

Oil-filled Corrugated Tank Power Transformers «TMF» type



Oil-filled Down-Step Power Transformers, three — phase, double winding of general purposes with rated power from 25kVA to 1600kVA for voltage up to 35kV are intended for national economy needs. Indoor and outdoor installation is possible.

The «TMF»-10 – 2500 Power Transformers are manufactured with primary winding (HV) rated voltage up to 35 kV and secondary winding (LV) rated voltage 0.4 kV. Connection scheme and group is Y/YH-0; Д/УН-11.

Exploitation terms

Altitude above sea level — up to 1000 m.

Ambient air temperature:

– for temperate climate: from –45°C to +40°C («TM» execution (Y));

– for cold climate: from –60°C to +40°C («C» execution (X)).

Relative air humidity no more than 80% at +25 °C.

Transformers are not to operate:

– In flammable and aggressive surroundings (containing gases, high concentration of dust, evaporations, etc.);

– In vibrating and shaking surroundings;

– At frequent switching on on feeding side (up to 10 times at 24-hour period).

Other combinations of voltage are possible on the customer's request.



TRANSFORMER SPECIFICATIONS

Voltage rate 6-10 kV

Power, kVA	No-load losses, V_t	Short-circuit loss, V_t , Y/YH-0	Short-circuit loss, V_t , Д/УН-11	Short-circuit voltage
10	65	280	280	4,0
16	85	460	500	4,0
25	110	600	650	4,5
40	150	880	990	4,5
63	220	1280	1460	4,5
100	290	1970	2200	4,5
160	400	2650	3100	4,5
250	550	3700	4200	5,0
400	800	5400	5600	5,0
630	1010	7600	8500	5,5
1000	1400		10600	5,5
1250	1600		14700	5,5
1600	2050		16000	6
2500	2800		28000	6

Voltage rate 15 kV

Power, kVA	No-load losses, V_t	Short-circuit loss, V_t , Y/YH-0	Short-circuit loss, V_t , Д/УН-11	Short-circuit voltage
25	115	660	750	4,5
40	165	880	970	4,5
63	220	1410	1600	4,5
100	270	2170	2490	4,5
160	410	2860	3190	4,5
250	580	4050	4620	4,5
400	830		6050	5,5
630	1000		8800	5,5
1000	1500		12000	6
1250	1600		15500	6
1600	2100		17500	6

Voltage rate 35 kV

Power, kVA	No-load losses, V_t	Short-circuit loss, V_t	Short-circuit voltage
100	380	1950	5,5
160	520	2650	6
250	650	3700	6,5
400	930	5600	6,5
630	1100	8500	6,5
1000	1550	10500	7
1250	1700	14700	7
1600	2050	16000	7,2

Oil-filled Power Transformers «TM» type



Oil-filled Power Down-Step Transformers, three-phase, double winding for general purposes with rated power from 10kVA to 4000kVA for voltage up to 35 kV are intended for national economy needs. Indoor and outdoor installation is possible.

To enlarge the cooling surface of transformers type «TM» 10–1250 with oil conservator the corrugated tank walls are used. In transformers type «TM» 1600–4000 with oil conservator radiators are used.

The «TM» 10–4000 Power Transformers are manufactured with primary winding (HV) rated voltage up to 35kV and secondary winding (LV) rated voltage 0.4kV.

Connection scheme and group is Y/YH –0; Д/YH –11.

Exploitation terms

Altitude above sea level — up to 1000 m.

Ambient air temperature:

- for temporary climate: from –45°C to +40°C («TM» execution (Y));
- for cold climate: from –60°C to +40°C («C» execution (X)).

Relative air humidity no more than 80% at +25°C.

Transformers are not to operate:

- In flammable and aggressive surroundings (containing gases, high concentration of dust, evaporations, etc.);
 - In vibrating and shaking surroundings;
 - At frequent switching on on feeding side (up to 10 times at 24-hour period).
- Other combinations of voltage are possible on the customer's request.



