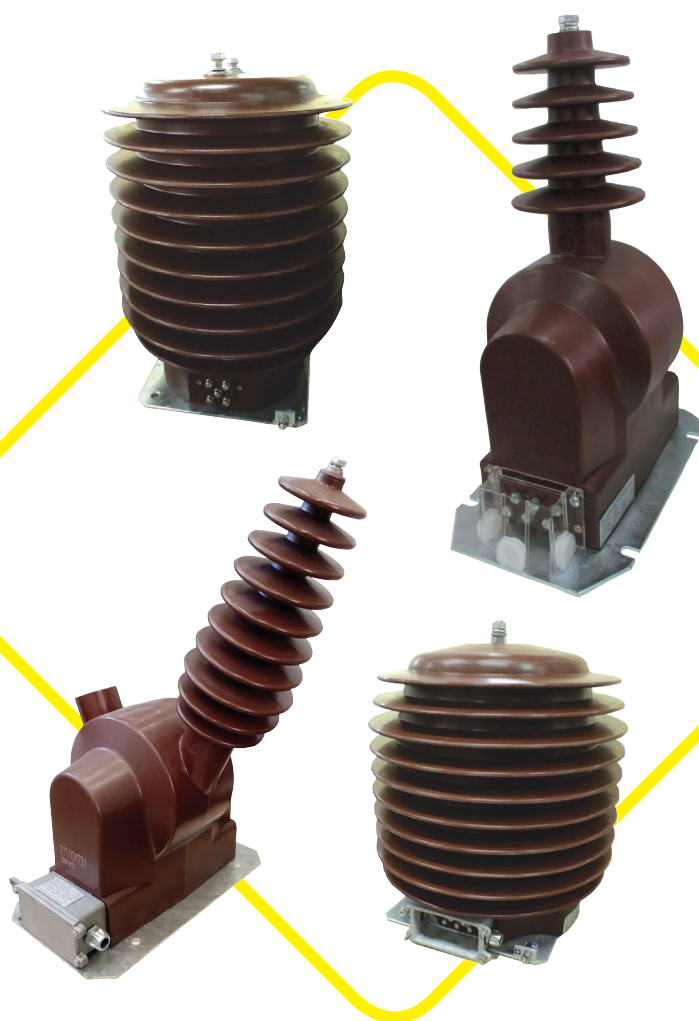


TRANSFORMERS FOR RAILWAY







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CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING

INTRODUCTION

DESCRIPTION

Basic insulation in these transformers is epoxy resin. Magnetic core consists of quality, cold rolled, oriented magnetic steel sheet. Secondary terminals have been carried out in a separated enclosure which is watertight and can be sealed. Transformers can be done with 1, 2 or 3 magnetic cores and as much separated secondary windings. Transformers for outdoor mounting have high creeping distance values (>1300 mm) and therefore they can work in the most difficult conditions of exploitation.

APPLIANCE

These transformers can be used for separating of measuring and protecting devices from high voltage and for transformation of measuring currents to the value that is convenient for measuring and protective devices. They are appropriate for mounting in power substations with rated voltages up to 42 kV and for outdoor mounting they can be used in power substations with highest voltages for equipment up to 52 kV. Supplying of ammeters, current circuits of electricity meters, protective and other devices can be accomplished with these transformers. Because of their high creeping distances they are appropriate for use in railway networks because they fulfill their strictest requirements.

MOUNTING

Transformers can be mounted only in vertical position. All connections on the primary and secondary side must be clean and well tightened, so they

will not be overheated. One of the secondary winding connections should be grounded (it is usually connection **k** i.e. **S1**). Whole burden of the connected measuring or protective devices together with cable losses must not exceed his rated value for more than 20 % because in that case accuracy class will not be satisfactory. If whole burden of the connected measuring or protecting devices together with cable losses is significantly less than his rated value, additional resistance should be added in secondary circuit. If some secondary winding is not charged its terminals must be short-circuited.

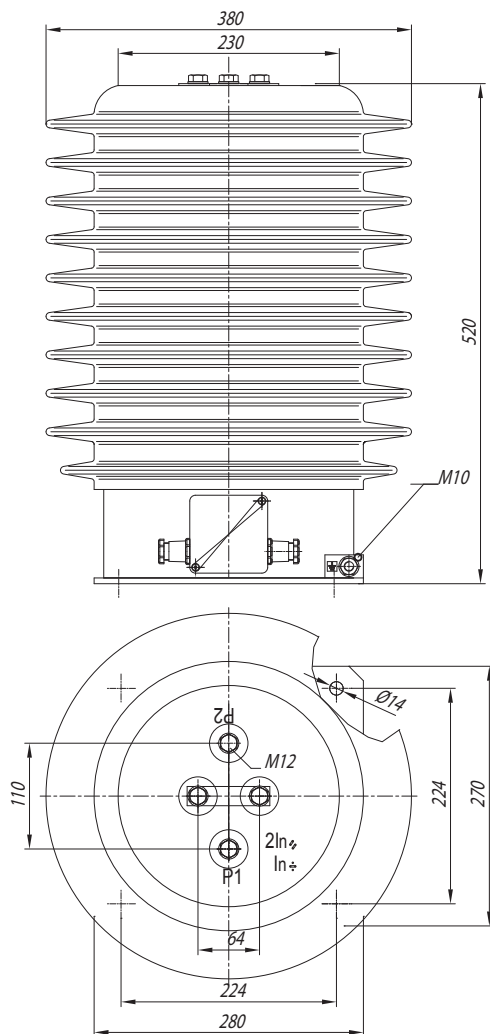
During mounting, take care that primary and secondary terminals don't change their places. Current input on the primary winding is marked with **K** or **P1** and output is marked with **L** or **P2**. Current input on the secondary winding is marked with **k** or **S1** and output is marked with **l** or **S2**.

