PRODUCT PORTFOLIO

MEDIUM VOLTAGE

- Current transformers
- Voltage transformers
- Neutral earthing resistors
- Billing metering assemblies for pole-mounted substations
- Easy-to-install pole-mounted power substation - Penda

1969

ZAJEČAR

FMT

MINEL FEPO 1956

CURRENT TRANSFORMERS
12-38 kV



1969 ZAJEČAR FMT

MINEL 1956 FEPO

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INTRODUCTION 2

BURDEN INFLUENCE TO THE INSTRUMENT SAFETY FACTOR
AND ACCURACY LIMIT FACTOR FOR CURRENT TRANSFORMERS 3

SUPPORTING-TYPE TRANSFORMERS

SUPPORTING-TYPE CURRENT TRANSFORMERS FOR INDOOR MOUNTING

STEM-N 1211, STEM-N 2411, STEM-N 3811 4

STEM-N 12*, STEM-N 24*, STEM-N 38* 5

STEM-NS 24(12)*, STEM-NS 38*, STEM-N 38*L 6

STEM-N 24*R, STEM-N 38*R 7

STEM-N 12*d(R), STEM-N 24*d(R) 8

SUPPORTING-TYPE CURRENT TRANSFORMERS FOR INDOOR MOUNTING - BLOCK TYPE

STEM 12*d, STEM 24*d 9

STEM 12*z, STEM 24*z 10

AS 12/150* 11

AS 24/180* 12

AN 36/250* 13

SUPPORTING-TYPE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING

ATMS 2411, ATMS 3811 14

ATM 2411, ATM 2411h, ATM 3811 15

ATM 24*, ATM 38*, ATM 38*h 17

STSM-38*, STSM-38L, STSM-38b (FOR RAILWAY) 19

STSM* (FOR RAILWAY) 21

STSM-38 III (FOR RAILWAY) 22

BUSHING CURRENT TRANSFORMERS

STPN 12* STPN 24*, STPN 38* 23

STPM 12*, STPM 38* 25

INTRODUCTION

APPLICATION

These transformers are used to isolate measuring and protection equipment from high voltage, and to transform measured currents to a level suitable for such equipment.

They are designed for installation in switchgear with voltage ratings up to 38 kV. They provide power to ammeters, meter current circuits, protection relays, and other devices.

The transformers can operate continuously at currents up to 20% above their rated value while still maintaining their specified accuracy class.

DESCRIPTION

Basic insulation in these transformers is epoxy resin. Magnetic core consists of quality, cold rolled, oriented magnetic steel sheet. Secondary terminals have been covered with transparent plastic cover which can be sealed.

Transformers can be made with 1, 2, 3 or more magnetic cores and as many separated secondary windings.

The primary winding can be made in two sections, allowing the transformer to be primarily switchable. The marking 2x100A means that the transformer can be used at the rated primary currents of 100 A and 200 A.

HANDLING AND MAINTENANCE

Regular maintenance is not required for these transformers.

Periodically, check that all terminals are securely fastened and clean the transformer if it has become soiled.

Ensure that the transformer is never operated with open secondary terminals, as dangerously high voltage may develop at these points, and serious damage to the insulation could occur.

In the event of any faults or failures within the installation, the transformers should be inspected to verify that they remain in proper working order.

INSTALLATION

The transformer can be mounted in any position. It is secured to the mounting surface via a base plate using appropriate screws. All connections on the primary and secondary sides must be clean and firmly tightened to prevent overheating. One terminal of each secondary winding must be grounded (typically terminal 'k' or 's1'). Ensure that the total load of the connected measuring or protective devices, combined with losses in the connecting cables, does not exceed the transformer's rated load.

If the total load of the devices connected to a measuring current transformer (including cable losses) is significantly lower than the rated load, additional resistance must be inserted into the transformer's secondary circuit to ensure proper operation. If any of the secondary windings are left unloaded during operation, their terminals must be short-circuited.

Primary switchable transformers feature a connection diagram. The switch is performed by simply repositioning the connected plates on the high-voltage terminals while the transformer is de-energized. Reconfiguration can also be carried out on the secondary side; in this case, the connection diagram indicates which secondary-side terminals should be used to select the appropriate transformation ratio—again, while the transformer is de-energized.

When mounting the transformer, take care not to reverse the primary or secondary connections. The current input on the primary winding is marked K or P1, and the output L or P2, while on the secondary winding the input is marked k or S1, and the output l or S2.

If the external dynamic forces of the primary feed lines are large (greater than 3.75 kN), support insulators must be installed near the power transformer. Transformers must be properly earthed at the designated point.

BURDEN INFLUENCE TO THE INSTRUMENT SECURITY FACTOR AND ACCURACY LIMIT FACTOR FOR CURRENT TRANSFORMERS

The standard values for the instrument security factor and accuracy limit factor provided by the manufacturer refer to the rated power (rated burden) of the current transformer cores. If the rated burden is not connected to the secondary of the current transformer, the security factor (or accuracy limit factor) will change according to the following formula:

$$F_{st} = F_s \cdot \frac{P_n + P_i}{P_t + P_i}$$

F_{st} – Instrument security factor at operating burden (P_t)

F_s – Instrument security factor at rated burden (P_n)

P_n – rated core power

P_t – core power at operating burden and rated current

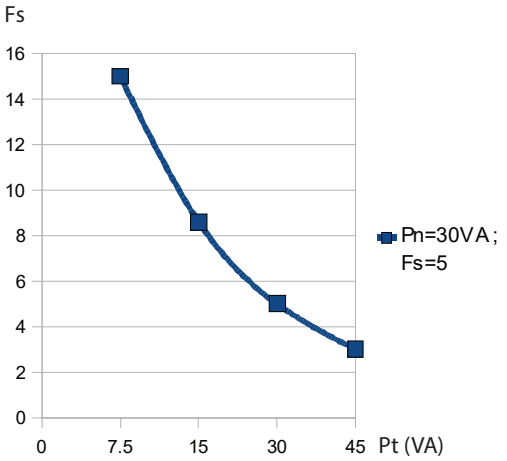
P_i – core's own consumption (0,05 P_n to 0,2 P_n)

This formula does not apply to so-called "linear" cores. The diagram below illustrates the relationship between the safety factor and the burden connected to a 30VA core, for a security factor of $F_s = 5$.

Connecting a burden with a power rating lower than the core's rated power results in a higher security factor; therefore, care must be taken to protect the measuring instrument due to the increased secondary current.

For the accuracy limit factor, the same functional dependence on the burden applies as for the security factor.

CONTENTS



PROPER SELECTION OF MEASUREMENT TRANSFORMERS

For three-phase measurement, 3 current transformers and 3 voltage transformers are required, rated for the voltage level of the network where the measurement is being performed. It is essential that the transformation ratio and power rating of the instrument transformers be determined as accurately as possible to ensure the highest possible measurement precision.

The primary current of current transformers is the line current, which is calculated based on the power rating of the power transformer upstream of the installation and rounded up to the nearest standard value. Since the power transformer itself is not always loaded to its rated capacity, it is necessary to determine the rated primary current of the current transformers as accurately as possible, using the following formula:

$$I(A) = \frac{Sn(kVA)}{\sqrt{3}\ Un(kV)}$$

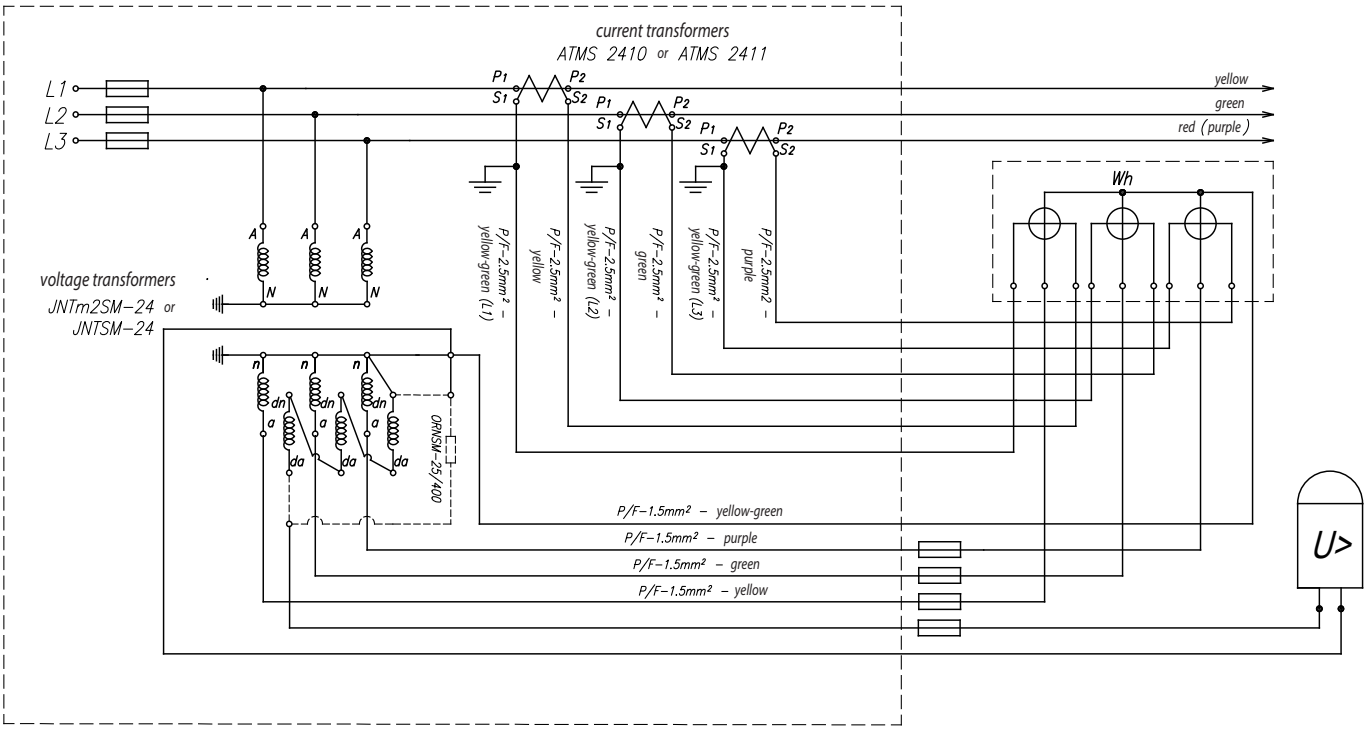
The rated primary currents I1n are 5, 7.5, 10, 12.5, 15, 20, 25, 30, 40, 50, 60, and 75 A, or their integer decimal multiples. The secondary current of current instrument transformers can be 5 A or 1 A.

The rated power of each secondary winding of a current instrument transformer must account for the consumption of all measuring or protection devices connected to the secondary terminals of that winding, plus the Joule power losses in the conductors themselves, as specified in the table below:

Consumer	Power consumption of the system (W/m)
Cu conductor 1m 2,5mm² at 5A	0.18
Cu conductor 1m 4mm² at 5A	0.11
Cu conductor 1m 1,5mm² at 1A	0.012
Cu conductor 1m 2,5mm² at 1A	0.007
Cu conductor 1m 4mm² at 1A	0.0044

The standard power ratings of the secondary windings of current measuring transformers are 2.5, 5, 10, 15 and 30 VA. The connection diagram for current and voltage transformers for three-phase measurement is shown below.

Note: A resistor is included in the tertiary winding circuit—in cases where the network has an isolated neutral point—to protect the voltage transformers against ferroresonance.



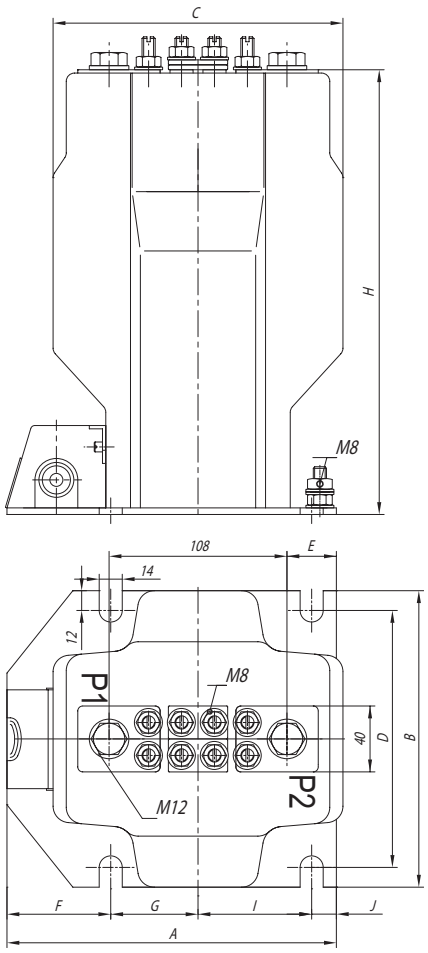
Three-system measurement scheme for 10 kV and 20 kV voltage level networks

CONTENTS

STEM-N 1211, 2411, 3811



STEM-N 2411



SINGLE-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM-N***

Type of transformer	Dimension (mm)										Mass (kg)
	A	B	C	D	E	F	G	H	I	J	
STEM-N 1211	216	158	162	134	27	72	63	220	66	15	~11
STEM-N 2411	200	180	176	156	30	63	53	270	69	15	~15
STEM-N 3811	215	184	198	160	45	54	62	390	82	17	~18

TECHNICAL DATA	STEM-N 1211 (STEM-N 1210)	STEM-N 2411 (STEM-N 2410)	STEM-N 3811 (STEM-N 3810)
Rated primary voltage (kV)	10	20	35
Highest voltage for equipment (eff.) (kV)	12	24	38
Rated power-frequency withstand voltage, 1 min. (kV)	28	50	70
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125	170
Rated frequency (Hz)	50/60		
Rated primary current (A)	5 to 600 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 thermal current 1 sec.	$I_{th} = (100\text{-}500)I_n$		
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$		
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$		
Number of cores	1		
Rated core power (VA)	5; 7,5; 10; 15; 30		
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30		
Temperature class of insulation	E/B		
Possibility of sealing	On primary and secondary side		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-2		

NOTE:

STEM-N 1211, STEM-N 2411, STEM-N 3811 – single-core transformer, primarily-switchable; STEM-N 1210, STEM-N 2410, STEM-N 3810 – single-core transformer, primarily non-switchable.

We manufacture these transformers as a standard series for a thermal current of 100In, but they can also be produced for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

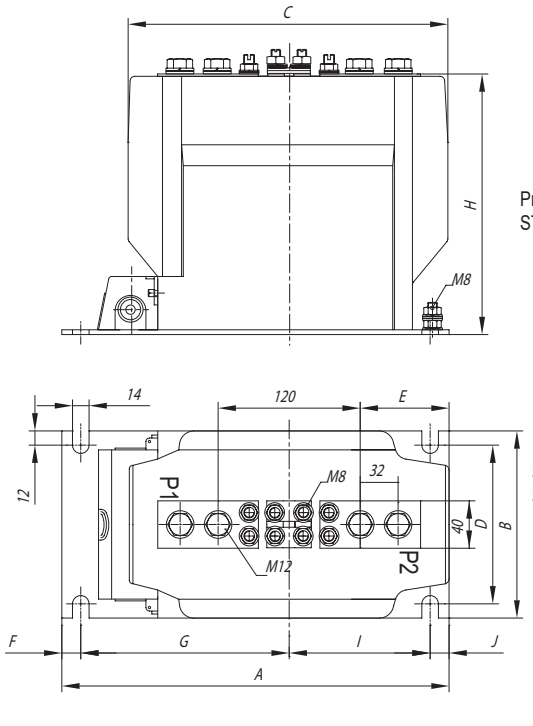
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and instrument security factor (accuracy limit factor).

The primary regulation cover is supplied on special request.

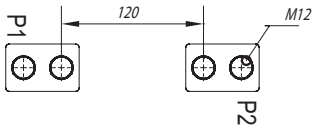
The right to make changes is reserved.

CONTENTS

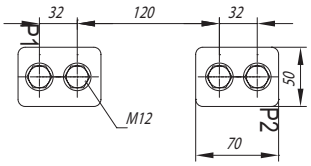
STEM-N 12*, 24*, 38*



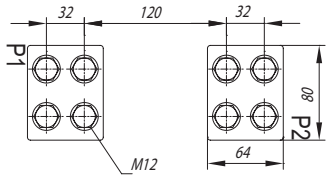
Primary connection
for In ≤ 1250A

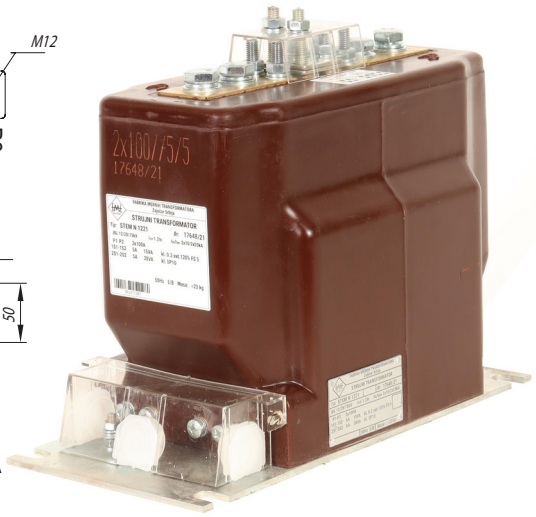


Primary connection
STEM-N for 12kV for 800 ≤ In ≤ 1600A



Primary connection
STEM-N for 12kV for 1600 < In ≤ 3000A
STEM-N 24-38kV for 1500 ≤ In ≤ 3000A





STEM-N 1221

MULTI-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM-N***

Type of transformer	Dimension (mm)										Mass (kg)
	A	B	C	D	E	F	G	H	I	J	
STEM-N 12*	327	158	270	134	75	16	176	220	119	16	~23
STEM-N 24*	339	178	294	154	87,5	17	175	265	130	17	~27
STEM-N 38*	305	184	300	162	91	21,5	133	390	133	17,5	~36
STEM-N 38*sa	305	184	300	162	91	21,5	133	360	133	17,5	~33

TECHNICAL DATA	STEM-N 12*	STEM-N 24*	STEM-N 38*(sa)
Rated primary voltage (kV)	10	20	35
Highest voltage for equipment (eff.) (kV)	12	24	38
Rated power-frequency withstand voltage, 1 min. (kV)	28	50	70
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125	170
Rated frequency (Hz)	50/60		
Rated primary current (A)	5 to 3000 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 thermal current 1 sec.	$I_{th} = (100\text{-}1000)I_n$		
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 power (VA)	5; 7,5; 10; 15; 30		
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30		
Temperature class of insulation	E/B		
Possibility of sealing	On primary and on secondary side		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-2		

NOTE:

STEM-N 1221 (STEM-N 1231), STEM-N 2421 (STEM-N 2431), and STEM-N 3821 (STEM-N 3831) - transformers with two (three) cores, primarily switchable;
STEM-N 1220 (STEM-N 1230), STEM-N 2420 (STEM-N 2430), and STEM-N 3820 (STEM-N 3830) - transformers with two (three) cores primarily non-switchable.

Change of transformation ratio can be done on the primary or secondary side. If it is on the secondary side, the suffix "sp" is added to the designation:
STEM-N 1220sp is a two-core transformer with a switchable secondary side.

The STEM-N 3821sa model shares the same characteristics as the STEM-N 3821 but is 30 mm shorter in height (360 mm compared to 390 mm for the STEM-N 3821). It is suitable for installation in power substation cells with limited space for instrument transformers.

We manufacture these transformers as a standard series featuring two cores: a metering core (15 VA, class 0.5 FS5) and a protection core (30 VA, class 5P10). We can also produce them for higher thermal currents (up to 500In or more), and with 1, 3, or 4 cores, depending on the transformation ratio, accuracy class, and core power.

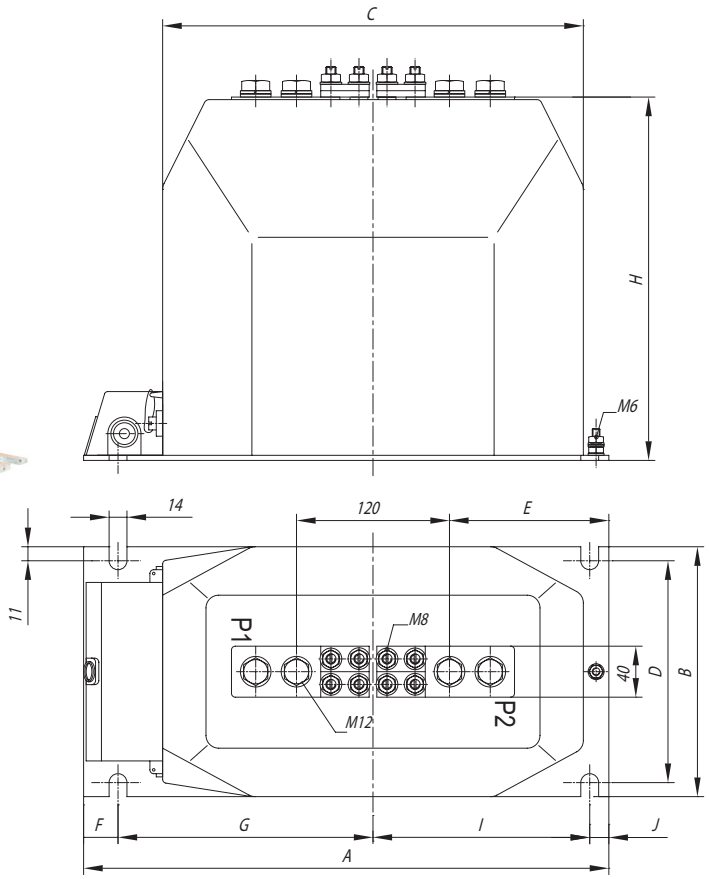
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and instrument security factor (or accuracy limit factor) for each core. The primary regulation cover is supplied on special request. The right to make changes is reserved.

CONTENTS

STEM-NS 24*(12*), 38*, 38*L



STEM-NS 2430



MULTI-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM-NS ***

Type of transformer	Dimension (mm)										Mass (kg)
	A	B	C	D	E	F	G	H	I	J	
STEM-NS 24(12)*	412	196	330	174	125	27	200	285	175	15	~42
STEM-NS 38*	412	196	330	174	125	27	200	390	175	15	~48
STEM-NS 38*L	385	220	350	190	115	27	160	390	160	15	~58

TECHNICAL DATA	STEM-NS 24*(STEM-NS 12*)	STEM-NS 38*L
Rated primary voltage (kV)	20(10)	35
Highest voltage for equipment (eff.) (kV)	24(12)	38
Rated power-frequency withstand voltage, 1 min. (kV)	50(28)	70
Rated impulse withstand voltage 1.2/50 μs (kV)	125(75)	170
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 3000 or 2x5 to 2x1250	
Rated secondary current (A)	5 (or 1)	
Rated accuracy class	0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P	
Rated thermal current 1 sec.	$I_{th} = (100\text{-}1000)I_n$	
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 power (VA)	5; 7,5; 10; 15; 30	
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Possibility of sealing	On primary and secondary side	
Type of basic insulation	Epoxy resin	
Valid standards	IEC 61869-1; IEC 61869-2	

NOTE:

STEM-NS 1221 (STEM-NS 1231), STEM-NS 2421 (STEM-NS 2431), STEM-NS 3821 (STEM-NS 3831) – transformer with two (three) cores, primarily switchable;
STEM-NS 1220 (STEM-NS 1230), STEM-NS 2420 (STEM-NS 2430), STEM-NS 3820 (STEM- NS 3830) – transformer with two (three) cores, primarily non-switchable.

Change of transformation ratio can also be done on the secondary side and in that case, the suffix 'sp' is added at the end of the denotation:
STEM-NS 3820Lsp – transformer with two cores, secondarily switchable.

These transformers can also be manufactured for higher thermal currents and with 1, 3, or 4 cores, depending on the transformation ratio, accuracy class, and core power ratings.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (or accuracy limit factor) for each core.

The primary regulation cover is supplied on special request.

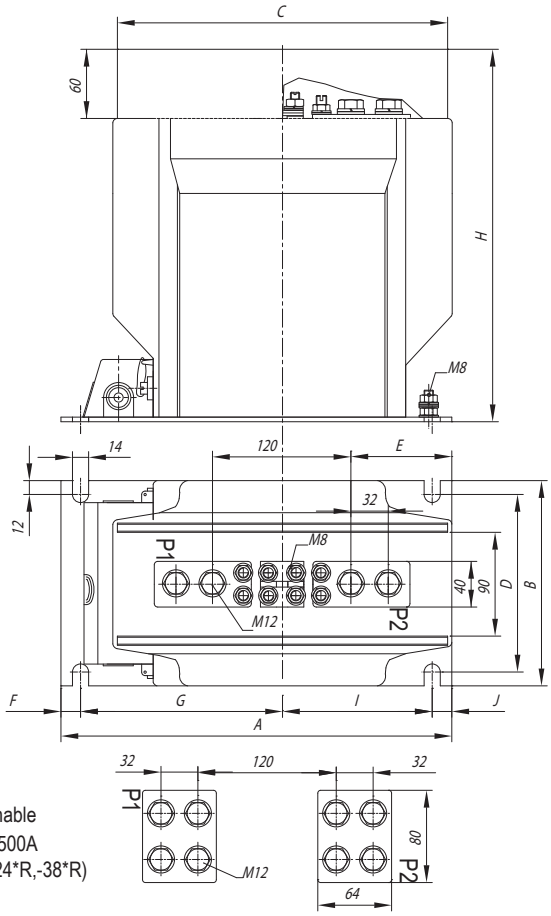
The right to make changes is reserved.

CONTENTS

STEM-N 24*R, 38*R



STEM N 24*R



Primarily non-switchable
For 1600A ≤ In ≤ 2500A
(valid for STEM-N 24*R,-38*R)

MULTI-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM-N 24*R STEM-N 38*R**

Type of transformer	Dimension (mm)										Mass (kg)
	A	B	C	D	E	F	G	H	I	J	
STEM-N 24*R	339	178	286	154	87	17	175	323	130	17	~29
STEM-N 38*R	305	184	292	162	90,5	21,5	133	448	133	17,5	~37

TECHNICAL DATA	STEM-N 24*R	STEM N-38*R
Rated primary voltage (kV)	20	35
Highest voltage for equipment (eff.) (kV)	24	38
Rated power-frequency withstand voltage, 1 min. (kV)	50	70
Rated impulse withstand voltage 1.2/50 μs (kV)	125	170
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 3000 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 thermal current 1 sec.	$I_{th} = (100\text{-}1000)I_n$	
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 power (VA)	5; 7,5; 10; 15; 30	
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Possibility of sealing	On primary and secondary side	
Type of basic insulation	Epoxy resin	
Valid standards	IEC 61869-1; IEC 61869-2	

NOTE:

STEM-N 2421R (STEM-N 2431R) and STEM-N 3821R (STEM-N 3831R) - transformers with two (or three) cores and a switchable primary side;

STEM-N 2420R (STEM-N 2430R) and STEM-N 3820R (STEM-N 3830R) - transformers with two (or three) cores and a non-switchable primary side.

Change of transformation ratio can also be done on the secondary side and in that case, the suffix 'sp' is added at the end of the denotation: STEM-N 3820Rsp denotes a two-core transformer with a switchable secondary side.

These transformers are designed for installation in power substation cells with limited spacing; they feature an extended creepage distance, achieved through epoxy-resin-cast ribs (barriers) located near the primary terminals.

As a standard production offering, these units are manufactured with a thermal current rating of 100In and two cores: a metering core (15 VA, class 0.5FS5) and a protection core (30 VA, class 5P10).

We can also manufacture them for higher thermal currents and with 1, 3, or 4 cores, depending on the transformation ratio, accuracy class, and core power.

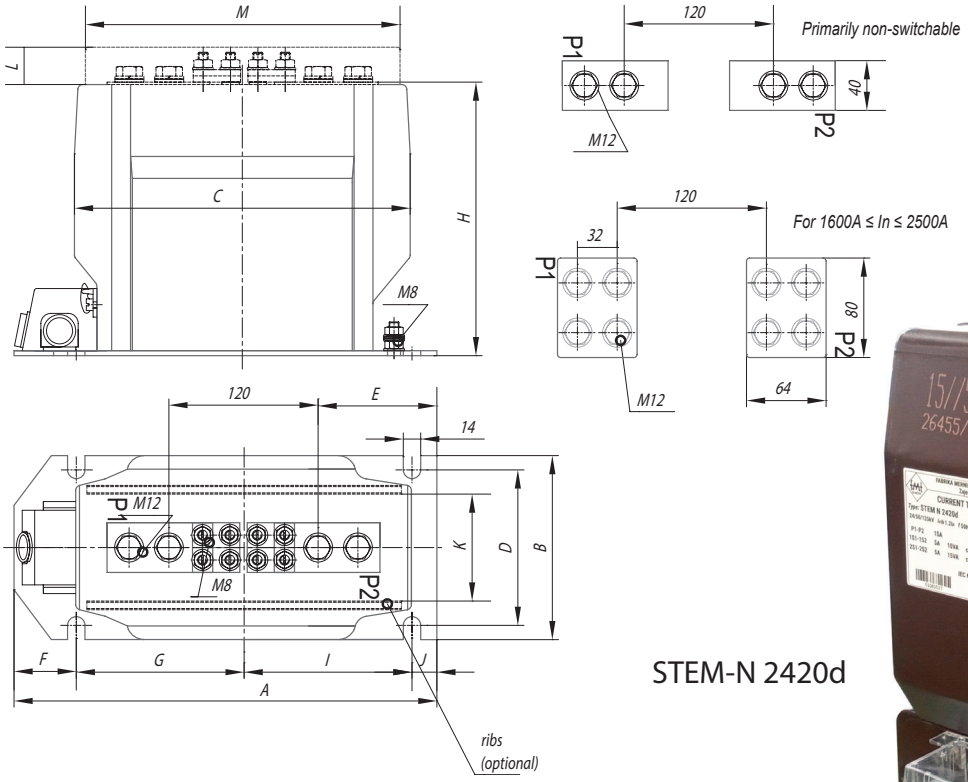
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (or accuracy limit factor) for each core.

The primary regulation cover is supplied on special request.

The right to make changes is reserved.

CONTENTS

STEM-N 12*d(R), 24*d(R)





STEM-N 2420d

MULTI-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM-N*d(R)**

Type of transformer	Dimension (mm)													Mass (kg)
	A	B	C	D	E	F	G	H	I	J	K	L	M	
STEM-N 12*d(R)	320	148	270	125	96	50	133	220	135	20	86	30	253	~19
STEM-N 24*d(R)	343	178	310	150	101	43	140	280	140	20	90	60	280	~33

TECHNICAL DATA	STEM-N 12*d(R)	STEM -N 24*d(R)
Rated primary voltage (kV)	10	20
Highest voltage for equipment (eff.) (kV)	12	24
Rated power-frequency withstand voltage, 1 min. (kV)	28	50
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 3000 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 thermal current 1 sec.	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 power (VA)	5; 7,5; 10; 15; 30	
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Possibility of sealing	On primary and secondary side	
Type of basic insulation	Epoxy resin	
Valid standards	IEC 61869-1; IEC 61869-2; DIN 42600-8	

NOTE:

These models for 12 kV and 24 kV are designed in accordance with the DIN 42600-8 standard. Upon request, they can be equipped with ribs (barriers), indicated by an additional 'dR' at the end of the designation.
Examples of designations: STEM-N 1221dR – 12 kV transformer, with two cores and ribs (barriers), primarily-switchable; STEM-N 2420d – 24 kV two-core transformer, primarily non-switchable.

Change of transformation ratio can also be done on the secondary side and in that case, the transformer is marked with 'sp' at the end of the denotation:
STEM-N 1220dsp – two cores, secondarily switchable.

We manufacture these transformers as a standard series with a thermal current rating of 100In and two cores: a measuring core (15 VA, class 0.5 FS5) and a protection core (30 VA, class 5P10). We can also manufacture them for higher thermal currents and with 1, 3, or 4 cores, depending on the transformation ratio, accuracy class, and core power ratings.

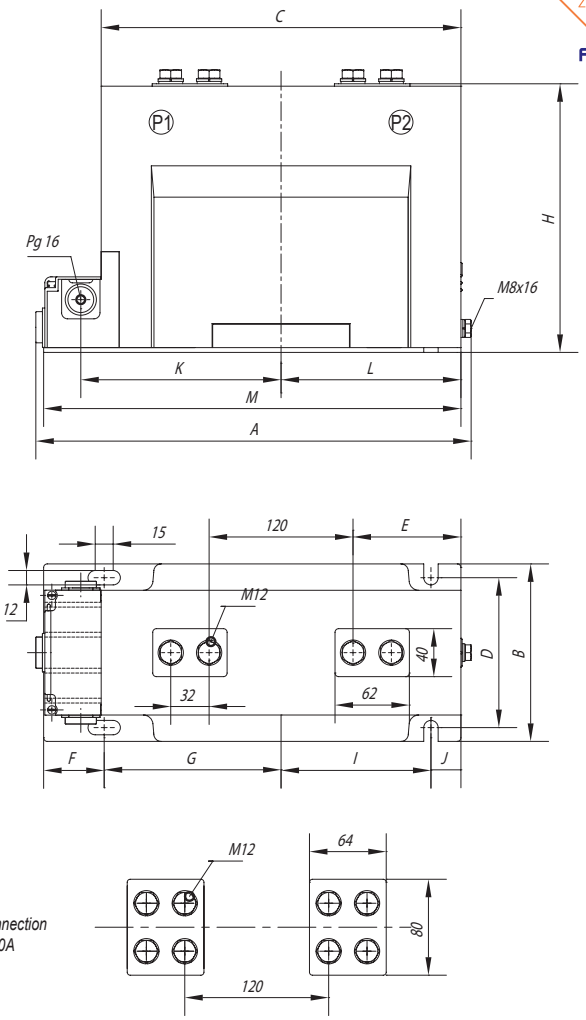
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (or accuracy limit factor) for each core. The primary regulation cover is supplied on special request. The right to make changes is reserved.

CONTENTS

STEM 12*d, 24*d



STEM 1220d



MULTI-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING STEM 12*d, 24*d

Type of transformer	Dimension (mm)													Mass (kg)
	A	B	C	D	E	F	G	H	I	J	K	L	M	
STEM 12*d	363	148	300	125	90	505	1475	224	155	25	167	150	348	~23
STEM 24*d	388	178	320	150	105	73	135	283	140	25	177	165	373	~33

TECHNICAL DATA	STEM 12*d	STEM 24*d
Rated primary voltage (kV)	10	20
Highest voltage for equipment (eff.) (kV)	12	24
Rated power-frequency withstand voltage, 1 min. (kV)	28	50
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 3000 or 2x5 to 2x600	
Rated secondary current (A)	5 (or 1)	
Rated accuracy class	0,2; 0,5; 0,5S; 0,2S; 1; 3; 5P; 10P	
Rated thermal current 1 sec.	$I_{th} = (100\text{-}1000)I_n$	
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$	
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$	
Number of cores	2 (1, 3 or 4)	
Rated core power (VA)	5; 7,5; 10; 15; 30	
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Possibility of sealing	On primary and on secondary side	
Type of basic insulation	Epoxy resin	
Valid standards	IEC 61869-1; IEC 61869-2; DIN 42600	

NOTE:

These models for 12 kV and 24 kV are designed according to the DIN 42600-8 standard and are primarily non-switchable. Example of denotation: STEM-1220d – 12 kV transformer with two cores.
STEM-2430d – 24 kV transformer with 3 cores.

Change of transformation ratio can be done on the secondary side and in that case denotation 'sp' is added at the end of denotation:
STEM 1220dsp - two-core transformer, secondarily switchable.

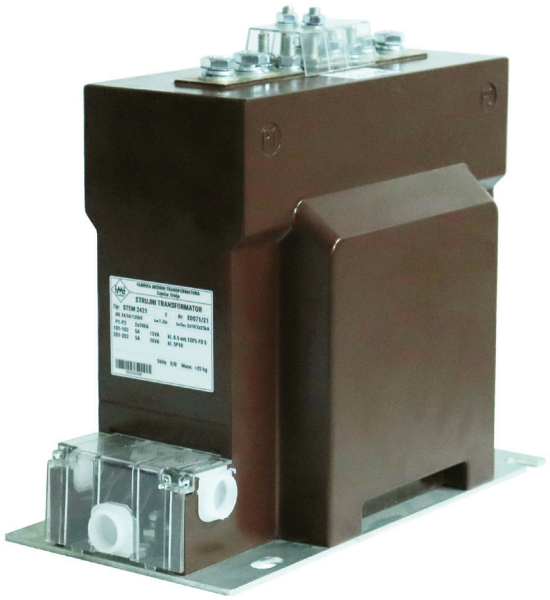
As a standard production offering, these transformers are manufactured with a thermal current rating of 100In and two cores: a metering core (15 VA, class 0.5 FS5) and a protection core (30 VA, class 5P10). We can also manufacture them for higher thermal currents (up to 500In or more) and with 1, 3, or 4 cores, depending on the transformation ratio, accuracy class, and core power.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (or accuracy limit factor) for each core. The primary regulation cover is supplied on special request.

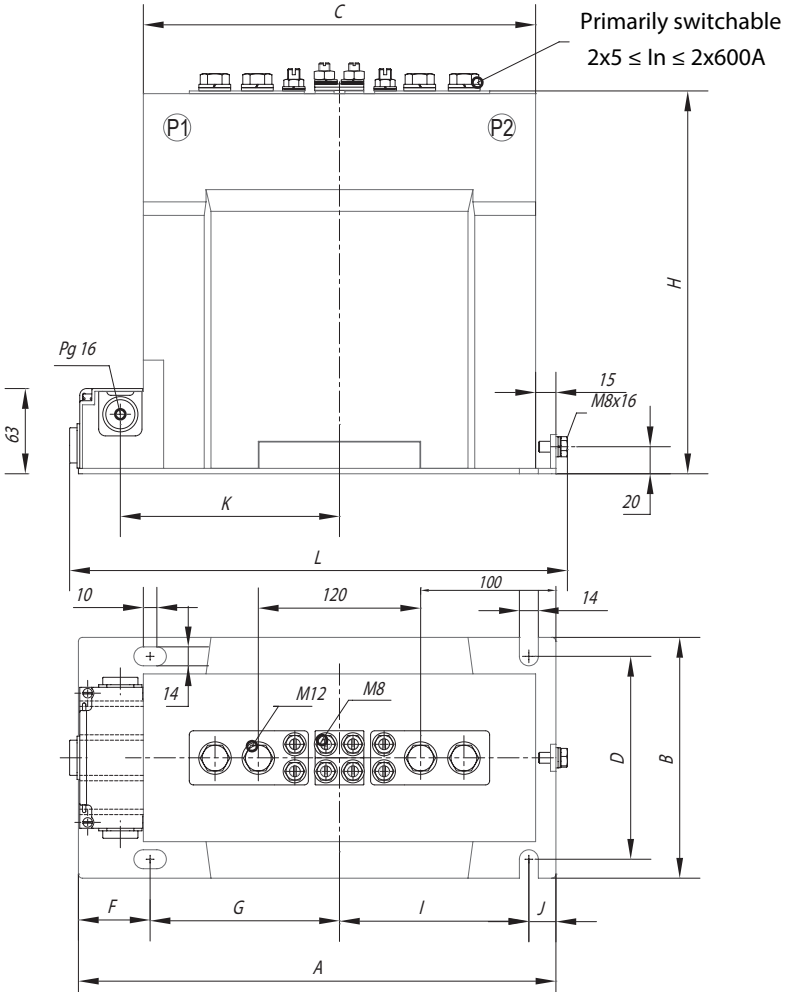
The right to make changes is reserved.

CONTENTS

STEM 12*z, 24*z



STEM 2421z



MULTI-CORE CURRENT TRANSFORMERS FOR INDOOR MOUNTING **STEM *z**

Type of transformer	Dimension (mm)												Mass (kg)
	A	B	C	D	E	F	G	H	I	J	K	L	
STEM 12*z	333	148	270	125	90	48	135	222	135	15	152	348	~18
STEM 24*z	353	178	290	150	100	53	140	283	140	20	162	368	~27

TECHNICAL DATA	STEM 12*z	STEM 24*z
Rated primary voltage (kV)	10	20
Highest voltage for equipment (eff.) (kV)	12	24
Rated power-frequency withstand voltage, 1 min. (kV)	28	50
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 3000 or 2x5 to 2x600	
Rated secondary current (A)	5 (or 1)	
Rated accuracy class	0,2; 0,5; 0,5S; 0,2S; 1; 3; 5P; 10P	
Rated thermal current 1 sec.	$I_{th} = (100\text{-}1000)I_n$	
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$	
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$	
Number of cores	2 (1, 3 or 4)	
Rated core power (VA)	5; 7,5; 10; 15; 30	
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Possibility of sealing	On primary and on secondary side	
Type of basic insulation	Epoxy resin	
Valid standards	IEC 61869-1; IEC 61869-2	

NOTE:

STEM 1221z (STEM 1231z), STEM 2421z (STEM 2431z) – transformer with two (three) cores, primarily switchable; STEM 1220z (STEM 1230z), STEM 2420z (STEM 2430z) – transformer with two (three) cores, primarily non-swtichable. Change of transformation ratio can be done also on the secondary side and in that case, ''sp'' is added at the end of denotation: STEM 1220zsp – transformer with two cores, secondarily switchable.

We manufacture these transformers as a standard series with a thermal current of 100In and 2 cores: a measuring core (15 VA, class 0.5FS5) and a protection core (30 VA, class 5P10). We can also manufacture them with different accuracy classes, rated powers, and higher thermal currents (up to 500In or more), as well as with 1, 3, or 4 cores, depending on the transformation ratio, accuracy class, and core power.