TRANSFORMER SPECIFICATIONS

Voltage rate 6-10 kV

Power, kVA	No-load losses, Vt	Short-circuit loss Vt, y/yH-0	Short-circuit loss Vt, Д/YH-11	Short-circuit voltage
10	65	280	280	4
16	85	460	500	4
25	110	600	650	4,5
40	150	880	990	4,5
63	220	1280	1460	4,5
100	290	1970	2200	4,5
160	400	2650	3100	4,5
250	550	3700	4200	5
400	800	5400	5600	4,5
630	1010	7600	8500	5,5
1000	1400	10600		5,5
1250	1600	14700		5,5
1600	2050	16000		6
2500	2800	28000		6
4000	5200	33500		7,5

Voltage rate 15 kV

Power, kVA	No-load losses, Vt	Short-circuit loss Vt	Short-circuit voltage
100	210	1750	4,5
160	300	2350	4,5
250	425	3250	4,5
400	610	4600	5,5
630	800	6750	5,5
1000	1100	10500	6,0
1250	1300	12500	6,0
1600	1700	17000	6,0
2000	2600	24000	6,0
2500	3000	26000	6,0

Voltage rate 35 kV

Power, kVA	No-load losses, Vt	Short-circuit loss Vt	Short-circuit voltage
100	540	1950	5,5
160	600	2800	6
250	680	3900	6,5
400	950	6100	6,5
630	1200	9000	6,5
1000	1650	12200	7,0
1250	1940	15800	7,0
1600	2400	17000	7,2
2500	3800	28500	7,2
4000	5300	34000	7,5
6300	7000	4650	7,5

Oil filled Power Transformers «TM3» type



Oil-filled Power Down-Step Transformers, three-phase, double winding with oil protection and rated power from 630kVA to 2500kVA are intended for transformer substation of indoor and outdoor installation.

The TOP Power Transformers are manufactured with primary winding (HV) rated voltage up to 10kV and secondary winding (LV) rated voltage 0.4; 0.69kV.

Connection scheme and group is Y/YH-0; Д/YH-11.

The voltage is regulated without excitation. Transformers are equipped with HV tap changers, which allow voltage regulation on LV and HV side by $\pm 2 \times 2.5\%$ steps while the transformer is switched off from the system. The tap changer is connected to the HV winding.

Exploitation terms

Altitude above sea level — up to 1000 m.

Ambient air temperature:

– for temporary climate: from -45°C to $+40^{\circ}\text{C}$ («TM» execution («Y»));

– for cold climate: from -60°C to $+40^{\circ}\text{C}$ («C» execution («XJ»)).

Relative air humidity: not more than 80% at $+25^{\circ}\text{C}$.

TECHNICAL SPECIFICATIONS

Power, kVA	No-load losses, Vt	Short-circuit loss Vt	Short-circuit voltage
630	1150	7600	5,5
1000	1650	10800	5,5
1600	2050	16500	6
2500	3750	28000	6

Complete Transformer Substation for Urban Power Network «КТПГCM» -100-630/10(6)/0,4 TM1 («Y1») type



Single-ended and double-ended complete transformer substations (here and then – CTS) with power from 100kVA to 630kVA for voltage 6kV or 10kV on the HV side and 0.4kV on the LV side, frequency 50Hz are intended for reception, transformation and distribution of electric power with radial (double-radial) and loop urban networks in regions with temporary climate (from -45°C to $+40^{\circ}\text{C}$).

The CTS substation is set in fully assembled metal cabins, which is equipped with a power transformer, HV and LV switchboards. The cabin can be finished, according to the customer's desire, with decorative finish "DRYVIT". The HV Switchboard is equipped with the disconnector and with ВНПР gas-blast load-breaking insulator with a spring or lever drive.

The CTS input lines are cable or overhead, the outgoing lines are cable. The CTS is mounted on foundation.

The full set is complete with a transformer, air line (if necessary).

The CTS weight with a transformer is:

CTS –100–1910 kg

CTS –160–2140 kg

CTS-250–2320 kg

CTS –400–2740 kg

CTS –630–3220 kg

Overall dimensions 3570x2340x2430



Complete Transformer Substation for Urban Power Network «КТПГС» - 1000/10(6)/0,4 TM1 («У1») type



Complete transformer substations (single-ended and double-ended) of power up to 1000kVA for voltage 6kV or 10kV on the HV side and 0,4kV on the LV side, frequency 50Hz are intended for reception, transformation and distribution of electric power in one-two radial and loop urban networks in regions with temporary climate (from -45 °C to +40 °C).

