



**TURNKEY SOLUTIONS  
IN POWER ENGINEERING**

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# BUSINESS AREAS

SVEL Group JSC is a leader among national manufacturers of the electrotechnical equipment. It is a producer of power dry-type and oil-immersed transformers, provider of solutions in electric power quality improvement and electric network protection. SVEL Group is also taking advantage of its cutting edge technologies to be a reliable provider in such products as switchgears, packaged transformer substations, instrument transformers, circuit breakers and disconnectors.

Our experience in the field has enabled us to solve a wide range of requirements even for special units, i.e. earthing transformers, transformers for 6-12-18-24 pulse converters, HV-HV transformers, three-monophas transformers, Scott type transformers, start motor transformers and autotransformers.

SVEL are present in the national and international market and count on a 14-year technical experience in the field. The recently built new works are equipped with high-tech producing plants, the most sophisticated automation job order systems via real time production management.



## PRODUCTION OF DRY-TYPE TRANSFORMERS



Year of production startup – 2003  
– Production capacity  
MVA per 3,000  
\_\_\_\_\_ . year

## PRODUCTION OF REACTOR EQUIPMENT



Year of production startup – 2004  
– Production capacity  
phases per year 960  
\_\_\_\_\_

## PRODUCTION OF OIL TRANSFORMERS



Year of production startup – 2009  
Production capacity under full load –  
24,000 MVA per year  
\_\_\_\_\_

## PRODUCTION OF MEDIUM VOLTAGE SWITCHGEARS      PRODUCTION OF MV/LV PREFABRICATED SUBSTATIONS      PRODUCTION OF LOW-VOLTAGE SWITCHBOARDS



Year of production startup – 2009  
Production capacity –  
2000 units per year



Year of production startup – 2009  
Production capacity –  
500 units per year



Year of production startup – 2016  
Production capacity –  
1,000 units per year

## PRODUCTION OF MODULAR INTEGRATED TRANSFORMER SUBSTATIONS



Year of production startup – 2009  
Production capacity – 88 substations  
per year  
\_\_\_\_\_

## PRODUCTION OF INSTRUMENT TRANSFORMERS



Year of production startup – 2010  
Production capacity – 100,000 units  
per year  
\_\_\_\_\_

## PRODUCTION OF CIRCUITBREAKERS, GAS-INSULATED TRANSFORMERS AND DISCONNECTORS



Year of production startup – 2011  
\_\_\_\_\_

DESIGN ENGINEERING

EQUIPMENT PRODUCTION  
DESIGNING, MANUFACTURING,  
TESTING

DELIVERY

CONSTRUCTION-AND-ASSEMBLING  
OPERATIONS  
ERECTION SUPERVISION WORK

STARTUP AND ADJUSTMENT  
OPERATIONS  
COMMISSIONING

MAINTENANCE SERVICE

# MODULAR INTEGRATED TRANSFORMER SUBSTATIONS



**RATED VOLTAGE** – from 35 to 220 kV

## ADVANTAGES:

### Reduction of project design period

Use of typical products catalogues.

### Convenient procedure of ordering

Use of code designation for prime MITS items. That decreases procedures of order clearing.

### Versatility

Modular versatility makes it possible to implement any type of high-voltage equipment tailored to individual project requirements.

### Reconstruction of existing switchgears

- Modules are adapted for any type of equipment;
- Rigid busbar can be arranged on wide spectrum of supporting insulators and disconnecting devices;
- Open switchgears configuration design with the consideration of individual project requirement.

### Decrease of terms of delivery

Availability of developed design documents.

### Decrease of terms of assemblage

- Use of bolting instead of welding both in modules with equipment and in rigid busbars;
- Fit-up assembly test at the manufacturing facility allows to exclude incompleteness of delivery to the site and to check assemblability of parts.

### Decrease of installation area for switchgear

- Block-modular design allows to decrease amount of foundations comparing to block constructions;
- Use of suspended cable constructions allows to cut additional expenditures for on-ground cable laying;
- Placement of cabinets of secondary control wiring directly on supporting metal construction allows to exclude expenditures on arrangement of separate foundations for these cabinets.

### Use of rigid busbar

It allows not to use bus portals, to avoid necessity of making foundations for them, it allows to exclude laying of flexible busbar; and that leads to decrease of land allocation for switchgear, to decrease construction-and-assembling operations, it leads to material saving.

