Voltage Transformers type UMZ

User's Manual, Operation and Maintenance

Safety at first

Safety instructions:

- Installation, connecting, operation and maintenance should be carried out by the authorised personnel only
-  Warning – Please read carefully notes which are marked with this sign
- This manual should always be accessible for the user's personnel
- **The voltage transformers are high voltage devices and their usage must be performed according to the appropriate safety rules.**

1. GENERAL

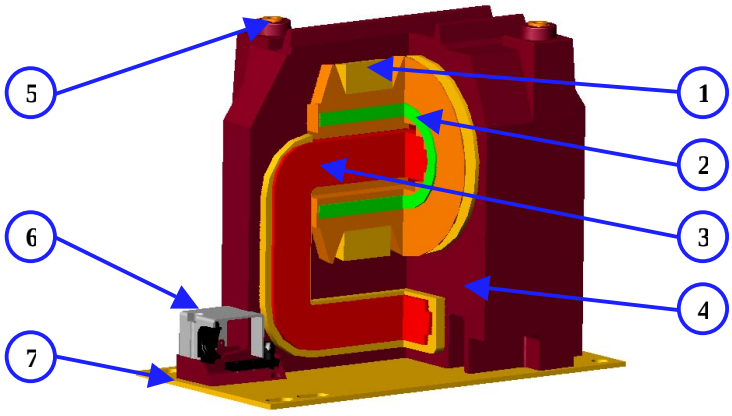
The scope of this Manual is voltage transformers type UMZ. The transformers are designed to supply measurement and protection circuits at high voltage power networks.
Voltage transformers UMZ type are manufactured in three versions:
1) one insulated pole: UMZ 12-1, UMZ 17-1, UMZ 24-1;
2) one insulated pole with fuse holder: UMZ 12-1F, UMZ 17-1F, UMZ 24-1F, UMZ 12-1P, UMZ 17-1P, UMZ 24-1P;
3) two insulated poles: UMZ 12, UMZ 17, UMZ 24.

Versions are differential in consideration of:
– dimensions
– rated primary voltage (insulation level)
– secondary voltage
– burden in given accuracy class.

Voltage transformers can operate at alititudes up to 1000 m above sea level, in the range of ambimient temperatures from 263 K (-10°C) to 328 K (55°C) with humidity up to 90%.
The lowest permissible temperature during transportation and storage is 243 K (-30°C).
This instruction contains information concerning technical-operating data and gives directions concerning service, maintenance etc. (it is intended as the assistance in correct installing, service and operation). Strict adherence to demands contained in this instruction enables correct operation of current and voltage transformers and in the case of failure of the transformers it is a condition of taking advantage of the warranty.

2. DESIGN

Design of Voltage transformers type UMZ are shown in the Figure No. 1 and 2.



1 – High voltage winding
2 - Low voltage windings
3 - Magnetic core
4 – Epoxy resin housing, insulation
5 – High voltage terminal (primary winding)
6 – Terminal box of the low voltage terminals (secondary windings)
7 – steel base plate with earthing terminal

Figure 1. Design of two insulated pole VT types UMZ

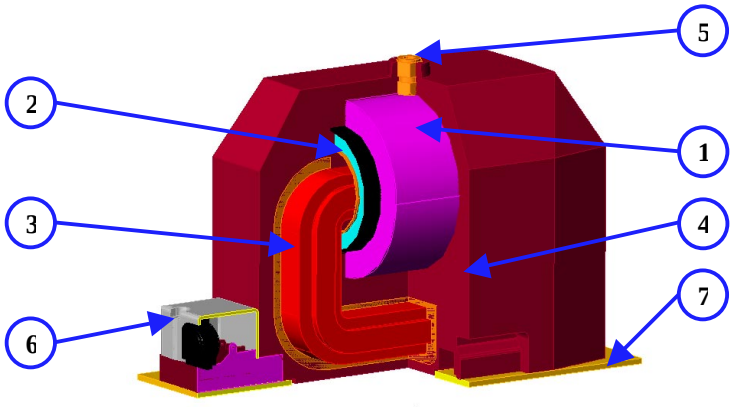


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Figure 2. Design of one insulated pole VT types UMZ

3. HIGH VOLTAGE INSULATION

Main insulation of the voltage transformer is epoxy resin witch are housing too.
The primary winding (high voltage winding) is build with multi-layer insulation .

4. PRIMARY TERMINALS (High voltage terminals)

Figure 3. Primary terminal for one insulated pole VT without fuse holder – Bolt M10 x 20 for UMZ 12-1 , UMZ 17-1 , UMZ 24-1

Figure 4. Primary terminal for two insulated poles VT– Bolt M10 x 20 for UMZ 12, UMZ 17 , UMZ 24

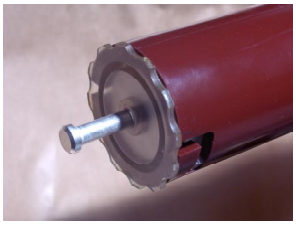


Figure 5. Primary terminal for one insulated pole VT with fuse holder – see dimension drawing for UMZ 12-1P , UMZ 17-1P , UMZ 24-1P

Figure 6. Primary terminal for one insulated pole VT with fuse holder – see dimension drawing for UMZ 12-1F , UMZ 17-1F , UMZ 24-1F

The primary terminals are located on the top side of voltage transformer (see dimension drawings) .

5. SECONDARY TERMINALS BOX

The terminals of secondary windings and the terminals designated to grounding,

(terminal N) are equipped with connectors shown at Figure 7 and 8

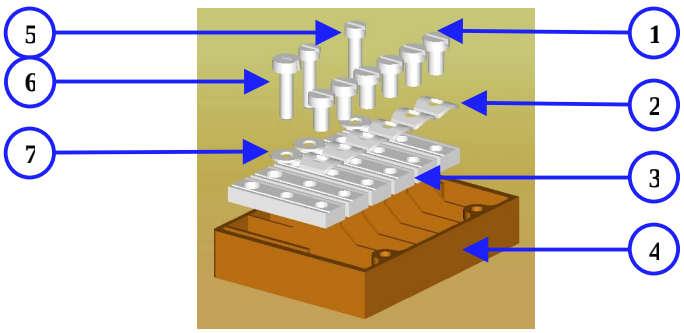


Figure 7. Secondary terminals and terminal N (to grounding end of primary winding)

1 – Screw M6 for connection cables to secondary terminal
2 - Special washer (to cables from 1 mm^2 up to 4 mm^2)
3 - Secondary terminal and terminal N (plate –width 12 mm)
4 – Plastic's support shelf
5 –Screw M5 for grounding secondary winding
6 – Special screw M5 (with especially for top) to grounding end of primary winding)* More information in next points
7 – Washer

* only for one insulated pole VT's

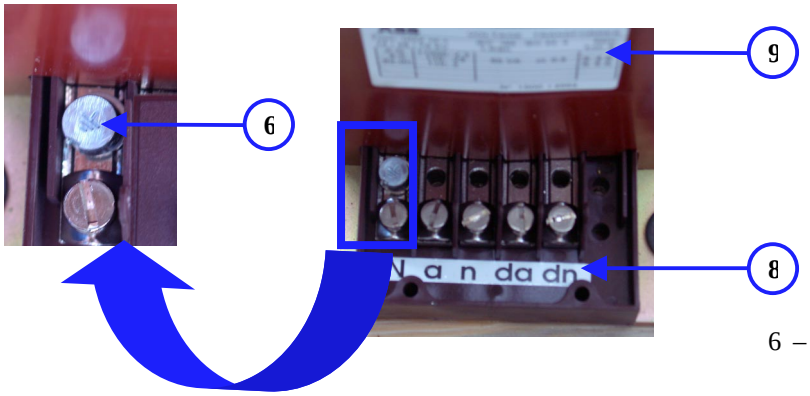


Figure 8. Secondary terminals and terminal N
(to grounding end of primary winding)

6 – Special screw M5 (with especially for top) to grounding end of primary winding)* More information in next points
8 – Plate with names of terminal
9 - Rating plate
10- Special key to assembling of screw to earthing end of primary winding (terminal N)**

