



Electroschild-C° OOO



## **CURRENT TRANSFORMER**

### **TLO-35**

Operation Manual

EK.1.760.020 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-35 current transformer.

In addition to this Operation Manual, the transformer passport EK.1.775.004 PS should be referred to as well.

### **1 Correct Use**

1.1 TLO-35 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 35 kV.

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

- climatic factors rated values – under GOST 15543.1 and GOST 15150, 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;
- 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;
- the transformer is resistant to high air humidity under III degree of GOST 20.57.406-81 for climatic class “N” and “NF” under IX degree of severity GOST 20.57.406-81 for climatic class “T”;
- 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 can be 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 does not exceed 20 pC at measurement

voltage of 25,75 kV.

Table 1

Parameter	Parameter value
Rated voltage, kV	35
Maximum operating voltage, kV	40,5
Rated primary current, A	According to Annex D
Rated secondary current, A	1; 5
Rated frequency, Hz	50; 60
Number of secondary windings	up to 5
Rated secondary burdens with $\cos\varphi=0,8$ : of measuring winding, VA of protection winding, VA	1 - 50 1 - 50
Rated accuracy class: measuring winding protection winding	0,2S; 0,2; 0,5S; 0,5; 1; 3 5P or 10P
Rated accuracy limit factor $ALF_{rat}$ of secondary protective winding:	from 2 to 30
Rated instrument security factor $FS_{rat}$ of measuring winding	from 3 to 30
Short-time (one second) thermal current, kA, at rated primary current:	
5-20 A	2,5; 5
30-50 A	5; 10; 20; 31,5
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 – 3000 A	40-100
Dynamic current, kA, at rated primary current:	
5-20 A	6,25; 12,8
30-50 A	12,8; 26; 52; 81
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 – 3000 A	100-250
Weight, kg not more	100

Table 2 – available versions for TLO-35 current transformer

Version	Description
<b>C</b>	sealing cover available
<b>D</b>	with flexible secondary terminals
<b>E</b>	with switching over on the secondary winding
<b>F</b>	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 or epoxy compound 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 500 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.

3.3 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.

3.4 Secondary terminals of the current transformer can be made of flexible wire of different length with a cross section of at least 2,5 mm<sup>2</sup> (the 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 To transport to the mounting place, use M12 lifting bolts.

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

4.5 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 1U1 to 1U2.

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

4.7 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.1.760.020 PS for respective product.

## **5 Marking**

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

5.2 Markings on the primary winding Л1, Л2, secondary windings 1И1, 1И2, 2И1, 2И2, 3И1, 3И2, 4И1, 4И2 were applied with the help of case casting.

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

## **6 Safety Measures**

6.1 Transformer mounting and operation must comply with safety requirement of GOST 12.2.007.0 and GOST 12.2.007.3, Electrical Installation Regulations, Regulations for Operation of Consumer Electrical Installations, Health and Safety Rules for Electrical Installations, 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 and GOST 1516.3.

6.4 Repeated tests for electric strength of the winding insulation should be performed by 10% lower than the initial 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 by 10% lower than the previous (in accordance with Electrical Installation Regulations, Edition 7, Chapter 1.8.17 cl.3.1, table 1.8.16 and GOST 1516.3-96 п. 4.16).

7.5 The transformers should be verified in accordance with EK.1.760.020 PM5 “Verification Method for Current Transformers TLO-35”.  
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 for N, NF or T versions respectively.

8.3 Transformers should be stored and kept in accordance with TU 3414-035-52889537-07 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.

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.

