PLUTON TURN ON THE FUTURE

X10 EVOLUTION 17.5 kV
AC switchgear with withdrawable vacuum circuit breaker

CITY ELECTRIC TRANSPORT ■
RAILWAYS ■ METRO ■
INDUSTRY ■ POWER INDUSTRY

X10 EVOLUTION

X10 EVOLUTION cubicle is an AC switchgear (hereinafter referred to as X10 or cubicle) with rated voltage up to 17.5 kV, in a metal housing, designed for indoor installation in step-down and distribution substations, as well as distribution centers.

Application areas

/ Urban electric transport, metro, and railway traction and step-down substations

/ Energy sector and infrastructure

/ Industry

X10 EVOLUTION cubicles are designed based on many years of experience in operating similar devices and are intended to ensure reliable and safe operation of electrical networks.

X10 EVOLUTION cubicle combines innovative solutions based on proven technologies and includes:

- high-efficiency switching devices;
- microprocessor-based protection, monitoring and control systems.

Reliability

/ X10 EVOLUTION cubicle is designed, manufactured and tested in accordance with the requirements of DSTU EN 62271-1:2018, DSTU EN IEC 62271-200:2022, DSTU EN 60071-2:2022 and GOST 1516.3-96, as well as in accordance with the requirements of international standards: quality management system ISO 9001:2015, environmental management system ISO 14001:2015 and occupational health and safety management system OHSAS 18001:2007.

Safety

/ All operations, including access to the outgoing line cables and busbars, are performed from the frontside of the cubicle.

/ High voltage indicator is located on the front of the cubicle.

/ Earthing disconnector is highly resistant to through short-circuit currents.

/ Operated by handles with protection against accidental position change.

/ Resistant to internal arcing.

Ease of operation

/ Intuitive user interface.

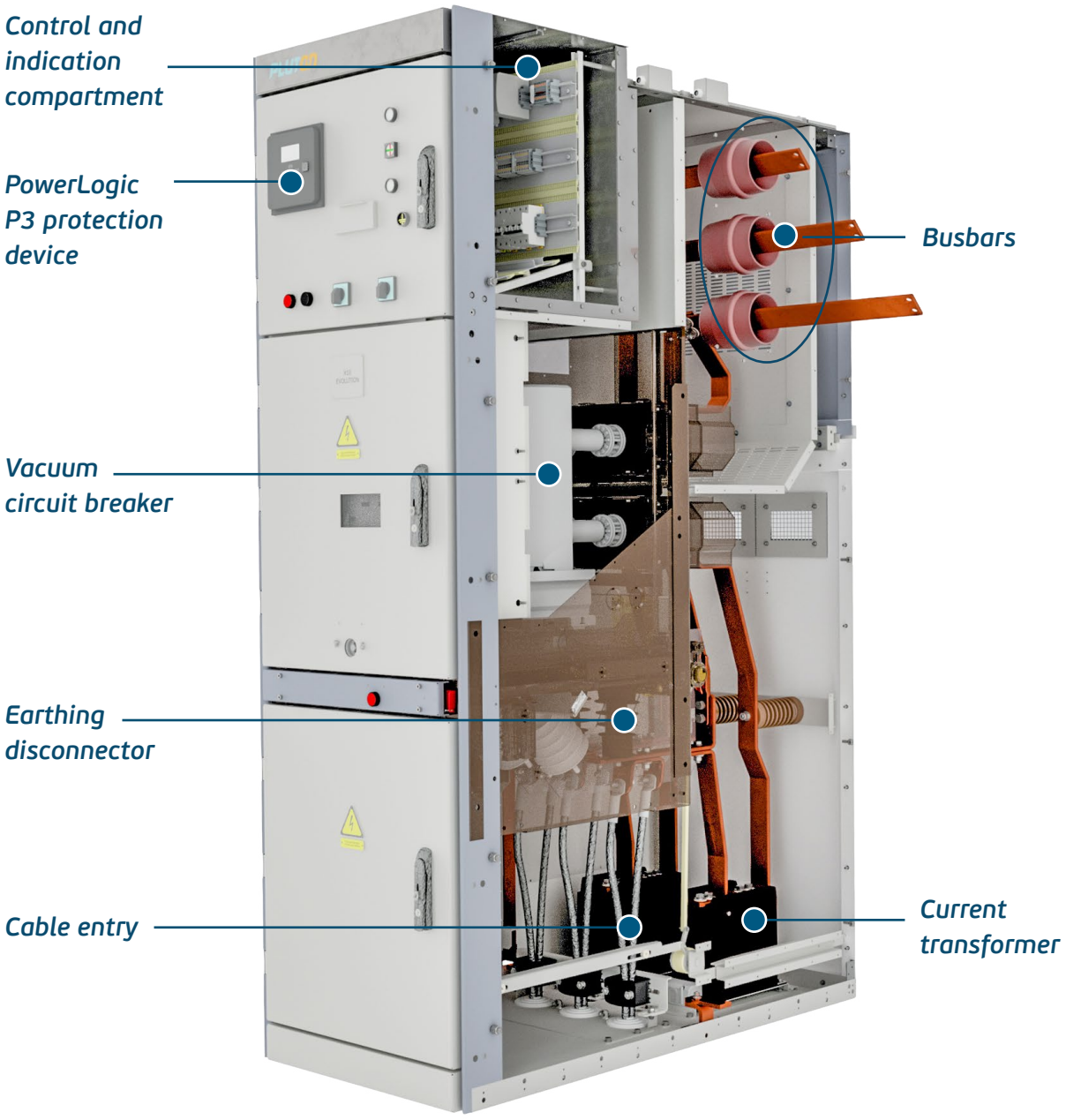
/ Protection against personnel incorrect operations by means of interlocks and locks.

/ Power Logic P3 type protection device (Sepam, MiCOM) ensures displaying of all necessary information. Thus, there is no need to install additional devices.

/ Maintenance is done no more than once every 5 years and includes routine checks, cleaning and greasing.

/ Easy installation due to unified installation dimensions, cubicles can be placed right up to the wall.

MAIN COMPONENTS



General information

X10 EVOLUTION series cubicle complies with the requirements of DSTU EN 62271-1:2018 and DSTU EN IEC 62271-200:2022.

The cubicle consists of 4 compartments separated by metal walls:

- **control and indication compartment**. PowerLogic P3 protection device (Sepam, MiCOM) (at the Customer's request), monitoring, control, energy metering devices, etc. are located in the compartment;
- **switchgear compartment**. In addition to withdrawable unit with vacuum circuit breaker (trolley with withdrawable disconnector or withdrawable unit of voltage measuring transformers), there are sliding metal curtains, automatically closed when the withdrawable unit is moved from the operating to control position;
- **power cables compartment.** Cable entries, earthing disconnector, high voltage indication system module, current transformers and voltage transformers are located in the compartment;
- **power and main busbars compartment**. Copper busbars and bushing insulators are located in the compartment.

All metal parts of X10 EVOLUTION cubicle are earthed:

- cubicle housing and doors;
- withdrawable unit (circuit breaker, trolley with disconnector or withdrawal unit of voltage measuring transformers) – in accordance with technical requirements for these components;
- cable entries, earthing disconnector, current transformers, and voltage transformers – in accordance with technical requirements for these components.

Each compartment (except for control and indication compartment) has its own gas discharge channel with a pressure relief valve.

X10 EVOLUTION cubicles provide a high degree of staff protection due to the interlocking system.

Low-voltage auxiliary equipment and monitoring unit are separated from high-voltage section and located in control and indication compartment.

Protection, monitoring, and control system

- voltage transformers;
- Easergy PowerLogic P3, Sepam, MiCOM protection, monitoring, and control system;
- zero sequence current transformer;
- current transformers.