* only for one insulated pole VT's
** additional equipment for especially order

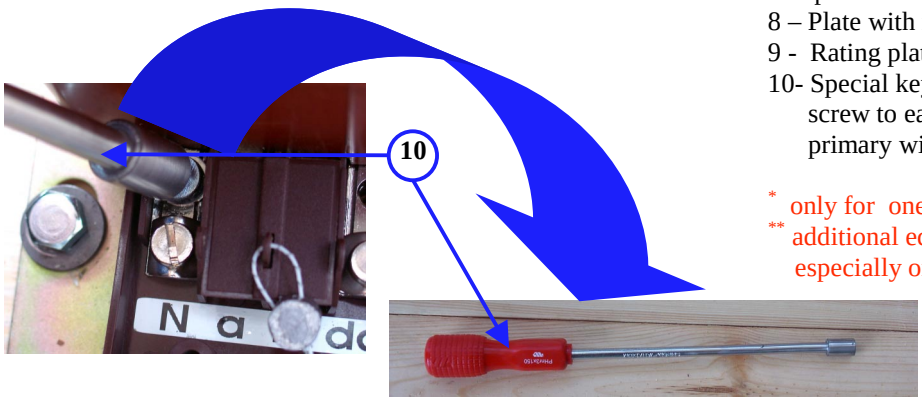
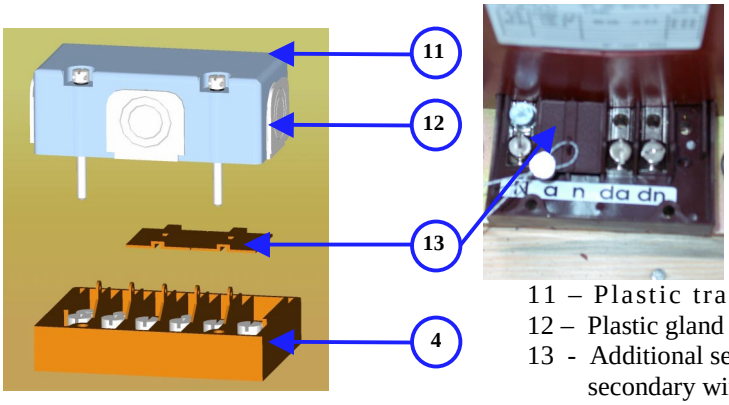


Figure 9. Assembling of terminal N (to grounding end of primary winding)

ATTENTION.

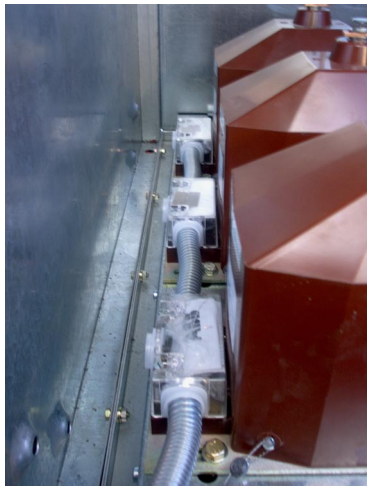
Ine case of measurement of insulation resistance of earthed transformer (with one insulated primary terminal) unscrew a screw which is used for earthing of terminal "N" placed in terminal strip, before measurement and screw this earthing screw in after measurement. Special screwdriver which is used to this end, customer could receive free of charge after placing an order.



11 – Plastic transparency cover
12 – Plastic gland type PG 16
13 - Additional sealing (singly) secondary windings

Figure 10. Cover and sealing of secondary terminals

At the flank of terminal box, there are 3glands PG 16 for fixing wires of secondary windings - range of choke dim. 5 mm up to 12 mm (see figure10 and 11).



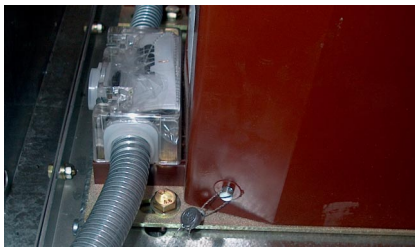


Figure 11. Removal of cables from terminal box.

6. EARTHING TERMINAL

For additionally grounding of VT earthing terminal M8 are used (see figure 12).

(Except for UMZ 12-1P ; UMZ 17-1P and UMZ 24-1P)

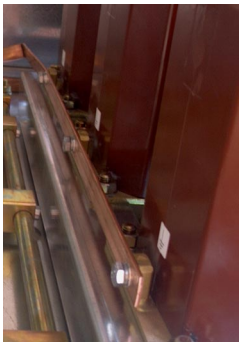


Figure 12. Earthing terminal M8

Figure 13. The grounding VT's in switchgear

ATTENTION.

Minimal crosssection earthing-connection to VT add 20 mm^2 .

7. FIXING TO THE BASE

The transformer can be slowly lifted and carefully put on the prepared supporting structure. The transformer must be fixed to supporting structure with bolts M10 or M8 for UMZ 12-1P , UMZ 17-1P and UMZ 24-1P.Fixing holes ϕ 11 mm (or ϕ 9 mm for UMZ 12-1P , UMZ 17-1P and UMZ 24-1P) are arranged as figure 14÷17 show. The thickness of the base at hole location is 4 mm. The fixing bolts are not delivered with the equipment.

Figure 14. Location of fixing holes behind VT

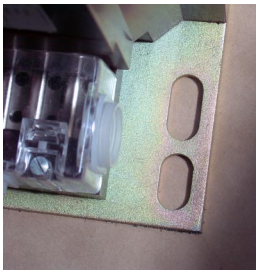


Figure 15. Location of fixing holes ahead VT

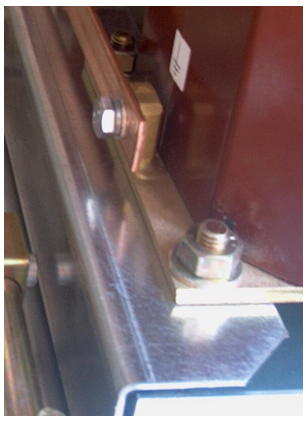


Figure 16. Fixing bolt behind VT

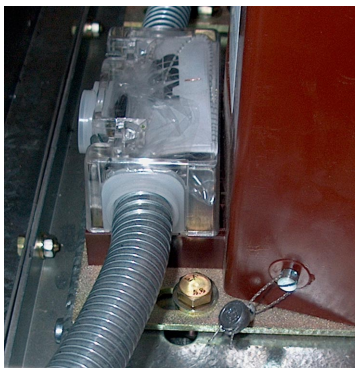


Figure 17. Fixing bolt ahead VT

7. REPLACEMENT OF FUSE

This point is adoption for VT's with fuse holder in range installation and replacement of fuse.

ATTENTION

The actions which are described must be executed without voltage state

The replacement or installing of fuse is made up of a few steps:

1. Disconnection of VT from bus-bar in safe distance without voltage state

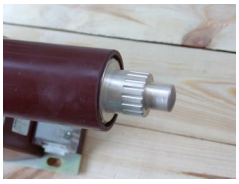


Figure 18.VT without voltage state

2. Unscrew of high voltage terminal

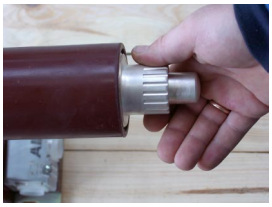


Figure 19. Unscrew HV terminal

3. Extraction of used fuse (this step only for replacement of fuse)

Figure 20. Extraction of used fuse

4. Insertion of new fuse

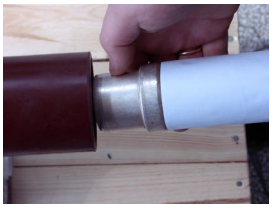


Figure 21. Insertion of fuse

5. Twisting of high voltage terminal

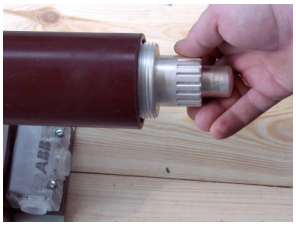


Figure 22. Twisting HV terminal

⚠ 6. Connecting of VT to bus-bar in without voltage state

8. TECHNICAL DATA

8.1 ELECTRIC WIRING DIAGRAMS

The electric wiring diagram of the voltage transformer is presented in Figure 23.

