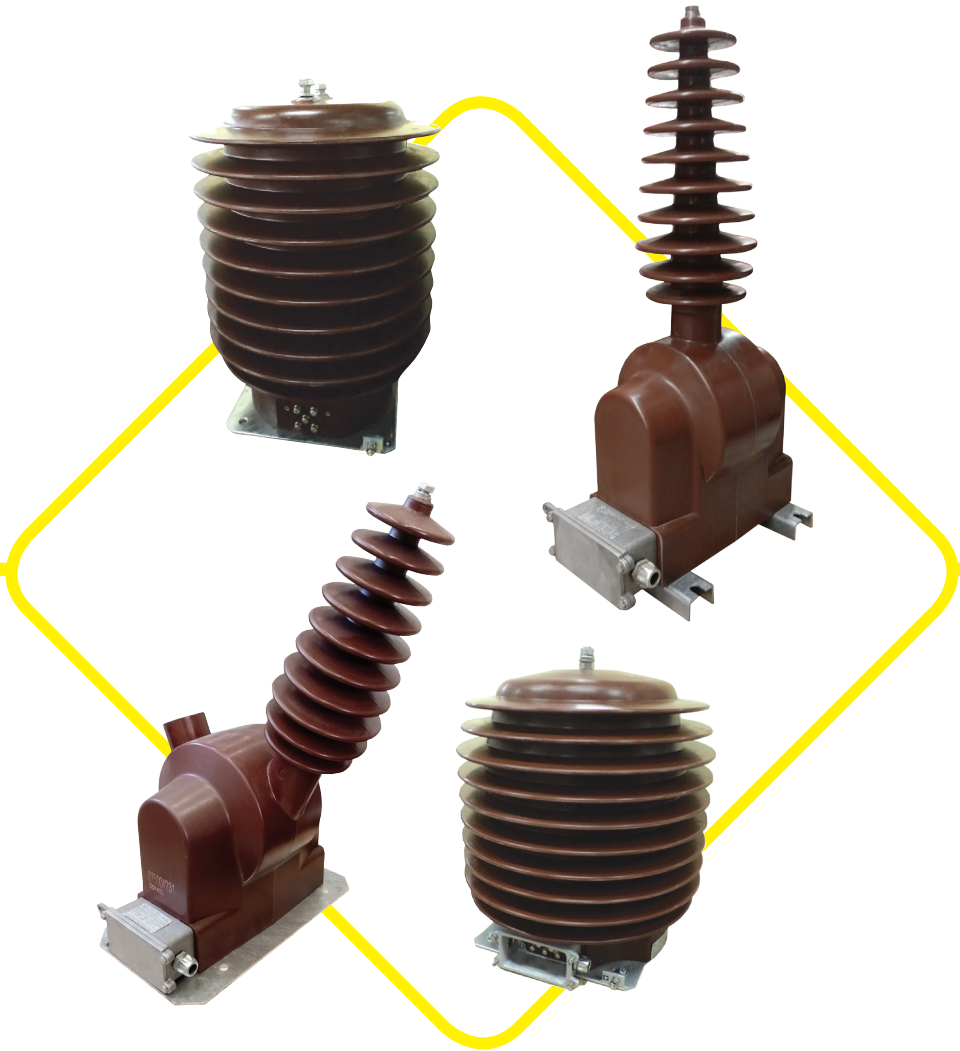
TRANSFORMERS FOR RAILWAYS



1969
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CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING

INTRODUCTION 2
SMTSM-38* 3

CURRENT TRANSFORMERS FOR INDOOR MOUNTING

STEM N-38 4

VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING

INTRODUCTION 5
JNT SM-36-10R 6
DNT SM-36-10R1 **measuring-type** 7
DNT SM-36-10R1 **power-type** 8
NMTSM-38 9
NMT-1-25 10

VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING

JNT 36 11

DRY-TYPE POWER TRANSFORMERS

INTRODUCTION 12
NTSM-38-1.5; NTSM-38-2.5 13
NTSM-38-5; NTSM-38-10 14
NTSM-38-16, NTSM-38-20; NTSM-38-25 15

CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING

INTRODUCTION

DESCRIPTION

The main insulation of these transformers is cycloaliphatic resin. Their cores are made of high-quality cold-rolled magnetic steel sheet with an oriented magnetic structure. The secondary terminals are extended into a special housing that is resistant to the effects of dust and water and can be sealed. The transformers are manufactured with 1, 2, or 3 cores and the same number of independent secondary windings. Due to their high creepage distance values (>1300 mm), outdoor installation transformers can operate even under the most severe operating conditions in highly aggressive environments because they feature a large creepage distance (>1300 mm).

APPLICATION

These transformers are used to isolate measuring and protective devices from high voltage and to transform measuring currents to a value adapted to the measuring and protective devices. They are designed for outdoor installation in distribution switchgear plants with the highest network voltage up to 42 kV. They supply ammeters, current circuits of meters, protective relays, and other devices. Due to their large creepage distances, they are particularly suitable for the measurement and protection of railway networks, as they meet their most stringent requirements.