If exterior dynamic forces of the primary connections are great (greater than 3,75 kN) than supporting-type insulators should be mounted near the current transformer.

Transformers must be grounded in the marked place.

HANDLING AND MAINTAINING

For these types of transformers regular maintaining is not necessary. It is enough, from time to time, to check if all connection are clean and well tightened and to clean the transformer if it is dirty. Take care that transformer must not work with open secondary circuit, because in that case high voltage appears on secondary side and insulation could be damaged. If some accident happens in the substation, transformers should be tested.

SMTSM-38*

SMTSM 3810

CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING **SMTSM 38***

Type of transformer	Dimensions (mm)	Mass (kg)
SMTSM 38	520	~78
SMTSM 38L	520	~126
SMTSM 38b	486	~146

TECHNICAL DATA	SMTSM 38	SMTSM 38*L	SMTSM 38*b
Rated primary voltage (kV)	35		
Highest voltage for equipment (eff.) (kV)	38 (42)		
Rated power frequency withstand voltage 1min.(kV)	70 (95)		
Rated impulse withstand voltage 1.2/50 μ s (kV)	170 (200)		
Creeping distance (mm)	1327	1327	1296
Mounting	Outdoor		
Rated frequency (Hz)	50/60		
Rated primary current (A)	5 do 3000* or 2x5 to 2x600		
Rated secondary current (A)	5 (ili 1)		
Rated accuracy class	0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P		
Rated thermal current, 1 sec.	$I_{th} = 100 I_n$		
Rated dynamic current	$I_{dyn} = 2,5 I_{th}$		
Rated continuous thermal current	$I_{cth} = 1,2 I_n$		
Number of cores	1-4		
Rated core power (VA)	5; 7,5; 10; 15; 30; 45*; 60*		
Temperature class of insulation	E		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-2		

NOTE:

Denotation:

SMTSM 3821L - transformer subtype SMTSM 38L, with two cores, primary switchable;
SMTSM 3820 - transformer sub-type SMTSM-38 with two cores, primary non-switchable;
SMTSM 3830b - transformer sub-type SMTSM-38b with three cores, primary non-switchable.

We have serial production of these transformers for short-time thermal current $100I_n$, but we can produce them with larger thermal currents (to $500I_n$ or even more), depending on the transformation ratio, accuracy class and power of the cores. Switching to another current transformation ratio can be done on primary or on secondary side, sealing of the terminals cover can be done on the secondary side.

These models are assumed for more demanding environmental conditions (BIL 40.5/95/200 kV) because they have creeping distance $\geq 31\text{mm/kV}$. Please state transformation ratio, rated power, accuracy class, instrument security factor (accuracy limit factor) for each core when ordering. We keep the right for a change.



VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING

INTRODUCTION

DESCRIPTION

Magnetic core consists of quality, cold rolled, oriented magnetic steel sheet. Primary and secondary windings have been moulded with epoxy resin which consists of quartz sand that gives electrical and mechanical strength to the windings. Impulse voltage is equally distributed over transformer surface by special design solution. That is why these transformers bear power-frequency withstand voltage test and impulse voltage test very well.

Because magnetic core consists of high quality magnetic sheet (with low specific losses) there is no dangerous overheating of magnetic core even in the cases of earth faults when magnetic induction become significantly higher. Single pole insulated voltage transformers have tertiary winding for open triangle vector group which is applied for earth-fault protection. When three single pole insulated voltage transformers are connected in star circuit connection in the network with isolated neutral point, their active resistance together with the resistor type ORN-* that we can deliver on a special request, can prevent occurrence of ferroresonance in the network transients.

We make voltage transformers for all climate conditions.

APPLIANCE

These transformers are used for separating of measuring and protecting devices from high voltage and for voltage transformation to the amount that is convenient for measuring and protecting devices. We produce single-pole insulated voltage transformers for voltages up to 42 kV for indoor mounting and for voltages up to 52 kV for outdoor mounting.

Accuracy class should be chosen according to transformers purpose.

- class 0.2: for laboratory measuring and testing stations, for the most accurate operative measuring and for electricity meters on the great consumers;
- class 0.5: for voltage and power operative measuring, electricity measuring and for accessory relays supplying;

- class 1: in cases when there is need for large rated power of the transformer and there is no need for more accurate measuring;

- class 3P; 6P for supplying of the electronic protecting devices.