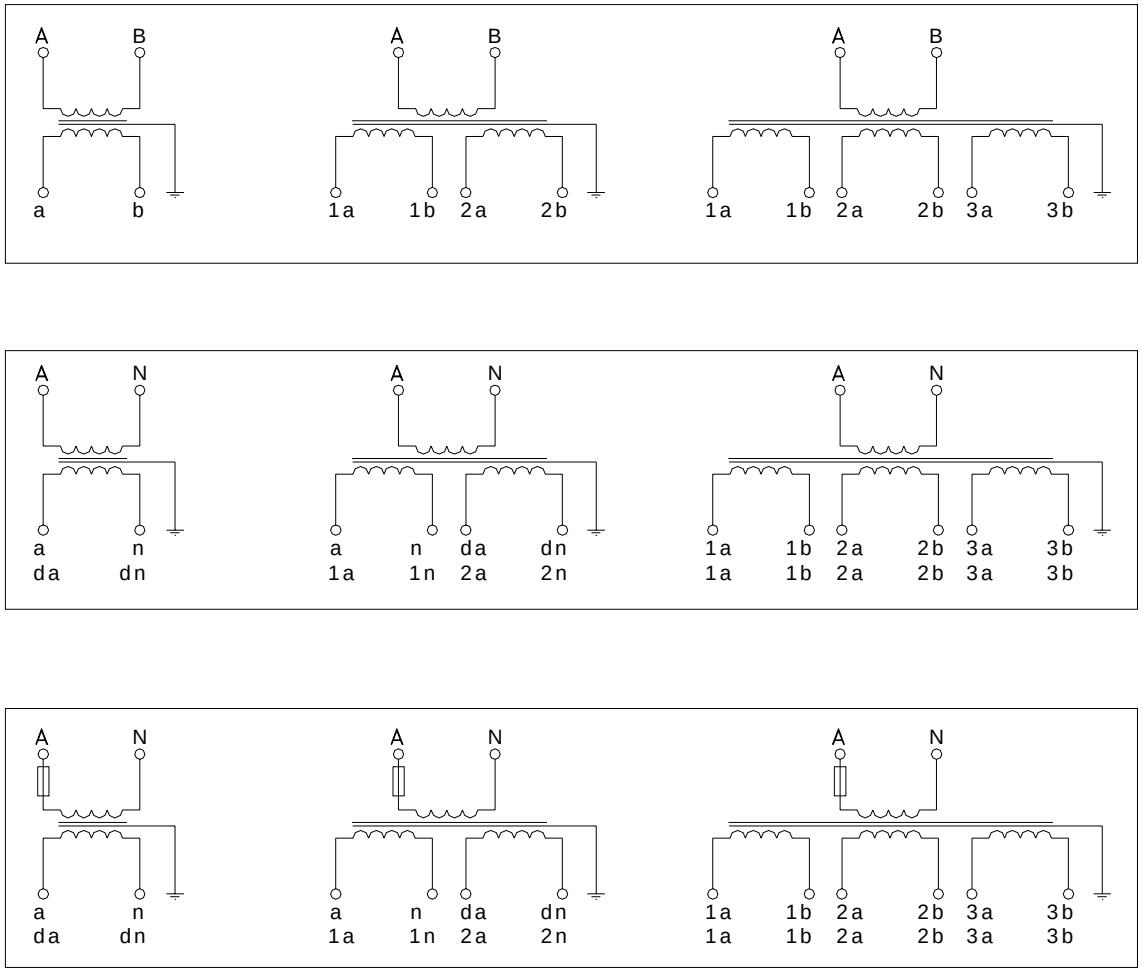


Figure 23. Electrical diagrams

8.2 TECHNICAL PARAMETERS

The list of technical parameters of the voltage transformers is shown in Table 1.

Table 1. Technical parameters

Type of transformers		UMZ 12-1, UMZ 12-1F, UMZ 12-1P			UMZ 17-1, UMZ 17-1F, UMZ 17-1P		UMZ 12			UMZ 17	
Insulation level	kV	3,6/10/40 or 7,2/20/60 or 12/28/75			17,5/38/95		3,6/10/40 or 7,2/20/60 or 12/28/75			17,5/38/95	
Rated primary voltage	kV	(1; 2; 2,5; 3; 3,3; 5; 5,5; 6; 6,3; 6,6; 10; 10,5; 11):$\sqrt{3}$			(12,5; 13,8; 15):$\sqrt{3}$		1; 1,3; 1,5; 2; 2,2; 2,5; 3; 3,3; 3,5; 4; 5 5,5; 6; 6,3; 6,6; 10			11,5; 12; 12,5; 13,8; 15	
Marking of primary terminals		A–N					A–B				
Rated secondary voltage	V	One winding	Two windings Measuring		Two windings Measuring	Two windings Additional	One winding	Two windings Measuring	Two windings Protecting	Two windings Measuring	
		100:$\sqrt{3}$ 110:$\sqrt{3}$	100:$\sqrt{3}$ 110:$\sqrt{3}$	100:$\sqrt{3}$ 110:$\sqrt{3}$	100:$\sqrt{3}$ 110:$\sqrt{3}$	100:3 110:3	100 110	100 110	100 110	100 110	100 110
Marking of secondary terminals		a–n	1a–1n	2a–2n	a–n	da–dn	a–b	1a–1b	2a–2b	1a–1b	2a–2b
Burden / accuracy class (measuring winding)	VA/–	20 (25*)/0,2; 50 (60*)/0,5; 100 (120*)/1					20 (25*)/0,2; 50 (60*)/0,5; 100 (120*)/1				
Burden / accuracy class (protection winding)	VA/–	25/3P; 50/6P					25/3P; 50/6P				
Thermal current	A	4	2	2	4	6	4	2	2	2	2
Voltage factor		1,9 / 8h					1,2 / –				
Insulation class		E					E				
Weight	kg	19÷23					20				

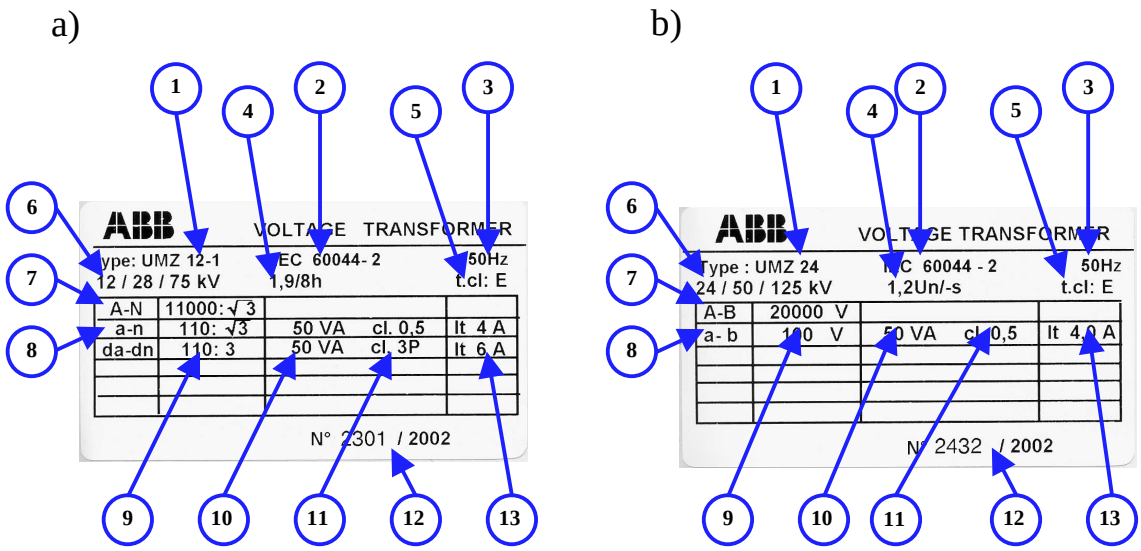
Type of transformers		UMZ 24-1, UMZ 24-1F, UMZ 24-1P					UMZ 24				
Insulation level	kV	12/28/75 or 17,5/38/95 or 24/50/125					12/28/75 or 17,5/38/95 or 24/50/125				
Rated primary voltage	kV	(10; 11; 12; 12,5; 13; 13,3; 13,8; 14; 15; 16; 20 i 22):$\sqrt{3}$					10; 11; 12; 12,5; 13; 13,3; 13,8; 14; 15; 16; 20; 22				
Marking of primary terminals		A–N					A–B				
Rated secondary voltage	V	One winding	Two windings Measuring		Two windings Measuring	Two windings Additional	One winding	Two windings Measuring	Two windings Protecting	Two windings Measuring	
		100:$\sqrt{3}$ 110:$\sqrt{3}$	100:$\sqrt{3}$ 110:$\sqrt{3}$	100:$\sqrt{3}$ 110:$\sqrt{3}$	100:$\sqrt{3}$ 110:$\sqrt{3}$	100:3 110:3	100 110	100 110	100 110	100 110	100 110
Marking of secondary terminals		a–n	1a–1n	2a–2n	a–n	da–dn	a–b	1a–1b	2a–2b	1a–1b	2a–2b
Burden / accuracy class (measuring winding)	VA/–	30/0,2; 50 (75*)/0,5; 100 (150*)/1					30/0,2; 50 (75*)/0,5; 100 (150*)/1				
Burden / accuracy class (protection winding)	VA/–	25 / 3P; 50 / 6P					25 / 3P; 50 / 6P				
Thermal current	A	4	2	2	4	6	4	2	2	2	2
Voltage factor		1,9 / 8h					1,2 / –				
Insulation class		E					E				
Weight	kg	31,5					31				