Withdrawable unit

- circuit breaker, cassette with earthing disconnector, trolley with vacuum circuit breaker, disconnectors;
- lever-type mechanism for drawing in and withdrawing;
- locks for fixing the withdrawable unit in both operating and control positions.

RELAY PROTECTION AND CONTROL DEVICES

X10 EVOLUTION applies advanced control and protection solutions, ensuring easy integration of X10 EVOLUTION cubicles into automated substation control systems.

Sepam

Sepam digital relay protection devices of 20, 40, 60, and 80 series are designed based on worldwide experience in the field of electrical network protection.

Sepam features:

- effective protection of equipment and staff;
- accurate measurements and detailed diagnostics;
- control of power switching devices;
- monitoring and indication of power switching device status;
- data exchange with centralized control system via communication network;
- easy functionality extension due to modular design: connection of additional communication modules, inputs/outputs, and temperature sensors.

MiCOM

MiCOM digital relay protection devices with various levels of functionality and hardware options allow to meet customer requirements with maximum efficiency and select the optimal solution.

Hardware platforms of 10, 20, 30, and 40 series are the basis for developing multifunctional solutions of protection, control, monitoring, measurement, and communication. MiCOM S1 universal software provides convenient tools for setup and configuration.

Support of multiple communication protocols, including IEC 61850, makes it easy to integrate MiCOM devices into existing SCADA monitoring and control systems.

PowerLogic P3

PowerLogic P3 provides a wide range of functions for earth fault protection, voltage and frequency protection. Additional features such as flexible automatic reclosing (ARC) and circuit breaker failure backup (CBFB) functions make it a versatile solution for distribution networks.

PowerLogic P3 is applied for medium and low voltage connections in distribution networks and industrial facilities. Due to its advanced overheating protection, the device is also effective for small and medium power asynchronous motors. The device supports directional current protection and automatic reclosing functions to protect feeders. Voltage, frequency, and compensation protection functions extend standard functionality of the device for use in various applications.

Benefits:

Reliable hardware
- Choice of Ethernet or RS-485 interface ports;
- Designed for harsh industrial environments;

One hardware platform to reduce costs
- Powerful processor with IEC 61850 and standard protocols support;

Friendly interface and high functionality
- One common software package for all PowerLogic P3 series;
- Standard USB (type B) port for connection to PC for working with software (eSetup Easergy Pro);

Up-to-date external interface (HMI)
- LCD display for messages and events;
- Cubicle mnemonic diagram with real-time control, indication, and measurement;
- Programmable keys and LEDs;
- ON/OFF circuit breaker control keys.

STANDARDS

The design and development of X10 EVOLUTION cubicles complies with the following national and international standards:

DSTU EN 62271-1:2018
(IEC 62271-1:2017)
High-voltage switchgear and controlgear.
Part 1. General technical requirements for AC high-voltage switchgear and controlgear.

DSTU EN 62271-100:2017
(IEC 62271-100:2008)
High-voltage switchgear and controlgear.
Part 100. AC automatic circuit breakers.

DSTU EN IEC 62271-102:2022
(IEC 62271-102:2018)
High-voltage switchgear and controlgear.
Part 102. AC disconnectors and earthing switches.

DSTU EN 62271-103:2016
(IEC 62271-103:2021)
High-voltage switchgear and controlgear.
Part 103. Load break switches for rated voltages above 1 kV and up to 52 kV.

DSTU EN IEC 62271-200:2022
(IEC 62271-200:2021)
High-voltage switchgear and controlgear.
Part 200. AC metal-enclosed switchgear for rated voltages above 1 kV and up to 52 kV.

DSTU IEC 60282-2
(IEC 60282-2:2008)
High-voltage fuses.
Part 2. Expulsion fuses.

DSTU EN 60255:1:2022
(IEC 60255-1:2009)
Measuring relays and protective equipment.
Part 1. General requirement.

DSTU EN 61869-2:2017
(IEC 61869-2:2012)
Measuring transformers.
Part 2. Additional requirements for current transformers.

DSTU EN 61869-3:2017
(IEC 61869-3:2011)
Measuring transformers.
Part 3. Additional requirements for inductive voltage transformers.

DSTU EN 60529:2019
Degrees of protection provided by enclosures (IP Code).

X10 EVOLUTION TECHNICAL FEATURES

Name of parameter	Unit	Value		
Rated voltage	kV	7.2	12	17.5
Industrial frequency voltage of 50 Hz, 1 min withstand	kV	20 (32)*	28 (42)*	38
Pulse value 1.2/50 μs	kV	95		
Rated short-term withstand current**	kA/s	25/3 31.5/3		
Rated peak withstand current**	kA	63/82		
Busbars rated current	A	1250		
Rated current of main circuits**	kA	630 800 1250		
Internal arc resistance (optional) IAC-AFLR	kA/0.5 s	25/0.5		

* - parameter values according to GOST 1516.3-96;

** - parameter values depending on the applied type of high-voltage vacuum circuit breaker.

IAC (classification according to internal arc resistance).
Access to metal parts of the cubicle can be provided from different sides.
The following symbols are used to indicate different sides of the enclosure (in accordance with the requirements of DSTU EN IEC 62271-200:2022):
A: restricted access, for authorized staff only;
F: access to the cubicle front;
L: access to the cubicle side;
R: access to the cubicle rear side.
LSC2B - this category indicates: when the doors of the main circuit compartment are open, the other compartments may be live.

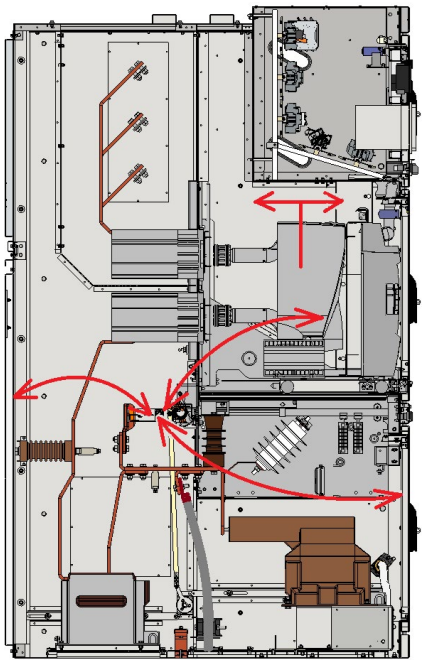
The cubicle includes:

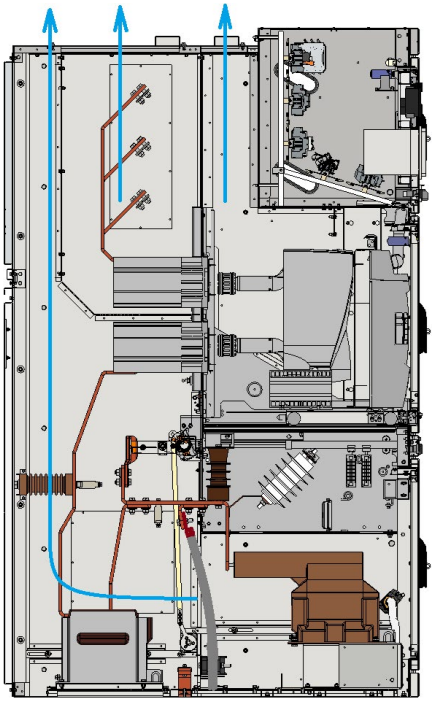
- withdrawable vacuum circuit breaker;
- cassette with metal protective curtains and special inputs;
- earthing disconnector;
- control and signaling circuits between the control and indication compartment, and the circuit breaker auxiliary equipment.

Design

- resistance to internal arc (IAC - AFLR classification);
- 3 high-voltage compartments (LSC2B classification in accordance with DSTU EN IEC 62271-200:2022 requirements);
- all metal surfaces have anti-corrosion coating;
- panels are made of galvanized steel sheet in accordance with ISO 3575: 2016 or hot-dip galvanized steel sheet in accordance with ISO 5002: 2008;
- both single-sided and double-sided cubicle maintenance is possible.

