



Electroshield-C° OOO



CURRENT TRANSFORMER

TLO-10

Operation Manual

EK.1.760.000 RE

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Introduction

The purpose of this Operation Manual is to provide guidance on the structure and technical details, and the Manual as well contains information on transportation, storage, mounting and operation, of TLO-10 current transformer.

In addition to this Operation Manual, the transformer passport EK.1.760.000 PS should be referred to as well.

1 Correct Use

1.1 TLO-10 current transformer (hereinafter referred to as the “transformer”) is designed to transmit a measurement data signal to metering instruments, protection and controlling devices, and to insulate secondary connection circuits from high voltage in indoor and outdoor switchgears (switchgears, package outdoor switchgears, unilateral maintenance switchgears) of alternating current for voltage class of up to 10 kV.

1.2 The transformer has the following climatic classes “N”, “NF” and “T”, placement category of 2 or 3 under GOST 15150-69 and is engineered for operation under the following conditions:

1) climatic factors rated values – under GOST 15543.1-89 1 and GOST 15150-69, except for the upper operating value of ambient air temperature, these values with due regard to air overheating within the switchgear is specified as equal to: for class “N” and “NF”: + 50°C, for class “T”: + 55°C;

2) the environment is non-explosive, contains no current-conducting dust, reactive gases and vapors in concentrations destroying metals - environment of type II under GOST 15150-69;

3) lower value of ambient air temperature:

- during operation: - 45°C,
- during transportation and storage: - 50°C;
- transformer position in space – any.

2 Technical Data

2.1 Basic technical data for the transformer are given in table 1.

2.2 The transformer is manufactured with two insulation levels «a» or «b» according to GOST 1516.3-96.

2.3 Partial discharge factor of the transformer primary insulation with «a» insulation level under GOST 1516.3-96 does not exceed 20 pC at measurement voltage of 7,62 kV.

Table 1

Parameter	Parameter value
1 Rated voltage, kV	10
2 Maximum operating voltage, kV	12
3 Rated primary current, A	According to Annex B
4 Rated secondary current, A	1; 5
5 Rated frequency, Hz	50; 60
6 Number of secondary windings	up to 5
7 Rated secondary burdens, $\cos\varphi=0,8$: - of measuring winding, VA - of protection winding, VA	from 1 to 50 from 1 to 50
8 Rated accuracy class according to GOST 7746: measuring winding protection winding	0,2S; 0,2; 0,5S; 0,5; 1; 3 5P or 10P
9 Rated accuracy limit factor ALF_{rat} of secondary protective winding:	from 2 to 30
10 Rated instrument security factor FS_{rat} of measuring winding:	from 3 to 30
11 One-second short-time withstand current, kA, at rated primary current:	
5-20 A	2,5; 5
30-50 A	5; 10; 20
75-100 A	10; 20; 31,5; 40
150 A	15; 20; 31,5; 40
200 A	20; 31,5; 40-60
300 A	31,5; 40-100
400 – 4000 A	40-100
12 Short time electrodynamic current, kA, at rated primary current:	
5-20 A	6,25; 12,8
30-50 A	12,8; 26; 52
75-100 A	26; 52; 81; 100
150 A	39; 52; 81; 100
200 A	52; 81; 100-150
300 A	81; 100-250
400 – 4000 A	100-250
13 Weight, kg not more	from 21 to 60

Table 2 – available versions for TLO-10 current transformer

Version	Description
A	secondary terminals from the transformer end surface
B	secondary terminals from the below of the transformer
C	sealing cover available
D	with flexible secondary terminals
E	with switching over on the secondary winding
F	with switching over on the primary winding

3 Configuration

3.1 The transformer is configured as a support structure. Transformer overall view is given in Annex A. The case of the transformer is made of polyurethane resin which simultaneously is the base insulation and ensures protection for the windings against mechanical and climatic impacts.

3.2 Transformers for rated current of up to 400 A have a coil-shaped multi-turn primary winding, and transformers for rated current of 600 A and over have one-turn winding. Primary terminals are located at the transformer upper surface.

Secondary windings are located each on its own magnet core.

Secondary terminals are made as M6 threaded contact elements and located in the transformer lower part.

3.3 The transformer can have one or several transformation ratios and different values of rated secondary current.

3.4 Secondary terminals of the current transformer can be made of flexible copper wire of different length with a cross section of at least 2,5 mm² (length to be agreed with the manufacturer at the time of order).

4 Installation and Mounting

4.1 The transformer should be installed in switchgear, package outdoor switchgear, unilateral maintenance switchgear cabinets in accordance with the switchgear drawings. The transformer is fixed at the installation place with the help of four M12 bolts to the fastening holes on the transformer base. Fixing torque for M12 bolts - $35 \pm 5 \text{ N} \cdot \text{m}$.

4.2 Prior to mounting, remove the preservation grease from the transformer, clean it off dust and dirt with the help of a dry fiber-free cleaning cloth.

4.3 During mounting, a reliable contact between the connecting bus bars and the primary terminals should be ensured. Fixing torque for M12 bolts - $35 \pm 5 \text{ N} \cdot \text{m}$.

4.4 Wires connected to the transformer secondary windings should have tips or should be ringed for M6 screw and should be tinned. During mounting, please take into consideration that if sense of current in the primary circuit is from J11 to J12, secondary current in the external circuit flows from 1H1 to 1H2.

4.5 The measuring winding for commercial metering can be sealed with the help of a protective plastic cap and sealing M5 screws.

4.6 If secondary terminals are made of flexible copper wire, it is forbidden to change their length during mounting and operation. Metrological characteristics are ensured at secondary terminal length stated in the annex to passport EK.1.760.000 PS for respective product.

5 Marking

5.1 The transformer has a rating plate matching GOST 7746-2001 and a plate with a warning sign on high voltage at open secondary terminals.

5.2 Markings on the primary winding J11, J12, secondary windings 1J1, 1J2, 2J1, 2J2 and 3J1, 3J2 were applied with the help of case casting.

5.3 Shipper containers are marked according to GOST 14192-96, the markings applied directly to the containers.

6 Safety Measures

6.1 Transformer construction, mounting and operation must comply with safety requirement of GOST 12.2.007.0 and GOST 12.2.007.3, Regulations for Operation of Consumer Electrical Installations, Health and Safety Rules for Electrical Installations, Electrical Installation Regulations, Scope and Rates for Testing Electrical Installations RD 34.45-51.300-97.

6.2 It is not allowed to perform any switching over in the transformer secondary circuits, if not have made sure that there is no voltage in the primary winding. When in operation, any chance of opening of the transformer secondary circuits should be precluded.

6.3 The transformers were tested for electric strength of the base insulation according to GOST 7746-2001 and GOST 1516.3-96.

6.4 Repeated tests for electric strength of the winding insulation should be performed with voltage of 37,8 kV (in accordance with Electrical Installation Regulations, Edition 7, Chapter 1.8.17 cl.3.1, table 1.8.16), the transformer should be in operating position.

7 Maintenance

7.1 The rules of the Safety Measures section must be complied with during maintenance of the transformer.

7.2 Maintenance should follow the schedule specified for the installation the transformer is built into.

7.3 Maintenance scope shall be as follows:

- transformer surface cleaning off dust and dirt;
- transformer visual inspection for damages;
- measuring primary insulation resistance. It should be measured with a megaohmmeter of 2500V. Resistance should be at least 1000 MOhm;

- measuring secondary insulation resistance. It should be measured with a megaohmmeter of 1000 V. Resistance should be at least 50 MOhm;
- measuring excitation current in secondary windings.

7.4 Repeated tests for electric strength of the winding insulation should be performed with voltage of 37,8 kV in accordance with Electrical Installation Regulations, Edition 7, Chapter 1.8.17 cl.3.1, table 1.8.16.

7.5 The transformers should be verified in accordance with EK.1.760.000 PM5 “Verification Method for Current Transformers TLO-10”.

Reverification interval – 8 years.

8 Packaging, Transportation, Storage and Scrappage

8.1 The transformers can be transported by any closed transportation means under group H transportation conditions in accordance with GOST 23216.

Transformer unpacked transportation is acceptable in containers and in closed vehicles, provided that the transformers are rigidly fixed with the help of wooden blocks, bolts or with the help of other means – with a clearance of not less than 10 mm between them.

8.2 Transformer transportation conditions in terms of climatic impact - according to the storage conditions group 5 or 6 under GOST 15150-69 for N, NF or T versions respectively.

8.3 Transformers should be stored and kept in closed premises packed or unpacked. If storing transformers unpacked, measures preventing from possible damages should be taken. Transformer storage term without repeated preparation for prolonged storage is 3 years.

8.4 When transporting and storing transformers, rapid temperature changes, especially rapid cooling, should be avoided (temperature differential should not exceed 40°C).

8.5 Transformers shall be scrapped upon expiration of the service life or in case of functional loss. For this purpose, crack the transformer observing applicable safety rules, remove polyurethane from ferrous and non-ferrous metal components.

Polyurethane fragments should be transferred to a solid waste land field. These wastes belong to the 5th hazard class (biotesting report No. 157 dd 28.12.2009). Ferrous and non-ferrous scrap should be transferred to a dedicated metal scrap company.

