Prefabricated Substations

ELECTRO SISTEM
electro sistem group

WE GIVE POWER TO ELECTRICITY

Individual, complete and flexible solutions for power distribution equipment and systems

/ PREFABRICATED SUBSTATIONS

/ MEDIUM VOLTAGE SWITCHGEAR

/ LOW VOLTAGE DISTRIBUTION PANELS

/ EQUIPMENT FOR MEDIUM VOLTAGE OVERHEAD POWER LINES

/ DISTRIBUTION TRANSFORMERS

/ MEDIUM VOLTAGE INSTRUMENT TRANSFORMERS

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TRANSFORMER SUBSTATIONS

General Features

Our prefabricated substations are industrially assembled in our specialized workshops and delivered turnkey directly to the customer, so that they can be put into service right after delivery.

They consist of:

- Substation housing: foundation (transformer tank, cable bushings, pressure relief, lifting anchors), walls, access doors, roof;
- Medium voltage switchgear;
- One or more distribution transformers;
- Low voltage equipment.

Areas of use:

Prefabricated substation units, in concrete or metallic housing, are used in electricity cable distribution networks, in urban or rural areas, public or industrial areas, building sites, irrigation in agriculture and many more.

In the recent years, prefabricated substation units are being increasingly used in alternative energy production installations, such as those based on solar energy, wind power, biofuels, biomass, geothermal, tidal power and wave power.

Types of prefabricated substations

Housing	Type	Rated voltage (kV)	Maximum transformer power (kVA)	Type of MV Voltage equipment
Non Walk-in Substations				
Concrete housing	BK	6/10/20	2x2500	SF_6 or air-insulated
Metallic housing	SIK	6/10/20	2x2500	SF_6 or air-insulated
Walk-in Substations				
Concrete housing	BK...I	6/10/20	2x2500	SF_6 or air-insulated
Metallic housing	SIK...I	6/10/20	2x2500	SF_6 or air-insulated

NOTE: On demand, 3x2500kVA transformer power substation can also be manufactured, as well as with higher rated voltages (up to 36 kV).

Standards and regulations

Norms and standards:
SR EN 62271-202, product standard SP 552/2001, SR EN 60076, SR EN 60439, SR EN 60529, SR EN 62271-1, SR ISO 9001/2015 etc.

Normal service conditions

Operator safety:
- degree of protection IP 43 (for substation housing) and IP 54 (for medium voltage and low voltage compartments)
- blast proof doors
- decompression, cooling and guided evacuation of gas in case of a medium voltage internal arc fault

Long operating life:
- use of reliable equipment
- housing made of time resistant materials: concrete, aluminum, hot-galvanized steel etc.
- modern technologies

Environmental friendliness:
- use of biodegradable and recyclable materials
- transformer oil tank of highly compacted, oil and water proof, specially coated concrete
- reducing the electromagnetic fields and the transformer's sound level

Easy mounting:
- the substation unit is delivered fully tested and equipped, ready for connection, only cable insertions and connections are needed on site
- easy placing in a dug pit, onto a bed of sand and gravel

Minimum surface on the ground:
from 2.77m (BK/SIK 001)

Low maintenance: periodic and predictive maintenance

Operating life: 30 years

Substation type coding

Our prefabricated substations are symbolized as follows:

Housing	Operating type	Codes
Concrete housing	Non Walk-in	BK 001, BK 002, BK 005, BK 007, BK 008, BK 010, BK 54-23, BK 64-26, BK90-27 etc.
	Walk-in	BK 007 I, BK 008 I, BK 010 I, BK 010 IM, BK 50-27 I, BK 76-28 I etc.
Metallic housing	Non Walk-in	SIK 001, SIK 002, SIK 005, SIK 007, SIK 008, SIK 010, SIK 54-23, SIK 64-26, SIK 90-27 etc.
	Walk-in	SIK 007 I, SIK 008 I, SIK 010 I, SIK 010 IM, SIK 50-27 I, SIK 76-28 I etc.

Our standard types of prefabricated substations with **concrete housing** or **metallic housing** are:

	Type	Transformer maximum power (kVA)	SF6 fully insulated Ring Main Unit	MV switchgear (air-insulated, modular, extensible)	Air-insulated load-break switch	MV metering
Non Walk-in	BK/SIK 001	250	●		●	
	BK/SIK002	630	●		●	●
	BK/SIK 003	630	●		●	
	BK/SIK 004	400	●		●	
	BK/SIK 005	800	●		●	●
	BK/SIK 005 L	1000	●		●	●
	BK/SIK 006	1000	●		●	●
	BK/SIK 007	1000		●	●	●
	BK/SIK 008	630		●	●	●
	BK/SIK 009	2500		●		●
	BK/SIK 010	1600		●		●
	BK/SIK 45-23	1000		●		●
	BK/SIK 54-23	2x630		●		●
	BK/SIK 64-23	2x1000		●		●
	BK/SIK 64-26	2x1600		●		●
Walk-in	BK/SIK 007 I	1000		●		●
	BK/SIK 008 I	630		●		●
	BK/SIK 010 I	1000		●		●
	BK/SIK 010 IM	2500		●		●
	BK/SIK 50-27 I	800		●		●
	BK/SIK 76-28 I	2x1600		●		●

Concrete housing (BK)

Metallic housing (SIK)

Using the same technology, Electro Sistem manufactures also **non-standard prefabricated substations**, equipped with one or two distribution transformers, with rated power up to 2x2500kVA. Upon special requests, we can manufacture prefabricated substations with rated power up to **3x2500kVA**, in this case the distribution transformers being mounted on site.

To provide a more economic, modern, reliable and risk-free alternative to distribution substations in radial networks, we designed the type of substation in concrete housing, and the type of substation in metallic housing, as **radial distribution prefabricated substations.** This type of unit offers an inexpensive solution to supply of urban or rural consumers, construction sites, agriculture, with rated power up to 250kVA, also providing an alternative to pole-mounted substations. It's designed for various LV configurations, whereas the MV compartment can be equipped with one three-phased air-insulated MV fuse switch disconnector or just with one three-phased MV fuse-holder.

Non-standard prefabricated substation

Normal service conditions

The prefabricated substations, in concrete or metallic housing, are designed to work under the following environmental conditions:

a.	Climatical and meteorological area	A, B, C, D, E (NTE 0003/04)
b.	Exploitation category	1
c.	Outdoor weather conditions, according to	SR EN 622711
	- maximum temperature	+40°C
	- minimum temperature	- 35°C
	- wind speed (ice-free) at ≤10 m height	32 m/s
	- wind pressure	750 N/m^2
	- ice thickness	20 mm
	- relative humidity (at 20 °C)	100%
d.	Maximum altitude	1000 m
e.	Seismic conditions	0,5g
f.	Fire danger category	C
g.	Fire proof degree	II
h.	Substation IP degree of protection	IP 43

Special service conditions

For prefabricated substations designed to operate under climatic conditions other than usual, the following values are applicable:

Altitude:
For altitudes exceeding 1000m, the use of MV switchgear and controlgear will comply with SR EN 622711 standard.
For altitudes exceeding 2000m, the use of LV switchgear and controlgear will comply with SR EN 60439-1 standard.
For altitudes exceeding 1000 m, the use of distribution transformers will comply with IEC 60076-2 and IEC 60076-11 standards.
Pollution:
If used in polluted environment, the pollution degree of devices will be according to the following standards:
- MV switchgear and controlgear: SR EN 622711
- LV switchgear and controlgear: IEC 60664-1
- distribution transformer: not applicable.