It is possible to order:

- Different secondary voltage (up to 400 [V])
- Different primary voltage
- Different burden – sum of windings should not exceeds: 20 [VA] cl. 0,2; 50 [VA] cl. 0,5 and 100 [VA] cl. 1;

8.3 RATING PLATE

The rating plate of transformers contains the detailed parameters for individual transformer. An example of such rating plate is shown in Figure 24.



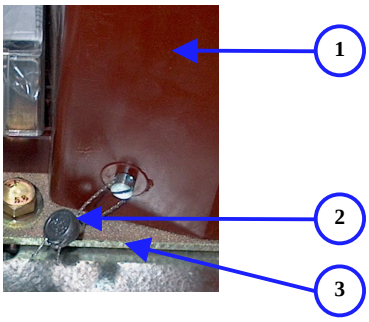
Marks : 1 – type of voltage transformer ; 2 – standard ; 3 – nominal frequency ; 4 – rated voltage factor ; 5 – insulation class ; 6 – insulation level (highest voltage for equipment / rated power-frequency withstand voltage / rated lightning impulse withstand voltage) ; 7 – marks of primary winding ; 8 – marks of secondary windings ; 9 – nominal value of voltage for each windings ; 10 – rated burden ; 11 – accuracy class for secondary windings ; 12 – serial number ; 13 – max. continuous thermal current for econdary winding .

Figure 24. Rating plates and marks for : a) one insulated pole transformer ;
b) two insulated pole transformer.

9. VERIFICATION OF VOLTAGE TRANSFORMER

The voltage transformers are made in measurement class 0,2 or 0,5 and are subject to verification, so they can be used to settlement of accounts.

Sign of verification is placed on the leaden seal, attached to instrument transformers (see figure 25).



1 – epoxy resin housing
2 – leaden seal
3 – steel base plate

Figure 25. The leaden seal for VT

10. CHECKING TRANSFORMERS UPON ARRIVAL

Upon arrival, the transformer and its package must be checked promptly for sings of damage or tampering.

Make sure that the parameters of the transformer provided on the rating plate comply with the parameters from the order.

If there are any damages, keep all the parts, including the skid, notify the carrier and contact the producer of the transformer - ABB.

11. ACTIVITIES BEFORE INSTALLING OF VOLTAGE TRANSFORMERS:

1. Before beginning of mounting, the transformer should be subjected to visual inspection with paying attention to:

- condition of resin casting,
- cleanness of transformer's terminals, casting surface and base (whether mechanical defects appear),
- moisture condition of transformer and in case of existing moisture symptoms, the transformer shall be subjected to drying,
- conformity of transformer's technical data with technical documentation concerning transformer connection.

2. Before beginning of mounting, the transformer should be subjected to following measurements:

a) measurement of primary winding insulation resistance:

- insulation resistance of unearthed transformer (with two insulated primary terminals) is not less than 1000MΩ.
  Make the measurement by means of coil megaohm-meter 2,5kV between shorted primary winding terminals and base.
- insulation resistance of earthed transformer (with one insulated primary terminal) is not less than 200MΩ.
  Make the measurement by means of coil megaohm-meter 1kV between shorted primary winding terminals and base.

ATTENTION.

Ine case of measurement of insulation resistance of earthed transformer (with one insulated primary terminal) unscrew a screw which is used for earthing of termina "N", placed in terminal strip, before measurement and screwing this earthing screw in after measurement. Special screwdriver which is used to this end, customer could receive free of charge after placing an order.

b) measurement of secondary windings insulation resistance.

- resistances of secondary windings insulation are not less than 50MΩ.
  Make then measurement by means of coil megaohm-meter 1kV.

ATTENTION.

In case of measurement of secondary windings insulation resistance unscrew screws which are used for earthing one of secondary windings terminals, if they are screwed in (at the top of terminal strip), before measurement. After measurement, screw these earthing screws in according to technical documentation concerning transformer connection .

c) measurement of primary windings resistance. Make the measurement by means of ohmmeter.

Resistance values should not differ from values given in table 1 more than ±20%.

TABLE 2.

Table 2. Resistance of primary windings

Primary windings resistances [kΩ]						
Primary voltage for single pole VT or (*) for double pole	UMZ 12-1; UMZ 12-1F; UMZ 12-1P	UMZ 12	UMZ 17-1; UMZ 17-1F; UMZ 17-1P	UMZ 17	UMZ 24-1; UMZ 24-1F; UMZ 24-1P	UMZ 24
kV	A-N kΩ	A-B kΩ	A-N kΩ	A-B kΩ	A-N kΩ	A-B kΩ
6/√3 or (6)*	0.58	1.95	0.58	1.95	0.55	1.79
6.6/√3 or (6.6)*	0.72	2.15	0.72	2.15	0.68	1.99
10/√3 or (10)*	1.65	5.23	1.65	5.23	1.57	4.51
11/√3 or (11)*	1.85	5.77	1.85	5.77	1.73	5.02
13.8/√3 or (13.8)*	X	X	3.01	12.9	2.94	8.01
15/√3 or (15)*	X	X	3.89	14.0	3.78	11.3
17.5/√3 or (17.5)*	X	X	X	X	4.74	13.8
20/√3 or (20)*	X	X	X	X	6.55	21.0
22/√3 or (22)*	X	X	X	X	7.2	23.1

d) measurement of secondary windings resistance. Make the measurement by means of Thomson bridge.Resistance values should not differ from values given in table 2 more than ±20%.

Table 3. Resistance of secondary windings

Secondary windings resistances [Ω]						
Type of transformer	Secondary winding rated voltage [V]					
	100:√3	100:3	110:√3	110:3	100	110
UMZ 12-1 UMZ 12-1F UMZ 12-1P	0,28	0,11	0,31	0,12	X	X
UMZ 12	X	X	X	X	0,32	0,35
UMZ 17-1 UMZ 17-1F UMZ 17-1P	0,28	0,11			X	X
UMZ 17	X	X	X	X	0,41	0,45
UMZ 24-1 UMZ 24-1F UMZ 24-1P	0,29	0,12	0,31	0,13	X	X
UMZ 24	X	X	X	X	0,33	0,36

3. **After installing the transformer, pay particular attention if correct secondary winding terminal is earthed (by means of special screw placed at the top of terminal strip).**

ATTENTION:

In case when secondary circuit is earthed in a few points, only and solely the same secondary winding terminal can be earthed. You should check very carefully if both secondary winding terminals weren't earthed by accident.

Earthed both secondary winding terminals lead to demage voltage transformer in a relatively short time. Any complaint would not be recognized if a transformer is damaged in this way.

ACTIVITIES DURING INSTALLING OF VOLTAGE TRANSFORMERS

One should be earthed:

a) on the primary side all terminals marked with „N" (only in the scheme „Y"),

b) one the secondary side:

- it is recommended to earth the lead of the winding, it is the terminal marked with the letter „n" in the circuits with one transformer,
- the star point of the scheme of connections „Y" and the scheme of connections „V",
- in the case of using of transformers for supplying of synchronisers the beginning of the winding of the phase L2 in the scheme „Y".

