flash in an installation and trips the feeding breaker.

Arc flash protection maximizes personnel safety and minimizes material damage to the installation in the most hazardous power system fault situations.

Monitoring and control

PIX-36 can be easily:

- Integrated into an existing monitoring and control system:
- Sepam digital relay or PowerMeter/Circuit Monitor metering device through a standard protocol (Modbus)
- Integrated into a SMS PowerLogic electrical installation monitoring system.
Schneider Electric Field Services

On-site to serve you better throughout your installation’s lifecycle

When it comes to your electrical distribution installation, we can help you

- Increase productivity, reliability, and safety
- Mitigate risk and limit downtime
- Keep equipment up to date and extend its lifespan
- Cut costs and increase savings
- Improve your return on investment

We are located wherever you need us.

Schneider Electric has 140,000 employees in more than 100 countries. We offer thousands of highly trained team members: technical support, project managers, and Field Service Engineers (FSE) who have earned a reputation as trusted advisors in the many industries we serve.

Major industries in which Schneider Electric offers experience and solutions:

- Automotive
- Building Management
- Data Centers and Networks
- Education
- Electrical Energy
- Food & Beverage
- Healthcare
- Hotels
- Life Sciences
- Machines
- Marine
- Mining, Minerals, Metals
- Residential Market
- Retail
- Offices
- Oil & Gas
- Water

Plan
What are my options?

Install
How do I install and commission?

Operate
How do I operate and maintain?

Optimize
How do I optimize?

Renew
How do I renew my solution?

More than 175 years of expertise

- Automation and control
- Building systems
- Critical power and cooling
- Electrical distribution
- Energy sustainability
- Engineering
- Industrial maintenance and repair
- Power monitoring
Quality assurance - environment

Certified quality: ISO 9001

A major asset
In each of its units, Schneider Electric has a functional organization whose main role is to check quality and monitor compliance with standards.

This procedure is:
- Uniform throughout all departments
- Recognized by many customers and approved organizations.

But above all, it is its strict application that has allowed us to obtain the recognition of an independent organization: Bureau Veritas.

The quality system for the design and manufacture of PIX-36 is certified as in conformity with the requirements of the ISO 9001:2008 quality assurance standard.

Protected environment
As part of the group’s environmental policy, Schneider Electric Services has an operational subsidiary to recover your medium voltage switchgear and thus eliminate any discharge into the atmosphere.

To help you protect the environment and to relieve you of any concerns regarding storage or dismantling, Schneider Electric Services offers to take back your equipment at the end of its life.

PIX-36 has been designed with environmental protection in mind:
- The materials used, insulators and conductors are identified, easily separable and recyclable
- Production sites are certified compliant with ISO 14001.
A few references

Energy and Infrastructures

**Electrical Energy**
- Bihar State Electricity Board (BSEB)  India
- OPTCL  India
- APCPDCL  India
- TSSPDCL  India
- APTRANSCO  India
- APSPDCL  India
- Reliance Energy Limited  India
- WBSEDCL  India
- Tata Power Limited  India
- Rural Electrification Board  India
- Energie du Mali  Mali
- Electricity Company of Senegal  Senegal
- Ministry of Energy & Water  Senegal

**Oil & Gas**
- Indian Oil Corporation Limited  India
- Indian Oil Corporation Limited  India
- Indian Oil Corporation Limited  India
- Indian Oil Corporation Limited  India
- HMEL  India
- Egyptian refining company  Egypt

**Infrasturctures**
- Delhi Metro Rail Corp. (DMRC)  India
- Mumbai Metro Rail Co. Limited  India
- Jaipur Metro Rail Limited  India
- Kolkata Metro Rail Limited  India
- Sun Edison Solar Project  India
- Renew Solar Project  India
- Inlaks Power solutions Ltd  Nigeria
- Jamuna Future Park  Bangladesh
- Ministry of Defense  Sri Lanka

**Airports**
- Delhi International Airport Limited (DIAL)  India
- Airport Authority Limited  India
- Vijayawada, India

**Industry and Mining, Minerals and Metals**
- Steel Authority of India (SAIL)  Burnpur, India
- Steel Authority of India (SAIL)  Durgapur, India
- Jindal Stainless Steel (JSL)  Jaipur, India
- Jindal Steel & Power Limited  Angul, India
- Essar Steel  Hazira, India
- Bangladesh Steel Re-Rolling Mills  Bangladesh
- Sarbottam Cement  Nepal
- Coast Thread Project  Sri Lanka
- Can Factory  Sri Lanka

**General**
Composition of an PIX-36 switchboard

- PIX-36 switchboards are made up of several interconnected functional units.
- Power connections are made between functional units within a switchboard via a single busbar.
- The electrical continuity of all metal frames is provided by the connection of each functional unit’s earthing busbar to the switchboard’s main earthing circuit.
- Low voltage wiring trays are provided in the switchboard above the LV control cabinets.
- LV control cables can enter the switchboard through the top and bottom of the cubicle.
Description (Cont.)

Description of a functional unit
A functional unit comprises all the devices in the main and auxiliary circuit which together provide a protection function. Each functional unit contains all the components which are required to perform this function:
- The cubicle
- The protection, monitoring and control system
- The withdrawable part.

The cubicle
The cubicle is of LSC2B (Loss of Service Continuity Category) type as defined by IEC standard 62271-200, in other words, the medium voltage parts are compartmented using metal partitions (PM class) which are connected to earth and which separate:
- The withdrawable part (circuit-breaker, disconnector unit or earthing unit)
- The busbars
- Medium voltage connections, earthing switch, current and voltage transformers as required.

The PIX-36 cubicle is available in 2 versions:
- An internal arcing version with IAC-AFLR classification for 0.1s
- An internal arcing version with IAC-AFLR classification for 1s

The PIX-36 is available with DIN current transformers.

The protection, monitoring and control system
This includes:
- Sepam protection, monitoring and control unit
- Vamp arc flash protection system
- Current transformers
- Voltage transformers:
  - withdrawable fused voltage transformers
- Zero sequence core balance current transformers.

The withdrawable part
This includes:
- The circuit-breaker or the earthing unit with its closing and opening mechanism, or the disconnector unit
- Interlocks to fix the withdrawable part on the fixed part either in service position or disconnected.
## Technical characteristics

The values below are given for normal operating conditions as defined in IEC 62271-1 and IEC 62271-200.