Temperature:
For prefabricated substations situated in areas with ambient temperature above the previously mentioned limits, it is not recommended to exceed the following ranges:
- for very cold climatic conditions: -50 °C / +40 °C
- for very hot climatic conditions: -5 °C / +50 °C

Components description

The electrical configuration of the substation is given by its electrical components as requested by the consumer.

The main electrical components of the substation unit are: the distribution transformer, MV switchgear and controlgear, LV switchgear and controlgear (the LV switchboard), the MV and LV connections (busbars, cable connections etc.) and auxiliary equipment.

All the components are protected by the substation's concrete (BK) or metallic (SIK) housing.

Each component complies with its relevant standard:
- The distribution transformer according to SR EN 60076-1 or SR EN 60726-11
- The MV switchgear and controlgear according to SR EN 62271-200 and SR EN 622711
- The LV switchgear and controlgear according to SR EN 60439-1

Medium Voltage Switchgear

The medium voltage compartment of the prefabricated substation is equipped with the following types of electrical devices:

- metallic-enclosed MV switchgear, SF6 insulated, compact or extensible design;
- medium voltage switchgear, with air-insulated busbars and SF6 (or vacuum) insulated switching devices, designed as extensible modules;
- air-insulated medium voltage devices (fuse-holders, fuse switch-disconnectors etc.) for direct mounting into the substation unit's MV compartment;
- small sized MV energy metering cubicle, air-insulated.

The medium voltage equipment can be composed of many functional units (cubicles), depending on the electrical diagram requested by the customer.
These functional units are:

- **"incoming"** (incoming cubicle with earthing switch or MV fuse-holder)
- **"switch-disconnector incoming"** (incoming cubicle with switch-disconnector, or air-insulated switch-disconnector mounted directly into the substation's MV compartment)
- **"fuse switch-disconnector"** (transformer protection cubicle with fuse switch-disconnector, or air-insulated fuse switch-disconnector mounted directly into the substation MV compartment)
- **"circuit breaker"** (incoming cubicle or transformer protection cubicle with vacuum circuit breaker)
- **"MV energy metering"** (air-insulated metering cubicle with medium voltage CT's and VT's)

Distribution transformer

The substation unit can be equipped with one or two distribution transformers, oil-immersed or cast-resin type, with 2 or 3 windings.

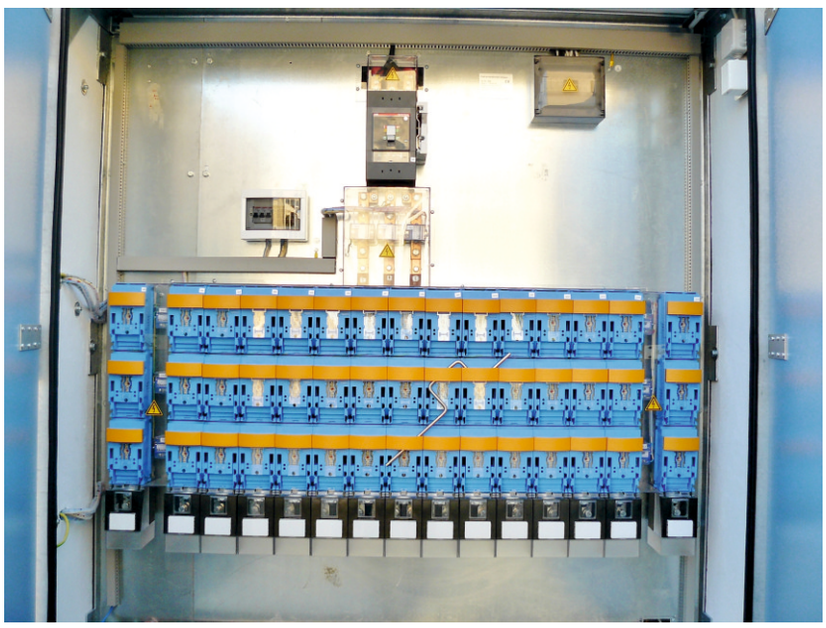
Rated voltage: 6-10-20/0,4kV
Rated power range: 16, 25, 40, 63, 100, 160, 250, 400, 630, 800, 1000, 1250, 1600, 2500 kVA

Upon special requests, the substation units can be equipped with distribution transformers with rated powers above 2500kVA.

The transformers used in our prefabricated substations are delivered with the following **accessories:**

- fixing devices
- 2 earthing terminals
- nameplates
- thermometer with auxiliary contacts or temperature sensors associated with an over-temperature electronic protection relay
- gas overpressure protection sensors (optional).

Low Voltage Switchboard



The low voltage switchboard is manufactured in accordance with the electrical diagram and types of equipment requested by the customer. Each type of prefabricated substation allows a maximum number of outgoing cables.

As incoming switching equipment, we use LV automatic circuit breakers (fixed or withdrawable), or switch-disconnectors (with or without fuses).

The automatic circuit breakers can be three-pole or four-pole, fixed or withdrawable type. The withdrawable ones give the operator a visual separation of the main circuit. These circuit breakers comply with the IEC 947-2 and EN 60947-2 standards. The maximum rated current of the circuit breakers used in our substations is 4000A. The outgoing low voltage cables are connected to fuse-switches. They comply with the IEC standards 60947-3, EN 60947-3. They ensure double separation. The three-pole switch disconnectors are mounted directly onto the busbars; both vertical and horizontal design switches can be used. They can be operated either individually for each phase separately, or simultaneously for all the phases.

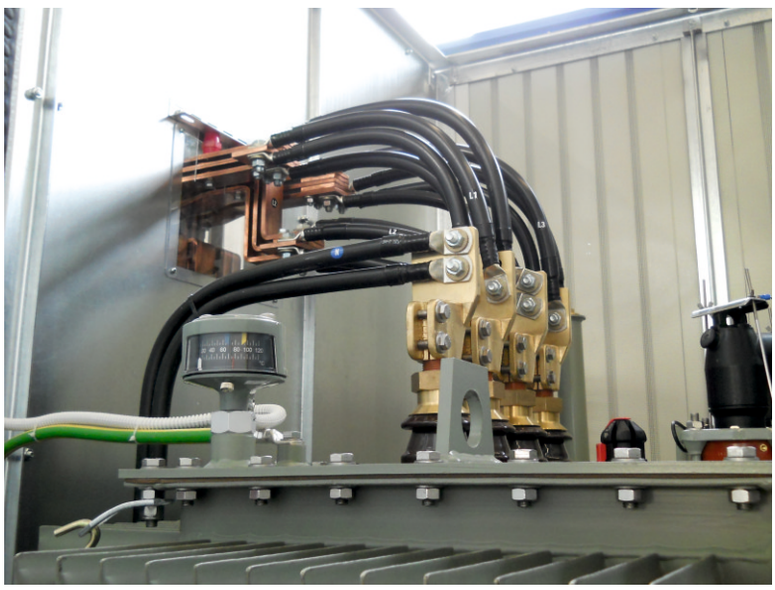
The size of the fuse switch-disconnector may be: NH1 (250A), NH2 (400A), NH3 (630A), NH4a (1250A, or 1600A).