The transformers should be secured with the fuses:

a) on the primary side according to the rated voltage and the limit power of the transformer,

b) on the secondary side:

- it is recommended to earth the beginning of the winding , it is the terminal marked with the letter „a" in the circuits with one transformer,
- all phases in the scheme „Y" and phases with connected secondary windings in the scheme „V",
- in the case of earthing of the L2 in the scheme „Y" - the neutral conductor of this scheme.

The fuses can not be use in secondary windings of voltage transformers installed in accounting meter circuit.

12. ACTIVITIES AFTER THE INSTALLING OF THE TRANSFORMER AND BEFORE BRINGING IT INTO OPERATION

visual inspection :

- checking of proper installing (use of all holes for fixing, proper holding down of fixing bolts),
- checking of distances between primary terminals of current transformers and the checking of proper grounding of terminals,
- checking of the legalisation of leaden seal (it applies to the transformers supplying electricity meters).

14. ACTIVITIES DURING OPERATING OF THE TRANSFORMER

During operating of the transformer one should do:
- live visual inspections,
- inspections in no voltage state.

Live inspection

The inspection should be done at least once a month.
During the live inspection one should pay attention to:
- condition of the main insulation of the transformer,
- condition of the primary terminals,
- condition of the supporting structures.

NOTE: Live inspections do not apply to the transformers installed in the cubicles.

No voltage inspection

Inspection should be done periodically, depending on local conditions, but at least twice a year.
These inspection include:
- measurement of the resistance of the winding insulation or secondary windings together with secondary circuits, which value can not be less than 10 MΩ (megaohms) (see table 2 and 3)
- cleaning of the external surfaces of the transformer,
- complement of the coat,
- checking of holding-down of the fixing, terminal and grounding bolts.

Transformers are adapted for operation at altitude up to 1000m above sea level, in indoor conditions, at temperature from -10°C do 55°C, at relative humidity 90%.
Ambient temperature less than -10°C may cause damage of transformer during its operation due to difference between ambient temperature and winding temperature.
Ambient temperature higher than 55°C may cause overheating of transformer.
Humidity higher then 90% may cause slide discharges on transformer's surface between high voltage side and low voltage side and as a result, destruction of secondary side or apparatus connected to transformer.

15. DAMPING FERRORESONANCE FOR VOLTAGE TRANSFORMER

A number of practical measures can be taken to prevent ferroresonance , whose overvoltages, overcurrents and distortions wave forms result in thermal and dielectric stresses which may be dangerous for electrical equipment (failure ,reduction in performance and lifetime of insulators...).

The following method can be used to compute load resistances values. It should be applied to each case individually:

1. VTs with one secondary winding:

A damping resistor R is connected to the secondary of each VT (see figure 26) if consumption downstream of the VT is not sufficient. In this case the resistors continuously absorb power as soon as the VTs are energized .The recommended minimum values for the resistance R and power P_R of this resistance are:

$$R = \frac{U_S^2}{kP_{outt} - P_m} \quad , \quad P_R = \frac{U_S^2}{R}$$

where:
Us- rated secondary voltage (V),k - factor between 0.25 and 1 such that errors and service conditions remain within the limits specified standard IEC (k P_t is for example around 30 W a 50 VA rated output).
P_{out} - VT rated output (VA),
P_m - power required for measurement (VA).

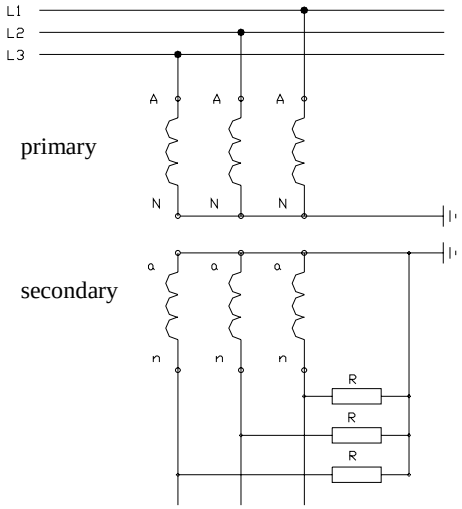


Figure 26. Protection device against the risk of ferroresonance for VTs by for

For example:

$$R = \frac{\left(100 : \sqrt{3}V\right)^2}{1 \cdot 30W - 10W} = \frac{3333{,}33}{20} = 166{,}6\Omega$$

$$P_R = \frac{\left(100 : \sqrt{3}V\right)^2}{166{,}6} \approx 20W$$

2. VTs with two secondary windings (one secondary winding for measurement, and one residual voltage secondary winding also known as a tertiary winding),
it is advisable to connect a resistance to the terminals of the open delta connected tertiary windings of the three transformers (see figure 27). The advantage of this damping device is that it does not affect measurement accuracy or introduce losses in normal (balanced) operating conditions, but only in unbalanced conditions in order to damp the phenomenon. The recommended minimum values for the resistance R and power P_R of this resistance are :

$$R = \frac{3\sqrt{3}U_S^2}{P_o} \quad , \; P_R = \frac{3U_S^2}{R}$$

where:
Us - rated voltage of the VT secondary, connected to the resistance (V)
P_e - rated thermal burden of the VT secondary winding concerned by the resistance (VA).
The rated thermal burden (in VA) is the apparent power that can be supplied by the VT to the secondary without exceeding the limits of normal temperature rise, without precision requirements.
Resistance R must be chosen to ensure permanent dissipation of power P_R.

For example:

Voltage ratio of VT 10000: 3 /100: 3 /100: 3 V ,
P_e = 100 VA
U_s = 100/3 V

$$R = \frac{3\sqrt{3}(100:3)^2}{100VA} = 57{,}7\Omega \approx 60\Omega$$

$$P_R = \frac{(3\cdot 100:3V)^2}{60\Omega} = 166{,}6W$$

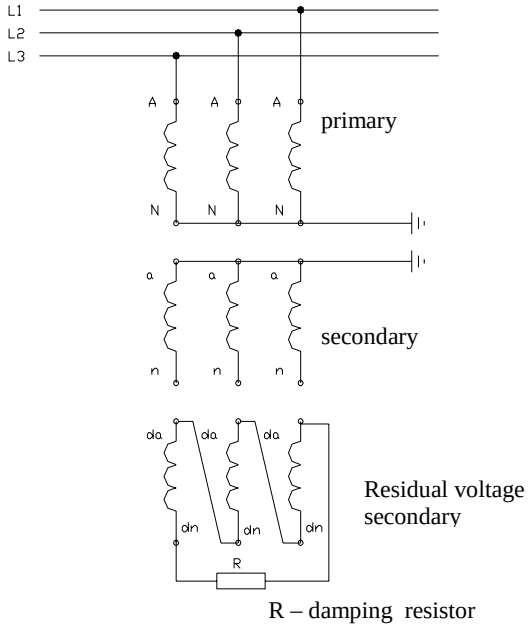


Figure. 27. Protection device against the risk of ferroresonance for VTs with two secondaries.

16. SELECTION OF FUSE TO VT.

Nominal current of fuse I_{bn} should keep two conditions:

$$\frac{S_g}{k\cdot U_{2n}} \geq I_{bn} > \frac{S_2}{U_{2n}} \quad , \quad S_g = I_{th}\cdot 0.95U_{2n}$$

where:
S_g - thermal limiting output ; U_{2n} – nominal secondary voltage , S_2 – burden of voltage transformer *;* I_{th} – maximal thermal current ; k – factor at value 1.5÷1.6.

17. PACKAGE, TRANSPORT AND STORAGE

Transformers are packed in wooden cases or on wooden palettes.
Dimensions are showing in the table 4.

Table 4. Transport data of package

Type of package	Length	Width	Height	Cubage	Weight of package
-	mm	mm	mm	m^2	kg
Case No.1	330	445	430	0.06	13
Case No.2	440	535	500	0.096	18
Case No.3	440	635	500	0.114	21
Case No.4	445	735	500	0.132	24
Palette No. 1	800	1200	500	0.51	38
Palette No. 2	600	800	500	0,25	28

Figure. 28. VT's in the wooden case

Figure. 29. VT's on the wooden palettes

ATTENTION:

During the transport of transformers one should pay attention to proper position of wooden cases in accordance with inscriptions and marks given on them and their protection against the influence of weather conditions.

Transformer should be stored in dry and clean accommodation, protecting from direct influence of precipitation and frost.