<table>
<thead>
<tr>
<th>Vacuum Circuit Breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated voltage</strong></td>
</tr>
<tr>
<td>$U_r$ (kV)</td>
</tr>
<tr>
<td>36</td>
</tr>
<tr>
<td>36</td>
</tr>
<tr>
<td><strong>Rated frequency</strong></td>
</tr>
<tr>
<td>$f_r$ (Hz)</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td>50</td>
</tr>
<tr>
<td><strong>Rated insulation level</strong></td>
</tr>
<tr>
<td>Power frequency withstand voltage 50 Hz - 1 min $U_d$ (kV)</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>70</td>
</tr>
<tr>
<td>Lightning impulse withstand voltage 1.2/50 µs $U_p$ (kV peak)</td>
</tr>
<tr>
<td>170</td>
</tr>
<tr>
<td>170</td>
</tr>
</tbody>
</table>

### Nominal current and maximum rated short-time withstand current

**Functional unit with circuit-breaker** (1)

<table>
<thead>
<tr>
<th></th>
<th>$I_{th\ max}$</th>
<th>$I_{k/tk}$ (kA 3 s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated short-time withstand current</td>
<td>26.3</td>
<td>26.3</td>
</tr>
<tr>
<td></td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Rated normal current**

<table>
<thead>
<tr>
<th></th>
<th>$I_r$ (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In max busbars</td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>2000</td>
</tr>
</tbody>
</table>

**In Circuit Breaker**

<table>
<thead>
<tr>
<th>$I_r$ (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1250</td>
</tr>
</tbody>
</table>

### Internal arc withstand

<table>
<thead>
<tr>
<th></th>
<th>$I_{th}$ (kA/1 s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>With tunnel</td>
<td>31.5</td>
</tr>
<tr>
<td>With Deflector</td>
<td>31.5</td>
</tr>
</tbody>
</table>

### Protection degree

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>IP4X</td>
</tr>
<tr>
<td>LV control cabinet</td>
<td>IP4X</td>
</tr>
</tbody>
</table>

### Dimensions / Weight

<table>
<thead>
<tr>
<th></th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>1000</td>
</tr>
<tr>
<td>Height without IAC Tunnel 2375</td>
<td>2640</td>
</tr>
<tr>
<td>With IAC Tunnel 2875 With Deflectors 2825</td>
<td>2640</td>
</tr>
<tr>
<td>without IAC Tunnel 2375 With IAC Tunnel 2875 With Deflectors 2825</td>
<td>2640</td>
</tr>
</tbody>
</table>

### Additional Information

(1) For functional units equipped with circuit-breakers, the breaking capacity is equal to the rated short-time withstand current. In all cases, the peak making capacity is equal to 2.5 times the rated short-time withstand current for 50 Hz.

(2) Depth is for the standard 2 cable run without line VT. In case of other features the depth may vary:
- Panel with 2 cable run and with line VT - 3100.
- Panel with 4/5 cable run and with line VT - 3560.
- Panel with 4 cable run without line VT - 3100.
- Bus coupler + riser - 2640.
- Bus bar metering - 2640.
- Bus CT - 2640.
Operating conditions

Normal operating conditions in accordance with IEC 62271-1 for indoor switchgear

**Ambient air temperature:**
- Less than or equal to 40°C
- Less than or equal to 35°C on average over 24 hours
- Greater than or equal to -5°C.

**Altitude:**
- Less than or equal to 1000 m
- Above 1000 m, a derating coefficient is applied (please consult us).

**Atmosphere:**
- Little or no dust, smoke, salt, corrosive or flammable gases or vapours (clean industrial air).

**Humidity:**
- Average relative humidity over 24 hours ≤ 95%
- Average relative humidity over 1 month ≤ 90%
- Average vapour pressure over 24 hours ≤ 2.2 kPa
- Average vapour pressure over 1 month ≤ 1.8 kPa.

**Specific operating conditions** (consult us)
PIX-36 has been developed to meet the following specific conditions:
- Temperature (possible derating)
- Altitudes (possible derating).

**Storage conditions**
In order to retain all the functional unit’s qualities when stored for prolonged periods, we recommend that the equipment is stored in its original packaging, in dry conditions sheltered from the sun and rain at a temperature of between -5°C and +40°C.

**Standards**
The PIX-36 range meets the following international standards:
- IEC 62271-1: common specifications for high voltage switchgear & controlgear
- IEC 62271-200: metal-enclosed switchgear for alternating current at rated voltages between 1 and 52 kV
- IEC 62271-100: high-voltage alternating current circuit-breakers
- IEC 62271-102: alternating current disconnectors and earthing switches
- IEC 60255: measurement relay and protection unit
- IEC 61869-2: Current transformers
- IEC 61869-3: Voltage transformers
Protection of people

PIX-36 internal arc (in conformance with IEC 62271-200)

The PIX-36 internal arc protection is AFLR type in order to protect operators when they go around the cubicle.

The PIX-36 switchboard is installed in a room with a minimum height of 4 m (for installation in a room under 4 m, please consult us).

PIX-36 is designed to eliminate the effects of internal arcing safely, by:

- Locating metal flaps above the enclosure to limit overpressure in the compartments in the event of an internal fault
- Using non-flammable materials for the cubicle.
- PIX-36 can be fitted with an optional system to detect internal arcing and disconnect the power supply in order to limit the duration of the fault current to less than 140 ms.

Switchboard operations

The switchboards are installed, operated and maintained from the front panel.

Certain installation and maintenance operations are performed from the rear of the cubicle:

- Installation of medium voltage cables
- Operation of voltage transformers.
- Operation of Earthing Switch

Dependable mechanical control devices

The switchboards are operated from the front panel.

The user is guided through icon-diagrams on each front panel, making it very easy to understand the operating sequence and the device’s status.

Interlocks and padlocks prevent operator errors.

Several additional levels of security also protect operators:

- Racking in and out is only possible with the door closed.
- The very extensive set of mechanical and electrical interlocks prevent operator error.
- These can be supplemented by keylocks or padlocks according to specific operating procedures.
Choice of functional units

The PIX-36 comprises several functional applications. The table below can be used to link requirements to functional units and gives information on the general composition of each unit.

Selection:
You want to supply power to a transformer.
You have selected a transformer feeder/breaker.
The corresponding functional unit will therefore be a TF-B, comprising an AD cubicle fitted with a withdrawable circuit-breaker and a transformer application.

<table>
<thead>
<tr>
<th>Function</th>
<th>Incomer (1)</th>
<th>Feeder/ Outgoing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Line</td>
<td>Transformer</td>
</tr>
<tr>
<td></td>
<td>Line</td>
<td>Transformer</td>
</tr>
<tr>
<td>Cubicle</td>
<td>AD6</td>
<td>AD6</td>
</tr>
<tr>
<td>Device</td>
<td>Vacuum</td>
<td>Vacuum</td>
</tr>
<tr>
<td>Protection relays</td>
<td>Substation</td>
<td>Transformer</td>
</tr>
<tr>
<td>Applications</td>
<td>Substation</td>
<td>Transformer</td>
</tr>
</tbody>
</table>

PIX-36 single-line diagrams

(1) The direct incomer is implemented using a specific cubicle: AL6 (only cable connection).
Choice of functional units (cont.)

<table>
<thead>
<tr>
<th>Bus sectioning</th>
<th>Busbar metering</th>
<th>Cable-in &amp; Cable-out feeder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switchboard</td>
<td>Substation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CL6 and GL6</th>
<th>AD6</th>
<th>TT6 (with earthing)</th>
<th>BM6 and GL6</th>
<th>CICO*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacuum Circuit-breaker</td>
<td>Vacuum Circuit-breaker</td>
<td></td>
<td>Vacuum Circuit-breaker</td>
<td></td>
</tr>
<tr>
<td>Busbar</td>
<td>Substation</td>
<td>Busbar</td>
<td>Busbar</td>
<td>Substation</td>
</tr>
</tbody>
</table>