9 Voltage Transformer Conventions

An example of a record to denote the transformer in M1 overall

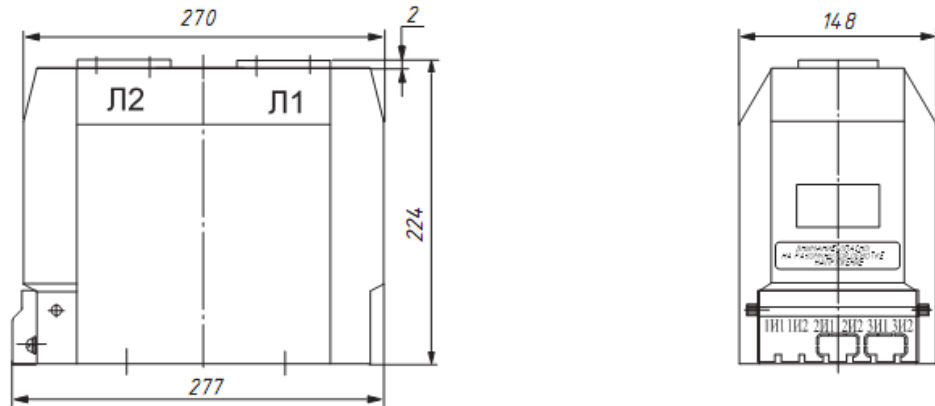
dimension (annex A) with secondary terminals at the lower side, version B, in accordance with table 2; with rated primary current of 600 A, rated secondary current 5 A with two secondary windings (one to connect measurement circuits with accuracy class of 0,2 and burden of 10 VA, the second to connect protection circuits with accuracy class of 10P and burden of 15 VA); climatic class «N», placement category 3 under GOST 15150-69, with one-second short-time withstand current 40kA and insulation level «b» in accordance with GOST 1516.3-96, at the time of order and in documents for another product:

Current transformer:

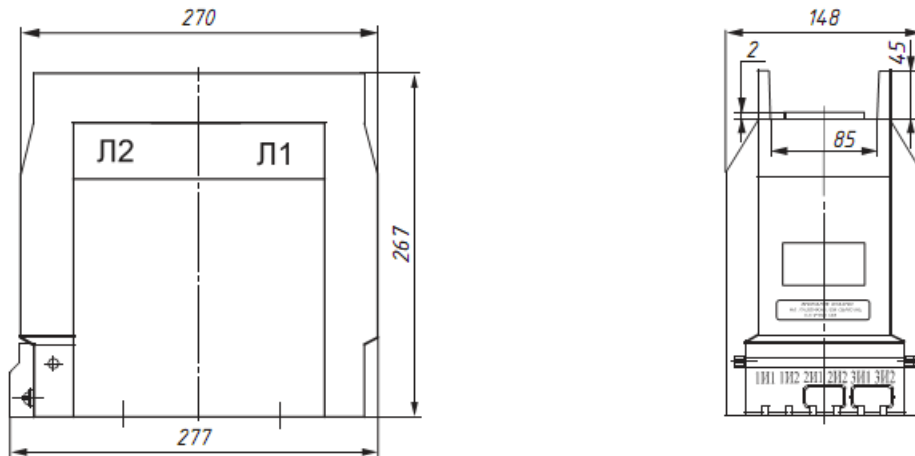
TLO-10 M1B – 0,2/10P -10/15 -600/5 N3 40 kA b, TU 3414-003-52889537-01

Overall Dimensions for TLO-10 Current Transformer

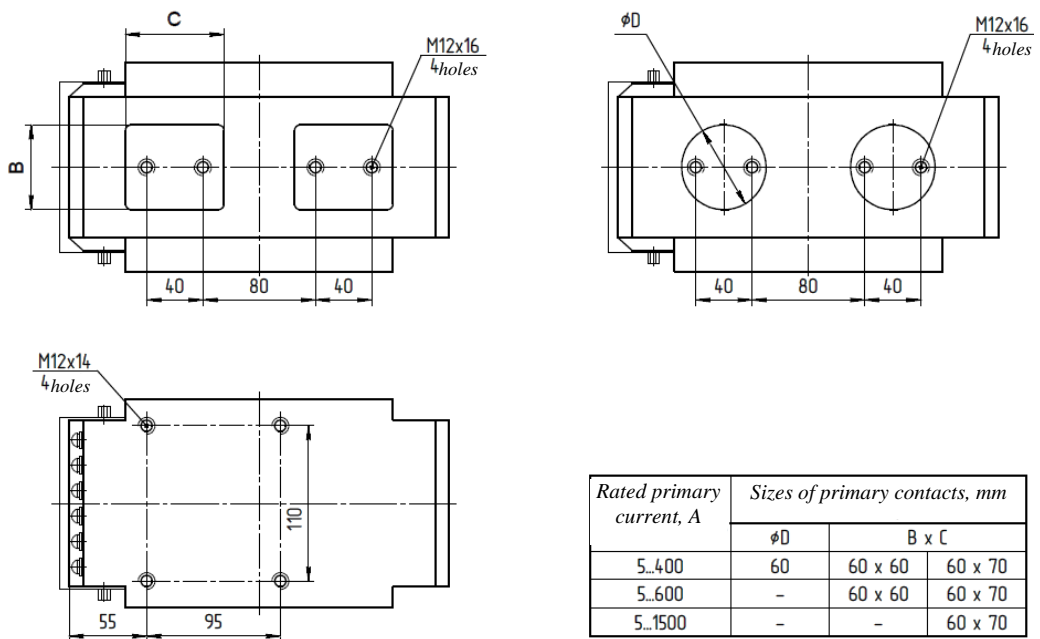
Version M1



Version M2

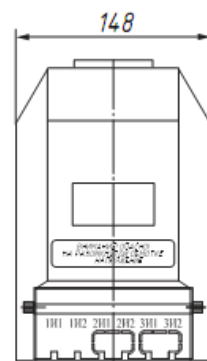
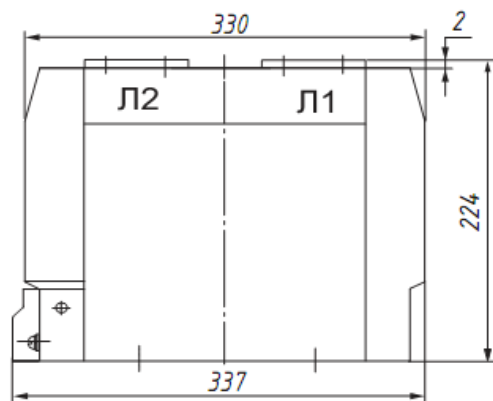


Installation and Mounting dimensions for TLO-10 Current Transformers for M1 and M2 versions

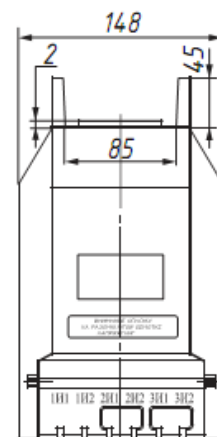
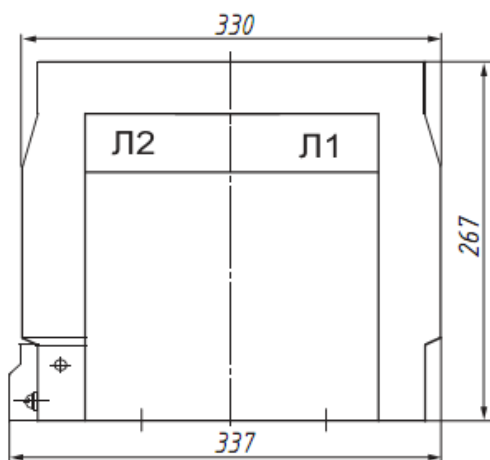


Rated primary current, A	Sizes of primary contacts, mm		
	φD	B x C	
5...400	60	60 x 60	60 x 70
5...600	-	60 x 60	60 x 70
5...1500	-	-	60 x 70

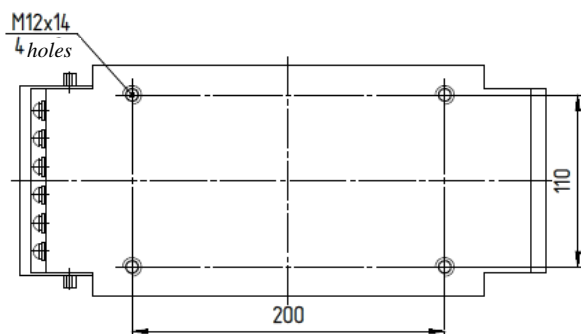
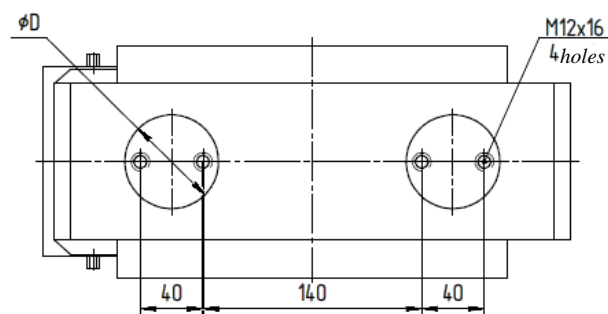
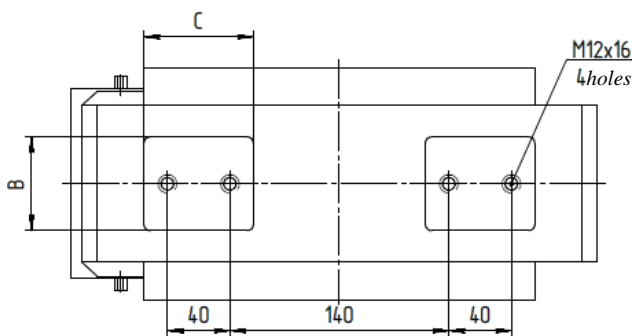
Version M3



Version M4

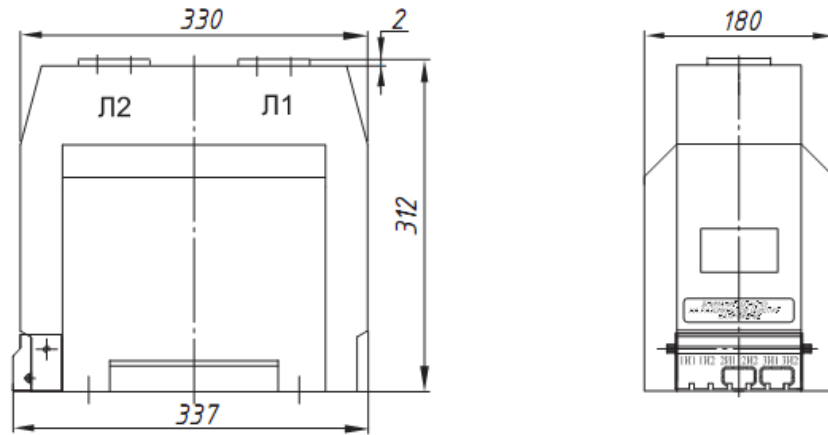


Installation and Mounting dimensions for TLO-10 Current Transformers for M3 and M4 versions