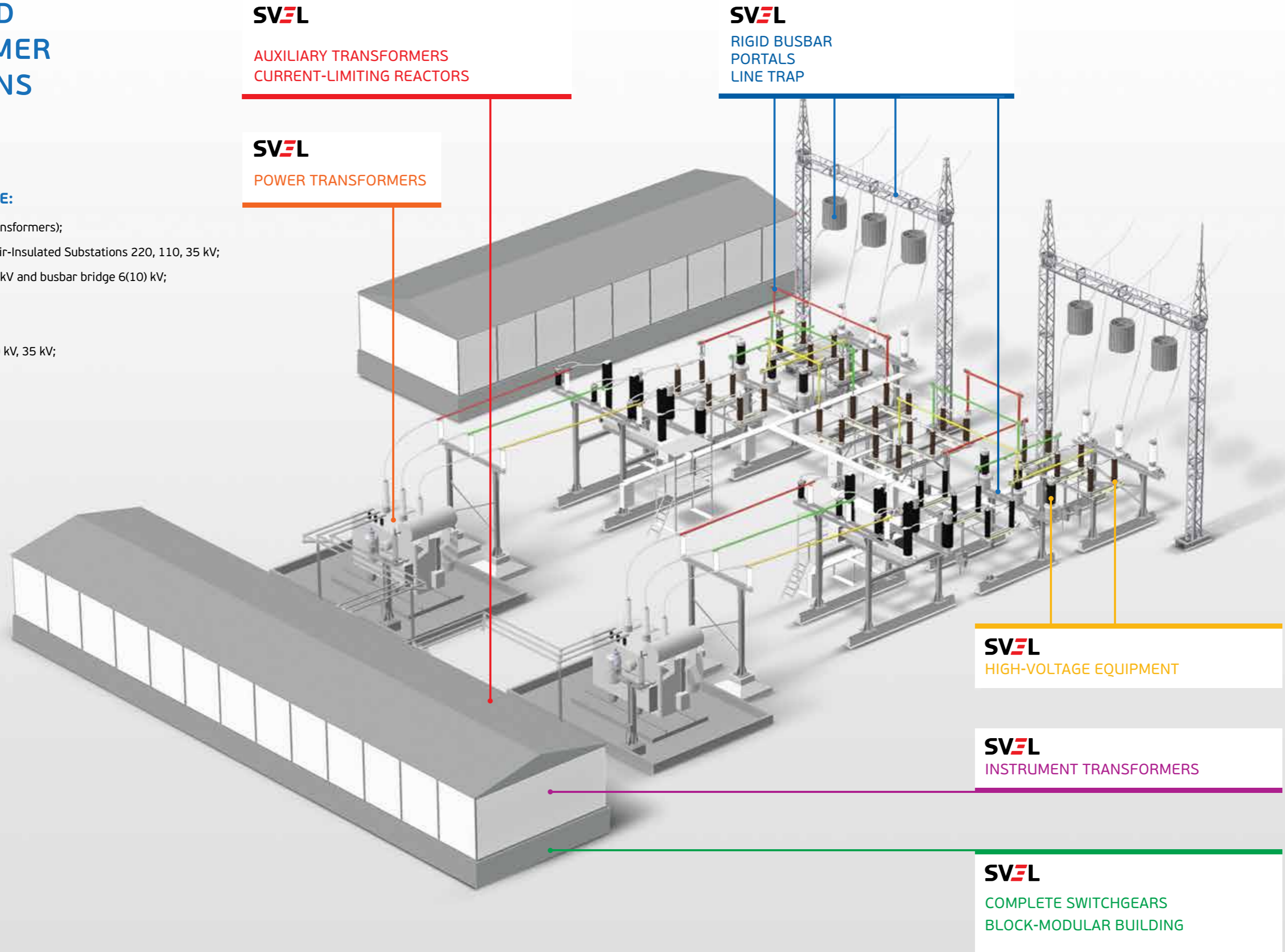
## MITS TECHNICAL DATA

No.	Data	AIS 220 kV	AIS 110 kV	AIS 35 kV	Notes
1	Rated Voltage, kV	220	110	35	
	Highest	220	110	35	
	Medium	35; 110	35	—	
	Lowest	6; 10; 35	6; 10	6; 10	
2	Power of transformer	125000*	63000*	16000*	* According to substation project requirements
3	Rated current, A				
	• AIS bay	630; 1000; 1600	630; 1000; 1600	630; 1000; 1600	According to single-line diagram 110-12...13, 220-7...14
	• incoming switchgear		to 4000		See Switchgears Catalogue
	• power transformer circuits		630		
	• busbars	1000; 2000; 3150	1000; 2000	1000; 2000	
4	Rated peak withstand current, kA	65; 81; 102; 128	65; 81; 102; 128	65; 81; 102	
5	Rated short-time withstand current (during 3 sec), kA	25; 31,5; 40; 50	25; 31,5; 40; 50	24; 31,5; 40	
6	Temperature range, °C		-60 up to +40		
7	Seismic sensity		7-9*		according to MKS-64 scale; *reinforced supporting metal frame
8	MITS lifetime, years		30		

# MODULAR INTEGRATED TRANSFORMER SUBSTATIONS

## MITS SET CAN INCLUDE:

- Power transformers (autotransformers);
- Compact Prefabricated HV Air-Insulated Substations 220, 110, 35 kV;
- Rigid busbar system 35-220 kV and busbar bridge 6(10) kV;
- Cable constructions;
- Local control cabinets;
- Closed switchgear ZRU 6(10) kV, 35 kV;
- Substation control building;
- Portals;
- Lighting;
- Earthing switches.