The low voltage panel can be equipped with metering circuits. The metering current transformers comply with standards IEC 60044-1, IAC 60044-2 and have metrological certification.

Optionally, the low voltage switchboards can be equipped with:

- data acquisition system;
- telemetry system;
- power factor compensation installations with automatic or manual command, with one or more steps.

Cable connections



The connections to the electrical equipment and/or apparatus are made in such a way that they can withstand internal vibrations (from transformers, MV compartment, LV panel) and external vibrations (caused by transport or as a result of operating activities).

Medium voltage connections

The medium voltage coupling to the connecting terminations of the incoming cubicle unit is made with indoor T-shaped plug-in terminations 24 kV, 630A for the SF6 insulated compact switchgear; and with indoor terminals in case of modular cubicles with air-insulated busbars, three-poles fuse holders or air-insulated switch-disconnectors mounted directly in MV compartment.

The medium voltage coupling to the connecting terminations of the transformer protection cubicle unit is made with one of the following: elbow plug-in terminals 250A, screw-type terminals 630A or indoor terminals 35 - 95mm^2 when using air-insulated cubicles.

The medium voltage coupling to the power distribution transformer is made with:
- indoor terminals, 35 - 95 mm^2, 24 kV, directly on the MV terminations, in case of porcelain bushings;
- elbow or straight plug-in terminals 250A, 24kV, in case of plug-in bushings.

The connection cable between the transformer protection cubicle unit and the transformer is a medium voltage, single-core cable, type N2XSY, with 35 mm^2 or 95 mm^2 cross section, screened copper conductor with insulation of cross-linked polyethylene, according to DIN VDE 0276. Minimal bending radius: 45 cm for cross section of 35mm^2 and 60 cm for cross section of 95 mm^2.

Low voltage connection

The medium voltage coupling to the connecting terminations of the power distribution transformer is made with special transformer clamps or cable lugs.

The connection cable between the transformer and the low voltage panel is a single-core, PVC insulated copper cable with cross section of 150 mm^2 or 240 mm^2.

Technical Ratings

Technical ratings according to IEC 62271-202

Ref. no.	Technical data	Values
1	Environmental conditions: - minimum air temperature	-35°C
	- maximum air temperature	+40°C
	- maximum altitude	1000m
2	Rated voltage insulation level for the medium voltage circuits	24 kV; 12 kV; 7,2 kV
3	Rated power-frequency withstand voltage 50Hz (1 min.) for medium voltage main circuits	50 kV
	Rated lightning impulse withstand voltage for medium voltage main circuits	125 kV (peak value)
4	Rated voltage insulation level for the low voltage main circuits	690 V
5	Rated voltage for the low voltage circuits	400 V
6	Rated power-frequency withstand voltage 50Hz (1 min.) for low voltage main circuits	4 kV
7	Rated lightning impulse withstand voltage for low voltage main circuits	10 kV (peak value)
8	Rated service voltage for the low voltage auxiliary circuits: - Local lighting circuits	230 V
	- Protection circuits	230 V
	- Other equipment	230 V
9	Rated insulation level voltage for the low voltage auxiliary circuits: - Local lighting circuits	250 V
	- Protection circuits	250 V
	- Other equipment	250 V
10	Rated power-frequency withstand voltage 50Hz (1 min.) for low voltage auxiliary circuits	1 kV
11	Rated lightning impulse withstand voltage for low voltage auxiliary circuits	2,5 kV (peak value)
12	Rated frequency	50 Hz
13	Rated normal service current for medium voltage circuits: - Incoming/outgoing ring main feeders	400; 630 A
	- Transformer feeders	200; 400; 630 A
14	Rated normal service current for low voltage circuits: - Phase circuits	up to 4000 A
	- Power circuits	up to 2500A
	- Other equipment	16 A
15	Rated short-time withstand current: - Medium voltage equipment	16 kA
	- Medium voltage connections	16 kA
	- Low voltage main circuits	up to 100 kA
	- Low voltage circuit breaker	up to 100 kA
	- Earthing circuits	12,5 kA
16	Rated duration of the short-circuit current: - Medium voltage circuits	1s
	- Low voltage main circuits	1s
	- Earthing circuits	1s
17	Rated maximum power of the prefabricated substation	max. 2x3150 kVA
	Rated maximum power of the transformer	up to 3150 kVA
18	Rated class of the housing	10 K (Sn ≤ 400 kVA)
		20 K (Sn > 400 kVA)
19	Internal arc classification	IAC-AB
20	Degree of protection against mechanical impacts	min IK 10
21	Service life	30 years
22	Degree of protection against the ingress of solid objects and/or water	IP 43
23	Maximum noise level	53 dB

Technical characteristics of the concrete or metallic housing

Ref. no.	Characteristics	Concrete housing BK BK...I	Metallic housing SIK SIK...I
1	Type of construction	compact, prefabricated	compact, prefabricated
2	Wall thickness	7 cm	6 cm
3	Partition thickness	2 mm	2 mm
4	Roof load resistance	5 kN/m^2	5 kN/m^2
5	Wind pressure resistance	2,5 kN/m^2	2,5 kN/m^2
6	Mechanical impact energy	20 J	20 J
7	Concrete classification	C 30/37	C 30/37 (foundation)
8	Concrete type	Oil and water proof	
9	Degree of protection for the housing	IP43	IP43
10	Degree of protection for the MV and LV compartments	IP54	IP54
11	Transformer tank	Oil and water proof	Oil and water proof
12	Seismic level	0,5 g	0,5 g

Design and construction

The prefabricated substation is designed in such a manner that normal operation, supervision and maintenance can be done safely.

Earthing
The substation has an earthing installation, providing protection against touch and step voltages. The value for the main earthing conductor will not exceed 4 Ω.

The prefabricated substation has an interior earthing grid (earthing conductor) made of zinc-coated steel, with cross section of 40x5 mm^2, to which all electrical equipments and other metallic parts of the substation are connected. The connection of the metallic parts to the substation's earthing grid is made of copper conductor with cross section of 50 mm^2. The current density does not exceed 200 A/mm^2 at short-circuit current duration of 1s. The foundation of the prefabricated substation has two external earthing terminals, situated on opposite sides.

Auxiliary equipment
Illumination within the prefabricated substation is provided for each compartment. The illumination switches on by means of limit switches, when opening the access door of a specific compartment. The 16 A grounded outlet is installed in the low voltage compartment. The supply voltage for the control and signaling circuits is provided by an internal electrical services box.