The «КТПГС» substation is set in fully assembled metal cabins (2«КТПГС» is set in two cabins), which are equipped with a power transformer, HV («УВН») and LV («РУНН») switchboards, a street lightning switchboard. This type of substations can substitute those which are assembled from separately supplied Sectional Front-Access Switchgear Cells («КСО»), and Switchboard Feeder Cubicles and other units.

The HV Switchboard («УВН») is equipped with the («ВНПР») gas-blast load-breaking insulator with a spring or lever drive. The LV Switchboard («РУНН») is equipped with fuses or automatic circuit breakers; there are total power account and account of street lightning.

HV input lines are cable or overhead, LV outgoing lines are cable.

The overall dimensions: 2500x4500x2900

TECHNICAL SPECIFICATIONS

Name of parameter	«КТПГС» -250	«КТПГС» -400	«КТПГС» -630	«КТПГС» -1000
Transformer power, kVA	250	400	630	1000
Rated current, A, and number of outgoing lines, pcs.	250-2	400-2	630-2	1000-2
	100-2	250-2	400-2	630-2
Current of the thermic stability on the HV side, kA	10	10	20	20
Current of the electrodynamic stability on the HV side, kA	23	23	51	51
The «КТПГС» weight, kg	3990	4730	4950	6000

Complete Transformer Substation Top-loaded Vertical «КТП» 25-250/10/0,4 type



Complete transformer substations with power from 25kVA to 250kVA three phase current with frequency 50Hz and voltage 6kV or 10kV are single-ended one transformer substations for outdoor installation are intended for power supply of agricultural customers, single settlements and small industrial units in regions with temporary climate (from -45 °C to +40 °C).

«КТП» consist of:

- Switchboard on the HV side («УВН»);
- Power transformer for outdoor installation;
- Distribution switchboard on the LV side («РУНН») with automatic breaker for the outgoing lines and street lights lines.

Phase-to-phase fault and mono-phase line-to-ground fault protection is provided. The breaker for outdoor installation «РЛНДэ»-10/400 У1 with a driving gear and a platform for «РУНН» service are provided. «КТП» is mounted on 2 ferroconcrete T-shaped poles (are not provided in the set).

TECHNICAL SPECIFICATIONS

Name	Rated current, A						Weight with transformer
	«РУНН»	Line 1	Line 2	Line 3	Line 4	Street lighting	
«КТП» 25/10/0,4	36	31,5	31,5	-	-	16	700
«КТП» 40/10/0,4	58	31,5	63	-	-	16	760
«КТП» 63/10/0,4	90	40	63	40	-	16	890
«КТП» 100/10/0,4	144	40	100	80	-	16	1028
«КТП» 160/10/0,4	231	80	160	100	-	16	1190
«КТП» 250/10/0,4	361	80	160	100	250	16	1560

**Complete Transformer Substations «КТП»-1 Single-Ended and «КТП» 2 Double-Ended 25 – 400/10/0.4 type**

«КТП»-1 Single-Ended Complete Transformer Substations and «КТП» 2 Double-Ended Complete Transformer Substations with rated power of 25, 40, 63, 100, 160, 250 and 400кVA, for voltage 6kV or 10kV (on the HV side) and 0.4kV (on the LV side) are intended for reception, transformation and distribution of three-phase AC electric power with frequency 50Hz in systems with solidly earthed neutral on the LV side.

The «КТП» is intended to supply agricultural consumers, separate settlements and small industrial objects in regions with temporary climate (from -45°C to $+40^{\circ}\text{C}$). The «КТП» is mounted on a simple concrete ground.

The double-ended «КТП» differ by the possibility of connection two HV transmission lines.

HV inputs are overhead or cable; out coming lines are overhead or cable.

The «КТП» is provided with street lightning lines which are automatically switched by the signal of built-in relay. Automatic circuit-breakers are installed on the LV side.

The «КТП» delivery set is completed with «УВН» and «РУНН» switchboards, a power transformer, the «РЛНДз»-10\630 disconnector of outdoor installation.