# OIL TRANSFORMERS

(POWER AND RECTIFIER)



**VOLTAGE CLASSES:** up to 500 kV  
**POWER:** from 2.500 to 267.000 kVA



## STRUCTURAL FEATURES

### Magnetic core

- Coiled grain-oriented electrical steel with low specific losses is used;
- Assembly of steel sheets is performed with complete chamfered joint using Step-Lap technology.

### Coils

- Winding technology allows to stabilize dimensions of coils during whole operating life;
- Use of transposed wire allows to increase electrodynamic firmness of transformer coils at short-cuts, and to decrease extra losses in coils.

### Active part

Structure of active part allows to decrease extra losses in its metal structures by half.

### System of test assembly of dismantled units of metal structures with part marking

- Design mistakes are excluded;
- Installation of transformers becomes easier.

## TRANSFORMER MONITORING SYSTEM

At the customer's request, additional functions of control, monitoring and diagnostics of transformers are installed. They increase safety of power facilities used in the production of power transformers of the SVEL Group:

- Control of condition of coolers and effectiveness of cooling system;
- Computation of time in operation for each oil pump and fan;
- Ambient temperature control;
- Oil temperature control in input/output of cooling system;
- Humidity-in-oil analysis;
- Analysis of gases dissolved in oil;
- Control of LTC current condition by analog sensors or through angular deflection of drive;
- Command generation and execution control for transformer tap changing in the mode of LTC manual control;
- Control of LTC drive current;
- Evaluation of real LTC resource depending on transformer load and time of inspections;
- Detection of such failures as creep, rejection of switching, crawling, and lack of synchronization;
- Coil temperature control and evaluation of thermal wear of insulation;
- Oil temperature control in the tank of LTC;
- Control of partial discharges and insulation of inputs.

Transformer monitoring system can include sensors for prime parameters measuring, prime parameters processing unit, archivation and visualization unit, control unit, unit for data exchange with a system of higher level, and integration unit for connection with automated controlling system.

## THREE MAIN REASONS TO CHOOSE OIL IMMERSED TRANSFORMERS OF SVEL:

- 1 Reduced no-load and load losses
- 2 Less operating costs
- 3 Higher electrodynamic firmness of transformer coils



# AIR-CORE CURRENT-LIMITING REACTORS

**VOLTAGE CLASSES:** up to 330 kV  
**NOMINAL CURRENT:** from 50 TO 10.000 A



## PURPOSE

SVEL develops and produces air-core reactors designed and suitable for electric power systems up to 330 kV with a purpose to limit short-circuit currents in electrical networks and to keep voltage level in electricity-generating equipment in case of short-circuit:

- current ranges from 50 to 10.000 A;
- non-standard implementation of reactor with angles between outputs different from 0, 90, 180 and 270 °C is possible;
- vertical, horizontal and stairstep placement of reactor phases is possible;
- climatic categories according to GOST and IEC standards.

Constructive innovations allow decrease weight and overall dimensions of reactors comparing to concrete reactors as well as with other kinds of air-core reactors.

## BASIC ELEMENTS OF CONSTRUCTION

The reactor windings are made of multiple-core aluminum cable specially designed for SVEL reactors.

Winding is designed to be multilayer to provide unattenuated current distribution across parallel wires without transposition between them (this construction is patented). As a result, reactors, though having rather small overall dimensions, have high electrodynamic firmness and thermal resistance.

Mechanical strength of reactors is provided by winding pressing design composed of a system of insulating ledges and vertical tension pins.

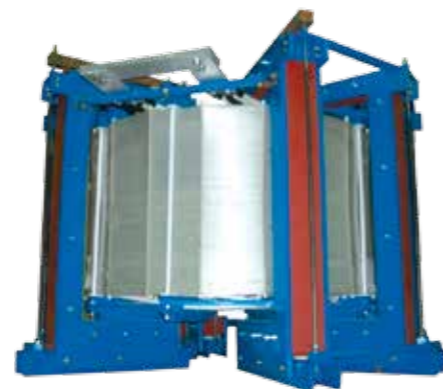
## BENEFITS

- Wide range of air-core current-limiting reactors with current range from 50 to 10.000 A and voltage up to 330 kV;
- Production based on own patent;
- Small overall dimensions and weight;
- Versatility of output implementation;
- Manufacture of air-core current-limiting reactors takes from 45 to 60 days;
- Manufacture of reactors with reduced losses.