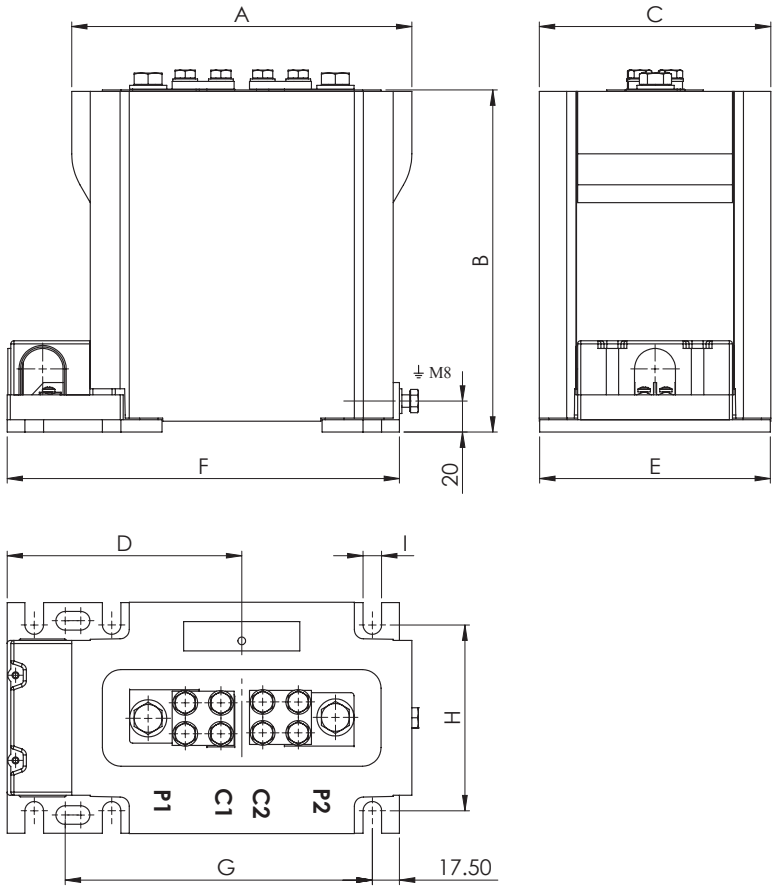
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (or accuracy limit factor) for each core. The primary regulation cover is supplied on special request. The right to make changes is reserved.

CONTENTS

AS 12/150*



AS 12/150-b1



CURRENT TRANSFORMERS FOR INDOOR MOUNTING, SUPPORTING BLOCK-TYPE **AS 12/150***

Type of transformer	Dimension (mm)									Mass (kg)
	A	B	C	D	E	F	G	H	I	
AS 12/150-b0	191	220	149	133	149	225	170	120	12	~16
AS 12/150-b1	219	220	149	152	149	253	198	120	12	~19
AS 12/150-b2	299	220	149	183	149	334	280	120	12	~22
AS 12/150-b3	299	220	149	183	149	334	280	120	12	~25
AS 12/150-b4	419	220	149	302	149	445	400	120	12	~28

TECHNICAL DATA	AS12/150-b0	AS12/150-b1	AS12/150-b2	AS12/150-b3	AS12/150-b4
Rated primary voltage (kV)	10				
Highest voltage for equipment (eff.) (kV)	12				
Rated power-frequency withstand voltage, 1 min. (kV)	28 (42)				
Rated impulse withstand voltage 1.2/50 μs (kV)	75				
Rated secondary power-frequency withstand voltage 50 Hz, 1 min. (kV)	3				
Rated frequency (Hz)	50/60				
Rated primary current (A)	5 to 2500 or 2x5 to 2x600				
Rated secondary current (A)	5 (or 1)				
Rated accuracy class	0,1; 0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P				
Rated thermal current, 1 sec.	$I_{th} = (100\text{-}500)I_n$				
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th;}$ max. 120 kA				
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$				
Number of cores	1 to 6				
Rated core power (VA)	1,25 do 45				
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30				
Temperature class of insulation	E				
Type of basic insulation	Epoxy resin				
Valid standards	IEC 61869-1; IEC 61869-2 (ГОСТ 7746)				

NOTE:

We manufacture these transformers as a standard product with a thermal current rating of 100In; however, they can also be produced for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core.

Upon request, the transformers can also be manufactured with barriers (ribs).

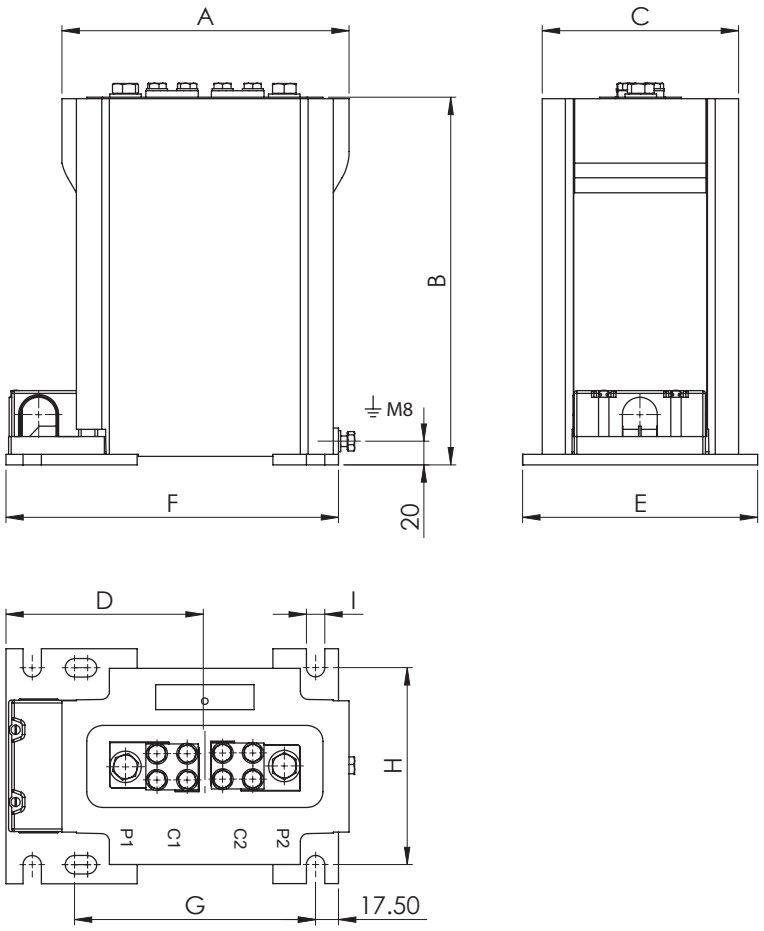
The right to make changes is reserved.

CONTENTS

AS 24/180*



AS 24/180-b3



CURRENT TRANSFORMERS FOR INDOOR MOUNTING, SUPPORTING BLOCK-TYPE **AS 24/180***

Type of transformer	Dimension (mm)									Mass (kg)
	A	B	C	D	E	F	G	H	I	
AS 24/180-b1	191	280	149	133	179	225	160	150	14	~18
AS 24/180-d1	191	280	179	133	179	225	160	150	14	~22
AS 24/180-b2	219	280	149	152	179	253	185	150	14	~26
AS 24/180-b3	299	280	149	183	179	334	265	150	14	~30
AS 24/180-b4	316	280	149	195	179	350	280	150	14	~34
AS 24/180-d4	316	280	179	195	179	350	280	150	14	~38

NOTE: We manufacture these transformers as a standard product with a thermal current rating of 100In; however, they can also be produced for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core. Upon request, the transformers can also be manufactured with barriers (ribs).
The right to make changes is reserved.

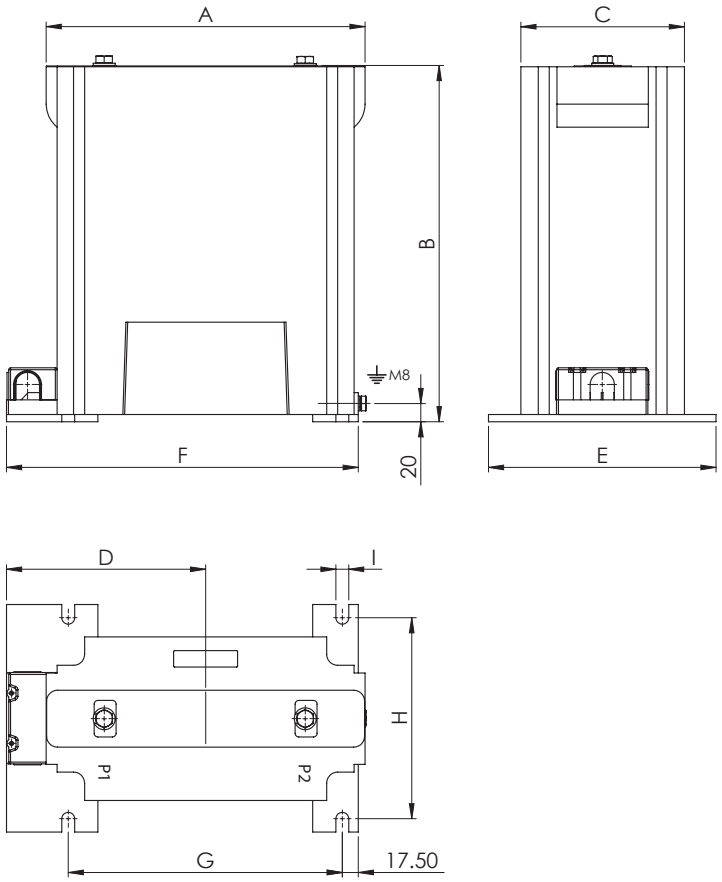
TECHNICAL DATA	AS24/180-b1	AS24/180-d1	AS24/180-b2	AS24/180-b3	AS24/180-b4	AS24/180-d4
Rated primary voltage (kV)	20					
Highest voltage for equipment (eff.) (kV)	24					
Rated power-frequency withstand voltage, 1 min. (kV)	50 (65)					
Rated impulse withstand voltage 1.2/50 μs (kV)	125					
Rated secondary power-frequency withstand voltage 50 Hz, 1 min. (kV)	3					
Rated frequency (Hz)	50/60					
Rated primary current (A)	5 do 2000 ili 2x5 do 2x600					
Rated secondary current (A)	5 (or 1)					
Rated accuracy class	0,1; 0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P					
Rated thermal current, 1 sec.	$I_{th} = (100\text{-}500)I_n$					
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th;}$ max. 120 kA					
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$					
Number of co$_{res}$	1 to 6					
Rated core power (VA)	1,25 to 45					
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30					
Temperature class of insulation	E					
Type of basic insulation	Epoxy resin					
Valid standards	IEC 61869-1; IEC 61869-2 (ГОСТ 7746)					

CONTENTS

AN 36/250*



AN 36/250-d2



CURRENT TRANSFORMER FOR INDOOR MOUNTING, SUPPORTING BLOCK-TYPE **AN 36/250***

Type of transformer	Dimension (mm)									Mass (kg)
	A	B	C	D	E	F	G	H	I	
AN 36/250-d1	191	390	179	133	249	225	140	225	14	~32
AN 36/250-d2	349	390	179	215	249	385	300	225	14	~38
AN 36/250-f2	349	390	224	215	249	385	300	225	14	~44

TECHNICAL DATA	AN36/250-d1	AN36/250-d2	AN36/250-f2
Rated primary voltage (kV)	35		
Highest voltage for equipment (eff.) (kV)	36 (42)		
Rated power-frequency withstand voltage, 1 min. (kV)	70 (95)		
Rated impulse withstand voltage 1.2/50 μs (kV)	170 (190)		
Rated secondary power-frequency withstand voltage 50 Hz, 1 min. (kV)	3		
Rated frequency (Hz)	50/60		
Rated primary current (A)	5 to 1250 or 2x5 to 2x600		
Rated secondary current (A)	5 (or 1)		
Rated accuracy class	0,1; 0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P		
Rated thermal current, 1 sec.	$I_{th} = (100\text{-}500)I_n$		
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th;}$ max. 120 kA		
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$		
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30		
Number of cores	1 to 6		
Rated core power (VA)	1,25 to 45		
Temperature class of insulation	E		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-2 (ГОСТ 7746)		

NOTE:

We manufacture these transformers as a standard product with a thermal current rating of 100In; however, they can also be produced for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core.

Upon request, the transformers can also be manufactured with barriers (ribs).

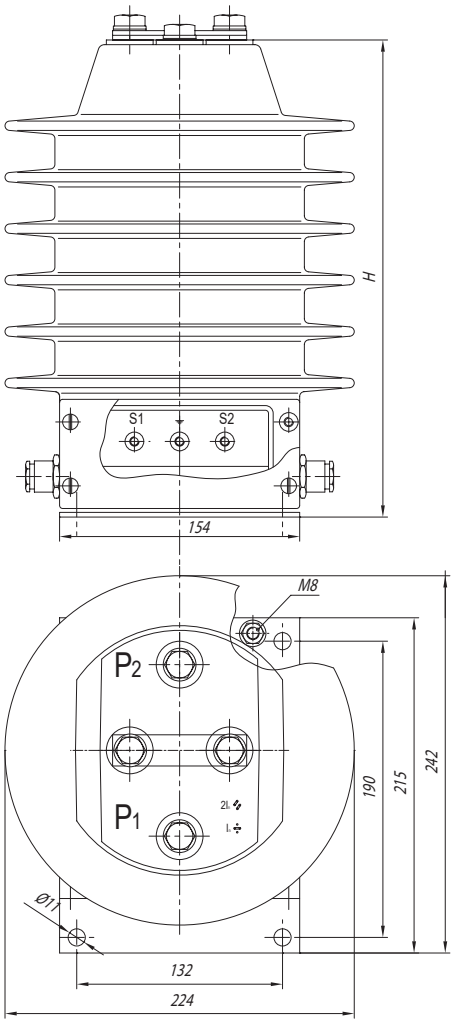
The right to make changes is reserved.

CONTENTS

ATMS 2411(1211), 3811



ATMS 2411



SINGLE-CORE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING, SUPPORTING-TYPE **ATMS 2411(1211), 3811**

Type of transformer	Dimension (mm)		Mass (kg)
	H	Broj rebara	
ATMS-2411(1211)	306	6	~15
ATMS-3811	405	9	~19

TECHNICAL DATA	ATMS-1211 (ATMS-1210) ATMS-2411 (ATMS-2410)	ATMS-3811 (ATMS-3810)
Rated primary voltage (kV)	20(10)	35
Highest voltage for equipment (eff.) (kV)	24(12)	38
Rated power-frequency withstand voltage, 1 min. (kV)	50(28)	70
Rated impulse withstand voltage 1.2/50 μs (kV)	125(75)	170
Creeping distance (mm)	570	860
Type of mounting	Outdoor	
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 500 or 2x5 to 2x75	
Rated secondary current (A)	5 (or 1)	
Rated accuracy class	0,5	
Rated thermal current 1 sec.	$I_{th} = (100\text{-}500)I_n$	
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$	
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$	
Number of cores	1	
Rated core power (VA)	5; 7,5; 10	
Security factor / Accuracy limit factor	5; 10/5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Type of basic insulation	Cycloaliphatic resin	
Valid standards	IEC 61869-1; IEC 61869-2	

NOTE:

Denotation examples:
ATMS-1211, ATMS-2411, ATMS-3811 – transformer with single core, primarily switchable;

ATMS-1210, ATMS-2410, ATMS-3810 – transformer with single core, primarily non-switchable.

We manufacture these transformers as a standard product for thermal current 100In with a rating of 10VA cl.0,5.

They are also used for measuring in assemblies at pole-mounted transformer substations at voltage levels of 10 kV and 20 kV.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor).

The right to make changes is reserved.

CONTENTS

ATM 2411(1211), 2411h, 3811;



ATM 3811

SINGLE-CORE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING, SUPPORTING T-TYPE
ATM 2411(1211), 2411h, 3811

Designation examples:
ATM-2411 (ATM-1211), ATM-3811 – transformer with single core, primarily switchable;
ATM-2410 (ATM-1210), ATM-3810 – transformer with single core, primarily non-switchable;
ATM-2410(1210)sp, ATM-3810sp – transformer with single core, secondarily switchable.

We manufacture these transformers as a standard product for a 100In thermal current; however, we can also produce them for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

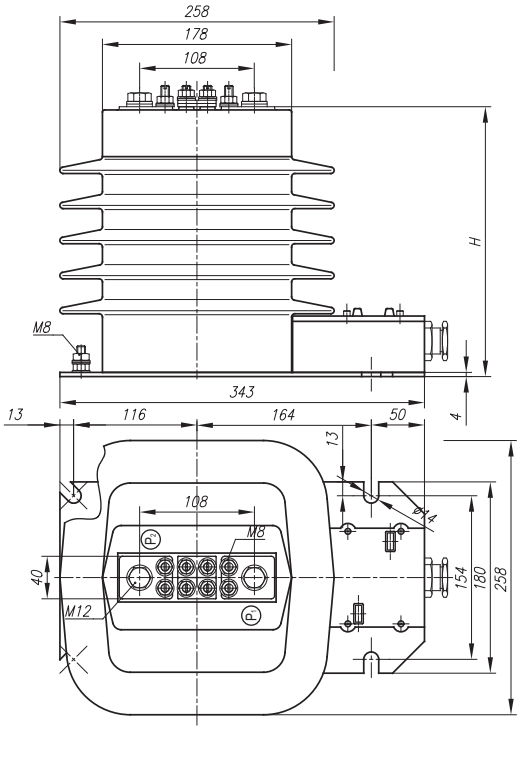
Switching to another current transformation ratio can be done on primary or on secondary side, with sealing of the terminals cover on the secondary side.

The ATM 2411h model is designed for more demanding conditions and has a creepage distance of ≥31mm/kV.

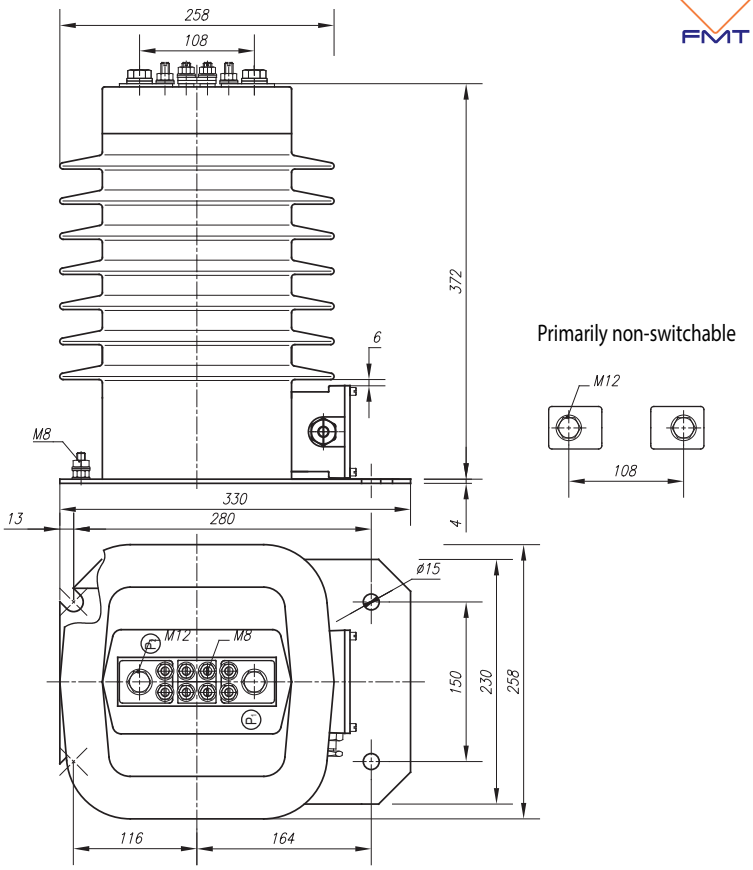
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core.

The primary regulation cover is supplied on special request.

The right to make changes is reserved.



ATM 2411 (3811*)



ATM 2411h

Type of transformer	Dimension (mm)		Mass (kg)
	H	Number of ribs	
ATM-2411 (ATM-1211)	254	5	~23
ATM-2411h	372	7	~29
ATM-3811	376	8	~29

TECHNICAL DATA	ATM-2411(ATM-1211) ATM-2410(ATM-1210)	ATM-2411h (ATM-2410h)	ATM-3811 (ATM-3810)
Rated primary voltage (kV)	20(10)	20	35
Highest voltage for equipment (eff.) (kV)	24(12)	24	38
Rated power-frequency withstand voltage, 1 min. (kV)	50(28)	50	70
Rated impulse withstand voltage 1.2/50 μs (kV)	125(75)	125	170
Creeping distance (mm)	490	750	840
Type of mounting	Outdoor		
Rated frequency (Hz)	50/60		
Rated primary current (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 thermal current 1 sec.	$I_{th} = (100\text{-}500)I_n$		
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$		
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$		
Number of cores	1		
Rated core power (VA)	5; 7,5; 10; 15; 30		
Security factor / Accuracy limit factor	5; 10/5; 10; 15; 20; 30		
Temperature class of insulation	E/B		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-2		

CONTENTS

ATM 24*(12*), 38*, 38*h



ATM 24*

MULTI-CORE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING, SUPPORTING-TYPE
ATM 24*(12*), 38*, 38*h

NOTE:

Denotation examples:
ATM-1221, ATM-2421, ATM-3821 – transformer with two cores, primarily switchable;
ATM-1220, ATM-2420, ATM-3820 – transformer with two cores, primarily non-switchable.

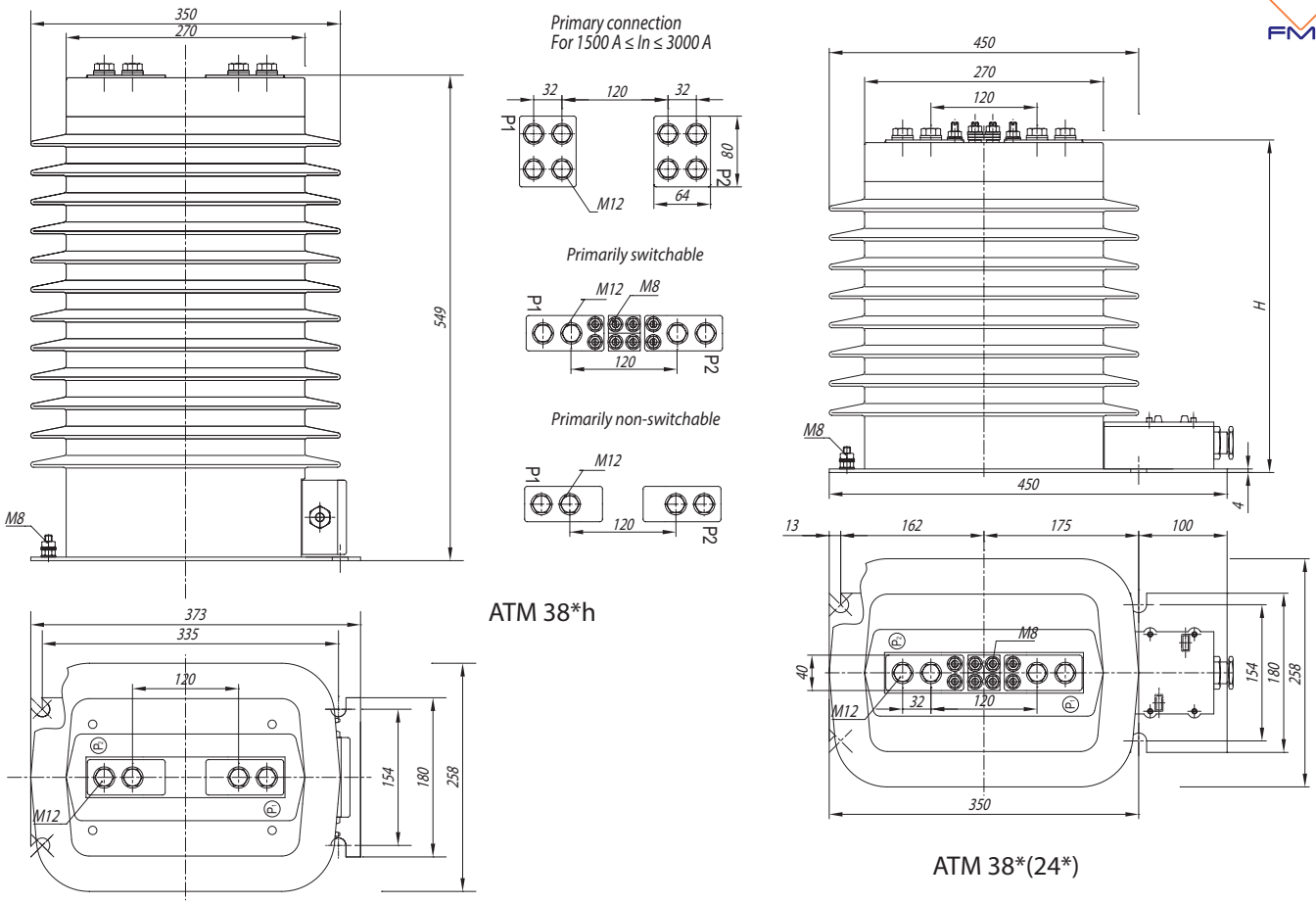
We manufacture these transformers as a standard product for a 100In thermal current; however, we can also produce them for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

Switching to another current transformation ratio can be done on primary or on secondary side, with sealing of the terminals cover on the secondary side.

The ATM 2411h model is designed for more demanding conditions and has a creepage distance of ≥31mm/kV.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core.

The right to make changes is reserved.



Type of transformer	Dimension (mm)		Mass (kg)
	H	Number of ribs	
ATM-24*(12*)	254	5	~36
ATM-38*	376	8	~44
ATM-38*h	549	12	~54

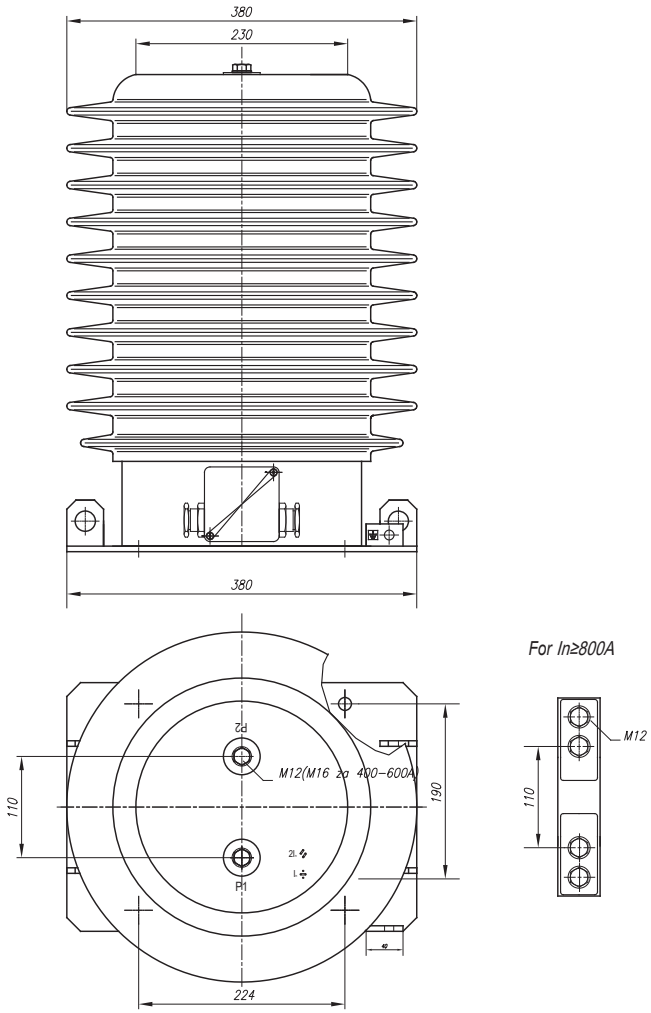
TECHNICAL DATA	ATM-24*(12*)	ATM-38*	ATM-38*h
Rated primary voltage (kV)	20(10)	35	35
Highest voltage for equipment (eff.) (kV)	24(12)	38	38 (40,5)
Rated power-frequency withstand voltage, 1 min. (kV)	50(28)	70	70 (95)
Rated impulse withstand voltage 1.2/50 μs (kV)	125(75)	170	170 (200)
Creeping distance (mm)	490	840	1296
Type of mounting	Outdoor		
Rated frequency (Hz)	50/60		
Rated primary current (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 thermal current 1 sec.	$I_{th} = (100\text{-}1000)I_n$		
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 power (VA)	5; 7,5; 10; 15; 30		
Security factor / Accuracy limit factor	5; 10/5; 10; 15; 20; 30		
Temperature class of insulation	E/B		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-2		

CONTENTS

STSM 38*, 38*L, 38*b



STSM 38*



MULTI-CORE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING, SUPPORTING-TYPE FOR RAILWAY
STSM 38*, 38*L, 38*b

NOTE:

Denotation examples:
STSM 3821L – transformer with two cores, primarily switchable;
STSM 3820 – transformer with two cores, primarily non-switchable.
STSM 3830b – transformer with three cores, primarily non-switchable.

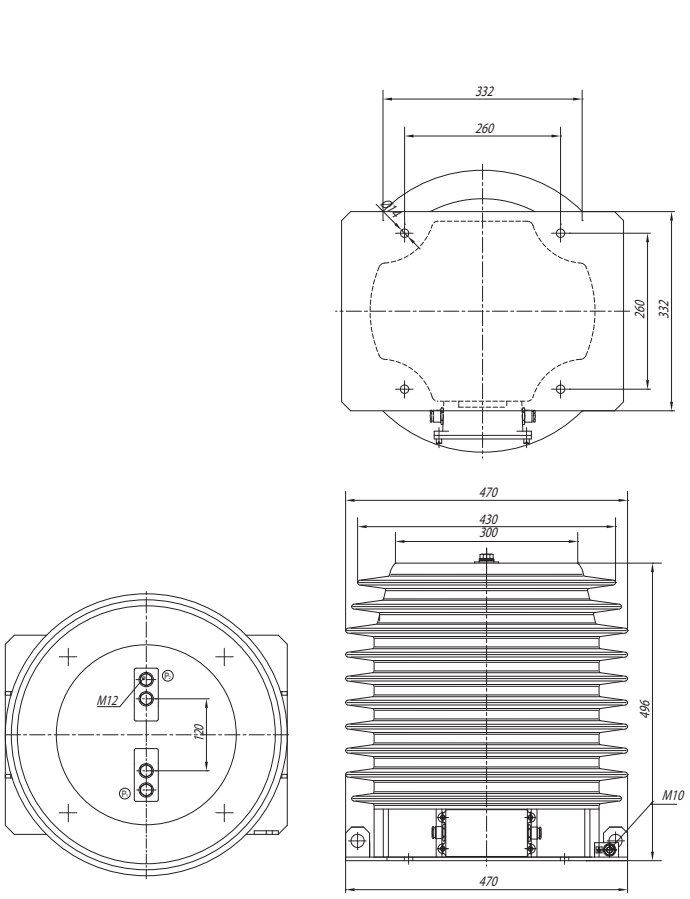
We manufacture these transformers as a standard product for a 100In thermal current; however, we can also produce them for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

Switching to another current transformation ratio can be done on primary or on secondary side, with sealing of the terminals cover on the secondary side.

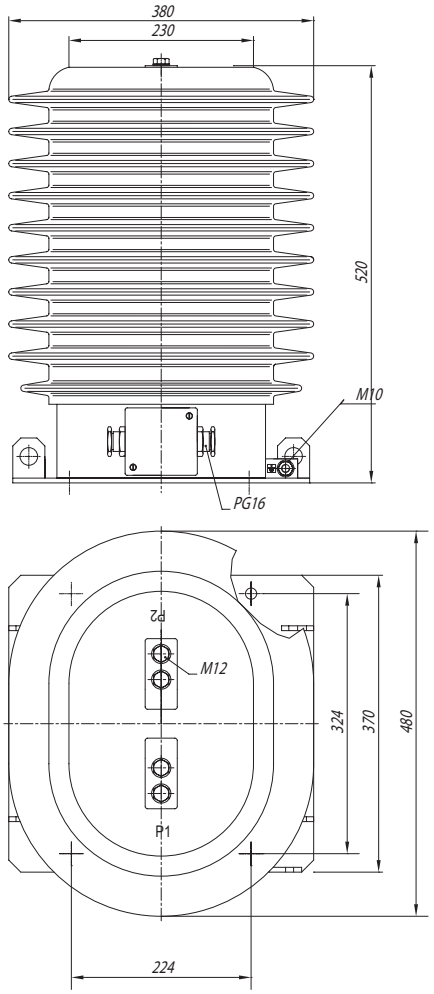
These models are intended for more demanding conditions (BIL 40.5/95/200 kV), because they have a creepage distance of ≥31mm/kV.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core.

The right to make changes is reserved.

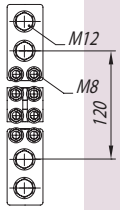


STSM 38*b



STSM 38*L

Primarily switchable



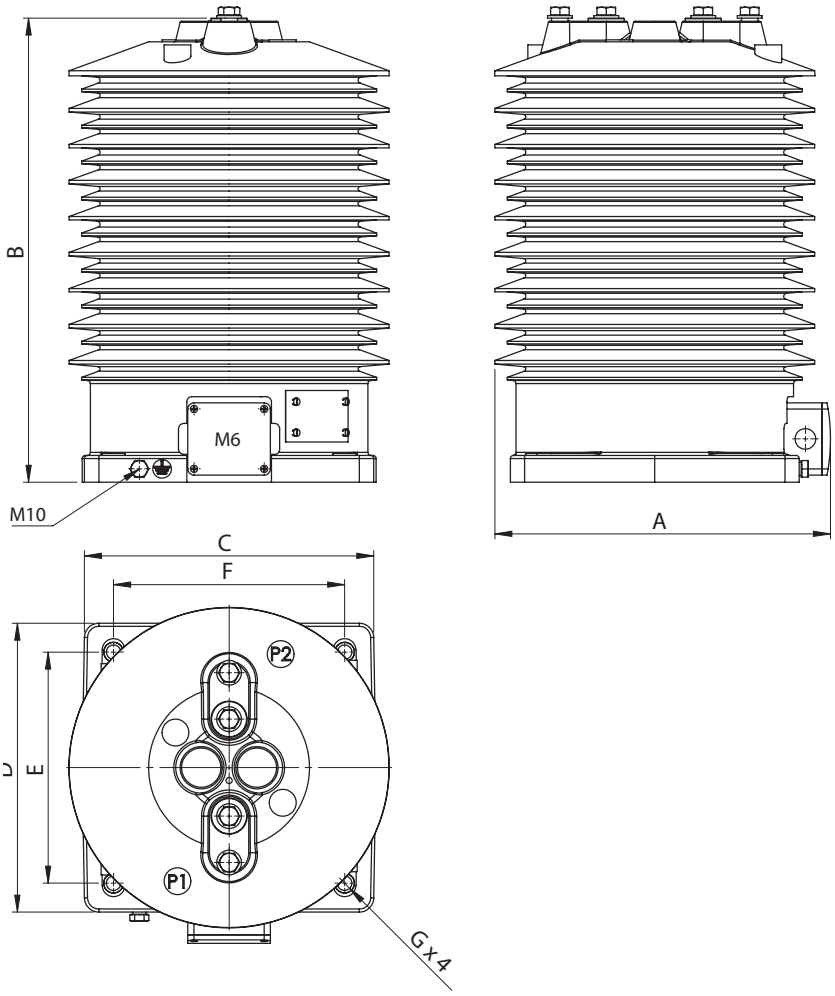
TECHNICAL DATA	STSM 38*	STSM 38*L	STSM 38*b
Rated primary voltage (kV)	35		
Highest voltage for equipment (eff.) (kV)	38 (40,5)		
Rated power-frequency withstand voltage, 1 min. (kV)	70 (95)		
Rated impulse withstand voltage 1.2/50 μs (kV)	170 (200)		
Creeping distance (mm)	1327	1327	1296
Mass (kg)	~78	~126	~146
Type of mounting	Outdoor		
Rated frequency (Hz)	50/60		
Rated primary current (A)	5 to 3000* 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 thermal current 1 sec.	$I_{th} = (100\text{-}500)I_n$		
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*		
Security factor / Accuracy limit factor	5; 10/5; 10; 15; 20; 30		
Temperature class of insulation	E/B		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-2		

CONTENTS

STSM*



STSM-38



MULTI-CORE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING, SUPPORTING-TYPE **STSM 12-42 kV**

Type of transformer	Dimension (mm)							Mass (kg)
	A	B	C	D	E	F	G	
STSM-12	315	372	280	276	224	224	Ø14	~30
STSM-24	315	452	280	276	224	224	Ø14	~48
STSM-38	315	520	280	276	224	224	Ø14	~65

NOTE: We manufacture these transformers as a standard product for a 100In thermal current; however, we can also produce them for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and the instrument security factor (accuracy limit factor) for each core. The right to make changes is reserved.

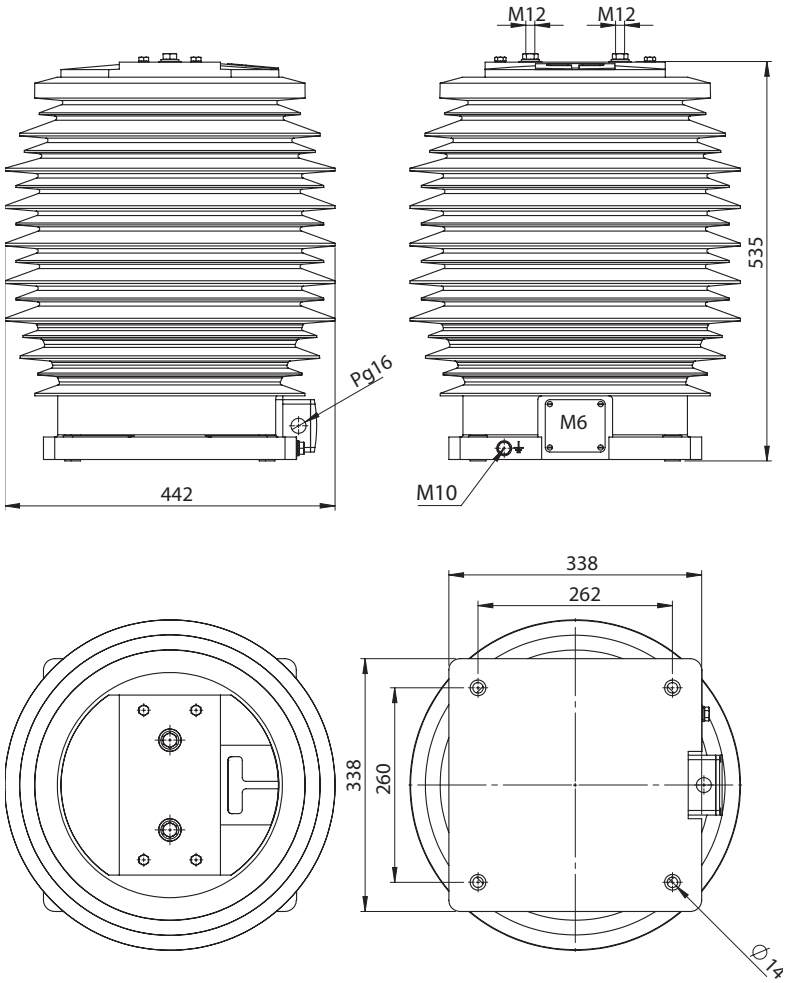
TECHNICAL DATA	STSM-12	STSM-24	STSM-38
Rated primary voltage (kV)	10	20	35
Highest voltage for equipment (eff.) (kV)	12	24	36 (42)
Rated power-frequency withstand voltage, 1 min. (kV)	28 (42)	50 (65)	70 (95)
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125	170 (190)
Rated secondary power-frequency withstand voltage 50 Hz, 1 min. (kV)	3		
Rated frequency (Hz)	50/60		
Rated primary current (A)	5 to 1200 or 2x5 to 2x600		
Rated secondary current (A)	5 (or 1)		
Rated accuracy class	0.1; 0.2; 0.5; 0.2S; 0.5S; 1; 3; 5P; 10P		
Rated thermal current, 1 sec.	$I_{th} = (100\text{-}500)I_n$		
Rated dynamic current	$I_{dyn} = 2.5\ I_{th;}$ max. 120 kA ($I_{dyn} = 2.5\ I_{th;}$ max. 120 kA)		
Rated continuous thermal current	$I_{cth} = 1.2\ I_n$		
Number of cores	1 to 4		
Security factor / Accuracy limit factor	5; 10/5; 10; 15; 20; 30		
Rated core power (VA)	1.25 to 45		
Temperature class of insulation	F		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-2 (ГОСТ 7746)		

CONTENTS

STSM-38 III



STSM-38 III



MULTI-CORE CURRENT TRANSFORMERS FOR OUTDOOR MOUNTING, SUPPORTING-TYPE FOR RAILWAY **STSM 38 III**

TECHNICAL DATA	STSM-38 III
Rated primary voltage (kV)	35
Highest voltage for equipment (eff.) (kV)	36 (42)
Rated power-frequency withstand voltage, 1 min. (kV)	70 (95)
Rated impulse withstand voltage 1.2/50 μs (kV)	170 (190)
Rated secondary power-frequency withstand voltage 50 Hz, 1 min. (kV)	3
Rated frequency (Hz)	50/60
Rated primary current (A)	5 to 1200 or 2x5 to 2x600
Rated secondary current (A)	5 (or 1)
Rated accuracy class	0,1; 0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P
Rated thermal current, 1 sec.	$I_{th} = (100\text{-}500)I_n$
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th;}$ max. 120 kA ($I_{dyn} = 2{,}53\ I_{th;}$ max. 120 kA)
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$
Number of cores	1 to 4
Rated core power (VA)	1,25 to 45
Security factor / Accuracy limit factor	5; 10/5; 10; 15; 20; 30
Mass (kg)	~90
Temperature class of insulation	F
Type of basic insulation	Cycloaliphatic resin
Valid standards	IEC 61869-1; IEC 61869-2 (ГОСТ 7746)

NOTE:

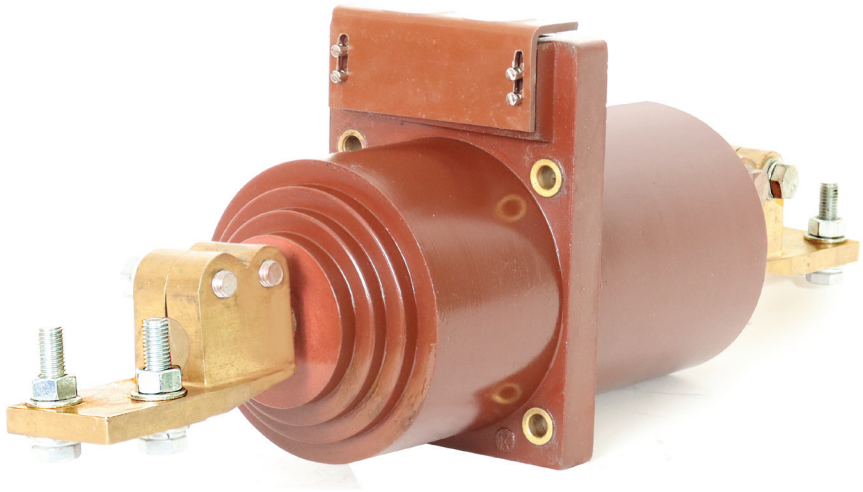
We manufacture these transformers as a standard product for a 100In thermal current; however, we can also produce them for higher thermal currents (up to 500In or more), depending on the transformation ratio, accuracy class, and core power.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, andthe instrument security factor (accuracy limit factor) for each core.