Overall dimensions of single-ended «КТП» with overhead lines: 1900x1600x4500;

Overall dimensions of double-ended «КТП» with overhead lines: 2866x1600x4530

**TECHNICAL SPECIFICATIONS**

Name	Power, kVA	Rated current, A and number of outgoing lines	Weight, kg
«КТП»-1 (single-ended)	25	31.5 – 3 pcs.	980*
	40	31.5 – 2 pcs, 63 – 1 pcs.	1100*
	63	63 – 2 pcs., 80 – 1 pcs.	1850*
	100	63 – 2 pcs., 80 – 1 pcs., 100 – 1 pcs.	1900*
	160	80 – 1 pcs., 100 – 1 pcs., 160 – 2 pcs.	2920*
	250	100 – 2 pcs., 200 – 2 pcs.	2155*
	400	100 – 2 pcs., 160 – 1 pcs., 200 – 1 pcs., 400 – 1 pcs.	2900*
«КТП»-2 (double-ended)	25	31.5 – 3 pcs.	1550
	40	31.5 – 2 pcs, 63 – 1 pcs.	1600
	63	63 – 2 pcs., 80 – 1 pcs.	2350
	100	63 – 2 pcs., 80 – 1 pcs., 100 – 1 pcs.	2400
	160	80 – 1 pcs., 100 – 1 pcs., 160 – 2 pcs.	2420
	250	100 – 2 pcs., 200 – 2 pcs.	2655
	400	100 – 2 pcs., 160 – 1 pcs., 200 – 1 pcs., 400 – 1 pcs.	3400

* Weight of the «КТП»1(single-ended) with HV cable input is the same as the weight of the «КТП» 2(double-ended) of the corresponding power.



Complete Transformer Substations
«КТП»-250...2500/10(6)/0,4 ТМЗ («УЗ»)



Complete transformer substations with power 250 – 2500kVA for voltage 6,10kV are intended to receive, transform and distribute electric power of three-phase AC frequency 50Hz. They are applied to supply enterprises under temporary climate conditions and can be installed in heated buildings.

«КТП» are produced:

- one transformer
- two transformers

«КТП» contain:

- In-put unit on the HV side
- Power transformer (oil filled or dry cast)
- Distribution unit on the LV side

The automatic reserve input, which provides LV input breaking and sectional switch operation when input or a phase voltage disappears, is put in double-transformer «КТП».

The scheme with the overload protection is executed on a demand.

The «КТП» is completed with automatic switch gear of Russian or foreign production on a customer's demand.

Complete Transformer Substations Block-Module
Type «КТПБМ» 1000-2500/10/0,4 ТМС 1 («УХЛ1»)



Single or Double transformer Single or Double-row Block-Type Complete Transformer Substations with rated power up to 2500kVA for primary voltage 6kV or 10kV and secondary voltage 0,4kV, frequency 50Hz are designed for power supply of enterprises under conditions of temporary and cold climate with temperatures from –60 °C to +40 °C.

The «КТПБМ» are produced in block-module cells, which are made of "Sandwich"-type fully assembled panels, with built-in power transformer, HV and LV switchboards.

The «КТПБМ» are provided with heating, power accounting, inside lightning and forced ventilation.

The «КТПБМ» incoming and outgoing lines are cable.

A power transformer is included into the «КТПБМ» delivery set.



Complete Transformer Substation Pole-mounted «КТПС» type



Complete Transformer Substation Pole-mounted type voltage 10 (6)/0,4kV and power rating up to 250kVA three phase AC with frequency of 50Hz is intended for reception of electrical power of three phase alternating current with 10 (6)kV voltage, transforming it into voltage of 380/220V and power supply customers of countryside with conditions that comply with climatic version "TM" («Y») (temperate) and category of location 1 according to GOST 15150-69.

Complete Transformer Substation Pole-mounted type can be supplied in 2 modifications:

- Input 10 (6) — by air, output 0,4kV — by cable
- Input 10 (6) and output 0,4kV — by air

In the latter case Complete Transformer Substation Pole-mounted type is completed with traverse for installation of low-voltage isolators, which are connected to outgoing transmission lines.