MOUNTING

Epoxy voltage transformers JNTSM-36 for indoor mounting and NMTSM-38 for outdoor mounting, can be mounted in vertical position.

Primary connections at the single-pole voltage transformers must be connected between phase and earth point.

All metal parts of the transformer that are not normally under voltage, but they can be under voltage in a case of earth fault should be earth-connected. There is a fixing strap on the transformer that is marked with earth sign.

One secondary terminal also have to be earth-connected depending on the measuring circuit. At single-pole insulated voltage transformers secondary terminal n connects to the earth as well as primary terminal N.

Secondary terminals at voltage transformer can stay open or charged with large resistance (voltmeters, voltage circuits of electricity meters and relays). Secondary terminals must not be short connected because there is possibility for damaging the transformer. Because of that secondary lines are usually assured with fuses. Earth-connected lines are not assured.

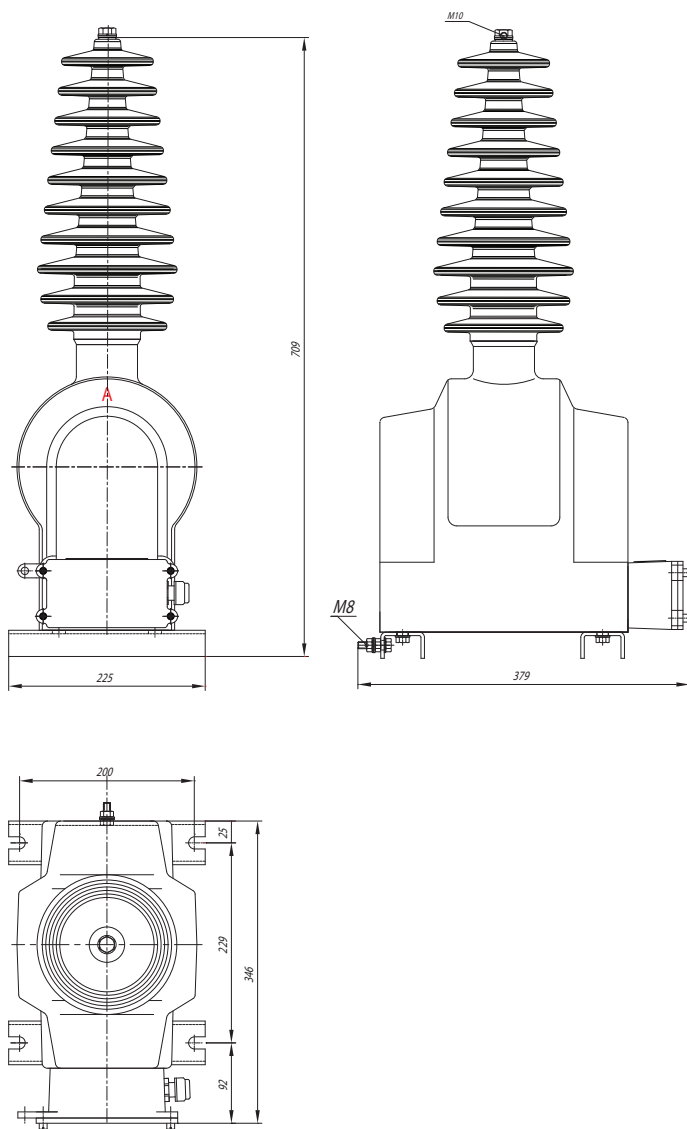
The permissible value of the tightening torque M_p on HV connections with screw M10 is 24.5 Nm, and for screw M16 it is 98 Nm.

PRODUCTION

We produce this kind of transformers for indoor and outdoor mounting with one or two secondary windings. At indoor mounting there is version with high voltage fuse bases, so the fuses can be mounted directly in the transformer.

HANDLING AND MAINTAINING

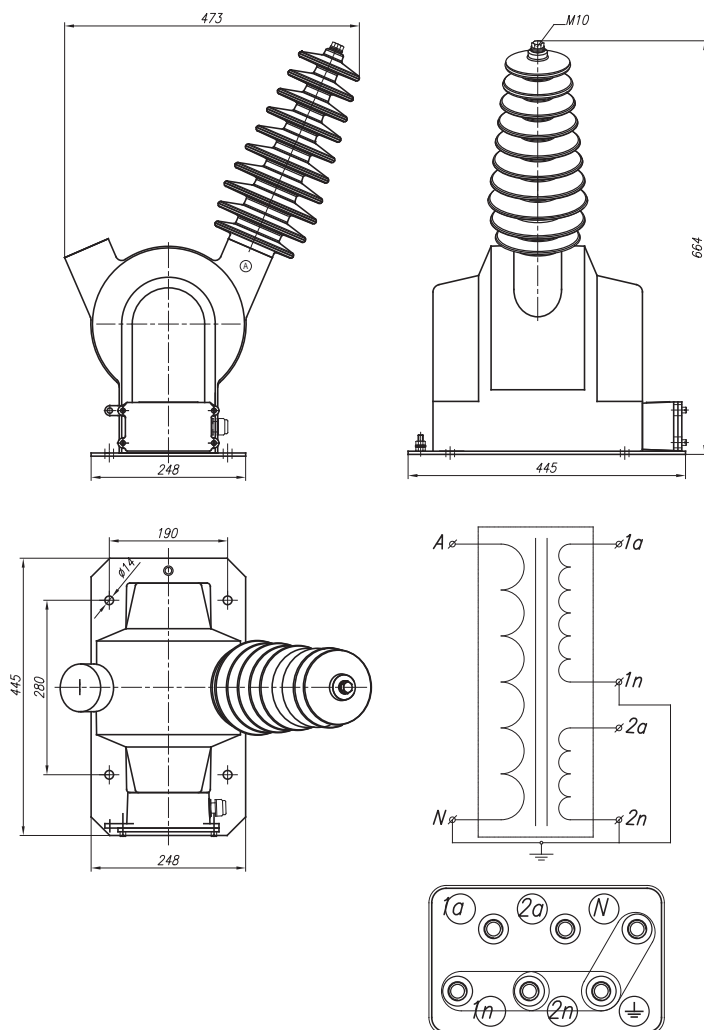
For these types of transformers regular maintaining is not necessary. It is enough, from time to time, to check if all connection are clean and well tightened and to clean the transformer if it is dirty. If some accident happens in the substation, transformers should be tested again.