# SHELL-TYPE CURRENT-LIMITING REACTORS

**VOLTAGE CLASSES:** from 3 to 20 kV  
**NOMINAL CURRENT:** 2.500 – 4.000 A

Major advantage of shell-type current-limiting reactors is a possibility of compact placement in reaction chambers because of decreased area of stray fields.



# DAMPING REACTORS

**VOLTAGE CLASSES:** 6 – 10 kV  
**NOMINAL CURRENT:** 20 – 250 A

Damping reactors with cast-insulation are designed to limit commutation current of capacitor bank appearing at switching of capacitor bank (or some stages of capacitor bank) into electric network. Damping reactors are installed in a capacitor bank in series with power factor high-voltage capacitors.



# SMOOTHING REACTORS

**VOLTAGE CLASSES:** up to 10 kV  
**NOMINAL CURRENT:** up to 9.000 A

Smoothing reactor is a static electromagnetic device designed to reduce content of ultraharmonics (ripple) in inverted current using its inductivity in electric network.



# FILTER REACTORS

**VOLTAGE CLASSES:** 3 – 110 kV  
**NOMINAL CURRENT:** up to 4.000 A

Filter reactors are series connected with filter capacitor bank to form resonant circuit, which can filter specified harmonic currents.



# LINE TRAP

**NOMINAL CURRENT:** from 100 to 4.000 A  
**MINIMUM ACTIVE RESISTANCE:** from 400 TO 650 OHM  
**BARRIER FREQUENCY COVERAGE:** from 24 TO 1.000 KHZ

Line trap are designed to provide transmission of signals of automatic emergency response system, as well as signals of relay protection, telephone lines, telemechanics and others.



# HIGH-VOLTAGE PRODUCTS



**VOLTAGE RANGE:** from 110 up to 500 kV



## LIVE TANK SF6 CIRCUIT BREAKERS FOR 110 AND 220 KV

Circuit-breakers are designed for operation under rated and short-circuit current conditions in three-phase AC networks

The circuit-breaker covers the whole temperature range from -60°C to +40°C, which makes it suitable almost for all climate zones.

## DEAD TANK SF6 CIRCUIT BREAKERS FOR 110 AND 220 KV

Circuit-breakers are designed for operation under rated and short-circuit current conditions in three-phase AC networks.

Characteristics of built-in current transformers can vary depending on customer's requirements.

TYPE OF CIRCUIT BREAKER	VGKT-110	VGKT-220
Voltage class, kV	110	220
Rated current, A	2500	
Rated short-circuit breaking current, kA	40	
Temperature range, °C	- 55... +40	
Drive mechanism	Stored-energy spring PPrA	

TYPE OF CIRCUIT BREAKER	VGBT-110	VGBT-220
Voltage class, kV	110	220
Nominal current, A	2500	
Rated current, kA	40	
Rated short-circuit breaking current, °C	- 60... +40	
Mechanism	Stored-energy spring PPr	

## SF6 CURRENT AND VOLTAGE INSTRUMENT TRANSFORMERS

SF6 current and voltage instrument transformers are designed for outdoor and indoor installation. Instrument transformers transform high currents and voltages into standardized low and easily measurable values that are isolated from the high voltage. Instrument transformers provide current and voltage signals for measuring, protection and control devices.

### TECHNICAL DATA OF CURRENT TRANSFORMER; TYPE TG-SVEL

DATA	VALUE
Rated voltage, kV	up to 500
Rated primary current, A	50-100-200; 75-150-300; 100-200-400; 150-300-600; 200-400-800; 300-600-1200; 400-800-1600; 500-1000-2000; 50; 75; 100; 150; 200; 400; 600; 800; 1000; 1200; 1500; 2000
Rated secondary current, A	1 or 5
Number of secondary windings	to 6
Metering accuracy class	0.2S; 0.2; 0.5S; 0.5; 1 5P; 10P
Ambient air temperature, °C	- 60 ... + 40

### TECHNICAL DATA OF VOLTAGE TRANSFORMER; TYPE ZNG-SVEL

DATA	VALUE
Rated voltage, kV	up to 220
Max. operating voltage, kV	126                      252
Rated voltage of primary winding, kV	110√3
Rated voltage of main secondary winding, V	110√3
Rated voltage of additional secondary winding, V	100
Number of secondary windings	up to 3
Ambient air temperature, °C	- 60 ... +40

## DISCONNECTORS FOR 110 AND 220 KV OUTDOOR INSTALLATION

Disconnectors are used to connect the circuit and indicate a visible isolating distance in an air isolated gap. They are designed for operation in three-phase AC networks.

Disconnectors can be equipped with earthing switches. A built-in mechanical Interlocks guarantee that the disconnector can't be operated when the earthing switch is in switched on position and vice-versa. Disconnectors may have manual and motor drive system equipped with the electro-magnetic interlock, witch guarantees the correct operation sequence. Disconnectors cover the whole temperature range from -60°C to +40°C.