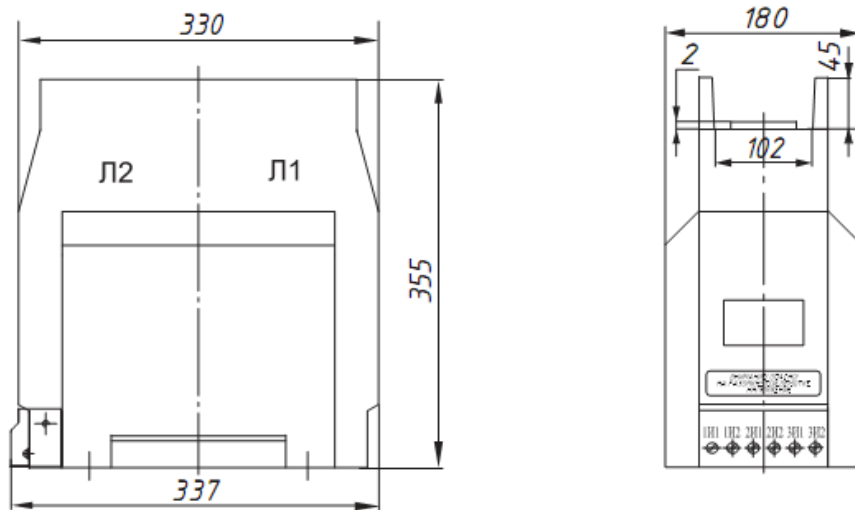


Rated primary current, A	Sizes of primary contacts, mm		
	ϕD	B x C	
5..400	60	60 x 60	60 x 70
5..600	-	60 x 60	60 x 70
5..1500	-	-	60 x 70

Version M5

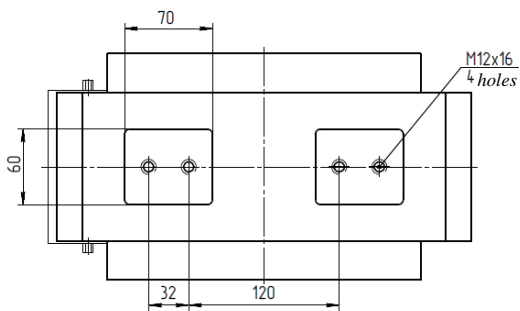


Version M6

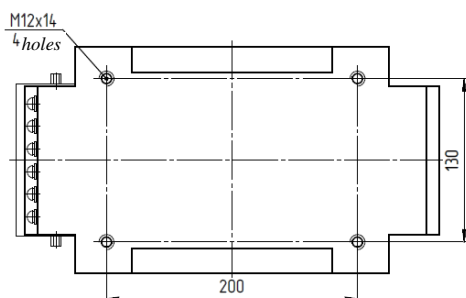
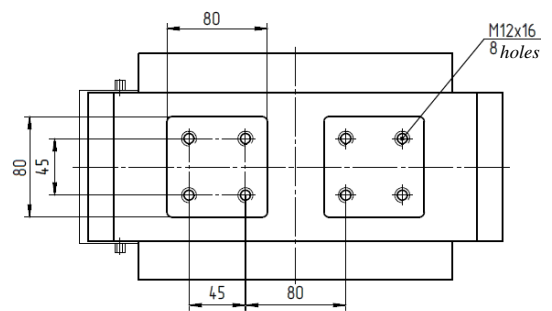


Installation and Mounting dimensions for TLO-10 Current Transformers for M5 and M6 versions

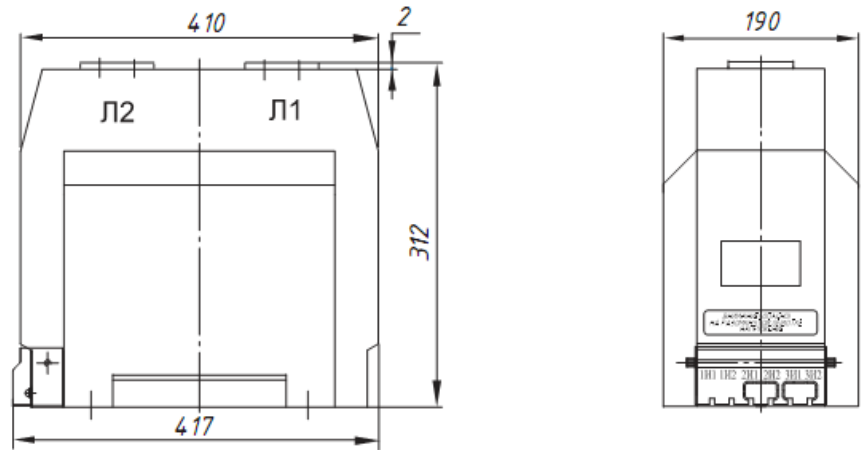
For rated primary currents from 5A to 1500A



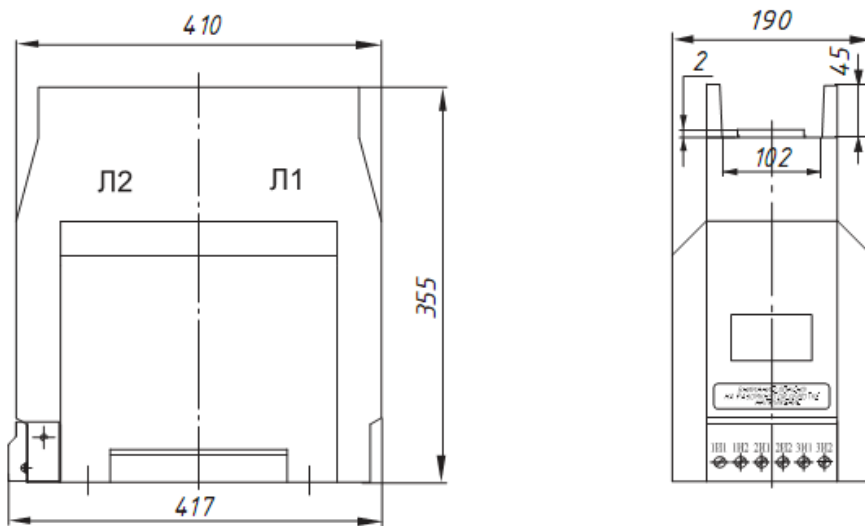
For rated primary currents from 1600A to 3000A



Version M7

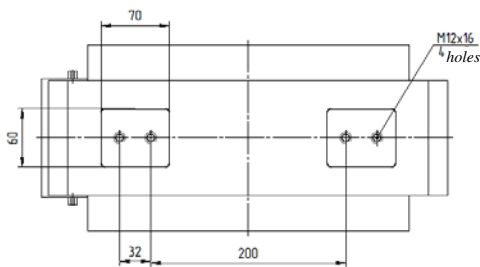


Version M8

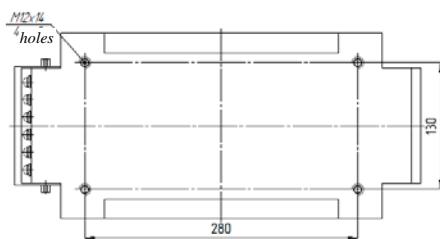
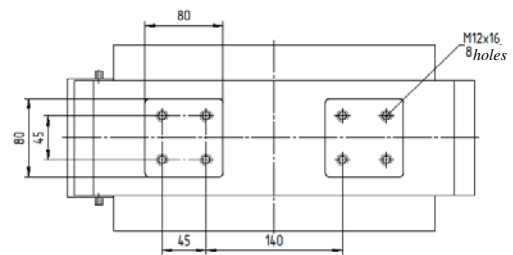


**Installation and Mounting dimensions for TLO-10 Current Transformers
for M7 and M8 versions**

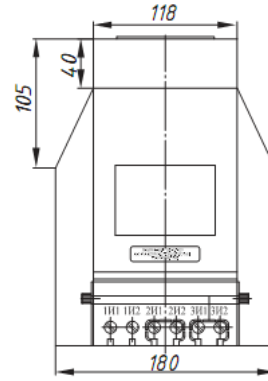
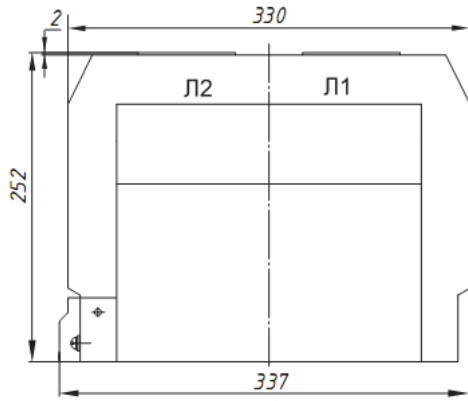
For rated primary currents from 5A to 1500A



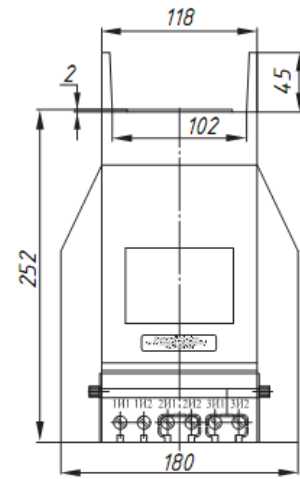
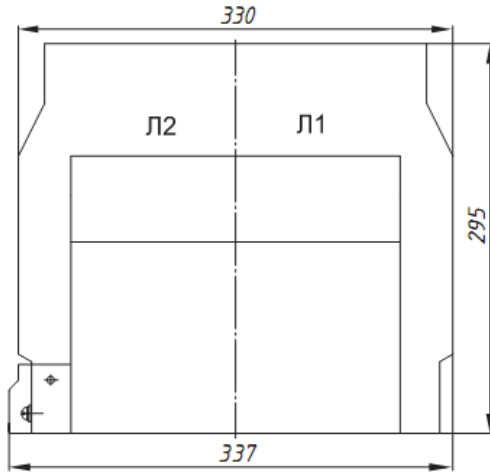
For rated primary currents from 1600A to 3000A