JNT SM-36-10R**VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING JNT SM-36-10R**

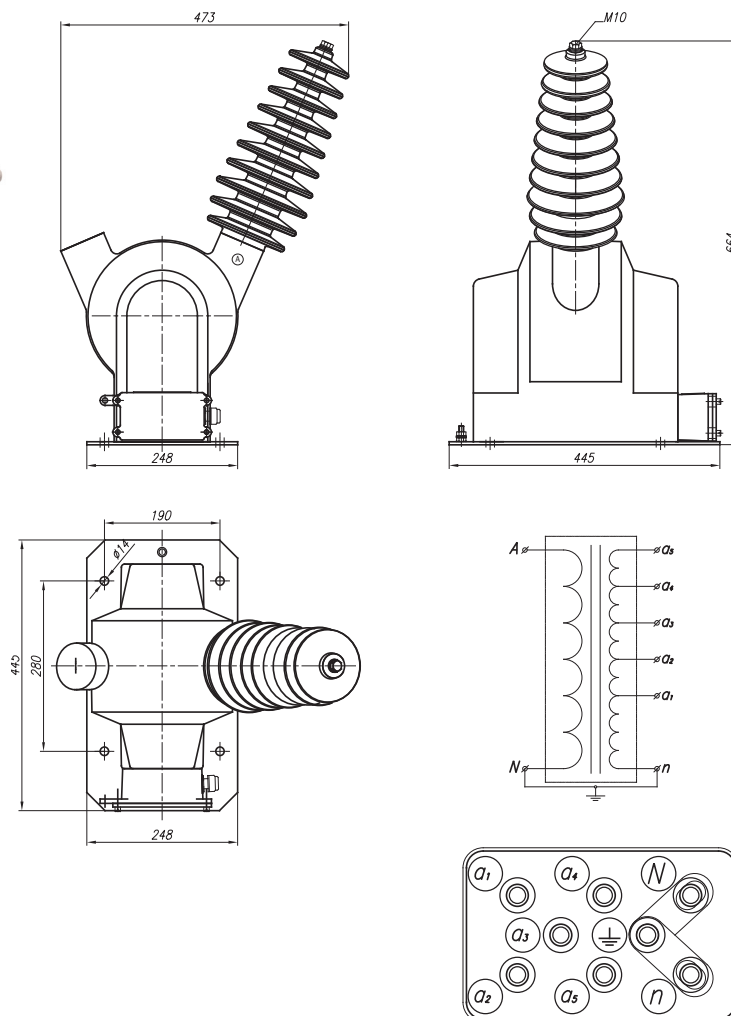
TECHNICAL DATA	JNT SM-36-10R
Rated primary voltage (kV)	25
Highest voltage for equipment (eff.) (kV)	42
Lowest operating voltage (kV)	19.5
Highest operating voltage (kV)	29
Creeping distance (mm)	1280
Mounting	Outdoor
Rated frequency (Hz)	50/60
Rated transformation ratio (kV/kV/kV)	25/0.1/0.1
Secondary winding (1) - rated voltage (V)	100
Rated power and accuracy class for the secondary winding (1)	30VA; class 0.5
Secondary winding (2) - rated voltage (V)	100
Rated power and accuracy class for the secondary winding (2)	60VA; class 1
Rated power-frequency withstand voltage, 1min (kV)	95
Impulse voltage 1.2/50μs (kV)	200
Mass (kg)	43
Temperature class of insulation	E
Type of basic insulation	Cycloaliphatic resin
Valid standards	IEC 61869-1; IEC 61869-3