TYPE OF DISCONNECTOR	RG-110	RG-220
Rated voltage, kV	110	220
Rated current, A	1600; 2500	1600; 2500
Rated peak withstand current, kA	102; 128	102;128
Rated short-time withstand current (during 3 sec), kA	40; 50	40; 50
Number of operating cycles	10000	10000
Drive: Motor Manual	NS080 NR080	NS080 NR080
Seismic intensity (MSK-64)	7 - 9 points	7 - 9 points



# MEDIUM VOLTAGE SWITCHGEARS

**VOLTAGE CLASSES:** 6(10), 35 kV

## PURPOSE AND SCOPE:

Air-insulated switchgears produced by SVEL are intended for operation in three-phase distribution networks up to 35 kV, rated frequency 50 Hz..



## TECHNICAL DATA

DATA	VALUE	
Switchgear type	MVS- SVEL	MVS-SVEL-K-3.1
Rated voltage, kV	6; 10	35
Maximum operating voltage, kV	7.2; 12	40.5
Rated busbar current, A	1000; 1600; 2000; 3150; 4000	1250; 2500
Rated main circuits current, A	630; 1000; 1250; 1600; 2000; 2500; 3150; 4000	1250; 2500
Rated short-circuit breaking current of circuit breakers installed in switchgear, kA	20; 25; 31,5; 40	25; 31.5
Rated peak withstand current, kA	51; 64; 81; 102	63; 81
Rated thermal current, kV	20; 25; 31,5; 40	25; 31.5
Rated short-time withstand current, sec for switchgear unit for earthing switch	3 1	
Rated voltage of secondary circuits, V ac control circuits dc control circuits switchgear lighting circuitsY	220 220 42 (36) 12	
Overall dimensions of switchgear unit, mm width depth height	650, 750, 900, 1000 1400, 1600*, 1500, 1700* 2400	1200 2500; 2800** 2400
Weight, kg	700... 1300	1500 - 2400

\* Depth 1400 mm and 1500 mm to be increased by 200mm for a unit with busbar bridges and junctions.

\*\* Single-line diagram

## SWITCHGEAR CLASSIFICATION

CHARACTERISTIC	VERSION
Insulation type	air
Busbar insulation	insulated busbars/busbars without insulation
Type of incoming/outgoing high-voltage connections	cables, busbars
Service side	front/front and rear
Protection class	up to IP4X
Type of units built-in equipment and connections	circuits breaker busbar-disconnector surge arrester voltage transformers with bus inputs incoming/outgoing from the top with cable inputs incoming/outgoing from below in cabinet with power fuses with auxiliary equipment and apparatus hardware, combined
Type of control	local, remote
Type of delivery	by separated units

## TYPES OF EQUIPMENT USED IN SWITCHGEARS

DESCRIPTION	MVS-SVEL		MVS-SVEL-K-3.1	
	TYPE	MANUFACTURE	TYPE	MANUFACTURE
Circuit-breakers	BB/TEL / VD4 / SION / VF12-M	Tavrida-Electric, ABB, Siemens, Eltechnika	VD4	ABB
Voltage transformers	ZNOL-SVEL-6(10) NALI-SVEL-6(10)	SVEL Instrument Transformers	TJP 7(7.1)	ABB
Current transformers	TOL-SVEL-6(10)	SVEL Instrument Transformers	TLK 35	SZTT
Earthing switch	ZR-10	SVEL-KRU	EK6	Ningbo Mingde
Surge arrester	OPN/TEL	Tavrida-Electric	OPN	Polymer-Apparat
Protection relay	different	different	different	different
Arc protection system	different	different	different	different

## ADVANTAGES

- Construction does not have welded joints, bolting or riveting only. That allows to use galvanized sheets in all switchgear elements;
- Double metal powder coating of metal constructions allows to avoid corrosion within 30 years;
- Any type of equipment build in a unit;
- Construction of switchgear is modular; that conduces fast realization of customer's requests (it is enough to change the block);
- During the complete cycle of production each equipment is submitted to electrical and mechanical tests until the final test;
- Small dimensions allows optimal using of inner space;
- Possibility of switchgear installation into block-modular building

# MEDIUM-VOLTAGE/ LOW-VOLTAGE PREFABRICATED SUBSTATIONS

**VOLTAGE CLASSES:** 6 (10)/0.4  
**RATED POWER:** up to 2.500 kVA

## ADVANTAGES:

- Pre-fabricated assembly;
- Minimum amount of welding seals, galvanized steel sheets;
- Design flexibility and quick changes;
- Any substation configuration;
- Maximum factory readiness;
- Possibility to use in for outdoor installation in block-modular building;
- Installation with dry-type transformer allows to avoid oil facilities;
- MV/LV PREFABRICATED SUBSTATIONS - SVEL conform with permissible shipping dimensions;
- Possibility of installation on foundation of any type;
- Seismic sensity is up to 9 points (MSK-64).