INSTALLATION

The transformers are mounted in a vertical position only. All connections on the primary and secondary sides must be clean and tightly fastened to prevent their overheating. One of the terminals of all secondary windings must be earthed (typically, this is terminal *k*, respectively *S1*). Care must be taken that the total burden of the connected measuring or protective devices, together with the losses in the connection cables, does not exceed the rated output of the current transformer. If the total burden of the connected devices, together with the burden originating from the connecting conductors, is less than one-quarter of the rated power of the winding, an additional burden should be inserted into that secondary circuit. With the additional burden, the current transformer will operate within its rated accuracy class. If, during operation, any of the secondary windings of the current transformer is not loaded, its terminals must be short-circuited.

During transformer installation, care must be taken not to interchange the primary or secondary connections. The current inlet on the primary winding is marked with *K* or *P1*, and the outlet with *L* or *P2*, while on the secondary winding, the inlet is marked with *k* or *S1*, and the outlet with *l* or *S2*.

If the external dynamic forces of the primary connection lines are large (greater than 3.75 kN), support post insulators should be mounted near the current transformer.

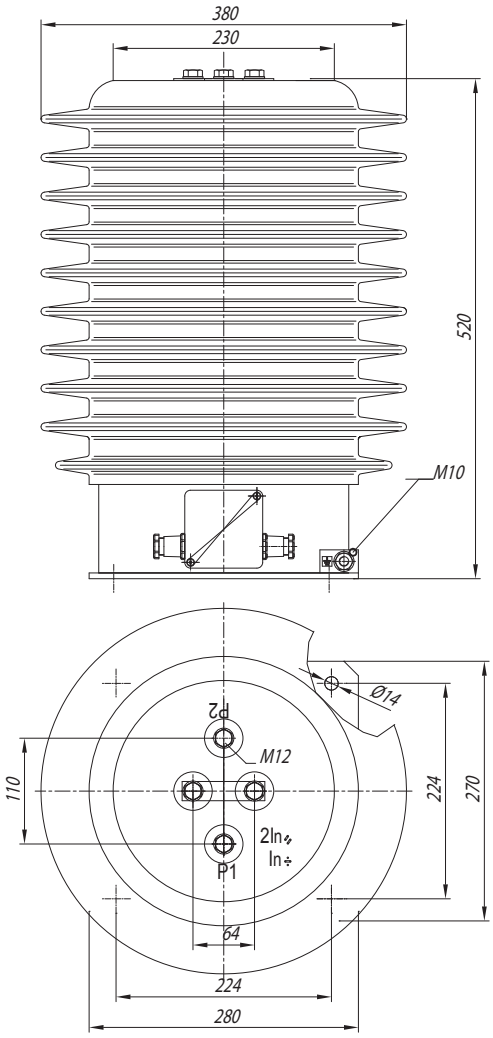
The transformers must be properly earthed at the designated location.

HANDLING AND MAINTENANCE

Regular maintenance is not mandatory for these transformers. From time to time, it should be checked whether all terminals are well secured, and the transformer should be cleaned if it is dirty. Ensure that the current transformer never operates with open secondary terminals, as a dangerously high voltage can appear across them, and serious damage to the insulation can occur. In the event of any breakdowns or short circuits in the plant, the current transformers should be tested to conclude whether they are still fully operational.

CONTENTS

SMTSM-38*





SMTSM 3810

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

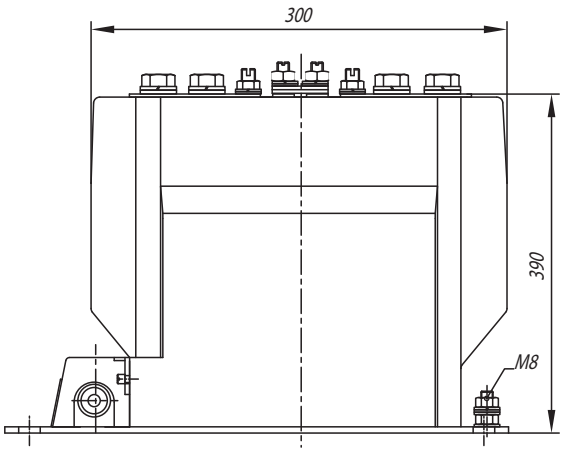
Type of transformer	Dimensions (mm)	Mass (kg)
SMTSM 38	520	~78
SMTSM 38L	520	~126
SMTSM 38b	486	~146

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 μs (kV)	170 (200)		
Creepage 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:
Designation examples:
SMTSM 3821L - transformer subtype SMTSM 38L, with two cores, primary-reconnectable;
SMTSM 3820 - transformer subtype SMTSM-38, with two cores, primary non-reconnectable;
SMTSM 3830b - transformer subtype SMTSM-38b, with three cores, primary non-reconnectable.
As a standard, we manufacture these transformers for a short-time thermal current of 100In, but we can also produce them for higher thermal currents (up to \500In or more) depending on the transformation ratio, class, and output of the cores.
Reconnection can be performed from the primary and secondary sides, and sealing can be done on the secondary side.
These models can also be for more demanding conditions - BIL (40.5/95/200 kV), as they feature a larger creepage distance (≥ 31 mm/kV).
When ordering, be sure to state the transformation ratio, rated output, accuracy class, and instrument security factor (the accuracy limit) factor for each core.