DNT SM-36-10R1

SINGLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **DNT SM-36-10R1**

TECHNICAL DATA	DNT SM-36-10R1	
Mounting	Outdoor	
Transformation ratio [kV/kV/kV]	25/0.1/0.1	27.5/0.1/0.1
Rated voltage[kV]	25	27.5
Highest voltage for equipment [kV]	40.5	
Secondary winding (1) - rated voltage [V]	100	
Rated power and accuracy class for the secondary winding (1)	30VA ; 75VA / class 0.2 ; class 0.5	
Secondary winding (2) - rated voltage[V]	100	
Rated power and accuracy class for the secondary winding (2)	60VA ; 100VA / class 1 ; class 3P	
Rated frequency (Hz)	50; 60	
Rated power-frequency withstand voltage, 1min[kV]	80	
Rated withstand impulse voltage 1.2/50μs[kV]	190	
Type of basic insulation	Cycloaliphatic resin	
Valid standards	IEC61869-1; IEC61869-3; IEC50152-3-3	
Mass (kg)	~64	



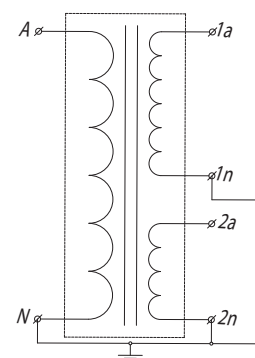
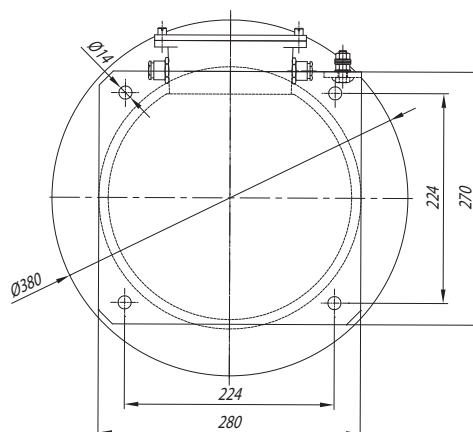
SINGLE-POLE VOLTAGE TRANSFORMERS FOR SUPPLY FOR OUTDOOR **DNT SM-36-10R1**

TECHNICAL DATA	DNT SM-36-10R1
Rated power [kVA]	1.5; 2; 2.5; 3; 4
Transformation ratio [kV/kV]	25/0.22
Highest voltage for equipment [kV]	52
Maximal operating voltage [kV]	40.5
Lowest operating voltage [kV]	19
Rated frequency (Hz)	50/60
Rated power-frequency withstand voltage, 1min (kV)	80
Rated withstand impulse voltage 1.2/50μs[kV]	190
Mounting	Outdoor
Creeping distance (mm)	1320
Type of basic insulation	Cycloaliphatic resin
Mass (kg)	60-70
Valid standards	IEC 61869-1 ; IEC 61869-3

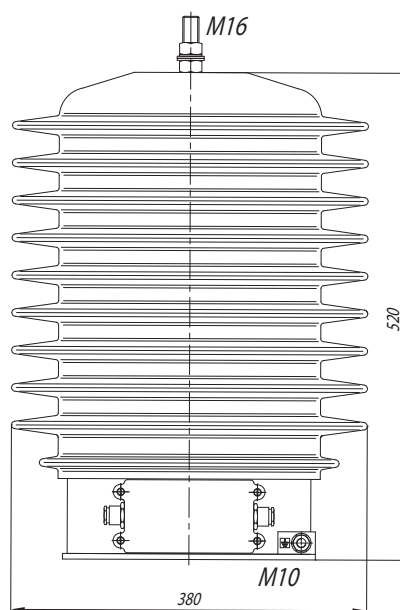
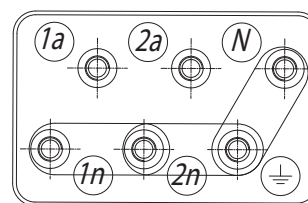
	Connections	Voltage
Rated primary voltage [V]	A-N	25000
Rated secondary voltages [V]	a1-n	209
	a2-n	220
	a3-n	231
	a4-n	242
	a5-n	253