Protection class
- IP4X for the enclosure according to DSTU IEC 60529: 2019;
- IP2X between cubicle compartments according to DSTU IEC 60529:20199.





Interlocks

Interlocks integrated into the cubicle prevent incorrect actions by staff.

X10 EVOLUTION ensures safety of:

- access to the power cables compartment;
- withdrawable units drawing in and out;
- earthing disconnector switching;
- switchgear unit (circuit breaker) compartment doors opening.

Safety

Basic design of the cubicle includes outlets for gas exhaust through pressure relief valves.

Each compartment has its own gas outlet.

Protection against internal arcing

X10 EVOLUTION cubicles are structurally protected against damaging internal arcing effects and ensure safety for service personnel.

Internal arc detector - an electronic module with optical sensors - can be installed as an option in X10 EVOLUTION cibicle. The optical sensors measure intensity of light produced by the arc in X10 EVOLUTION cubicle. After processing data from sensors, the electronic module issues a signal to trip the circuit breaker.

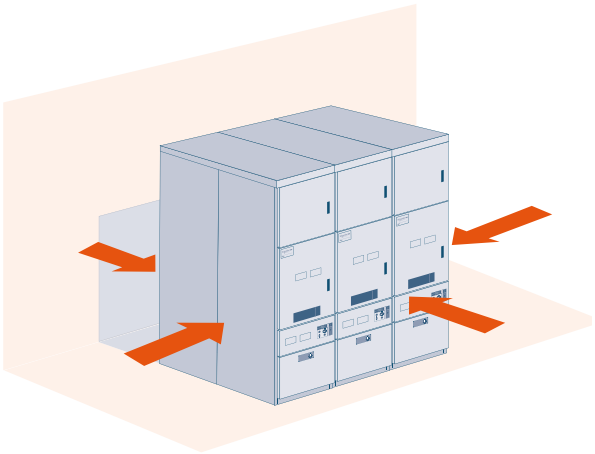
In case X10 EVOLUTION is installed in the middle of facility, four-sided protection is provided for the safety of service personnel.

Safety levels

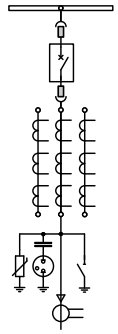
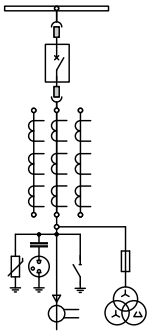
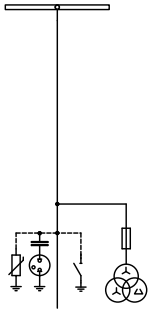
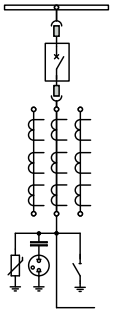
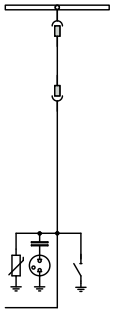
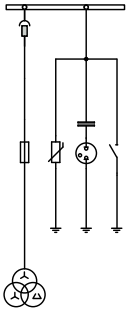
The service staff is guided by mnemonic diagrams on the front panel of the cubicle, allowing them to determine the sequence of equipment control operations and check the device status at any given moment. Interlocks and locks prevent errors by service personnel.

Several additional safety levels are provided for the personnel safety:

- vacuum circuit breaker can only be operated with the compartment doors closed;
- a number of mechanical and electrical interlocks prevent errors by service personnel;
- locking interlocks are provided;
- cubicle is controlled from the front panel;
- voltage indicator is installed on the cubicle front side on control and indication compartment door.



MAIN FUNCTIONAL VERSIONS*

Appli-cation	Connection to input or feeder line				Connection of two busbar systems		Connection of voltage transformer to busbar for measurement purposes
	EBW	EBM	EDC	EDM	EBC	EBR	EVM
Cubicle identi-fication	Cubicle with vacuum circuit breaker	Cubicle with vacuum circuit breaker and voltage transformer	Blind input/ output cubicle	Blind input/ output cubicle with voltage transformers	Coupling breaker cubicle	Section disconnector cubicle	Measuring cubicle
Single-line diagram							

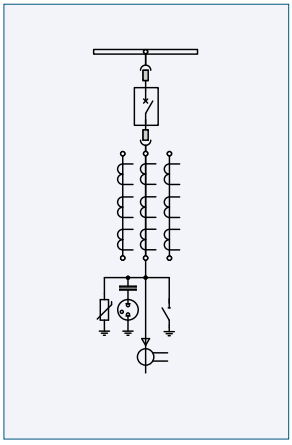
*Depending on the application and the Customer requirements, AC switchgear based on X10 EVOLUTION cubicles can be configured with X10 EVOLUTION cubicles with other diagrams and components.

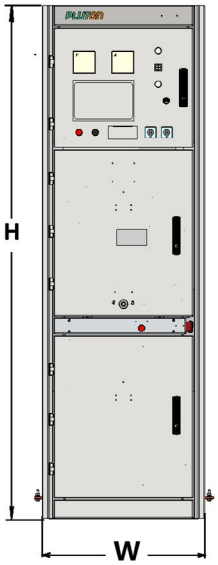
FUNCTIONAL VERSIONS

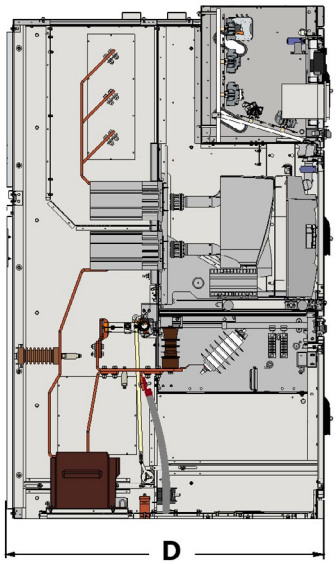
X10 EVOLUTION EBW
cubicle with vacuum circuit breaker

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	630, 800, 1250**
Breaking capacity	kA	25/3; 31.5/3**
Rated short-time withstand current	kA/s	25/3; 31.5/3**
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96;
** - parameter values depending on the type of high-voltage vacuum circuit breaker applied.







Components

Control and indication compartment:
- PowerLogic P3, Sepam, or MiCOM relay protection device

Circuit breaker:
- EasyPact EXE series circuit breaker

Earthing disconnector

Voltage indicator

7.2 (12, 17.5) kV cables connection:
- cables connection from top;
- cables connection from bottom

Current transformers*:
- 3 current transformers;
- 2 current transformers

Surge arresters

Anti-condensation heaters

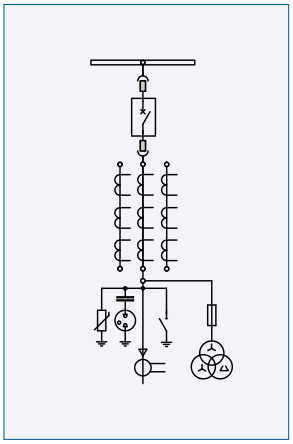
* - upon agreement, the cubicles can be equipped with current and voltage transformers manufactured by Schneider Electric or other manufacturers

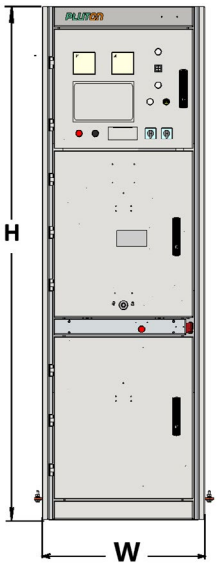
FUNCTIONAL VERSIONS

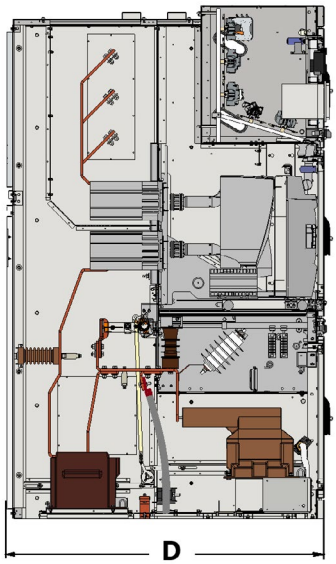
X10 EVOLUTION EBM
Cubicle with vacuum circuit breaker and voltage transformer

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	630, 800, 1250**
Breaking capacity	kA	25/3; 31.5/3**
Rated short-time withstand current	kA/s	25/3; 31.5/3**
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96;
** - parameter values depending on the type of high-voltage vacuum circuit breaker applied.







