



Prefabricated Substation

US, EU & Afghanistan Standard

Catalogue

12KV / 24KV / 36KV / 40.5KV

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FOR YOUR NEEDS**

ABSTRACT

A substation is a part of an electrical generation, transmission, and distribution system. Substations generally have switching, protection and control equipment, and transformers. The low voltage distribution networks are supplied from MV/LV substation transformer that represent the last step of bringing transformation to the low voltage and ensuring the protection and monitoring of the network. There are three types of MV/LV substation: pole-mounted transformer substation, the substation in an envelope and substation in masonry.

Keywords: Substation Transformer; MV Cells; Substation in Masonry & Pole-Mounted Transformer Substation.

Introduction

Distribution networks are typically of two types, radial or interconnected. A radial network leaves the station and passes through the network area with no normal connection to any other supply. This is typical of long rural lines with isolated load areas. An interconnected network is generally found in more urban areas and will have multiple connections to other points of supply. These points of connection are normally open but allow various configurations by the operating utility by closing and opening switches. Operation of these switches may be by remote control from a control center or by a lineman. The benefit of the interconnected model is that in the event of a fault or required maintenance a small area of network can be isolated and the remainder kept on supply.

The MV/LV substations are a node of a network, which includes a set of equipment designed to protect and facilitate the operation of the electrical energy.

The MV/LV substations provide the interface between the distribution MV and LV. The MV / LV adapts to all modes of operation and why should fulfill the following functions:

- Distribute the power and protect the LV departures;
- Isolate the MV/LV substation in case of default;
- Manage the MV network in case of default and the position by remote control.

MV/LV substation transformer has two purposes:

- The interconnection between the lines of the same voltage level, it helps to distribute the power of the different lines from substations.
 - The transformation of electrical power, processors can switch between voltage levels to another.
- So, we can classify the MV/LV substations over the networks on which they are used as well as the functions they perform. The realization of MV/LV substations needs prior knowledge:

- Standards of reference and statutory instruments (voltage, quality of supply, short-circuit power, ...,etc);
- Needs to be performing (power plant availability, operation);
- Specific needs-related uses (voltage variations tolerated, compensation of reactive power, immunity to interference receivers, regulations related to facility security);
- Constraints, installation and environment

The consumer must provide certain data at the earliest stage of the project. (maximum anticipated power demand (kVA), layout plans and elevations showing location of proposed substation, degree of supply continuity required from the information provided by the consumer), the power-supplier must indicate:

- The type of power supply proposed, and define the kind of power-supply system: over headline or underground-cable network, the service connection details: single-line service, ring-main installation, or parallel feeders, and the power (kVA) limit and fault current.
- The nominal voltage and rated voltage (Highest volt- age for equipment)
- Metering details which define: The cost of connection to the power network and tariff details (consumption and standing charges).

GENERAL

PPC series products is a kind of set of equipment which assembles the MV switch apparatus, transformer, LV distribution equipment together according to fixed connection scheme. This series substation is suitable for neighborhood unit, hotel, large-scale work site and high building that the voltage is 12kV /24kV/36kV/40.5kV, the frequency is 50Hz and the capacity is under 2500kVA.



Implementation

Before any installation work is started, the official agreement of the power-supplier must be obtained. The request for approval must include the following information, largely based on the preliminary exchanges noted above:

- Location of the proposed substation;
- Single-line diagram of power circuits and connections, together with earthing-circuit proposals;
- Full details of electrical equipment to be installed, including performance characteristics;
- Layout of equipment and provision for metering components;
- Arrangements for power-factor improvement if required;
- Arrangements provided for emergency standby power plant (MV or LV) if eventually required



Prefabricated Substations



Masonry Substation






Pole mounted substation



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Main technical specifications

Name	Unit	HV equipment	Transformer	LV Equipment
Rated voltage	kV	12/24/36	(12/24/36)/0.4	0.4
Rated current	A	630	3/75-150/3750	Less than 4000
Frequency	Hz	50		
Rated Capacity	kVA	50-2500		
Pfr withstand	kV	42/50/70/95		2.5
BIL	kV	75/125/170/185		
Crust Protection Grade		IP23	Oil type 55; dry type 65	IP23
Noisy Grade	dB			
Appearance Dimensions	mm	According to primacy wiring circuit schema		