NMTSM-38

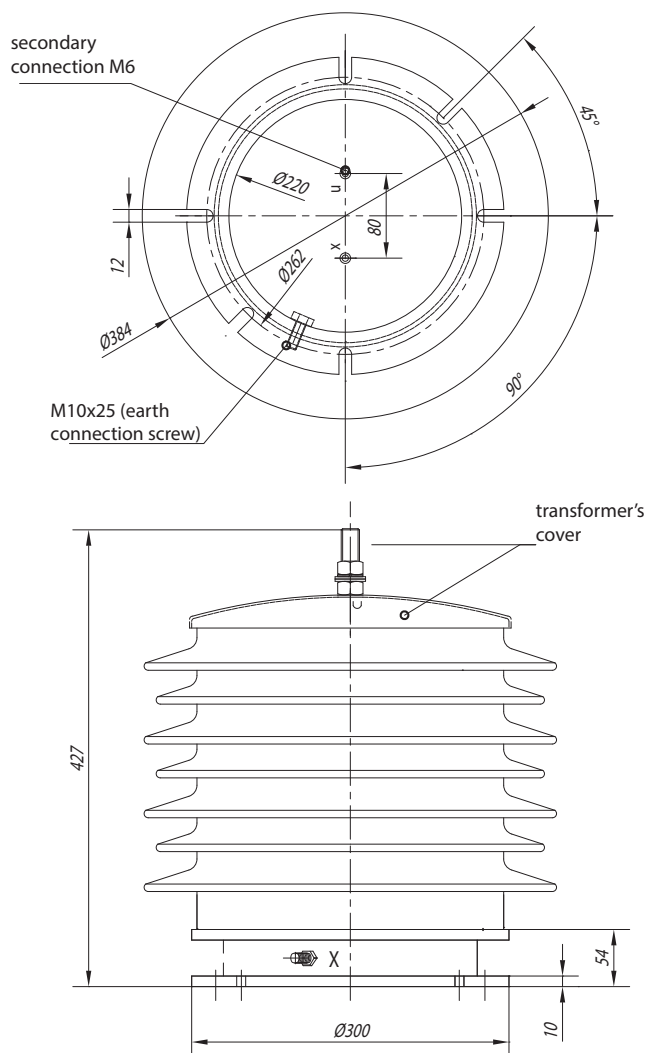


Secondary connections detail

VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **NMTSM-38**

TECHNICAL DATA	NMTSM-38
Rated primary voltage (kV)	35
Highest voltage for equipment [kV]	52
Mounting	Outdoor
Rated frequency (Hz)	50; 60
Rated transformation ratio (kV/kV/kV)	35/0.1/0.1
Secondary winding (1) - rated voltage (V)	100
Rated power and accuracy class for the secondary winding (1)	30VA; class 0.5
Secondary winding (2) - rated voltage (V)	100
Rated power and accuracy class for the secondary winding (2)	60VA; class 1
Rated power-frequency withstand voltage, 1min (kV)	95
Rated withstand impulse voltage 1.2/50μs (kV)	250
Creeping distance (mm)	1329
Mass (kg)	~82
Temperature class of insulation	E
Type of basic insulation	Cycloaliphatic resin
Valid standards	IEC 61869-1; IEC 61869-3

NMT-1-25



VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING TYPE NMT-1-25

TECHNICAL DATA	NMT-1-25
Highest voltage for equipment (eff.) (kV)	36
Rated primary voltage (kV)	25
Rated secondary voltage (V)	100 or 403
Rated power-frequency withstand voltage, 1 min (kV)	70
Rated impulse withstand voltage 1.2/50 μ s (kV)	170
Rated frequency (Hz)	50
Secondary power (VA) for accuracy class 0.5	10
Secondary power (VA) for accuracy class 1	20
Thermal limiting power (VA)	600
Mass (kg)	~60
Temperature class of insulation	E
Type of basic insulation	Epoxy resin
Valid standards	IEC 61869-1; IEC 61869-3



DRY POWER TRANSFORMERS

INTRODUCTION

DESCRIPTION

Transformers NTSM* are carried out as dry, moulded with epoxy resin with temperature insulation class "F" (maximal temperature 155°C). Transformation ratios have been given in the appropriate tables. Rated primary voltage is 25 kV, highest voltage for equipment is up to 52 kV.

APPLIANCE

From the wide range of applications, we especially single out the application on the railway at the level crossings for signalization power supply.

MOUNTING

According to their construction, these transformers are primarily used in places where resistance to flammability, moisture, chemical influences and short circuits is required. Transformers are designed for outdoor installation and due to their construction (creeping distances $>31\text{mm/kV}$) can be installed in very dirty environments. The transformer is connected to the supply and output lines via stainless steel connections. Connect the transformer via cable lugs of appropriate cross-section. It is necessary to ensure good tightening of the screws in order to have a good electrical and mechanical connection. Non-tightened connections will result in heating of the contact surfaces above the permitted limit, which can be transferred to the winding temperature and heating of the connecting conductors. In order to reduce the vibrations and noise of the transformer, it is recommended to clamp the transformer

on the stand with screws in the places where it is provided on the transformer. Before putting the transformer into operation, it is obligatory to check the correctness of the connections as well as the protective line connection at the place provided for the grounding of the transformer. If the transformer has voltage regulation terminals, it is necessary to properly connect the transformer terminals to obtain the desired voltage. For this purpose, the special instructions provided in these cases, in which there is a switching table according to the secondary voltages, which must be observed.