18. PROCEDURE OF WASTING

For pollutants our suggestion is to use biodegradable chemicals which can be used for greasy surface (practically most of the washing chemicals like washing-up liquid).

The materials from disassembled transformer should be wasted with reference to local regulations.

ATTENTION:
Washing without voltage state !

19. ENVIRONMENT

Properly used transformers and without mechanic damages can operate twenty five years. After this period or if damage occurs earlier, the transformer should be processed with regard to the environmental protection.

20. PRIME MATERIAL SPECIFICATION

Table 5 .The prime material used in transformers:

Material	UMZ 12-1	UMZ 12-1F	UMZ 12-1P	UMZ 12	UMZ 17-1	UMZ 17-1F	UMZ 17-1P	UMZ 17	UMZ 24-1	UMZ 24-1F	UMZ 24-1P	UMZ 24
Epoxy	1.6	1.96	2.0	1.6	1.6	1.96	2.0	1.6	2.56	2.89	3.1	2.56
Hardner	1.6	1.96	2.0	1.6	1.6	1.96	2.0	1.6	2.56	2.89	3.1	2.56
Quartz (Si)	5.12	6.27	6.5	5.12	5.12	6.27	6.5	5.12	8.5	9.24	9.9	8.2
Cupper *	3.30	3.30	3.30	2.0	3.30	3.30	3.30	2.0	6.35	6.35	6.35	4.5
Steel	7.70	7.70	7.70	7.70	7.70	7.70	7.70	7.70	8.34	8.34	8.34	8.34
Brass	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Rubber	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.24	0.24	0.24	0.24
Plastic (poliamid)	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542	0.0542
Plastic (polycarbon)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Plastic (polythene)	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177	0.0177
Solder (Sn)	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027

* - weight different according to ratio
Weight of materials are presented in kilograms.

21. WARRANTY

The factory grants 24 months of warranty from the day of putting to use of the transformer, but no longer than 36 months from the day of purchase.

The warranty concerns only manufacturing defects and does not include defects which arose because of:
- improper transport,
- improper storage,
- not abiding of the instruction before installing and during operating of the transformers,
- improper selection of the transformer for the electric power system.

22. OPERATING CONDITIONS

Transformers are adapted to work at the altitude up to 1000 m above sea level in indoor equipment in temperature:

- from 268 K (-5°C) to 313 K (40°C) at the relative humidity not exceeding 70 % for transformers intended to work in the temperature climate (N3),
- from 263 K (-10°C) to 328 K (55°C) at the relative humidity not exceeding 90 % for transformers intended to work in the tropical climate (T3).

The lowest temperature of transport and store 243 K (-30°C).

23. SPARE PARTS

The construction of cast resin insulated current and voltage transformers does not consider spare parts.

24. PROCEDURE REGARDING THE PRODUCTS AFTER THE END OF THEIR USE

The manufacturer gets back or indicates the store place for instrument transformers of its own production, which the period of use is finished, in order to their recycling.