* PT could be located on either section
AD6
Incomer or Feeder

Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Vacuum Circuit Breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AD6</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>kV</td>
</tr>
<tr>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Rated insulation level</td>
<td>kV 50 Hz - 1 min</td>
</tr>
<tr>
<td></td>
<td>70</td>
</tr>
<tr>
<td>kV impulse 1.2/50 µs</td>
<td>170</td>
</tr>
<tr>
<td>Busbar current</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Feeder current</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Breaking capacity</td>
<td>kA</td>
</tr>
<tr>
<td></td>
<td>26.3 / 31.5</td>
</tr>
<tr>
<td>Short-circuit withstand current</td>
<td>kA rms 3 s / 50Hz</td>
</tr>
<tr>
<td></td>
<td>26.3 / 31.5</td>
</tr>
<tr>
<td>Dimensions</td>
<td>mm Width Height Depth</td>
</tr>
<tr>
<td></td>
<td>1000 2375(1)/2825(2)/2875(3) 2640(4)/3100(5)/3560(6)</td>
</tr>
<tr>
<td>Approximate weight (7)</td>
<td>kg</td>
</tr>
<tr>
<td></td>
<td>2000/2200</td>
</tr>
</tbody>
</table>

1) standalone panel  2) with vertical deflectors for 0.1s IAC  3) with arc tunnel for 1s IAC  4) upto 2 run w/o LPT  5) upto 2 run with LPT/ upto 4/5 run  6) upto 4/5 run with LPT  7) fully equipped cubicle
AL6
Direct incomer

MV components
1 Busbars for cubicle connection
3 MV connections by cable accessible from rear
LV control cabinet
7 Low voltage auxiliaries and protection, monitoring
and control unit are in one cabinet, separated from
the medium voltage part.

Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>AL6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
</tr>
<tr>
<td>Rated insulation level</td>
<td>kV 50 Hz - 1 min</td>
</tr>
<tr>
<td></td>
<td>kV impulse 1,2/50 µs</td>
</tr>
<tr>
<td>Busbar current</td>
<td>A</td>
</tr>
<tr>
<td>800</td>
<td></td>
</tr>
<tr>
<td>1250</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Feeder current</td>
<td>A</td>
</tr>
<tr>
<td>800</td>
<td></td>
</tr>
<tr>
<td>1250</td>
<td></td>
</tr>
<tr>
<td>Short-time withstand current kA rms 3 s</td>
<td></td>
</tr>
<tr>
<td>Dimensions mm</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>1000</td>
</tr>
<tr>
<td>Height</td>
<td>2375(1)/2825(2)/2875(3)</td>
</tr>
<tr>
<td>Depth</td>
<td>2640</td>
</tr>
<tr>
<td>Approximate weight(4) kg</td>
<td>1200</td>
</tr>
</tbody>
</table>

(1) Standalone panel  (2) with vertical deflectors for 0.1s IAC  (3) with arc tunnel for 1s IAC
(4) Fully equipped cubicle

Cubicle description
CL6 - GL6
Bus sectioning

MV components
1 Busbars for cubicle connection
2 Withdrawable part (Vacuum circuit breaker)
5 Current transformers
6 Voltage transformers (withdrawable with fuses)
7 Low voltage auxiliaries and protection, monitoring and control unit are in one cabinet, separated from the medium voltage part.

Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Vacuum Circuit Breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CL6</td>
</tr>
<tr>
<td>Rated voltage (kV)</td>
<td>36</td>
</tr>
<tr>
<td>Rated insulation level (kV)</td>
<td>70</td>
</tr>
<tr>
<td>Busbar current (A)</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>2500</td>
</tr>
<tr>
<td>Feeder current (A)</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td>1250</td>
</tr>
<tr>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>Breaking capacity (kA)</td>
<td>26.3 / 31.5</td>
</tr>
<tr>
<td>Short-circuit withstand current (kA rms 3 s / 50Hz)</td>
<td>26.3 / 31.5</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>Width</td>
</tr>
<tr>
<td></td>
<td>Height</td>
</tr>
<tr>
<td></td>
<td>Depth</td>
</tr>
<tr>
<td>Approximate weight (kg)</td>
<td>1500/1700</td>
</tr>
</tbody>
</table>

(1) Standalone panel  (2) with vertical deflectors for 0.1s IAC  (3) with arc tunnel for 1s IAC
(4) Fully equipped cubicle
TT6
Busbar metering (with earthing)

Cubicle description

MV components
1 Busbars for cubicle connection
4 Earthing switch.
6 Voltage transformers (withdrawable with fuses)

LV control cabinet
7 Low voltage auxiliaries and protection, monitoring and control unit are in one cabinet, separated from the medium voltage part.

Characteristics

<table>
<thead>
<tr>
<th></th>
<th>TT6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>36</td>
</tr>
<tr>
<td>Rated insulation level</td>
<td>70</td>
</tr>
<tr>
<td>kV 50 Hz - 1 min</td>
<td>70</td>
</tr>
<tr>
<td>kV impulse 1.2/50 µs</td>
<td>170</td>
</tr>
<tr>
<td>Busbar current</td>
<td>800</td>
</tr>
<tr>
<td>1250</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>Short-time withstand current</td>
<td>25</td>
</tr>
<tr>
<td>Dimensions</td>
<td></td>
</tr>
<tr>
<td>mm Width</td>
<td>1000</td>
</tr>
<tr>
<td>Height</td>
<td>2375(1)/2825(2)/2875(3)</td>
</tr>
<tr>
<td>Depth</td>
<td>2640</td>
</tr>
</tbody>
</table>

Approximate weight(4) kg 1200

(1) Standalone panel  (2) with vertical deflectors for 0.1s IAC  (3) with arc tunnel for 1s IAC
(4) Fully equipped cubicle
**BM6 - GL6**

**Current and voltage metering**

---

**MV components**
1. Busbars for cubicle connection
2. Busbars for cubicle connection
3. Current transformers
4. Voltage transformers (withdrawable with fuses)
5. Voltage transformers (withdrawable with fuses)
6. Voltage transformers (withdrawable with fuses)
7. Low voltage auxiliaries and protection, monitoring and control unit are in one cabinet, separated from the medium voltage part.

---

**Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>BM6</th>
<th>GL6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rated voltage</strong></td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td><strong>Rated insulation level</strong></td>
<td>50 Hz - 1 min</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>170</td>
<td>170</td>
</tr>
<tr>
<td><strong>Busbar current</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>800</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1250</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td></td>
</tr>
<tr>
<td><strong>Short-time withstand current</strong></td>
<td>3s</td>
<td>26.3 / 31.5</td>
</tr>
<tr>
<td></td>
<td>26.3 / 31.5</td>
<td>26.3 / 31.5</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Width</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>2375 / 2825 / 2875</td>
</tr>
<tr>
<td></td>
<td>Depth</td>
<td>2640</td>
</tr>
<tr>
<td><strong>Approximate weight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200 / 1400</td>
<td>1500 / 1700</td>
</tr>
</tbody>
</table>

---

**(1) Standalone panel  (2) with vertical deflectors for 0.1s IAC  (3) with arc tunnel for 1s IAC  (4) Fully equipped cubicle**
CICO
Cable-in & Cable-out Feeder

MV components
1 Busbars for cubicle connection
2 Withdrawable part (Vacuum circuit breaker)
3 MV connections by cable accessible from rear
4 Earthing switch
5 Current transformers
6 Voltage transformers (withdrawable with fuses). PT could be located on either section

LV control cabinet
7 Low voltage auxiliaries and protection, monitoring and control unit are in one cabinet, separated from the medium voltage part.