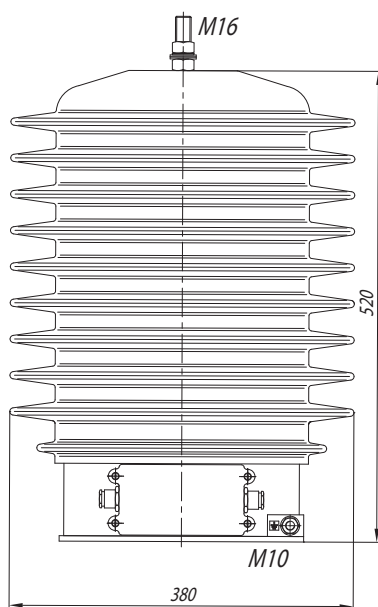
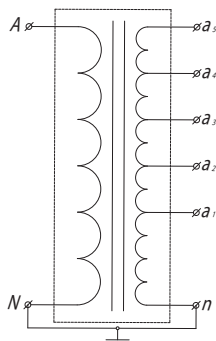
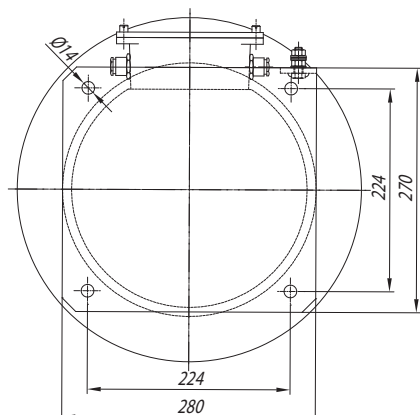
Each transformer of this type manufactured in FMT has passed a routine test which is confirmed by the accompanying test report.

HANDLING AND MAINTAINING

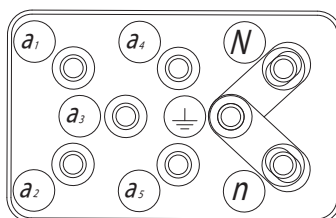
For these types of transformers regular maintaining is not necessary. It is enough, from time to time, to check if all connection are clean and well tightened and to clean the transformer if it is dirty. This can be done only after switching off the transformer from the network from both sides primary and secondary. The vibrations can cause loosening of connections. If some accident happens in the substation, transformers should be tested again before putting them to operate..

If the transformer has been out of operation for a long time and if it has been under the influence of moisture or some other influences, it is necessary to clean it of all dirt, bring it to a dry state and only then put it into operation. In a room with a maximum ambient temperature of 40°C, transformers of this type are completely safe to operate.

NTSM-38-1.5 and NTSM-38-2.5



Secondary connections detail



DRY POWER TRANSFORMERS NTSM-38-1.5 and NTSM-38-2.5

TECHNICAL DATA	NTSM-38-1.5	NTSM-38-2.5
Rated power [VA]	1500	2500
Transformation ratio [kV/kV]	25/0,22	25/0,22
Maximal operating voltage [kV]	27,5	27,5
Highest voltage for equipment [kV]	52	52
Rated power-frequency withstand voltage, 1min[kV]	95	95
Rated withstand impulse voltage 1.2/50μs[kV]	250	250
Lowest operating voltage [kV]	19	19
Type of basic insulation	Epoxy resin	
Creeping distance (mm)	1329	
Mass (kg)	85	102

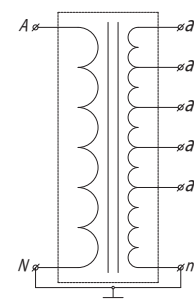
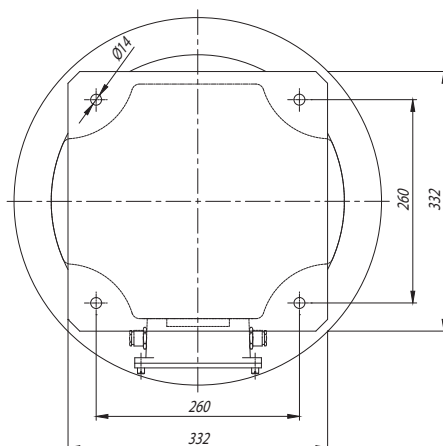
	Connections	Version 1	Version 2
Rated primary voltage [V]	A-N	25000	25000
Rated secondary voltages [V]	a1-n	209	220
	a2-n	220	231
	a3-n	231	242
	a4-n	242	253
	a5-n	253	264



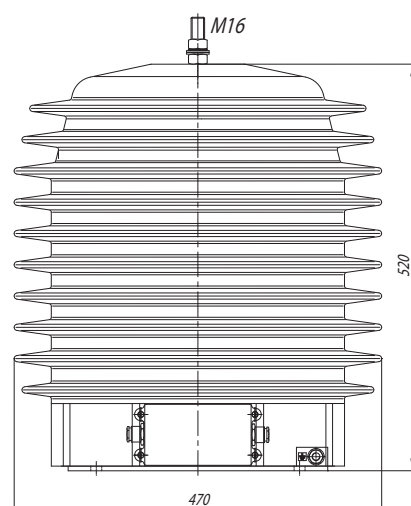
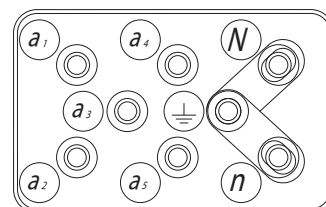
NTSM-38-5 and NTSM-38-10