Components

Control and indication compartment:
- PowerLogic P3, Sepam, or MiCOM relay protection device

Circuit breaker:
- EasyPact EXE series circuit breaker

Voltage transformers*:
- fixed with fuses;

Earthing disconnector

Voltage indicator

7.2 (12, 17.5) kV cables connection:
- cables connection from top;
- cables connection from bottom

Current transformers*:
- 3 current transformers;
- 2 current transformers

Surge arresters

Anti-condensation heaters

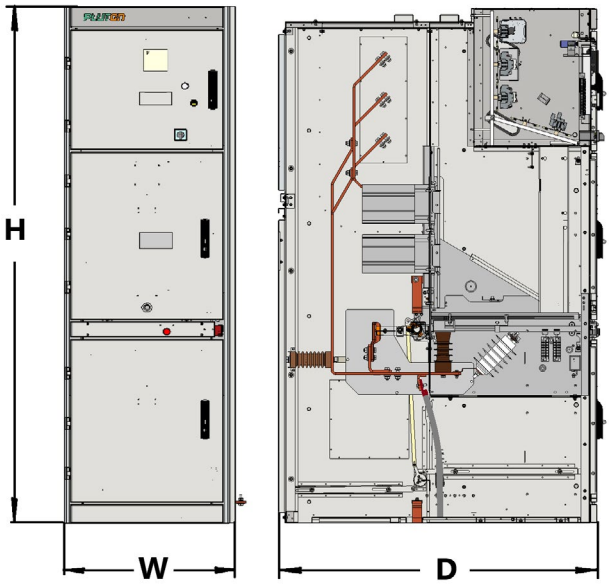
* - upon agreement, the cubicles can be equipped with current and voltage transformers manufactured by Schneider Electric or other manufacturers

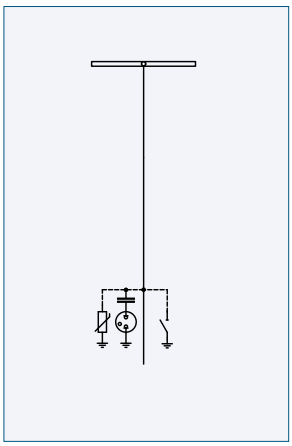
FUNCTIONAL VERSIONS

X10 EVOLUTION EDC
Blind input/output cubicle

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	up to 1250
Rated short-time withstand current	kA/s	25/3; 31.5/3**
KNumber of cables connected per phase	-	2
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96.
** - parameter values depending on the switchgear parameters.





Components

Voltage indicator

Surge arrester

Fixed earthing device*

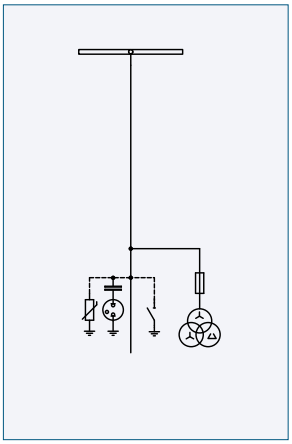
* -upon agreement with the Customer.

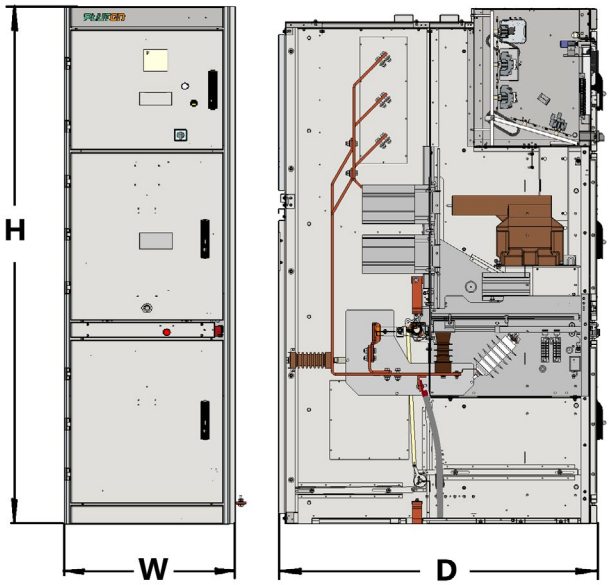
FUNCTIONAL VERSIONS

X10 EVOLUTION EDM
Blind input/output cubicle with voltage transformers

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	up to 1250
Rated short-time withstand current	kA/s	25/3; 31.5/3**
Number of cables connected per phase	-	2
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96;
** - parameter values depending on the switchgear parameters.





Components

Control and indication compartment:
- voltmeter

Voltage transformers*:
- fixed with fuses

Voltage indicator

Surge arresters

Fixed earthing device**

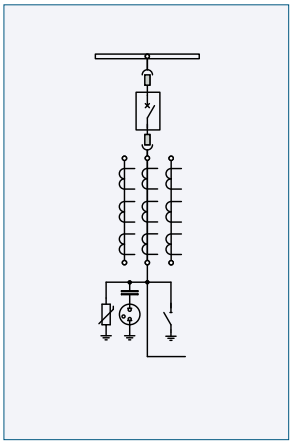
* - upon agreement with X10 EVOLUTION manufacturer, the cubicles can be equipped with products manufactured by Schneider Electric or other manufacturers.
** - upon agreement with the Customer.

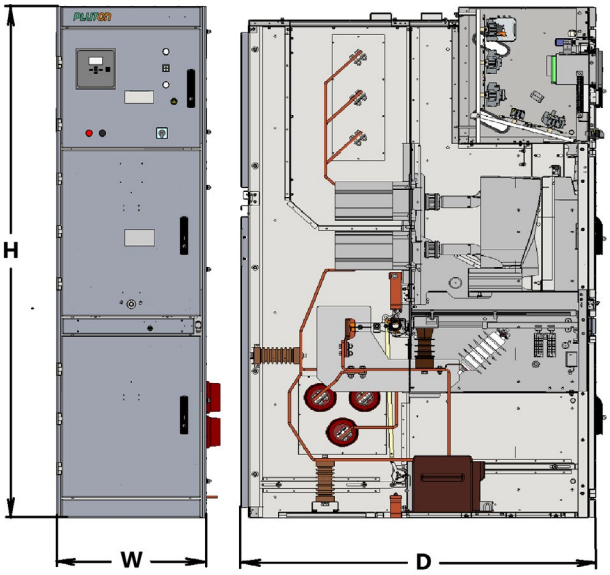
FUNCTIONAL VERSIONS

X10 EVOLUTION EBC
Coupling breaker cubicle

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	630, 800, 1250**
Breaking capacity	kA	25/3; 31.5/3**
Rated short-time withstand current	kA/s	25/3; 31.5/3**
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96;
** - parameter values depending on the type of high-voltage vacuum circuit breaker applied.