Compound fragments should be transferred to a solid waste land field. 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 M2 overall dimension (annex B) with a sealing cover (version C according to 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, with short-time (one second) thermal current 40kA and insulation level «b» in accordance with GOST 1516.3-96, at the time of order and in documents for another product:

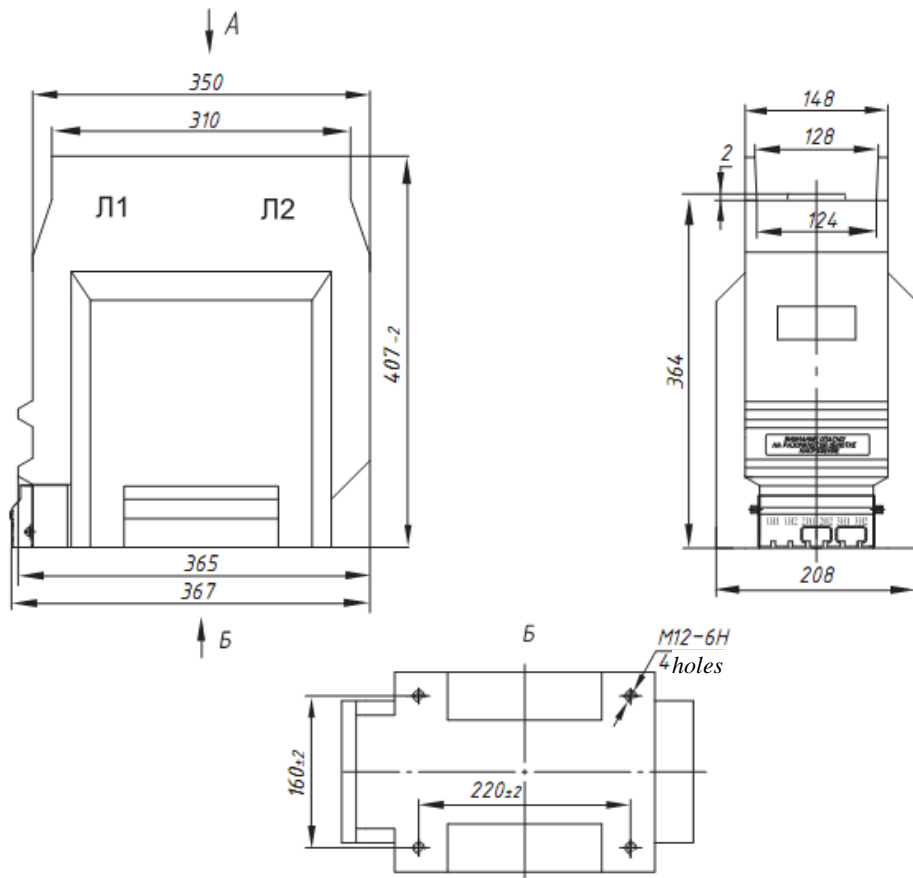
Current transformer:

**TLO-35 M2C-0,2/10P-10/15-600/5 N3 40kA b, TU 3414-035-52889537-07**



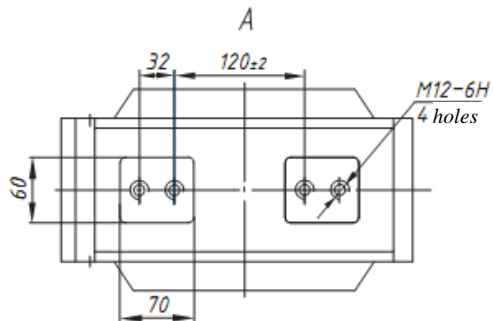
**Overall Dimensions for TLO-35 Instrument Current Transformer**