Characteristics

<table>
<thead>
<tr>
<th></th>
<th>CI</th>
<th>AD6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>kV</td>
<td>36</td>
</tr>
<tr>
<td>Rated insulation level</td>
<td>kV 50 Hz - 1 min</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>kV impulse 1.2/50 µs</td>
<td>170</td>
</tr>
<tr>
<td>Busbar current</td>
<td>A</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1250</td>
</tr>
<tr>
<td>Rated current</td>
<td>A</td>
<td>800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1250</td>
</tr>
<tr>
<td>Short-time making current</td>
<td>kA</td>
<td></td>
</tr>
<tr>
<td>Short-time withstand current</td>
<td>kA rms 3 s/50 Hz</td>
<td>26.3/31.5</td>
</tr>
<tr>
<td>Dimensions</td>
<td>mm</td>
<td>Width</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td>2375/2825/2875(1)</td>
</tr>
<tr>
<td></td>
<td>Depth</td>
<td>1610</td>
</tr>
<tr>
<td>Approximate weight</td>
<td>kg</td>
<td>300</td>
</tr>
</tbody>
</table>

(1) Standalone panel (2) with vertical deflectors for 0.1s IAC (3) with arc tunnel for 1s IAC
(4) Fully equipped cubicle
Withdrawable parts

Withdrawable parts include:

- The circuit-breaker with its opening and closing mechanism, the disconnector unit and the earthing unit
- The racking in/out handle drive mechanism
- Interlocks for fixing the withdrawable part firmly to the fixed part.

The devices used to equip the PIX-36 range of functional units have outstanding features:

- Long service life
- Maintenance-free live parts
- High electrical endurance
- Very low overvoltage
- Dependability
- Insensitivity to the environment
- Breaking capacity and dielectric strength maintained at atmospheric pressure

**Circuit-breaker**

A circuit-breaker is a safety device used to operate and protect electrical distribution networks. It is fitted in the PIX-36 cubicle to protect all the downstream components in the event of a short circuit.

**Disconnector unit**

The disconnector unit enables the busbar & circuit side of the cubicle to be short-circuited. It is installed in place of the circuit-breaker and provides the same locking possibilities.

**Earthing unit**

The earthing unit is a safety feature used to earth the cubicle busbar. It is installed in place of the circuit-breaker and provides many locking possibilities.

**Metering unit**

The metering unit enables the user to take the voltage input from the busbar or circuit side of the cubicle. It consists of three single phase PTs, whose secondary windings are connected in star, delta or open-delta and the output of these PTs can be used for metering or protection purposes. It provides the same locking possibilities as that of a circuit breaker.

**Racking handle**

This handle is used to:

- Rack the withdrawable part in/out
- In addition to above handle - A "torque handle" slips on applying excess torque thus preventing any accidental damage of the equipment due to mal-operation
# HVX circuit-breakers - Selection guide

## Electrical characteristics according to IEC 62271-100

<table>
<thead>
<tr>
<th></th>
<th>HVX</th>
<th>36</th>
<th>36</th>
<th>36</th>
<th>36</th>
</tr>
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<tbody>
<tr>
<td><strong>Rated voltage</strong></td>
<td>Ur</td>
<td>kV</td>
<td>50 Hz</td>
<td>36</td>
<td>36</td>
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<tr>
<td><strong>Insulation voltage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Power frequency withstand</td>
<td>Ud</td>
<td>kV 50 Hz 1min</td>
<td>70</td>
<td>70</td>
<td>70</td>
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<tr>
<td>- Lightning impulse withstand</td>
<td>Up</td>
<td>kV peak</td>
<td>170</td>
<td>170</td>
<td>170</td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td>Ir</td>
<td>A</td>
<td>1250</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2000</td>
<td>n/a</td>
<td>n/a</td>
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<tr>
<td><strong>Short circuit current</strong></td>
<td>Isc</td>
<td>kA</td>
<td>26.3</td>
<td>26.3</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Rated short-time withstand current</strong></td>
<td>Ik/tk</td>
<td>kA/3 s</td>
<td>26.3</td>
<td>26.3</td>
<td>31.5</td>
</tr>
<tr>
<td><strong>Short-circuit making current</strong></td>
<td>Ip</td>
<td>kA peak</td>
<td>65.75</td>
<td>65.75</td>
<td>78.75</td>
</tr>
<tr>
<td><strong>Rated switching sequence</strong></td>
<td></td>
<td></td>
<td>O-3 min-CO-3 min-CO</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>O-0.3 s-CO-3 min-CO</td>
<td>n/a</td>
<td>n/a</td>
</tr>
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<td><strong>Phase to phase</strong></td>
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<td>254</td>
<td>n/a</td>
<td>n/a</td>
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<td><strong>Operating mechanism</strong></td>
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<td>Frontal</td>
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<td>n/a</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening (ms)</td>
<td></td>
<td></td>
<td>30-65</td>
<td>30-65</td>
<td>30-65</td>
</tr>
<tr>
<td>Arcing (ms)</td>
<td></td>
<td></td>
<td>&lt;15</td>
<td>&lt;15</td>
<td>&lt;15</td>
</tr>
<tr>
<td>Breaking (ms)</td>
<td></td>
<td></td>
<td>45-80</td>
<td>45-80</td>
<td>45-80</td>
</tr>
<tr>
<td>Closing (ms)</td>
<td></td>
<td></td>
<td>40-65</td>
<td>40-65</td>
<td>40-65</td>
</tr>
<tr>
<td><strong>Service temperature</strong></td>
<td>T°C</td>
<td></td>
<td>-5 to +50</td>
<td>-5 to +50</td>
<td>-5 to +50</td>
</tr>
<tr>
<td><strong>Mechanical endurance</strong></td>
<td></td>
<td></td>
<td>M2</td>
<td>M2</td>
<td>M2</td>
</tr>
<tr>
<td>Number of switching operations</td>
<td></td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td><strong>Electrical endurance</strong></td>
<td></td>
<td></td>
<td>E2</td>
<td>E2</td>
<td>E2</td>
</tr>
<tr>
<td><strong>Capacitive current breaking capacity</strong></td>
<td></td>
<td></td>
<td>C2</td>
<td>C2</td>
<td>C1*</td>
</tr>
</tbody>
</table>

- Available
- Not available
* C1 class for capacitor switching & C2 for cable & line charging
Operating mechanism

The operating mechanisms have been simplified to increase reliability and give extended life with very low maintenance. Instead of the traditional spring operating mechanism, the HVX series incorporates a single-shaft system and only one torsion spring, reducing the number of parts and increasing reliability. The cam output from three independent phases is ideal for the vacuum interrupter. The transmission mechanism’s one-step output and the special axletree design provides optimum transmission efficiency to ensure energy saving and a stable, reliable mechanism.

Operating principle

Energy is stored in the spiral spring by means of the electric motor or manual crank. Opening and closing of the vacuum interrupter is controlled by the cam; upon closing, the spring automatically restores the energy for an integrated automatic on/off operating cycle.

An on/off storage mechanism, with its special mechanism, can absorb the excess energy of the drive mechanism through a quick on/off operation. The operating mechanism has electric and manual charging devices. The relevant interlock prevents manipulation errors after energy storage.

Drive spring-charging mechanism using a crank

Electrical circuit diagram - HVX-O without anti-pumping relay *

1. This circuit diagram shows the maximum switchgear equipment. The standard equipment doesn’t include option items; if the customer requires option items, please state it when placing the order.