Version M9



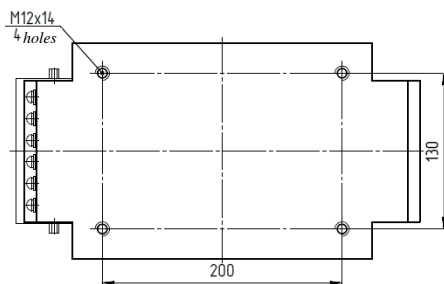
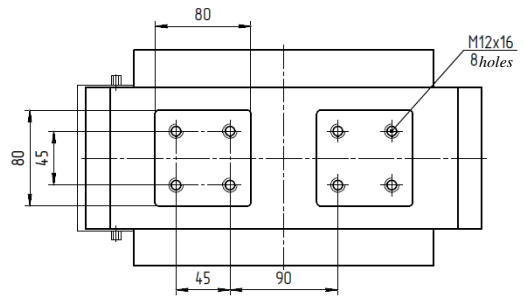
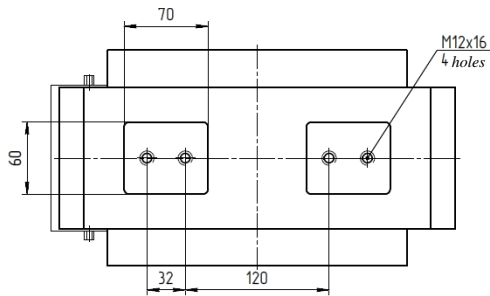
Version M10



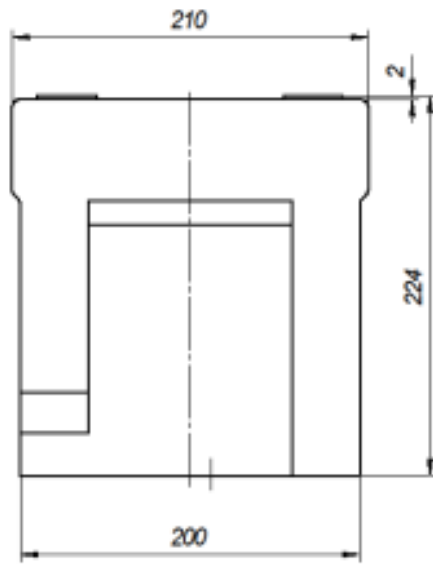
Installation and Mounting dimensions for TLO-10 Current Transformers for M9 and M10 versions

For rated primary currents from 5A to 1500A

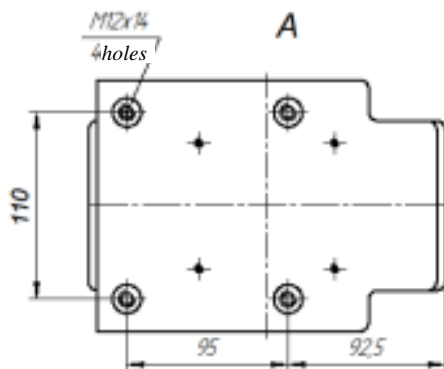
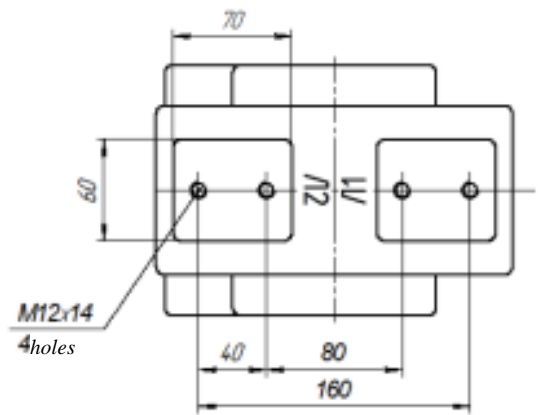
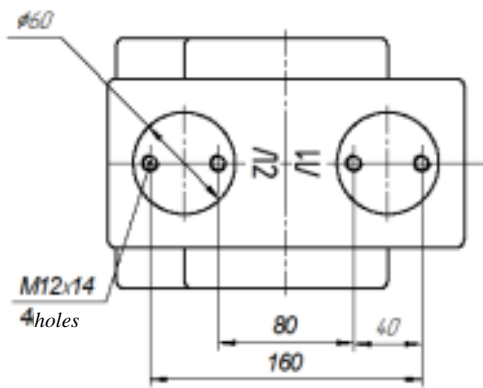
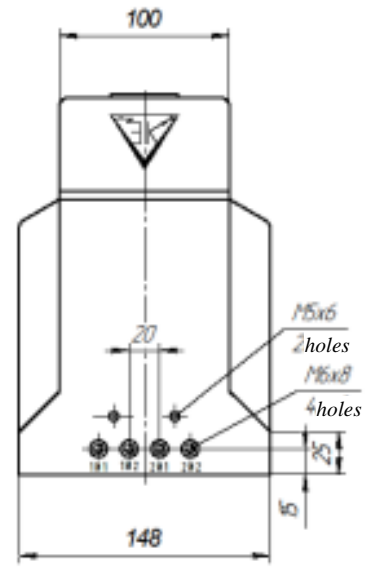
For rated primary currents from 1600A to 3000A



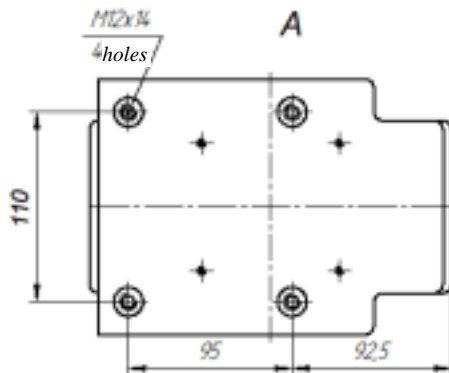
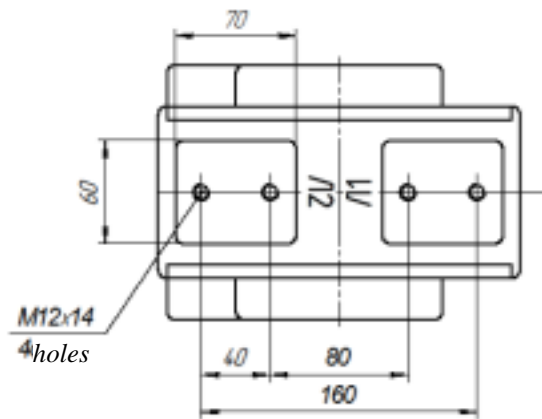
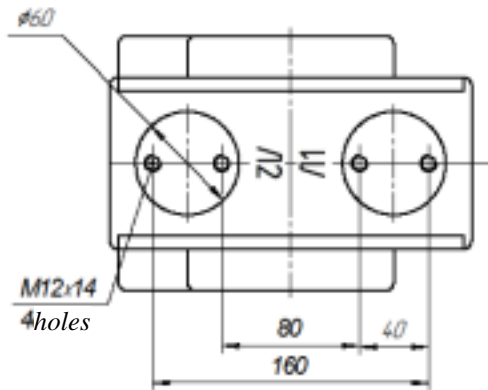
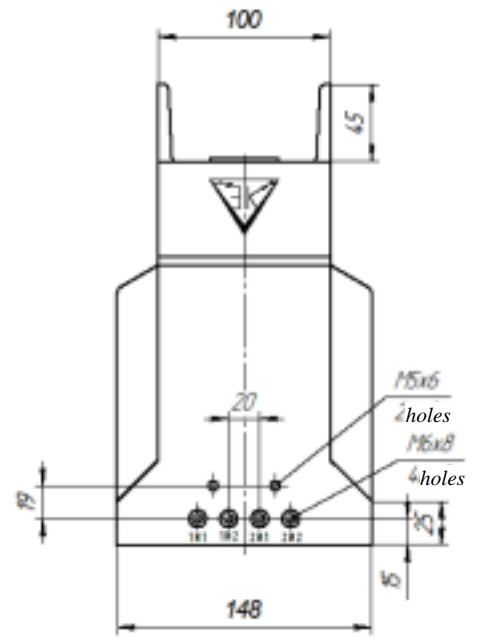
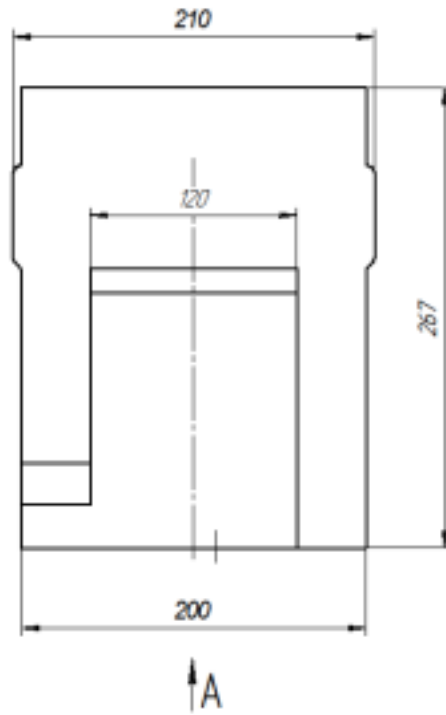
Version M11