Components

Control and indication compartment:
- PowerLogic P3, Sepam, or MiCOM relay protection device

Circuit breaker:
- EasyPact EXE series circuit breaker

Earthing disconnector

Voltage indicator

Busbars output:
- Busbars output to the right;
- Busbars output to the left.

Current transformers*:
- 3 current transformers;
- 2 current transformers;

Surge arresters

Anti-condensation heaters

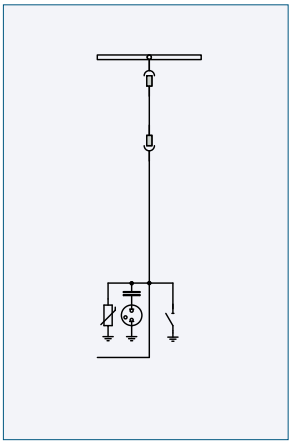
* - upon agreement, the cubicles can be equipped with current and voltage transformers manufactured by Schneider Electric or other manufacturers

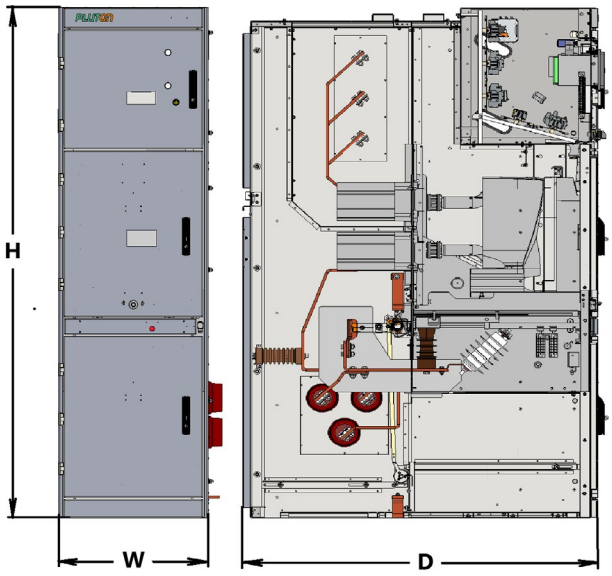
FUNCTIONAL VERSIONS

X10 EVOLUTION ESR
Section disconnector cubicle

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	1250
Breaking capacity	kA	25/3; 31.5/3**
Rated short-time withstand current	kA/s	25/3; 31.5/3**
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96;
** - parameter values depending on the switchgear parameters.





Components

Disconnector (jumper):
- EasyPact EXE series jumper.

Earthing disconnector

Voltage indicator

Busbars output:
- Busbars output to the right;
- Busbars output to the left;
- Cables connection from bottom.

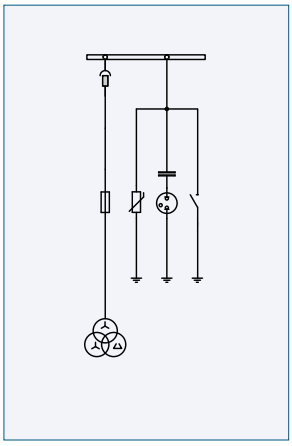
Anti-condensation heaters

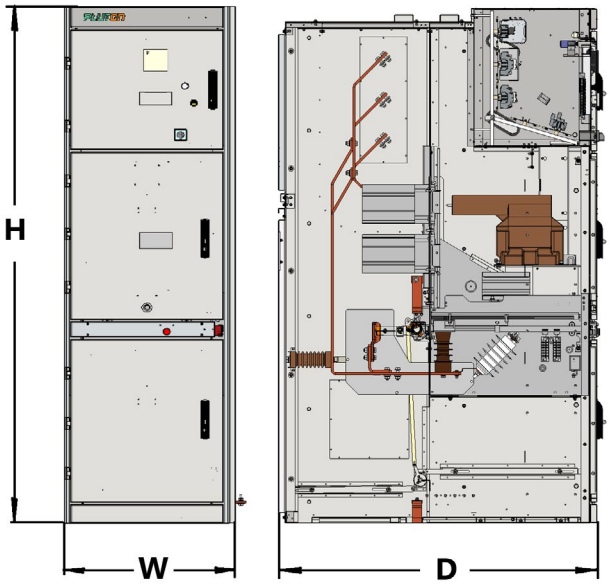
FUNCTIONAL VERSIONS

X10 EVOLUTION EVM
Measuring cubicle

Name of parameter	Unit	Value
Technical data		
Rated voltage	kV	7.2; 12; 17.5
Electrical insulation strength		
Power frequency withstand voltage 50 Hz -1 min	kV	20 (32)*; 28 (42)*; 38
Voltage pulse value 1.2/50 μs	kV	95
Rated current	A	630, 800, 1250**
Rated short-time withstand current	kA/s	25/3; 31.5/3**
Dimensions		
Width (W)	mm	650
Height (H)	mm	2217
Depth (D)	mm	1375

* - parameter values according to GOST 1516.3-96;
** - parameter values depending on the switchgear parameters.





Components

Control and indication compartment:
- voltmeter

Voltage transformers*:
- withdrawable with fuses

Earthing disconnector

Voltage indicator

Surge arresters

Anti-condensation heaters

* - upon agreement with X10 EVOLUTION manufacturer, the cubicles can be equipped with products manufactured by Schneider Electric or other manufacturers

CONTROL, MONITORING AND PROTECTION

Current transformers

Standard current transformers are applied to supply measuring, counting, and control equipment. Current transformers comply with IEC 61869-2:2012 standard.

We recommend application of the current transformers listed below together with the relay protection system. Current transformers from other manufacturers may be installed upon agreement with the Customer.

Transformers are installed in the rear lower part of the cubicle. The transformer operating part is completely sealed with epoxy resin, providing electrical insulation and mechanical strength.

For EBW, EBM, and EBC cubicles, ATB 10-BSB current transformers with a rated primary winding current of 50-2500 A are used.

Voltage transformers

These transformers are used to supply power to:

- measuring, control, and monitoring equipment;
- relay protection devices;
- secondary circuits for powering other switching equipment.

All these devices are protected and separated from the busbar compartment. Voltage transformers comply with IEC 61869-3:2012 requirements. Voltage transformers are recommended to be used together with digital protection system.

Transformers are installed in the middle or front lower part of the cubicle. The operating part is completely sealed with epoxy resin, providing electrical insulation and mechanical strength.

For measuring cubicles, cubicles with vacuum circuit breakers and voltage transformers, and for blind input/output cubicles with voltage transformers:
Voltage transformer with VTB 10-KFP fuse
- Phase/ground;
- Frequency 50-60 Hz.

Transformation ratio		6000-17500/√3 //100/√3//100/3
Measurement	class 0.5	50 VA
	1,0	50 VA
Protection	3P	100 VA

CONTROL, MONITORING AND PROTECTION

Zero-sequence current transformers (CSH type)

CSH 120 and CSH 200 type toroidal current transformers provide more sensitive protection by directly measuring the earth fault current.
Zero sequence current transformers differ only in diameter:

- CSH 120 - 120 mm internal diameter;
- CSH 200 – 200 mm internal diameter.

Earthing disconnector

Earthing disconnector is used to ground and short-circuit cable terminals before starting works in the cable compartment.
The earthing disconnector in voltage transformer functional module grounds the switchgear busbar.

Earthing disconnector meets the requirements of IEC 60271-102:2018 standard and includes:

- high speed closing mechanism independent of the operator;
- device blocking the disconnector operation when the switching device compartment is opened and the circuit breaker is withdrawn.

Low voltage equipment

The following equipment can be used for installation in the control and indication compartment:

- low-voltage automatic circuit breakers for currents from 1 A to 25 A;
- buttons;
- rotary switches.

CONTROL, MONITORING AND PROTECTION

Voltage availability indication system (SN 2/SN 3/SN 4)

Voltage availability indication system together with the cubicle power circuit capacitive dividers provide indication (light signal) of voltage availability in each phase of the main circuit.