Nameplate
Each prefabricated substation has a legible identification plate, resistant to mechanical stress and environmental conditions, and contains the following information, according with the SR EN 62271-202 standard: manufacturer's name, type designation, rated power, rated voltage MV / LV, serial number / production year, SR EN 62271-202 standard.

Environmental protection
The prefabricated substation provides protection of the environment:
- the components are reusable and biodegradable
- the transformer tank is water and oil resistant
- it can be mounted even in areas of drinking water collector systems.

To protect the aquatic and terrestrial ecosystem, the prefabricated substation has an oil resistant tank, preventing environmental pollution in case of oil leakage from the transformer.

Protection against internal short-circuit
According to the product standard, the possibility of appearance of an internal fault (short-circuit) is reduced to minimum.

In case of short-circuit in the medium voltage cubicle or at the cable terminals, the hot gases are guided by special channels into the transformer compartment, where they are cooled down and decompressed. In this way, the gases leave the substation through the door's ventilation grilles, protecting both the personnel and the environment.

The substation housing

Construction
The prefabricated substation's housing is made of prefabricated parts: foundation, metallic frame, concrete or thermo-insulated metallic walls, concrete or metallic roof, ventilation walls, access doors, doors with ventilation elements, partition walls between the compartments etc. Access to the equipment is made through the access doors, which are arranged depending on the substation's partitioning. The prefabricated substation's housing has three distinct compartments: medium voltage compartment, transformer compartment and the low voltage compartment.

In case of walk-in substations, the medium voltage compartment and the low voltage compartment is the same, allowing one access to both medium and low voltage equipment. Between the medium voltage and the low voltage equipment there is a distance of minimum 800 mm.

In case of substations which have two or three transformers, each transformer has its own compartment.

The structure of the prefabricated substation is calculated and manufactured to comply with all the technical and construction characteristics, in order to prevent any kind of deformations due to transport and maintenance.

The foundation

The foundation is made of reinforced concrete type C 30/37, waterproof and oil resistant. Any possible dielectric fluid leaking from the transformer is retained by the foundation's tank. It is designed for regular ground with admissible pressure of 20 N/cm2. It is partitioned and contains also the transformer's compartment.

In the foundation there are mounted cable bushings for medium voltage cables, which provide sealing between the interior and exterior of the substation. The area of the cable terminals communicates with the transformer's compartment through a tunnel equipped with three connection pipes, thus providing protection for the operating personnel against any faults appeared at the MV panels or at the cable terminals. Low voltage cables are inserted through a clear opening. The foundation also contains the earthing internal grid, with two external connecting terminals.

The construction of the housing

A metallic frame, made of hot galvanized steel, rests on the foundation, sustaining the walls, doors and the roof. The walls are made of 70 mm reinforced C 30/37 concrete slabs or 60 mm insulated metallic panels, attached to the frame by means of screws. One can choose between several design patterns for the walls: washed concrete, brick appearance, decorative plaster painted with washable paint etc. The walls are painted in the color requested by the customer. Sealing the walls against the foundation is achieved by using insulating rubber band (hannoband).

The roof is an 85 mm thick concrete plate, covered with water resistant washable paint. In case of metallic housing, the roof is made of insulated metallic panels with 40 mm thickness. The roof is removable and allows the placing and/or removing of the transformer.

Perfect sealing of the roof is provided. The roof has a slope of at least 2%, in order to allow rain water drainage and to prevent water accumulation.

The compartments of the substations are separated with walls of 2 mm galvanized metallic sheets. The materials used in the structure of the prefabricated substation housing meet the minimum combustibility and fire resistance requirements, both on the inside and the outside.

The doors

The doors of the medium and low voltage compartments have a thickness of 28 mm, and they are made of two aluminum sheets with insulation between them. They are sealed with neoprene gaskets, which preserve their elastic properties and their structure over time.

In closed position, they provide a degree of protection prescribed for the substation's housing. Hinges are not accessible from the outside. The doors close in three points and they have a cylindrical lock each. The doors are equipped with a system able to maintain them in open position.

The ventilation

In order to provide the necessary ventilation of the transformer, blinds of aluminum blades, ventilation windows, ventilation openings on the doors and ventilation walls are being used. The doors are fitted with ventilation elements, which ensure effective ventilation of interior spaces and a protection degree for the entire substation of IP43.

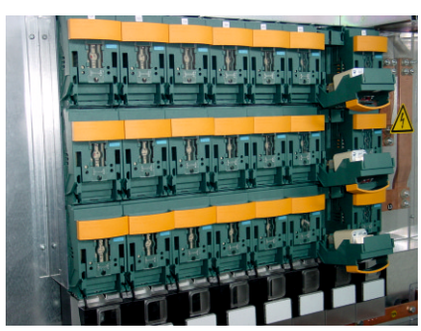
The blinds (painted aluminum) of the transformer compartment doors provide natural ventilation; they do not allow the entry of insects or other objects larger than 1 mm, or snow penetration. A stainless steel wire net is covering the interior of the blinds. The special geometry of the blinds and the stainless steel wire net behind them provide a protection degree of IP43. The doors with ventilation blinds can only be opened from within the medium voltage compartment. For substations up to 250 kVA, temperature class of 10K, and for 400 kVA or higher, temperature class of 20K is guaranteed.

Accessories
Appropriate places for the operating levers, earthing devices, warning plates, supports for capacitive voltage indicators and a pocket for the technical documentation are provided in the medium voltage compartment.

Equipment assembly

Medium voltage cubicles
They are mounted in the medium voltage compartment, above foundation level, on a metallic frame. The openings in the floor, around the cubicles, are closed with metallic sheets. Thus, in case of a short-circuit, resulting gases are forced to move under the cubicles, towards the transformer compartment through a pressure relief system mounted between the two compartments. Connection to the transformer cubicle unit is made with appropriate terminals. The operation of the medium voltage cubicles is done from the outside, or from the access lane between the medium voltage and the low equipment, in case of the walk-in substations.

Transformer
The transformer is mounted either without wheels inside the foundation tank, onto rubber gaskets, or with wheels, on two supporting rails above the foundation level. In the latter case, it can be placed or removed trough the access door.
MV cable connections are made with non-insulated indoor terminals (for transformers with porcelain bushings) or with elbow or straight plug-in terminals (for transformers with plug-in bushings). LV cable connections are made with special connection clamps or with cable lugs.



Low voltage distribution panel
The low voltage distribution panel is an open construction; all the equipment is mounted onto a galvanized sheet panel which divides the low voltage compartment from the transformer's compartment. In case of walk-in substations, on the other hand, ES-TD type of cubicles are used, manufactured by Electro Sistem, degree of protection IP 2X, with appropriate cuttings for handling circuit-breakers and fuse-switches, as well as viewing windows for energy meters. The power circuit is made of copper busbars, fixed onto support insulators. Vertical fuse-switches are mounted onto the horizontal busbar system. The neutral bar is located on the lower side of the panel. The panel's equipment is chosen accordingly to the electrical diagram required by the customer.