The right to make changes is reserved

CONTENTS

STPN 12*, 24*, 38*



STPN 1220

CURRENT TRANSFORMER FOR INDOOR MOUNTING, BUSHING TYPE **STPN 12*, 24*, 38***

TECHNICAL DATA	STPN-12*	STPN-24*	STPN-38*
Rated primary voltage (kV)	10	20	35
Highest voltage for equipment (eff.) (kV)	12	24	38
Rated power-frequency withstand voltage, 1 min. (kV)	28	50	70
Rated impulse withstand voltage 1.2/50 μs (kV)	75	125	170
Rated frequency (Hz)	50/60		
Rated primary current (A)	50 to 4000		
Rated secondary current (A)	5 (or 1)		
Rated accuracy class	0,2; 0,5; 1; 3; 5P; 10P		
Rated thermal current 1 sec.	$I_{th} = (100\text{-}500)I_n$		
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$		
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$		
Number of cores	1; 2; 3 or 4		
Rated core power (VA)	10; 15; 30		
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30		
Temperature class of insulation	E/B		
Type of basic insulation	Epoxy resin		
Mass (kg)	~24	~38	~48
Valid standards	IEC 61869-1; IEC 61869-2		

NOTE:

Examples of denotation '*':
STPN 1210 – 10kV transformer, with single core,
STPN 2420 –20kV transformer, with two cores.
STPN 3820 –35kV transformer, with two cores.
This type of transformer is primarily non-switchable.

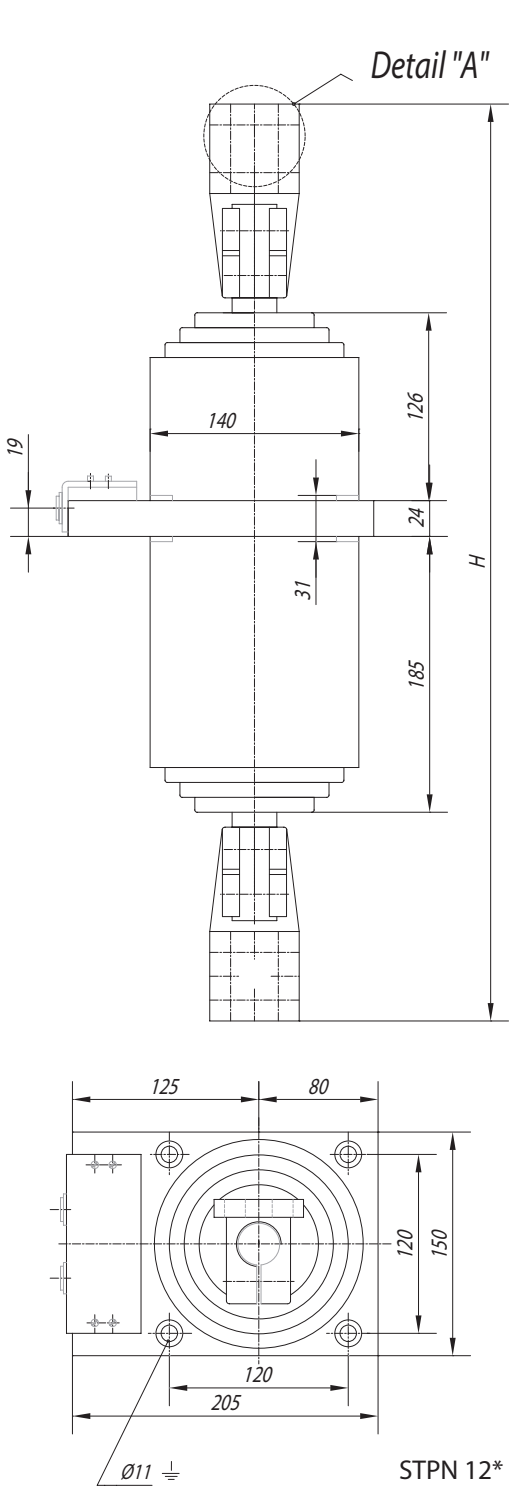
We manufacture these transformers as a standard product for short-time thermal current of 100In.

They have a measuring core of 15VA; cl.0.5FS5; and a protective core of 30VA cl.5P10.

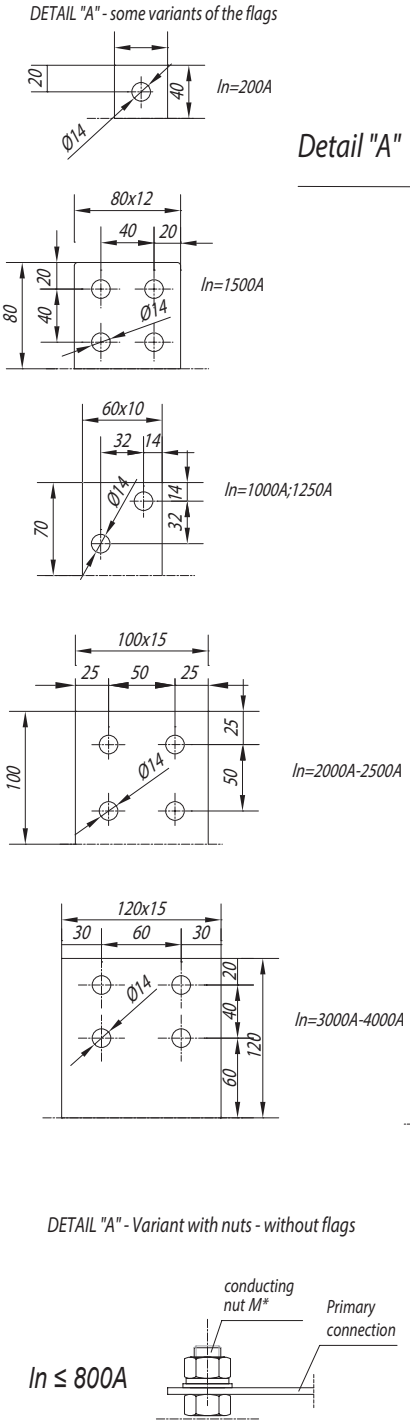
We can also make them for higher thermal currents depending on the transformation ratio, accuracy class and core power.

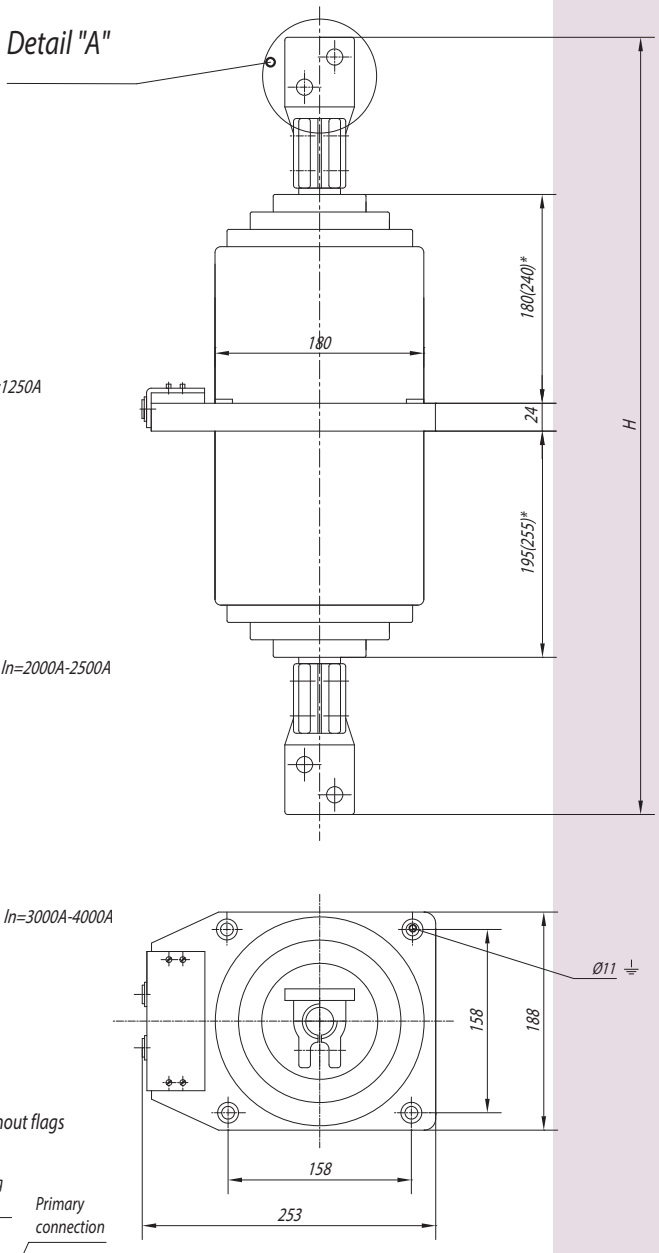
When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, and theinstrument security factor (accuracylimit factor) for each core.

The right to make changes is reserved.



STPN 12*





STPN 24 (38*)

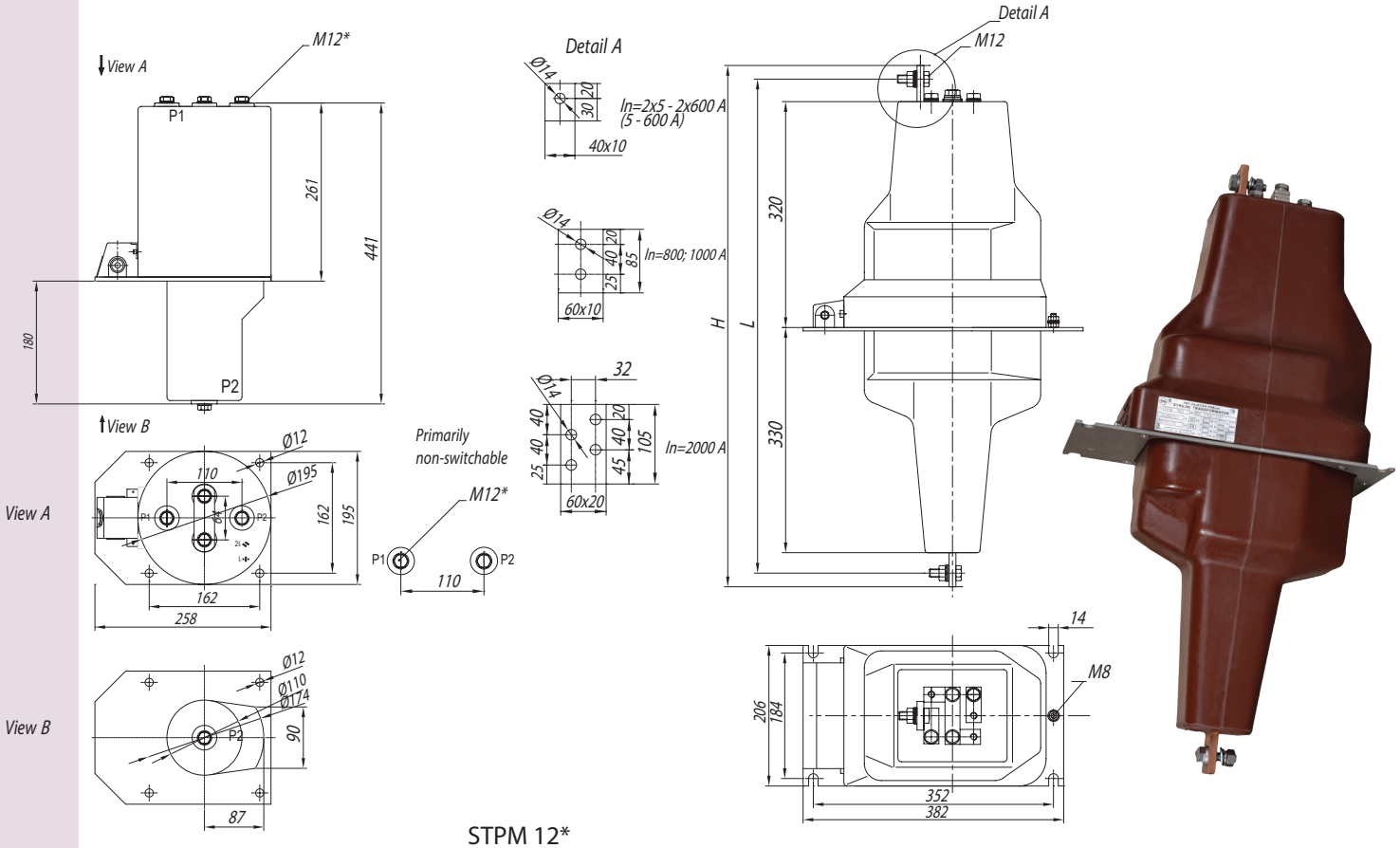
I_1 (A)	Thread of the flag	Primary conductor Cu (mm)	Lenght of the primary conductor (mm)			Total lenght together with the flags H (mm)		
			12kV	24kV	38kV	12kV	24kV	38kV
200-300	M16	Ø16	400	465	585	490	545	665
400-500	M20	Ø20	460	525	645	600	665	785
600-800	M24	Ø24	460	525	645	600	665	785
1000-1250	M30	Ø30	460	525	645	600	665	785
1500	M36	Ø36	480	545	665	660	725	845
2000	M40	Ø40	500	565	685	726	791	911
2500	M42	Ø42	500	565	685	726	791	911
3000-4000	M48	Ø48	500	565	685	760	825	945

Length of the primary conductor, as well as the dimension H, depend on the dimension of the flag, i.e. value of the primary current.

For primary currents up to 800 A it is possible to establish the connection with appropriate nuts without the flags.

CONTENTS

STPM 12*, 38*



CURRENT TRANSFORMER FOR INDOOR MOUNTING, BUSHING TYPE **STPM 12*, 38***

TECHNICAL DATA	STPM-12*	STPM-38*
Rated primary voltage (kV)	10	35
Highest voltage for equipment (eff.) (kV)	12	38
Rated power-frequency withstand voltage, 1 min. (kV)	28	70
Rated impulse withstand voltage 1.2/50 μs (kV)	75	170
Rated frequency (Hz)	50/60	
Rated primary current (A)	5 to 600 or 2x5 to 2x300	
Rated secondary current (A)	5 (or 1)	
Rated accuracy class	0,2; 0,5; 0,2S; 0,5S; 1; 3; 5P; 10P	
Rated thermal current 1 sec.	$I_{th} = (100\text{-}500)I_n$	
Rated dynamic current	$I_{dyn} = 2{,}5\ I_{th}$	
Rated continuous thermal current	$I_{cth} = 1{,}2\ I_n$	
Number of cores	1	1, 2, 3 or 4
Rated core power (VA)	5; 7,5; 10; 15; 30	
Security factor / Accuracy limit factor	5; 10 / 5; 10; 15; 20; 30	
Temperature class of insulation	E/B	
Possibility of sealing	On secondary side	
Type of basic insulation	Epoxy resin	
Mass (kg)	~23	~46
Valid standards	IEC 61869-1; IEC 61869-2	

Dimension of the transformer STPM 38:*

I1 (A)	Dimension (mm)	
	H	L
2x5 – 2x600 5 – 600	756	716
800 – 1000	830	790
2000-3000	870	830

NOTE:

Denotation examples:
STPM-1211, STPM-3821, STPM-3831 – transformer with one, two, or three cores; primarily switchable;
STPM-1210, STPM-3810, STPM-3820, STPM-3830 – transformer with one, two or three cores; primarily non-switchable.

We manufacture these transformers as a standard product for short-time thermal current of 100In.
STPM 12* - standardly with single measuring core of 15VA cl.0,5FS5. STPM 38* - standardly with two cores: measuring core of 15VA cl.0,5FS5, and protective core of 30VA cl.5P10.
We can manufacture them for higher thermal currents (up to 500In) and with 1, 3 or 4 cores, depending on the transformation ratio, rated power and accuracy class.

When ordering, please be sure to specify the transformation ratio, rated power, accuracy class, andthe instrument security factor (accuracy limit factor) foreach core. The right to make changes is reserved

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VOLTAGE TRANSFORMERS
12-38 kV



1969 ZAJEČAR FMT

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INTRODUCTION 2

SINGLE-POLE VOLTAGE TRANSFORMERS

SINGLE-POLE VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING

JNT-12, JNT-24, JNT-24/12, JNT-36 5

JNT-10, JNT-10U, JNT-20U, JNT-30U 6

JNT-10d, JNTm2-24, JNTm2-24/12 7

JNT SOP-12, JNT SOP-24, JNT SOP-24/12 8

BLOCK-TYPE

REL 10, REL 20, REL 20/10 9

JNT-12z, JNT-24z, JNT-12d, JNT-24d 10

JNT-38z, JNT-38d, JNT-36d 11

SINGLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING

JNTSM-12, JNTSM-24, JNTSM-24/12, JNTSM-36 12

JNTSM-10 13

JNTm2SM-24, JNTm2SM-24/12 14

NTSM-12, NTSM-24, NTSM-38 15

DOUBLE-POLE VOLTAGE TRANSFORMERS

DOUBLE-POLE VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING

DNT-12, DNTm1-24, DNT-24, DNT-24/12, DNT-36 16

DNT-24E - **POWER VOLTAGE TRANSFORMER** 17

DNT-36 - **POWER VOLTAGE TRANSFORMER** 18

RZL 10, RZL 20, RZL 20/10 **BLOCK TYPE** 19

DOUBLE-POLE VOLTAGE RANSFORMERS FOR OUTDOOR MOUNTING

DNTSM-17.5, DNTSM-24, DNTSM-24/12, DNTSM-36, DNTSM- 36S, DNTSM-36-8R, DNTSM-36-10R 20

NTDSM-12, NTDSM-24, NTDSM-24/12 21

NTDSM-0,63-12, NTDSM-1,25-12, NTDSM-0,63-24, NTDSM-1,25-24 22

NTDSM-24h, NTDSM-24/12h 23

AUXILIARY EQUIPMENT FOR VOLTAGE TRANSFORMERS

RESISTORS FOR THE RESIDUAL WINDING ORN-* 24

RESISTORS FOR THE RESIDUAL WINDING FOR OUTDOOR MOUNTING ORN SM-* 25

HOUSINGS FOR HIGH-VOLTAGE FUSES FT-* 26

HOUSINGS FOR HIGH-VOLTAGE FUSES VVC-* 27

EXAMPLES OF FUSE HOUSING INSTALLATION ON A TRANSFORMER 28

INTRODUCTION

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 from epoxy resin filled with quartz sand, resulting in a very solid electrical and mechanical construction.
The special winding construction design ensures an even distribution of surge overvoltages along the winding and on the surface of the insulating part of the transformer.

Due to all these properties, despite their small dimensions, these transformers perform exceptionally well when tested to withstand industrial frequency voltage and surge overvoltage. Since the core is made of high-quality magnetic steel sheet (low specific losses), there is no dangerous overheating of the transformer core, even in cases of earth faults in single-pole insulated transformers when magnetic induction is high.

Single-pole insulated voltage transformers also have an auxiliary residual winding (tertiary) for an open-delta configuration intended for earth-fault protection. When three single-pole insulated voltage transformers are connected in a star circuit in networks with isolated neutral point, their active resistance together with the resistor type ORN-* (delivered upon request) prevent ferroresonant occurrence in the transient modes of the network operation.

We make voltage transformers for all climatic conditions.

APPLICATION

Measuring voltage transformers are used to isolate measuring and protection equipment from high voltage, and to transform the voltage to a level suitable for such equipment. We manufacture single-pole and double-pole insulated voltage transformers for voltage levels up to 38 kV, designed for both indoor and outdoor installation.

VARIANTS

We manufacture transformers for both indoor and outdoor installation. For indoor applications, there are variants with high-voltage fuse holders that can be mounted directly onto the transformer. We also offer switchable (reconnectable) transformer models, which can be used in both 10 kV and 20 kV voltage networks by means of a special switching plate of their primary windings.

HANDLING AND MAINTENANCE

Regular maintenance is not required for these transformers. From time to time, the transformers should be cleaned, especially if they operate in aggressive or dirty environments. Ensure the transformers are de-energized before cleaning them. In the event of any major faults or failures within the installation, the transformers should be inspected to verify that they remain in proper working order.

ACCURACY CLASS SELECTION

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

- **Class 0.1**: for high-precision laboratory measurements and calibration;

- **Class 0.2**: for laboratory measurements and testing facilities, for high-precision power measurements in operational settings, and for measuring electricity consumption for billing purposes for large-scale consumers;

- **Class 0.5**: for operational voltage and power measurements, for measuring electricity consumption, and for supplying auxiliary relays;

- **Class 1**: for applications requiring a high rated power of the transformer, not necessarily requiring high-precision measuring.

CONSUMPTION DATA FOR CONNECTING CABLES USED TO DETERMINE THE RATED POWER OF INSTRUMENT TRANSFORMERS

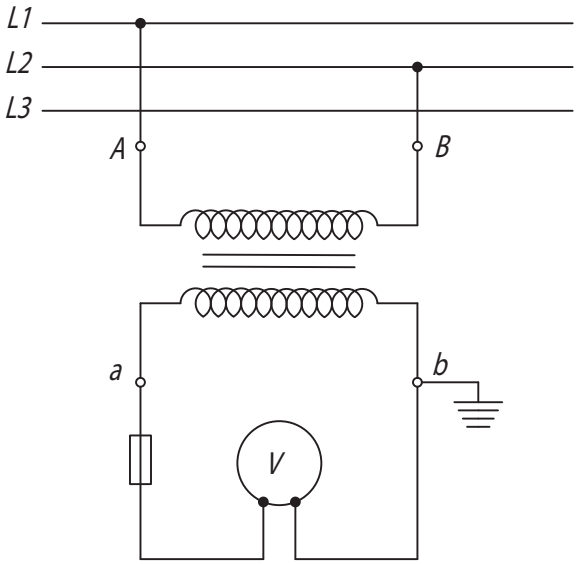
This data must be taken into account when selecting the rated output of measuring transformers, in addition to the consumption data of the connected measuring or protective devices themselves.

Consumer	Power consumption (W/m)
Cu conductor 1m 2,5mm^2 at 5A	0.18
Cu conductor 1m 4mm^2 at 5A	0.11
Cu conductor 1m 2,5mm^2 at 1A	0.007
Cu conductor 1m 4mm^2 at 1A	0.0044

VOLTAGE TRANSFORMERS IN A THREE-PHASE SYSTEM

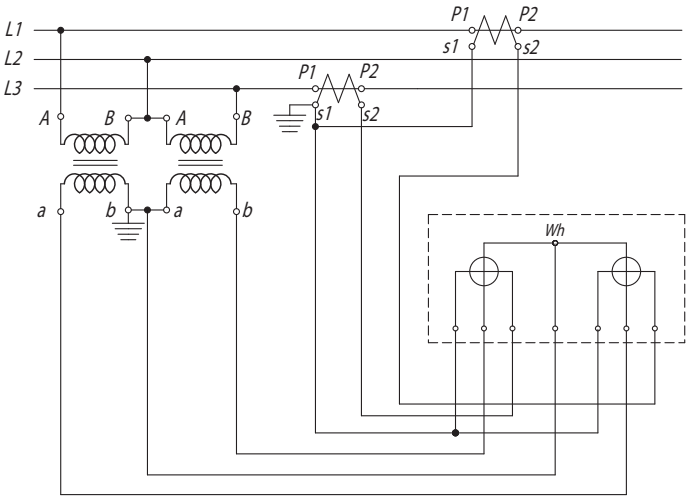
1. A double-pole insulated voltage transformer

is used for connecting voltmeters, frequency meters, synchroscopes, certain types of relays, and similar equipment. It is applied whenever it is necessary to supply power to instruments and devices, regardless of conditions during an earth fault.



2. Two double-pole insulated voltage transformers in a "V" connection.

This connection can be used to supply three-phase wattmeters and meters (the "Aron connection"). In the event of an earth fault, power measurement remains accurate only if the fault occurs on the middle line (L2). If the earth fault involves one of the outer lines (L1 or L3), the measurement results will be either too high or too low.



3. Star connection ("Y" connection) of 3 single-pole insulated voltage transformers for general purposes

This configuration accurately transforms all voltages of a three-phase system. The neutral point on the high-voltage side must be earthed. This connection allows for the measurement of all three phase-to-phase voltages U_{L1L2}, U_{L2L3}, U_{L1L3}, as well as all three phase-to-earth voltages.

In normal operating conditions, the voltage transformer functions at an induction level of 0.8–0.9 T.
In the event of a single-pole earth fault on line L2, the primary winding of the middle voltage transformer becomes short-circuited, while the voltages on the two outer transformers increase by a factor of √3. Their induction levels increase accordingly. The tertiary windings of the three voltage transformers (100/3 V) are connected in an "open delta" configuration.
Under normal operating conditions, there is a negligible voltage across the terminals of the open delta. In the event of a direct earth fault on one of the lines of the three-phase system, the voltage across the open delta terminals rises to 100 V.

Measuring instruments built for phase-to-phase voltage (voltmeter, frequency meter, power-meter, two-system electricity meters, relays, etc.) are connected between the secondary terminals (a and b).

Voltmeters, earth-fault signalizing relays, three-system power meters, three-system electricity meters have to be connected between the secondary terminal (a) and the earth-connected neutral point (n). Three-system instruments measure accurately even in the event of an earth fault on any phase line.

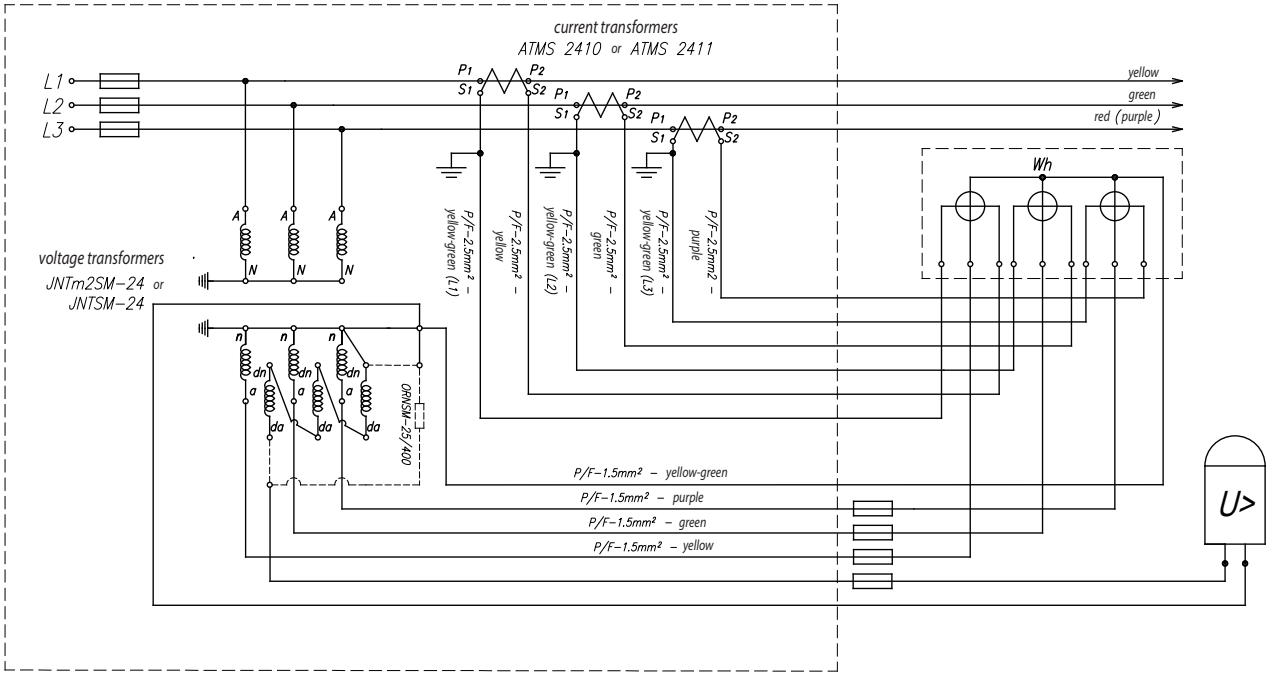
INSTALLATION

Epoxy-insulated voltage transformers can be mounted in any position.

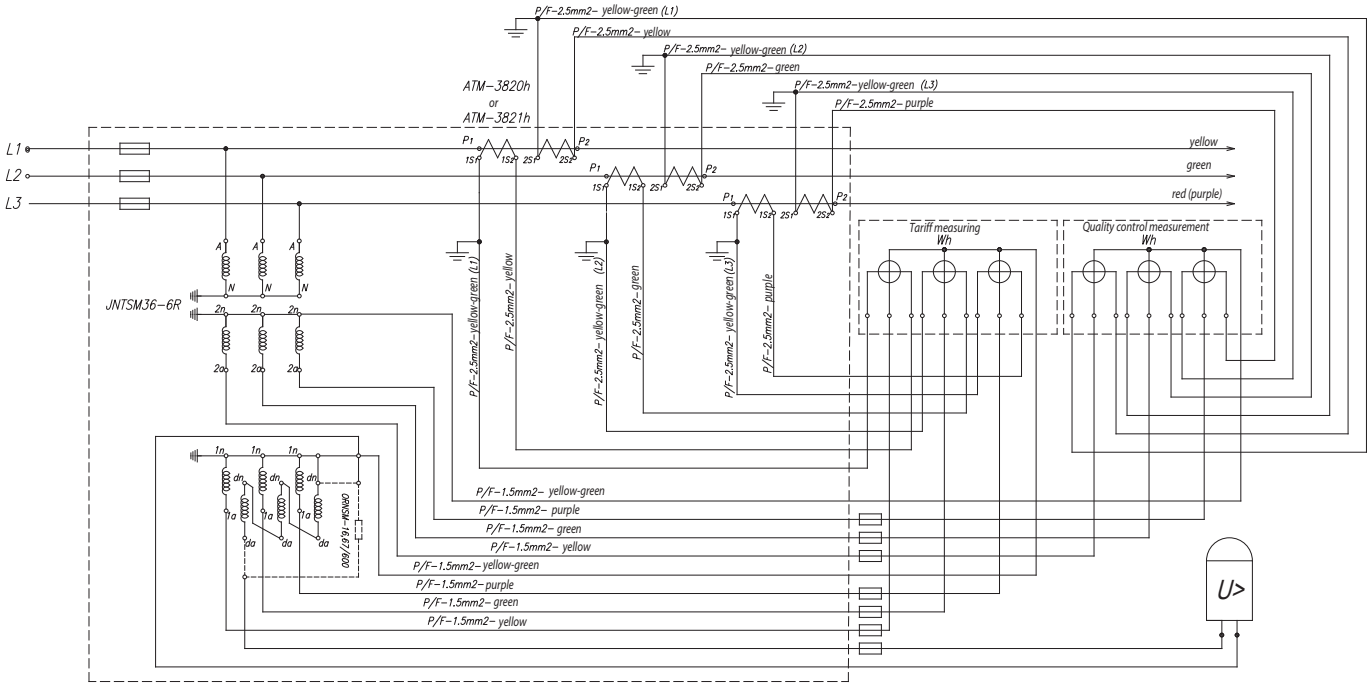
The primary winding of double-pole insulated voltage transformers must be connected between two phases, whereas for single-pole insulated voltage transformers, the primary terminals are connected between a phase and earth.

In the open-delta circuit for voltage levels of 12 kV and 24 kV, a resistor of 25 Ω, 400 W or of higher values should be installed for JNT single-pole voltage transformers (for the voltage level of 38 kV, the values should be at least 16.7 Ω, 600 W).

CONTENTS



Three-system measurement scheme for 10 kV and 20 kV voltage level networks



Three-system measurement scheme for 35 kV voltage level networks

For REL-10 and REL-20 type transformers, a 50 Ω, 200 W resistor is required in the open-delta circuit. All metal parts of the transformer that are not normally live, but could become live in the event of a fault, should be grounded. The transformer is equipped with a fixing strap marked with the grounding symbol.

Depending on the measuring circuit, one secondary terminal also must be earthed. In the case of the single-pole insulated voltage transformers, the secondary terminal "n" is earthed, as well as the primary "N".

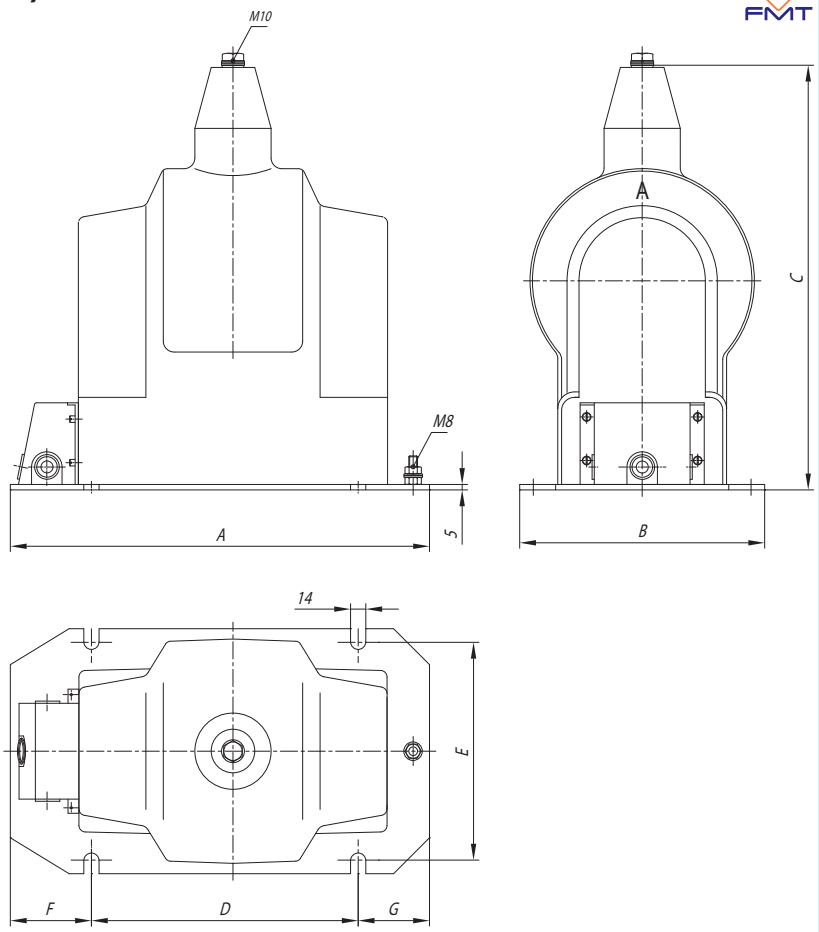
In double-pole insulated voltage transformers, the secondary terminal "b" is usually earthed. In a "V" connection of two double-pole insulated voltage transformers, the central connection which joins the secondary terminal "b" of the first transformer and the secondary terminal "a" of the second transformer is earthed according to electrical schematics on page 3. The secondary terminals of the voltage transformer in operation can stay open or loaded with large-scale consumers of high resistance (voltmeters, voltage circuits of electricity meters and relays).
The secondary terminals must never be short-circuited as this may damage the voltage transformer. For this reason, the secondary lines are secured with fuses. Earth-connected lines are not secured.

CONTENTS

JNT-12, JNT-24, JNT-24/12, JNT-36



JNT-12



SINGLE-POLE VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING **JNT-***

Type of transformer	Dimensions (mm)						
	A	B	C	D	E	F	G
JNT-12	355	180	245	190	155	93	72
JNT-24	375	200	298	210	175	93	72
JNT-24/12	375	200	298	210	175	93	72
JNT-36	385	225	389	245	200	74.5	65.5

TECHNICAL DATA	JNT-12	JNT-24	JNT-24/12	JNT-36
Rated primary voltage (kV)	10/√3	20/√3	20/√3//10/√3	35/√3
Highest voltage for equipment (r.m.s.) (kV)	12	24	24	38(36)
Rated secondary voltage (V)	100/√3 or 110/√3			
Rated tertiary voltage (V)	100/3 or 110/3			
Rated power-frequency withstand voltage (kV)	28	50	50	70
Rated impulse voltage 1.2/50 μs (kV)	75	125	125	170
Rated frequency (Hz)	50/60			
Maximal rated power for accuracy class 0.2 (VA)	25	30	30/10	30
Maximal rated power for accuracy class 0.5 (VA)	75	75	75/25	100
Maximal rated power for accuracy class 1 (VA)	150	150	150/50	200
Rated tertiary power (VA)	25; 50; 100			
Rated tertiary accuracy class	3P; 6P			
Rated voltage factor	1.9/8h			
Additional resistance in the tertiary circuit (W)	25	25	25	16.5
Limiting thermal power (VA)	600	600	600/300	800
Mass (kg)	24.6	31.5	32.5	41
Temperature insulation class	E/B			
Type of basic insulation	Epoxy resin			
Valid standards	IEC 61869-1; IEC 61869-3;			

NOTE:

We can also produce these transformers for the following rated primary voltages: 3/√3; 5/√3; 6/√3; 15/√3; 17.5/√3; 25/√3 and 33/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

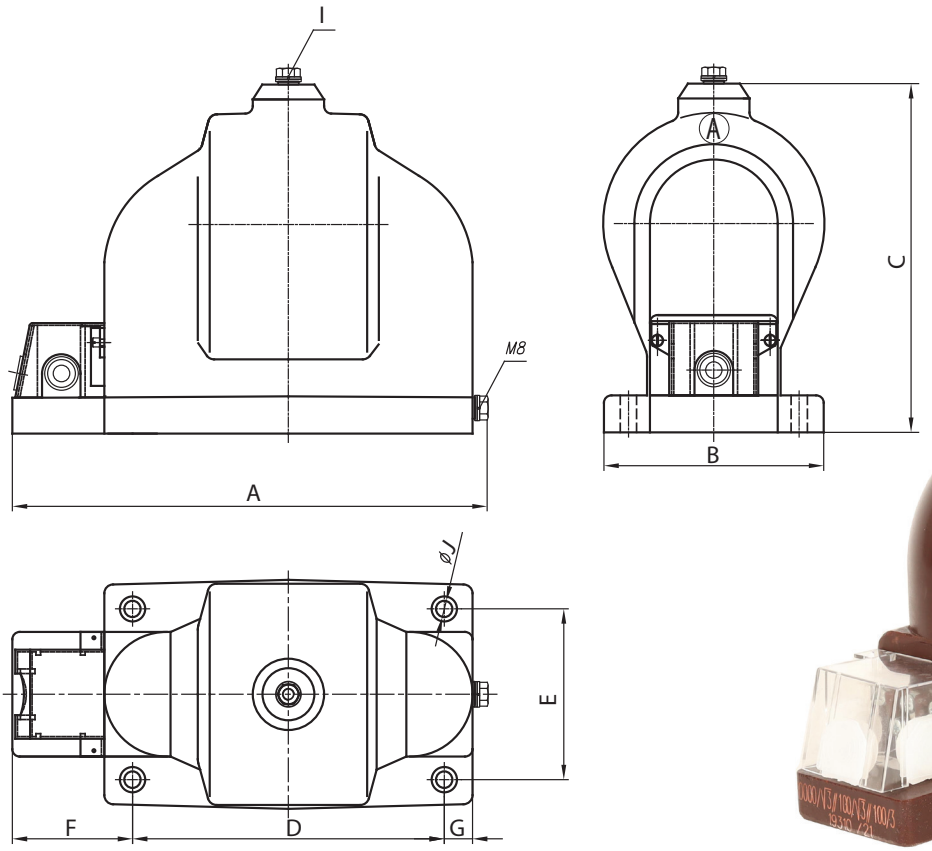
In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

We reserve the right to make changes.