## TECHNICAL DATA

DATA	VALUE			
Power transformer capacity, kVA	250; 400	630; 1000	1600	2000; 2500
Rated voltage on HV side, kV	6; 10			
Maximum operating voltage on HV side, kV	7.2; 12			
l rated voltage on LV side, kV	0.4; 0.69			
Rated short-time withstand current on HV side in 1 sec, kA	20			
Rated peak withstand current on HV side, kA	51			
Rated short-time withstand current on LV side in 1 sec, kA	10	20	40	40/60
Rated peak withstand current on LV side, kA	25	50	100	100/150
Insulation level according to GOST1516.3-96 with oil transformer with dry-type transformer	standard insulation reduced insulation			
Seismic sensity according to MSK-64	9 points			

## TYPES OF EQUIPMENT USED IN MV/LV PREFABRICATED SUBSTATIONS

DESCRIPTION	TYPE, PART NO.	MANUFACTURER
Power transformers	TS, TMZ, TSZ, TSZD, TMG, TMGF	SVEL, METZ n.a. V.I.Kozlov Russky Tansformator
Load-break switch	SL12	Elektrotshit TM Samara Group of Companies Eltehnika
Fuse	PKT, VVT-D	any
Automatic circuit breaker	BA, BA50-45Πpo TS, AH, AN, AS 3VT, 3VL, 3WL, 3WT CVS, NSX, MVS, NW, NT	Kontaktor LSIS Siemens Schneider Electric
Current transformers	TOP-0,66 TSHP- 0,66 TTI	different

## CLASSIFICATION OF MV/LV PREFABRICATED SUBSTATIONSS

CHARACTERISTICS	VERSION
Type of power transformer	dry-type transformer/ oil transformer
Type of neutral on LV side	solid-grounded neutral insulated neutral
Mutual alignment	one-row/two-row
Number of power transformers	with one transformer/with two and more transformers
Protection degree	IP20, IP23, IP34
HV incoming connection	cable/air
Outgoing arrangement in low-voltage panel bus cable	top top and bottom bottom
Circuit breaker installation	plug-in withdrawable / fixed-mounted
Designation	incoming, outgoing, coupling, secondary wiring
Service conditions	front and rear side
Control	local, remote

## DELIVERY SET

Depending on customer's request, delivery set can include:

1. HV switchgear
2. LV distribution panel
3. Power transformer;
4. SUNN, SUVN specified by design of MV/LV PREFABRICATED SUBSTATIONS and power transformer;
5. Block-modular buildings;
6. Busbar trunking system
7. Truck for circuit breaker transportation with weight exceeding 30 kg
8. Spare parts and accessories;
9. Set of operating documentation.

Guaranteed service life is 2 years, guaranteed storage life is 3 years in original packaging provided the transportation and storage conditions are observed.

# LOW VOLTAGE SWITCHBOARDS



## PURPOSE

LVS-SVEL low-voltage switchboard is designed for low-voltage distribution at three-phase systems.

## APPLICATION

The demands on power distribution are extremely diverse. At present days customers require reliability and safety of the power supply. LVS-SVEL complies with high demands on the power supply and can be used in oil and gas industry

- Chemical industry;
- Metallurgy ;
- Manufacturing industry;
- Infrastructure and transport;
- Nuclear power industry.

## ADVANTAGES

- Modular structure allows to perform LV switchboard e for wide range of application;
- Changing of configuration and functional blocks without supply switching off;
- Possibility of extension by adding sections as the number of receivers of electric power is increased;
- Highest operating personnel safety;
- Motor control.

## LV SWITCHBOARDS SPECIFICATIONS

DATA	VALUE
Rated voltage, kV	0.4; 0.69
Rated frequency, Hz	50
Rated busbar current, A	up to 6300
Rated peak withstand current, kA	up to 220
Rated short-time withstand current 1sec, kA	up to 100
Type of connection to earth	TN-C, TN-C-S, TN-S, IT
Internal division	1, 2a, 2b, 3a, 3b, 4a, 4b
Panel	incoming feeders coupling outgoing feeders universal mounting design compensation of reactive power
Mounting design	Fixed-mounted withdrawable
Configuration of functional units	circuit breakers installation fuse installation motor softstarter and smooth braking device frequency converter
Panel Over-all dimensions, mm height depth width	2200 600-1200 200-1200
Protection degree	IP30, IP31, IP40, IP41, IP42, IP54
Seismic sensity MSK-64 scale	9 points
Life time (not less), years	30
Operational altitude above sea, up to elevation (no more), m	1000
Warranty since placed in operation	3 years
Accordance to	GOST, IEC