Non walk-in type prefabricated substations

Standard types

Substation type	Maximum power of the transformer kVA	Exterior Dimensions length (m)	width (m)	hight (m) total	above ground	Print on the ground (m^2)	Mass of empty substation (t)
BK/SIK 001	250	1,69	1,65	2,0	1,6	2,78	3,1 (2,4)
BK/SIK002	800	2,79	1,94	2,3	1,6	5,41	6,8 (5,4)
BK/SIK 003	630	3,02	1,28	2,25	1,6	3,67	6,4 (4,6)
BK/SIK 004	400	2,07	1,73	2,09	1,6	3,58	5,1 (3,8)
BK/SIK 005	800	2,9	2,38	2,3	1,65	5,95	7,2 (4,8)
BK/SIK 005 L	1000	3,33	2,38	2,3	1,65	7,14	7,5 (5,1)
BK/SIK 006	1000	3,59	1,94	2,3	1,6	6,97	8,2 (6,7)
BK/SIK 007	1000	3,69	2,28	2,8	2,3	7,98	11,5 (7,5)
BK/SIK 008	630	3,31	1,94	2,7	2,2	6,045	8,5 (6,0)
BK/SIK 009	2500	4,79	2,28	2,8	2,3	10,4	12,0 (8,5)
BK/SIK 010	1600	4,61	2,09	2,7	2,2	8,184	10,5 (7,5)
BK/SIK 45-23	1000	4,56	2,36	2,8	2,3	10,35	11,9 (7,5)
BK/SIK 54-23	2 x 630	5,78	2,27	2,9	2,4	12,54	12,3 (9,5)
BK/SIK 64-23	2 x 1000	6,8	2,53	2,9	2,4	15,18	12,6 (11,1)
BK/SIK 64-26	2 x 1600	6,8	2,83	2,9	2,4	17,9	13,3 (11,7)

Other substation types can be designed and produced, upon customer's request, accordingly to the desired configuration and equipment.
E.g.: BK(SIK) 57-23 (2x1000 kVA), BK(SIK) 55-26 (2x1600 kVA), BK(SIK) 71-23 (3x1000 kVA) etc.
In these cases, in the type designation, the digits represent the length and the width of the substation, in dm.

Walk-in type prefabricated substations

Standard types

Substation types	Maximum power of the transformer kVA	Exterior dimensions length (m)	width (m)	hight (m) total	above ground	Print on the ground (m^2)	Mass of empty substation (t)
BK/SIK 007 I	1000	4,62	2,28	2,8	2,3	9,98	12,5 (7,8)
BK/SIK 008 I	630	4,22	1,94	2,8	2,3	6,95	10,5 (6,8)
BK/SIK 010 I	1000	4,77	2,68	2,8	2,3	11,12	13,8 (10,2)
BK/SIK 010 IM	2500	5,97	2,53	2,93	2,43	13,85	16,1 (10,5)
BK/SIK 50-27 I	800	5,2	2,9	2,9	2,4	14,12	12,1 (9,1)
BK/SIK 76-28 I	2x1600	7,72	3,08	3,0	2,5	22,2	15,4 (13,4)

Other substation types can be designed and produced, upon customer's request, accordingly to the desired configuration and equipment.
E.g.: BK(SIK) 50-27 I (630 kVA), BK(SIK) 70-25 I (2x1000 kVA), BK(SIK) 83-28 I (2x2500 kVA) etc.
In these cases, in the type designation, the digits represent the length and the width of the substation, in dm.

SWITCHING SUBSTATIONS

General Features

Electro Sistem produces a wide and diversified range of **switching substations**, employing the same modular technology that consists of prefabricated elements as those used for substations. In the same manner, the switching substations are delivered as a **single transportation unit.**

These consist of:

- Housing: foundation (tank, cable bushings, pressure reliefs, lifting anchors), walls, doors, ventilation elements, roof;
- Medium voltage switchgear;
- Supervisory control and data acquisition (SCADA) equipment, internal services panel, communication panel etc.

Employment areas:

Switching substations are used within electric cable distribution networks, urban or rural, for the medium voltage of one or more public, commercial or industrial facilities.

Switching substations may also be used in photovoltaic parks for the connection to the national energetic system.

We also produce switching substations for the internal part of substations.

Switching substations production types

Model	Type	Medium voltage equipment
Non walk-in switching substations		
Concrete	BK...	SF_6 fully insulated switchgear — Modular extensible cubicles with air-insulated bus bars and SF_6, vacuum or air switching apparatus
Metallic, insulated	SIK...	SF_6 fully insulated switchgear — Modular extensible cubicles with air-insulated bus bars and SF_6, vacuum or air switching apparatus
Walk-in switching substations		
Concrete	BK...I	Modular expanding cells with overhead bars insulation, SF_6 medium voltage devices, vacuum or overhead (ES 01-Plus, ES 02)
Metallic, insulated	SIK...I	Modular expanding cells with overhead bars insulation, SF_6 medium voltage devices, vacuum or overhead (ES 01-Plus, ES 02)

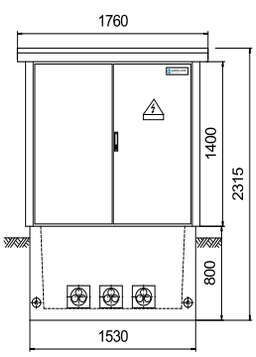
We manufacture a standardized range of switching substations both for walk-in types as well as for non walk-in ones. In addition, we offer solutions with properly-sized and equipped housing, for any kid of project requested by the beneficiary, the limitations being imposed only by the overall dimensions admitted to be transported.

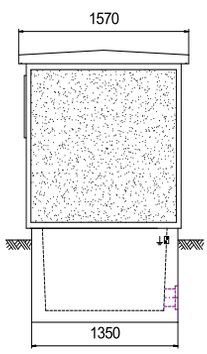
Walk-in switching substations

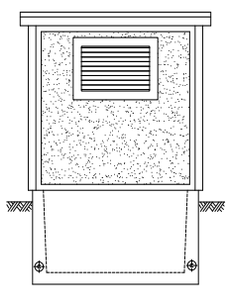
The basic constructive types are described in the following table:

Production type concrete/metallic	MV switchgear		Internal net dimensions (m)		
	SF6 fully insulated switchgear	Modular, extensible, air-insulated	Length	Width	Height
BK/SIK 19-11	●		1,66	0,8	1,4
BK/SIK 15-15	●		1,33	1,0	1,4
BK/SIK 20-15		●	1,83	1,4	2,0
BK/SIK 25-15		●	2,3	1,4	2,0
BK/SIK 28-13	●		1,3+1,3	0,85	1,5
BK/SIK 30-15		●	2,8	1,4	2,0
BK/SIK 40-16		●	3,8	1,4	2,0

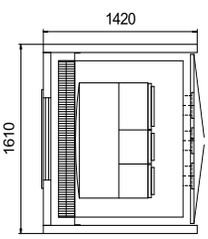
Examples:

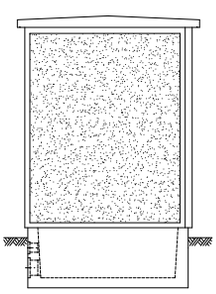


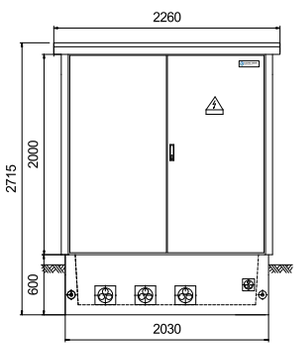


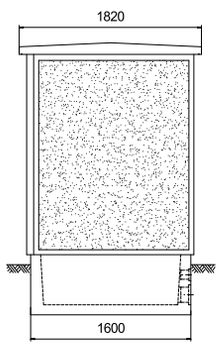


BK 15-15

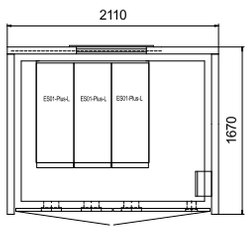








BK 20-15

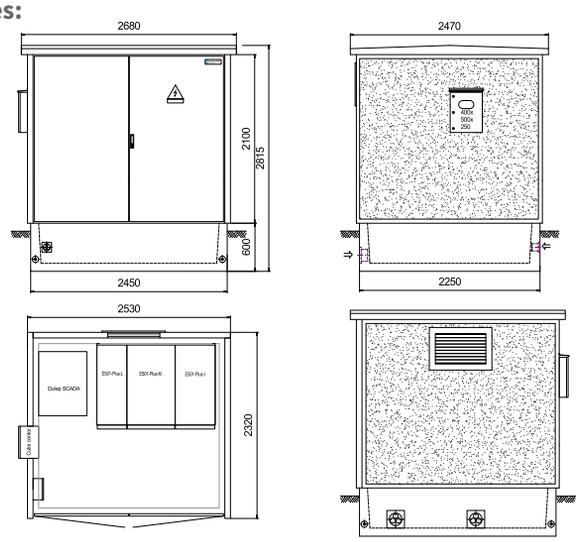


Non walk-in switching substations

The basic constructive types are described in the following table:

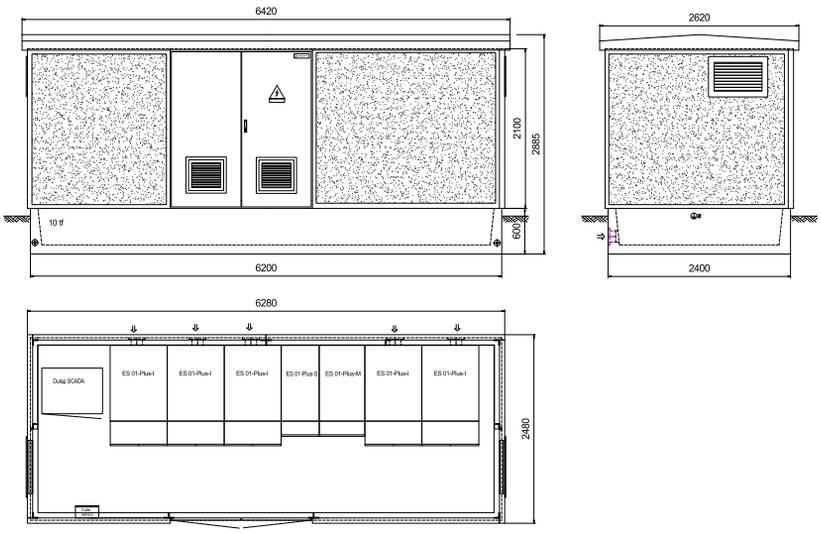
Production type concrete/metallic	MV switchgear	Internal net dimensions (m)		
		Length	Width	Height
BK/SIK 25-23 I	●	2,25	2,05	2,1
BK/SIK 29-24 I	●	2,6	2,1	2,1
BK/SIK 35-23 I	●	3,3	2,1	2,1
BK/SIK 39-23 I	●	3,7	2,1	2,1
BK/SIK 42-24 I	●	4,1	2,1	2,1
BK/SIK 45-24 I	●	4,3	2,1	2,1
BK/SIK 53-24 I	●	5,1	2,1	2,1
BK/SIK 62-24 I	●	6,0	2,1	2,1

Examples:



BK 25-23 I

BK 35-23 I


6420
2100
2985
600
10 tf
6200
2620
2400
6280
2480
Dulap SCADA
ES 01-Plus-I
ES 01-Plus-I
ES 01-Plus-I
ES 01-Plus-S
ES 01-Plus-M
ES 01-Plus-I
ES 01-Plus-I

BK 62-24 I

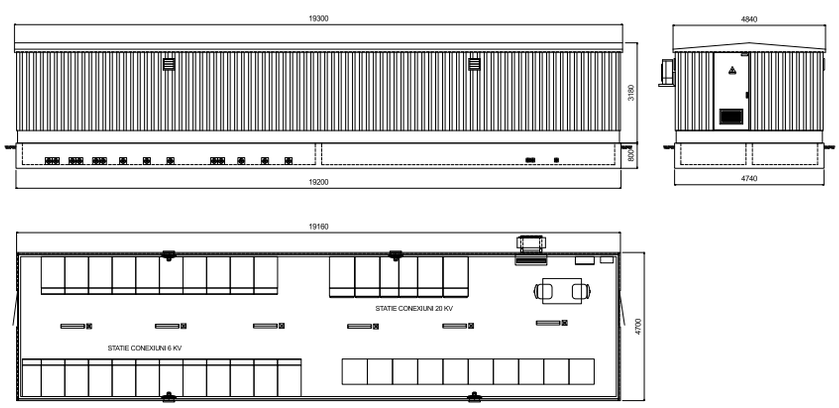
Switching substations for primary distribution substations

These are walk-in switching substations in concrete or metallic housing, and designed for primary distributions substations.

These may be equipped with medium voltage cubicles, type **ES 02** up to 1250 A, 25kA, 3s (manufactured by Electro Sistem) accordingly to any electrical diagram requested.

We also provide complete equipment for the switching substations, namely:

- Panel for SCADA integration
- Telecommunication panel
- AC internal services panel
- DC internal services panel
- Rectifier and rechargeable batteries panel
- General signaling panel
- Internal services panel
- Air conditioning installation



SIK 192-47 I

INVERTER SUBSTATIONS

General Features

They are designed for photovoltaic parks and are produced in a diversified range to answer all technical requests. They are produced in our specialized workshops accordingly to the SR EN 62271-202 standard and are delivered directly as a single transportation unit. Their mounting on site does not require special works.

The inverter housing may be produced in concrete or in insulated metallic and internally operated (BK…I or SIK…I) housings.

The main constructive elements are: concrete waterproof and oil resistant foundation, hot galvanized steel frame, concrete walls or thermo-insulated metallic panels, dismountable roof, powder-coated aluminum sheet access doors, ventilation windows and walls, separation walls made of zinc-coated steel sheet and various other accessories. The passage of medium and low voltage cables is made by using bayonet cable bushings (UGA System).