25. DIMENSIONS DRAWINGS

Dimensions drawings are shown at figure 30÷

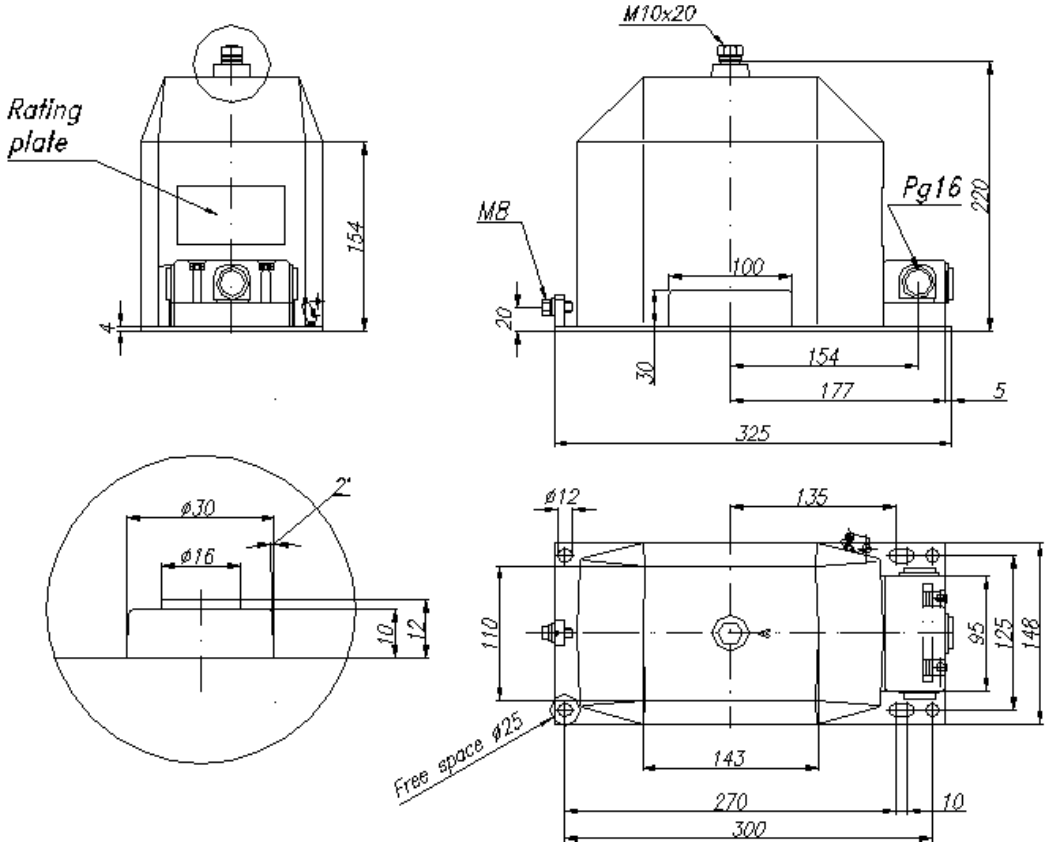


Figure 30. Dimensions drawing UMZ 12-1 or UMZ 17-1

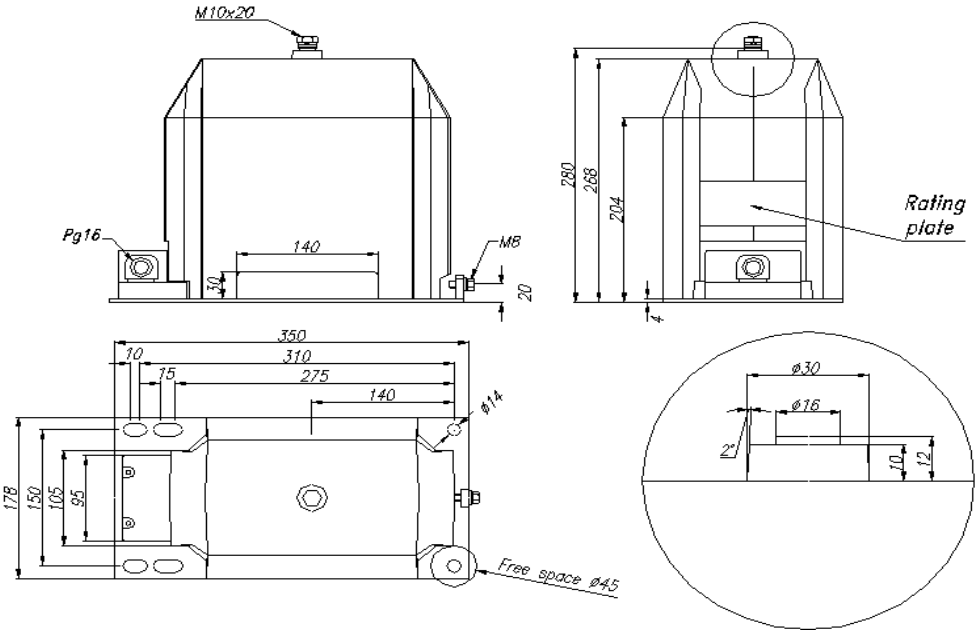


Figure 31. Dimensions drawing UMZ 24-1

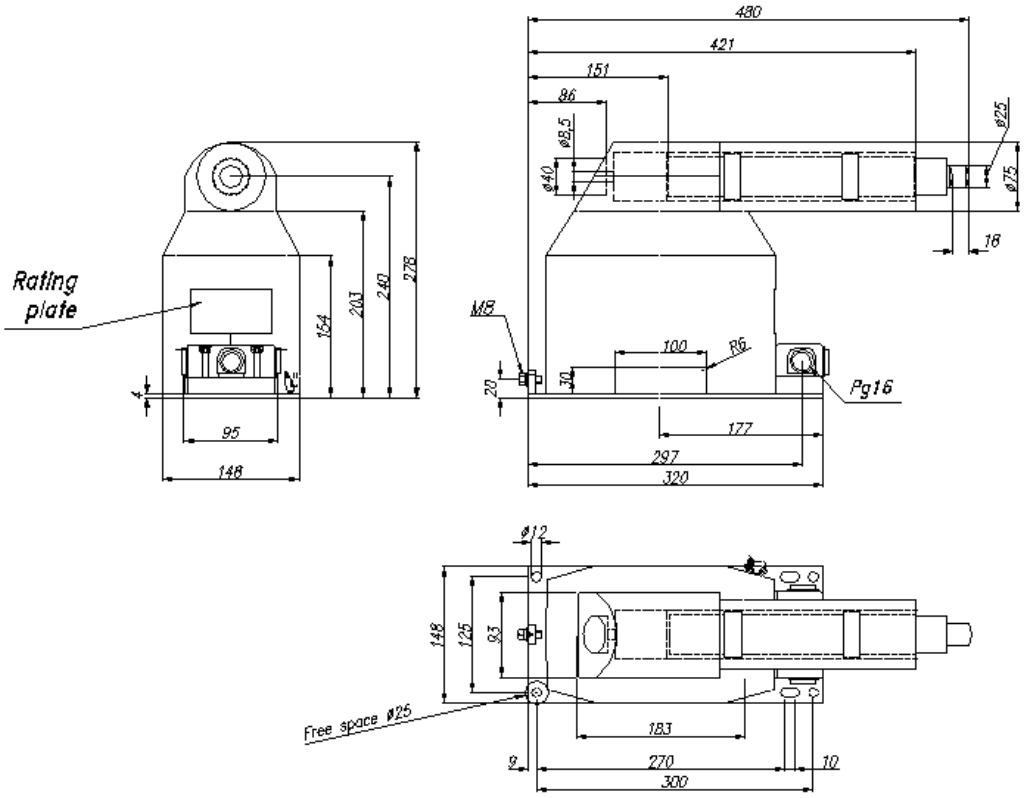


Figure 32. Dimensions drawing UMZ 12-1F or UMZ 17-1F

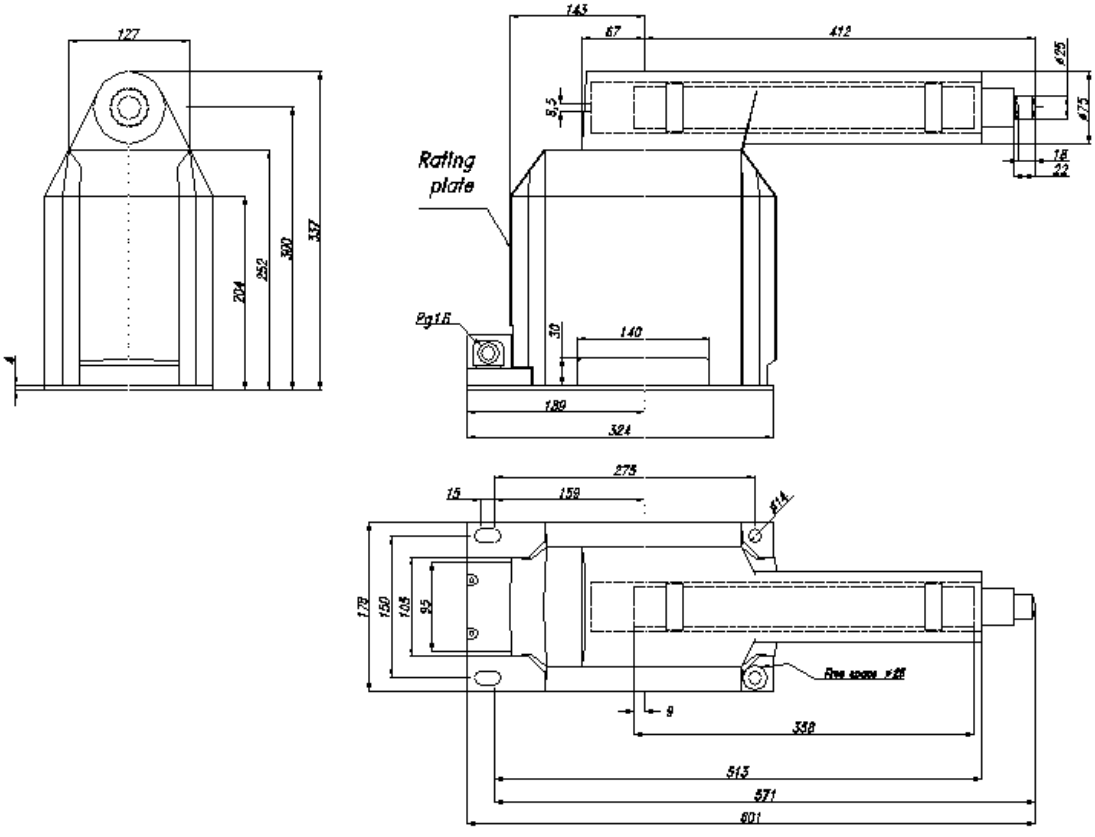


Figure 33. Dimensions drawing UMZ 24-1F