A



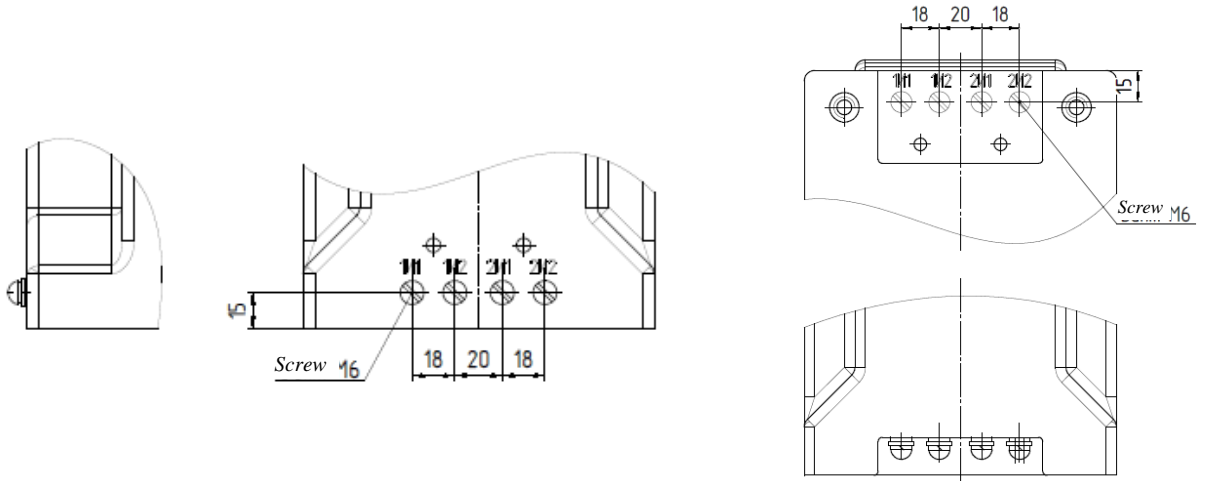
Version M12



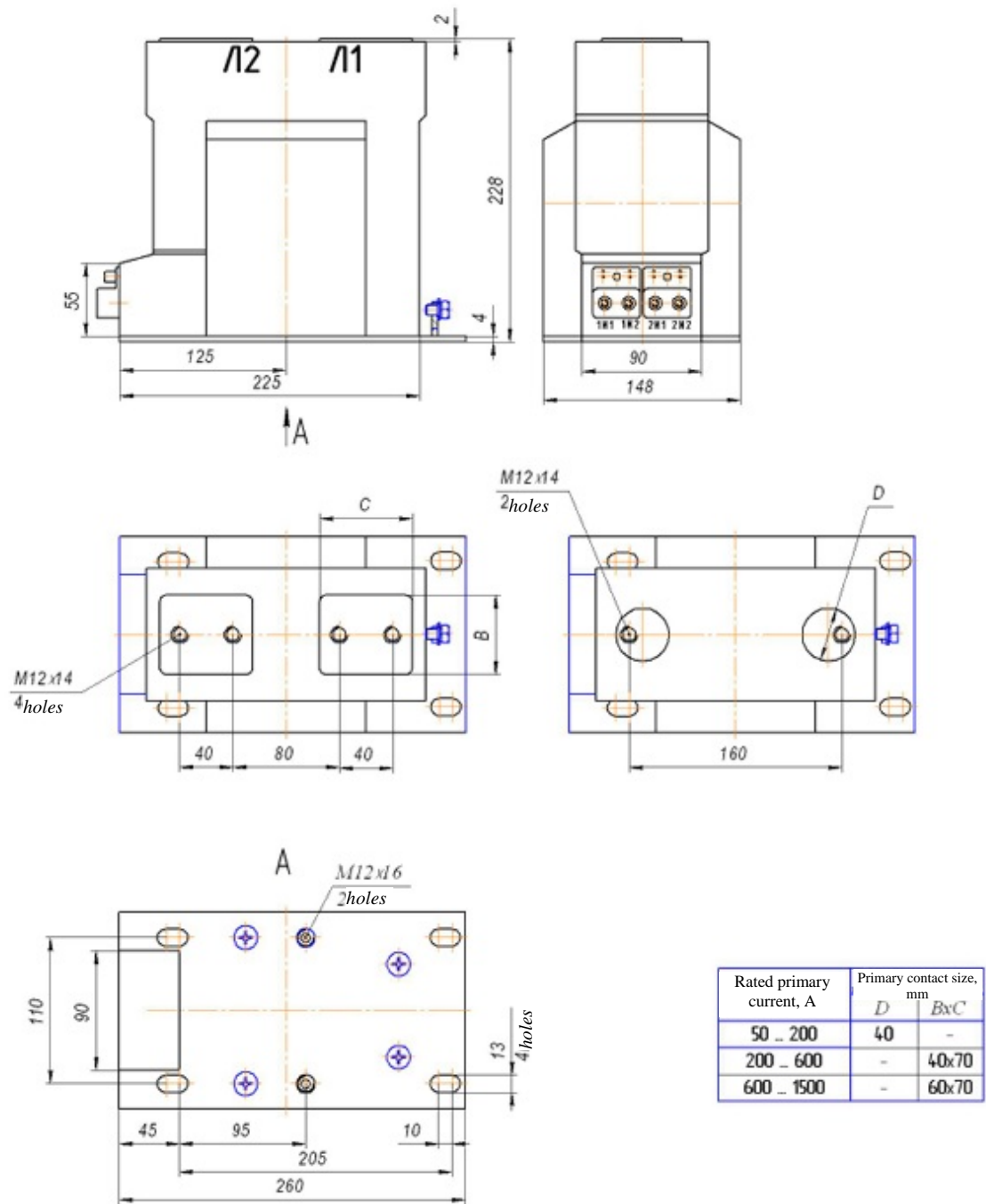
Location options for secondary terminals of TLO-10 current transformer in versions M11-M12

Version A – secondary terminals are located at the end surface on the transformer case.

Version B - secondary terminals are located from on the transformer case.

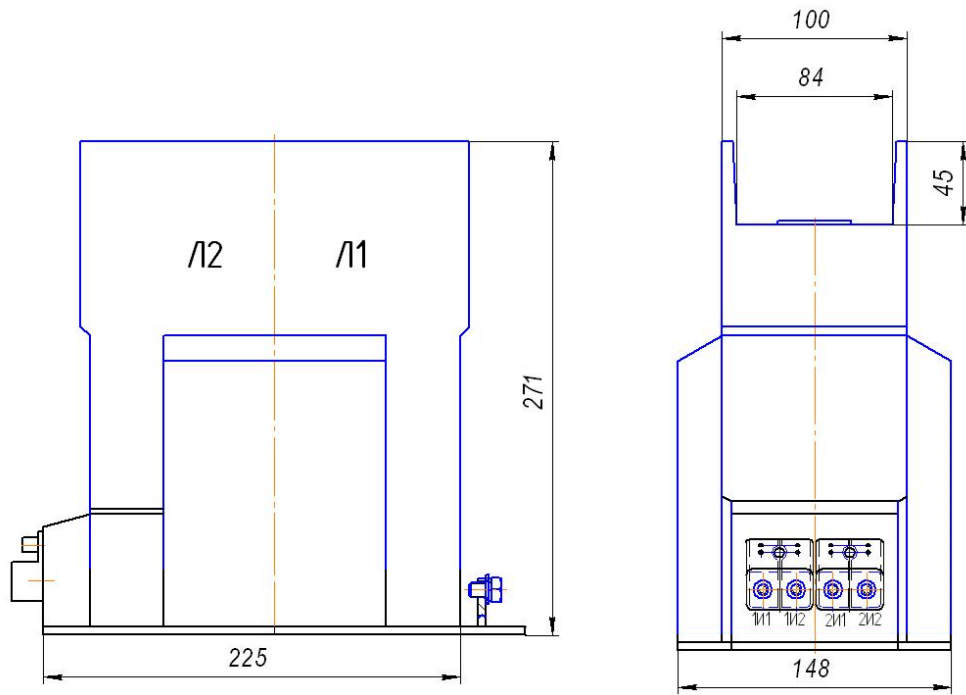


Version M13



Rated primary current, A	Primary contact size, mm	
	D	BxC
50 - 200	40	-
200 - 600	-	40x70
600 - 1500	-	60x70

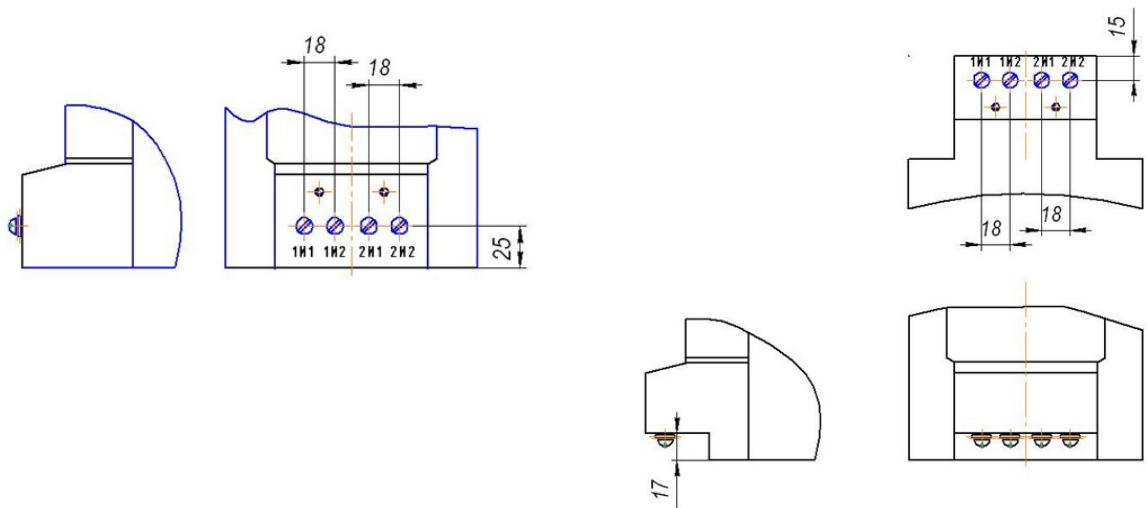
Version M14 (for the rest, see Version M13)



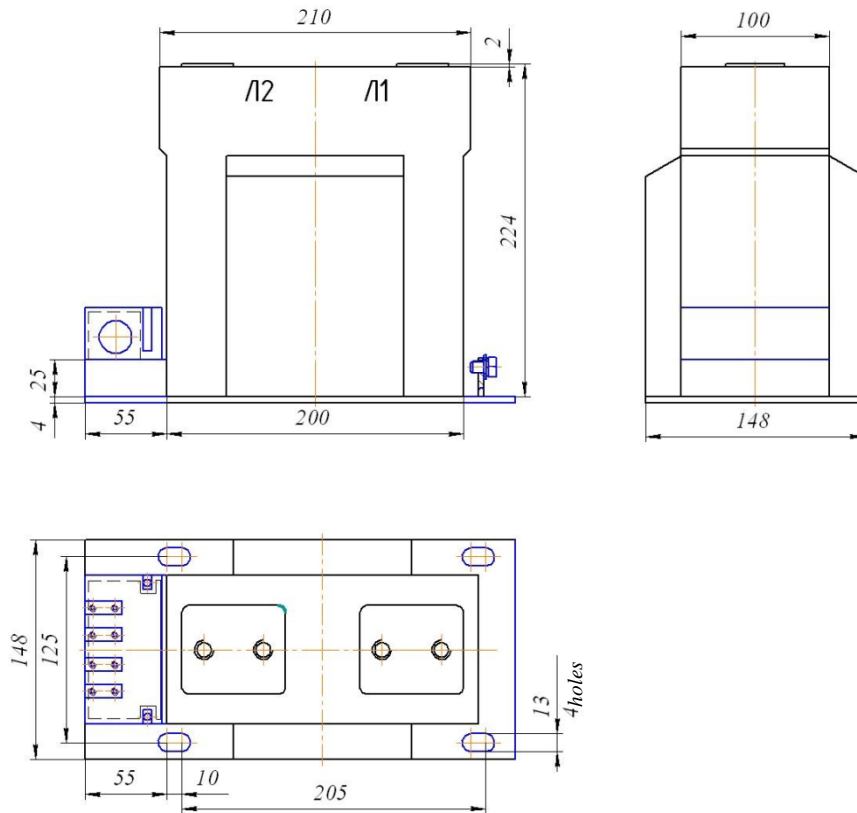
Location options for secondary terminals of TLO-10 current transformer in versions M13-M14

Version A – secondary terminals are located at the end surface on the transformer case.