		
HV Room	LV Room	Transformer Room

Service environment

- a) Air temperature: Maximum temperature: +45°C; Minimum temperature :- 25°C
- b) Humidity: Monthly average humidity 95%; Daily average humidity 90%.
- c) Altitude above sea level: Maximum installation altitude: 2500m
- d) Ambient air not apparently polluted by corrosive and flammable gas, vapor etc.
- e) No frequent violent shake

Main Designation Characteristics

- The crust of the substation is designed according to the foreign advanced technology and physical reality. We provide many kinds of crust material such as aluminum alloy steel composite stainless steel board and no metal material (glass fiber).
- The HV side use charge switch or vacuum circuit breaker. The transformer could be oil type hermetically-sealed type and dry type.
- The proof of the box is double layer structure and between the layers is filled with foam. There are independent boards in HV and LV room, and in the transformer room will install auto thermal controller heater and cooling equipment.

Each different outside coating style for client options.

	
<p style="text-align: center;">Aluminum Alloy Composite Board Crust- A</p>	<p style="text-align: center;">Board Aluminum Alloy Composite Crust-B</p>
	
<p style="text-align: center;">Aluminum Sheet Crust-C</p>	<p style="text-align: center;">Package System With Steel board Crust-D</p>
	
<p style="text-align: center;">Non-metallic Crust-G</p>	<p style="text-align: center;">Non-metallic Crust-H</p>

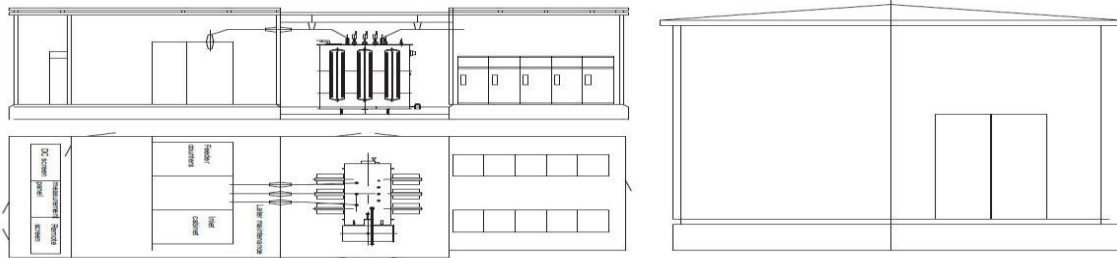
Note: we offer special customized products according to client's requirement.

36kV/40.5kV Prefabricated Substation Characteristics

This type substation's are the HV side 40.5 kV, LV side 0.4-12 kV and 3 phase outdoor complete equipment It is wide used in cities, towns, factories and oil fields, wharfs etc. It is also used in some construction sites. The characteristics are small volume, convenient installation, low cost, high automation safe and reliable operation. Substation is combined with HV switch room, LV switch room, relay room and transformer room.

- **Main technical specifications for 36kV/40.5kV Prefabricated Substation**

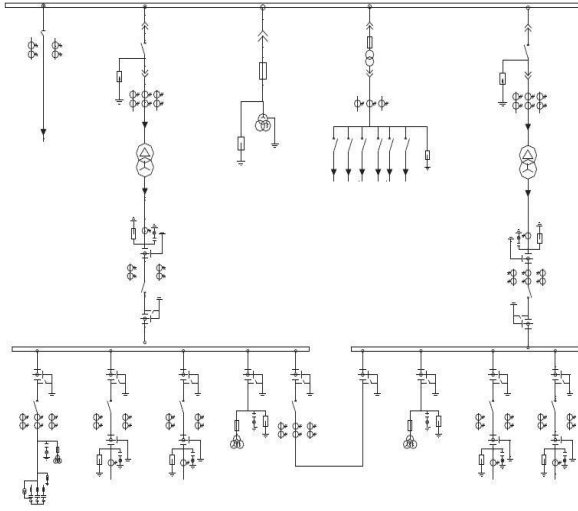
Name	Unit	HV equipment	Transformer	LV Equipment
Rated voltage	kV	40.5	40.5/12/0.69/0.4	12/6.3/0.69/0.4
Rated current	A	Less than 1250		Less than 4000
Frequency	Hz	50		
Rated Capacity	kVA	1250-20000		
Pfr withstand	kV	70/95		42/2.5(Auxiliary)
BIL	kV	170/185		75
Crust Protection Grade		IP23	Oil type 55; dry type 65	IP23
Noisy Grade	dB			
Appearance Dimensions	mm	According to primacy wiring circuit schema		