Type	Rated current, A						Weight of transformer, kg
	Distribution Device Low Voltage	line 1	line 2	line 3	line 4	street lightning	
«КТПС» 25/10/0.4 T1 («Y1»)	36	25	25	-	-	16	460
«КТПС» 40/10/0.4 T1 («Y1»)	58	31,5	31,5	40	-	16	460
«КТПС» 63/10/0.4 T1 («Y1»)	90	80	80	100	-	16	460
«КТПС» 100/10/0.4 T1 («Y1»)	144	80	80	100	-	16	460
«КТПС» 160/10/0.4 T1 («Y1»)	231	80	100	160	-	16	530
«КТПС» 250/10/0.4 T1 («Y1»)	361	80	100	160	250	16	530

One-sided Operation Panel of Switchboards «ЩО» -94 type



Switchboard panel «ЩО»-94 (built up construction) are intended for reception and distribution of three-phase AC frequency 50Hz for voltage up to 0,66kV and protection of feeder lines from overload and short circuit current. The SP is to operate at temperature from -10 to +35°C.

According to the function, there are lead-in, distribution, cell-type and auxiliary type of panels. Altogether there are 40 «ЩО»-94 schemes. Panels are assembled into a switchboard with total length up to 4m. Panels of supervisory control, accounting boards and face panels, which protect the board from both sides, are referred to as the auxiliary panels. The two-row assembly of a switchboard is completed with bus-bar shafts. The panels are completed with following equipment: lead-in and cell-type panels – with extendable circuit-breakers BA55-41(43) type or PE -19-41 disconnectors; distributive panels – with fixed circuit-breakers BA51-39 or BA04-36 type or with knife-switches "Multivert"

TECHNICAL SPECIFICATIONS

Voltage, kV	0,22; 0,38; 0,66
Number of outgoing lines, pcs.	1...9
Outgoing lines rated current, A	16-200; 160...630; 1000; 1600
Lead-in panels rated current, A	400; 630; 1000; 1600; 2500
Collecting bus stability at short circuit current	
Dynamic	40
Thermal, during 1 second	16
Overall Dimensions	
Panels	700x600x2000
Accounting boards	420x165x450 (860)
One weight is not more, kg	350

**One-Sided Operation Built-Up Switchgear
Cells «KCO» -210 (310) type**

The «KCO» Sectional One-sided operational built-up switchgear with bus-bar shafts attached are intended to complete the distributive devices and single-ended substations with voltage 6 or 10 kV and AC frequency 50 Hz in systems with insulated neutral and are installed indoors in moderate climate zones with operating temperatures from -25 °C to +40 °C.

The main circuit equipment is installed inside the cells:

- The gas-blast load-breaking insulator «БНП» with spring drive (03-06, 08, 09 and 24 cells);
- Vacuum breaker BB/TEL with electromagnetic shift;
- Voltage transformer (10, 11 cells);
- An auxiliary transformer «OM»-1,25/10/0,23 (cell 23);
- An auxiliary transformer «ТМГ»-25/10/0,4 (cell 23M);

The two-row assembly of a switchboard is completed with bus-bar shafts.

TECHNICAL SPECIFICATIONS

Rated current of the main chains, A		630, 1000, 1600
Rated voltage of the auxiliary chains, V 50 Hz		220
Overall dimensions, mm:	of the «KCO» cells 310 - 15, 16	500x950x1900
	of the «KCO» cells 210 - 12B; 14B*	1600x950x2200
	of the «KCO» cells 210 -11M, 17B, 23M	800x950x2200
	of other «KCO» cells**	800x950x1900
	of the account board	420x165x860
Weight, kg, no more		350

* for cells with rated current of 1600 A the dimensions are 800x290x2200

** cells height of «KCO» 210 – 2200mm, cells height of «KCO» 410 – 1600mm

**Complete Transformer Substation for
Railway «КТПЖ» 25 – 1000/27.5/0.4 type**

The «КТПЖ» complete transformer substations with rated power from 25 kVA up to 1000 kVA are single-transformer substations of outdoor installation. They are fed by two wire rails scheme and are intended for the reception of three-phase AC of frequency 50 Hz and voltage 27.5 kV, transformation into electric power for of 0.4 kV voltage and supply linear customers of railway stations: halts, crossings, linear-road buildings. The substations are for installation in temperate climate regions (-40 °C to +40 °C).