2. Circuit-breaker is in discharged and open position, trolley is in service position.

* Schematic with anti pumping relay will be available on request
Composition
The circuit opening function can be implemented using the following components:
- Auxiliary release F11/F12
- Under-voltage release F4
- Anti-pumping relay K01

Auxiliary release F11/F12
The auxiliary release coil is actuated by the auxiliary power supply. The coil is designed for short-term operation only; its main circuit is therefore routed via an auxiliary switch contact controlled by the circuit breaker shaft, and upon release it interrupts the current circuit.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>V AC</th>
<th>110/220</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V DC</td>
<td>24/48/110/220</td>
</tr>
<tr>
<td>Threshold</td>
<td>V AC</td>
<td>0.7 to 1.1 Ur</td>
</tr>
<tr>
<td></td>
<td>V DC</td>
<td>0.7 to 1.1 Ur</td>
</tr>
<tr>
<td>Consumption</td>
<td>V AC</td>
<td>250 W</td>
</tr>
<tr>
<td></td>
<td>V DC</td>
<td>250 W</td>
</tr>
</tbody>
</table>

Under-voltage release F4
Under-voltage releases are used for the auxiliary boost voltage return circuit. Whenever the auxiliary current is interrupted or its voltage drops significantly, the switching device is immediately tripped.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>V AC</th>
<th>110/220</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V DC</td>
<td>24/48/110/220</td>
</tr>
<tr>
<td>Threshold</td>
<td>Closing</td>
<td>0.35 to 0 Ur</td>
</tr>
<tr>
<td>Consumption</td>
<td>V AC</td>
<td>approx. 12 W</td>
</tr>
<tr>
<td></td>
<td>V DC</td>
<td>approx. 12 W</td>
</tr>
</tbody>
</table>

Anti-pumping relay K01
If both ON and OFF commands are permanently present on the circuit breaker at the same time, the latter returns to open position after closing; it remains in this open position until the ON command is issued again. This prevents continuous closing and opening (i.e. “anti-pumping”).
HVX circuit-breakers - Circuit closing function

**Function**
Remote control enables remote opening and closing of the circuit breaker.

**Composition**
The remote control mechanism comprises:
- Charging motor M1
- Auxiliary switch in charging position S2
- Auxiliary release F2

**Charging motor M1**
The operation counter installed on the operating interface records the circuit breaker operating frequency.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>V AC</th>
<th>V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>110/220</td>
<td>24/48/110/220</td>
</tr>
<tr>
<td>Threshold</td>
<td>0.85 to 1.1 Ur</td>
<td>0.85 to 1.1 Ur</td>
</tr>
<tr>
<td>Consumption</td>
<td>approx. 100 W</td>
<td>approx. 100 W</td>
</tr>
</tbody>
</table>

**Auxiliary switch in charging position S2**
The auxiliary switch is mainly used to check and indicate the charging status. It is connected by the charging mechanism to ensure that, during the closing operation, the driving mechanism can automatically store energy.

When charging is complete, it breaks the electrical charging circuit. Generally speaking, the circuit breaker is equipped with an auxiliary switch with eight contact elements.

**Auxiliary release F2**
The auxiliary release coil is actuated by the auxiliary power supply. The coil is designed for short-term operation only; its main circuit is therefore routed via an auxiliary switch contact controlled by the circuit breaker shaft, and upon release it interrupts the current circuit.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>V AC</th>
<th>V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>110/220</td>
<td>24/48/110/220</td>
</tr>
<tr>
<td>Threshold</td>
<td>0.85 to 1.1 Ur</td>
<td>0.85 to 1.1 Ur</td>
</tr>
<tr>
<td>Consumption</td>
<td>250 W</td>
<td>250 W</td>
</tr>
</tbody>
</table>
HVX circuit-breakers
- Indication and locking/interlocking function

“Open/closed” auxiliary contacts
The number of contacts available depends on the options chosen on the operating mechanism.
In the basic configuration, the circuit breaker’s operating mechanism comprises a total of:
- 7 normally closed contacts (NC)
- 8 normally open contacts (NO).

Auxiliary switch in switching position S11/S12
Auxiliary switches are always actuated directly by the switch shaft via an intermediate linkage, the position of which always corresponds to the position of the main contacts, indicating the breaker’s on and off position status; during wiring, the interlock assists the release to prevent handling errors.
Generally speaking, the circuit breaker is equipped with two auxiliary switches with a total of eight contact elements.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>DC</th>
<th>AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage of auxiliary switch V</td>
<td>≤ 48</td>
<td>125</td>
</tr>
<tr>
<td>Breaking capacity</td>
<td>A</td>
<td>10</td>
</tr>
<tr>
<td>Time constant T=LR</td>
<td>s</td>
<td>10</td>
</tr>
<tr>
<td>Rated short-circuit withstand current</td>
<td>A/3s</td>
<td>250</td>
</tr>
<tr>
<td>Rated current</td>
<td>A</td>
<td>15</td>
</tr>
</tbody>
</table>

Operation counter
The operation counter installed on the operating interface records the circuit breaker operating frequency.
HVX series

The HVX series vacuum circuit breaker is the technical result of Schneider Electric's years of experience in the medium-voltage field. The HVX series offers a proven state-of-the-art design with Vacuum interrupters in embedded poles to meet the specifications for power switching devices in air-insulated switchgear.

The HVX series circuit breaker is operated via a spring mechanism that provides an operating speed independent of the operator.

Enclosed Pole

Contribution of Schneider Electric to medium voltage products, with its over 10 years experience in design and manufacture, and it has been tested proven in practice of many years.

Employing the enclosed pole technology, it completely integrates the vacuum interrupter, the main circuit and the insulated shaft in an epoxy pole to realize total isolation of the main circuit from the exterior.

This gives the pole the highest environmental adaptability, whereby the circuit breaker can function normally under harsh conditions.

Vacuum interrupter

The Schneider Electric VG series vacuum interrupter achieves the true optimal design, thanks to the newest computer modeling tools. With the most advanced one-stop seal-off technology, the VG series minimizes artificial pollution in production. Based on our patent design and full knowledge of vacuum interrupter technology, the vacuum interrupter of Schneider Electric is a standout in the medium-voltage field with its high reliability, small size and long service life.

Operating principle of Vacuum interrupter

Vacuum interrupters basically have two electrical contacts (fig.1), one fixed and the other mobile, and a sealed enclosure. The latter enables a high level of vacuum to be maintained inside the interrupter (less than 10^-2 Pa) to provide insulation between the open contacts.

The dielectric strength of the vacuum allows the contact-to-contact distance to be reduced. This short distance together with the low opening speed allow the use of a low energy control mechanism. A metal clusters provides the link between the mobile contact and the enclosure.

In order to keep the vacuum level required for the correct operation of the interrupter for 30 years, the enclosure must be perfectly sealed.

In vacuum breaking, the electrical arc generated on separation of the contacts is made up of a plasma of metal vapors produced by the vaporization of the contact material.

At low values of current, these vapors very quickly condense on the shield and contacts when the arc disappears, thus allowing:

- the vacuum to be re-established
- a contact-to-contact dielectric strength to be restored that is greater than the recovery voltage: breaking is then complete.

At high currents, the electrical arc in the vacuum switches to a concentrated mode which causes high, localized temperature rises on the contacts. The existence of these hot spots is detrimental to the quick restoring of the dielectric strength.