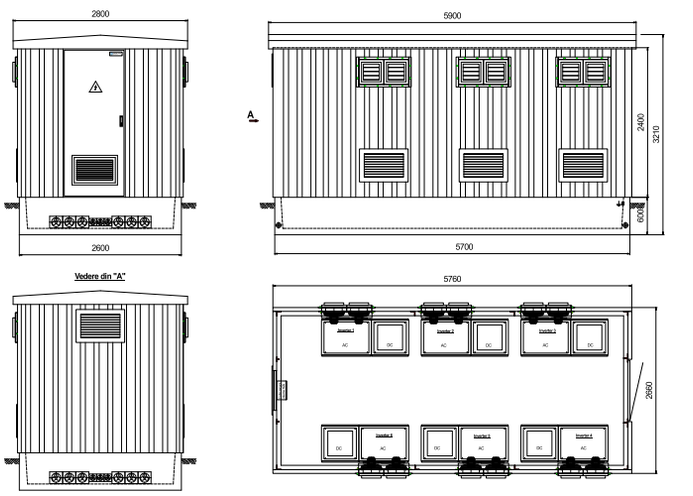
The technology used for the production of substation housing provides great flexibility. This allows us to design the substation housing accordingly to the dimensions and the technical features of the electrical equipment that will be incorporated. Thus, our substations can be equipped with equipment coming from various manufacturers, all necessary adjustments being performed very rapidly.

In the case of photovoltaic parks we employ two basic solutions, consistent with the location of centralized inverters. Therefore, we may have the following situations:

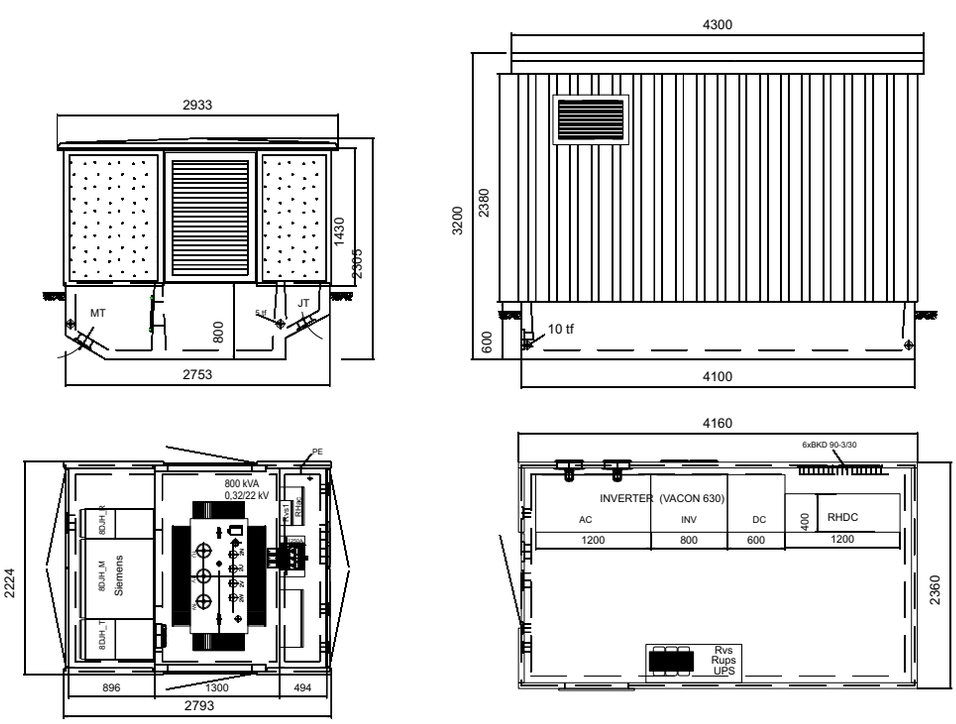
- Special substations for inverters
- Transformer substations with inverters

Special substations for inverters

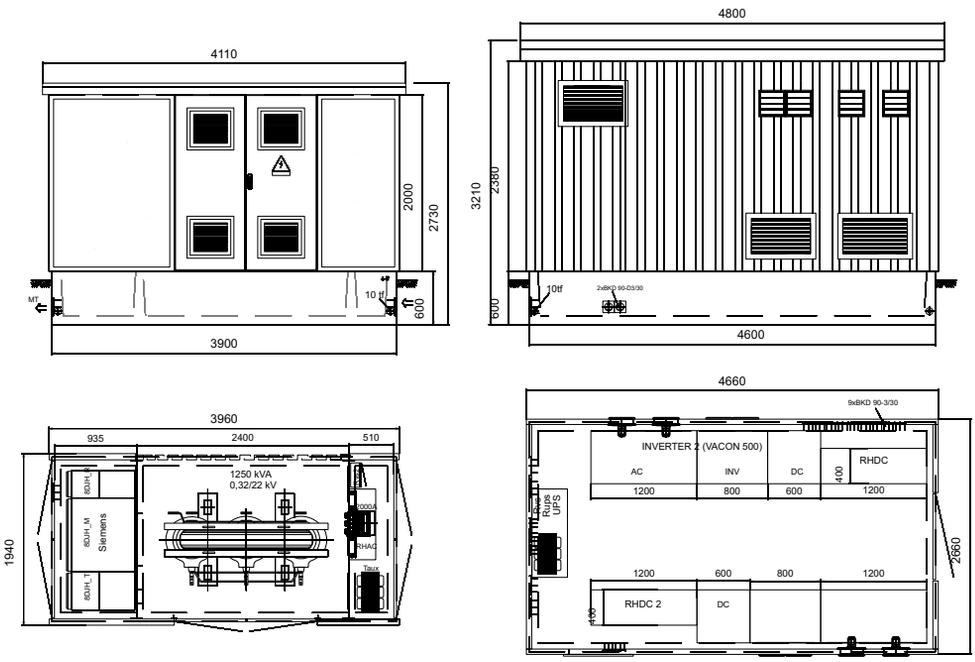
This solution consists in placing the centralized inverters in a separate housing, while the low voltage panel, the transformer and the medium voltage switchgear are placed in a prefabricated transformer substation.



*Substation for inverters **SIK 57-26 IS***



*Transformer substation type **BK 005,** 630 kVA together with substation for inverters, type **SIK 46-23 I***



BK 010H**, 1250 kVA substation group and substation with inverters **SIK 46-26 I

Transformer substation and substation for inverters mounted on site

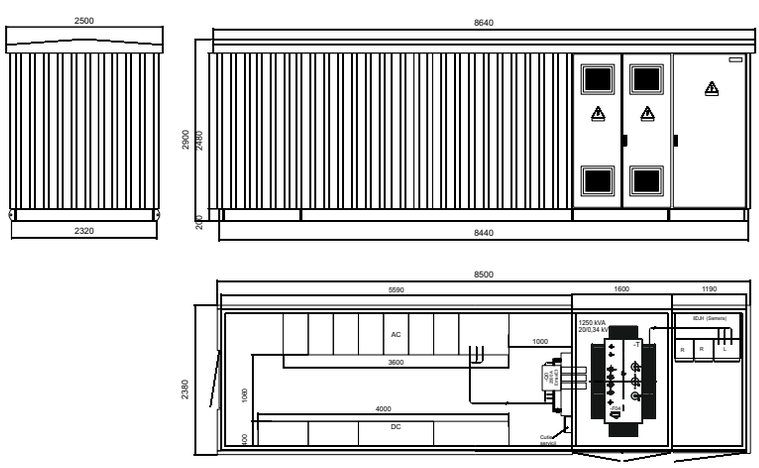
Transformer substations with inverters

As far as the second solution is concerned, the centralized inverters are incorporated into the housing of the prefabricated substation. The substation has a compartment where all inverters, DC connection cabinets (if applicable), low voltage panels, internal services box, supply (UPS) etc are being located. The other two are the transformer and the medium voltage compartments.