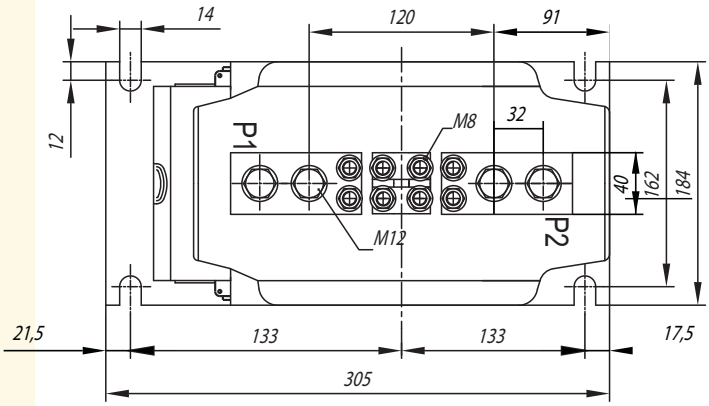
CONTENTS

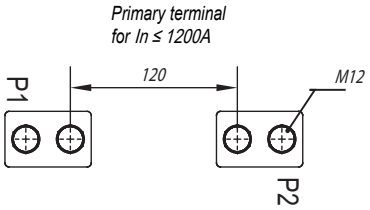
STEM N-38





STEM N-3821





CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM N-38***

TECHNICAL DATA	STEM-N 38*
Rated primary voltage (kV)	25
Maximum operating voltage (kV)	29
Lowest operating voltage (kV)	19.5
Highest voltage for equipment (r.m.s.) (kV)	36 (42)
Power-frequency withstand voltage 50 Hz, 1 min. (kV)	70 (95)
Impulse withstand voltage 1.2/50 μs (kV)	170 (200)
Rated frequency (Hz)	50/60
Rated transformation ratio (A/A)	5 to 1200 or 2x5 to 2x600
Rated secondary current (A	5 (or 1)
Rated accuracy class	0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P
Rated short-time thermal current, 1 s	I_{th} = (100-1000)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 output (VA)	5; 7,5; 10; 15; 30
Instrument security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30
Insulation temperature class	E/B
Sealing capability	On the primary and secondary side
Type of mounting	Indoor
Mass (kg)	36
Type of main insulation	Epoxy resin
Valid standards	IEC 61869-1; IEC 61869-2

CONTENTS

VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING

DESCRIPTION

The transformer cores are made of high-quality cold-rolled magnetic steel sheet with an oriented crystal structure. The primary and secondary windings are cast in epoxy resin filled with quartz sand, resulting in an electrically and mechanically very robust construction. A special structural solution for the windings ensures a uniform distribution of lightning impulse overvoltages along the windings and over the surface of the insulating part of the transformer. Due to all these characteristics, and despite their small dimensions, these transformers excellently withstand tests with an induced overvoltage of increased frequency and tests with lightning impulse overvoltages.

Since the core is made of very high-quality magnetic steel sheet (low specific core losses), even at high magnetic inductions that can occur in the event of an earth fault on an ungrounded network in single-pole insulated transformers, there is no danger of impermissible heating of the transformer core. Single-pole insulated voltage transformers can also be executed with an auxiliary winding (tertiary winding) for open-delta connection intended for earth-fault protection in three-phase networks. An ohmic resistance (resistor) in the open-delta winding circuit of three single-pole insulated voltage transformers connected in a star configuration in networks with an isolated neutral point prevents the occurrence and maintenance of ferroresonant phenomena, which can arise during transient operating conditions of the network.

We manufacture voltage transformers for all climatic conditions.

APPLICATION

Measuring voltage transformers are used to isolate measuring and protective devices from high voltage and to transform the voltage to a value adapted to the measuring and protective devices. Transformers intended for installation in networks supplying railways are produced as single-pole insulated for indoor installation with the highest voltage for equipment up to 42 kV, and for outdoor installation with the highest voltage for equipment up to 52 kV.

The accuracy class of the voltage transformer should be selected according to its purpose:

- Class 0.2: for laboratory measurements and test stations, for the most accurate power measurements in operation, and for measuring electrical energy consumption for billing at large consumers;
- Class 0.5: for operational voltage and power measurements, for measuring electrical energy consumption, and for supplying auxiliary relays;
- Class 1: for cases where a large rated power output is required, and a higher accuracy class is not necessary;
- Class 3P, 6P: for supplying electrical protective relay devices.

INSTALLATION

Epoxy-insulated voltage transformers JNTSM-36 for indoor installation and NMTSM-38 for outdoor installation are mounted in a vertical position.

The primary terminals of single-pole transformers are connected between phase and earth.

All metal parts of the transformer that are not live under normal conditions but can become live in the event of a fault must be earthed. A fixing strap marked with the earthing symbol is located on the transformer.

Depending on the measuring connection, one secondary terminal is also earthed. For single-pole insulated voltage transformers, the secondary terminal *n* is earthed, as well as the primary terminal *N*.

The secondary terminals of a voltage transformer may be open in operation or loaded with small consumers of high resistance (voltmeters, voltage circuits of meters and relays). The secondary terminals must never be short-circuited, as this would cause the destruction of the voltage transformer. Therefore, secondary lines are usually protected with fuses. Earthed conductors are not fused.

The permissible tightening torque value Mp on the high-voltage (HV) terminals with an M10 bolt is 24.5 Nm, and with an M16 bolt is 98 Nm.