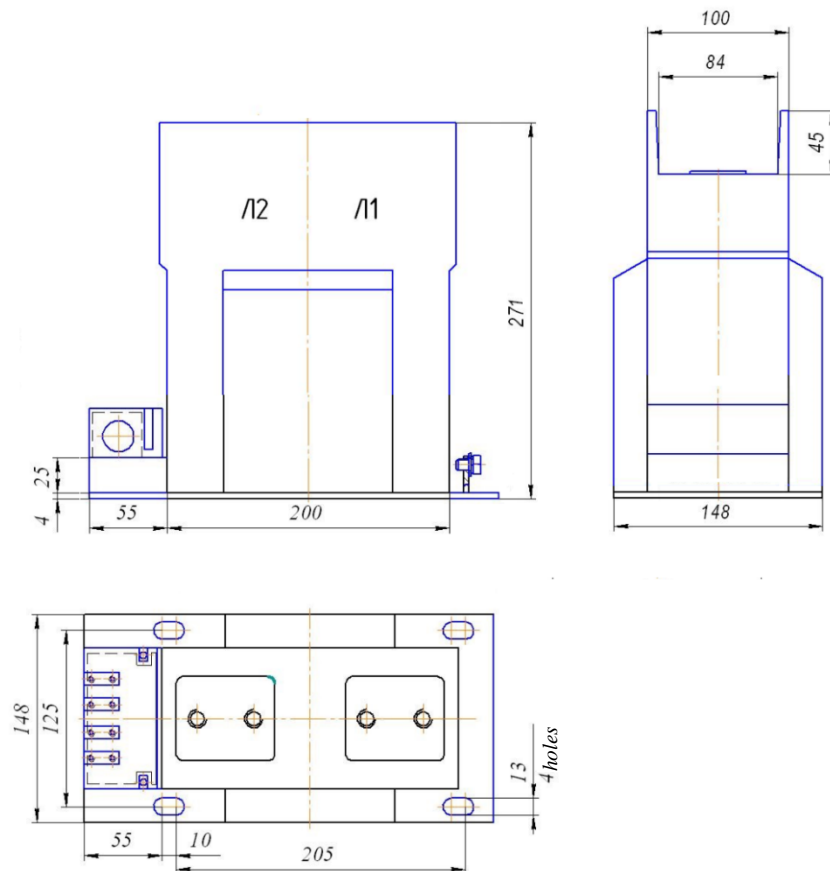
Version B - secondary terminals are located from below on the transformer case.



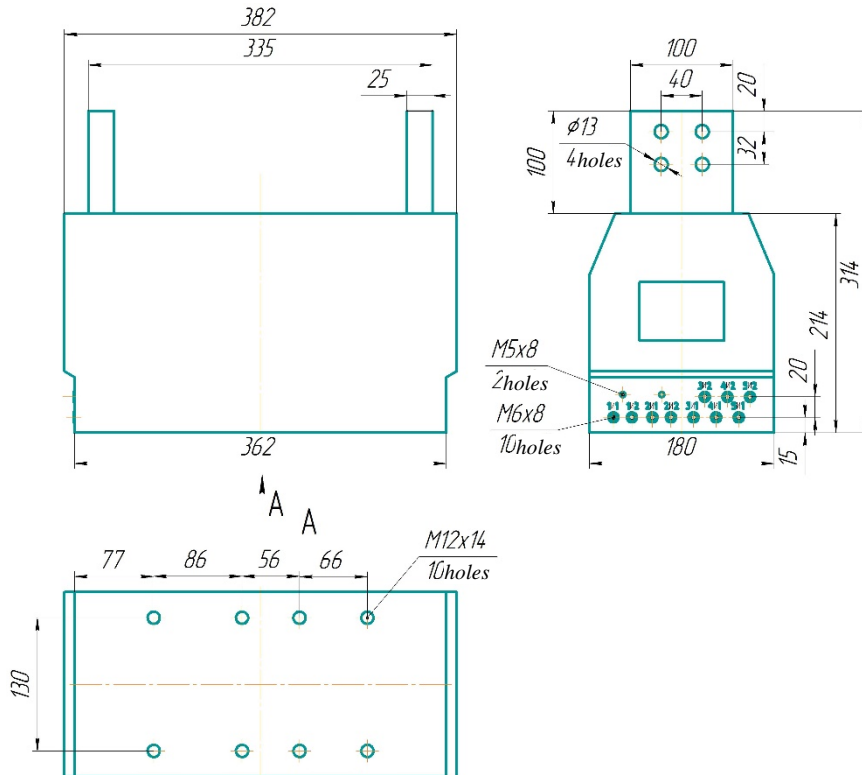
Version M15 (for the rest, see Version M13)



Version M16 (for the rest, see Version M13)

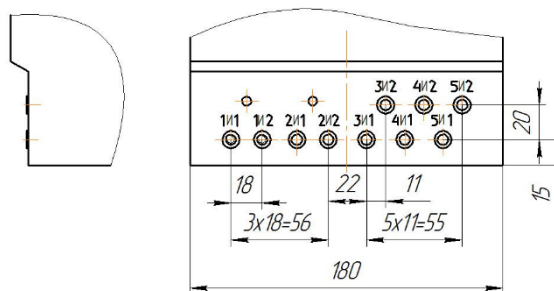


Version M17



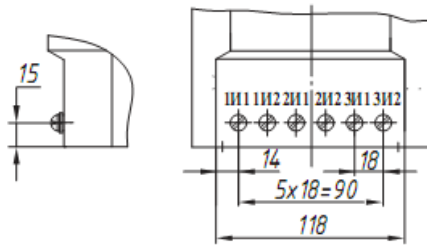
Location options for secondary terminals of TLO-10 current transformer in version M17

Version A – secondary terminals are located at the end surface on the transformer case.

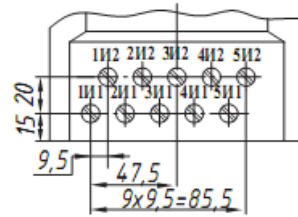


Location options for secondary terminals of TLO-10 current transformer in versions M1-M10

Version A – secondary terminals are located at the end surface on the transformer case.

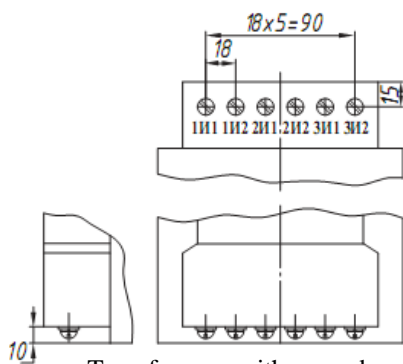


Transformers with secondary windings

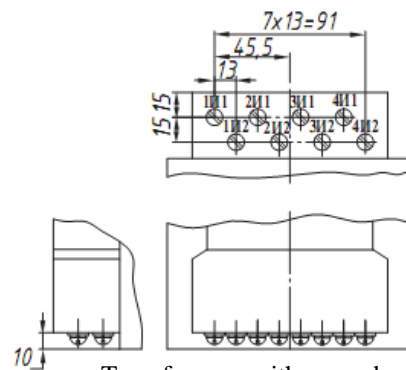


Transformers with secondary windings from one to five

Version B - secondary terminals are located from below on the transformer case.
Only for versions M1, M2, M3, M4



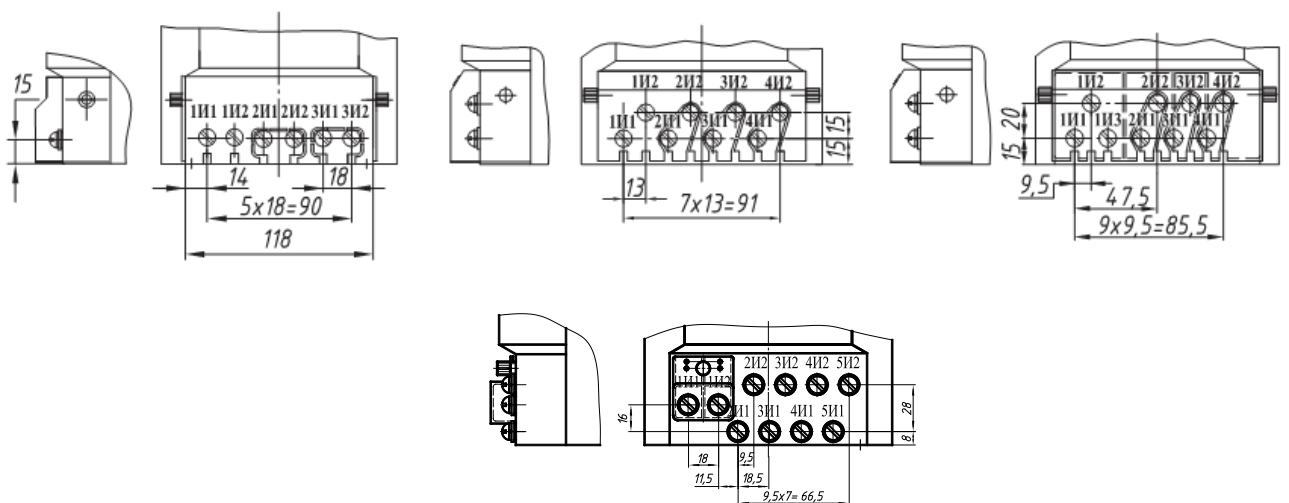
Transformers with secondary windings from one to three



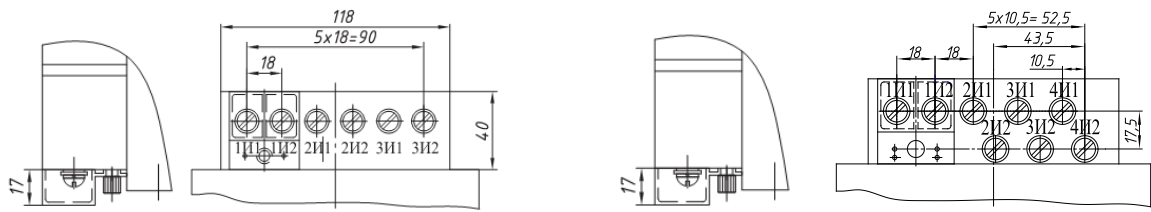
Transformers with secondary windings from one to four

Version C – with a cover for protection and sealing of the transformer measuring winding.