NTSM-38-5



Secondary connections detail

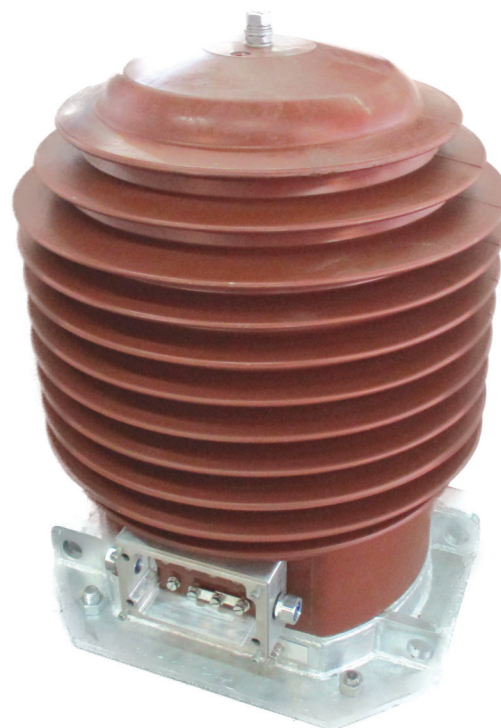
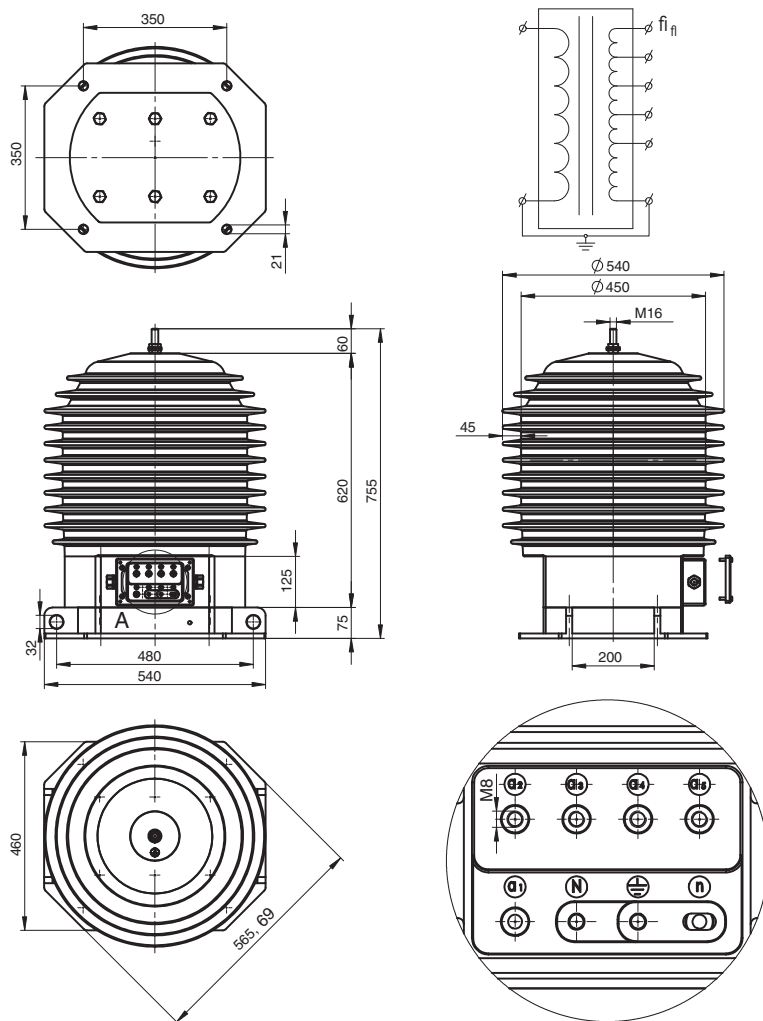


DRY POWER TRANSFORMERS NTSM-38-5 and NTSM-38-10

TECHNICAL DATA	NTSM-38-5	NTSM-38-10
Rated power [VA]	5000	10000
Transformation ratio [kV/kV]	25/0,22	25/0,22
Maximal operating voltage [kV]	27,5	27,5
Highest voltage for equipment [kV]	52	52
Rated power-frequency withstand voltage, 1min[kV]	95	95
Rated withstand impulse voltage 1.2/50μs[kV]	250	250
Lowest operating voltage [kV]	19	19
Type of basic insulation	Epoxy resin	
Creeping distance (mm)	1332	
Mass (kg)	132	152

	Connections	Version 1	Version 2
Rated primary voltage [V]	A-N	25000	25000
Rated secondary voltages [V]	a1-n	209	220
	a2-n	220	231
	a3-n	231	242
	a4-n	242	253
	a5-n	253	264

NTSM-38-16; NTSM-38-20 and NTSM-38-25



NTSM-38-16

DRY POWER TRANSFORMERS NTSM-38-16, NTSM-38-20 and NTSM-38-25

TECHNICAL DATA	NTSM-38-16	NTSM-38-20	NTSM-38-25
Rated power [VA]	16000	20000	25000
Transformation ratio [kV/kV]	25/0,22	25/0,22	25/0,22
Maximal operating voltage [kV]	27,5	27,5	27,5
Highest voltage for equipment [kV]	52	52	52
Rated power-frequency withstand voltage, 1 min[kV]	95	95	95
Rated withstand impulse voltage 1.2/50μs[kV]	250	250	250
Lowest operating voltage [kV]	19	19	19
Type of basic insulation	Epoxy resin		
Creeping distance (mm)	1366		
Mass (kg)	328	350	370







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