**Version M2**

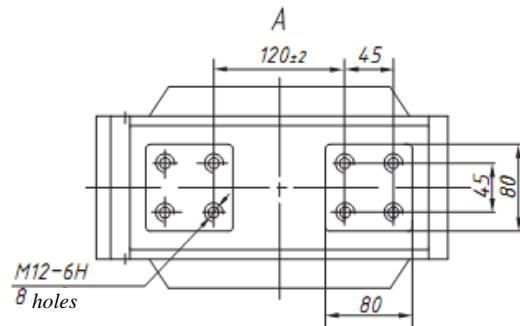


**Installation and Mounting dimensions for TLO-35 Current Transformers for M2 version**

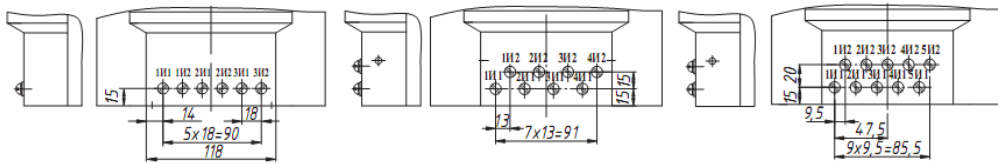
For rated primary currents from 5A to 1500A



For rated primary currents from 2000A to 3000A



## Location options for secondary terminals of TLO-35 current transformer

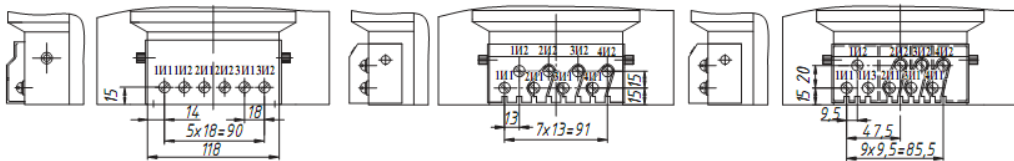


Transformers with secondary windings from one to three

Transformers with secondary windings from one to four

Transformers with secondary windings from one to five

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



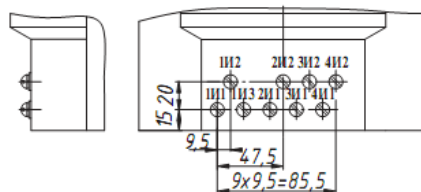
Transformers with secondary windings from one to three with a cover to protect and seal the measuring winding

Transformers with secondary windings from one to four with a cover to protect and seal the measuring winding

Transformers with secondary windings from one to four and switching over on the secondary winding with a cover to protect and seal the measuring winding

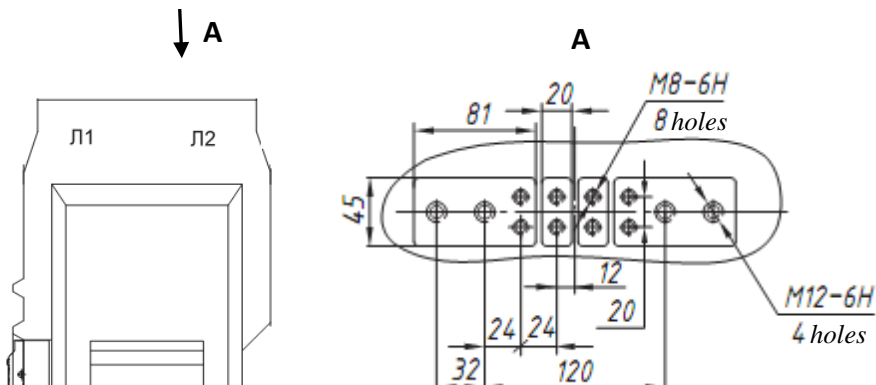
**Version D** – secondary terminals made of flexible secondary terminals of required length.