CONTENTS

JNT-10, JNT-10U, JNT-20U, JNT-30U





JNT 10

SINGLE-POLE VOLTAGE TRANSFORMERS OF REDUCED RATED POWER AND DIMENSIONS FOR INDOOR MOUNTING
JNT-10, JNT-10U, JNT-20U, JNT-30U

TECHNICAL DATA	JNT-10	JNT-10U	JNT-20U	JNT-30U
Rated primary voltage (kV)	10/√3	10/√3	20/√3	35/√3
Highest voltage for equipment (r.m.s.) (kV)	12	12	24	36 (42)
Rated secondary voltage (V)	100/√3 or 110/√3			
Rated tertiary voltage (V)	100/3 or 110/3			
Rated power-frequency withstand voltage (kV)	28	28 (42)	50 (65)	70 (95)
Rated impulse voltage1.2/50 μs (kV)	75	75	125	170 (190)
Rated frequency (Hz)	50/60			
Maximal rated power for accuracy class 0.2 (VA)	15	30	30	30
Maximal rated power for accuracy class 0.5 (VA)	50	75	75	75
Maximal rated power for accuracy class 1 (VA)	100	150	150	150
Rated tertiary power (VA)	25; 50; 100	10-50	10-50	10-50
Rated tertiary accuracy class	3P; 6P	3P; 6P	3P; 6P	3P; 6P
Rated voltage factor	1.9/8h	1.9/8h	1.9/8h	1.9/8h
Additional resistance in the tertiary circuit (W)	25	25	25	25
Limiting thermal power (VA)	400	600	600	800
Mass (kg)	17	30	43	60
Temperature insulation class	E/B			
Type of basic insulation	Epoxy resin			
Valid standards	IEC 61869-1; IEC 61869-3	IEC 61869-1; IEC 61869-3; GOST 1983		

Type of transformer	Dimensions (mm)								
	A	B	C	D	E	F	G	I	J
JNT-10	320	148	237	210	115	81	19	M8	11
JNT-10U	275	220	251	215	180	30	30	M10	13
JNT-20U	315	242	290	240	207	37.5	37.5	M10	13
JNT-30U	415	250	390	300	225	90	25	M10	13

NOTE:

We can also produce these transformers for the following rated primary voltages: 3/√3; 5/ √3; 6/√3; 15/√3; 17.5/√3; 25/√3 and 33/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

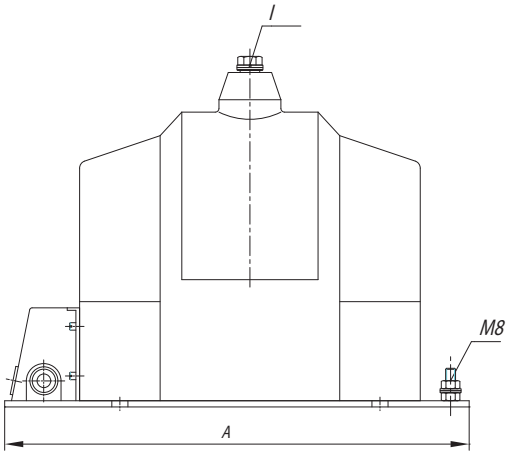
In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

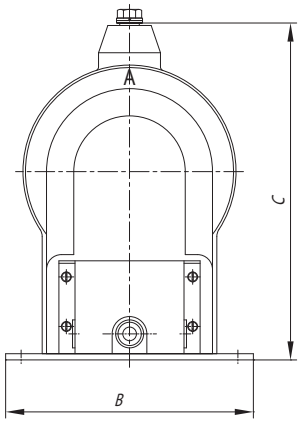
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

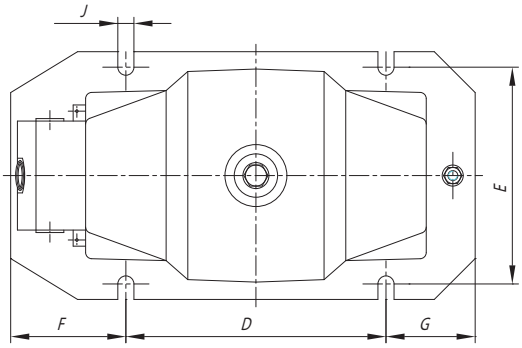
We reserve the right to make changes.

CONTENTS

JNT-10d, JNTm2-24, JNTm2-24/12









JNTm2-24

SINGLE-POLE VOLTAGE TRANSFORMERS OF REDUCED RATED POWER AND DIMENSIONS FOR INDOOR MOUNTING
JNT-10d, JNTm2-24, JNTm2-24/12

Type of transformer	Dimensions (mm)								
	A	B	C	D	E	F	G	I	J
JNT-10d	340	148	220	270	125	53	17	M10	11
JNTm2-24	355	178	271	280	150	53	22	M10	14
JNTm2-24/12	355	178	271	280	150	53	22	M10	14

TECHNICAL DATA	JNT-10d	JNTm2-24	JNTm2-24/12
Rated primary voltage (kV)	10/√3	20/√3	20/√3//10/√3
Highest voltage for equipment (r.m.s.) (kV)	12	24	24
Rated secondary voltage (V)	100/√3 or 110/√3		
Rated tertiary voltage (V)	100/3 or 110/3		
Rated power-frequency withstand voltage (kV)	28	50	50
Rated impulse voltage 1.2/50 μs (kV)	75	125	125
Rated frequency (Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	15	15	-
Maximal rated power for accuracy class 0.5 (VA)	50	50	50/15
Maximal rated power for accuracy class 1 (VA)	100	100	75/25
Rated tertiary power (VA)	25; 50; 100		
Rated tertiary accuracy class	3P; 6P		
Rated voltage factor	1.9/8h		
Additional resistance in the tertiary circuit (W)	25	25	25
Limiting thermal power (VA)	400	400	400/200
Mass (kg)	21	27	27
Temperature insulation class	E/B		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-3		

NOTE:

We can also produce these transformers for the following rated primary voltages: 3/√3; 5/√3; 6/√3; 11/√3; 15/√3 and 22/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

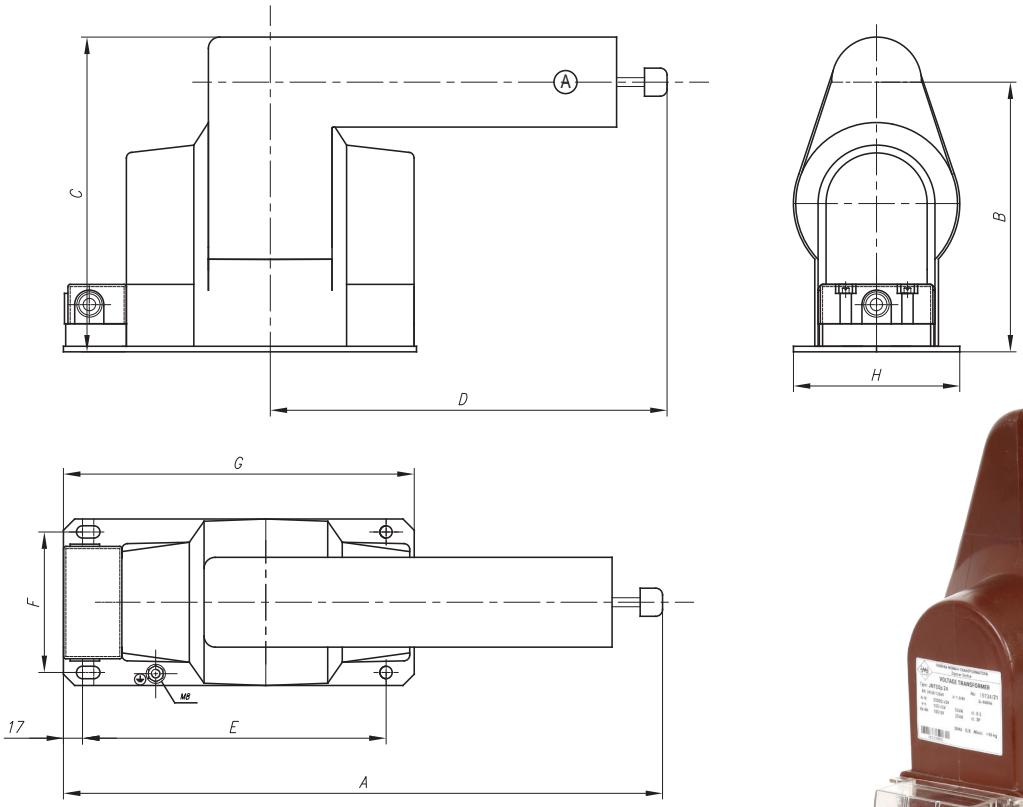
In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

We reserve the right to make changes.

CONTENTS

JNT SOP-12, JNT SOP-24, JNT SOP-24/12



JNT SOP-24



SINGLE-POLE VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING WITH REDUCED POWER AND FUSES **JNT SOP***

Type of transformer	Dimensions (mm)							
	A	B	C	D	E	F	G	H
JNT SOP-12	533	240	280	353	270	125	312	148
JNT SOP-24	606	300	340	416	275	130	325	164
JNT SOP-24/12	606	300	340	416	275	130	325	164

TECHNICAL DATA	JNT SOP-12	JNT SOP-24	JNT SOP-24/12
Rated primary voltage (kV)	10/√3	20/√3	20/√3//10//√3
Highest voltage for equipment (r.m.s.) (kV)	12	24	24
Rated secondary voltage (V)	100/√3 or 110/√3		
Rated tertiary voltage (V)	100/3 or 110/3		
Rated power-frequency withstand voltage (kV)	28	50	50
Rated impulse voltage1.2/50 μs (kV)	75	125	125
Rated frequency (Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	25	30	30/10
Maximal rated power for accuracy class 0.5 (VA)	75	75	75/25
Maximal rated power for accuracy class 1 (VA)	150	150	150/50
Rated tertiary power (VA)	25; 50; 100		
Rated tertiary accuracy class	3P; 6P		
Rated voltage factor	1.9/8h		
Additional resistance in the tertiary circuit (W)	25	25	25
Limiting thermal power (VA)	600	600	600/300
Mass (kg)	23	29	30.5
Temperature insulation class	E/B		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-3		

NOTE:

JNT SOP transformers are designed for indoor mounting and are suitable for installation in smaller cells up to voltage level of 24 kV. They have fuse enclosures on the high-voltage side. Along with the transformer, we supply the corresponding fuse cartridges, which are extremely easy to assemble and disassemble.

We can also produce these transformers for primary voltages: 3/√3; 5/√3; 6/√3; 11/√3; 15/ √3 and 22/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

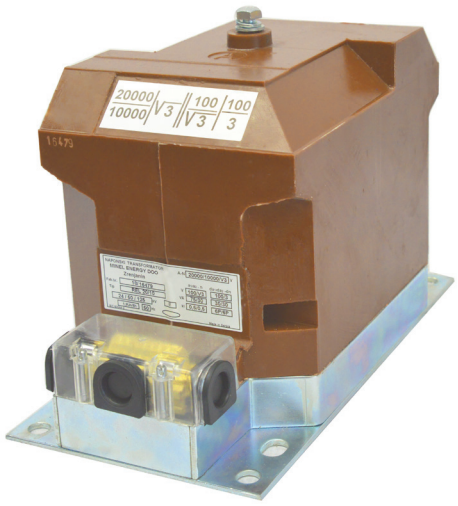
In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

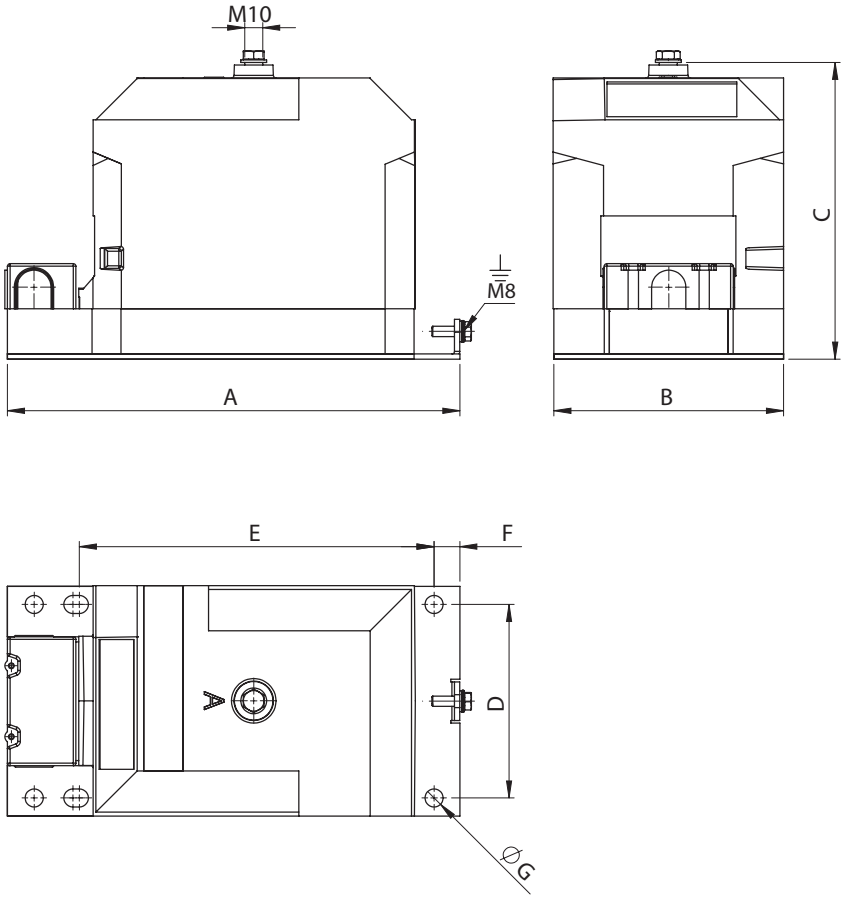
We reserve the right to make changes.

CONTENTS

REL 10, REL 20 and REL 20/10



REL-20



SINGLE-POLE VOLTAGE TRANSFORMERS 12-24 kV OF REDUCED DIMENSIONS - BLOCK TYPE **REL***

Type of transformer	Dimensions (mm)							Mass (kg)
	A	B	C	D	E	F	G	
REL 10	325	148	200	125	260	15	11	~18.5
REL 20	351	178	230	150	275	20	14	~25
REL 20/10	351	178	230	150	275	20	14	~25

TECHNICAL DATA	REL 10	REL 20	REL 20/10
Rated primary voltage (kV)	10/√3	20/√3	20/√3//10/√3
Highest voltage for equipment (r.m.s.) (kV)	12	24	24
Rated secondary voltage (V)	100/√3 or 110/√3		
Rated tertiary voltage (V)	100/3 or 110/3		
Rated power-frequency withstand voltage (kV)	28 (42)	50 (65)	50 (65)
Rated impulse voltage 1.2/50 μs (kV)	75	125	125
Rated frequency (Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	15	15	10(5)
Maximal rated power for accuracy class 0.5 (VA)	50	50	30(15)
Maximal rated power for accuracy class 1 (VA)	100	120	120(50)
Rated tertiary power (VA)	10-50		
Rated tertiary accuracy class	3P; 6P		
Rated voltage factor	1.9/8h		
Additional resistance in the tertiary circuit (W)	40	40	40
Limiting thermal power (VA)	400	400	400/200
Temperature insulation class	E		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-3 (ГОСТ 1983)		

NOTE:

We can also produce these transformers for primary voltages: 3/√3; 5/√3; 6/√3; 11/√3; 15/√3 and 22/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

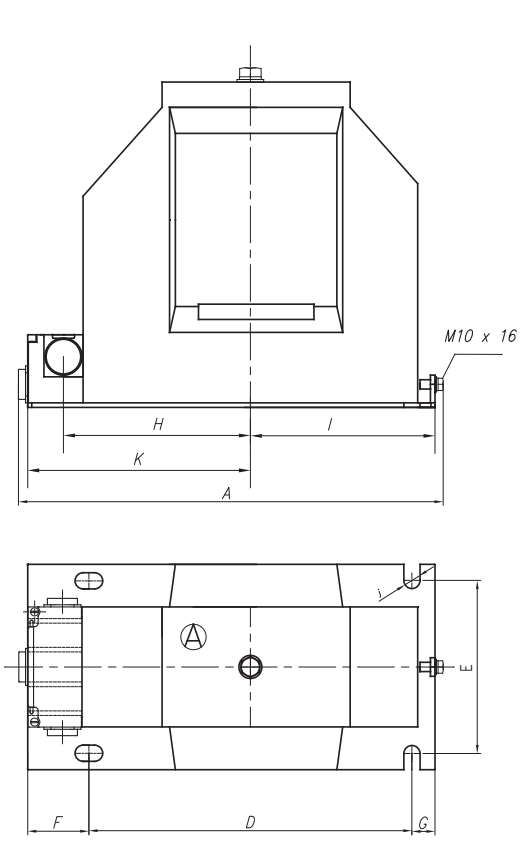
In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

We reserve the right to make changes.

CONTENTS

JNT-12z, JNT-12d, JNT-24z, JNT-24d, JNT-24/12z, JNT-24/12d





JNT-12z

SINGLE-POLE VOLTAGE TRANSFORMERS 12-24 kV REDUCED DIMENSIONS - BLOCK TYPE **JNT***

Type of transformer	Dimensions (mm)										
	A	B	C	D	B	F	G	H	I	K	j
JNT-12z	348	148	234	270	125	48	15	152	150	183	Ø12,Ø14
JNT-12d	358	148	234	275	125	55	15	162	150	195	Ø12,Ø14
JNT-24z	368	178	293	280	150	53	20	162	160	193	Ø12,Ø14
JNT-24d	392	178	293	275	150	70	32	174	172	205	Ø12,Ø14
JNT-24/12z	368	178	293	280	150	53	20	162	160	193	Ø12,Ø14
JNT-24/12d	392	178	293	275	150	70	32	174	172	205	Ø12,Ø14

TECHNICAL DATA	JNT-12z	JNT-12d	JNT-24z	JNT-24d	JNT-24/12z	JNT-24/12d
Rated primary voltage (kV)	10/√3	10/√3	20/√3	20/√3	20/√3//10/√3	20/√3//10/√3
Highest voltage for equipment (r.m.s.) (kV)	12	12	24	24	24	24
Rated secondary voltage (V)	100/√3 or 110/√3					
Rated tertiary voltage (V)	100/3 or 110/3					
Rated power-frequency withstand voltage (kV)	28	28	50	50	50	50
Rated impulse voltage1.2/50 μs (kV)	75	75	125	125	125	125
Rated frequency(Hz)	50/60					
Maximal rated power for accuracy class 0.2 (VA)	25	25	30	30	30/10	30/10
Maximal rated power for accuracy class 0.5 (VA)	75	75	75	75	75/25	75/25
Maximal rated power for accuracy class 1 (VA)	150	150	150	150	150/50	150/50
Rated tertiary power (VA)	25; 50; 100					
Rated tertiary accuracy class	3P; 6P					
Rated voltage factor	1.9/8h					
Additional resistance in the tertiary circuit (W)	25	25	25	25	25	25
Limiting thermal power (VA)	500	600	600	700	600/300	700/350
Mass (kg)	24.6	24.6	31.5	33	32.5	34.5
Temperature insulation class	E/B					
Type of basic insulation	Epoxy resin					
Valid standards	IEC61869-1; IEC61869-3, DIN 42600-9					

NOTE:

We can also produce these transformers for primary voltages:

3/√3; 5/√3; 6/√3; 11/√3; 15/√3 and 22/√3 kV.

At the customer's request, we can produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

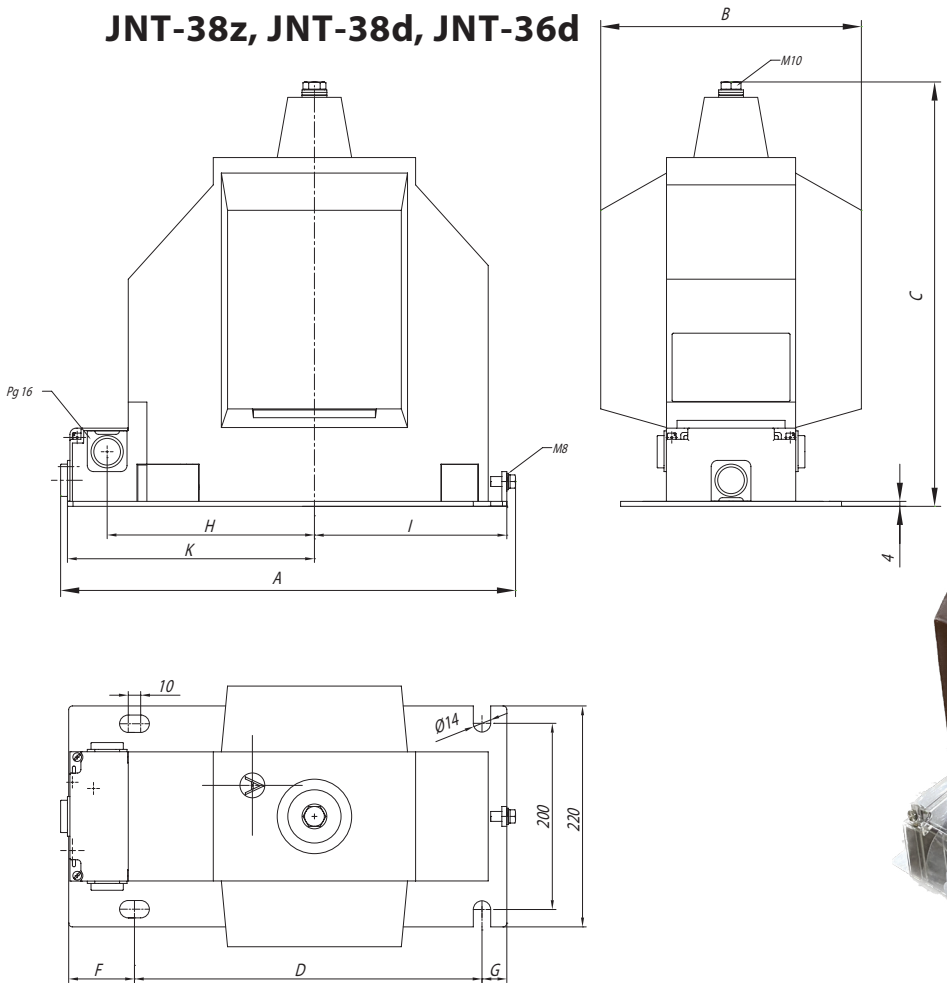
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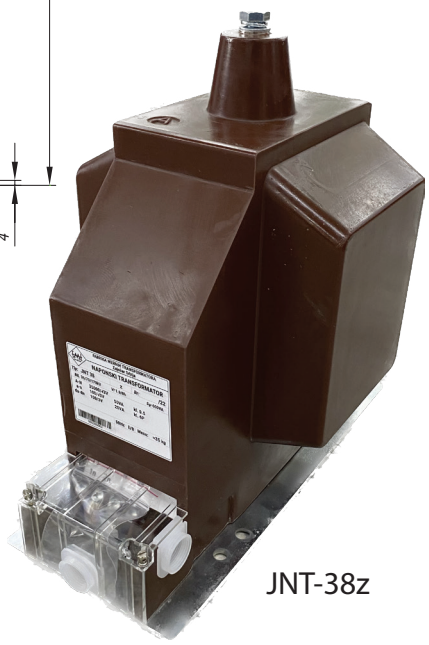
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

We reserve the right to make changes.

CONTENTS

JNT-38z, JNT-38d, JNT-36d





JNT-38z

SINGLE-POLE VOLTAGE TRANSFORMERS 38 kV REDUCED DIMENSIONS - BLOCK TYPE **JNT-38z, JNT-38d, JNT-36d**

Type of transformer	Dimensions (mm)								
	A	B	C	D	F	G	H	I	K
JNT-38z	368	210	342	245	70,5	37,5	162	160	193
JNT-38d	392	220	384	245	82,5	49,5	174	172	205
JNT-36d	443	240	376	300	88	40	207	190	238

TECHNICAL DATA	JNT-38z	JNT-38d	JNT-36d
Rated primary voltage (kV)	35/√3	35/√3	35/√3
Highest voltage for equipment (r.m.s.) (kV)	38	38 (40.5)	36, 38 (40.5)
Rated secondary voltage(V)	100/√3 or 110/√3		
Rated tertiary voltage (V)	100/3 or 110/3		
Rated power-frequency withstand voltage (kV)	70	70 (80)	70 (80)
Rated impulse voltage1.2/50 μs (kV)	170	170 (190)	170 (190)
Rated frequency(Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	25	30	50
Maximal rated power for accuracy class 0.5 (VA)	75	100	150
Maximal rated power for accuracy class 1 (VA)	150	200	300
Rated tertiary power (VA)	25; 50; 100		25; 50; 100; 150
Rated tertiary accuracy class	3P; 6P		
Rated voltage factor	1.9/8h		
Additional resistance in the tertiary circuit (W)	25	25(16.7)	16.7(12,5)
Limiting thermal power (VA)	600	800	1200
Mass (kg)	34	40	72
Temperature insulation class	E/B		
Type of basic insulation	Epoxy resin		
Valid standards	IEC61869-1; IEC61869-3		

NOTE:

We can also produce these transformers for primary voltages: 3/√3; 5/√3; 6/√3; 11/√3; 15/√3; 22/√3 and 30/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

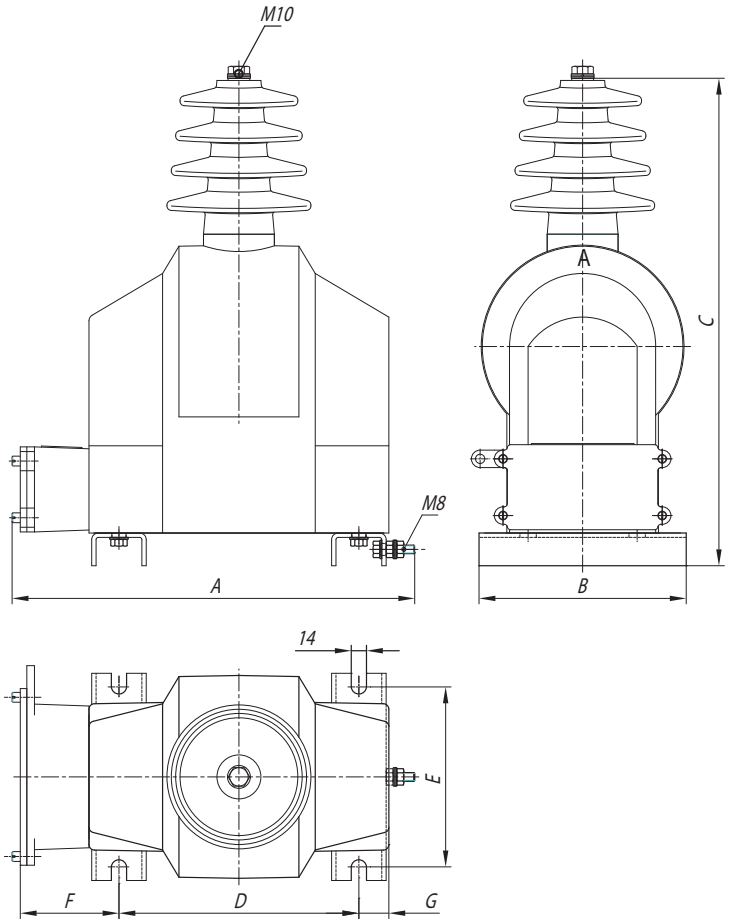
We reserve the right to make changes.

CONTENTS

JNT SM-12, JNT SM-24, JNT SM-24/12, JNT SM-36*



JNT SM-12



SINGLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **JNT SM-***

Type of transformer	Dimensions (mm)							Broj rebara	Creeping distance (mm)
	A	B	C	D	E	F	G		
JNT SM-12	366	190	367	209	165	98	21	3	500
JNT SM-24	370	190	447	220	165	90.5	27.5	4	630
JNT SM-24/12	370	190	447	220	165	90.5	27.5	4	630
JNT SM-36-5R	379	225	549	229	200	92	25	5	855
JNT SM-36-6R	379	225	579	229	200	92	25	6	920
JNT SM-36-8R	379	225	626	229	200	92	25	8	1125
JNT SM-36-10R	379	225	695	229	200	92	25	10	1280

TECHNICAL DATA	JNT SM-12	JNT SM-24	JNT SM-24/12	JNT SM-36*
Rated primary voltage (kV)	10/√3	20/√3	20/√3//10/√3	35/√3
Highest voltage for equipment (r.m.s.) (kV)	12	24	24	38(36)
Rated secondary voltage (V)	100/√3 or 110/√3			
Rated tertiary voltage (V)	100/3 or 110/3			
Rated power-frequency withstand voltage (kV)	28	50	50	70
Rated impulse voltage1.2/50 μs (kV)	75	125	125	170
Rated frequency (Hz)	50/60			
Maximal rated power for accuracy class 0.2 (VA)	25	30	30/10	30
Maximal rated power for accuracy class 0.5 (VA)	75	75	75/25	100
Maximal rated power for accuracy class 1 (VA)	150	150	150/50	200
Rated tertiary power (VA)	25; 50; 100			
Rated tertiary accuracy class	3P; 6P			
Rated voltage factor	1.9/8h			
Additional resistance in the tertiary circuit (W)	25	25	25	16.5
Limiting thermal power (VA)	600	600	600/300	800
Mass (kg)	25.9	31.5	32.5	43
Temperature insulation class	E/B			
Type of basic insulation	Cycloaliphatic resin			
Valid standards	IEC 61869-1; IEC 61869-3			

NOTE:

We can also produce these transformers for primary voltages: 3/√3; 5/√3; 6/√3; 11/√3; 15/√3; 22/√3 and 30/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

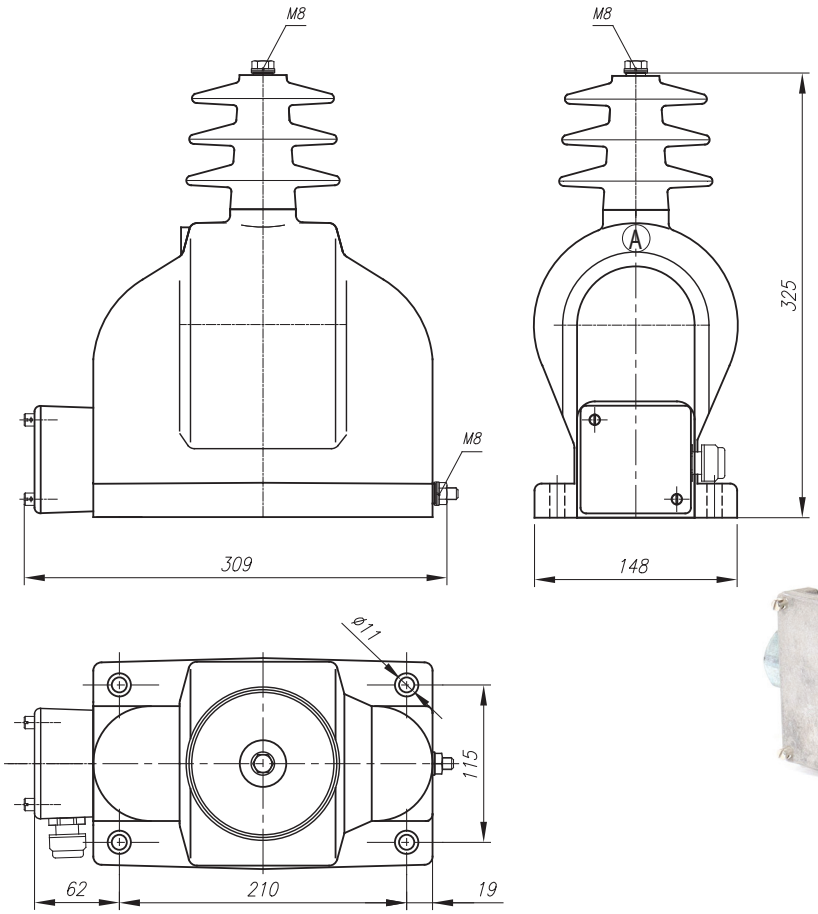
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

We reserve the right to make changes.

* - applies to all models of this type.

CONTENTS

JNT SM-10





JNT SM-10

SINGLE-POLE VOLTAGE TRANSFORMERS OF REDUCED RATED POWER FOR OUTDOOR MOUNTING **JNT SM-10**

TECHNICAL DATA	JNT SM-10
Rated primary voltage (kV)	10/√3
Highest voltage for equipment (r.m.s.) (kV)	12
Rated secondary voltage(V)	100/√3 or 110/√3
Rated tertiary voltage (V)	100/3 or 110/3
Rated power-frequency withstand voltage (kV)	28
Rated impulse voltage1.2/50 μs (kV)	75
Rated frequency(Hz)	50/60
Maximal rated power for accuracy class 0.2 (VA)	15
Maximal rated power for accuracy class 0.5 (VA)	50
Maximal rated power for accuracy class 1 (VA)	100
Rated tertiary power (VA)	25; 50; 100
Rated tertiary accuracy class	3P; 6P
Rated voltage factor	1.9/8h
Additional resistance in the tertiary circuit (W)	25
Limiting thermal power (VA)	400
Creeping distance (mm)	465
Mass (kg)	18.2
Temperature insulation class	E/B
Type of basic insulation	Cycloaliphatic resin
Valid standards	IEC 61869-1; IEC 61869-3

NOTE:

We can also produce these transformers for primary voltages:

3/√3; 5/√3; 6/√3 and 11/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

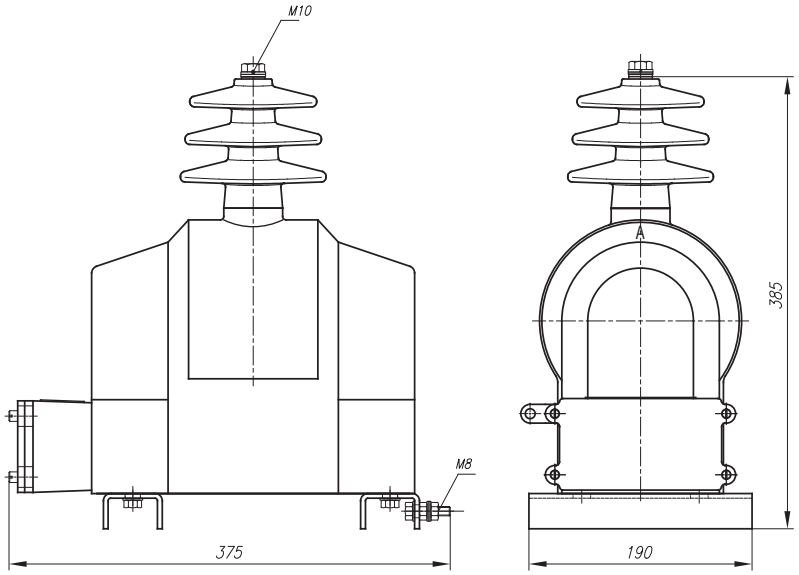
In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

We reserve the right to make changes.

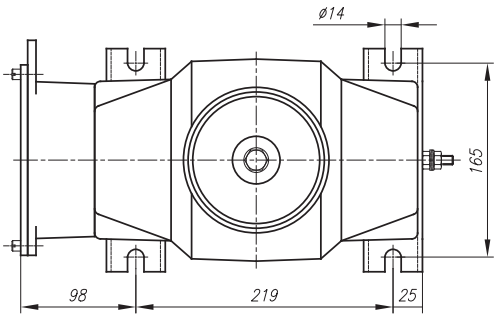
CONTENTS

JNTm2 SM-24, JNTm2 SM-24/12





JNTm2 SM-24



SINGLE-POLE VOLTAGE TRANSFORMERS OF REDUCED RATED POWER FOR OUTDOOR MOUNTING
JNTm2 SM-24, JNTm2 SM-24/12

TECHNICAL DATA	JNTm2 SM-24	JNTm2 SM-24/12
Rated primary voltage (kV)	20/√3	20/√3//10/√3
Highest voltage for equipment (r.m.s.) (kV)	24	
Rated secondary voltage (V)	100/√3 or 110/√3	
Rated tertiary voltage (V)	100/3 or 110/3	
Rated power-frequency withstand voltage (kV)	50	
Rated impulse voltage1.2/50 μs (kV)	125	
Rated frequency (Hz)	50/60	
Maximal rated power for accuracy class 0.2 (VA)	15	-
Maximal rated power for accuracy class 0.5 (VA)	50	50/15
Maximal rated power for accuracy class 1 (VA)	100	75/25
Rated tertiary power (VA)	25; 50; 100	
Rated tertiary accuracy class	3P; 6P	
Rated voltage factor	1.9/8h	
Additional resistance in the tertiary circuit (W)	25	
Limiting thermal power (VA)	400	400/200
Creeping distance (mm)	535	
Mass (kg)	27.5	28
Temperature insulation class	E/B	
Type of basic insulation	Cycloaliphatic resin	
Valid standards	IEC 61869-1; IEC 61869-3	

NOTE:

We can also produce these transformers for primary voltages: 3/√3; 5/√3; 6/√3; 11/√3; 15/√3 and 22/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, an additional resistance must be installed in the open-delta tertiary circuit of the transformers.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

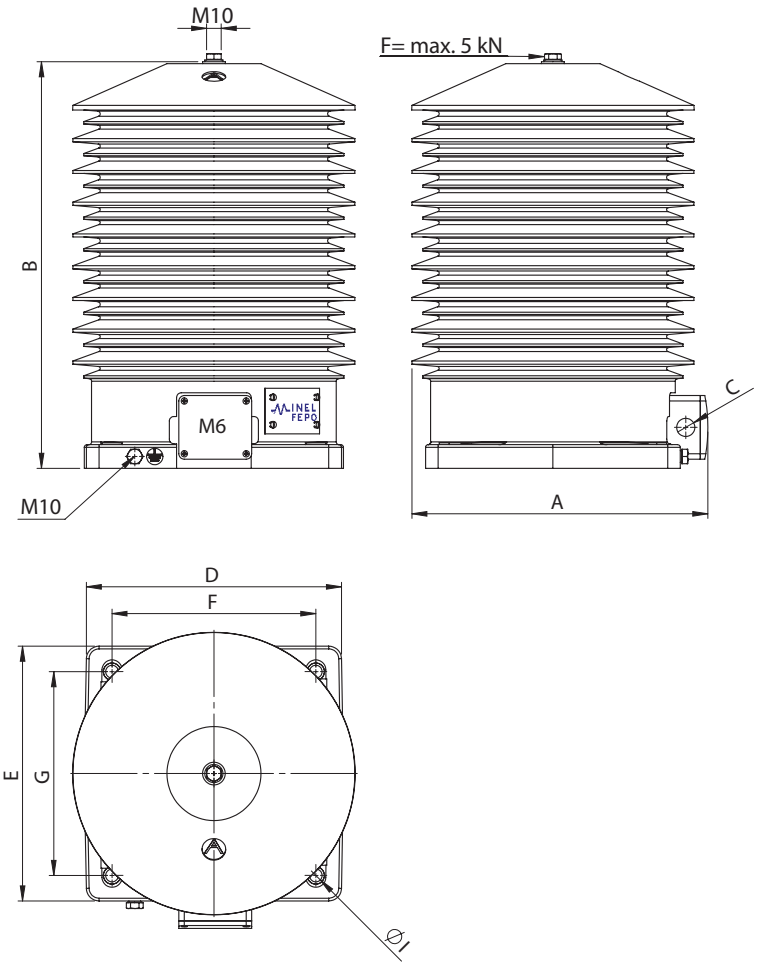
We reserve the right to make changes.

CONTENTS

NTSM-12, NTSM-24, NTSM-38



NTSM-38



SINGLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING 12-42 kV - **NTSM-12, NTSM-24, NTSM-38**

Type of transformer	Dimensions (mm)								Mass (kg)
	A	B	C	D	E	F	G	I	
NTSM-12	315	372	Pg16	280	276	224	224		
NTSM-24	315	450	Pg16	280	276	224	224	14	~58
NTSM-38	315	520	Pg16	280	276	224	224	14	~72

TECHNICAL DATA	NTSM-12	NTSM-24	NTSM-38
Rated primary voltage (kV)	10/√3	20/√3	35/√3
Highest voltage for equipment (r.m.s.) (kV)	12	24	36 (42)
Rated secondary voltage (V)	100/√3 or 110/√3		
Rated tertiary voltage (V)	100/3 or 110/3		
Rated power-frequency withstand voltage (kV)	28 (42)	50 (65)	70 (95)
Rated impulse voltage 1.2/50 μs (kV)	75	125	170 (190)
Rated frequency (Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	15	15	20
Maximal rated power for accuracy class 0.5 (VA)	50	50	75
Maximal rated power for accuracy class 1 (VA)	100	120	150
Rated tertiary power (VA)	10-50		
Rated tertiary accuracy class	3P; 6P		
Rated voltage factor	1.9 / 8h		
Additional resistance in the tertiary circuit (W)	25		
Limiting thermal power (VA)	600		
Temperature insulation class	F		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-3 (ГОСТ 1983)		

NOTE:

We can also produce these transformers for primary voltages:

3/√3; 5/√3; 6/√3; 11/√3; 15/√3; 22/√3 and 30/√3 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary, secondary and tertiary).

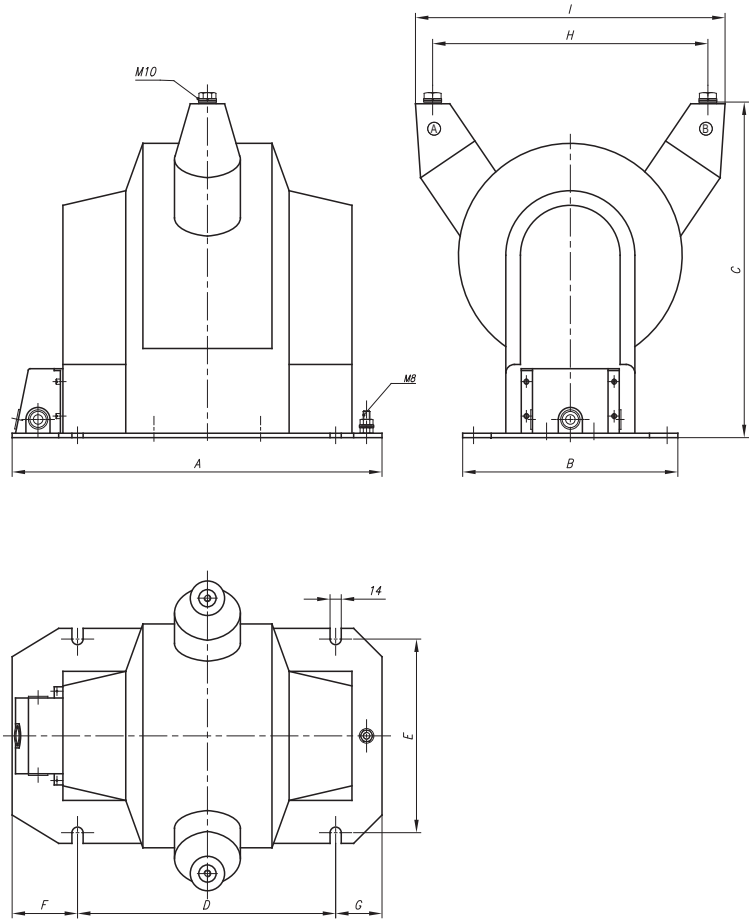
We reserve the right to make changes.