The «КТПЖ» are mounted near railways and are connected to overhead contact system by a disconnector (which is mounted on a pole).

The substations provide active and reactive energy accounting.

The «КТПЖ» is equipped with electric and mechanic blocking, which support safe work for the stuff.

Knife-switch/safety device blocks (on request) or automatic circuit breakers (on request) are installed on outgoing lines.

Overall dimensions: 2450x2640x3300mm

TYPES AND SPECIFICATIONS

Type	Filament current, A	Rated current Line 1	Rated current Line 2	Rated current Line 3	Rated current Line 4
«КТПЖ»-25/27.5/0.4-98	2	31,5	31,5	-	-
«КТПЖ»-40/27.5/0.4-98	3,2	31,5	63	-	-
«КТПЖ»-63/27.5/0.4-98	5	40	63	40	-
«КТПЖ»-100/27.5/0.4-98	8	40	100	80	-
«КТПЖ»-160/27.5/0.4-98	8	80	160	100	-
«КТПЖ»-250/27.5/0.4-98	10	80	160	100	250
«КТПЖ»-400/27.5/0.4-98	16	100	100	250	400
«КТПЖ»-630/27.5/0.4	31,5	100	160	250	400
«КТПЖ»-1000/27.5/0.4	50	250	250	250	630

**Oil-Filled Power Transformer for Railway
«ТМЖ» type**



The «ТМЖ» transformers with rated power from 25kVA up to 2500kVA are produced with primary winding rated voltage (HV) 27.5kV and 0.4kV voltage of secondary winding (LV). They are intended for power supply of railways equipment, which is electrified by AC.

To provide off-circuit voltage control transformers are equipped with high-voltage switches, which are connected to the HV winding and allow controlling voltage by $\pm 2 \times 2.5\%$ steps when transformer is being switched off on LV and HV sides. The switcher is connected to the HV winding.

Operation Conditions:

- Elevation above sea level — up to 1000m
- Ambient air temperature from -45°C to $+40^{\circ}\text{C}$
- Relative air humidity at most 80% at $t=+25^{\circ}\text{C}$.
- Transformers are not intended to operate in aggressive and explosive environment

TECHNICAL SPECIFICATIONS:

Power, kVA	25	100	160	250	400	630	1000	1600	2500
No-load losses, Wt	145	420	480	700	950	1180	1650	2100	2900
No-load current, %	3,1	2,1	2,0	1,2	1,0	0,9	0,8	0,7	0,6
Short-circuit loss, Wt	680	1920	2650	3700	5500	7100	12200	17000	28500
Short-circuit voltage, %	6,5	6,5	6,5	6,5	6,5	6,5	7	7,2	7,2

**Complete Transformer Substation
One-phase Railway «КТПЖО» type**



The «КТПЖО» Complete Transformer Substations with power 2,5; 4 and 10kVA for outdoor installation, single-phase single-transformer substations, intended to receive electrical power of single-phase AC frequency 50Hz and voltage 27,5kV, to transform it into voltage 0,23kV and to supply railway station linear consumers, crossroads, stopping post, crossings, linear-road buildings in regions with temporary climate (from -40°C to $+40^{\circ}\text{C}$).

The «ОМЖ» transformer and a low-voltage cell are installed on a frame on a PLC pole (for the «КТПЖО» rating 2,5 and 4 kVA) or T-posts (for the «КТПЖО» rating 10 kVA) directly near railway and are connected to the contact system by using a disconnector, which is installed on the pole of the contact system or on the detached pole. A high-voltage safety device and an excess-voltage suppressor are installed on the same frame.

Automatic switches and knife switch fuses are arranged on outgoing lines on request.

TECHNICAL SPECIFICATIONS

Type	Rated current, Line 1	Rated current, Line 2	Rated current, Line 3
«КТПЖО»-2.5/27.5/0.23	16	16	-
«КТПЖО»-4/27.5/0.23	16	16	-
«КТПЖО»-10/27.5/0.23	25	25	25