**Version E** – transformer made with switching over on the secondary winding.

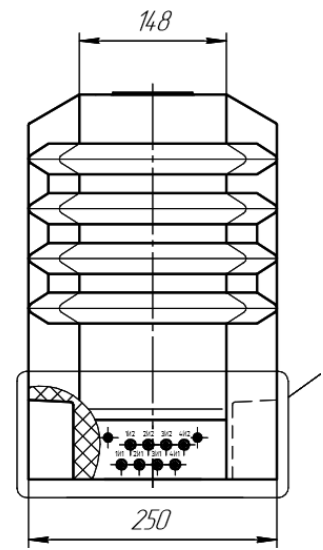
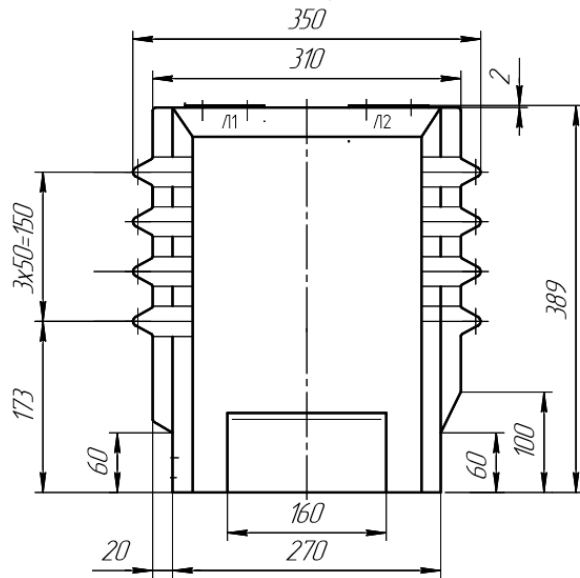


Secondary terminals on the transformer body on the end surface and with switching over on the secondary winding

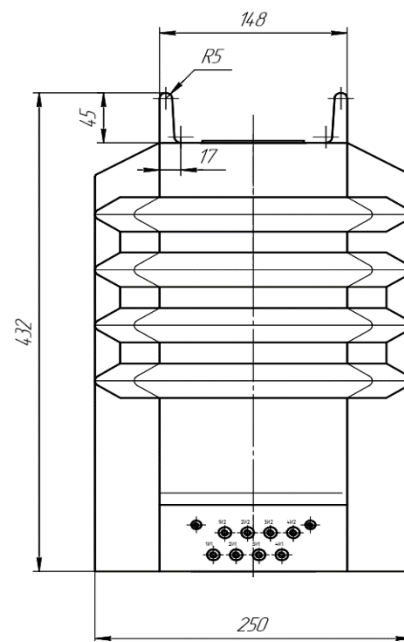
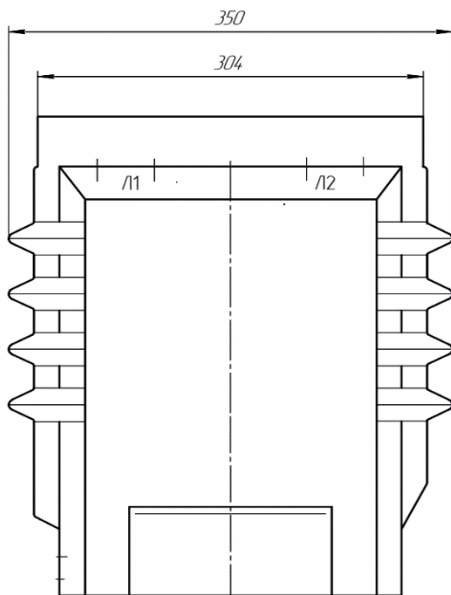
**Version F** – transformer made with switching over on the primary winding.