CONTENTS

DNT-12, DNTm1-24, DNT-24, DNT-24/12, DNT-36



DNT-12



DOUBLE-POLE VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING **DNT-***

Type of transformer	Dimensions (mm)								
	A	B	C	D	E	F	G	H	I
DNT-12	355	180	246	190	155	93	72	150	198
DNTm1-24	355	180	300	190	155	93	72	210	246
DNT-24	375	200	300	210	175	93	72	210	246
DNT-24/12	375	200	300	210	175	93	72	210	246
DNT-36	430	250	397	300	225	76	54	320	364

TECHNICAL DATA	DNT-12	DNTm1-24	DNT-24	DNT-24/12	DNT-36
Rated primary voltage (kV)	10	20	20	20/10	35
Highest voltage for equipment (r.m.s.) (kV)	12	24	24	24	38(36)
Rated secondary voltage (V)	100 or 110				
Rated power-frequency withstand voltage (kV)	28	50	50	50	70
Rated impulse voltage1.2/50 μs (kV)	75	125	125	125	170
Rated frequency (Hz)	50/60				
Maximal rated power for accuracy class 0.2 (VA)	25	15	30	30/10	30
Maximal rated power for accuracy class 0.5 (VA)	75	50	75	75/25	100
Maximal rated power for accuracy class 1 (VA)	150	100	150	150/50	200
Rated voltage factor	1.2 permanently				
Limiting thermal power (VA)	600	400	600	600/300	800
Mass (kg)	27.4	28	34.5	35.5	58
Temperature insulation class	E/B				
Type of basic insulation	Epoxy resin				
Valid standards	IEC 61869-1; IEC 61869-3				

NOTE:

The voltage transformer DNTm1-24 is a subtype with reduced power and smaller dimensions and is therefore suitable for smaller cells.

We can also produce these transformers for primary voltages:

3; 5; 6; 11; 15; 22 and 30 kV.

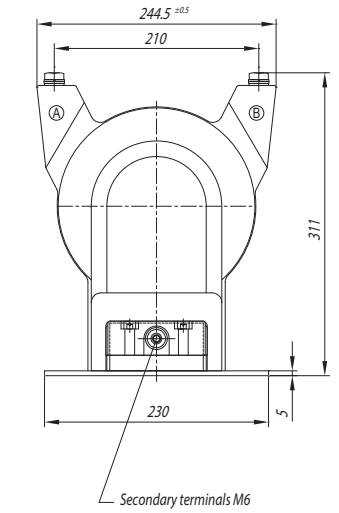
At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

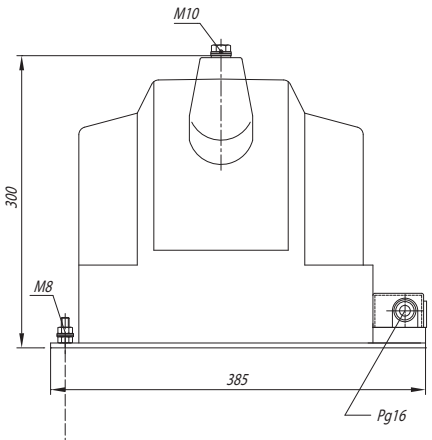
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

We reserve the right to make changes.

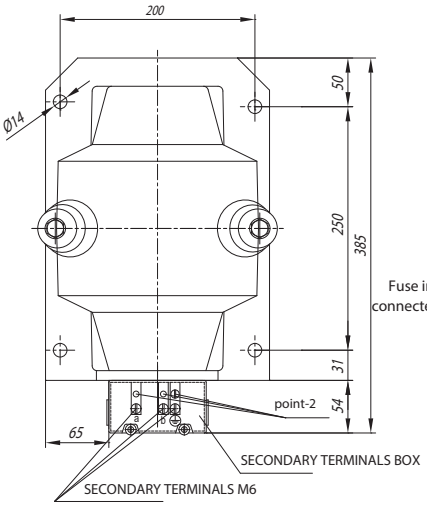
CONTENTS

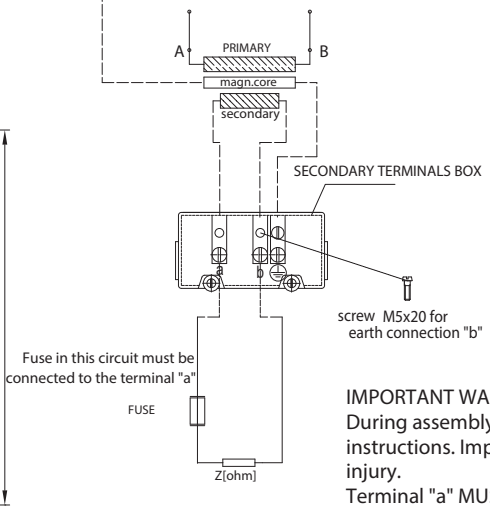
DNT-24E











IMPORTANT WARNING:
During assembly, pay attention to the connection according to these instructions. Improper connection can cause transformer damage and injury.
Terminal "a" MUST NOT be connected to ground - IT CAUSES SHORT CIRCUIT AND DAMAGE to the transformer if terminal "b" in the secondary terminal box is connected with an M5x20 screw at point 2 to the base.

DOUBLE-POLE POWER VOLTAGE TRANSFORMER FOR INDOOR MOUNTING TYPE **DNT-24E**

TECHNICAL DATA	DNT-24E			
Rated primary voltage(kV)	6	10	15	20
Highest voltage for equipment(eff.) (kV)	7.2	12	17.5	24
Rated secondary voltage (V)	220or230			
Rated power-frequency withstand voltage 1 min. (kV)	20	28	38	50
Rated impulse voltage 1.2/50 μs (kV)	60	75	95	125
Rated frequency(Hz)	50/60			
Limiting thermal power (VA)	2500	2500	2000	2000
Rated voltage factor V_f	1.2 permanently			
Mass(kg)	38.5	39	40	40
Temperature class of insulation	E/B			
Type of basic insulation	Epoxy resin			
Valid standards	IEC 60076-1; IEC61869-1; IEC61869-3			

NOTE:

We can produce these transformers for primary voltages: 3; 5; 6; 15; 17.5; 22 kV.

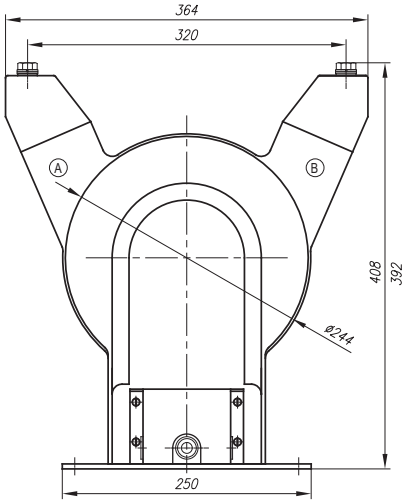
At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

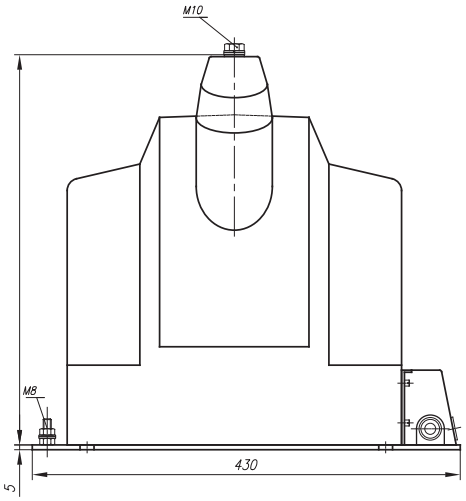
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

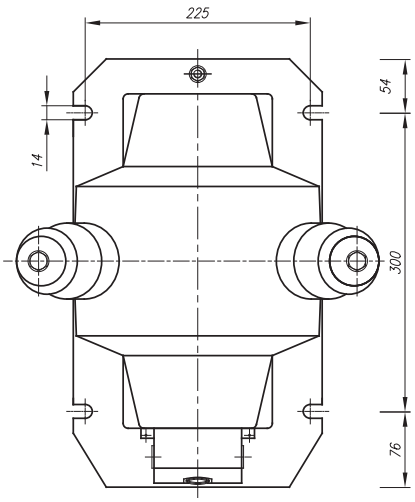
We reserve the right to make changes.

CONTENTS

DNT-36









DOUBLE-POLE POWER VOLTAGE TRANSFORMER FOR INDOOR MOUNTING TYPE **DNT-36**

TECHNICAL DATA	DNT-36			
Rated primary voltage(kV)	6	10	20	35
Highest voltage for equipment(eff.) (kV)	7.2	12	24	36
Rated secondary voltage (V)	220 or 230			
Rated power-frequency withstand voltage, 1 min. (kV)	20	28	50	70
Rated impulse voltage 1.2/50 μs (kV)	60	75	125	170
Rated frequency(Hz)	50/60			
Limiting thermal power (VA)	5000	5000	4000	2500
Rated voltage factor V_f	1.2 permanently			
Mass(kg)	58.5	59	62	64
Temperature class of insulation	E/B			
Type of basic insulation	Epoxy resin			
Valid standards	IEC 60076-1; IEC61869-1; IEC61869-3			

NOTE:

We can produce these transformers for rated voltages: 3; 5; 6; 15; 17.5; 25 and 33 kV.
At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

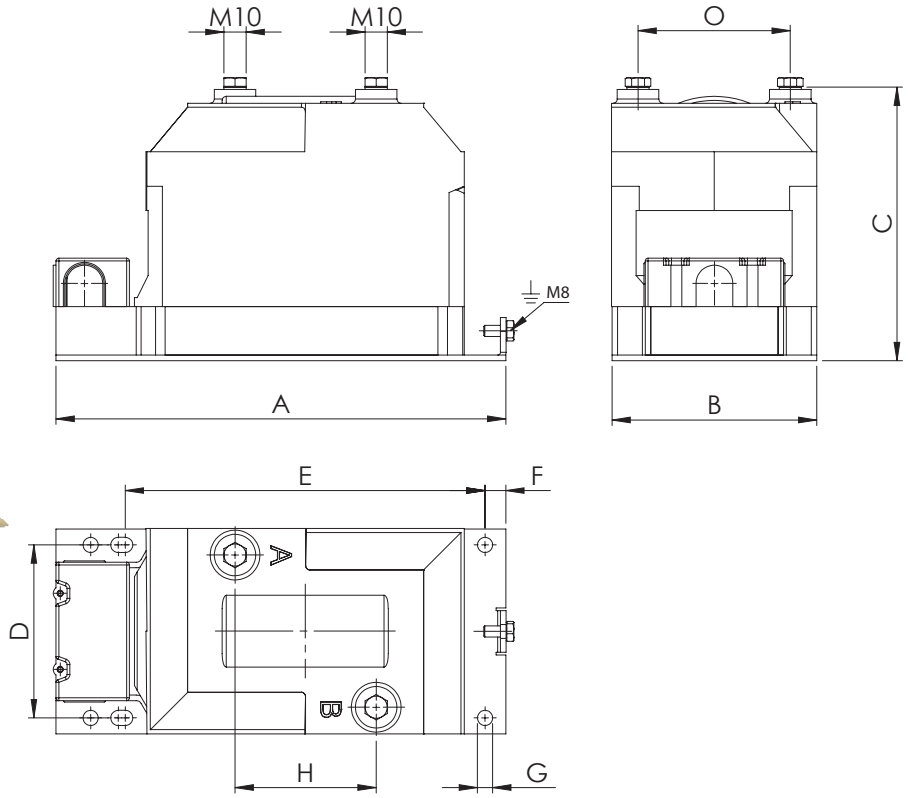
We reserve the right to make changes.

CONTENTS

RZL 10, RZL 20, RZL 20/10



RZL 10



DOUBLE-POLE VOLTAGE TRANSFORMERS FOR INDOOR MOUNTING 12-24 kV REDUCED DIMENSIONS
BLOCK TYPE **RZL**

Type of transformer	Dimensions (mm)									Mass (kg)
	A	B	C	D	E	F	G	H	O	
RZL 10	325	148	200	125	260	15	11	102	110	~18.5
RZL 20	351	178	230	150	275	20	14	165	130	~25
RZL 20/10	351	178	230	150	275	20	14	165	130	~26

TECHNICAL DATA	RZL 10	RZL 20	RZL 20/10
Rated primary voltage (kV)	10	20	20/10
Highest voltage for equipment (r.m.s.) (kV)	12	24	
Rated secondary voltage (V)	100; 110 or 230		
Rated power-frequency withstand voltage (kV)	28 (42)	50 (65)	
Rated impulse voltage 1.2/50 μs (kV)	75	125	
Rated frequency (Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	10	15	10(5)
Maximal rated power for accuracy class 0.5 (VA)	30	50	30(15)
Maximal rated power for accuracy class 1 (VA)	100	120	120(50)
Rated voltage factor	1.2 x Un / permanently		
Limiting thermal power (VA)	400		
Temperature insulation class	E		
Type of basic insulation	Epoxy resin		
Valid standards	IEC 61869-1; IEC 61869-3 (ГОСТ 1983)		

NOTE:

We can also produce these transformers for primary voltages: 3; 5; 6; 11; 15 and 22 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

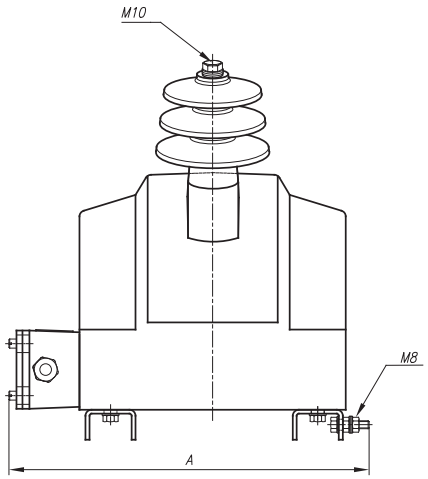
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

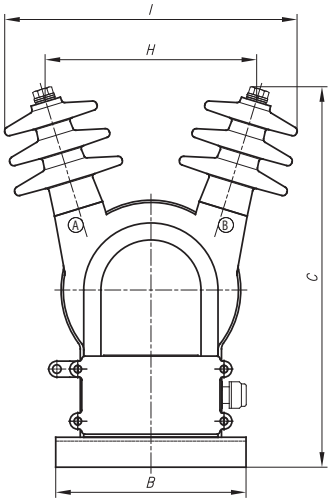
We reserve the right to make changes.

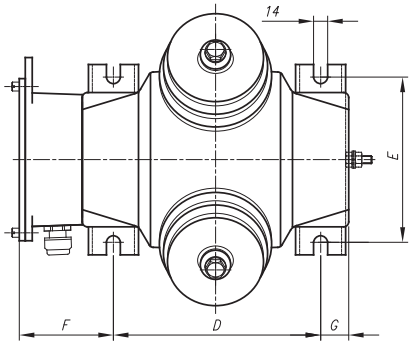
DNT SM-17.5, DNT SM-24, DNT SM-24/12, DNT SM-36, DNT SM-36S, DNT SM-36-8R, DNT SM-36-10R



DNT SM-12







TWO-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **DNT SM-***

Type of transformer	Dimensions (mm)									Number of ribs	Creeping distance (mm)
	A	B	C	D	E	F	G	H	I		
DNT SM-17.5	360	190	367	207	165	94	28	210	292	3	500
DNT SM-24	373	190	449	220	165	94	31	320	406	4	650
DNT SM-24/12	373	190	449	220	165	94	31	320	406	4	650
DNT SM-36	425	225	551	270	200	96	33	430	520	5	900
DNT SM-36s	410	225	506	260	200	91	28	430	515	6	900
DNT SM-36-8R	425	225	613	270	200	96	33	490	573	8	1152
DNT SM-36-10R	425	225	676	270	200	96	33	536	613	10	1320

TECHNICAL DATA	DNT SM-17.5	DNT SM-24	DNT SM-24/12	DNT SM-36	DNT SM-36s	DNT SM-36-8R	DNT SM-36-10R
Rated primary voltage (kV)	15(10)	20	20/10	35	35	35	35
Highest voltage for equipment (r.m.s.) (kV)	17.5(12)	24	24	38	38	40.5	40.5
Rated secondary voltage (V)	100 or 110						
Rated power-frequency withstand voltage (kV)	38(28)	50	50	70	70	80	80
Rated impulse voltage1.2/50 μs (kV)	95(75)	125	125	170	170	190	190
Rated frequency (Hz)	50/60						
Maximal rated power for accuracy class 0.2 (VA)	25	30	30/10	30	30	30	30
Maximal rated power for accuracy class 0.5 (VA)	75	75	75/25	100	100	100	100
Maximal rated power for accuracy class 1(VA)	150	150	150/50	200	200	200	200
Rated voltage factor	1.2 permanently						
Limiting thermal power (VA)	600	600	600/300	800	800	800-1200	800-1200
Mass (kg)	27.6	36	37	60	53	63	66
Temperature insulation class	E/B						
Type of basic insulation	Cycloaliphatic resin						
Valid standards	IEC61869-1; IEC61869-3						

NOTE:

We can also produce these transformers for primary voltages:

3; 5; 6.3; 11; 15; 22 and 30 kV.

At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

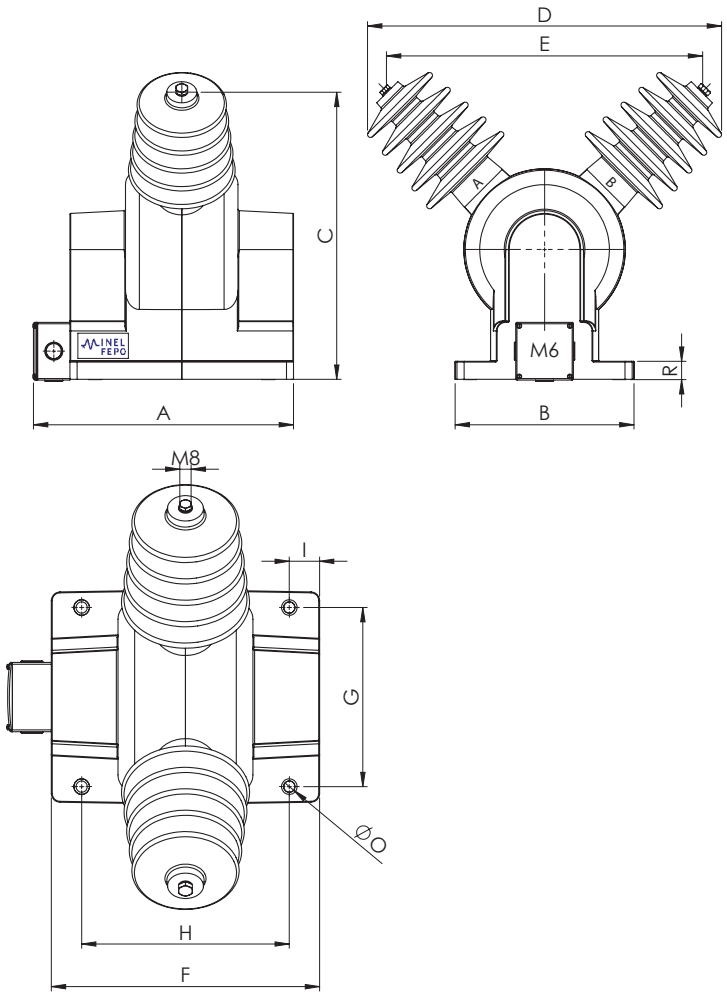
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

We reserve the right to make changes.

* - applies to all models of this type

CONTENTS

NTDSM-12, NTDSM-24, NTDSM-24/12





NTDSM 24

DOUBLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING 12-24 kV
NTDSM-12, NTDSM-24, NTDSM-24/12

Type of transformer	Dimensions (mm)											Mass (kg)
	A	B	C	D	E	F	G	H	I	O	R	
NTDSM-12	320	220	315	370	303	270	183	215	27.5	13	25	~32
NTDSM-24	350	242	430	449	368	300	207	240	30	13	25	~48
NTDSM-24/12	350	242	430	449	368	300	207	240	30	13	25	~49

TECHNICAL DATA	NTDSM-12	NTDSM-24	NTDSM-24/12
Rated primary voltage (kV)	10	20	20/10
Highest voltage for equipment (r.m.s.) (kV)	12	24	
Rated secondary voltage (V)	100; 110 or 230		
Rated power-frequency withstand voltage (kV)	28 (42)	50 (65)	
Rated impulse voltage 1.2/50 μs (kV)	75	125	
Rated frequency (Hz)	50/60		
Maximal rated power for accuracy class 0.2 (VA)	15	15	10(5)
Maximal rated power for accuracy class 0.5 (VA)	75	75	30(15)
Maximal rated power for accuracy class 1 (VA)	150	150	120(50)
Rated voltage factor	1.2 permanently		
Limiting thermal power (VA)	600		
Temperature insulation class	F		
Type of basic insulation	Cycloaliphatic resin		
Valid standards	IEC 61869-1; IEC 61869-3 (ГОСТ 1983)		

NOTE:

We can also produce these transformers for primary voltages: 3; 5; 6; 11; 15 and 22 kV.

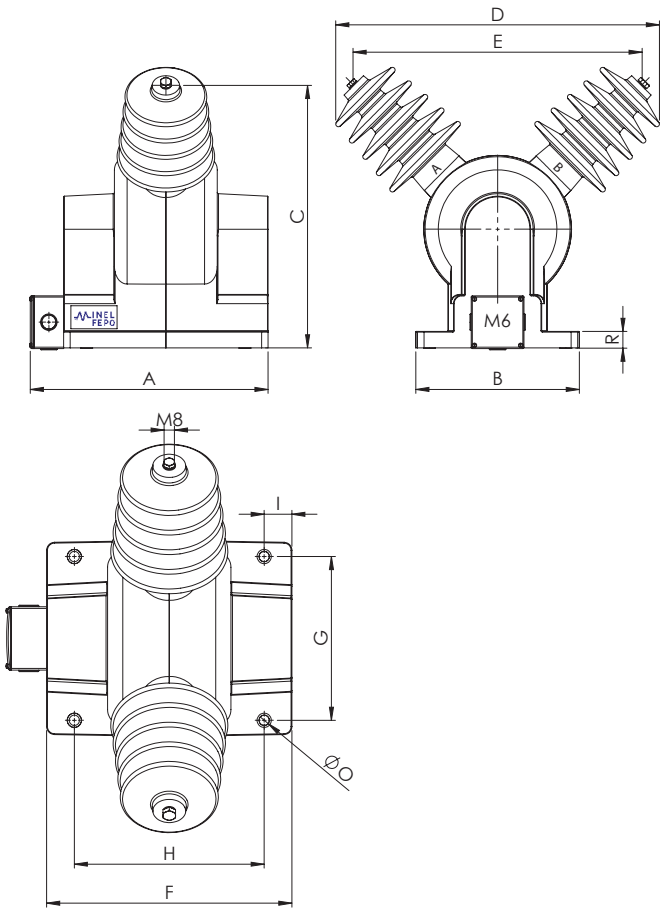
At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

We reserve the right to make changes.

CONTENTS

NTDSM-0,63-12, NTDSM-1,25-12
NTDSM-0,63-24, NTDSM-1,25-24





NTDSM 0,63-12

DOUBLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING 12-24 kV
NTDSM-0.63-12, NTDSM-1.25-12, NTDSM-0.63-24, NTDSM-1.25-24

Type of transformer	Dimensions (mm)											Mass (kg)
	A	B	C	D	E	F	G	H	I	O	R	
NTDSM-0,63-12	320	220	315	370	303	270	183	215	27,5	13	25	~32
NTDSM-1,25-12	320	220	315	370	303	270	183	215	27,5	13	25	~34
NTDSM-0,63-24	350	242	430	449	368	300	207	240	30	13	25	~48
NTDSM-1,25-24	350	242	430	449	368	300	207	240	30	13	25	~50

TECHNICAL DATA	NTDSM-0,63-12	NTDSM-1,25-12	NTDSM-0,63-24	NTDSM-1,25-24
Rated primary voltage (kV)	3; 6; 10		10; 15; 20	
Highest voltage for equipment (r.m.s.) (kV)	12		24	
Rated secondary voltage (V)	218; 224; 230; 236; 242			
Rated power-frequency withstand voltage (kV)	28		50	
Rated impulse voltage 1.2/50 μs (kV)	75		125	
Rated frequency (Hz)	50/60			
Rated power (VA)	630		1250	
No load losses (W)	50		50	
Short-circuit voltage (%)	4,5		4,5±10	
Load losses (W)	55		50	
Rated voltage factor	1.2 x Un / permanently			
Temperature insulation class	E			
Type of basic insulation	Cycloaliphatic resin			
Valid standards	IEC 61869-1; IEC 61869-3 (ГОСТ 1983)			

NOTE:

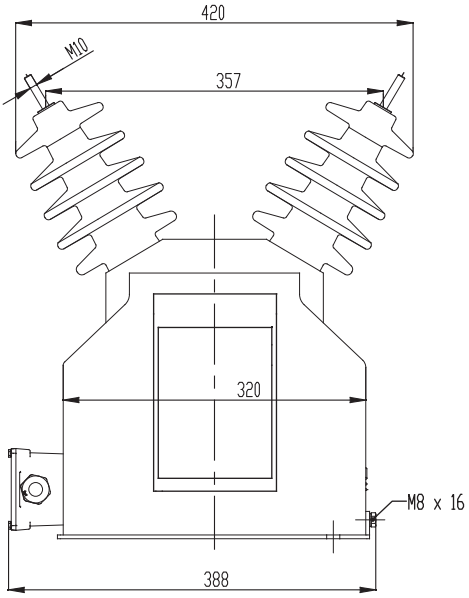
At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

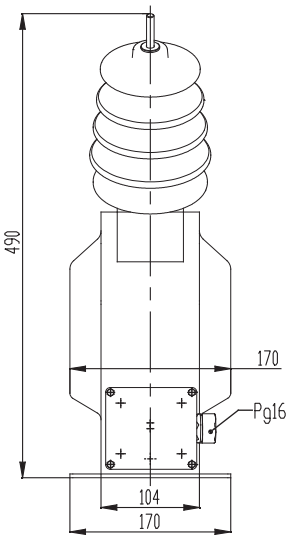
When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

We reserve the right to make changes.

CONTENTS

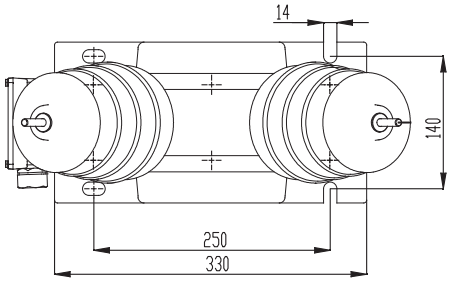
NTDSM-24h, NTDSM-24/12h







NTDSM-24h



DOUBLE-POLE VOLTAGE TRANSFORMERS FOR OUTDOOR MOUNTING **NTDSM-24h, NTDSM-24/12h**

TECHNICAL DATA	NTDSM-24h	NTDSM-24/12h
Rated primary voltage (kV)	20	20/10
Highest voltage for equipment (r.m.s.) (kV)	24	24
Rated secondary voltage (V)	100, 110 or 230	
Rated power-frequency withstand voltage (kV)	50	50
Rated impulse voltage1.2/50 μs (kV)	125	125
Rated frequency (Hz)	50/60	
Maximal rated power for accuracy class 0.2 (VA)	30	30/10
Maximal rated power for accuracy class 0.5 (VA)	75	75/25
Maximal rated power for accuracy class 1 (VA)	150	150/50
Rated voltage factor	1.2 permanently	
Limiting thermal power (VA)	600	600/300
Mass (kg)	36	37
Temperature insulation class	E/B	
Type of basic insulation	Cycloaliphatic resin	
Valid standards	IEC 61869-1; IEC 61869-3	

NOTE:

We can also produce these transformers for primary voltages: 3; 5; 6; 6.3; 11; 15 and 22 kV

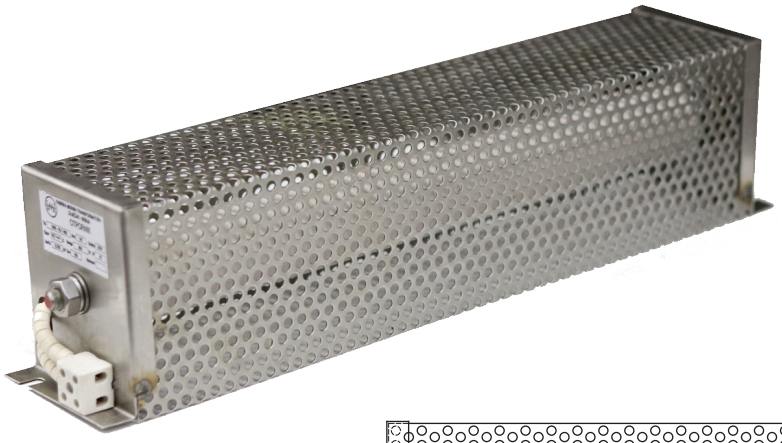
At the customer's request, we can also produce other combinations of indicated transformation ratios, accuracy classes, rated powers and voltage factors.

When ordering, please be sure to specify the rated voltage, accuracy class and rated power for each winding (primary and secondary).

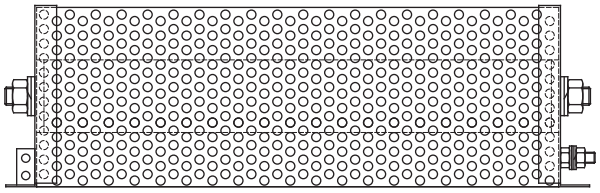
We reserve the right to make changes.

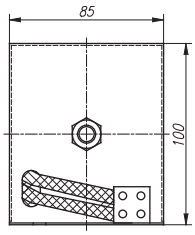
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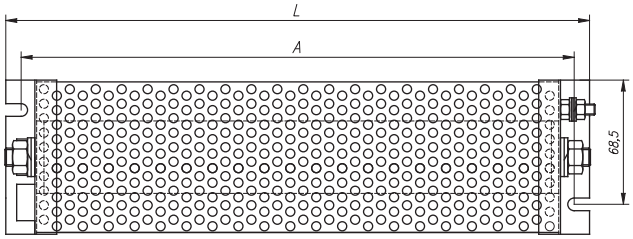
ORN

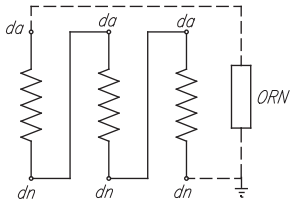


ORN-25/400









Resistor for suppressing ferroresonance
(Connection to open delta tertiary circuit)

FERRORESONANCE PREVENTING RESISTOR **- ORN**

Type of the resistor	For voltage transformers FMT	Power (W)	Resistance (Ω)	L(mm)	A(mm)
ORN-25/400	10 and 20 kV	400W	25Ω	322	305
ORN-16.7/600	35 kV	600W	16.7Ω	432	415

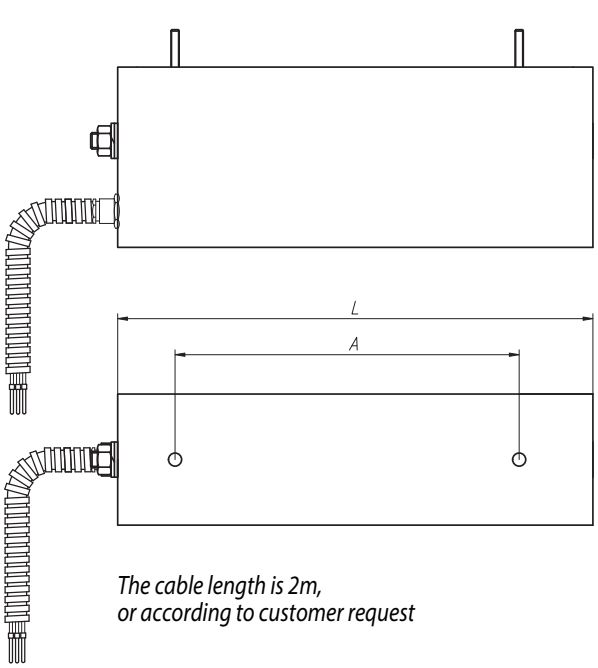
NOTE:

In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, additional resistance must be installed in their tertiary open delta circuit.

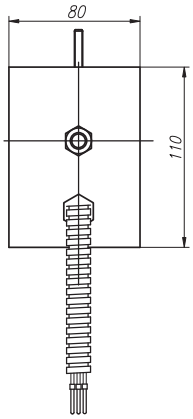
The resistance value is 25 Ω; 400 W for 10 and 20 kV transformers.
For 35 kV transformers, a the resistance is 16-20 Ω; 600 W.

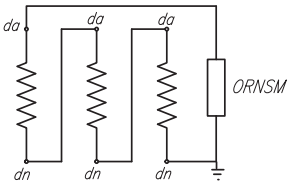
This will significantly reduce the risk of the ferroresonance phenomenon occuring.

ORN SM



The cable length is 2m,
or according to customer request





Resistor for suppressing ferroresonance
(Connection to open delta tertiary circuit)



ORN SM-25/400

FERRORESONANCE PREVENTING RESISTOR FOR OUTDOOR MOUNTING - **ORN SM**

Type of the resistor	For voltage transformers FMT	Power (W)	Resistance (Ω)	L(mm)	A(mm)
ORN SM-25/400	10 and 20 kV	400W	25Ω	290	210
ORN SM-16.7/600	35 kV	600W	16.7Ω	400	320

NOTE:

In order to prevent ferroresonance phenomena, when three single-pole voltage transformers are used in networks with an isolated neutral point, additional resistance must be installed in their tertiary open delta circuit.

The resistance value is 25 Ω; 400 W for 10 and 20 kV transformers.
For 35 kV transformers, a the resistance is 16-20 Ω; 600 W.

This will significantly reduce the risk of the ferroresonance phenomenon occurring.

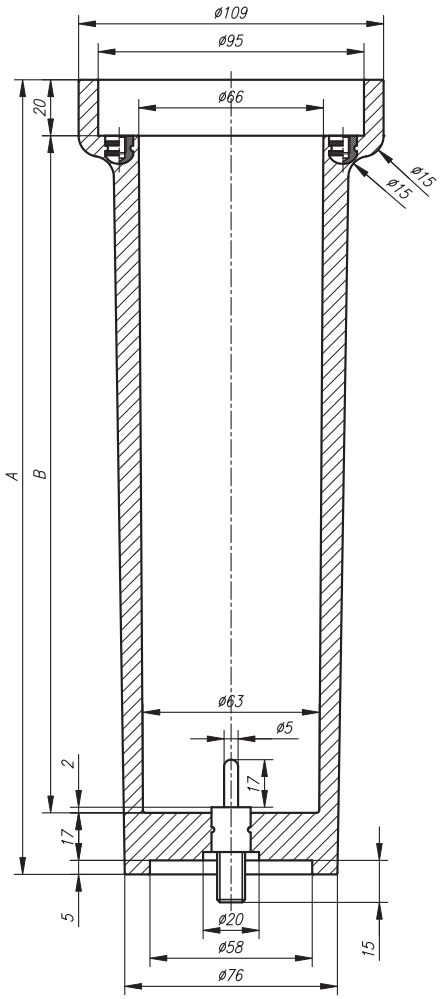
These resistors are standardly installed without on the three-system medium-voltage power measuring assemblies manufactured by FMT.

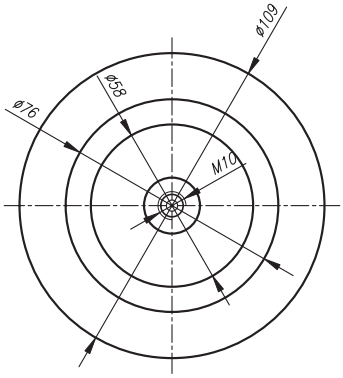
CONTENTS

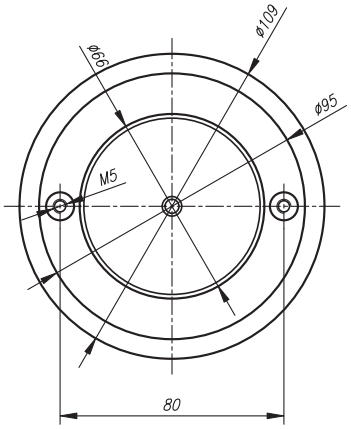
FT-*



FT-12







FUSE HOUSING **FT-***

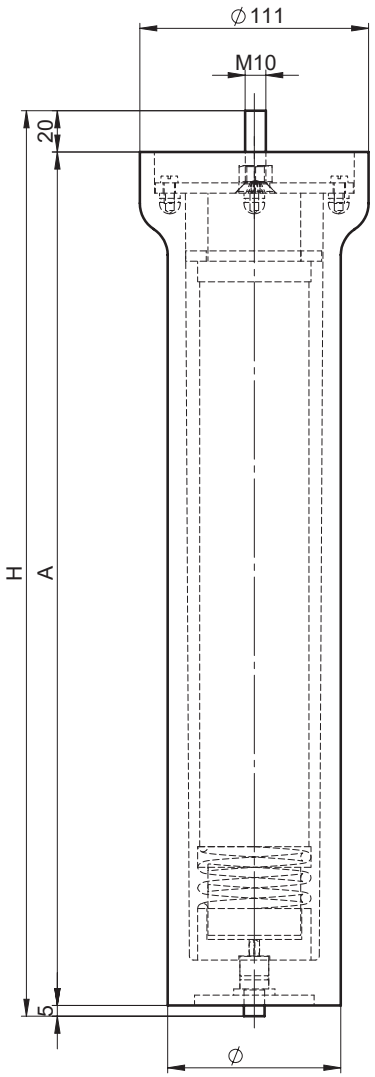
Type of housing	Rated voltage (kV)	A (mm)	B (mm)	Fuse dimensions (mm)	Mass of the enclosure without the fuse (kg)
FT-12	10	179	137	Ø60x160	0.8
FT-24	20	284	242	Ø60x265	1.06
FT-36	35	380	338	Ø60x358	1.44

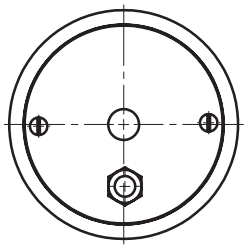
NOTES:

FT fuse housing can be mounted on the voltage transformer in a vertical or horizontal position with the additional element we supply.

We deliver these housings at customer request, with or without fuse cartridges.

VVC-*







KO VVC36kV

FUSE HOUSING **VVC-***

Type of housing	Rated voltage (kV)	A (mm)	H (mm)	Fuse dimensions (mm)	Mass of the enclosure without the fuse (kg)
KO VVC12kV	10	314	339	Ø53x192	1.93
KO VVC24kV	20	414	439	Ø53x292	2.33
KO VVC36kV	35	564	589	Ø53x442	2.88

NOTE:

VVC fuse boxes can only be mounted on a voltage transformer in a vertical position.

We deliver the housings at customer request, with or without fuse cartridges.

CONTENTS







CONTENTS

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NEUTRAL EARTHING RESISTORS FOR MEDIUM-VOLTAGE NETWORKS



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INTRODUCTION 2

OVN-* without disconnectors 4

OVNR- * with disconnectors 6



INTRODUCTION

APPLICATION

The resistors are designed for neutral point grounding in medium-voltage networks. To limit fault current at the neutral points, it is necessary to connect a resistor between the neutral point and the substation grounding grid.

OPERATION

Under normal conditions, the neutral point potential equals the earth potential, so the currents flowing through the neutral point are negligible. These currents are the result of higher harmonics and phase asymmetry.

In the event of a phase-to-earth fault, heavy currents flow through the neutral point. The function of the connected resistor is to limit the current to the prescribed value until the protection system activates. The voltage at the resistor terminals can rise up to the network voltage level. The resistor can withstand an unlimited number of protection activation cycles at an ambient temperature of up to 40°C.

CONSTRUCTION

The resistors are housed in a metal enclosure made of pickled, hot-dip galvanized steel sheet. Alternatively, it can be manufactured entirely from stainless steel, or from a combination of stainless steel and hot-dip galvanized steel sheet.

The resistor elements themselves are metallic and cooled by natural air circulation.

We standardly make the following models of resistors: OVN 6; OVN 12; OVN 21, for rated short-time fault currents of 150; 300; 700; and 1000 A.

The resistor enclosure is made of high-quality steel sheet with a low temperature coefficient, high specific and mechanical resistivity.
Each individual resistor element is cut using a special method to achieve the required resistance and continuous current-carrying capacity.

The upper and lower sections of the resistor element have reinforcements that are insulated from the element itself. These elements are arranged into resistor assemblies which, together with support insulators, form resistor banks. These banks undergo testing equivalent to high-voltage equipment testing.



OVNR2-12/300

The system is equipped with an appropriate current transformer at the inlet toward the neutral point, which is used for connecting protection and signaling devices.

Upon customer request, we can supply the resistor without an inlet current transformer; in this case, we provide an outdoor-mounting current transformer (type ATM or ATMS) to be mounted directly upstream of the resistor toward the neutral point.

An outlet current transformer toward the earth, as well as a heating element for low-temperature winter operation (under snowy conditions), can be installed upon special request.

Also upon special request, the metal enclosure of the resistor can be equipped with disconnectors (one or two) with a manual operating mechanism, linkages, and, if required, an auxiliary switch (with normally open and normally closed contacts); in such cases, the overall enclosure dimensions are increased.

Alternatively, the disconnectors can be housed in a separate metal enclosure, the dimensions of which depend on the disconnector type and the designated voltage level. For these resistors, the suffix "R1" or "R2" is added to the type designation to indicate the number of disconnectors (e.g., OVNR1-6/300 – with one disconnector, OVNR2-6/300 – with two disconnectors).

Due to their dimensions, type OVNR1-21/300 and OVNR2-21/300 resistors are manufactured in two enclosures (an inlet section containing the disconnectors and an outlet section) interconnected by a copper busbar.