VERSIONS

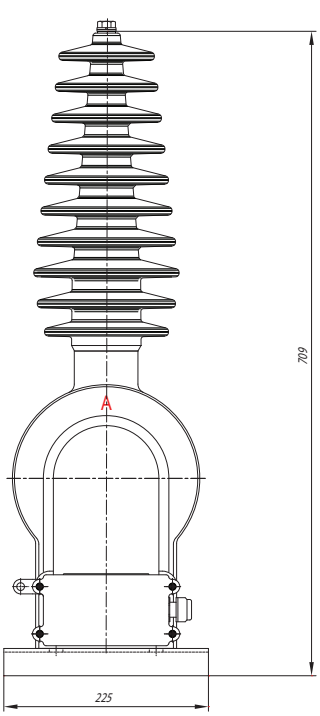
We manufacture transformers for indoor and outdoor installation with one or two secondary windings. For indoor installation, there are also variants with high-voltage fuse holders, allowing these fuses to be integrated directly into the transformer.

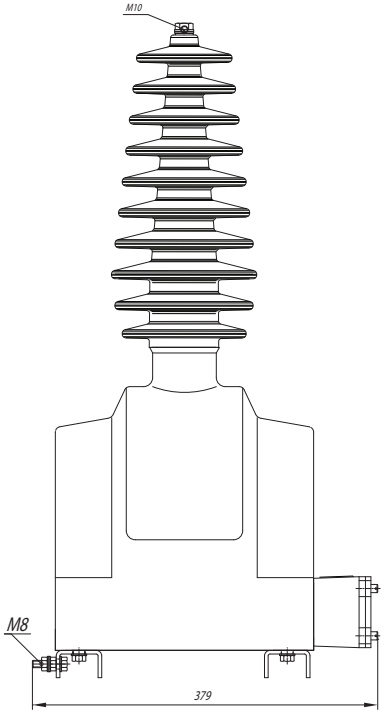
HANDLING AND MAINTENANCE

Regular maintenance is not mandatory for these transformers. From time to time, the transformers should be wiped down (cleaned), especially if they operate in aggressive or dirty environments. Wiping of the transformers must be performed in a de-energized (dead) state. In the event of breakdowns in the plant, it should be tested whether the transformers are still operational.

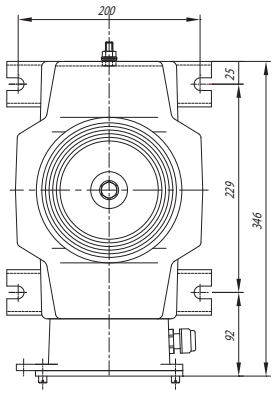
CONTENTS

JNT SM-36-10R







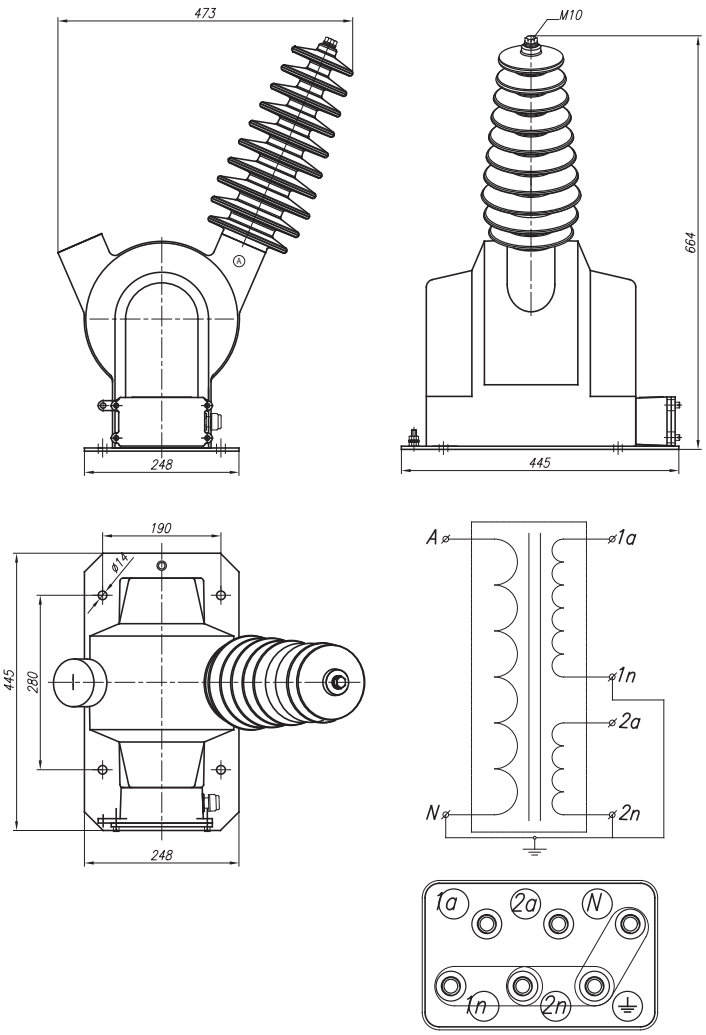


VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **JNT SM-36-10R**

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
Creepage 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

CONTENTS

DNT SM-36-10R1





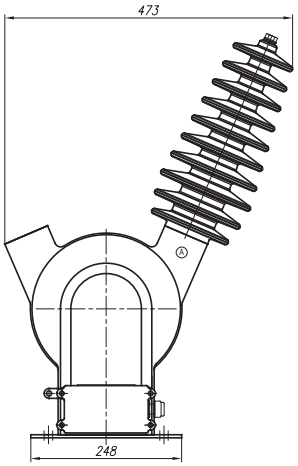
SINGLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **DNT SM-36-10R1**