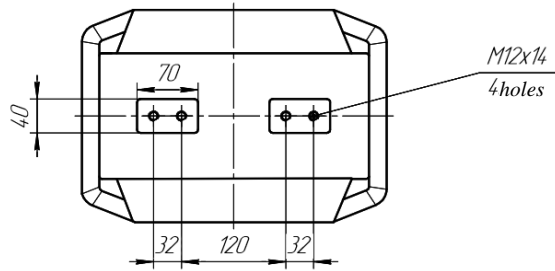
### Version M3



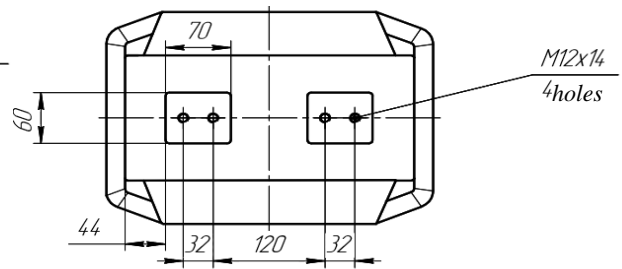
### Version M4



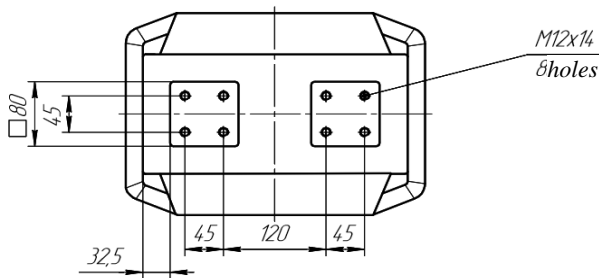
## Installation and Mounting dimensions for TLO-35 Current Transformer for versions M3, M4



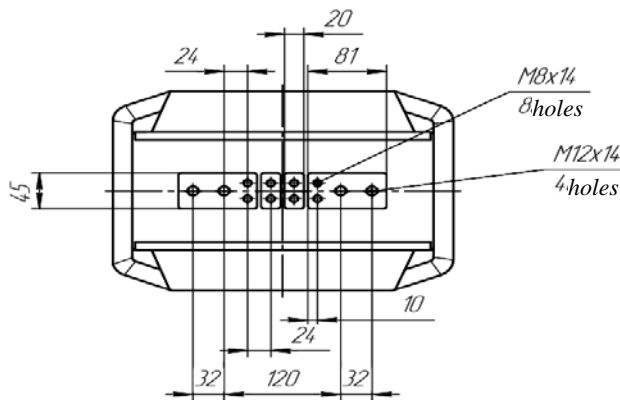
**For rated primary currents from  
5A to 600A**



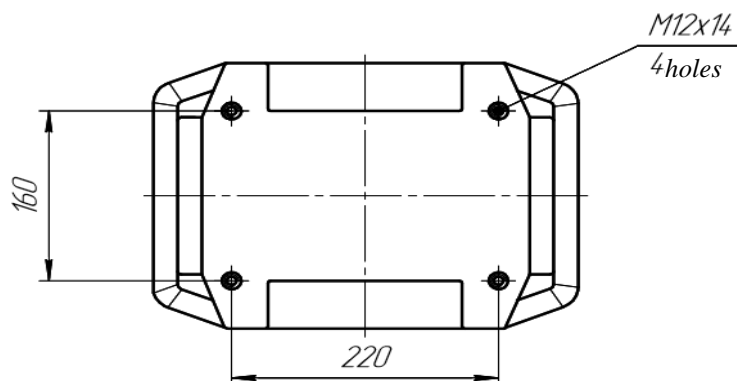
**For rated primary currents from  
600A to 1500A**



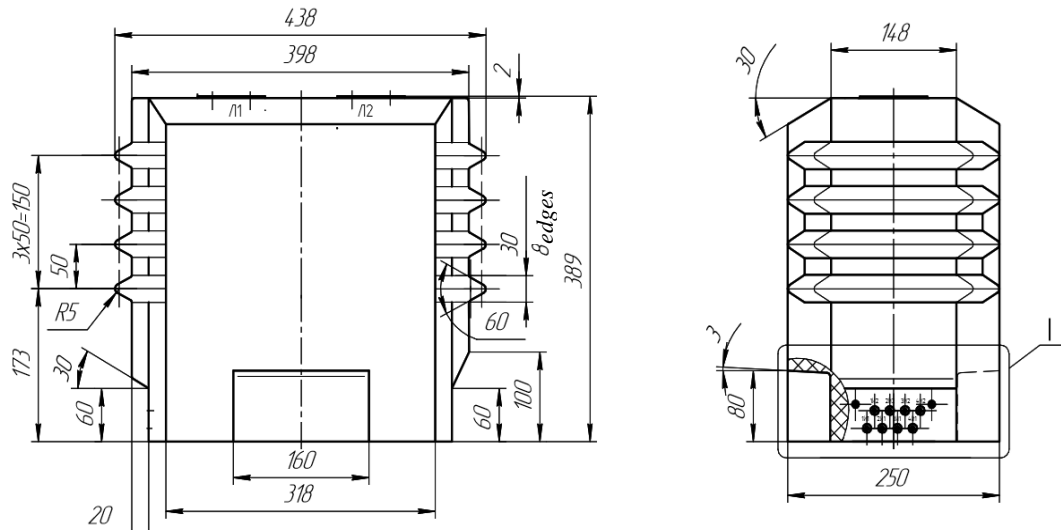
**For rated primary currents from  
2000A to 3000A**