Voltage availability is signaled separately for each monitored phase. The signaling device is manufactured in accordance with LRM system requirements of IEC 62271-215:2021 and IEC 62271-213:2021 standards. The signaling device is connected by means of isolators with capacitive dividers.

The front panel is equipped with:

- power supply LED;
- voltage availability LED for at least one of the monitored phases;
- voltage absence LED for all monitored phases;
- button for starting local monitoring of DOC device operation;
- LCD display;
- test connector in accordance with LRM system.

Electric power monitoring and metering device

PowerLogic Power Meter electric power monitoring and metering device offers high performance and optimal cost.
The device can operate independently or as a component of an automated electric power monitoring and metering system.

The device features:

- internal memory for storing/analyzing electric power consumption;
- built-in clock/calendar/date setting.

Application:

- separate measurement and displaying modules;
- direct connection to 600 V: higher voltages with transformers.

Other devices, PowerLogic Circuit Monitor, are available for application with 7.2, 12, and 17.5 kV voltage.

Main functions:

- comprehensive electric power monitoring;
- electric power quality analysis;
- results recording.

EASYPACT EXE VACUUM CIRCUIT BREAKER

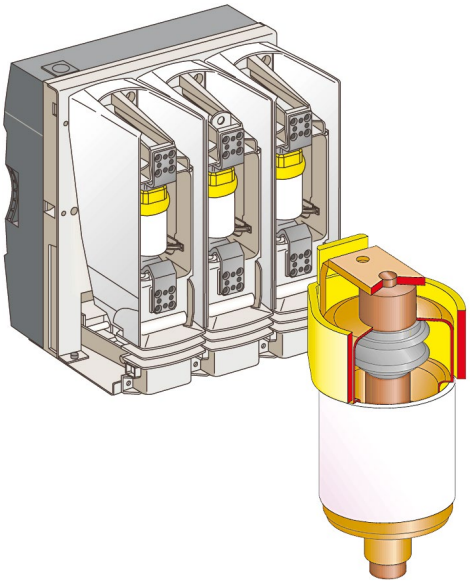
EasyPact EXE circuit breakers are applied as switching devices for protection and control of distribution and industrial networks.

EasyPact EXE circuit breaker parameters:
- rated voltage 17.5 kV;
- maximum breaking capacity at short circuit up to 31.5 kA;
- rated current: from 630 A to 1250 A;
- axial magnetic field (AMF) technology during tripping;
- withdrawable design.

Electrical wear resistance

Special shape of operating contacts in the circuit breaker vacuum tubes and axial magnetic field during arc extinction ensure «the softest» arc extinction possible for this type of circuit breaker, even at high currents.

Advantages of this technology:
- compact operating contacts and vacuum tubes;
- “soft” arc extinguishing.



Mechanical wear resistance

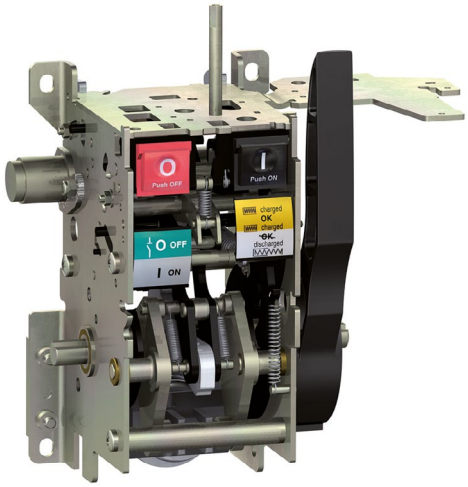
Electromagnetic field is generated by an external winding around the contact area.
This technical solution has many advantages:
- simplifies and thus increases reliability of the vacuum tube;
- heavy-duty contacts are not deformed during closing and opening.

The control mechanism used in EasyPact EXE circuit breakers offers advantages that have been proven over 10 years in hundreds thousands of electrical installations.
EasyPact EXE meets the highest requirements for mechanical wear resistance (IEC 62271-100: class M2).

SPRING DRIVE P2

Principle of spring drive P2 operation

The drive ensures independent closing and opening of the circuit breaker, both in manual and remote control modes. The electric control mechanism activates the device and automatically resets via gear motor each time after activation.



Components:

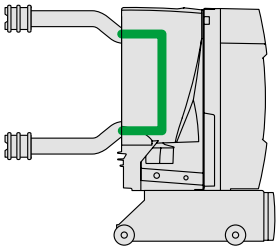
- spring drive, energizing springs for circuit breaker closing and opening;
- gear motor with manual release (applied at no voltage)
- manual actuator with operating buttons (available in “Test” position)
- remote switching device with interlock relay;
- disconnecting device with one or more tripping coils:
  - tripping coil;
  - minimum voltage coil;
- switching cycles counter;
- main contacts and springs status mechanical indicators and three auxiliary contact blocks, each consisting of four switching contacts operating in accordance with the diagram;
- drive armed status indicating device consisting of mechanical indicator and electrical contact.

■ standard configuration
□ option

WITHDRAWABLE BRIDGE

Provides disconnection of power circuit parts in the cubicle. Installed in a cassette in place of withdrawable circuit breaker.

Electrical characteristics				
Rated voltage	Ur	kV	7.2- 17.5	
Pole-to-pole distance		mm	150	
Rated current	Ir	A	1250	1250
Thermal withstand current (3 s)	Ik	kA	25	31.5



TECHNICAL CHARACTERISTICS

Rated parameters					
Parameter name		Unit	Value		
Voltage	Ur	kV	7.2	12	17.5
Insulation voltage: • Industrial frequency 50 hz - 1 min • lightning surge (1.2/50 µs)	Ud Up	kV	20 (32) 57	28 (42) 75	38 95
Frequency			50-60		
Thermal withstand current	Ik/tk	kA/s	25/3		
Electrodynamic withstand current (surge)	Ip	kA	2,5 Ik/tk (50 Hz)		
Rated making current		kA	2,5 Ik/tk (50 Hz)		

Other characteristics			
Parameter name		Unit	Value
Sequence of operations			O-0.3 s-CO-15 s-CO O-0.3 s-CO-3 min-CO O-3 min-CO-3 min-CO
Time characteristics	Opening	µs	< 50
	Total interruption	µs	< 66
	Closing	µs	< 71
Mechanical strength	Class		M2
	Lifetime	cycles	10 000
Switching wear resistance	Class		E2
Number of switching operations at full Isc	25 kA		50
	31,5 kA		50
Operating temperature		°C	–5 up to +40
Average relative humidity	24 hours	%	< 95
	1 month	%	< 90

WITHDRAWABLE UNITS

Equipment configuration

Draw-in function is provided by:

- withdrawable trolley with circuit breaker (movable part);
- cassette with bushing insulators (fixed part);
- low-voltage connector.

Functions

- Worm gear mechanism for easy drawing in and withdrawal. It allows operation with the doors closed.
- Mutual interlocking of the circuit breaker and withdrawable unit control buttons in different positions makes operation safer. Drawing in and withdrawal is only possible when the circuit breaker is off.
- Mutual interlocking between the low-voltage connector and the circuit breaker is provided. Drawing in is only possible when the operating voltage is connected.
- The withdrawable trolley is automatically earthed once drawing in has started.
- Protective curtains located on the cassette prevent access to the bushing insulators' contact pins when the circuit breaker is withdrawn (protection degree index: IP2X).
- During maintenance, it is possible to:

- block the curtains with padlocks in closed position;
- unlock the curtains to access the bushing insulators' contact pins.

Accessories

Set of additional contacts:

- 4-contact block for "Drawn-in/Withdrawn" position;
- 1 contact for circuit breaker position indication (circuit breaker fixed on trolley).