Two techniques can be used in order to avoid this stagnation of the static concentrated arc:

- the so called RMF (Radial Magnetic Field) technique, involves rotating the arc thanks to an electromagnetic effect generated by a radial magnetic field; this therefore limits contact erosion.
- a more recent technique called AMF (Axial Magnetic Field) involves applying an axial magnetic field parallel to the axis of the two contacts (fig. 2) which allows a diffuse arc to be maintained (fig. 3) even at high current values. The arc energy is spread over the whole contact surface area, therefore causing very low levels of erosion.
- Schneider Electric has chosen this last technique for the HVX range.
PIX-36 connection

Switchgear resistance to ageing in a substation depends on three key factors

- Correctly executed connections
  New cold-connecting technologies facilitate installation and improve durability over time. They are designed for use in polluted environments with harsh weather conditions.

- Impact of relative humidity
  It is essential to install a heating element in climates with high relative humidity and wide temperature differentials.

- Ventilation control
  The dimensions of the air vents must be appropriate for the energy dissipated in the substation.

The end-pieces are cold-connectable

Schneider Electric’s experience has led it to favour this technology wherever possible for optimum durability over time.

The maximum permissible cable cross-sections for standard assembly are:

- 630 mm² for incomer or feeder cubicles with single-core cables
- 300 mm² for incomer or feeder cubicles with three-core cables
- The diameter of the cables must be <95 mm.

### Dry single-core cable

<table>
<thead>
<tr>
<th>Short cold-connectable end-piece</th>
<th>Performance</th>
<th>Cross-section mm²</th>
<th>Supplier</th>
<th>Number of cables</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.2 to 36 kV</td>
<td>630 mm² XLPE</td>
<td>All suppliers of cold-connectable terminals: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 to 5 per phase</td>
<td>For larger cross sections and more cables, please contact us</td>
</tr>
</tbody>
</table>

### Dry three-core cable

<table>
<thead>
<tr>
<th>Short cold-connectable end-piece</th>
<th>Performance</th>
<th>Cross-section mm²</th>
<th>Supplier</th>
<th>Number of cables</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.2 to 36 kV</td>
<td>300 mm² XLPE</td>
<td>All suppliers of cold-connectable terminals: Silec, 3M, Pirelli, Raychem, etc.</td>
<td>1 to 5 per phase</td>
<td>For larger cross sections and more cables, please contact us</td>
</tr>
</tbody>
</table>

### Connection possibilities using dry cables

<table>
<thead>
<tr>
<th>Number of cables</th>
<th>AD6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 single-core/phase</td>
<td>■</td>
</tr>
<tr>
<td>2 single-core/phase</td>
<td>■</td>
</tr>
<tr>
<td>3 single-core/phase</td>
<td>■</td>
</tr>
<tr>
<td>4 single-core/phase</td>
<td>■</td>
</tr>
<tr>
<td>5 single-core/phase</td>
<td>■</td>
</tr>
<tr>
<td>1 three-core/cubicle</td>
<td>■</td>
</tr>
<tr>
<td>2 three-core/cubicle</td>
<td>■</td>
</tr>
<tr>
<td>3 three-core/cubicle</td>
<td>■</td>
</tr>
<tr>
<td>4 three-core/cubicle</td>
<td>■</td>
</tr>
<tr>
<td>5 three-core/cubicle</td>
<td>■</td>
</tr>
</tbody>
</table>
Implementation examples

Line-up switchboard with internal arc cubicle
- AD6 - Incomer (with or without voltage transformers)
- AD6 - Feeder (with or without voltage transformers)
- CL6 - Bus riser (with or without voltage transformers)
- GL6 - Bus sectioning
## Protection relay - Selection

### Protection relays

<table>
<thead>
<tr>
<th>Protection relay</th>
<th>MiCOM Px10</th>
<th>Sepam series 20</th>
<th>Sepam series 40</th>
<th>MiCOM Px20</th>
<th>Sepam series 60</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="MiCOM Px10" /></td>
<td><img src="image2.png" alt="Sepam series 20" /></td>
<td><img src="image3.png" alt="Sepam series 40" /></td>
<td><img src="image4.png" alt="MiCOM Px20" /></td>
<td><img src="image5.png" alt="Sepam series 60" /></td>
<td></td>
</tr>
</tbody>
</table>

### Functions

Provides protection of network for each application:
- Substations (incomer or feeder type) / Transformers / Motors / Generators / Busbars / Capacitors
- Effective protection of life and property
- Accurate measurements and detailed diagnosis
- Integral equipment control
- Local or remote indications and operation

### Self power / Auxiliary supply

- Auxiliary supply
- Self or Dual supply

### Protection

- Current (1 or 5A)
- Voltage
- Phase & Earth basic
- Directional
- Phase & Earth basic
- Directional
- Phase & Earth basic
- Directional
- Synchro-check

### Display

- Standard UMI
- Remote UM

### Other characteristics

- Input / Output (up to)
- I/O terminals
- Screw type
- Ring lug
- Temperature sensor (up to)
- Communication protocol
- Modbus RTU
- IEC 60870-5-103
- DNP3
- Modbus TCP/IP
- IEC 61850
- No GOOSE
- RSTP*
- Modbus RTU
- IEC 60870-5-103
- DNP3
- Modbus TCP/IP
- IEC 61850
- No GOOSE
- RSTP*

### Logic equations

- Comprehensive logic equations
- Basic logic equations
- Comprehensive logic equations

### Safety characteristics

- IEC and specific country standards (GOST...)
- IEC and specific country standards (UL, CSA, GOST...)
- IEC and specific country standards (UL, CSA, GOST...)
- IEC and specific country standards (UL, CSA, GOST...)

* Ethernet high availability communication
## Protection relay - Selection

<table>
<thead>
<tr>
<th>Sepam series 80</th>
<th>MiCOM Px30</th>
<th>MiCOM Px40</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Sepam series 80" /></td>
<td><img src="image2" alt="MiCOM Px30" /></td>
<td><img src="image3" alt="MiCOM Px40" /></td>
</tr>
</tbody>
</table>

### Functions

#### Self power / Auxiliary supply

<table>
<thead>
<tr>
<th>Auxiliary supply</th>
<th>Auxiliary supply</th>
<th>Auxiliary supply</th>
</tr>
</thead>
</table>

#### Protection

- Current (1 or 5A or LPCT)
- Voltage
- Phase & Earth basic
- Directional
- Synchro-check
- Differential

- Current (1 or 5A)
- Voltage
- Phase & Earth basic
- Directional
- Synchro-check
- Differential
- Line differential
- Distance

- Current (1 or 5A)
- Voltage
- Phase & Earth basic
- Directional
- Synchro-check
- Differential
- Line differential
- Distance
- Busbar differential

#### Display

- Standard UMI
- Remote UM
- Mimic based UMI

- Standard UMI
- Remote UM
- Mimic based UMI
- Standard UMI

#### Other characteristics

- Removable S/W cartridge
- Input / Output (up to)
  - 42 / 23
  - 50 / 26
  - 32 / 32
- I/O terminals
  - Screw type
  - Ring lug
- Temperature sensor (up to)
  - 8 to 16
  - 1/9/10
  - 10
- Communication protocol
  - Modbus RTU
  - IEC 60870-5-103
  - DNP3
  - Modbus TCP/IP
  - IEC 61850
  - Customised GOOSE
  - RSTP*
  - Modbus RTU
  - IEC 60870-5-103
  - DNP3
  - IEC 61850 with GOOSE
  - RSTP / SHP / DHP*
  - Modbus RTU
  - IEC 60870-5-103
  - DNP3
  - IEC 61850 with GOOSE
  - RSTP / SHP / DHP*

#### Logic equations

- Control logic by ladder diagram
- Comprehensive logic equations
- Comprehensive logic equations

#### Safety characteristics

- IEC 61508 - SIL2
- IEC and specific country standards (UL, CSA, GOST...)
- IEC and specific country standards (GOST...)
- IEC and specific country standards (GOST...)
- IEC and specific country standards (GOST...)