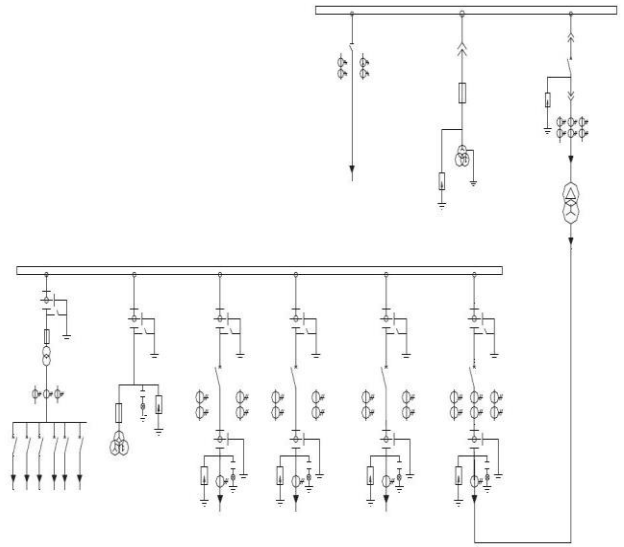
Sketch diagram of 36kV/40.5kV prefabricated transformer substation

Main Primacy Wiring Circuit Schemas for Substation (40.5Kv)

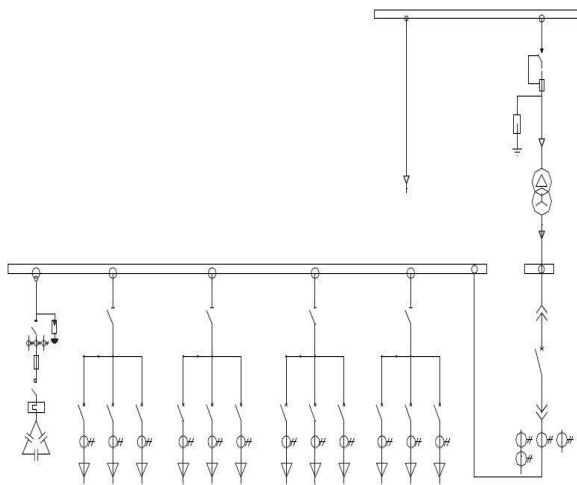
● Wiring type A-40.5k



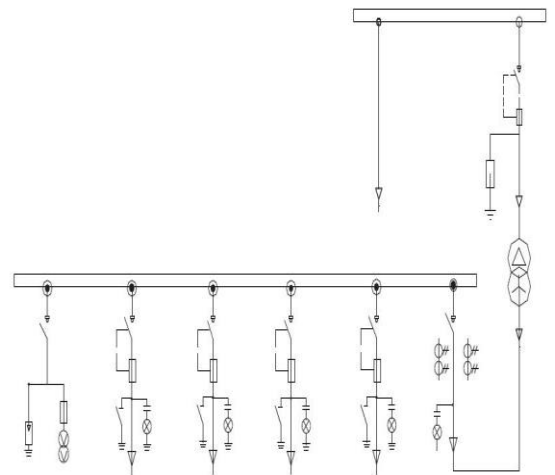
● Wiring type B-40.5kV



● Wiring type C-40.5KV



● Wiring type D-40.5KV



Note: we offer special customized products according to client's requirement.