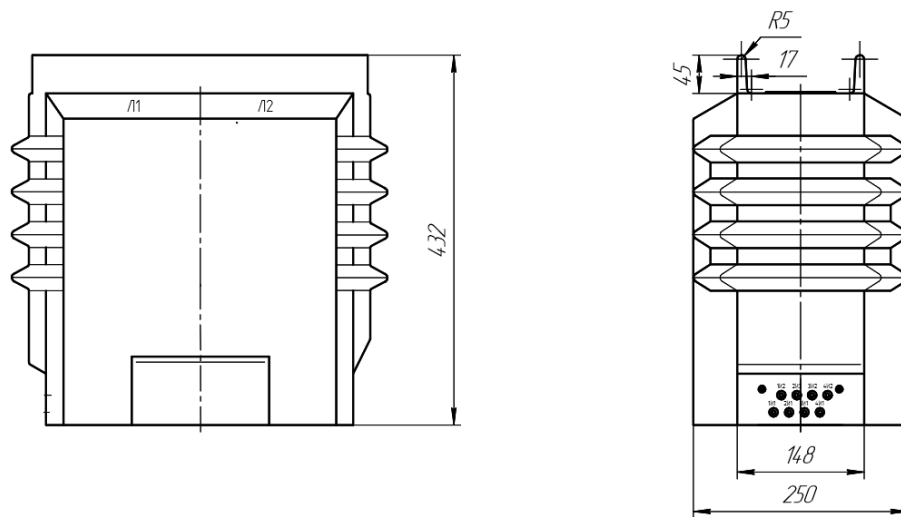
**Version with switching over on  
the primary tap (Version F)**