Should the height required by the centralized inverters exceed 2,4 m, the substation may be produced on metallic frames, and the concrete foundation will be built on-site.

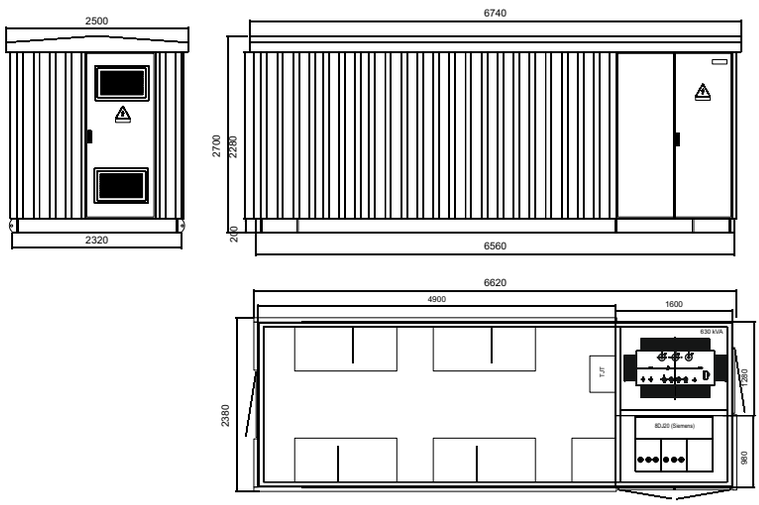
SIK 85-24 I

Compartment with inverters and low voltage panel

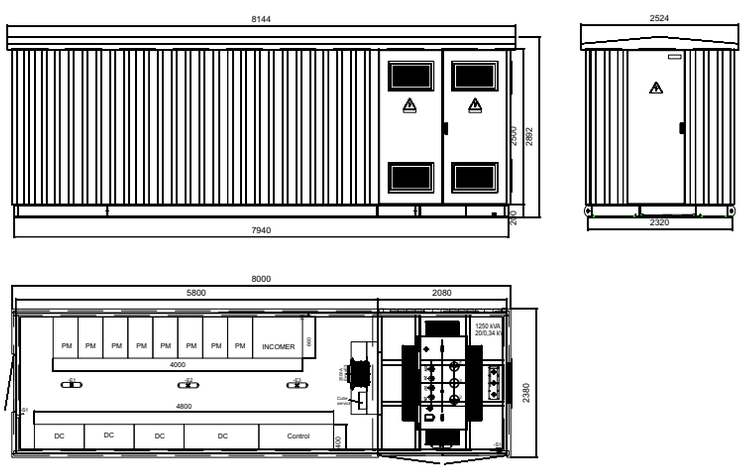


*Transformer substation with inverters, 1250 kVA, type **SIK 85-24 I***

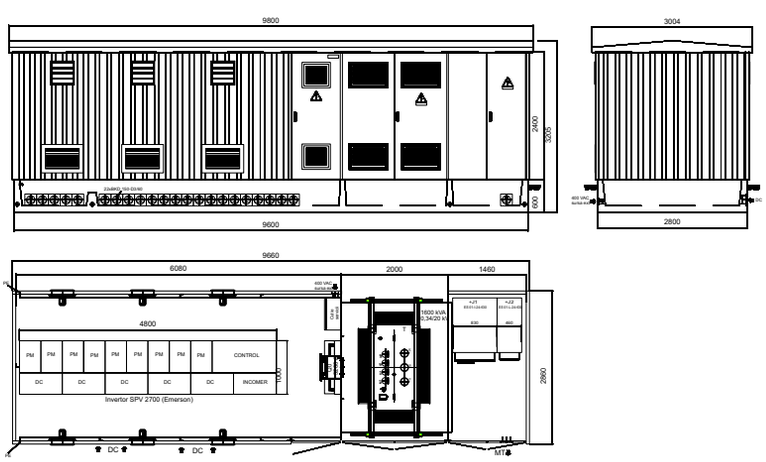
Other substations with inverters



SIK 66-24 I, *630 kVA*



SIK 80-24 I, 1250 kVA, *without medium voltage compartment*



SIK 96-28 I, *1600 kVA, with medium voltage compartment*

SUBSTATIONS FOR SPECIAL APPLICATIONS

General Features

These are custom-made substations for special applications. They are manufactured with the same technology used for the prefabricated substations.

They can be manufactured in concrete (BK…) or in metallic insulated housings (SIK…), non walk-in or walk-in operated.

The technology employed for the production of substation housing provides great flexibility.

This allows us to design the substations accordingly to the dimensions and the technical features of the electrical equipment that will be incorporated. Thus, our substations can be equipped with equipment coming from various manufacturers, all necessary adjustments being performed very rapidly.

Semi-underground substation

We produce the following categories of substations for special applications:

Prefabricated substation in special housing:

- semi-underground substation housing for situations in which the height of the substation housing above ground level may not exceed a certain limit so the architectural setting of the area should not be disturbed.
- metallic frame mounted housing for temporary or mobile substations or for the ones whose height, together with the concrete foundation would exceed the transportation allowable parameters

Metallic-frame mounted housing

Substation housing specially designed for various equipment:

- substation for distribution panels or automation equipment
- substation for distribution boxes
- substation for electricity metering
- substation for telecommunication equipment

Special substation for various uses:

- command rooms, offices, warehouses, etc.

Semi-underground substation

Housing for telecommunication equipment

Air-conditioned housing for automation equipment

Metallic frame mounted housing

Metallic frame mounted substation

Substation with air-conditioned low voltage compartment

Individualized substations, perfectly integrated into the urban landscape and the environment

The components of the urban landscape such as substations are often inconsistent with the aesthetics and architecture of the buildings and surrounding areas.

By designing and manufacturing individual substations, we manage to integrate them perfectly into the urban landscape, thus increasing its value and quality.

/ Low-cost investments
/ Easy operation
/ Low maintenance
/ Recyclable and biodegradable materials, specially insulated concrete and oil-water resistant concrete
/ Durable materials
/ High-reliability solutions, state-of-the-art technologies
/ Secure construction against vandalism and theft
/ Surface reduced to ground

substations painted in the colors of the surrounding buildings

substations with prewashed concrete walls or brick façade walls

substations with walls and doors with stickers

semi-underground substations

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