For terminals located at the end surface on the transformer (i.e. version “AC”)

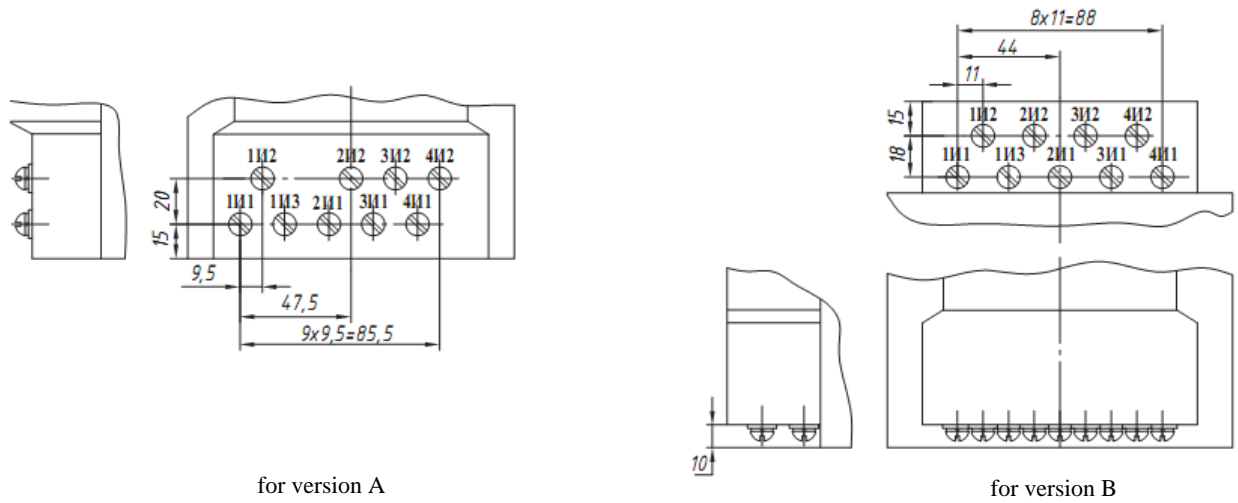


For terminals located from below on the transformer case (i.e. version “BC”)

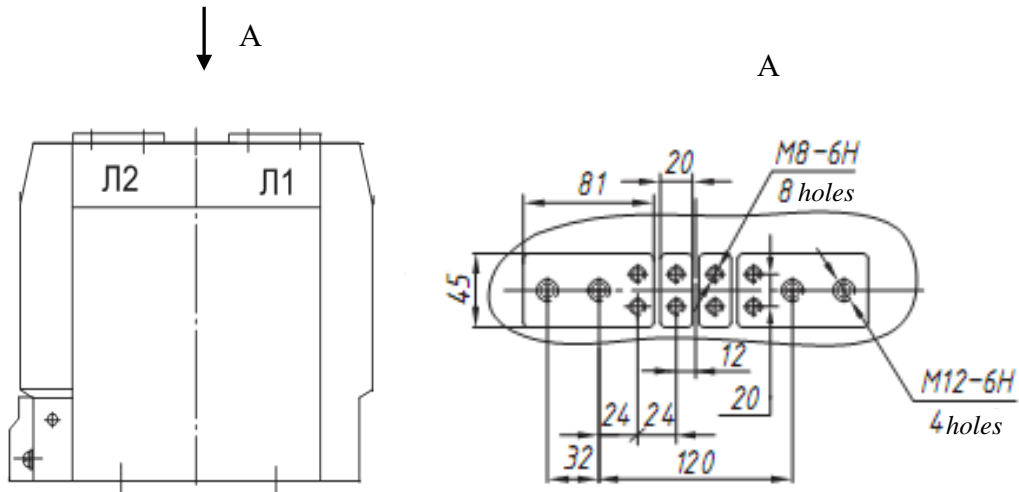


Version D – secondary terminals are made of flexible wire of various length.

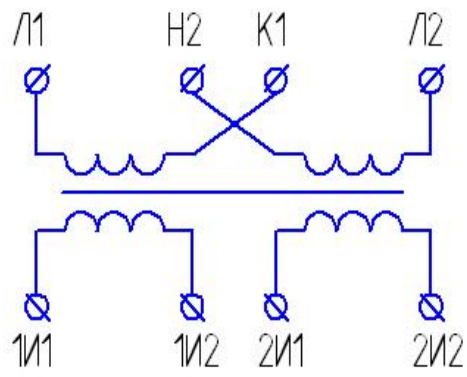
Version E – availability of tap on the secondary winding.



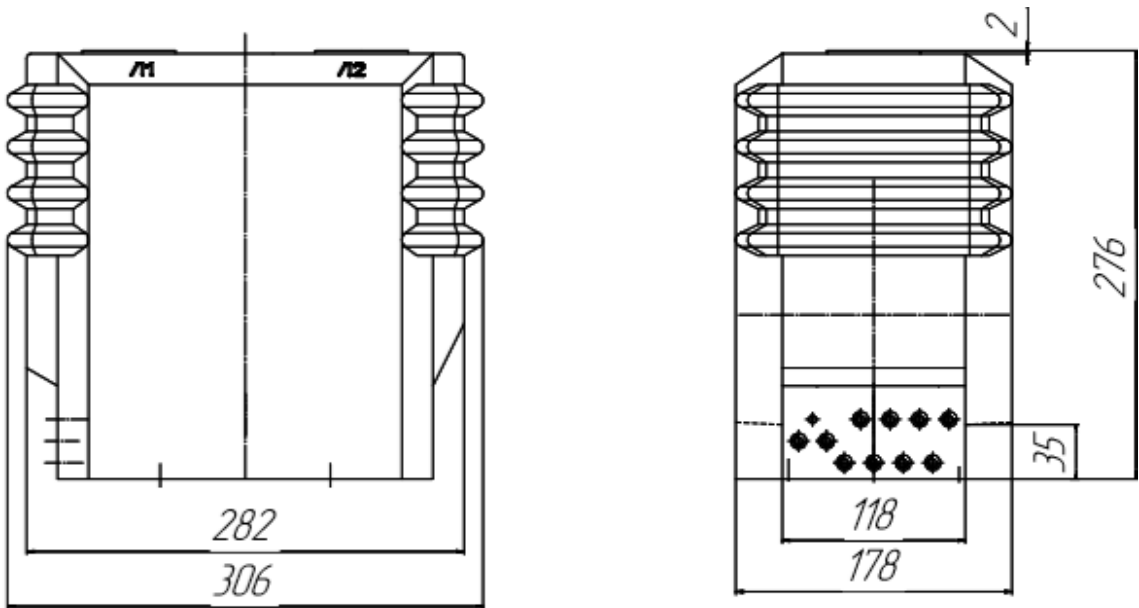
Version F – transformer with primary winding switching over.



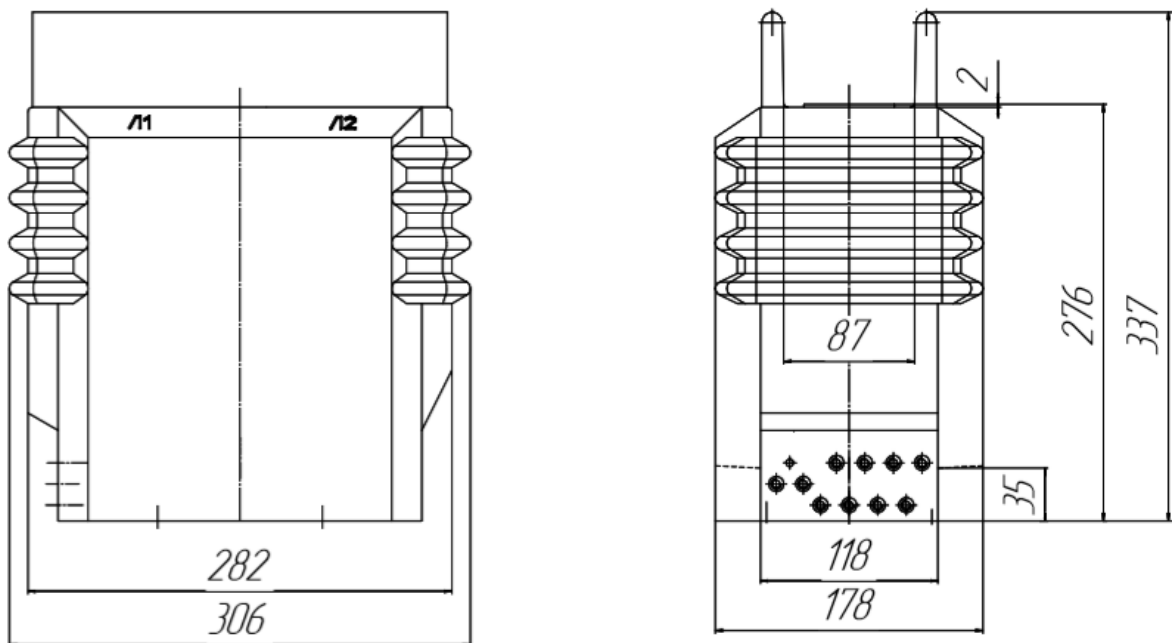
Connection diagram for TLO-10 current transformer with primary winding switching over