Built-in locks (Ronis or Profalux type) secure the circuit breaker in "Withdrawn" position, ensuring safety work in the lower parts of the circuit. The circuit breaker interlock system is interlocked with the earthing switch.

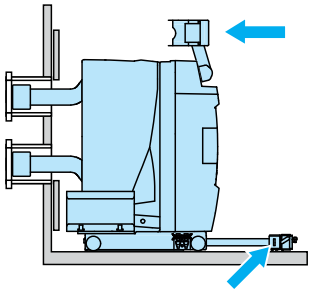
The circuit breaker compartment door is blocked to prevent the circuit breaker from drawing in/withdrawing when the compartment door is opened.

WITHDRAWABLE UNITS

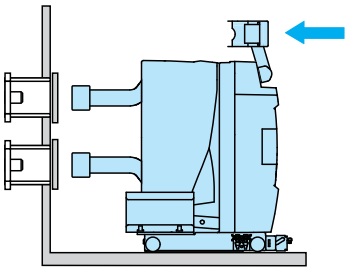
Operating cycle

The circuit breaker has three positions:

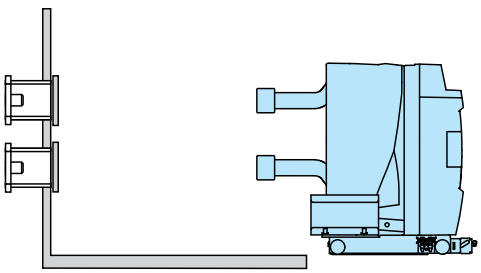
- **operating" position**: the circuit breaker is drawn in and blocked in this position; the low-voltage connector is connected;
- **"test":** the circuit breaker is withdrawn and blocked in this position; the low-voltage connector is connected;
- **"withdrawn":** the circuit breaker can be unblocked and withdrawn from the cubicle.



"Operating" position



"Test" position

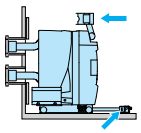
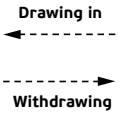
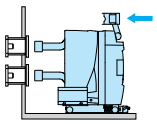
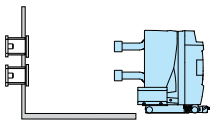


Withdrawn" position

Note: arrows indicate blocking positions for the circuit breaker and low-voltage connector.

WITHDRAWABLE UNITS

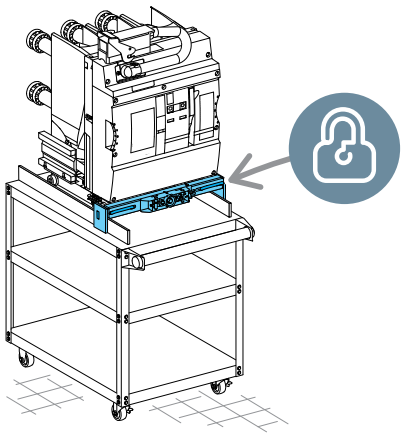
The table shows safety functions provided by X10 EVOLUTION cubicles

Components	Circuit breaker positions			
				
	Operating Position	**Intermediate position**	**Off/Test**	**Withdrawal**
1 - Latches	Locked	Locked	Locked / Unlocked	
2 - Low-voltage connector - Adapter	Connected	Connected	Connected / Disconnected	Disconnected
3 - Compartment doors	Closed and locked	Closed and locked	Unlocked	Unlocked
4- Circuit breaker contacts position VI	Opened Closed	Opened	Opened Closed	Opened Closed
5 - Earthing switch position	Earthing switch Off	Earthing switch Off	Earthing switch Off Earthing switch On	Earthing switch Off Earthing switch On
6 - Curtains	Opened	In operation	Closed	Closed

Circuit breaker service trolley

Allows removal of the circuit breaker from the cubicle and manipulation during maintenance or assembly of the cubicle.

- The trolley height can be increased by bolt connections up to 250 mm.
- There is a latch between the trolley and the cassette.



Control handle

- Used to draw in/withdraw the circuit breaker trolley and to operate the earthing switch.

CONNECTIONS

Three key factors determine service life of switchgear at a substation:

Proper connection
New “cold” connection technologies ensure easy assembly. They allow operations even in contaminated environment and harsh climatic conditions.

Resistance to relative humidity
Heating elements should be used when operating equipment in climates with high relative humidity and sudden temperature changes.

Ventilation control
The size of ventilation openings should correspond to the heat energy generated in the substation room.

Cold shrink terminals

Based on worldwide experience, Pluton IC recommends using this technology to ensure maximum durability.
Maximum permissible cable cross-section:

- 630 mm² for input and feeder lines with single-core cable;
- 300 mm² for input and feeder lines with three-core cables;
- 95 mm² for transformer cubicles with fuse protection.

Access to the cubicle is only possible when earthing switch is closed. The clamp is tightened with a wrench to a torque of 50 N·m.

Cable connection from the bottom

Cable duct height (from the floor)

Cubicle type	X10 EVOLUTION EBW, EBM
Parameters	from 630 to 1250 A 1 set of current transformers
Height (mm)	630

Cubicles connection with dry cables

Connection from the bottom

X10 EVOLUTION	EBW, EBM 630 A	EBW, EBM 1250 A
1 single-core cable per phase	+	+
2 single-core cables per phase	+	+
1 three-core cable per phase	+	+
2 three-core cables per phase	+	+

Top connection

X10 EVOLUTION	EBW, EBM 630 A	EBW, EBM 1250 A
1 single-core cable per phase	+	+
1 three-core cable per phase	+	+

Single-phase dry cables

Simple cold-shrink terminal	
Version	up to 10 kV; 400 A - 1250 A
Cross-section, mm²	from 50 mm² to 630 mm²
Supplier	All manufacturers of cold shrink terminals: Silec, 3M, Pirelli, Raychem
Number of cables	from 1 to 3 per phase
Note	please contact the manufacturer if a larger cross-section or number of cables per phase is required

Three-phase dry cables

Simple cold-shrink terminal	
Version	up to 10 kV; 1250 A
Cross-section, mm²	from 50 mm² to 300 mm²
Supplier	All manufacturers of cold shrink terminals: Silec, 3M, Pirelli, Raychem
Number of cables	from 1 to 3 per phase
Note	please contact the manufacturer if a larger cross-section or number of cables per phase is required

EXAMPLE OF A SWITCHGEAR CONFIGURATION

Equipment			Cubicle type				
			EBW, EBM	**EDC, EDM**	**EBC**	**ESR**	**EVM**
Circuit breaker			■		■		
Withdrawable jumper			□		□	■	
Busbar earthing device			□		□		
Fixed connections				■		■	
Withdrawable unit contact position indication		4 HO + 4 H3	□		□		
Withdrawable unit isolating curtains interlock			■		■		■
Voltage availability indicator			□	□	□	□	□
Withdrawable unit mechanical blocking (locks)			■		■		
Withdrawable unit mechanical blocking (keys)			□		□		
Withdrawable unit electromagnetic interlock			□		□		
Earthing disconnector			□	□			□
Earthing disconnector contacts position indicator		3 HO + 3 H3	■	■		■	■
Key blocking			□	□			□
Electromagnetic interlock			□	□			□
Voltage transformers (1 per phase) phase-earth	Installed circuit breaker		□	□			■
	Installed fuses		■	■			■
Current transformers			■		■		
Cubicle							
Protection index		IP4X	■	■	■	■	■
	Compartments	IP2X	■	■	■	■	■
Arc protection	25 kA - 0.5 s		□	□	□	□	□
	Internal arcing alarm contacts (contact the manufacturer)		□	□	□	□	□
Low-voltage compartment locking (keys)			□	□	□	□	□
Low-voltage compartment lighting			□	□	□	□	□
Anti-condensation heater			□	□	□	□	□

■ : standard configuration
□ : option

OPERATION CONDITIONS

Operation condition

X10 EVOLUTION cubicles are designed for operation in normal climatic conditions indoors in accordance with the requirements of DSTU EN 62271-1:2018.