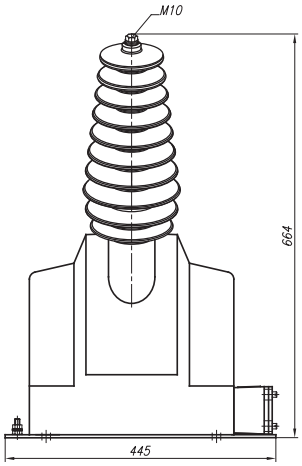
TECHNICAL DATA	DNT SM-36-10R1	
Mounting	Outdoor	
Transformation ratio [kV/kV/kV]	25/0.1/0.1	27.5/0.1/0.1
Rated voltage[kV]	25	27.5
Highest voltage for equipment [kV]	40.5	
Secondary winding (1) - rated voltage [V]	100	
Rated power and accuracy class for the secondary winding (1)	30VA ; 75VA / class0.2 ; 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	

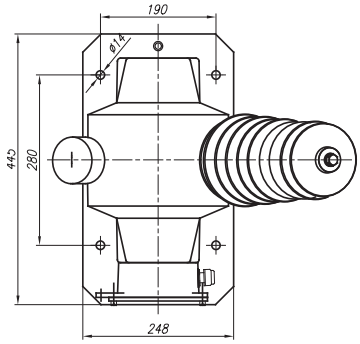
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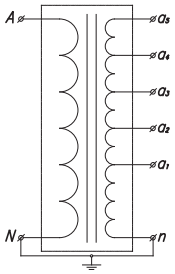
DNT SM-36-10R1
POWER VOLTAGE TRANSFORMER

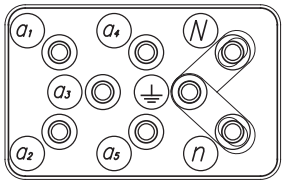












SINGLE-POLE POWER VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING
DNT SM-36-10R1

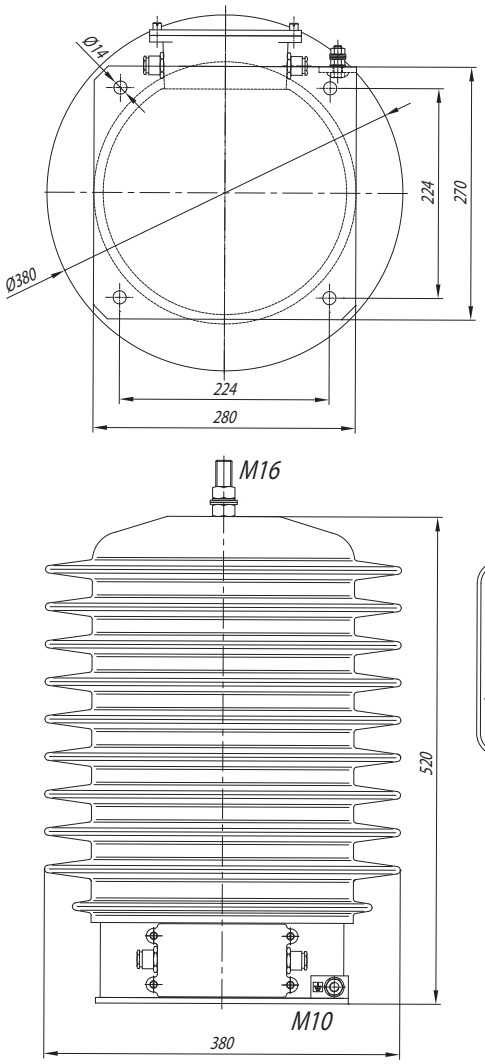
TECHNICAL DATA	DNT SM-36-10R1
Rated power [kVA]	1.5; 2; 2.5; 3; 4
Transformation ratio [kV/kV]	25/0.22
Highest voltage for equipment [kV]	52
Maximal operating voltage [kV]	40.5
Lowest operating voltage [kV]	19
Rated frequency (Hz)	50/60
Rated power-frequency withstand voltage , 1min (kV)	80
Rated withstand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

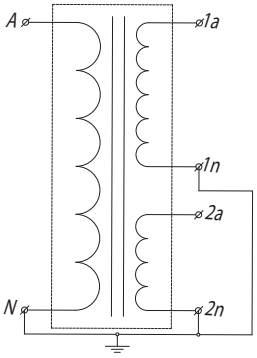
	Connections	Voltage
Rated primary voltage [V]	A-N	25000
Rated secondary voltages [V]	a1-n	209
	a2-n	220
	a3-n	231
	a4-n	242
	a5-n	253