### Benefits

**Sepam**
- Hardware modularity and common hardware modules
- Large range of auxiliary power
- ROHS compliant and conformal coated components

**MiCOM**
- Complete and comprehensive product offer
- Full IEC 61850 solution with GOOSE
- All-in-the-box solution
Sepam protection system
- Sepam protection relay range

Sepam: protection digital relays

Sepam is a range of digital monitoring protection and control units. Sepam is the centre of the protection, monitoring and control system for PIX-36 functional units: all the necessary protection, metering, control, monitoring and signalling functions are carried out by Sepam.

The Sepam range is a range of units defined to provide an optimal solution for each application, and includes (e.g.):
- Sepam S, substation incomer and feeder
- Sepam B, bus sectioning
- Sepam T, transformer feeder
- Sepam M, motor feeder
- Sepam G, generator feeder
- Sepam C, capacitor feeder.

The Sepam range consists of the Sepam series 20, series 40, series 60 and series 80, a range of modular protection relays to adapt precisely to your needs.

Protection chain

The Sepam protection units combined with innovative current sensors, provide a comprehensive measurement, protection and energy management chain. *

A high-performance, economical solution

The modular Sepam offer provides a cost-effective solution tailored to every requirement.

Easy to order and install

All the components of the protection chain are referenced and can be delivered very quickly.

The power of a multi-functional digital unit

Sepam is more than a simple protection relay; it is a truly multi-functional unit offering, in particular:
- Circuit-breaker diagnosis functions (switching counter and time, rearming time, cumulated broken A2)
- Direct circuit-breaker control, whatever the type of release unit
- Remote equipment operation using the communication option.

(*) Please check in the Sepam catalogue the sensor to use with each Sepam version.

Each PIX-36 functional unit can be equipped with a comprehensive protection, monitoring and control system comprising:
- Instrument transformers to measure the necessary electrical values (phase current, residual current, voltages, etc.)
- Protection relays, providing functions adapted to the part of the network to be protected
- Metering equipment, to inform operators
- Low voltage relaying, to provide control of the breaking device and of the withdrawable part
- Various auxiliaries: secondary circuit test units, etc.

Sepam advantages

Reliability
- Over 30 years of experience in multi-function digital protection relays.
- Over 600,000 Sepam units in service in more than 90 countries.

Quality
- Quality design based on dependability studies and strict definition of environmental constraints: temperature, pollution, EMC, dielectric strength, etc.
- Quality manufacturing based on procurement agreements with suppliers and inspection at all stages of manufacturing.
- All Sepam series 20, 40, 60 and 80 boards and electronic components are industrially conformal coated. This manufacturing process makes Sepam suitable for use in the most severe industrial environments, including off-shore oil rigs and chemical factories (IEC 60068-2-60 and EIA 364-65A IIIA).

Simplicity of use
- Ergonomic and intuitive user machine interface (UMI).
- User-friendly and powerful PC setting software.
- Predefined functions implemented by simple parameter setting.

Easy installation
- The same, easy-to-install remote modules for all Sepam units.

Intuitive use
- Clear graphic LCD display of all data required for local operation and installation diagnosis.
- Working language may be customized to be understood by all users.
The Sepam range of protection relays is designed for the operation of machines and electrical distribution networks of industrial installations and utility substations at all voltage levels. It includes 3 families:

- Sepam series 20, for routine applications.
- Sepam series 40, series 60 for demanding applications.
- Sepam series 80, for custom applications.

To cover all needs, from the simplest to the most complex.

Sepam is compliant with IEC 61850 (series 20, 40, 60, 80).

### Sepam 100 additional units

Sepam 100 units round off the Sepam range and can be installed either separately or combined with Sepam series 20, series 40, series 60 and series 80 units.

**Sepam 100 has several variants:**

- Sepam 100 MI has local breaking device control and signalling modules (many different line diagram types are available)
- Sepam 100 LA contains self-powering protection (back-up protection without auxiliary power supply)

---

### Sepam 100 MI

- Integrated mimic-based UMI
- Integrated or remote advanced UMI.

### Sepam 100 LA

- Connection of each port to 1 or 2 S-LAN and/or E-LAN networks
- Modbus, Modbus TCP/IP, IEC60870-5-103, DNP3 and IEC 61850 communication protocols
- GOOSE messages and TCP/IP redundancy
- RS485(2 or 4 wire) or fibre-optic network.

### Sepam series 80 modular architecture

1. Base unit, with two types of User Machine Interfaces (UMI):
   - Integrated mimic-based UMI
   - Integrated or remote advanced UMI.

2. Parameters and protection settings saved on removable memory cartridge.

3. 42 logic inputs and 23 relay outputs, including 5 outputs on the base unit, plus 3 optional modules each providing 14 inputs and 6 outputs.

4. 2 independent communication ports:
   - Connection of each port to 1 or 2 S-LAN and/or E-LAN networks
   - Modbus, Modbus TCP/IP, IEC60870-5-103, DNP3 and IEC 61850 communication protocols
   - GOOSE messages and TCP/IP redundancy
   - RS485(2 or 4 wire) or fibre-optic network.

5. Temperature data from 16 sensors: Pt100, Ni100, or Ni120.

6. 1 analogue output: 0-1 mA, 0-10 mA, 4-20 mA or 0-20 mA.

7. Synchro-check module

8. Software tools:
   - Sepam parameter and protection setting and control function customization
   - Programming of specific functions (Logipam)
   - Recovery and display of disturbance recording data
   - Local or remote operation via a communication network.

---

### Sepam multifunction protection relays

**A range of solutions adapted to your application**

- Substation protection (incomers, feeders, busbars)
- Transformer protection
- Motor and generator protection.

**All of the necessary functions for your application**

- Effective protection of people and property
- Accurate measurements and detailed diagnosis
- Full equipment control
- Local or remote indication and operation.

**Flexibility and upgrading capability**

To adapt to as many situations as possible and to allow for future installation upgrading, optional modules may be added to Sepam at any time for new functions.
MiCOM protection system
- MiCOM protection relay range

MiCOM offers varying levels of functionality and hardware.

- Series 10 is designed for universal overcurrent protection for the primary or back-up protection on LV or MV systems.
- Series 20 fulfills the basic requirements of industrial, utility and building applications, providing simplicity and ease of use in a wide range of installations.
- Series 30 is designed to meet the rigorous requirements of MV & HV applications with particular focus on feeder and transformer protection and control.
- Series 40 fulfills the protection requirements for a wide market of utility and industrial systems and offers a complete range of protection functions.

MiCOM protection relays

MiCOM protection provides the user with a choice of cost-optimised solutions for specific protection requirements within the distribution network.

The MiCOM relay series offers comprehensive protective function solutions for all power supply systems, as well as for the various functional and hardware project stages.

With their modular design, the MiCOM device platforms provide the user with multifunctional equipment that can act as:

- Grid protection equipment, and
- Combined protection and control systems
- MiCOM devices integrate most standard communication protocols used in station control systems and SCADA systems
- Due to the continuous further development of these products, compatibility with technical progress in the field of switchgear and controlgear communication is ensured
The arc protection unit detects an arc flash in an installation and trips the feeding breaker.