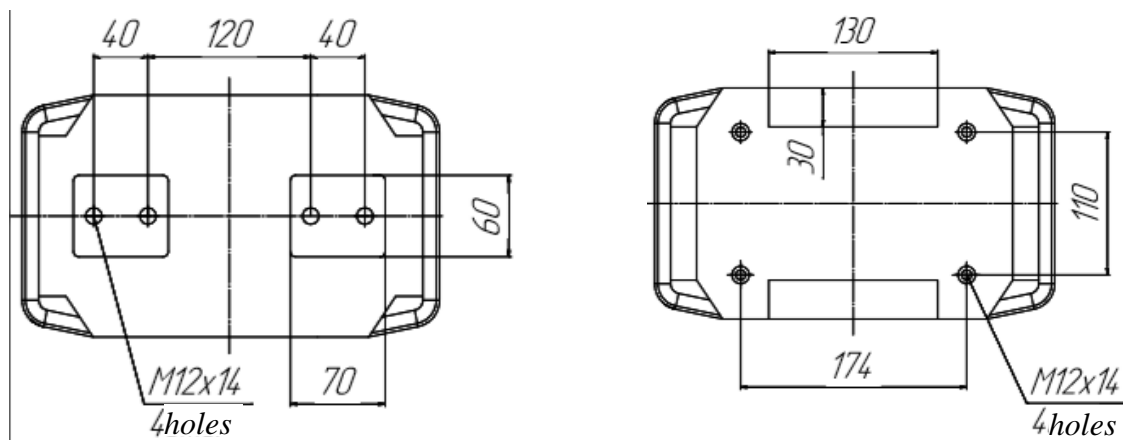
Version M19



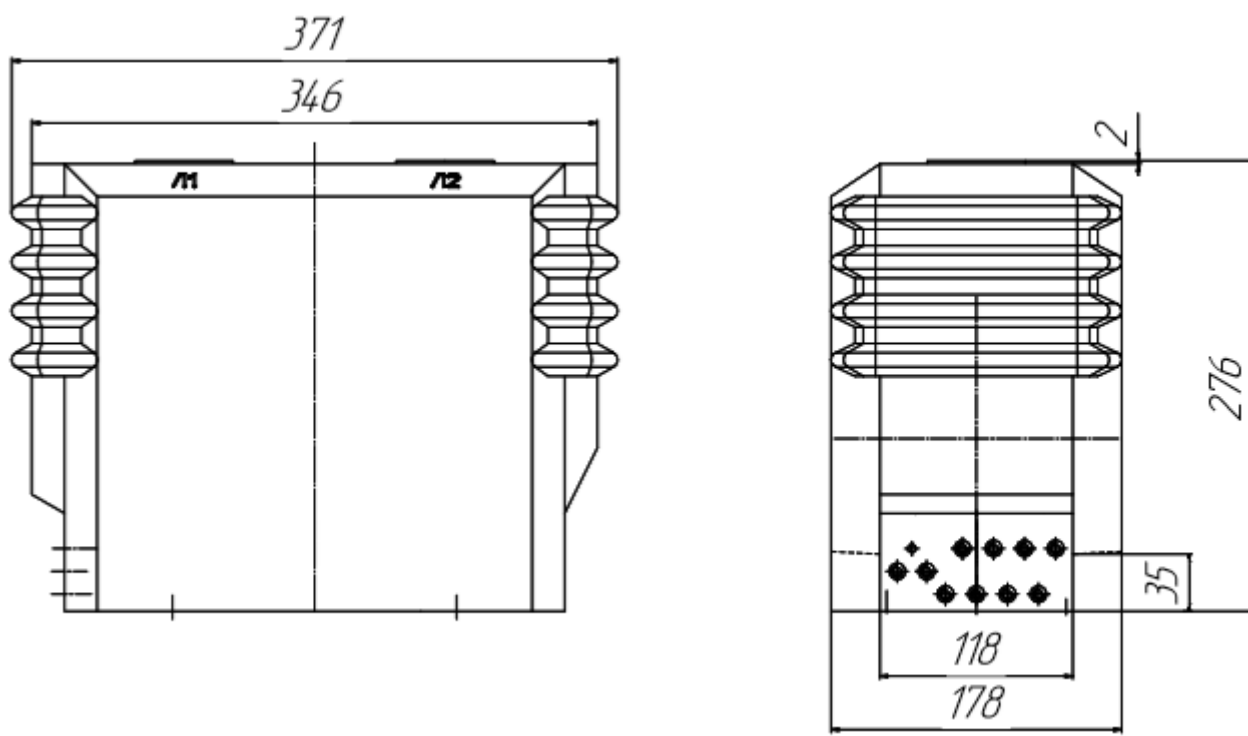
Version M20



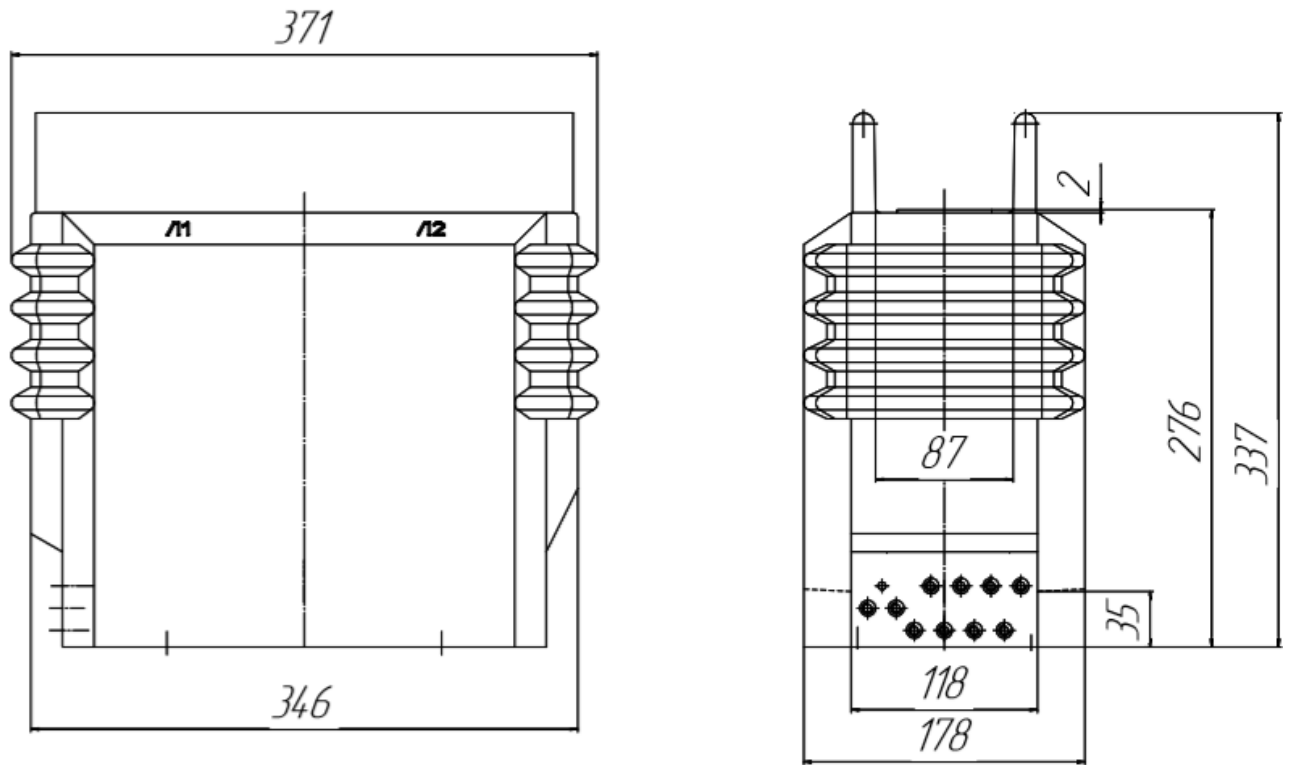
Installation and Mounting dimensions for TLO-10 Current Transformer for versions M19, M20



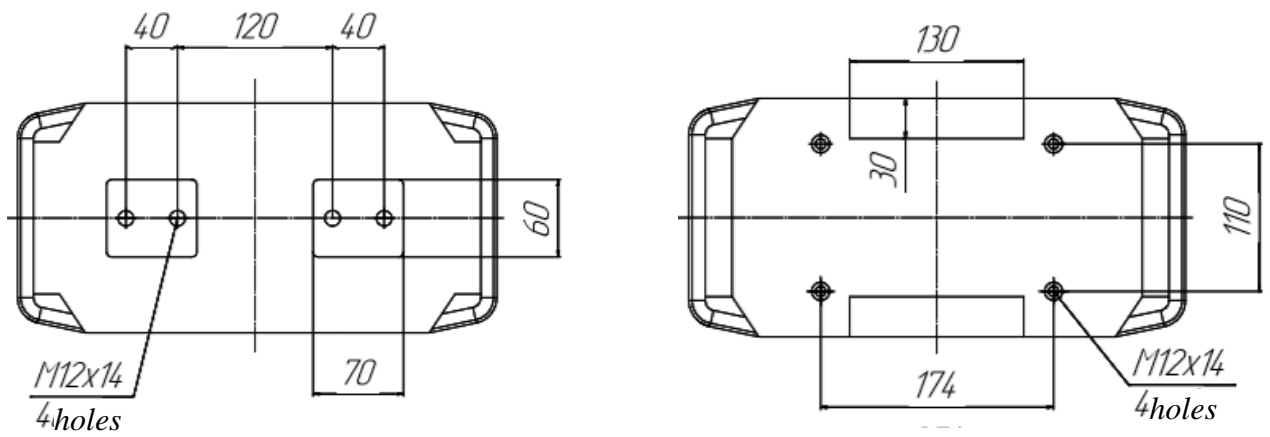
Version M21



Version M22



Installation and Mounting dimensions for TLO-10 Current Transformer for M21 and M22 versions



Annex B
(normative)

List of current values for TLO-10 current transformers when TTI 5000.5 (A) current transformer used as reference current transformer

4000; 3900; 3800; 3750; 3700; 3650; 3600; 3550; 3500; 3300; 3250; 3200; 3100; 3000; 2900; 2800; 2750; 2700; 2650; 2600; 2550; 2500; 2300; 2250; 2200; 2100; 2000; 1900; 1800; 1750; 1700; 1650; 1600; 1550; 1500; 1400; 1300; 1250; 1200; 1150; 1100; 1050; 1000; 900; 800; 750; 700; 650; 600; 550; 500; 400; 350; 300; 250; 200; 150; 100; 90; 80; 75; 70; 65; 60; 55; 50; 40; 37,5; 35; 32,5; 30; 27,5; 25; 22; 20; 18; 16; 15; 14; 13; 12; 11; 10; 7,5; 5.