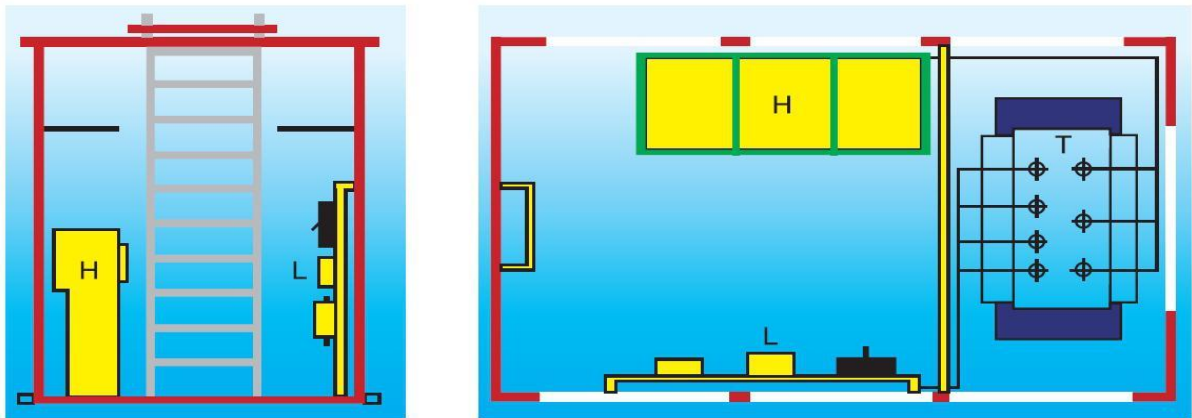
Underground Prefabricated substation

This equipment also belong to Prefabricated substation category with a compact and special function of HV, LV and Transformer are all underground. People can enter into it through a well.

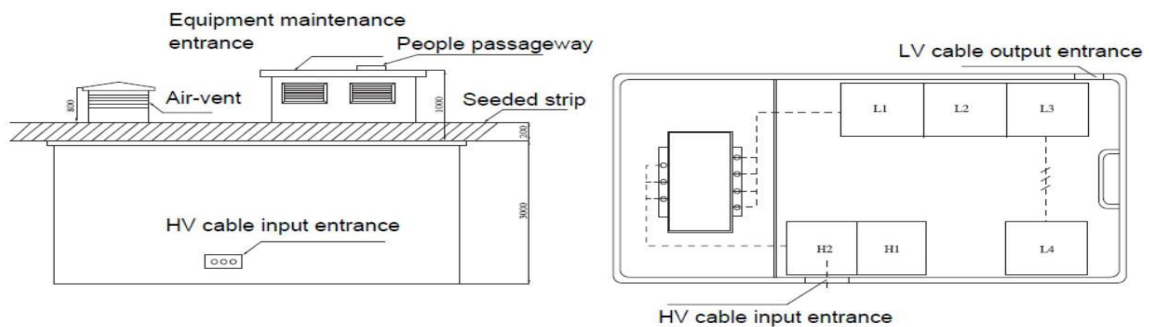
This substation is suitable for installing in square seeded strip and park The clients can choose half-buried type or whole-buried type.



- Sketch map of half-buried substation



- Sketch diagram of whole-buried substation



Miniaturization Intelligent Prefabricated Substation

This series pre-fabricated substation uses imported SF6 ring switch as its HV incoming and outgoing network realized the power ring system easily. And the substation selects integrated automation system which can realize unattended mode.



M-Substation



HV Room



LV Room



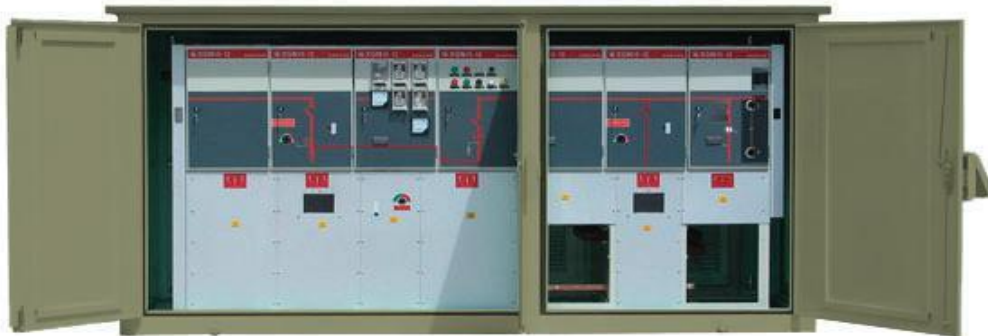
ABB type uniswitch



ABB type Safering



Schneider type SM6



HV switch substation

Note: Main switches can choose SC6, SFG or FLUSARC type.