# CAST RESIN DRY-TYPE TRANSFORMERS

(DISTRIBUTION AND RECRIFIER)

**VOLTAGE CLASSES:** up to 36 kV  
**POWER:** from 25 to 25.000 kVA



- Reduced no-load and load losses
- Reduced noise level
- Ambient temperature from minus 60 C° up to 55 C°
- High level of fire-resistance allowing to locate transformer sites as close as possible to electric power consumers, which will significantly reduce losses in course of electric power transmission in LV mains
- Ecological cleanliness. As there is no oil in the transformer, threat of environment pollution because of oil leakage will not be possible
- Operation security. Transformer windings are not flammable and cannot be a source of fire
- Minimum operational costs, as there is not necessity in periodic check and replacement of dielectric fluid
- Small overall sizes, which provides possibility to install a more powerful transformer in the existing transformer compartment in course of reconstruction of the substation
- High dynamic strength at short circuit currents
- Windings are not subjected to wetting and polluting
- Increased reliability. High pulse strength of dry-type transformers allows omitting installation of surge arresters.

## TECHNICAL PARAMETERS OF CAST DRY-TYPE TRANSFORMERS

TRANSFORMER TYPE	DISTRIBUTION			
Rated power, kVA	10-6300*			
HV insulation level, kV*	12	17.5	24	36
HV tapping range	Off load tap changer +-2x2.5%			
Frequency, Hz	50, 60			
Vector group	DYN-11, DYN-5, YYN-0 (and other)			
Thermal class	F, H			
Environmental, Climatic and Fire behaviour class (according to IEC 60076-11)	E2	C2	F1	
Enclosure	Without enclosure (IP00). With metal enclosure (IP21-IP54)			
Earthquake activity of the installation site per MSK-64 scale	Up to 9 points			
Service life	30 years at least			

\* Note: basic characteristics of transformers of insulation classes 17.5 - 36 kV and power over 6300 kVA are to be agreed by individual requests of customers.

The company has an efficient quality control of the products in accordance with ISO 9001:2008. The Quality System covers all production stages from the offer to the after sale service.

SVEL follows the current trends and the highest quality standards. That is why we certify management systems and products from leaders in their field.

### SVEL Group produce follow dry-type transformers:

- Distribution transformers
- Earthing transformers
- Transformers for 6-12-18-24 pulse converter
- HV-HV transformers
- Scott type transformers
- Autotransformers
- Marine transformers
- Transformers for Urban electric transport
- Transformers for renewable energy
- Amorphous cast resin dry-type transformers

# INSTRUMENT TRANSFORMERS



HIGHEST RATED VOLTAGE FOR EQUIPMEN: 252 kV



## ADVANTAGES

- Operation is possible within temperature range from -60 to 55 °C ;
- Mounting and connecting dimensions conform to transformers manufactured previously;
- Reduced mass and over-all dimensions;
- Absence of air holes;
- Convenient transportation/installation of transformers;
- Insulation class F;
- Maximum automated process of production and test operations.

One of directions of SVEL activity is designing and manufacturing of instrument current and voltage transformers with cast coil and gas insulation for voltage classes up to 252 kV, as well as power transformers of low capacity.

SVEL Group produces following types of instrument transformers:

- Current transformers TOL, TPOL, TPL, TV, TG, TShL; TZLK;
- Grounded and ungrounded voltage transformers NOL, ZNOL, ZNG, as well as three-phase antiresonance groups of voltage transformers;
- Power transformer OL-SVEL-0.63(1.25)-6(10), OLS-0.63(1.25)-6(10), OLSP-0.63(1.25)-6(10), TSK-SVEL-25(40, 63) kVA.

Modern developments allow to produce current transformers with number of windings up to four. With that, combinations of accuracy classes can be widely different; that can comply with any requirements of operations department.

## SPECIAL FEATURES OF DEVELOPMENT AND MANUFACTURE

When developing instrument transformers, SVEL Group uses innovative approaches and experiences of leading manufacturers of this equipment, which allows to make transformers with high level of reliability and measuring accuracy.

Reliability and long serviceable life of cast coil instrument transformers are based on the technology of epoxy compound pouring-in. SVEL instrument transformers are poured in open molds under deep vacuum. Probability of occurrence of hidden internal defects of insulation of transformers is excluded as a result of special construction of the mold with open upper part and individual selection pouring-in modes for each type of transformer.

Specialists of SVEL Group, in cooperation with German manufacturers of casting equipment for instrument transformers of highest voltage class from 7.2 to 40.5 kV, developed design of outdoor instrument transformer. It has following features:

- Manufacturing through one pouring-in by epoxy compound;
- High ultraviolet radiation resistance;
- Acceleration of the process of transformer manufacturing through exclusion of second pouring-in;
- Reduced heating factors of transformer;
- Lower equipment cost because of refusal of polyurethane resin.