Ambient temperature:

- during operation: lower air temperature limit - minus 5 °C, upper limit - plus 40 °C (average daily air temperature not exceeding plus 35 °C);
- during transportation: lower air temperature limit - minus 45 °C, upper limit - plus 70 °C.

Altitude above sea level:

- max. 1000 m;
- when using cubicles for operation at above 1000 m altitude, additional requirements of DSTU EN 62271-1:2018 shall be observed upon agreement with X10 EVOLUTION cubicles manufacturer.

Operating environment:

- non-explosive, free of conductive dust, salts, water vapour and aggressive gases in concentrations reducing parameters of X10 EVOLUTION switchgear,
- average daily relative humidity - max 95 %,
- average monthly relative humidity - max 90 %,
- average daily atmospheric pressure - max 2.2 kPa,
- average monthly atmospheric pressure - max 1.8 kPa.

Scheduled maintenance

Maintenance procedures for X10 EVOLUTION cubicles are specified in the operating manual. The operating and maintenance manual for X10 EVOLUTION cubicles provides the most important basic technical instructions:

- equipment wear reduction (failures reduction);
- equipment safety during installation, repair, and maintenance

The manual provides information necessary for:

- installation and assembly of X10 EVOLUTION;
- preparation for operation;
- operation of X10 EVOLUTION switchgear, control mechanisms, power circuits and control circuits, switching devices, and protection and control system;
- maintenance.

Requirements for installation and operation conditions are provided.

QUALITY GUARANTEE AND SERVICE

Certification according to international standards

All Pluton IC products, including X10 EVOLUTION series AC switchgear, comply with European and international standards and have certificates and declarations of conformity.

Pluton IC quality management system complies with ISO 9001:2015 international quality management system requirements. Pluton IC has also confirmed compliance of its management principles with the requirements of ISO 14001:2015 international environmental management system standards and ISO 45001:2018 occupational health and safety management system standards.

Operating cycle

In order to achieve maximum quality in X10 EVOLUTION series products manufacturing, the following quality control criteria have been defined:

- incoming inspection of electrical components and materials parameters;
- control of parts and assemblies during technological operations;
- time between failures tests for individual types of assemblies and mechanisms;
- acceptance tests for each product and cubicles assembly as a whole in accredited testing laboratory.

The test results are recorded and documented in reports.

Vacuum circuit breaker test

Vacuum circuit breaker is tested by Schneider Electric manufacturing factory. Retesting of vacuum circuit breaker is done by Pluton IC during cubicle acceptance tests.

Technical support

Our company provides full range of services from recommendations on X10 EVOLUTION optimal components selection to installation and commissioning of the supplied equipment at the site.

Equipment operation

After X10 EVOLUTION commissioning, we provide:

- warranty maintenance;
- post-warranty maintenance;
- training of staff on X10 EVOLUTION correct and safe operation and maintenance;
- supply of spare parts;
- repair works.

Equipment upgrade

We can upgrade and improve technical characteristics of your X10 EVOLUTION. Our specialists will audit, diagnose, upgrade, extend service life, etc.

Additional services

The warranty extension is offered in case X10 EVOLUTION switchgear is commissioned by Pluton IC specialists.

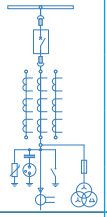
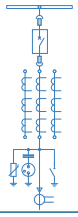
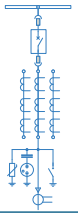
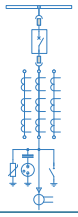
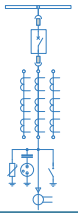
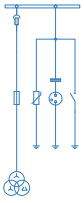
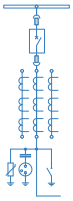
CONFIGURATION DATA SHEET

Data filled in by design organization

No.	Requested data			Equipment parameters						
1	Cabinet serial number									
2	Rated voltage		kV							
3	Rated breaking current		kA							
4	Rated busbar current		A							
5	Primary connections diagram									
6	Cubicle type									
7	Cabinet designation									
8	Load type									
9	EasyPact EXE vacuum circuit breaker, rated current, A									
10	Spring drive, drive supply voltage, V									
11	Operating circuits supply voltage, V									
12	Current transformers	Type								
		Trans-formation ratio								
		Accuracy class								
		Quantity								
13	Zero sequence current transformer, quantity	Type:								
14	Cable quantity, type, and cross-section									
15	Microprocessor device type									
16	Voltage transformers	Type								
		Accuracy class								
		Quantity								
17	Surge arrester, quantity									
18	Energy meters	Type:								
19	Digital measuring converter									
20	Ammeter availability									
21	Voltmeter availability									
22	Anti-condensation heating element									
23	Optical arc protection availability									
24	RS-485/Ethernet communication module availability									
25	Mechanical locks for mutual interlocks									

EXAMPLE OF CONFIGURATION DATA SHEET CONTENT

Data filled in by design organization

No.	Requested data		Equipment parameters						
1	Cabinet serial number		1	2	3	4	5	6	7
2	Rated voltage	12 kV							
3	Rated breaking current	25 kA							
4	Rated busbar current	1250 A							
5	Primary connections diagram								
6	Cubicle type		EBM	EBW	EBW	EBW	EBW	EVM	EBC
7	Cabinet designation		Input line	Output line	Output line	Output line	Output line	SHTN (voltage transformer cabinet)	SV (coupling circuit breaker)
8	Load type		-	-	-	-	-	-	-
9	EasyPact EXE vacuum circuit breaker, rated current, A		1250	630	630	630	630	-	1250
10	Spring drive, drive supply voltage, V		=220	=220	=220	=220	=220	-	=220
11	Operating circuits supply voltage, V		=220	=220	=220	=220	=220	=220	=220
12	Current transformers	Type	ATB 10-BSB	ATB 10-BSB	ATB 10-BSB	ATB 10-BSB	ATB 10-BSB	ATB 10-BSB	ATB 10-BSB
		Trans-formation ratio	400/5/5/5	200/5/5/5	150/5/5/5	100/5/5/5	300/5/5/5	-	400/5/5/5
		Accuracy class	0.5S/5P	0.5/10P	0.5/10P	0.5/10P	0.5/10P	-	0.5/10P
		Quantity	3	3	3	3	3	-	3
13	Zero sequence current transformer, quantity	Type: CSH-120	+	+	+	+	+	-	-
14	Cable quantity, type, and cross-section		NA2XS2Y 6x1*150RM /25	NA2XS2Y 3x1*70RM /16	NA2XS2Y 3x1*50RM /16	NA2XS2Y 3x1*50RM /16	NA2XS2Y 3x1*120RM /16	-	-
15	Microprocessor device type		P3U30	P3U30	P3U30	P3U30	P3U30	-	P3U30
16	Voltage transformers	Type	VTB 10-KFP	-	-	-	-	VTB 10-KFP	-
		Accuracy class	0.5/3P	-	-	-	-	0.5/3P	-
		Quantity	3	-	-	-	-	3	-
17	Surge arrester, quantity		3	3	3	3	3	3	3
18	Energy meters	Type: ELGAMA	LZQM	-	GAMA 300	GAMA 300	-	-	-
19	Digital measuring converter		-	-	-	-	-	-	-
20	Ammeter availability		+	+	+	+	+	-	+
21	Voltmeter availability		+	-	-	-	-	+	-
22	Voltmeter availability		-	-	-	-	-	-	-
23	Optical arc protection availability		+	+	+	+	+	+	+
24	RS-485/Ethernet communication module availability		+	+	+	+	+	-	+
25	Mechanical locks for mutual interlocks		+	+	+	+	+	+	+

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