CONTENTS

OVN-*

OVN-6/300



OVN-21/300

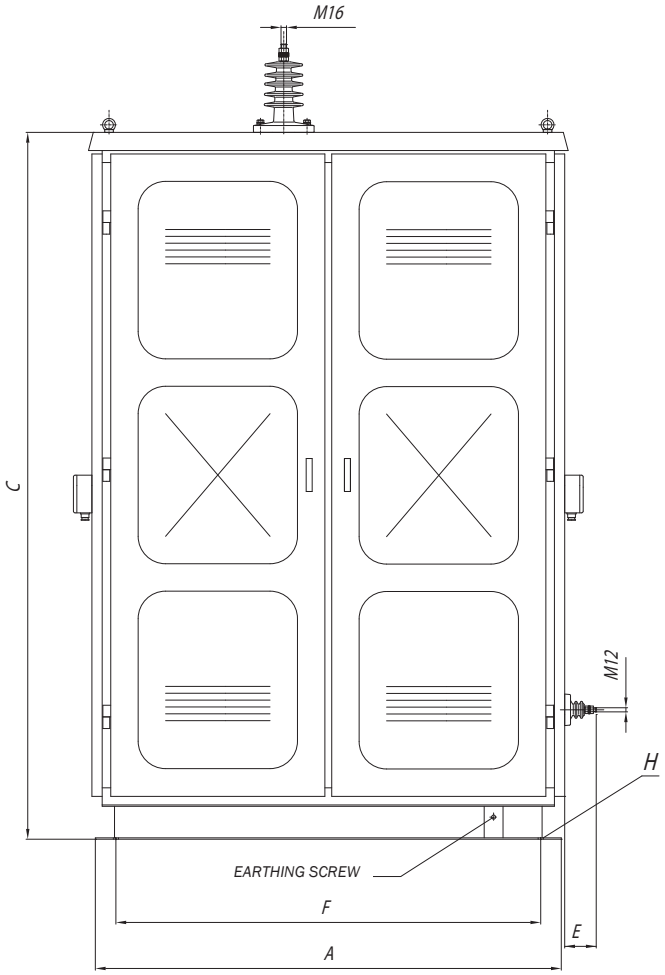


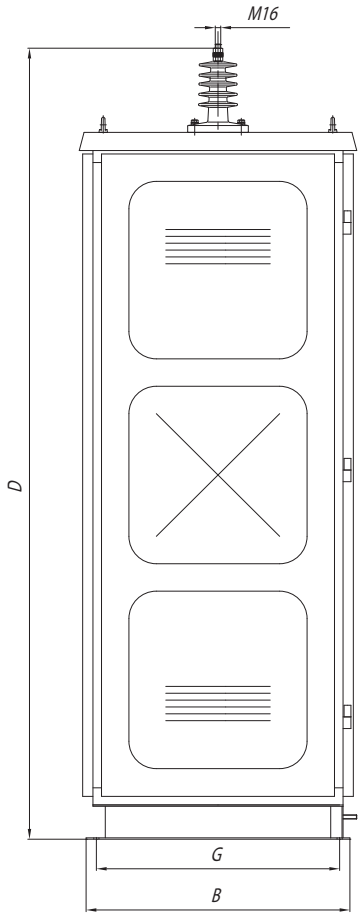
TYPE OF THE RESISTOR	OVN-6/300	OVN-12/300	OVN-21/300
Rated network voltage (kV)	10	20	35
Rated resistor's voltage (kV)	6	12	21
Rated short-time current, 5 sec. (A)	300	300	300
Permissible current / duration	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous
Number of resistor banks	5	10	18
Rated resistance of the resistor bank (at ambient temperature 20°C) (Ω)	4±5%	4±5%	4±5%
Rated resistance of the resistor at +20°C (Ω)	20±5%	40±5%	70±5%
Rated power-frequency withstand voltage 1min, 50Hz (kV)	12	24	42
Degree of mechanical protection	IP23 / IP33		
Valid standards	IEEE 32, IEC 60060-1, IEC 62271-1, IEC 60529, IEC 60071-1		
Inlet bushing insulator	IPSU-12/630	IPSU-24/630	IPSU-38/630
Inlet current transformer	STEM-N-1210	STEM-N-2410	STEM-N-3810
Outlet current transformer	ST-081: 0.72 kV, 50/5 A/A, 5 VA, 5P10		
Mass (kg)	440	850	1420

NOTE:

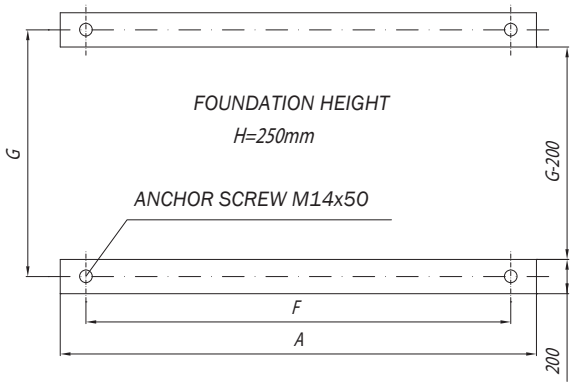
The characteristics of current transformers are customized to meet customer requirements (the resistor can also be configured without a transformer).

Cable entry can also be provided from the bottom side (upon customer request)

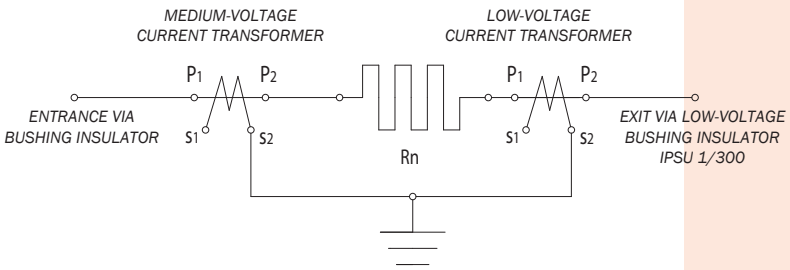




BASE FOUNDATION



SINGLE-POLE SCHEME



TYPE OF THE RESISTOR	A	B	C	D	E	F	G	H
OVN-6/300	1360	770	2065	2212	90	1240	710	Ø17
OVN-12/300	1360	1500	2197	2422	90	1240	1440	Ø17
OVN-21/300	2680	1500	2197	2570	90	2480	1440	Ø17

CONTENTS

OVNR-*



OVNR2-6/300



OVNR2-21/300

A resistor consisting of two housings interconnected by a copper busbar

TYPE OF THE RESISTOR	OVNR1-6/300	OVNR2-6/300	OVNR1-12/300	OVNR2-12/300	OVNR1-21/300	OVNR2-21/300
Rated network voltage (kV)	10	10	20	20	35	35
Rated resistor's voltage (kV)	6	6	12	12	21	21
Rated short-time current, 5 sec. (A)	300	300	300	300	300	300
Permissible current / duration	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous	300A/5s 20A/10min 5A/continuous
Number of resistor banks	5	5	10	10	18	18
Rated resistance of the resistor bank (at ambient temperature 20°C) (Ω)	4±5%	4±5%	4±5%	4±5%	4±5%	4±5%
Rated resistance of the resistor at +20°C (Ω)	20±5%	20±5%	40±5%	40±5%	70±5%	70±5%
Rated power-frequency withstand voltage 1min, 50Hz (kV)	12	12	24	24	42	42
Degree of mechanical protection	IP23 / IP33					
Valid standards	IEEE 32, IEC 60060-1, IEC 62271-1, IEC 60529, IEC 60071-1					
Inlet bushing insulator	IPSU-12/630	IPSU-12/630	IPSU-24/630	IPSU-24/630	IPSU-38/630	IPSU-38/630
Inlet current transformer	STEM-N-1210	STEM-N-1210	STEM-N-2410	STEM-N-2410	STEM-N-3810	STEM-N-3810
Outlet current transformer	ST-081: 0.72 kV, 50/5 A/A, 5 VA, 5P10					
Disconnector	JRUK-12/630	JRUK-12/630	JRUK-24/630	JRUK-24/630	JRUK-38/630	JRUK-38/630
Mass (kg)	600	650	1020	1075	1816	1856

NOTE:

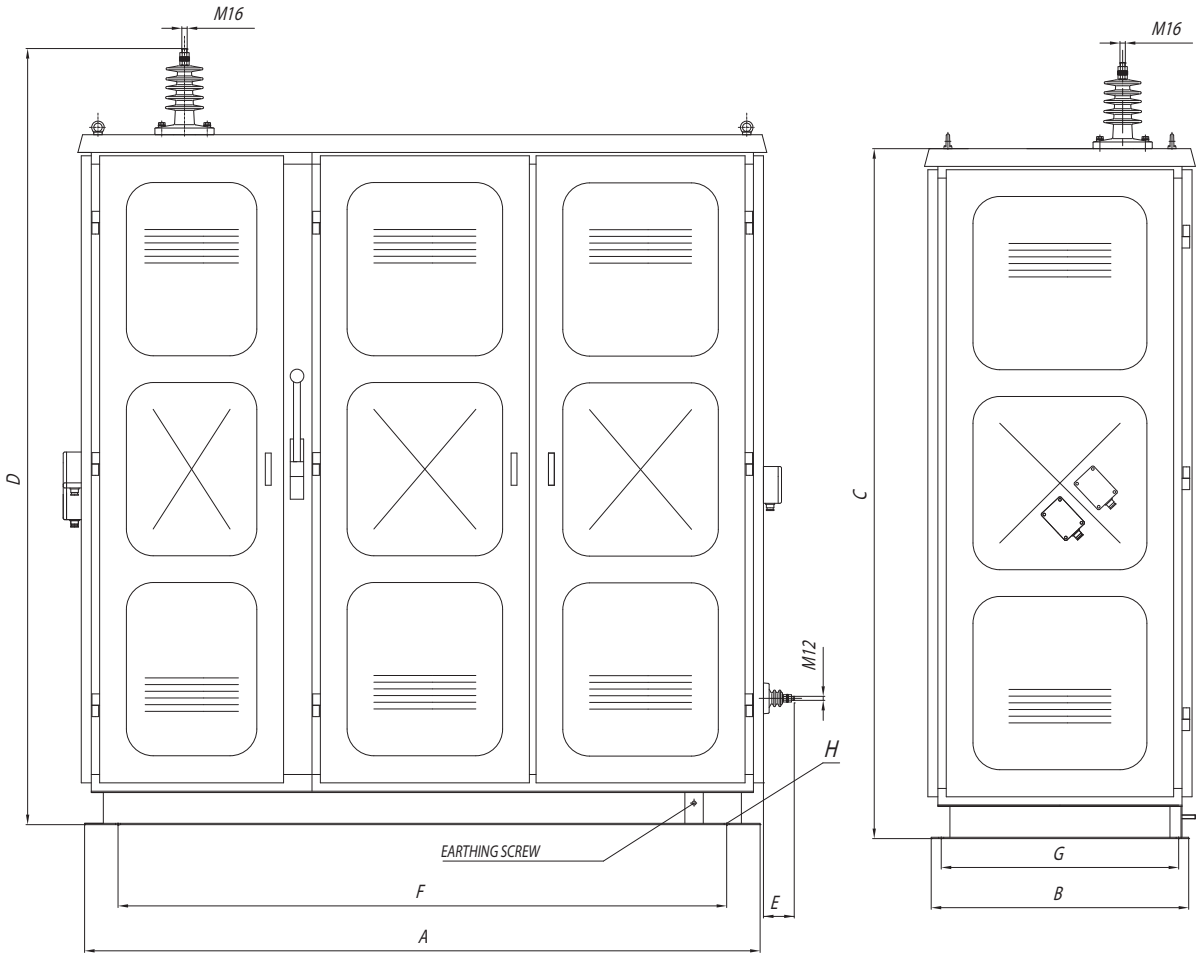
- Characteristics of the current transformers can be adapted to meet the customer's requirements (the resistor can also be made without the current transformers)

- Bottom cable entry is also available.

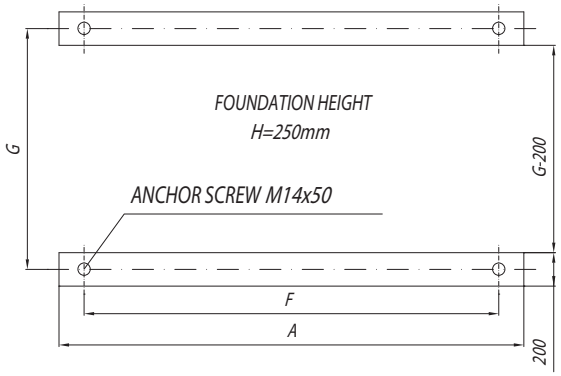
- The designation "R1" in the model type mark indicates that the resistor is equipped with 1 disconnector; "R2" has 2 disconnectors.

TYPE OF THE RESISTOR	A	B	C	D	E	F	G	H
OVNR1-6/300	2020	770	2065	2212	90	1820	710	Ø17
OVNR2-6/300	2150	770	2065	2212	90	1950	710	Ø17
OVNR1-12/300	2020	1500	2197	2422	90	1820	1440	Ø17
OVNR2-12/300	2020	1500	2197	2422	90	1820	1440	Ø17
OVNR1-21/300	2020	1500	2197	2570	90	1820	1440	Ø17
	1360	1500	2197	2422	90	1240	1440	Ø17
OVNR2-21/300	2130	1500	2197	2570	90	1930	1440	Ø17
	1360	1500	2197	2422	90	1240	1440	Ø17

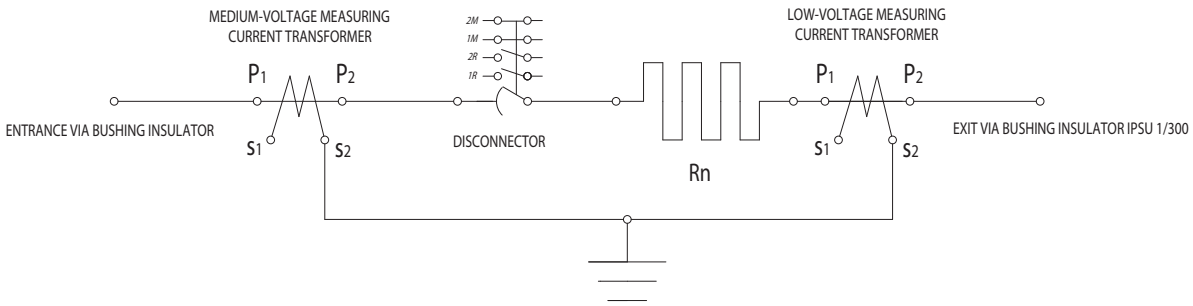
CONTENTS



BASE FOUNDATION



SINGLE-POLE SCHEME



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BILLING METERING ASSEMBLIES FOR POLE-MOUNTED SUBSTATIONS



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INTRODUCTION 2

ASSEMBLY ELEMENTS 3

SUPPOTING STRUCTURE 3

FUSE HOLDERS 3

VOLTAGE TRANSFORMERS 4

CURRENT TRANSFORMERS 5

CORRECT INSTRUMENT TRANSFORMER SELECTION 5

INDIRECT THREE-SYSTEM METERING UNIT 6

CONNECTION DIAGRAMS FOR THREE-SYSTEM METERING 7

SMST-V1 8

SMST-V2 12

SMST-V3 15

POLE INSTALLATION OF THE THREE-SYSTEM ASSEMBLY 18

INTRODUCTION

In accordance with the EPS (Elektroprivreda Srbije) Tariff System, prices are determined for the active and reactive electrical energy taken, as well as for the maximum active power, which differ depending on the voltage level at which the billing metering is performed.

For connections at higher voltage levels, the consumer's share of the costs for the construction of power facilities (per 1 kW) is higher, but the prices for the active and reactive energy consumed and for the maximum active power are lower.

The consumer has the right to choose the voltage level for billing, according to their specific needs.

From a long-term perspective, it is more cost-effective for the consumer to pay at a higher voltage level, provided that the maintenance of the power facility does not present an undue burden.

From the perspective of the electricity supplier, delivery at a higher voltage level is preferable for at least two reasons:

- The bill includes losses in the power transformer and in transmission up to the metering point;
- There is no obligation to maintain the facility since, according to legal regulations, the supplier's jurisdiction extends up to the metering point (including the metering point itself).

Investors who wish to retain ownership of the pole-mounted substation would not, formally, be able to achieve this without such a solution, due to the provisions of the Law on Energy stating that the boundary of jurisdiction is the metering point.

Until 15 years ago, the application of revenue metering at 10 kV, 20 kV, and 35 kV levels was only possible in indoor transformer substations, where the instrument transformers were installed in metal-enclosed metering (and connecting-metering) cubicles within the 10 kV, 20 kV, or 35 kV switchgear.

Given that the proposer of this solution – the Instrument Transformer Factory Zaječar – has in its production program all the elements necessary for outdoor billing metering, the idea for this project was born, with the aim of offering a mutually beneficial solution to both interested power distribution companies and investors.

The solution offered by this project is the SMST BILLING METERING ASSEMBLY (hereinafter referred to as SMST) for outdoor installation. It can be installed primarily on pole-mounted transformer substations, but also at points of separation from the 10 kV, 20 kV, or 35 kV overhead lines (cables, 10 kV, 20 kV, or 35 kV aerial bundled cables - ABC) to supply consumers at the 10 kV, 20 kV, and 35 kV levels.

This project provides for three variants of the SMST assembly for **three-system indirect metering** on pole-mounted substations:

- **SMST V1** - Consists of 3 current and 3 voltage measuring transformers with high-voltage high-rupturing-capacity (HV HRC) fuses that protect the supply lines and the power transformer from short circuits;
- **SMST V2** - Consists of 3 current and 3 voltage measuring transformers with HV HRC (VVC) fuses that protect the voltage measuring transformers and other elements from short circuits;
- **SMST V3** - Consists of 3 current and 3 voltage measuring transformers with appropriate connections (without HV fuses).

ELEMENTS

The THREE-SYSTEM BILLING METERING ASSEMBLY basically consists of:

- **A supporting structure**;
- **3 single-pole HV fuse holders with HV fuses** (except for variant 3);
- **3 single-pole insulated voltage measuring transformers** 10/√3 kV/kV, 20/√3, or 35/√3 kV/kV;
- **3 current measuring transformers** of insulation level 20 kV or 35 kV;
- **1 resistor** for protecting voltage measuring transformers from ferroresonance, which is connected in series into the tertiary circuit of 3 single-pole voltage measuring transformers in networks with an isolated neutral point (isolated star point);
- **A complete indirect three-system metering unit** in a separate cabinet on the pole-mounted substation itself **(not an integral part of the SMST assembly).**

NOTE: For the 35 kV voltage level, 2 metering groups are provided - one for billing metering and the other for quality control. Both should be bidirectional so that the assembly can be used with solar power plants.

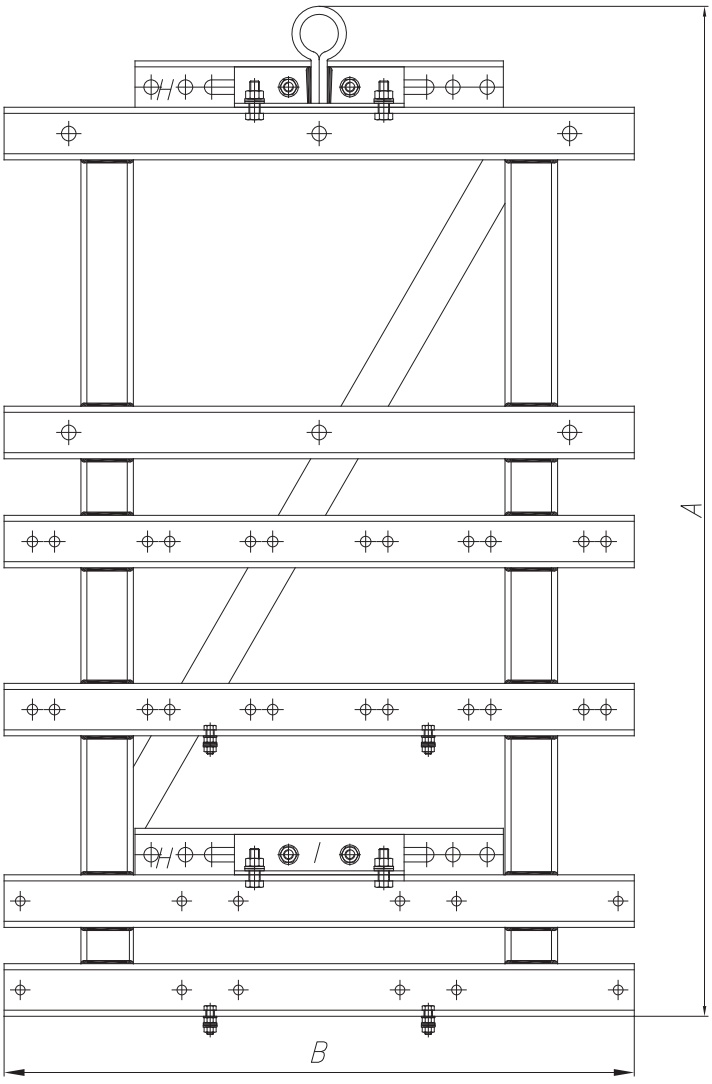
Metering groups are not an integral part of the SMST assembly. On request, we can also make an assembly for two-system billing metering, which is covered in a separate brochure material.

Supporting Structure

The supporting structure is metal, composed of welded aluminum profiles 60x40mm.

It is intended for mounting on a round utility pole stem of an overhead network, via 2 general-purpose brackets, which are made of standard steel channel profile NP U6.5, with U-bolts adapted to the installation height. The supporting structure connects to the general-purpose brackets using 2 connectors, made of standard angle profile NP L 5.

Steel parts are protected from corrosion by the hot-dip galvanizing process.



Supporting structure

HV Fuse Holders

The applied fuse holders are on apparatus post insulators of type C4-125, which are certified for an operating voltage of 20 kV, respectively C4-170d for an operating voltage of 35 kV.

The fuse clips (grips) for the HV fuses are made of hard copper, protected against corrosion by electrolytic tin plating.

Mechanical safety latches for protecting the HV fuse links from falling out are steel, galvanized.

CONTENTS

Voltage measuring transformers

For three-system metering, dry-insulated single-pole voltage transformers are used, cast in cycloaliphatic resin and intended for outdoor installation, for vertical and horizontal placement.

The magnetic cores of these transformers are of the laminated type, and the windings are made of copper, executed as layered. This ensures a rational distribution of radial and axial stresses, as well as good endurance against power-frequency overvoltages and impulse overvoltages.

Since the transformers are completely cast, a body with a smooth surface is obtained, made of one piece, whose homogeneity ensures high dielectric strength and mechanical endurance.

They are connected between phase and earth and are harmonized with standards: IEC, CSA, VDE, ANSI, BS, GOST, and SRPS.

Characteristics of Dry Voltage Measuring Transformers:

- These transformers cannot catch fire, and the insulation cannot leak out;
- They are of smaller dimensions because they have special electromagnetic field absorbers;
- The insulation does not change characteristics at extreme temperatures from -50°C to +50°C;
- It is possible to place the transformers anywhere and in any position;
- There is no need for maintenance;
- They do not pollute the environment;
- They are quiet during operation – they do not produce noise;
- The outer surface is smooth and rounded and does not retain dust;
- Their service life is longer under operating conditions – they are highly reliable;
- They are of smaller dimensions, cost less, and installation is easier and cheaper.

Technical characteristics of voltage measuring transformers

Type	JNT SM-12	JNTm2 SM-24	JNT SM36-6R
Highest voltage for equipment (kV)	12	24	38(36)
Rated primary voltage (kV)	10/√3	20/√3	35/√3
Rated secondary voltage (V)	100/√3	100/√3	100/√3
Power-frequency withstand voltage 50 Hz, 1 min. (kV)	28	50	70
Impulse withstand voltage 1.2/50μs (kV)	75	125	170
Rated frequency (Hz)	50/60		
Rated accuracy class	0,5	0,5	0,5 (0,2)
Rated poser (VA)	30	30	30 (15)
Creepage distance (mm)	500	535	920
Mass(kg)	26	28	43
Thermal insulation class	E/B		
Type of main insulation	Cycloaliphatic resin		
Mounting	Outdoor		
Operating temperature range	-50°C to +50°C		
Valid standards	IEC 61869-1, IEC 61869-3		

Resistor

In case the assembly is used in networks with an isolated neutral point, the voltage measuring transformers are protected from ferroresonance via resistors (25 Ω, 400 W for 10 and 20 kV, respectively 16.6 Ω, 600 W for 35 kV), which are located in the open-delta circuit of the residual windings of the 3 voltage transformers.

Current measuring transformers

They can be placed in vertical and horizontal positions.

Technical characteristics of current measuring transformers:

Technical data	ATMS-2411	ATM-3820h (ATM-3821h)
Rated voltage (kV)	20	35
Highest voltage for equipment (kV)	24	38(36)
Power-frequency withstand voltage 50 Hz, 1 min. (kV)	50	70
Impulse withstand voltage 1.2/50μs (kV)	125	170
Rated frequency (Hz)	50/60	
Rated primary current (A)	2x5 do 2x600	
Rated secondary current (A)	5 (or 1)	
Rated short-time thermal current, 1s	I_{th}=(100-200)In	
Rated dynamic current	$I_{dyn}=2,5I_{th}$	
Rated continuous thermal current	$I_{cth}=1,2I_n$	
Instrument security factor	FS5	
Rated burden (VA)	10	15/15
Rated accuracy class	0,5	0,2; 0,5 (0,2s; 0,5s)
Number of cores	1	2
Creepage distance (mm)	570	1296
Mass kg)	~15	~54
Thermal insulation class	E/B	
Type of main insulation	Cycloaliphatic resin	
Mounting	Outdoor	
Operating temperature range	-50°C to +50°C	
Valid standards	IEC 61869-1, IEC 61869-2	

CORRECT SELECTION OF MEASURING TRANSFORMERS FOR THE ASSEMBLY

For three-system metering, 3 current and 3 **voltage measuring transformers** for outdoor mounting are required, of the rated voltage level of the network on which the metering is performed. It is important that the transformation ratio and power of the measuring transformers are determined as accurately as possible, so that the metering is as precise as possible.
The primary voltage of the voltage measuring transformers is the phase voltage of the network (for three-pole assemblies 10/√3, 20/√3, or 35/√3 kV, and for two-pole 10, 20, or 35 kV). The secondary voltage of the voltage measuring transformers is 100//√3 V or 110/√3 V.
The rated power of the secondary and/or tertiary windings should include the consumption of the connected measuring or protective devices supplied in that circuit plus the Joule power losses in the lines themselves, which are given in the table below.

Consumer	Power consumption per system (W/m)
Cu conductor 1m 2,5mm² at 5A	0.18
Cu conductor 1m 4mm² at 5A	0.11
Cu conductor 1m 1,5mm² at 1A	0.012
Cu conductor 1m 2,5mm² at 1A	0.007
Cu conductor 1m 4mm² at 1A	0.0044

The primary current of current measuring transformers is the line current calculated according to the power of the power transformer in front of which the assembly is placed and is rounded to the nearest higher standard value. Since the power transformer itself is not always loaded with the rated power, it is necessary to determine as realistically as possible the rated primary current of the current transformers, which is calculated according to the formula:

$$I(A) = \frac{Sn(kVA)}{\sqrt{3}\,Un(kV)}$$

The rated values of primary currents I_{1n} are 5 - 7.5 - 10 - 12.5 - 15 - 20 - 25 - 30 - 40 - 50 - 60 - 75 A or their integer decimal multiples.

The secondary current of current measuring transformers can be 5 A or 1 A. The rated power of each secondary winding of the current measuring transformer should include the consumption of all measuring or protective devices connected to the secondary terminals of that secondary winding plus the Joule power losses in the lines themselves according to the given table.
Standard powers of the secondary windings of voltage measuring transformers are 5, 10, 25, and 50 VA, and of the measuring cores in current measuring transformers are 2.5, 5, 10, 15, and 30 VA.

CONTENTS

Indirect metering unit

The metering of consumed electrical energy and peak (maximum reached 15-minute power in the billing period) is provided using a three-system metering group for indirect metering, on the 10 kV, 20 kV, or 35 kV side, located in a separate cabinet, which is placed on the pole stem.

A metering group with a multi-functional digital meter for three-system metering is recommended.

Through the meter, the following are also performed:

- Metering of consumed active electrical energy in 2 tariffs, Class 1;
- Metering of consumed reactive electrical energy in 2 tariffs, Class 3;
- Metering of the reached maximum of 15-minute active power, in 2 tariffs, Class 1;
- Reception of MTK (ripple control) telegrams;
- Memorizing the state of the power maximum for the 12 last reading cycles.

The meter should be approved for use by the Federal Bureau of Measures and Precious Metals and accepted for use in the consumption area.

For networks of rated voltage 35 kV, the installation of two metering groups is provided. One is a metering group for bidirectional metering (intended for measuring electrical energy in both directions in solar power plants), and the second metering group is intended for measuring the quality of electrical energy.

The factory does not supply the metering unit and the cabinet as part of the SMST, but if customers wish, they can order them separately.

The cabinet also contains:

- A metering connection box with 3 automatic circuit breakers 6 A and a sealed transparent cover;
- Conductors for wiring, small materials, and accessories.

The connection between the voltage measuring transformers and the metering group is established using a 1 kV cable, type PP, cross-section 4x1.5 mm^2, and between the current measuring transformers and the metering group using a 1 kV cable, type PP, cross-section 6x2.5 mm^2.

The number of cables going to the electrical energy meter depends on the number of metering groups.
All cables are individually placed in flexible galvanized steel conduits, and all connection points are sealed.
The conduits are fastened to the pole with straps made of stainless material, at a distance of 1 m.

EARTHING OF EQUIPMENT

All provided equipment is insulated.
The secondary circuits of current measuring transformers are earthed directly on the terminals of the current measuring transformers and connect to the supporting metal structure.
The same applies to the secondary circuits (windings) of voltage measuring transformers.

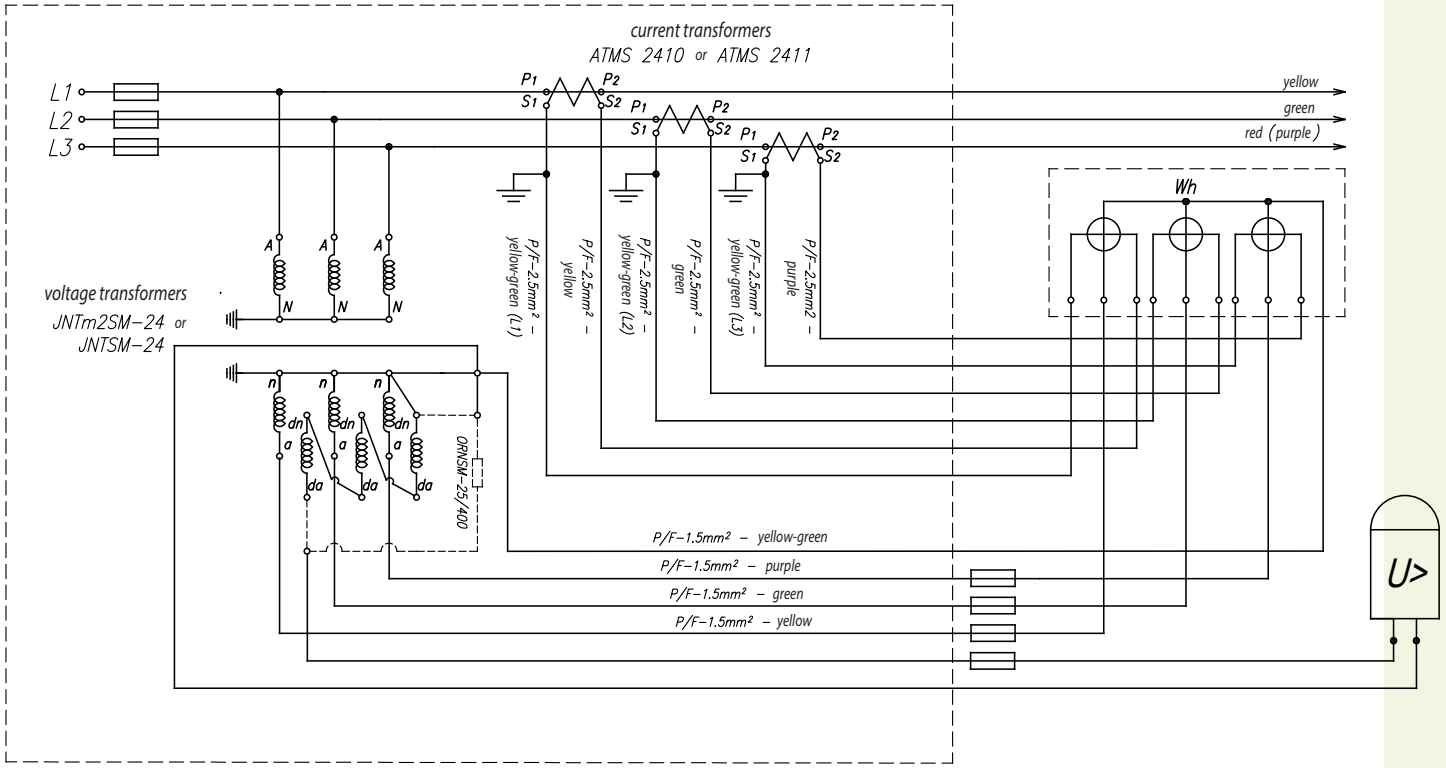
The supporting structure connects to the collective earth conductor of the pole using the ELDS kit, which is not an integral part of the SMST but can be ordered specially.
For this purpose, a hole with an opening of 13mm is provided on the upper bar of the structure. As the supporting structure has a profile cross-section greater than 100 mm^2, it is used as part of the earth conductor for connecting the earthing of the equipment it carries.

PROTECTION AGAINST HAZARDOUS TOUCH VOLTAGE

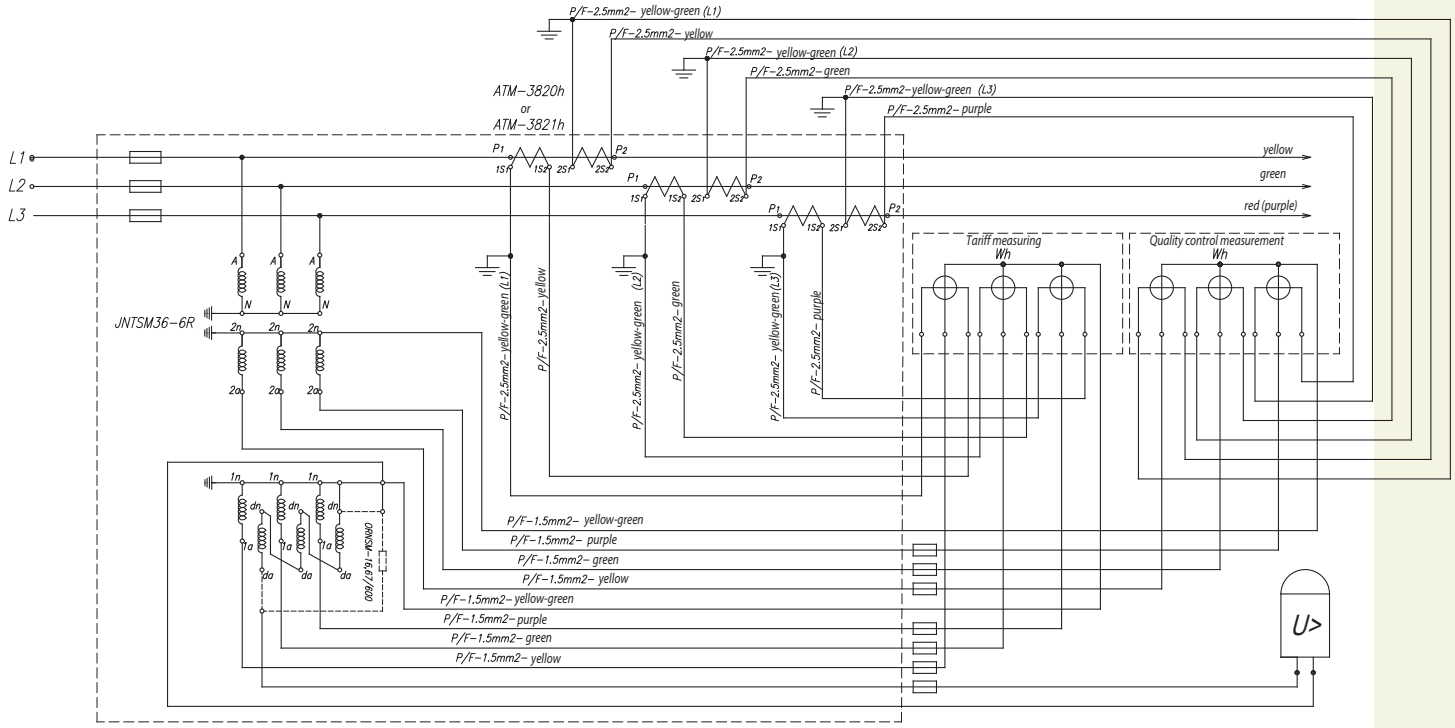
The height from the ground to the unprotected live parts of the equipment is greater than 5 m, and all cables up to a height of at least 2 m have mechanical protection, earthed to the earth conductor of the pole-mounted substation.

All provided supply lines are of appropriate construction and supplied with the necessary insulations or placed in protective pipes, and their correct entry into cabinets and protective housings of electrical equipment is also provided.

CONNECTING DIAGRAMS FOR THREE-SYSTEM METERING



Three-pole connecting diagram for three-system metering for 20 kV



Three-pole wiring diagram for three-system metering for 35 kV

ASSEMBLY FOR THREE-SYSTEM BILLING METERING SMST-V1



SMST - VARIANT 1

In the direction of power flow, the SMST connects directly behind (below) the switch-disconnector with surge arresters, and in front of the power transformer, as shown in the attached drawings.

In the case of mounting the SMST on existing pole-mounted transformer substations, the HV HRC fuses located above the power transformer should be removed, thereby achieving the necessary protection and freeing up space to accommodate the SMST.

Protection of all elements of the SMST (and the power transformer) is primarily via HV HRC fuses (25 A or 31.5 A), and secondarily (on the 100 V side), the metering group is protected via 3 automatic fuses 6 A, in the connection box.

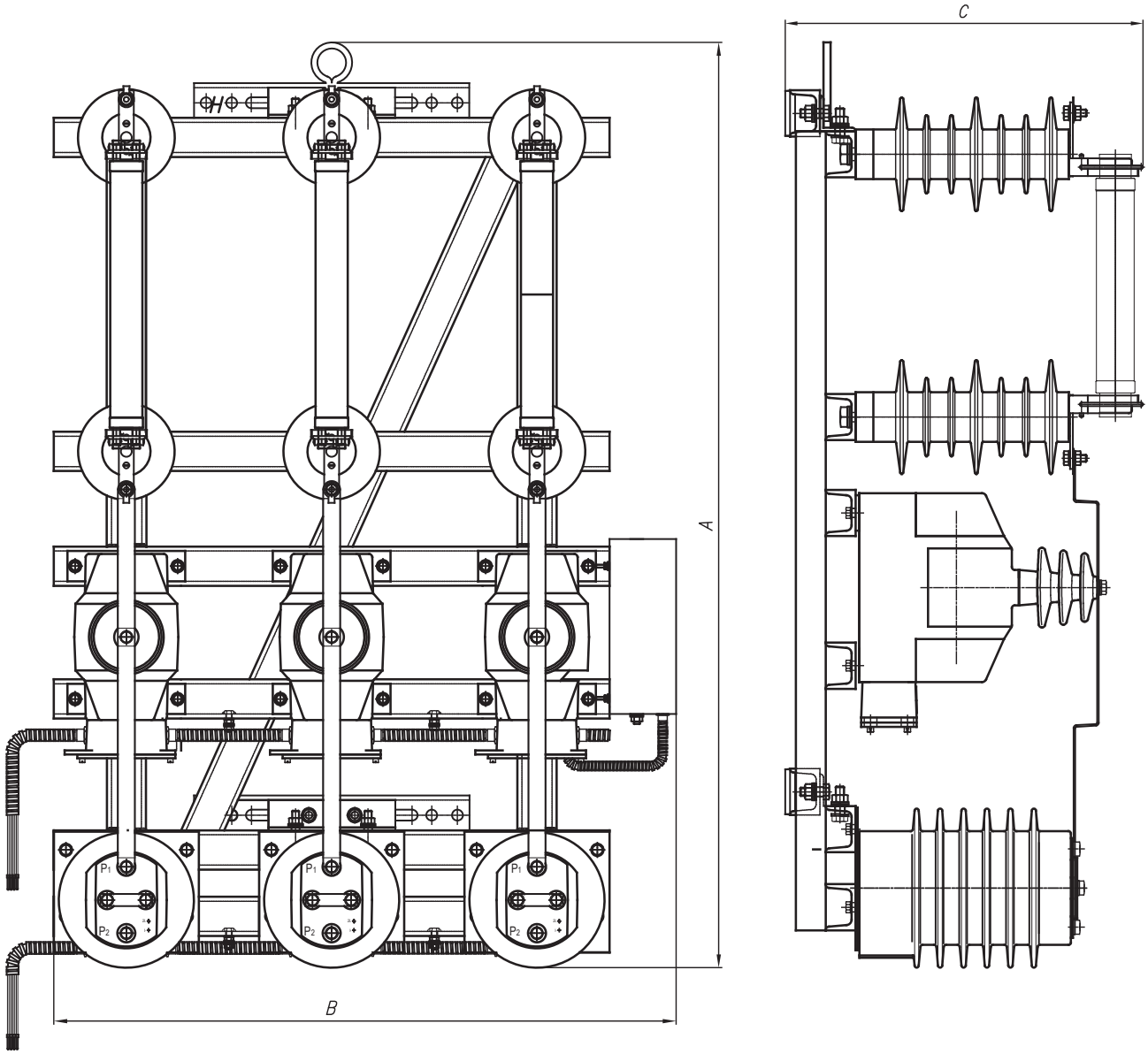
Special protection (against overload and short circuit) of the voltage measuring transformers is not provided. The reason should be sought in the facts that special HV HRC fuses for this purpose require an increased envelope size of the equipment, that failures on voltage measuring transformers are very rare, and even if they happen – due to the circumstance that the primary current values are very small (below 1 mA), and the primary windings of the voltage measuring transformer are of a very small cross-section, the eventual failure is interrupted locally without consequences.

In case the assembly is used in networks with an isolated neutral point, the voltage measuring transformers are protected from ferroresonance via resistors (25 Ω, 400 W for 10 and 20 kV, respectively 16.6 Ω, 600 W for 35 kV), which are located in the open-delta circuit of the residual windings of the 3 voltage transformers.

This protection is provided in case the assembly is used in isolated networks, but it does not interfere if it is installed in other networks. The SMST can be placed on the side opposite to the placement of the power transformer or on the same side, and the connection between the SMST and the power transformer is executed with single-core cables X00-A, 1×35 mm^2 (from a 10, 20, or 35 kV aerial bundled cable - ABC), with cable terminations for outdoor mounting on both sides. The cable is attached to the end of the SMST on one side, and on the other directly to the 10 kV (20 kV or 35 kV) insulators on the power transformer.