CONTENTS

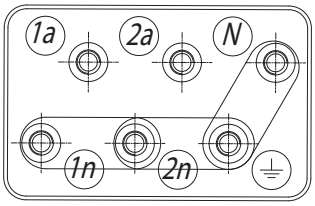
NMTSM-38







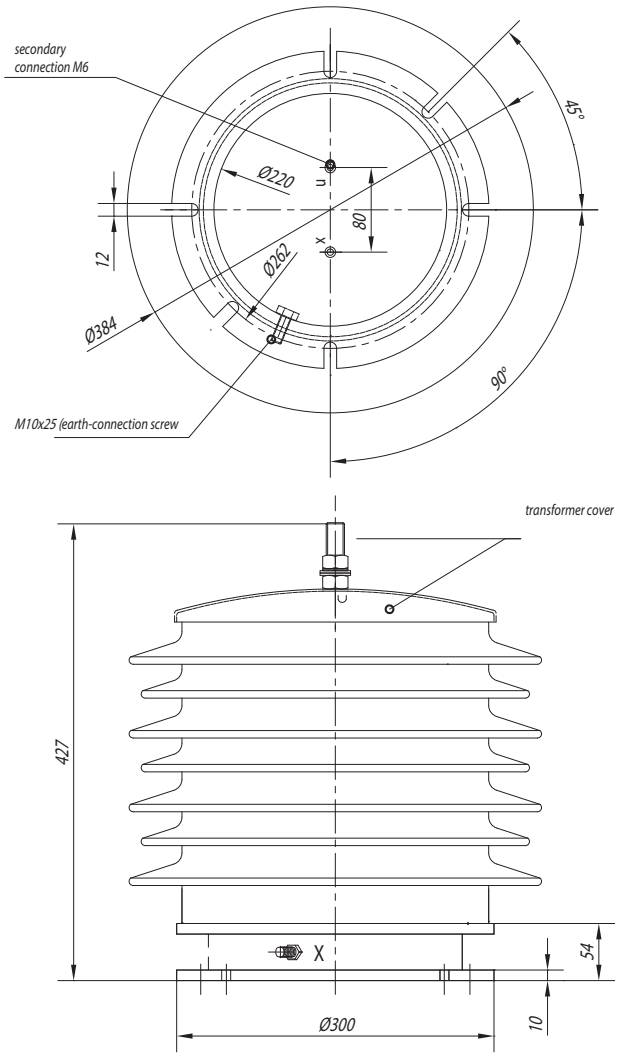
Secondary connection - detail



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
Creepage 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



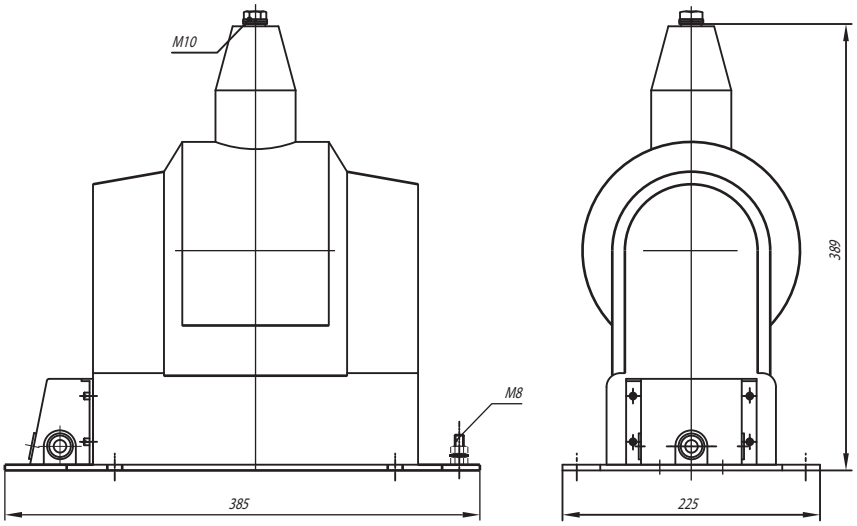


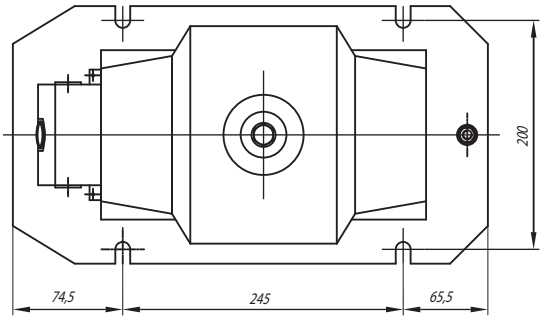
VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **NMT-1-25**

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, 1min (kV)	70
Rated impulse withstand voltage 1.2/50 μs (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

CONTENTS

JNT-36







VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING **JNT-36**

TECHNICAL DATA	JNT-36
Rated primary voltage (kV)	25
Highest voltage for equipment (eff.) (kV)	36(42)
Maximum operating voltage (kV)	29
Lowest operating voltage (kV) 19.5	19.5
Power-frequency withstand voltage 50 Hz, 1 min (kV)	70(95)
Rated impulse withstand voltage 1.2/50 μs (kV)	170(200)
Rated frequency (Hz)	50/60
Rated transformation ratio (kV/kV/kV)	25/0.1/0.1
Secondary winding (1) - rated voltage (V)	100
Rated output and accuracy class of secondary winding (1)	UP to30VA; class 0.5
Secondary winding (2) - rated voltage (V)	100
Rated output and accuracy class of secondary winding (2)	Up to 60VA; class 1
Type of mounting	Indoor
Mass (kg)	40
Insulation temperature class	E/B
Type of main insulation	Epoxy resin
Valid standards	IEC 61869-1; IEC 61869-3;

DRY-TYPE POWER TRANSFORMERS

INTRODUCTION

DESCRIPTION

The NTSM* transformers are designed as dry-type, cast in cycloaliphatic resin under insulation class "F" (maximum permissible temperature 155°C). The transformation ratio of the transformers is given in the table. They are manufactured for a rated primary voltage of 25 kV, respectively a highest voltage for equipment up to 52 kV.