An arc flash protection system maximizes personnel safety and minimizes material damage caused by arc faults.

Arc flash protection maximizes personnel safety and minimizes material damage to the installation in the most hazardous power system fault situations.

Minimized damage also means limited need for repair work and enables rapid restoration of the power supply.

**Vamp advantages**

**Personnel Safety**
A fast and reliable arc protection unit may save human lives in the event of an arc fault occurring in switchgear during work in or near the installation.

**Reduces production losses**
The shorter the operating time of the arc flash protection unit, the smaller will be the damage caused by the arc fault and the shorter the possible power outage.

**Extended switchgear life cycle**
A modern arc protection unit increases the life-cycle expectancy of switchgear installations, so that decisions to invest in new switchgear installations can be postponed and money can be saved by re-Vamping existing switchgear systems.

**Reduced insurance costs**
The faster and better the protection system of a power installation, the more generous will be the insurance terms and costs.

**Low investment costs and fast installation**
A comprehensive arc protection system is characterized by low investment costs and fast installation and commissioning times. One successful operation of the arc flash protection units provides an immediate investment payoff.

**Reliable Operation**
Operation is based on the appearance of light or alternatively on the appearance of light and current from an external device. Immune to nuisance trippings due to dual tripping criteria; light & current.
Vamp arc flash protection
Vamp arc flash range

**System features**

- Operation on light only (I > criteria can be supplied from another device)
- Integrated 19-256 Vac/dc aux. supply
- Optimized for wind power and other small applications
- Supports point and/or smoke sensors
- Up to 4 sensors
- Selective trip for 2 zones and possibility of generator set emergency trip (separate contact)
- Operation time 7 ms (including the output relay)
- Non-volatile trip status.

- Current and light tripping criteria (possibility of tripping by light only)
- Operating time 7 ms or less (electromechanical contact)
- Accurate location of arc fault utilizing point sensors
- Four selective protection zones per central unit
- Self-supervision of the entire system
- Easy interconnect using VX001 cables
- Phase current measuring
- Earth fault current measuring
- Personal protector option
- Panel or rail mount I/O units
- Circuit breaker fail protection (CBFP).

**Sensors**

**Point sensor (surface)**
- Arc detection from two compartments simultaneously
- Self-monitored
- Cable length adjustable from 6 m or 20 m down.

**Point sensor (pipe)**
- Self-monitored
- Cable length adjustable from 6 m or 20 m down.

**Portable sensor**
- Snap-in connection to I/O unit
- Enhanced work safety.

**Loop sensor (Fibre)**
- Monitors various compartments
- Small bending radius for easy installation.

**Options**

- Please check in the Vamp catalogue for reference number

<table>
<thead>
<tr>
<th>I/O units</th>
<th>VAM 3L</th>
<th>VAM 10L/LD</th>
<th>VAM 12L/LD</th>
<th>VAM 4C/CD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication port for central unit (Vamp 221) and I/O unit</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Point sensor (surface or pipe)</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Loop sensor (Fibre)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portable sensor</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Protection zone supported</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Current inputs</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trip contact</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Protection, monitoring and control**
Conventional current transformers are used to provide power to measuring, metering and monitoring devices. They measure primary currents from 50 A to 2500 A.

Schneider Electric has drawn up a list of preferred current transformers which are appropriate for use with digital protection devices to make it easier to determine accuracy characteristics.

The live parts of the dry-insulated current transformers are incorporated in a resin enclosure. These compact transformers have excellent electrical and mechanical characteristics and are fully protected against fire hazards.

Conventional current transformers provide power to the “current” circuits of measuring instruments and/or protection devices.
DIN current transformers

The PIX-36 cubicles are fitted with DIN current transformers. The current transformers contain 1, 2 or 3 secondary windings rated at 1 to 5 A\(^1\). The primary current values for conventional 1 A or 5 A current transformers are between 200 and 2000 A.

Sepam can be used with all types of current transformer.

\(^1\) For all other characteristics, please contact us.

Instrument transformers (cont.)

For AD6, CL6, GL6, BM6, CICO cubicles

<table>
<thead>
<tr>
<th>Ratio (A/A)</th>
<th>Measurement VA cl 0.5</th>
<th>VA cl 0.5</th>
<th>Protection VA 5P20</th>
<th>25 kA/1sec</th>
<th>25 kA/3sec</th>
<th>31.5 kA/1sec</th>
<th>31.5 kA/3sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>200A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>600A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
<td></td>
<td></td>
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<tr>
<td>800A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
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<td></td>
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<td></td>
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<tr>
<td>1000A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
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<tr>
<td>1250A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
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</tr>
<tr>
<td>1600A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
<td></td>
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<tr>
<td>2000A/ 1+1A</td>
<td>SVA</td>
<td>SVA</td>
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</tr>
</tbody>
</table>

Zero sequence core balance current transformers (CSH type)

For AD6, CICO cubicles

Core balance CT’s provide more sensitive protection by direct measuring of earth fault currents.

Specifically designed for the Sepam range, they can be directly connected to the Sepam “residual current” input.
Rotary voltage transformers

PIX-36 cubicles can be fitted with replaceable fuse type voltage transformers. Please consult us.

The three phase/earth voltage transformers are disconnectable devices.

Each transformer is protected by a fuse incorporated in the transformer primary winding. They are operated simultaneously from the rear of the cubicle.

For AD6, AL6, GL6, TT6, CICO cubicles

<table>
<thead>
<tr>
<th>Ratio</th>
<th>1st secondary winding (VA - class)</th>
<th>2nd secondary winding (VA - class)</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>1st secondary winding voltage</td>
<td>2nd secondary winding voltage</td>
<td></td>
</tr>
<tr>
<td>voltage</td>
<td>voltage</td>
<td>voltage</td>
<td></td>
</tr>
<tr>
<td>22000 / √3</td>
<td>110 / √3</td>
<td>110 / 3</td>
<td>100 VA/CL : 0.5</td>
</tr>
<tr>
<td>22000 / √3</td>
<td>110 / √3</td>
<td>110 / 3</td>
<td>100 VA/CL : 0.5</td>
</tr>
<tr>
<td>33000 / √3</td>
<td>110 / √3</td>
<td>110 / 3</td>
<td>100 VA/CL : 0.5</td>
</tr>
<tr>
<td>33000 / √3</td>
<td>110 / √3</td>
<td>110 / 3</td>
<td>100 VA/CL : 0.5</td>
</tr>
</tbody>
</table>
## PIX-36 cubicle equipment

### 36 kV - 70 kV - 170 kV

### Equipment

<table>
<thead>
<tr>
<th>Cubicle types</th>
<th>AD6</th>
<th>AL6</th>
<th>CL6</th>
<th>GL6</th>
<th>TT6</th>
<th>BM6</th>
<th>CICO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switchgear</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Vacuum circuit-breaker</td>
<td>☑</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
</tr>
<tr>
<td>Disconnector truck</td>
<td>☑</td>
<td>☑</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>☑</td>
</tr>
<tr>
<td>Earthing truck</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Metering truck</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
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<td>Cable connection from the bottom, 1 to 5 three-pole</td>
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(1) With earthing switch option
(2) Integrated fuse
(3) up to 1250 A only
(4) up to 2 n/m phase only

- : Standard equipment
- : Option.
* : Please consult us