SMST-V1 is also often used when technical conditions provide for the assembly to be placed on a pole before the pole carrying the pole-mounted substation. In that case, the fuses protect the supply line supplying the pole-mounted substation from short circuits as well, and the technical conditions provide for a disconnector and the SMST-V1 assembly to be placed on a special pole.

CONTENTS



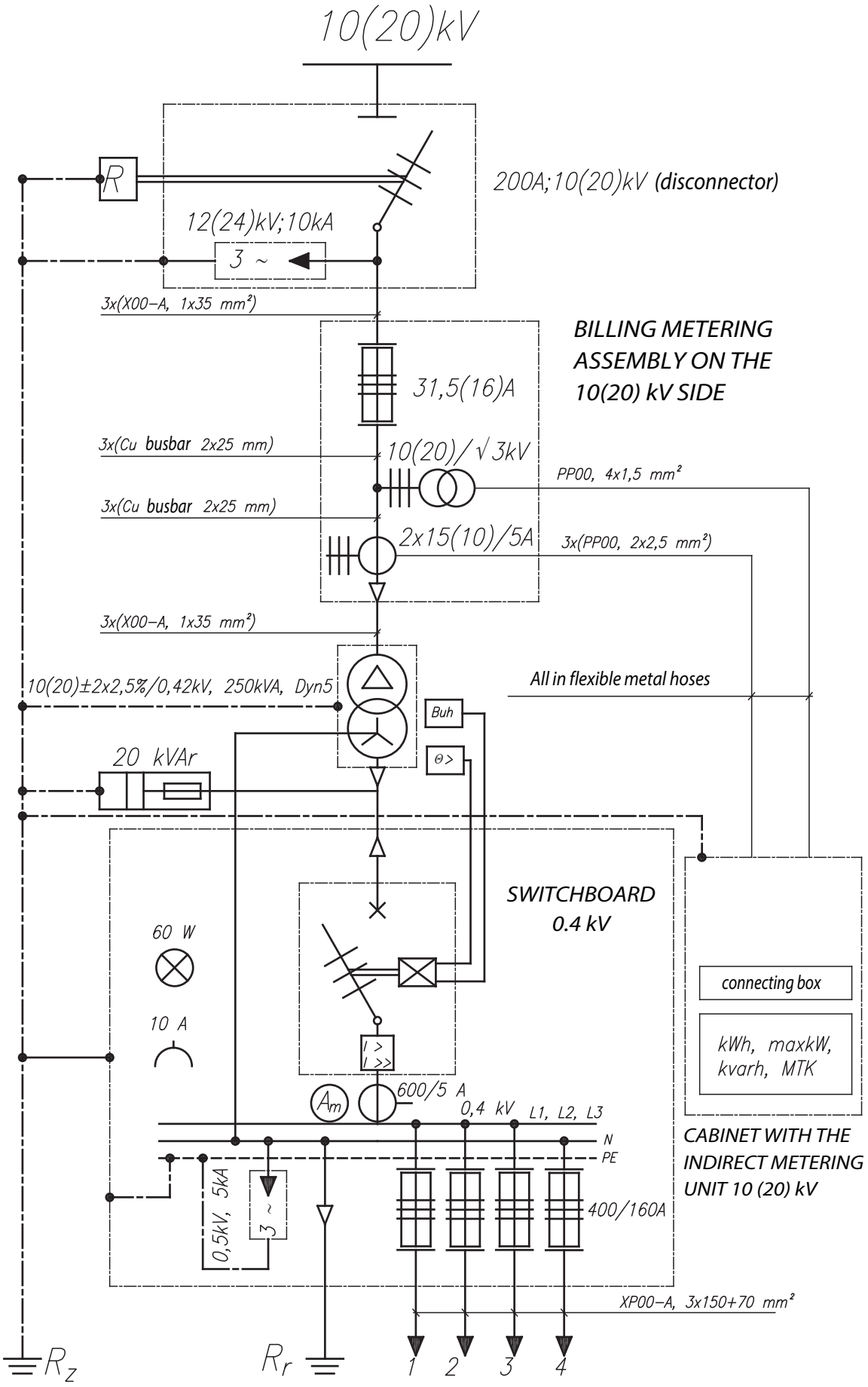
ASSEMBLY FOR THREE-SYSTEM BILLING METERING ON THE 10 kV, 20 kV and 35 kV SIDE

Item No.	Description	Designation*	Dimensions AxBxC (mm)	Dimensions of the supporting structure (mm)	Current transformer	Voltage transformer	Fuse base	Mass (kg)
1	Assembly for three-system billing metering on 10 kV side	SMST-12-3-V1	1302.5x970x503.5	1125x860x80	ATMS-2411	JNT SM-12	PVOs-12	182
2	Assembly for three-system billing metering on 20 kV side	SMST-24-3-V1	1532.5x1030x503.5	1382,5x920x80	ATMS-2411	JNTm2 SM-24	PVOs-24	221
3	Assembly for three-system billing metering on 35 kV side	SMST-36-3-V1	1812x1230x635	1687x1120x85	ATM-3821h	JNT SM-36-6R	PVOs-38	390

NOTE: Dimensions and weights of the assembly may deviate from those given in the table above depending on the characteristics of the assembly. We reserve the right to make modifications.

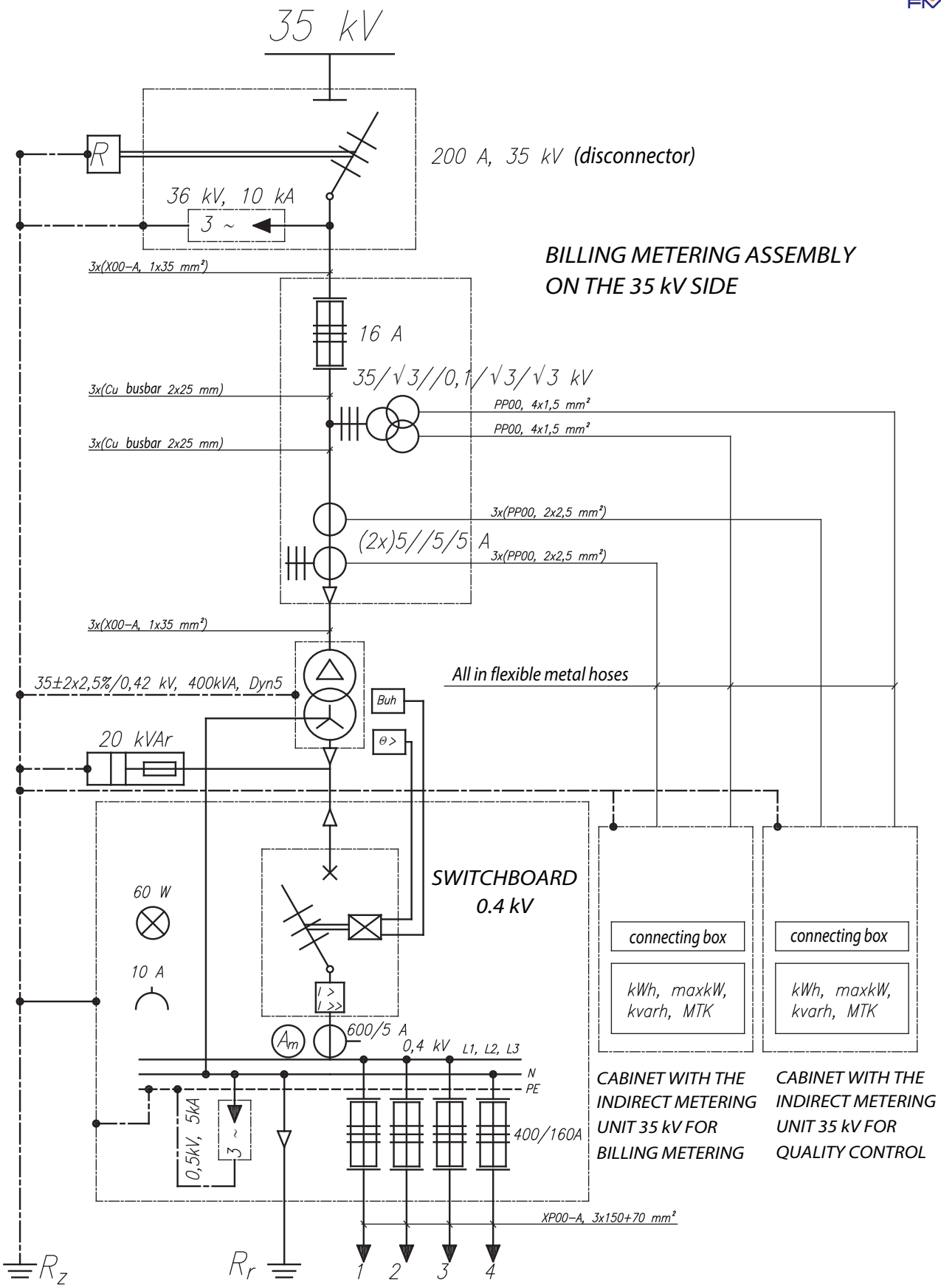
* • **Designation interpretation:** SMST-Um-3-V1(V2/V3) - assembly for three-system indirect metering on pole-mounted substations for maximum voltage Um(kV).

CONTENTS



Single-pole connecting scheme for three-system measuring at 10(20) kV side, SMST-12-3-V1 (SMST-24-3-V1)

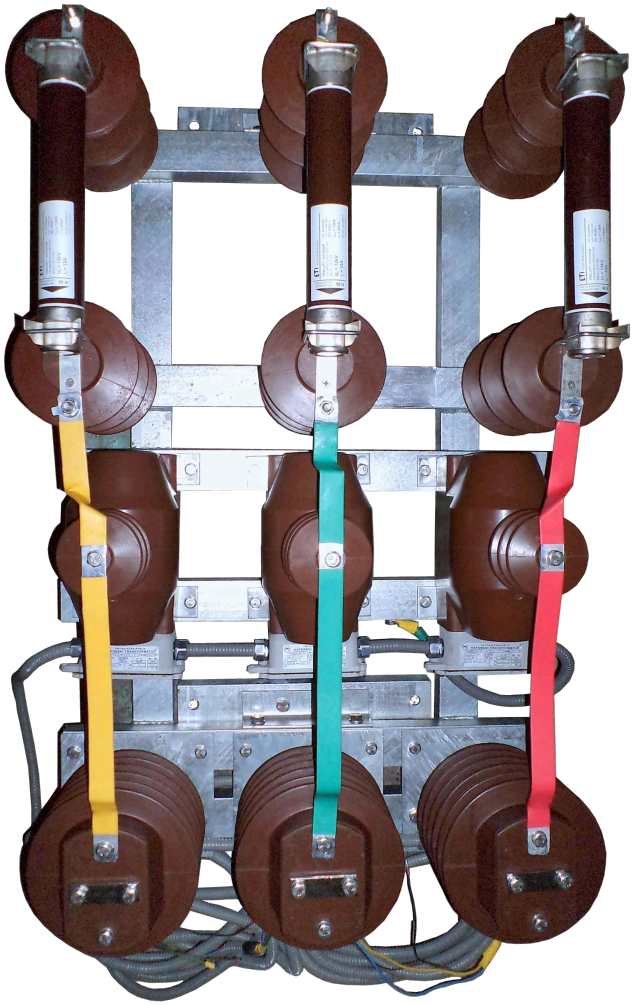
CONTENTS



Single-pole connecting scheme for three-system measuring on the 35 kV side,
SMST-35-3-V1

CONTENTS

ASSEMBLY FOR THREE-SYSTEM BILLING METERING SMST-V2



SMST - VARIANT 2

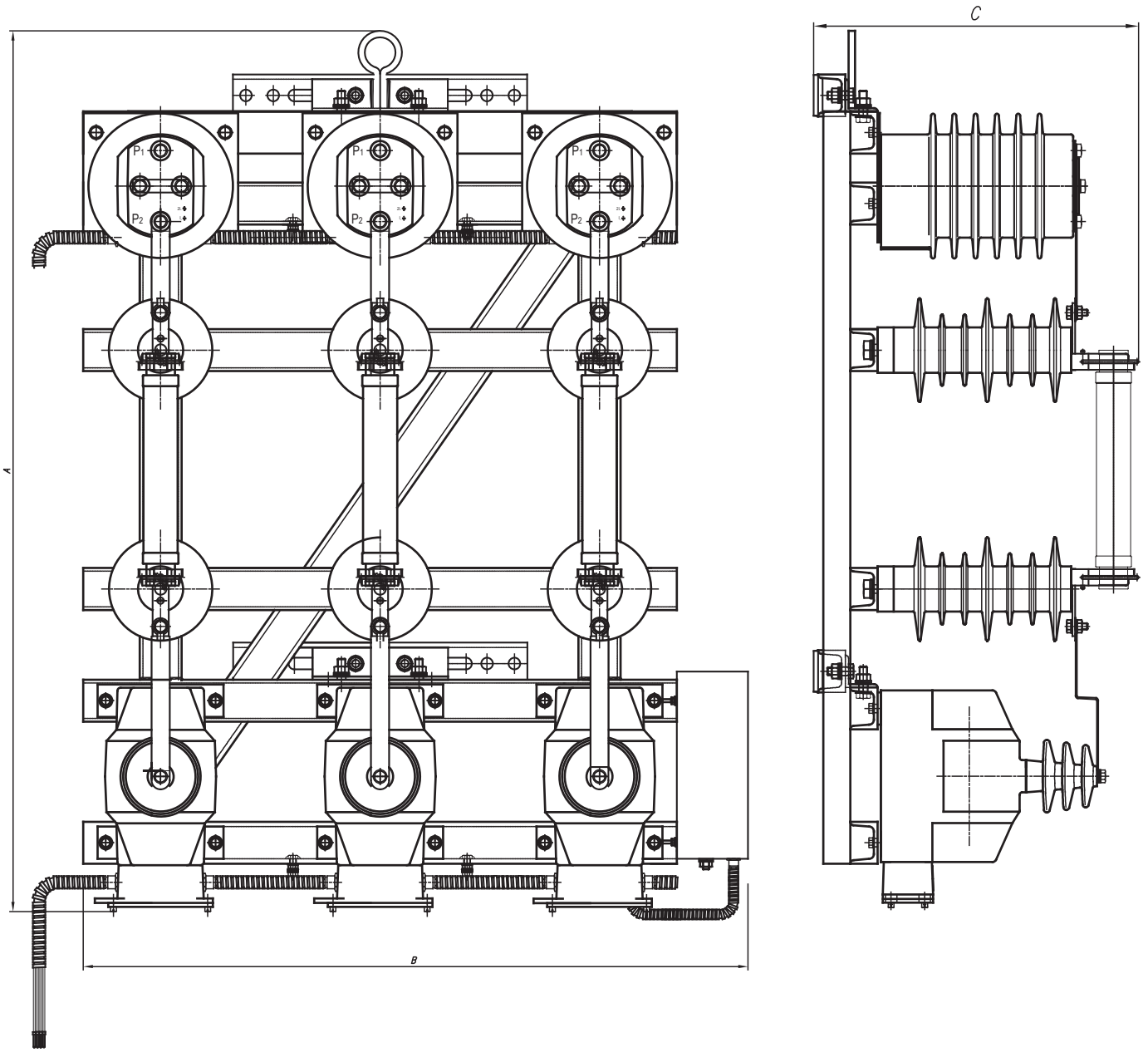
In this variant, protection of the voltage measuring transformers is executed using special HV HR fuses 10 kV (20 or 35 kV), 2 A.

This variant is most often executed at the request of customers who wish to meet the condition of protecting voltage transformers against the occurrence of ferroresonance when the assembly is used in isolated networks.

The SMST can be placed on the side opposite to the placement of the power transformer or on the same side.

In case the assembly is used in networks with an isolated neutral point, the voltage measuring transformers are protected from ferroresonance via resistors (25 Ω, 400 W for 10 and 20 kV, respectively 16.6 Ω, 600 W for 35 kV), which are located in the open-delta circuit of the residual windings of the 3 voltage transformers.

The connection between the SMST and the power transformer is with single-core cables X00-A, 1x35 mm^2 (from a 10 kV, 20 kV, or 35 kV aerial bundled cable - ABC), with cable terminations for outdoor mounting on both sides. The cable is attached to the SMST on one side, between the current measuring transformers and the HV fuses, and on the other directly to special HV fuses (for protection of the power transformer), placed on the 10 kV (20 or 35 kV) insulators on the power transformer.



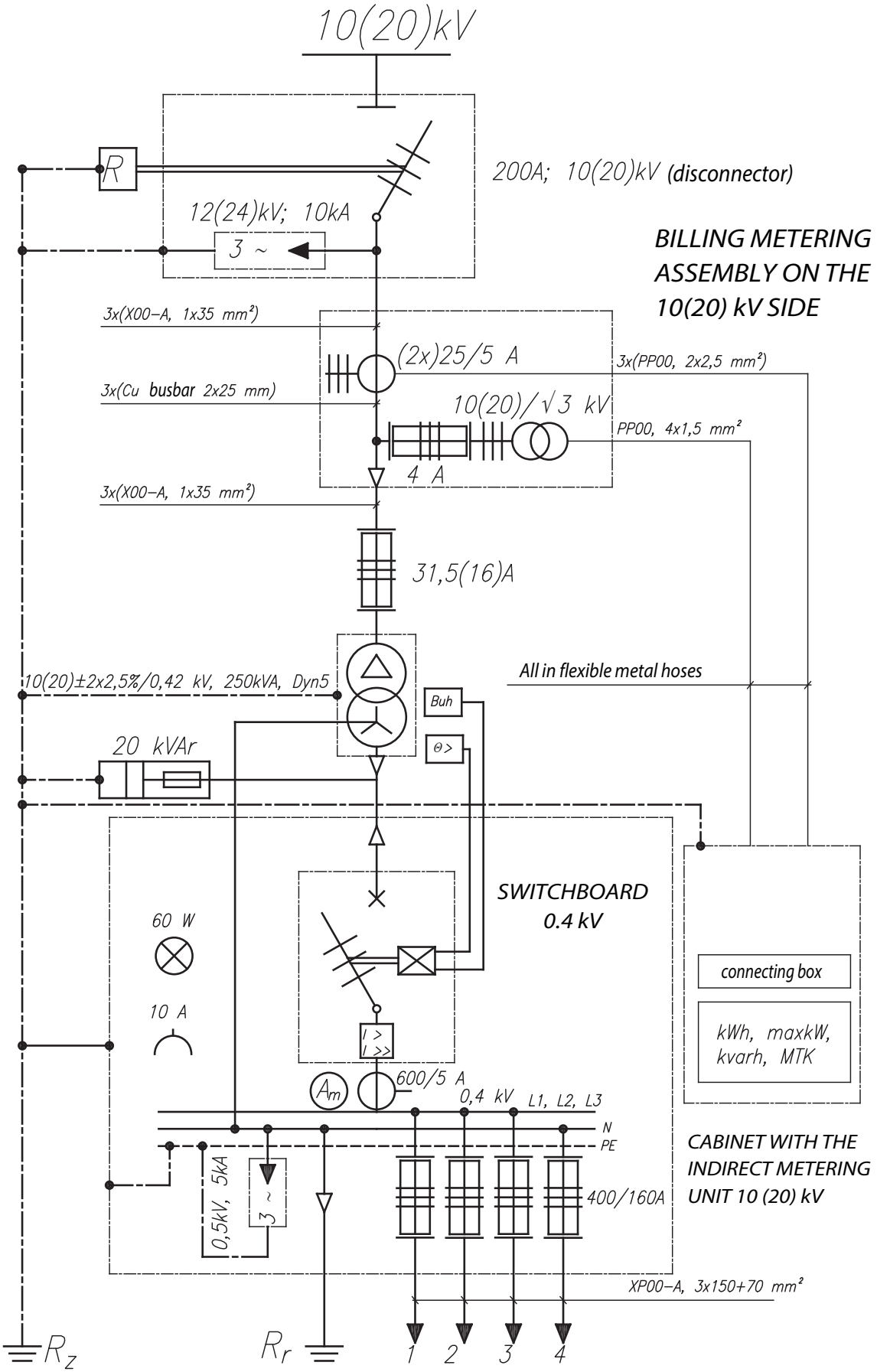
ASSEMBLY FOR THREE-SYSTEM BILLING METERING ON THE 10 kV, 20 kV and 35 kV SIDE

Item No.	Description	Designation*	Dimensions AxBxC (mm)	Dimensions of the supporting structure (mm)	Current transformer	Voltage transformer	Fuse base	Mass (kg)
1	Assembly for three-system billing metering on the 10 kV side	SMST-12-3-V2	1450x890x500	1267,5x780x80	ATMS-2411	JNT SM-12	PVOs-12	182
2	Assembly for three-system billing metering on the 20 kV side	SMST-24-3-V2	1364,5x1030x500	1165x920x80	ATMS-2411	JNTm2 SM-24	PVOs-24	221
3	Assembly for three-system billing metering on the 35 kV side	SMST-36-3-V2	1889x1230x635	1697x1120x85	ATM-3821h	JNT SM-36-6R	PVOs-38	390

NOTE: Dimensions and weights of the assembly may deviate from those given in the table above depending on the characteristics of the assembly. We reserve the right to make modifications.

*** Designation interpretation**: SMST-Um-3-V2 - assembly for three-system indirect metering on pole-mounted substations for maximum voltage Um(kV).

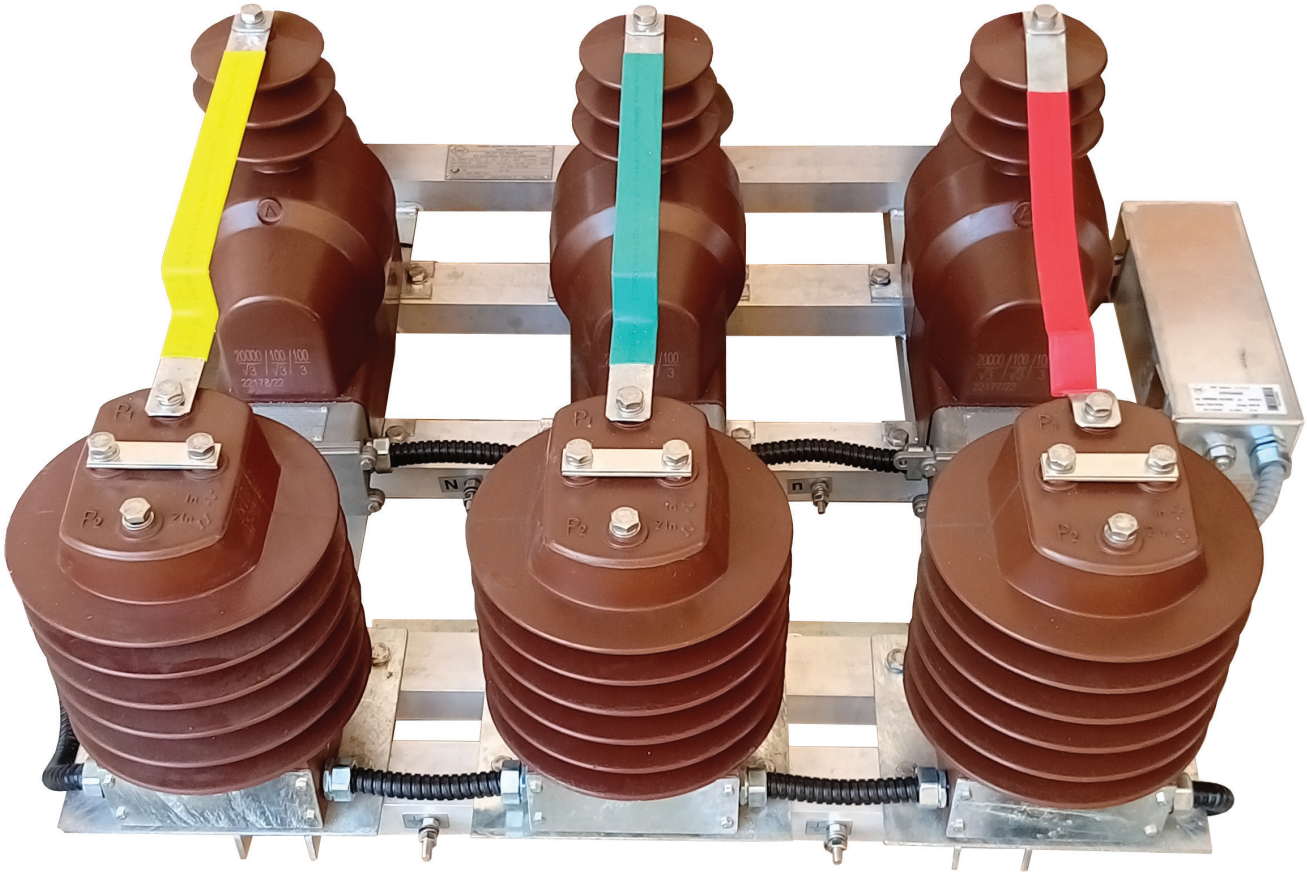
CONTENTS



Single-pole connecting scheme for three-system billing metering on the 10(20) kV side, SMST-12-3-V2 (SMST-24-3-V2)

CONTENTS

ASSEMBLY FOR THREE-SYSTEM BILLING METERING SMST-V3

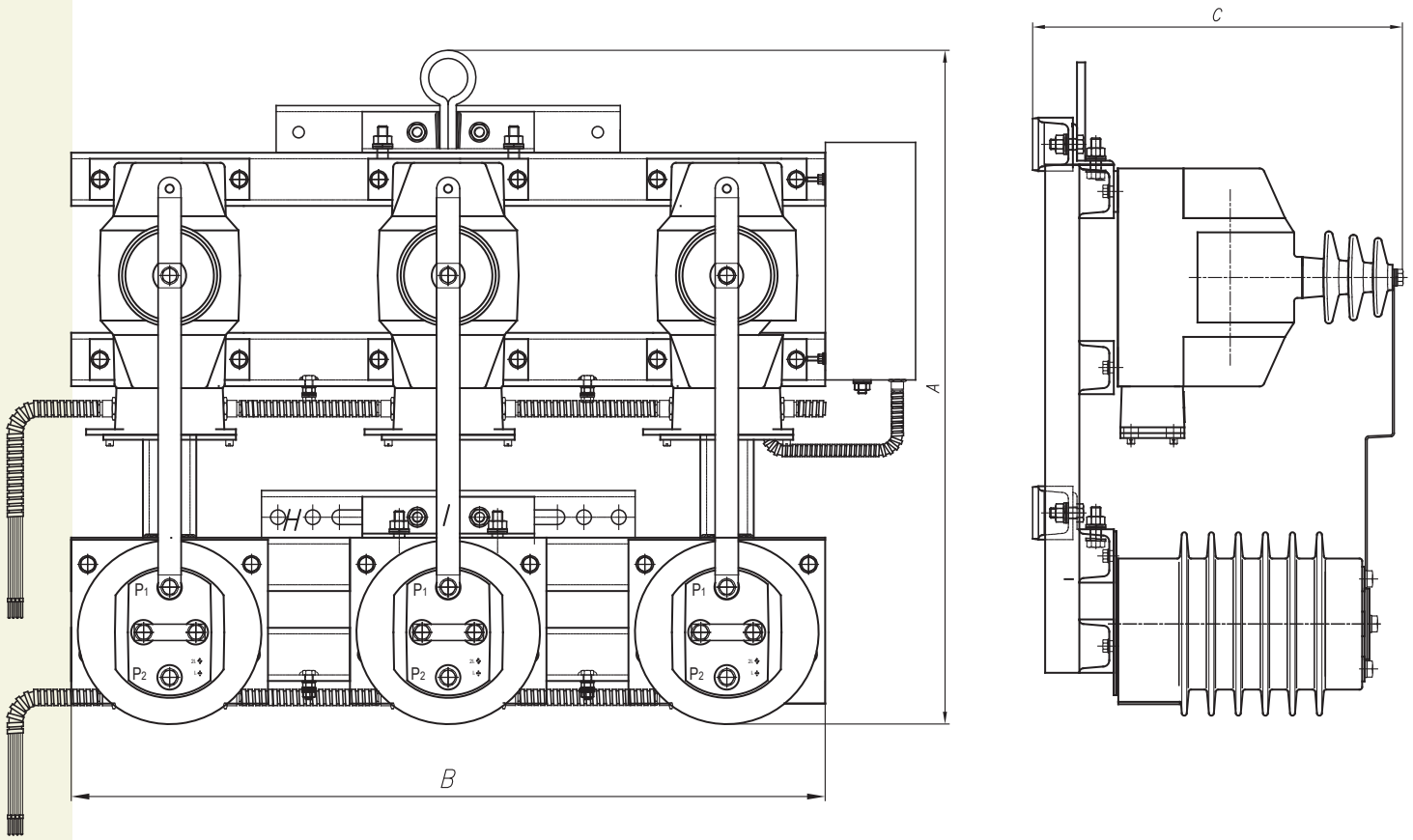


SMST - VARIANT 3

In this variant, the SMST does not possess fuses for protection, so during mounting, it is not necessary to remove the HV fuses located on the power transformer itself. The SMST basically consists only of a supporting structure with 3 current and 3 voltage transformers.

In case the assembly is used in networks with an isolated neutral point, the voltage measuring transformers are protected from ferroresonance via resistors (25 Ω, 400 W for 10 and 20 kV, respectively 16.6 Ω, 600 W for 35 kV), which are located in the open-delta circuit of the residual windings of the 3 voltage transformers.

CONTENTS

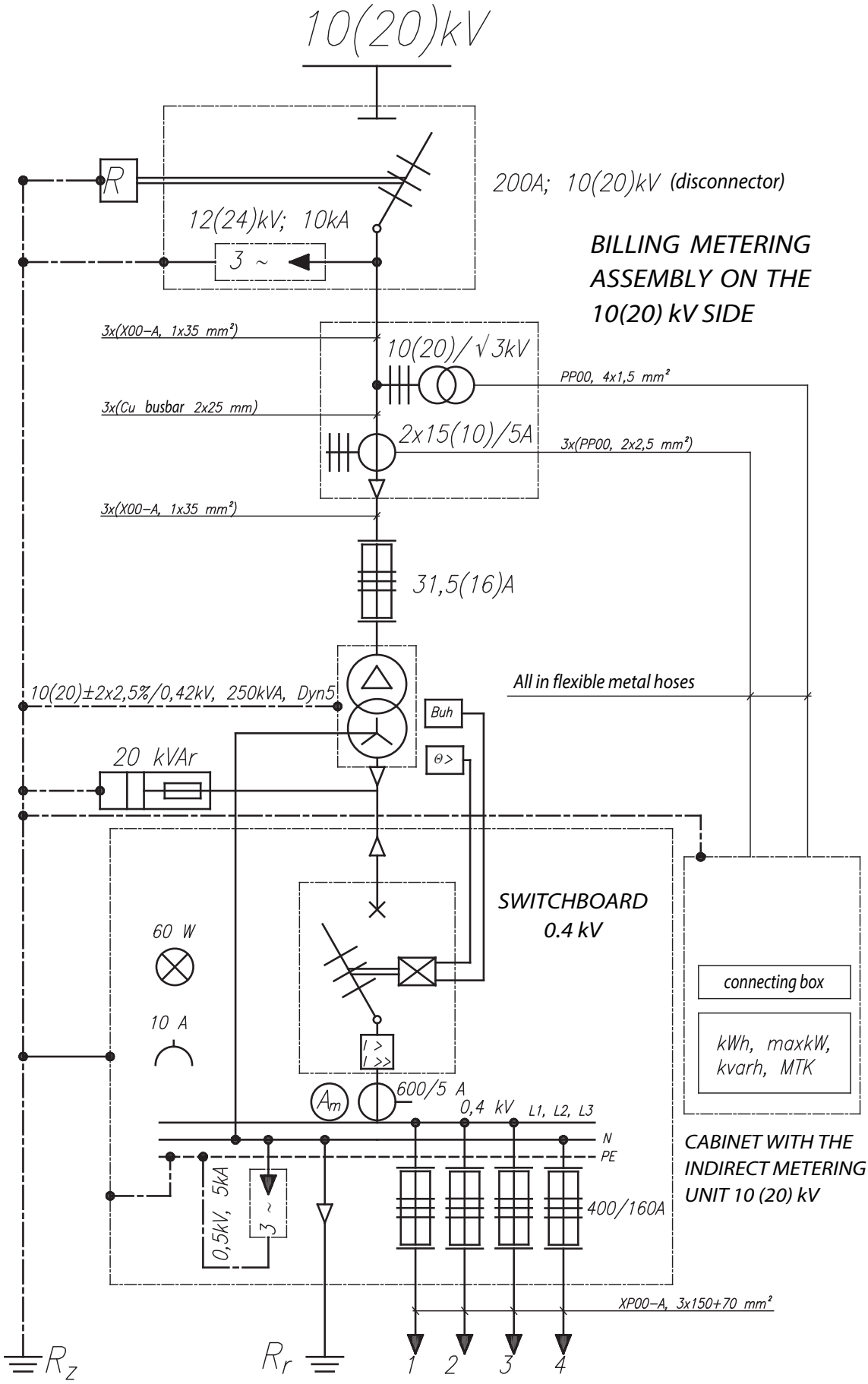


ASSEMBLY FOR THREE-SYSTEM BILLING METERING ON THE 10 kV, 20 kV and 35 kV SIDE

Item No.	Description	Designation*	Dimensions AxBxC (mm)	Dimensions of the supporting structure (mm)	Current transformer	Voltage transformer	Mass (kg)
1	Assembly for three-system billing metering on the 10 kV side	SMST-12-3-V3	797,5x970x446	620x860x80	ATMS-2411	JNT SM-12	150
2	Assembly for three-system billing metering on the 20 kV side	SMST-24-3-V3	825x1030x466	645x920x80	ATMS-2411	JNTm2 SM-24	167
3	Assembly for three-system billing metering on the 35 kV side	SMST-36-3-V3	1015x1230x635	890x1120x85	ATM-3821h	JNT SM-36-6R	336

NOTE: Dimensions and weights of the assembly may deviate from those given in the table above depending on the characteristics of the assembly. We reserve the right to make modifications.

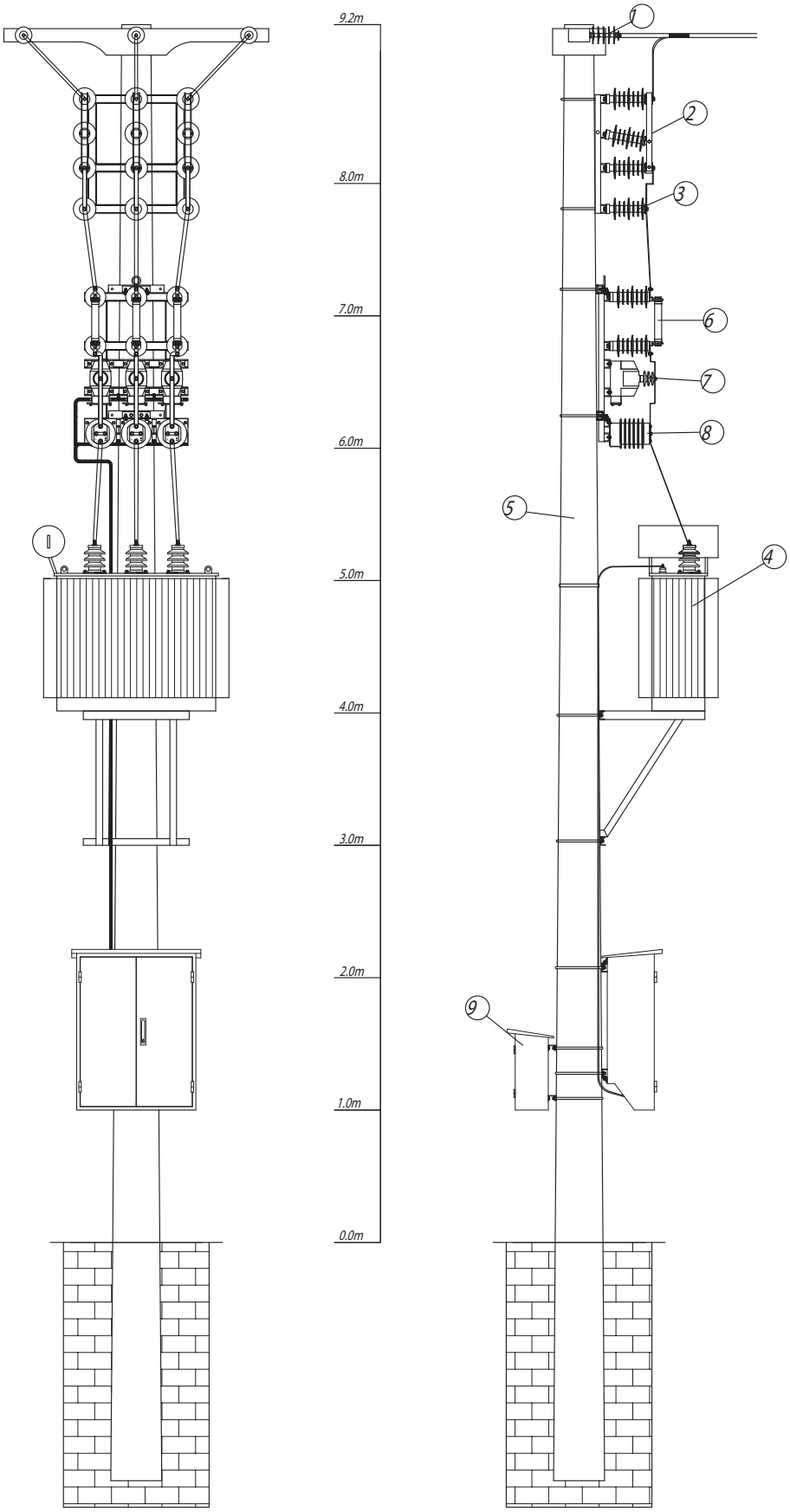
***• Designation interpretation**: SMST-Um-3-V3 - assembly for three-system indirect metering on pole-mounted substations for maximum voltage Um(kV).



Single-pole connecting scheme for three-system billing metering on the 10(20) kV side, SMST-12-3-V3 (SMST-24-3-V3)

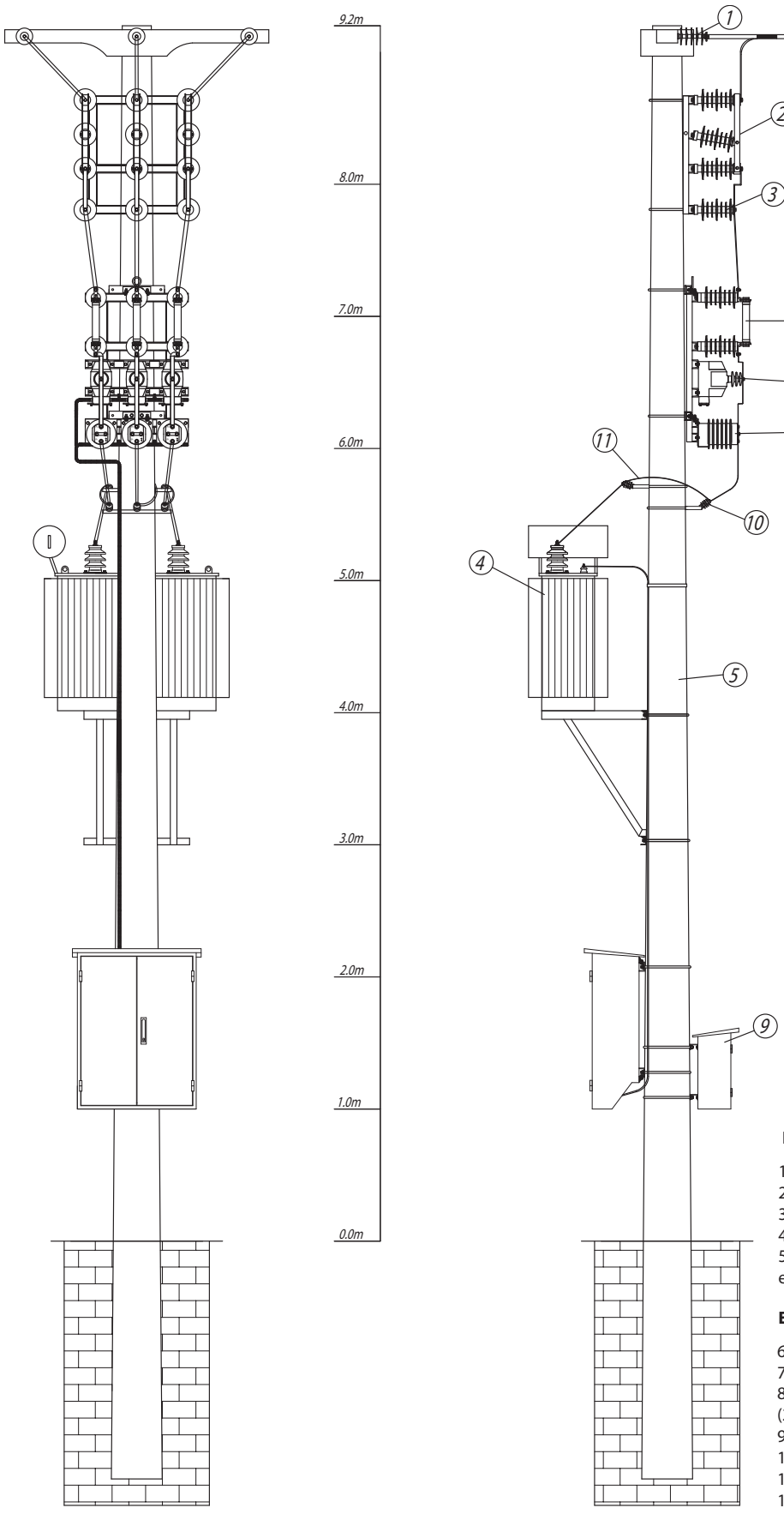
CONTENTS

POLE INSTALLATION OF THE THREE-SYSTEM ASSEMBLY



Mounting of the assembly on a pole with the power transformer and the assembly on the same side of the pole

POLE INSTALLATION OF THE THREE-SYSTEM ASSEMBLY



LEGEND

Equipment of the pole-mounted substation:

1. Tension clamping 10 kV or 20 kV, ACSR (Al/Če)
2. Disconnector 10 kV or 20 kV
3. Surge arrester 12 kV, 10 kA or 24 kV, 20 kA
4. Power transformer 10/0.4 kV or 20/0.4 kV
5. Utility pole for carrying pole substation equipment

Equipment for metering on the 10 kV or 20 kV side

6. HV fuse 10 kV or 20 kV with fuse base
7. Voltage measuring transformer 10/√3 kV or 20/√3 kV
8. Current measuring transformer (2x)15/5 A/A or (2x)10/5 A/A
9. Cabinet for housing the indirect metering group
10. Cable head (termination) for outdoor mounting for 10 kV or 20 kV cable
11. Cable 10 kV or 20 kV, XHE 48A, 1x50 mm^2

Mounting of the assembly on a pole with the power transformer on the opposite side from the assembly.