APPLICATION

From a wide spectrum of applications, we particularly highlight the application on railways at level crossings for supplying power to signaling systems.

INSTALLATION

By their construction, these transformers are primarily applied in locations where resistance to flammability, moisture, chemical influences, and short circuits is required. The transformers are designed for outdoor installation, and due to their construction (creepage distances >31 mm/kV), they can be installed in highly contaminated environments.

The connection of the transformer to the supply and distribution lines is carried out via stainless steel terminals. The connection of the transformer into operation should be done using cable lugs of the appropriate cross-section. It is necessary to ensure good tightening of the bolts in order to achieve a good electrical and mechanical connection. Loose connection interfaces will result in the heating of contact surfaces beyond the permissible limit, which can also be transferred to the winding temperature and cause heating of the connection conductors. To reduce transformer vibrations and noise, it is recommended to secure the transformer to the base with bolts at the locations designated on the transformer. Before putting the transformer into operation, it is mandatory to double-check the correctness of the connection interfaces as well as the connection of the protective line at the location provided for transformer earthing. If the transformer features voltage regulation terminals, it is necessary to select the appropriate ones according to the specified diagram in order to obtain the desired secondary voltage. For this purpose, a special manual delivered in those cases should be respected, which contains a reconnection table according to secondary voltages.

Every transformer of this type manufactured at FMT has passed a routine test, which is confirmed by the accompanying test report.

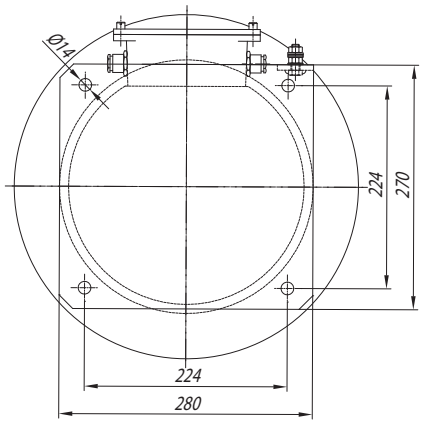
HANDLING AND MAINTENANCE

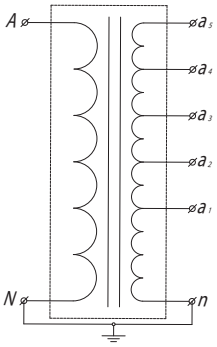
During the exploitation of dry-type epoxy transformers, almost no maintenance is required. It is recommended from time to time to check the safety of connections at the transformer terminals, as vibrations can lead to a loosening of the connections. The transformer should also be wiped clean of dust and other impurities.

If the transformer has been out of service for a long time and has been under the influence of moisture or some other factors, 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 operationally completely safe.

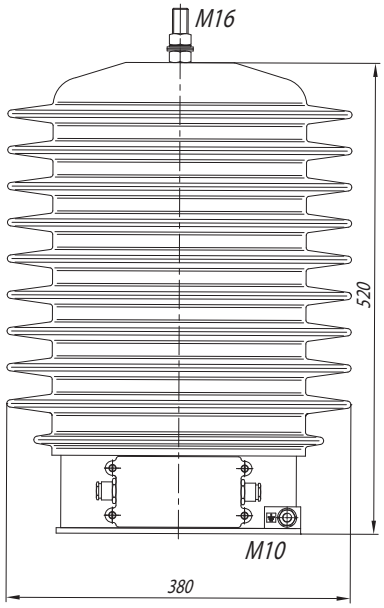
CONTENTS

NTSM-38-1.5; NTSM-38-2.5

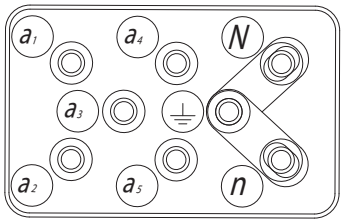








Secondary connections detail



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	
Creepage distance (mm)	1329	
Mass (kg)	85	102

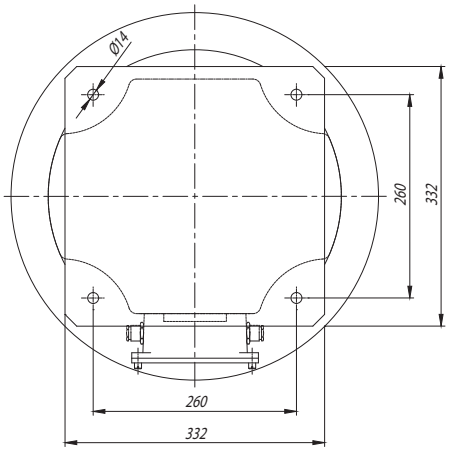
	Connections	Version 1	Version 2
Rated primary voltage [V]	A-N	25000	25000
Rated secondary voltages [V]	a1-n	209	220
	a2-n	220	231
	a3-n	231	242
	a4-n	242	253
	a5-n	253	264