## CURRENT TRANSFORMERS

TYPE	VOLTAGE CLASS, kV	ACCURACY CLASS OF MEASURING WINDINGS	ACCURACY CLASS OF PROTECTION WINDINGS	NUMBER OF SECONDARY WINDINGS
TOL-SVEL	7.2 – 40.5	0.2; 0.2S; 0.5; 0.5S; 1; 3; 5	5P, 10P	up to 4
TPOL-SVEL				up to 4
TPL-SVEL				up to 4
TV-SVEL	40.5 – 252			up to 6
TShL-SVEL	0,72 – 24			up to 5

## VOLTAGE TRANSFORMERS

TYPE	VOLTAGE CLASS, kV	ACCURACY CLASS	SECONDARY VOLTAGE, V	NUMBER OF SECONDARY WINDINGS
NOL-SVEL	3.6 – 40.5	from 0.2 and below	100 or 110	2
ZNOL(P)-SVEL			100/√3 or 110/√3	up to 4
3XZNOL-SVEL			100 or 110	

## POWER TRANSFORMERS

TYPE	VOLTAGE CLASS, kV	RATED POWER, VA	RATED PRIMARY VOLTAGE, V
OL-SVEL	7.2 – 40.5	630; 1250	6300; 6600; 10500; 11000
OLS-SVEL			
OLSP-SVEL			

# HISTORY

2003

2004

2005

2007

2008

2009

2011

2012

2013

2014

2015

2016

Start-up of Dry-type transformers production



2003

35 kV  
25-25000 kVa

TRSZP-3200/6



Development and production of TRSZP-3200/6 outdoor dry-type rectifier transformer

-60°C

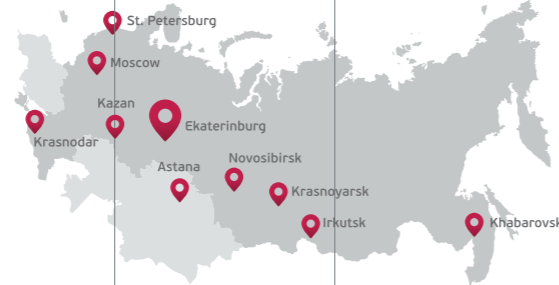
2005

Start-up of AIR-CORE current-limiting reactors production

10000 A  
330 kV  
2,5 OHM



2004



Representations established  
Single branding

2008 SVEL

Quality Management System Certificate of Conformity

ISO 9001:2000

2007



Start-up of instrument transformers production

Start-up of the new plant SVEL- Power transformers, specializing in manufacturing of oil-immersed transformers, voltage classes are from 10 to 220 kV, rated power is from 2500 to 250000kVa.



2009



Development and production of ATDCTN-250000/220 voltage transformer with the highest capacity in the Urals

2011

No 1 IN RUSSIA

Development and production shell-type reactor, the first in Russia



Development and production of SPUE-SVEL-10 multiuse electro-magnetic withdrawable protecting device for over voltage protection of voltage transformers.

2012



Development and production of KSO-SVEL line

Operation tests of SVEL complete switchgear cell in JSC NTC FGS UES. Certificate of Conformity and Declaration of Compliance

GAZPROM

Certification of SVEL complete switchgear cell in JSC Gazprom. Certificate of Conformity within the frame of GAZPROMCERT system.

2013

KSO-SVEL

Operation tests of KSO-SVEL-K-1.2 single-end service assembled chamber. Certificate of Conformity and Declaration of Compliance.



Tests of KSO-SVEL-K-3.1 in JSC NTC FGS UES. Certificate of Conformity and Declaration of Compliance.

Batch production of MVS-SVEL-K-3.1 complete switchgears.

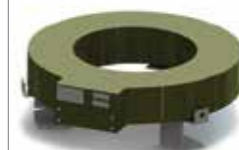
Operation tests of KSO-SVEL-K-1.3 chamber in JSC NTC FGS UES. Certificate of Conformity and Declaration of Compliance.

Batch production of KSO-SVEL-K-1.3 chambers.

ROSSETI

Certification of SVEL complete switchgear in JSC Rosseti. Certificate of Conformity.

2014



Report on certification in JSC Rosseti concerning TV-SVEL-35(110,220) current transformer. Development and production of the first transformer of 500 kV voltage class.

2015

SVEL Group accredited own tests center for checking whole line of equipment.

Rosatom licenses for design and production of equipment of nuclear power stations.

Development of NKU-SVEL low-voltage complete switchgear. Certificate of Conformity on LVS-SVEL.



Development, production and start-up of current-limiting reactors of 330 kV voltage class, the first in Russia.

2016

2003 - 2016