MV Cells

Devices (circuit breakers, switches, busbar, ..., etc) are integrated in metal casings that facilitate the installation and operation, safe people, these envelopes are called cells, they can achieve MV part transformer stations.

The different cells Schneider Electric 36 or 24 KV in the composition of MV / LV substation transformer are:

- IM, IMC, IMB switch;
- PM fused switch;
- QM fuse-switch combination;
- DM1-A, DM1-D, single-isolation SF6 type circuit breaker;
- DM2 double-isolation SF6 type circuit breaker;
- CM, CM2 voltage transformers;
- SM disconnecter ;
- GBC-A, GBC-B current and/or voltage measurements;
- GIM intermediate bus unit;
- GBM connection unit.

Fault Current Indicator

The fault current detector is designed for the detection of permanent faults on MV underground networks, covering all types of MV systems

Choice of MV/LV Transformer

The MV/LV power transformers are usually step-down, they used to supply low voltage from a medium voltage network. They are characterized by the rated power Pn (50, 100, 160, 250, 315, 400, 630, 800, 1000, 1250 1600KVA,..) and rated primary and secondary voltages (30/0.4 KV for overhead networks and 10/0.4 KV for underground MV networks). In order to select an optimal power (kVA) rating for a transformer, the following factors must be taken into account list the power of installed power-consuming equipment Pi, the power factor, the utilization factor (ku) ,the simultaneity factor (ks), the rated power Sn transformer is given by:

$$S_n = \sum_{i=1}^n \frac{P_i}{K_{\eta} K_{\phi} \cdot \cos \alpha_i} \cdot k_s \quad (1)$$

Choice of LV Circuit Breaker

The main role of a circuit breaker is to protect the electrical system during faults, overload and short circuit; it is designed to open a circuit automatically when the current flowing through it exceeds a predetermined value. To effectively function, the trigger circuit breaker must take into account the evolution of the receptors. The LV circuit breaker can be fixed, removable, CLPG (general protection cell), removable LV circuit breaker, or TDP (Public Distribution Table). The choice of the LV circuit breaker will be from the secondary rated current.

Public Distribution Table

The table for public distribution (TDP) is the lower voltage distribution station public; it is used at the top of LV circuit to provide the following main functions:

- Power supplied of LV consumer;
- The distribution by multiplying the number of departures (4 or 8 departures).
- Opening, isolation of each departure.

The table for public distribution includes a switching device which can be a general switch or a circuit breaker

Choice of Cables and Connections

The connection between the MV cells and transformer (MV side) will be through a MV cable, able to pass the input current of the network, the connection of the transformer (LV terminals) with LV circuit breaker will be through a LV cable. LV cable length is calculated by measuring the distance between the transformer and LV circuit breaker. The number of cables per phase is determined from the current supplied by the transformer and cable characteristics. The optimal choice of the cable must meet several criteria (rated current, operating temperature, fashion poses, voltage drop, and short circuit.

Choice of Fuses

Fuses are a very widely used means of protecting distribution transformers, mainly due to their simplicity and the correspondingly reduced cost of the equipment. The rules regarding the selection of fuses, given by the manufacturers and dependent upon the characteristics of each fuse type, cover the following criteria: the transformer's operating voltage, the switching currents, and technology of fuses.

Materials for Operation and Safety

Safety equipment for a MV/LV substation transformer consists essentially of:

- Insulating stool.
 - Insulating mat.
 - Insulating gloves.
 - Voltage detector.
 - Earthing attachments;
- Safety alarms and plaque and fire-extinguishing

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