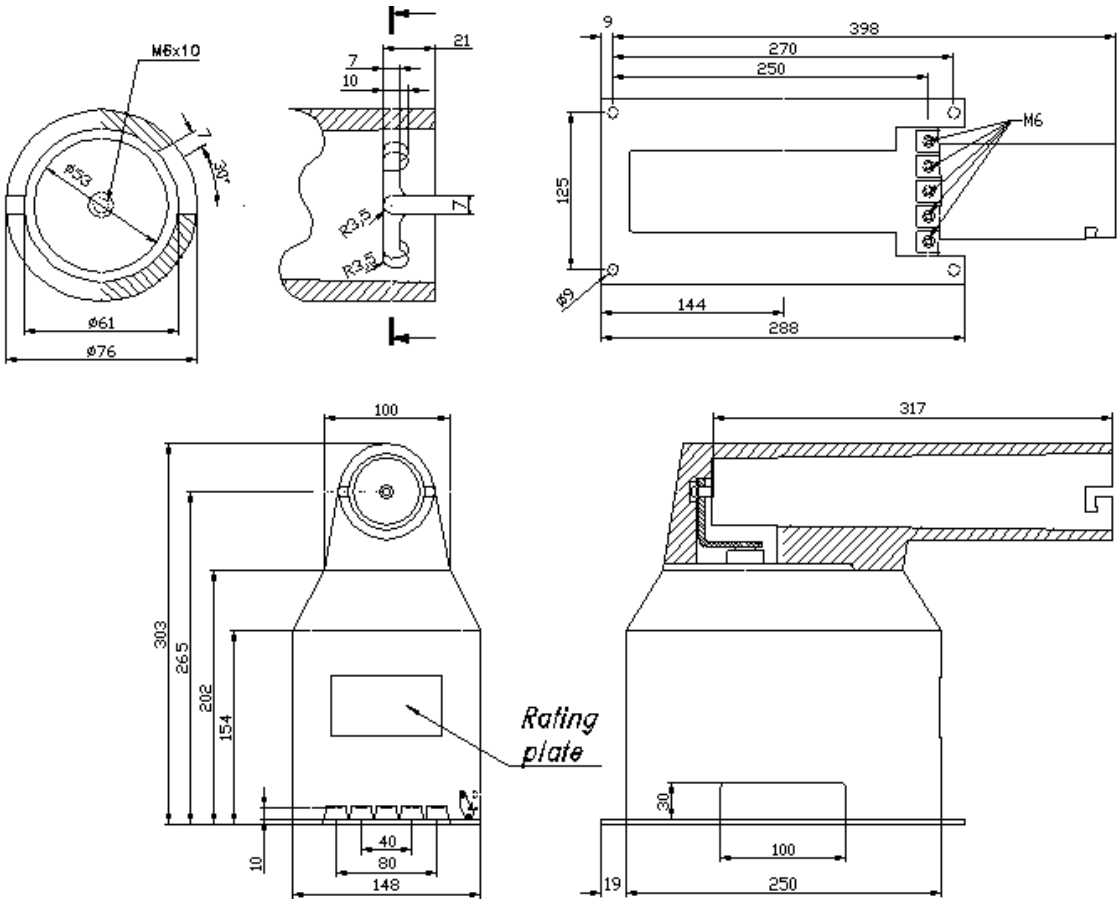


Figure 34. Dimensions drawing UMZ 12-1P or UMZ 17-1P

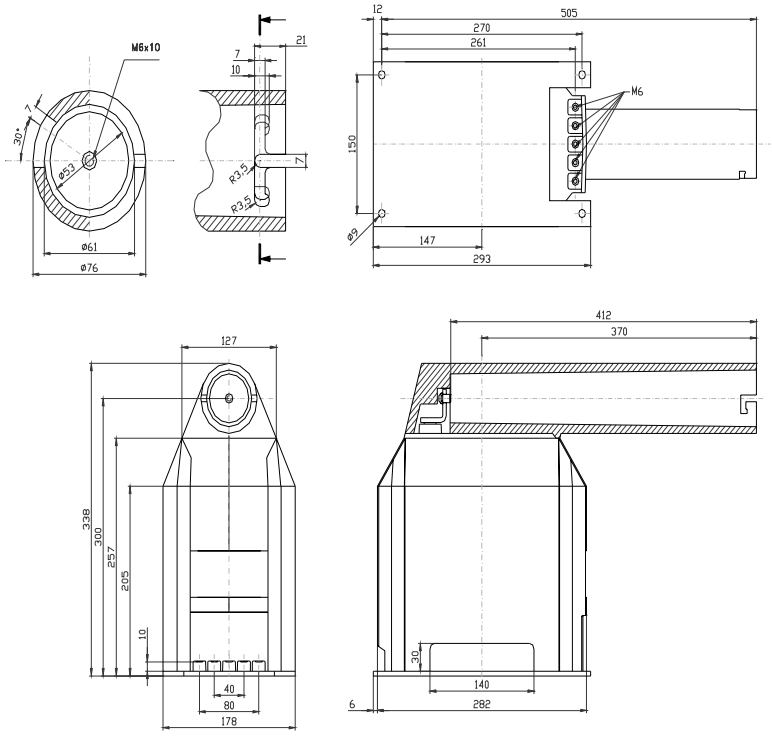


Figure 35. Dimensions drawing UMZ 24-1P

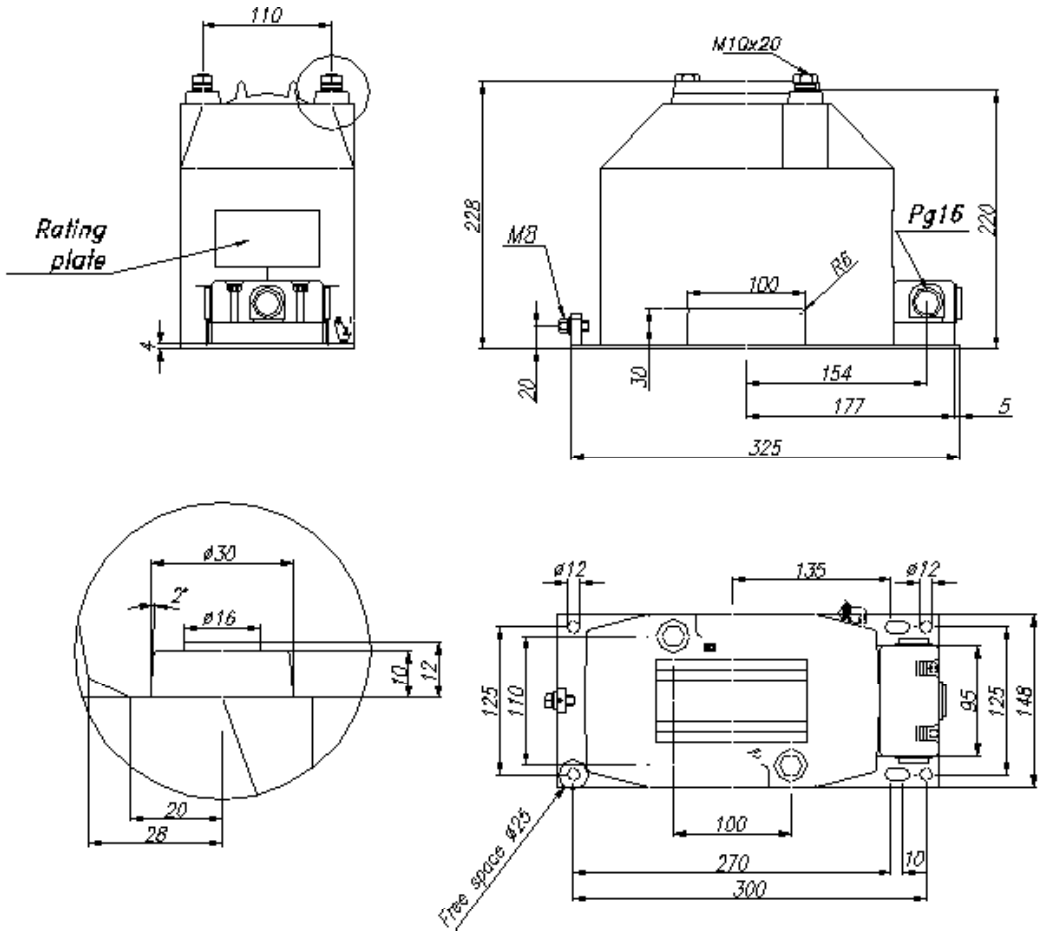


Figure 36. Dimensions drawing UMZ 12 or UMZ 17

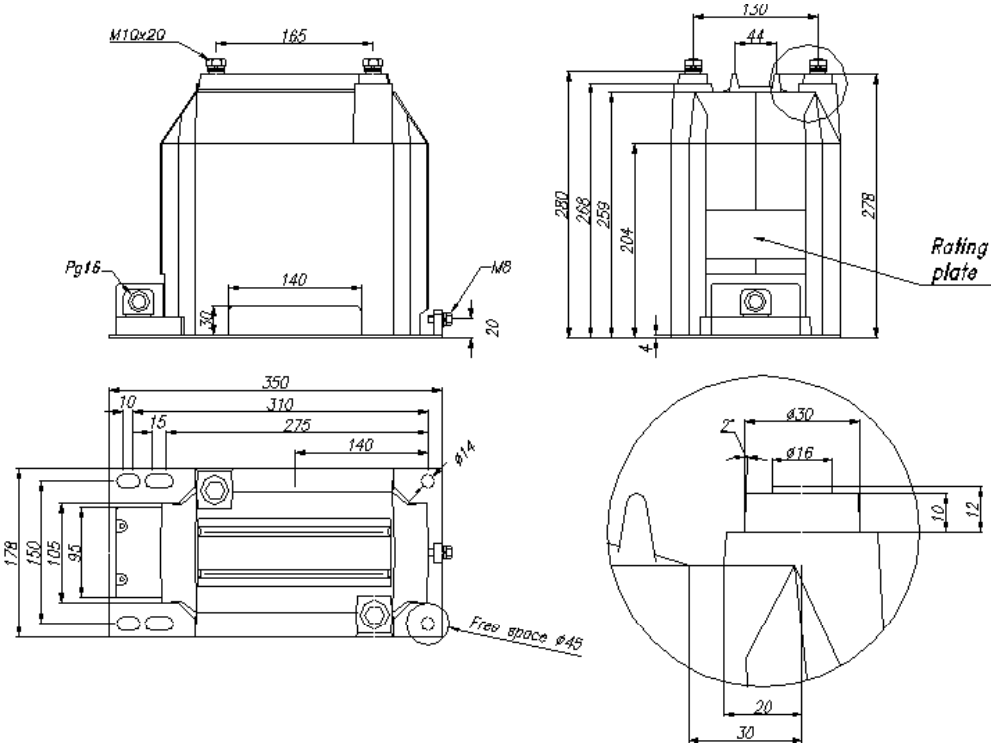


Figure 37. Dimensions drawing UMZ 24

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