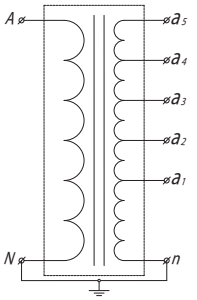
CONTENTS

NTSM-38-5; NTSM-38-10

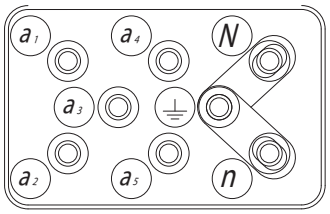


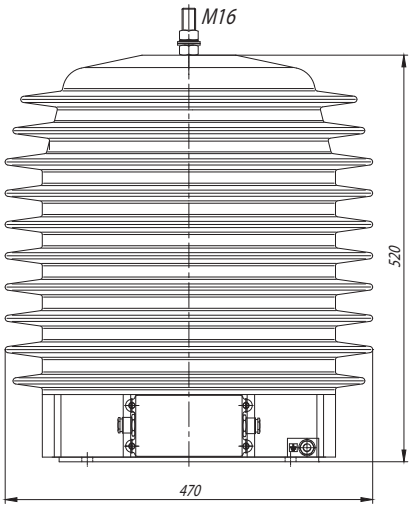
NTSM-38-5





Secondary connections detail





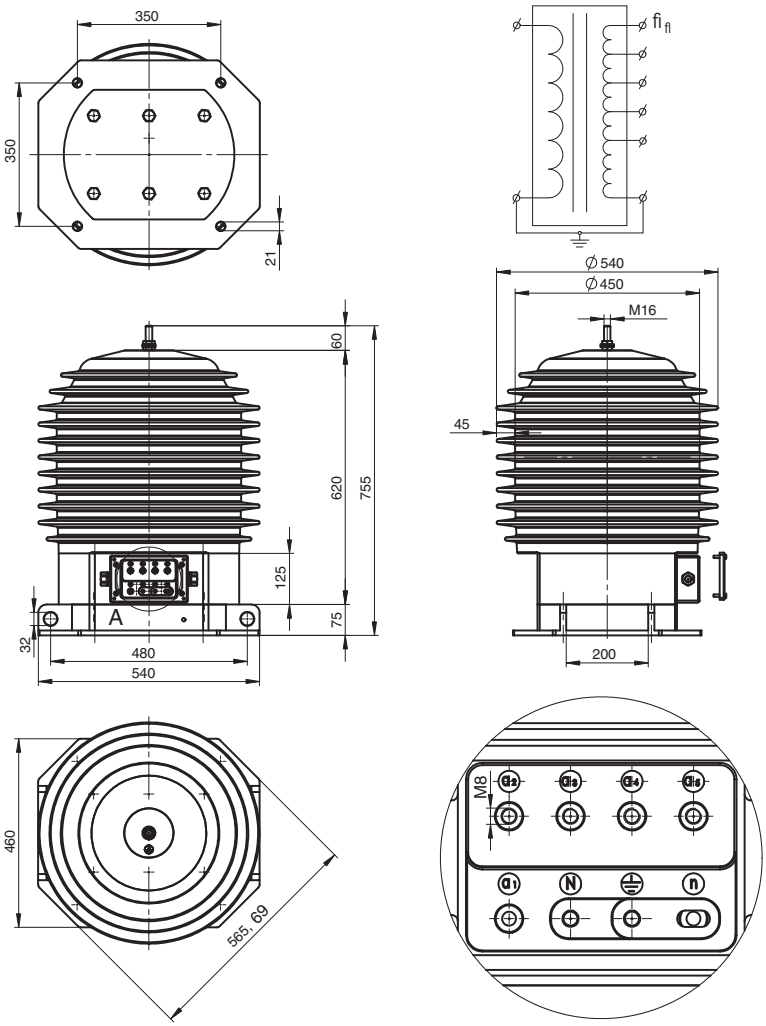
DRY POWER TRANSFORMERS **NTSM-38-5** and **NTSM-38-10**

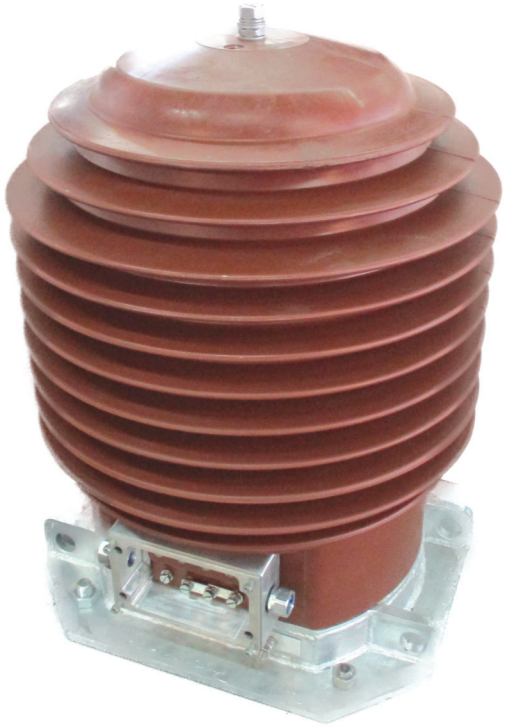
TECHNICAL DATA	NTSM-38-5	NTSM-38-10
Rated power [VA]	5000	10000
Transformation ratio [kV/kV]	25/0,22	25/0,22
Maximal operating voltage [kV]	27,5	27,5
Highest voltage for equipment [kV]	52	52
Rated power-frequency withstand voltage, 1min[kV]	95	95
Rated withstand impulse voltage 1.2/50μs[kV]	250	250
Lowest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

CONTENTS

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





NTSM-38-16

DRY-TYPE 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, 1min[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		
Creepage distance (mm)	1366		
Mass (kg)	328	350	370

CONTENTS

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