CONTENTS

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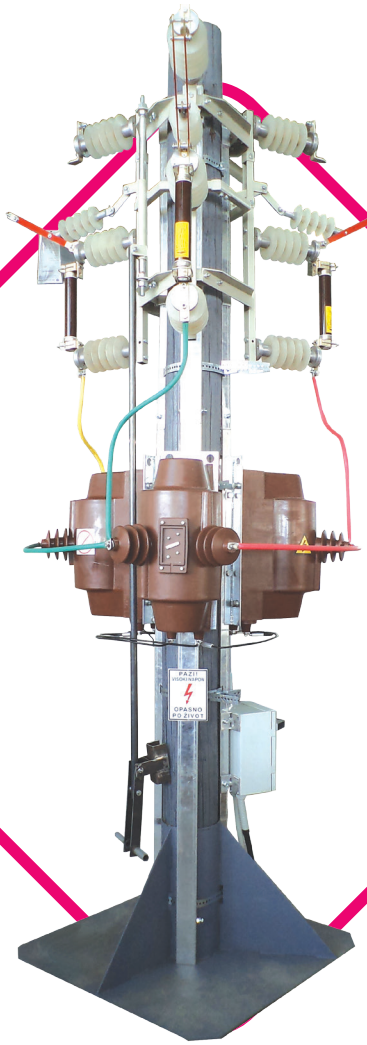
1969

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EASY-TO-INSTALL POLE-MOUNTED POWER SUBSTATION



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EASY-TO-INSTALL POLE-MOUNTED POWER SUBSTATION "PENDA" 2
TECHNICAL DESCRIPTION 3

POLE-MOUNTED SUBSTATION WITH LOW-VOLTAGE METERING 4

POLE-MOUNTED SUBSTATION WITH INDIRECT MEDIUM-VOLTAGE METERING 7

SUPPORTING STRUCTURE 10
HV FUSE HOLDERS 10
VOLTAGE TRANSFORMERS 10
CURRENT TRANSFORMERS 11

POWER SUPPLY TRANSFORMERS 12
TYPE DTES-3.3, DTES-4, DTES-5 13
TYPE DTES-10, DTES-17, DTES-21 14

INDIRECT THREE-SYSTEM METERING UNIT 15

EASY-TO-INSTALL POLE-MOUNTED POWER SUBSTATION



CONTENTS

TECHNICAL DESCRIPTION

According to the recommendations of EPS (Electric power of Serbia), conditions have been determined for the construction of pole-mounted substations in 10 and 20 kV networks. The construction of substations is allowed once energy permit is obtained with respect to the location of installation, and when all technical conditions for the construction of pole-mounted substations from 50 to 400 kVA are met.

One of the technical conditions is the installation of new supporting poles for the pole-mounted substation, as well as the installation of a tension pole before the supporting pole of the substation. In order to avoid these conditions, especially in requests for smaller substations, FMT comes forward with a solution for building the substation on 10 and 20 kV line poles for a rated power up to 63 kVA.

Until now, the construction of pole-mounted power substations was possible only with three-phase transformers and three-pole line disconnectors with fuses and surge arresters, and all that equipment was placed on one side of the substation pole. Equipment completed in this way had a lot of weight and thus overloaded the pole, so that supporting poles with increased load-bearing capacity had to be specially designed. In addition to those poles, due to the tension force from the entire structure of the substation, and according to the recommendations of EPS, a tension pole also had to be installed before the substation pole.

To avoid this, the solution offered by FMT is placing the substation equipment for each phase individually at 120° looking from above, so that the lateral tension forces from the equipment are cancelled out. The equipment is designed and built in such a way that the single-phase equipment is coupled into a three-phase system on-site, and the entire load from the equipment results in a force attacking the bottom of the pole, i.e., the foundation.

Since FMT has dry power transformers in its production program, as well as all measuring transformers for billing metering in the open – for outdoor mounting, the idea for creating such a project was born, with the aim of offering a solution to interested power distribution companies and investors that would suit both parties.

The solution offered by this project is the COMPLETE EQUIPMENT FOR SUBSTATION CONSTRUCTION for outdoor mounting, which can be placed, first of all, on line poles of 9, 11, and 12 m in height.

This project provides for the following types of EASY-TO-INSTALL POLE-MOUNTED POWER SUBSTATIONS:

Item.No.	Type of the substation	Voltage regulation	Power transformer
1	STS – 10; 10 kVA, 10/0.42±5% kV/kV	From the secondary side	DTES – 3.3
2	STS – 12; 12 kVA, 10/0.42±5% kV/kV		DTES – 4
3	STS – 15; 15 kVA, 10/0.42±5% kV/kV		DTES – 5
4	STS – 30; 30 kVA, 10/0.42±5% kV/kV	From the primary side	DTES – 10
5	STS – 50; 50 kVA, 10/0.42±5% kV/kV		DTES – 17
6	STS – 63; 63 kVA, 10/0.42±5% kV/kV		DTES – 21

This project also offers two variant solutions:

- **Pole-mounted power substation with low-voltage metering**, and
- **Pole-mounted power substation with indirect medium-voltage metering.**

CONTENTS

POLE-MOUNTED POWER SUBSTATION WITH LOW-VOLTAGE METERING

This type of pole-mounted substation is designed for individual phase element installation on concrete line poles, with metering on the low-voltage side.

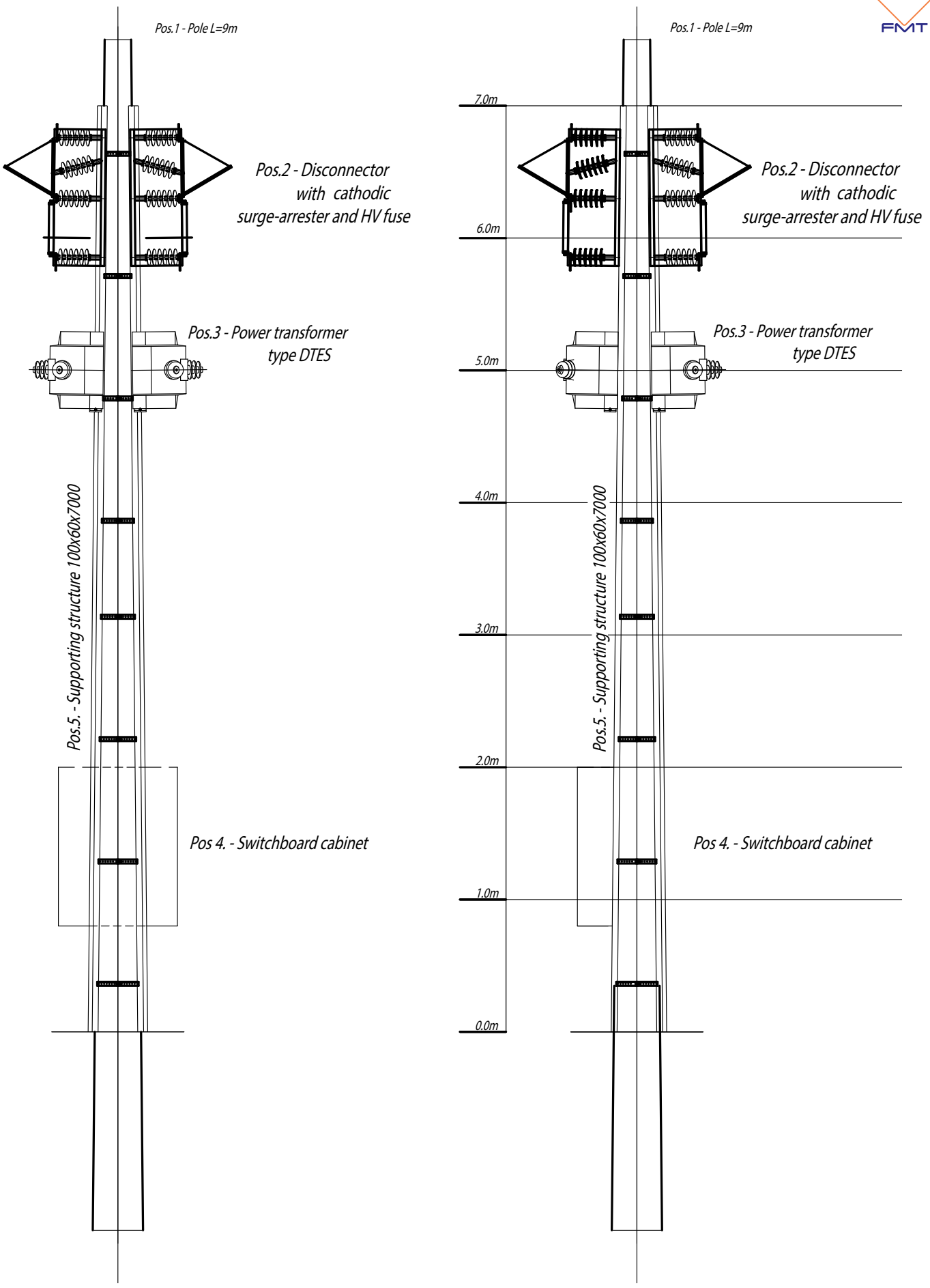
The pole-mounted substation consists of:

- **a supporting structure,** 7 m;
- **three single-pole disconnectors coupled into a three-phase system at 120°**, with HV HRC fuse holders and surge arresters;
- **three two-phase power transformers coupled into a three-phase system.**

Protection of the power transformer against short-circuit current from the primary side is executed via HV HRC fuses, and protection against atmospheric overvoltages is executed by surge arresters located on the disconnector itself.

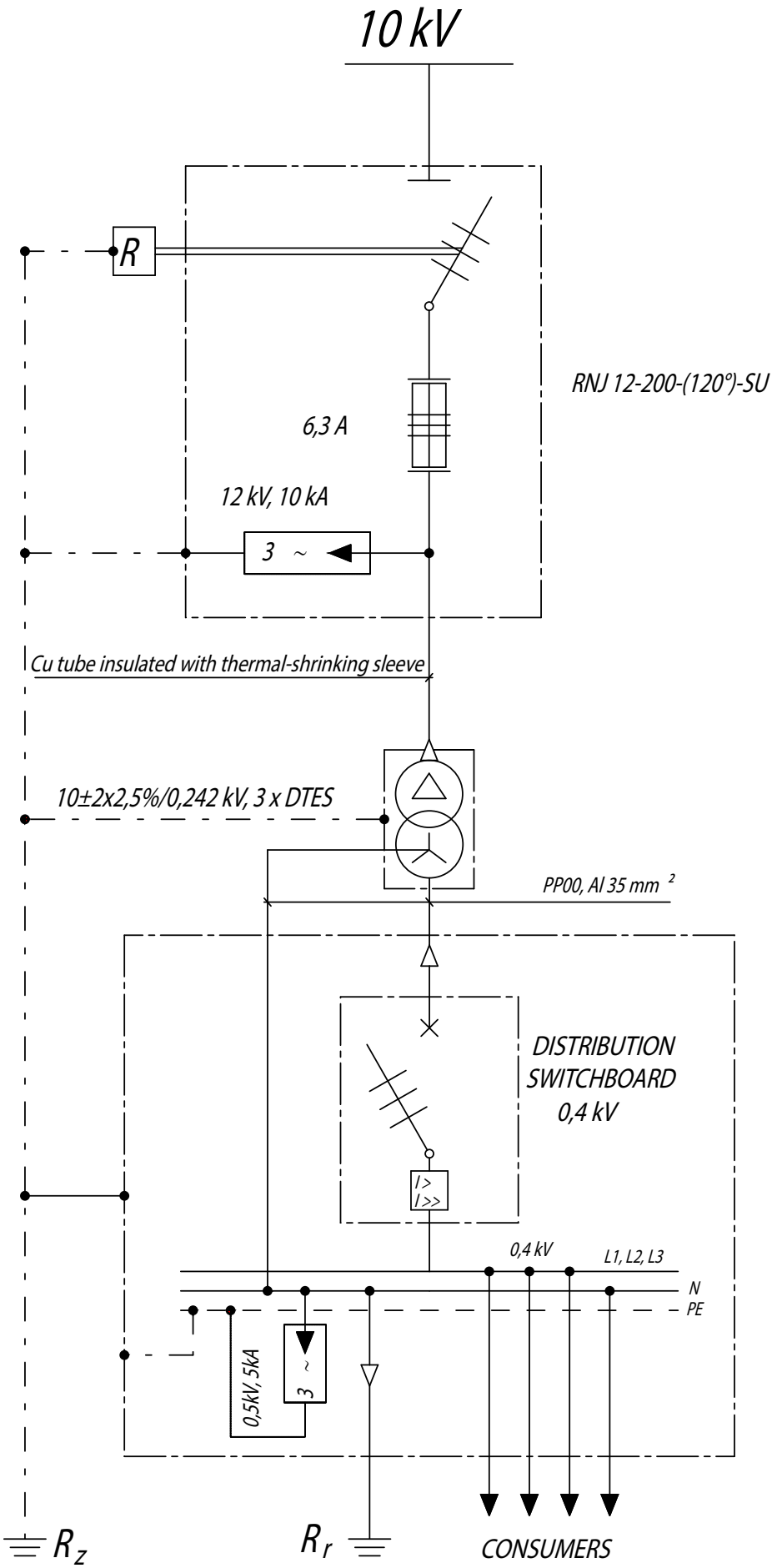
Protection against short-circuit current from the secondary side is an automatic molded case circuit breaker (MCCB) 100 A; 500 V, and against atmospheric overvoltages there are low-voltage surge arresters 500 V; 5 kA.

The automatic molded case circuit breaker and low-voltage surge arresters are located in the low-voltage distribution cabinet.



Pole-mounted power substation 10/0.42 kV/kV with low-voltage metering

CONTENTS



Single-pole scheme of the power substation STS 10/0.42 kV/kV with low-voltage metering

CONTENTS

POLE-MOUNTED SUBSTATION WITH INDIRECT MEDIUM-VOLTAGE METERING

This type of pole-mounted substation is designed for individual phase element installation on concrete line poles, with indirect metering on the medium-voltage side.

Pole-mounted substation consists of:

- **a supporting structure,** 9 m;
- **three single-pole disconnectors coupled into a three-phase system at 120°**, with surge arresters;
- **three two-phase power transformers coupled into a three-phase system;**
- **trhree single-pole HV fuse holders with HV HRC fuses;**
- **three single-pole insulated voltage measuring transformers** 10√3//0,1√3 kV/kV;
- **three current measuring transformers** of insulation leve20 kV;
- **a complete indirect three-system metering unit** in a separate cabinet on the same pole.

In the direction of power flow, the metering assembly on the 10 kV side connects directly behind (below) the switch-disconnector with surge arresters, and in front of the power transformer, as shown in the attached drawings.

The metering assembly on the 10 kV side consists of: an HV fuse holder, voltage measuring transformers, and a current measuring transformer. All these parts are mounted individually and very quickly via pins and cotter pins.

Protection of all elements of the assembly (and the power transformer) is primarily via HV HRC fuses (6.3 A or 10 A), and secondarily (on the 100/√3 V side), the metering group is protected via 3 automatic circuit breakers 6 A, in the connection box.

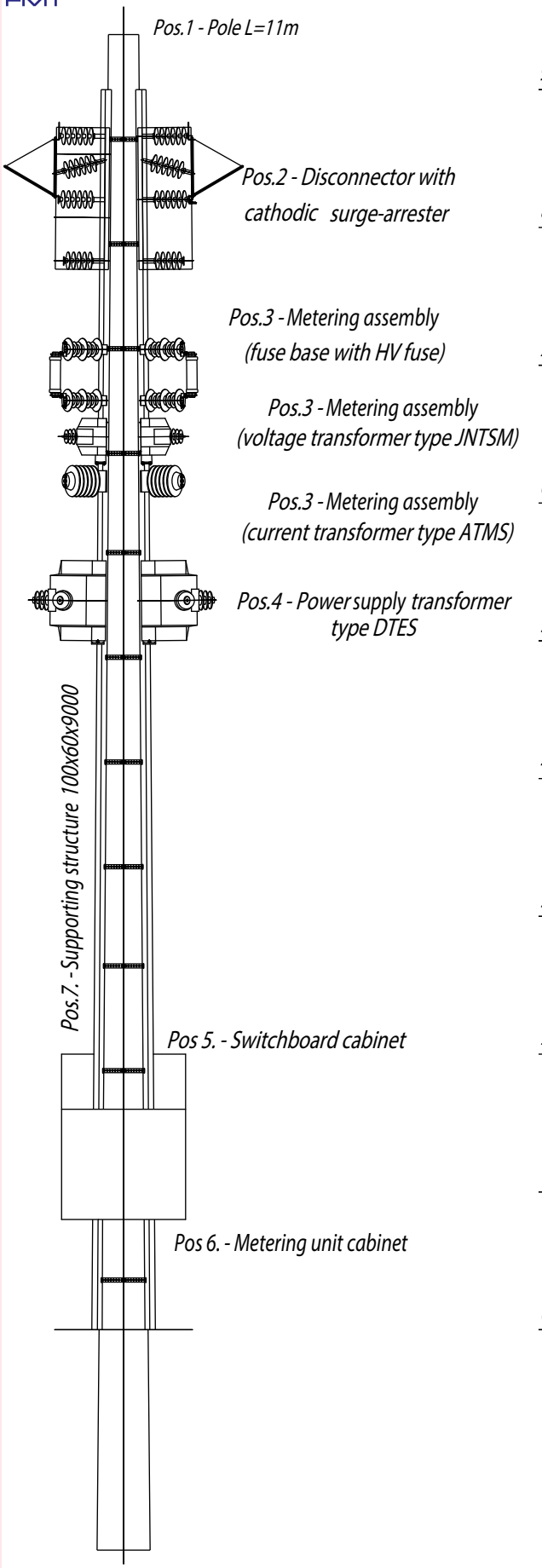
Special protection (against overload and short circuit) of the voltage measuring transformers is not provided, which is in accordance with the modern technical approach, because such (special) protection has been abandoned by (almost) all world equipment manufacturers.

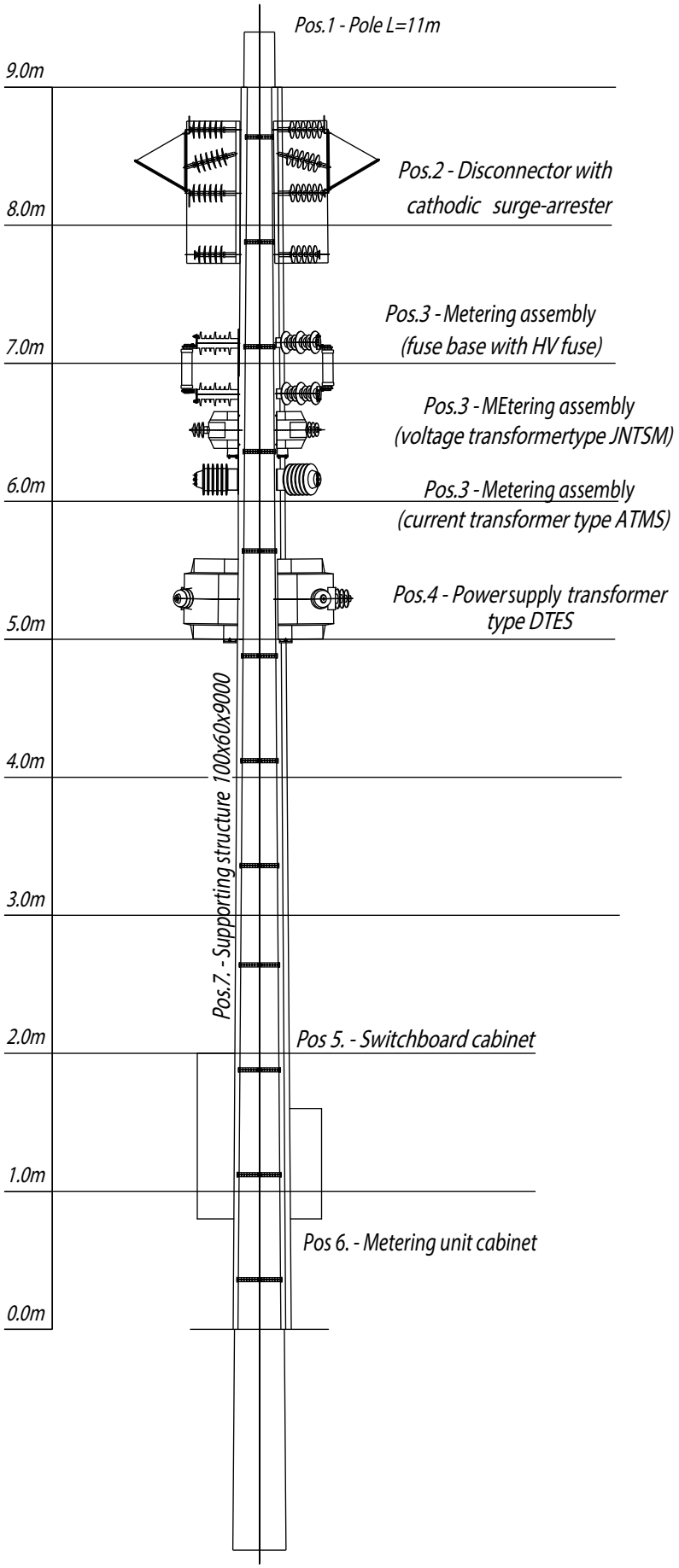
The reason should be sought in the facts that special HV HRC fuses for this purpose require an increased equipment size and that failures on voltage measuring transformers are very rare. Even if they do happen – due to the circumstance that the primary current values are very small (below 1 mA), and the primary windings of the voltage measuring transformer are of a very small cross-section – the eventual failure is interrupted locally without consequences.

All elements of the substation are placed in one line, and the connections between all electrical devices and the power transformer are executed with single-core cables XHE 49A, 1x35 mm^2 (from a 10 kV aerial bundled cable - ABC), with cable terminations for outdoor mounting on both sides or copper tubes with a heat-shrinkable sleeve.

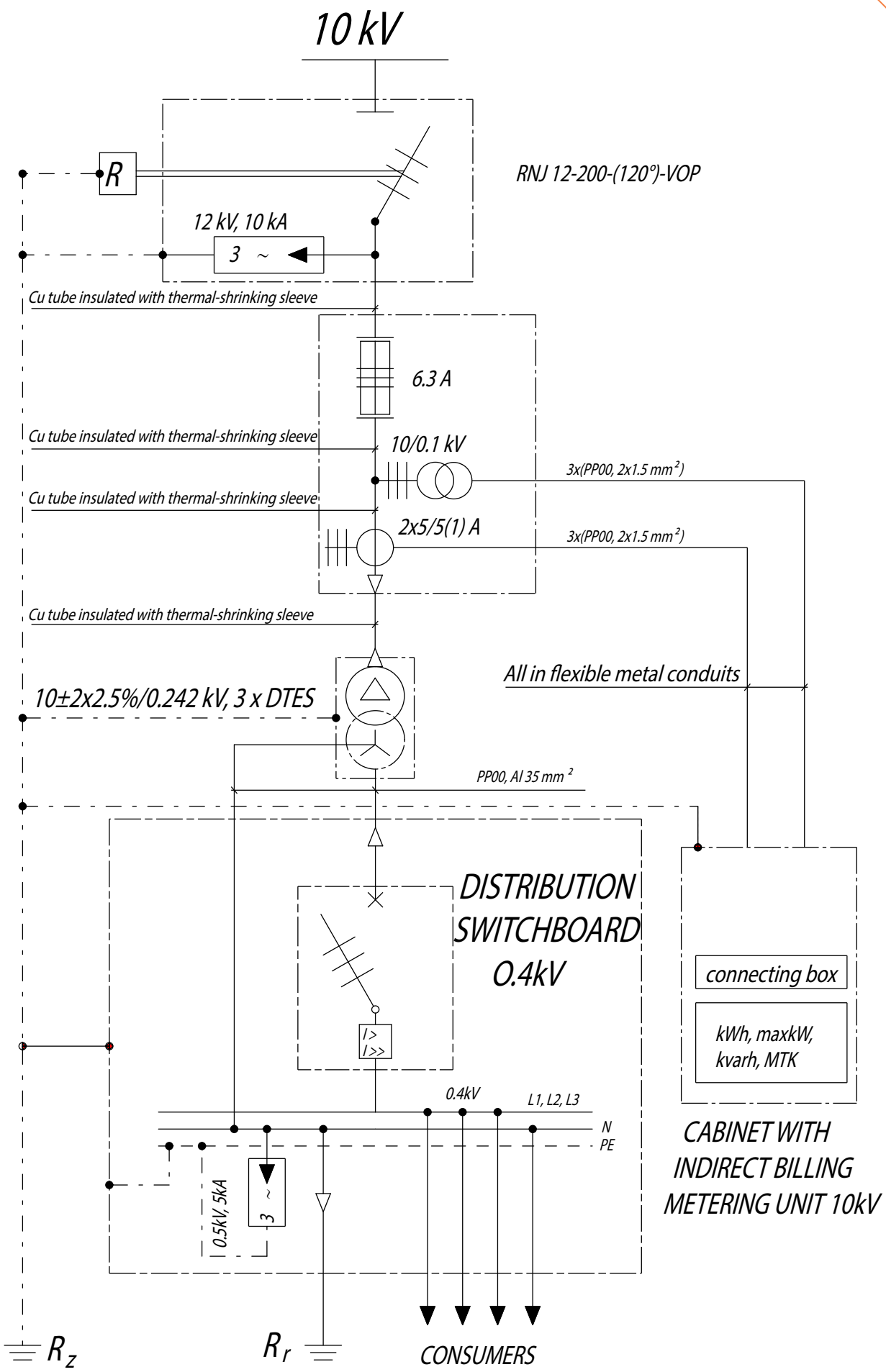
CONTENTS

EASY-TO-INSTALL POLE-MOUNTED POWER SUBSTATION





CONTENTS



Single-pole scheme for pole-mounted substation STS 10/0.42 kV/kV with medium-voltage metering

CONTENTS

SUPPORTING STRUCTURE

The supporting structure is metal, composed of assembly perforated „U" profiles of dimensions 100x60x3000 mm assembled so as to achieve the required height. These profiles are placed on the round stem of a concrete pole at an angle of 120°, specifically 3 profiles on each side. These profiles are fastened at the joint locations with clamps so that 3 profiles placed in a single line give a height of 7 m or 9 m. These consoles have openings in specific places for fitting individual devices of the substation, primarily power transformers, voltage and current measuring transformers, as well as HV fuse holders.

The supporting structure connects to special general-purpose consoles using 2 connectors for each of the elements, made of steel rod material.
The supporting structure and all connecting parts are made of steel sheet, which is hot-dip galvanized for corrosion protection.

The supporting structure connects to the main earth conductor of the pole at the same place as the disconnector, using the ELDS kit. For this purpose, a hole with an opening of 13 mm is provided on the upper part of the structure.

The metal supporting structure, to which the equipment is attached, has a profile cross-section greater than 100 mm^2. Connected via the ELDS kit to the main earth conductor of the pole-mounted transformer substation, it is considered an integral part of the earth conductor and is used for connecting the earthing of the equipment it carries.

HV FUSE HOLDERS

The applied fuse holders are mounted on apparatus post insulators of type C4-125, which are certified for an operating voltage of 20 kV. They are intended for outdoor mounting, for vertical and horizontal placement, with a certified breaking load of 4 kN and a creepage distance of 670 mm.

The fuse clips (grips) for the HV fuses are made of hard copper, protected against corrosion by electrolytic tin plating. Mechanical safety latches for protecting the HV fuse links from falling out are made of galvanized steel.

VOLTAGE TRANSFORMERS

Dry-insulated voltage transformers of type JNT SM-12 are applied. The transformers are insulated with epoxy resin, intended for outdoor installation, for vertical and horizontal placement. They are completely cast, obtaining a body with a smooth surface, made of one piece, whose homogeneity ensures high dielectric strength and mechanical endurance.

The voltage transformers JNT SM-12 are single-pole insulated, with one core. The magnetic core is of the stacked type, and the windings are made of copper, executed as layered. This ensures a rational distribution of radial and axial stresses, as well as good endurance against power-frequency overvoltages and impulse overvoltages.

Transformers of type JNT SM-12 are intended for connection between phase and neutral. The transformers are also designed for operation at line voltage for a duration of 8 hours because they have a voltage factor of 1.9/8h. They are harmonized with standards: IEC, CSA, VDE, ANSI, BS, GOST, and SRPS. Three single-pole voltage transformers are placed independently, each on its own U profile at an angle of 120°, looking from above.

Characteristics of the voltage transformer

TECHNICAL DATA	JNT SM-12
Rated voltage for equipment (kV)	12
Rated primary voltage (kV)	10
Rated secondary voltage (V)	100/√3
Test induced withstand voltage 150Hz/40s (kV)	28
Test impulse voltage (kV)	75
Rated frequency (Hz)	50
Accuracy class	0,5
Rated power (VA)	50
Valid standards	EN/IEC 61869-1, EN/IEC 61869-3
Creepage distance (mm)	500
Mass (kg)	26
Installation	in any position
Operating temperature range	-55°C do +75°C

CURRENT TRANSFORMERS

Current transformer of type ATMS-2411 are applied. They are primary-reconnectable.
They can be installed in both vertical and horizontal positions.

Characteristics of the current transformer:

TECHNICAL DATA	ATMS-2411
Rated voltage (kV)	20
Rated voltage for equipment (kV)	24
Test voltage 50Hz, 1min (kV)	50
Test impulse voltage 1,2/50μs (kV)	125
Rated frequency (Hz)	50/60
Rated primary current (A)	2x5 do 2x600
Rated secondary current (A)	5 or 1
Rated thermal current, 1s	Ith=(100-200)In max 20 kA
Rated dynamic current	Idyn=2,5Ith
Rated continuous thermal current	Itth=1,2In
Instrument security factor	FS5
Rated power (VA)	10
Accuracy class	0,5
Thermal class of insulation	E/B
Number of cores	1
Basic insulation type	epoxy resin
Creepage distance (mm)	570
Mass (kg)	16.5
Valid standards	EN/IEC 61869-1, EN/IEC 61869-2

CONTENTS

POWER SUPPLY TRANSFORMERS

Dry-insulated power transformers of type DTES are applied, for the 10 kV voltage level. The transformers are insulated with epoxy resin, intended for outdoor installation, for vertical and horizontal placement.
The magnetic core is of the laminated type, and the windings are made of copper, executed as layered. This ensures a rational distribution of radial and axial stresses, as well as good endurance against power-frequency overvoltages and impulse overvoltages.

The transformers are completely cast. In this way, a body with a smooth surface is obtained, made of one piece, whose homogeneity ensures high dielectric strength and mechanical endurance. Transformers of type DTES are intended for connection between phases, so it is possible to couple three transformers from the primary side into a delta connection, and from the secondary side into a star connection. The transformers are designed for continuous operation at line voltage. The transformers are harmonized with the standard: EN/IEC 60076-11.

Three power transformers are galvanically connected by connectors made of copper tubes with a heat-shrinkable sleeve.

Characteristics of dry-power transformers.

- These transformers cannot catch fire, and the insulation cannot leak out;
- They are of smaller dimensions because they have special electromagnetic field absorbers;
- The insulation does not change characteristics at extreme temperatures from -30°C to +45°C;
- There is no need for maintenance;
- They do not pollute the environment;
- They are quiet during operation – they do not produce noise;
- The outer surface is smooth and rounded and does not retain dust;
- Their service life is longer under operating conditions – they are highly reliable;
- They are of smaller dimensions, and installation is easier and cheaper.

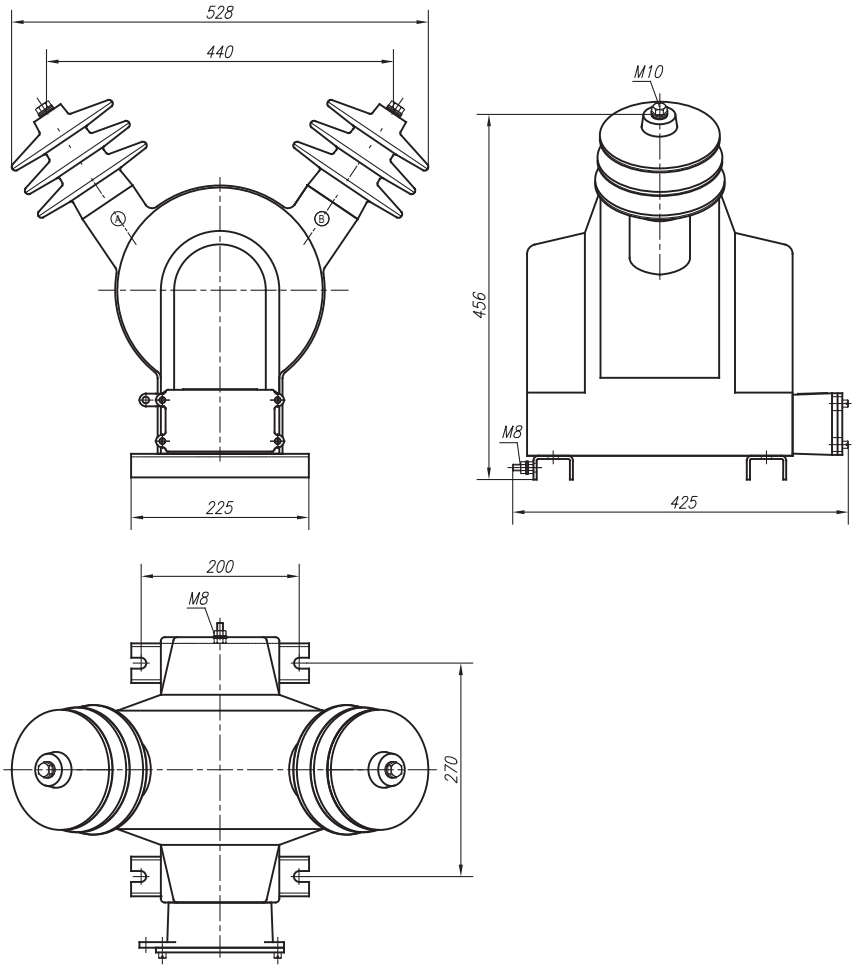
Characteristics of the power supply transformer:

TECHNICAL DATA	DTES-3.3	DTES-4	DTES-5	DTES-10	DTES-17	DTES-21
Rated voltage for equipment (kV)	12	12	12	12	12	12
Rated primary voltage (kV)	10 kV	10 kV	10 kV	10 kV	10 kV	10 kV
Rated secondary voltage (V)	242	242	242	242	242	242
Power-frequency withstand voltage 50Hz, 1min (kV)	28	28	28	28	28	28
Impulse voltage (kV)	75	75	75	75	75	75
Rated frequency (Hz)	50	50	50	50	50	50
Rated power (kVA)	3.3	4	5	10	17	21
Valid standards	EN/IEC 60076-11					
Creepage distance (mm)	660	660	660	650	650	650
Mass (kg)	65	71	78	145	165	185
Mounting	Horizontal and vertical					
Operating temperature range	-30°C do +45°C					

The base of the power transformer is designed for easy mounting. Openings of Ø30mm serve for hanging hooks, by means of which the transformer is raised to the required height with the help of a pulley block and then a pin (pin Ø16mm with beta cotter pin - 2 pcs) is simply passed through, by which the transformer is hung onto the supporting structure.

CONTENTS

DTES-3.3, DTES-4, DTES-5

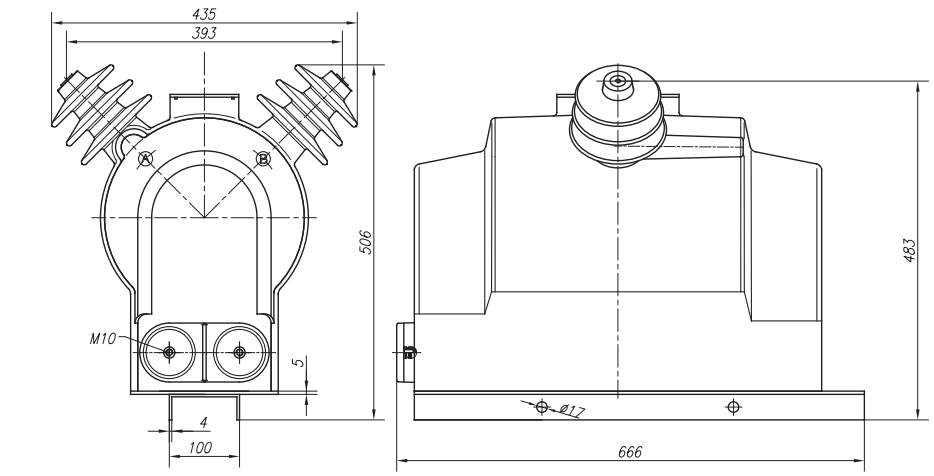


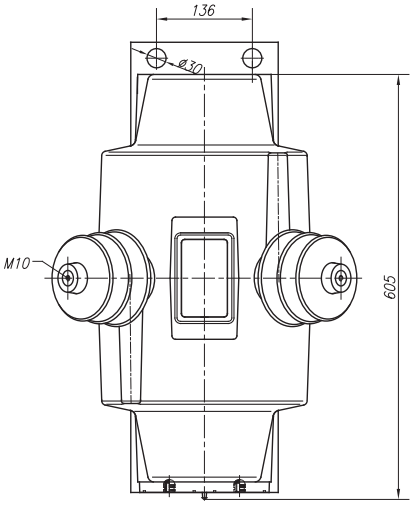
TECHNICAL DATA	DTES-3.3	DTES-4	DTES-5
Highest voltage for equipment (kV)	12	12	12
Rated primary voltage (kV)	10	10	10
Rated secondary voltage (V)	242	242	242
Power-frequency test voltage 50 Hz, 1 min. (kV)	28	28	28
Impulse voltage1.2/50 μs (kV)	75	75	75
Rated frequency (Hz)	50	50	50
Rated power (kVA)	3.3	4	5
Valid standards	EN/IEC 60076-11		
Mass (kg)	65	71	78
Mounting position	Horizontal and vertical, outdoor mounting		
Operatingtemperature range	-55°C do +75°C		

NOTE:
At the customer's request, we can also produce other combinations of rated transformation ratios. When ordering, be sure to state the primary and secondary voltages and power.

CONTENTS

DTES-10, DTES-17, DTES-21







TECHNICAL DATA	DTES-10	DTES-17	DTES-21
HIghest voltage for equipment (kV)	12	12	12
Rated primary voltage (kV)	10	10	10
Rated secondary voltage (V)	242	242	242
Power-frequency withstand voltage 50 Hz, 1 min. (kV)	28	28	28
Impulse voltage 1.2/50 μs (kV)	75	75	75
Rated frequency (Hz)	50	50	50
Rated power (kVA)	10	17	21
Valid standards	EN/IEC 60076-11		
Mass (kg)	145	165	185
Mounting position	Horizontal and vertical, outdor mounting		
Operating temperature range	-30°C do +45°C		

NOTE:
At the customer's request, we can also produce other combinations of rated transformation ratios. When ordering, be sure to state the primary and secondary voltages and power.

CONTENTS

INDIRECT THREE-SYSTEM METERING UNIT

The metering of consumed electrical energy and peak (maximum reached 15-minute power in the billing period) is provided using a three-system metering unit for indirect metering, on the 10 kV side, located in a separate cabinet which is placed on the pole stem.

A multi-functional digital meter of type TMG2 (100/√3 V) is used as the metering unit, which performs in a single housing:

- Metering of consumed active electrical energy in 2 tariffs, Class 1;
- Metering of consumed reactive electrical energy in 2 tariffs, Class 3;
- Metering of the reached maximum of 15-minute active power, in 2 tariffs, Class 1;
- Reception of ripple control telegrams;
- Memorizing the maximum power state for the last 12 reading cycles.

The meter is approved for use by the Directorate of Measures and Precious Metals and accepted for use in the consumption area of EDB (Belgrade Electro-distribution).

Connection diagrams can be seen on the single-pole schemes.
The cabinet also contains:

- A metering connection box, with 3 automatic circuit breakers 6 A, with a sealed transparent cover;
- Conductors for wiring, small materials, and accessories.

The connection between the voltage measuring transformers and the metering group is established via 3 cables of 1 kV, type PP, cross-section 2x1.5 mm^2, and between the current measuring transformers and the metering group via 3 cables of 1 kV, type PP, cross-section 2x2.5 mm^2. All cables are individually placed in flexible galvanized steel conduits, and all connection points are sealed. The conduits are fastened to the pole with straps made of stainless material, at a distance of 1 m.

POWER CURRENT CONNECTIONS

For medium-voltage connections: disconnector – HV fuse holders - voltage measuring transformers – current measuring transformers, copper tubes insulated with a heat-shrinkable sleeve are provided.
The connection between the Metering Assembly on the 10 kV side and the power transformer is also via copper tubes insulated with a heat-shrinkable sleeve.
For each phase, the copper tubes are insulated with a heat-shrinkable sleeve of the corresponding color (red, yellow, and green), so that the complete connection per phase is in the same color.

EARTHING OF EQUIPMENT

All provided equipment is insulated. The secondary circuits of current measuring transformers are earthed directly on the terminals of the current measuring transformers – they are connected to the supporting metal structure. The same applies to the secondary circuits (windings) of voltage measuring transformers.
The supporting structure connects to the main earth conductor of the pole-mounted transformer substation. As the supporting structure has a profile cross-section greater than 100 mm^2, it is used as part of the earth conductor for connecting the earthing of the equipment it carries.

PROTECTION AGAINST HAZARDOUS TOUCH VOLTAGE

The height from the ground to the unprotected live parts of the equipment is greater than 5 m, and all cables up to a height of at least 2 meters have mechanical protection, earthed to the earth conductor of the pole-mounted substation (STS).

CONTENTS

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