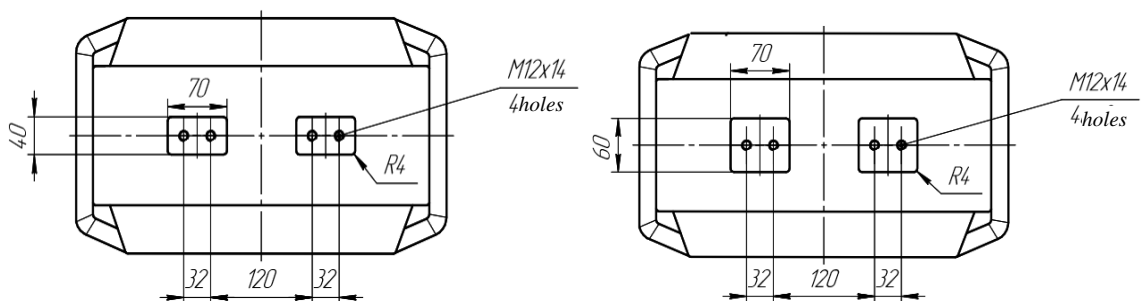
**Version M5**



**Version M6**

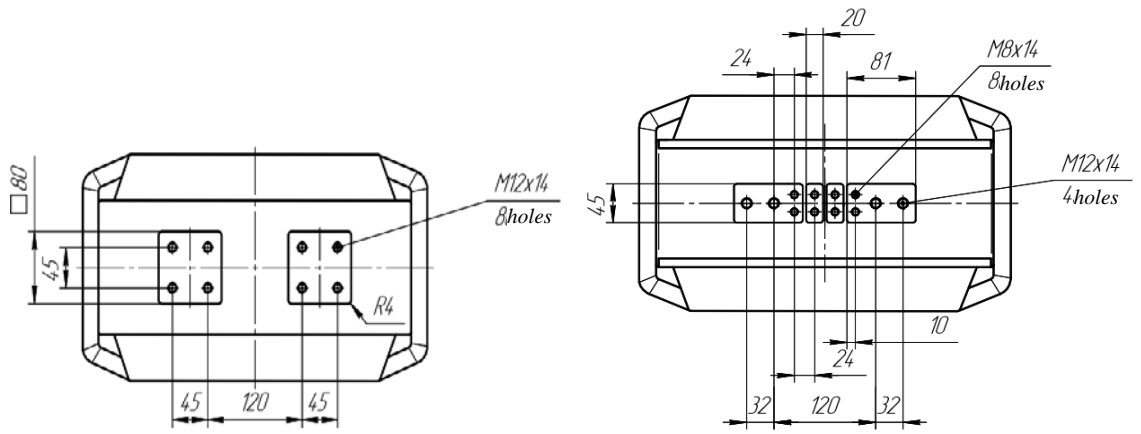


**Installation and Mounting dimensions for TLO-35 Current Transformer for versions M5, M6**



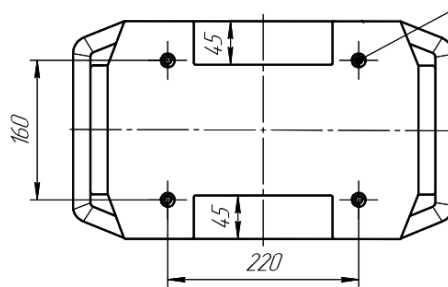
**For rated primary currents from 5A to 600A**

**For rated primary currents from 600A to 1500A**

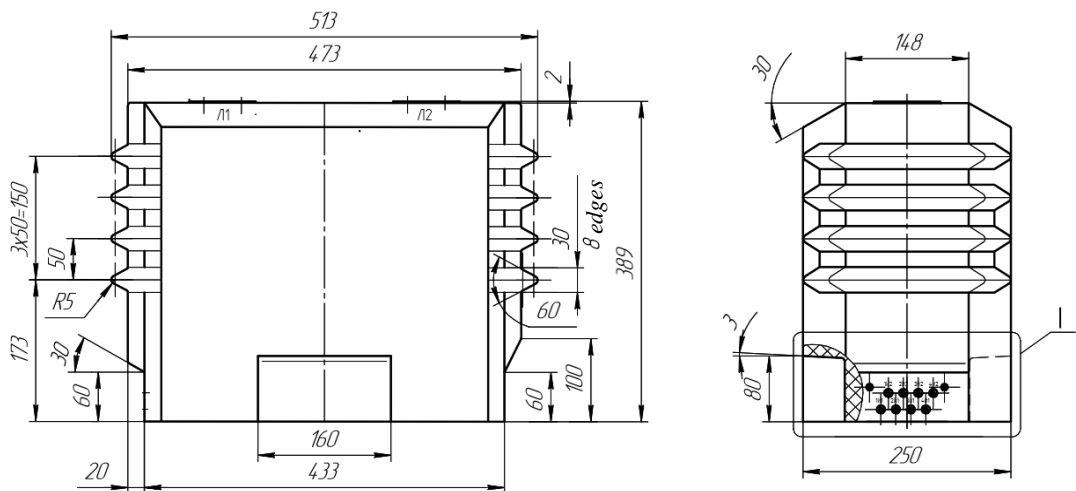


For rated primary currents from 2000A to 3000A

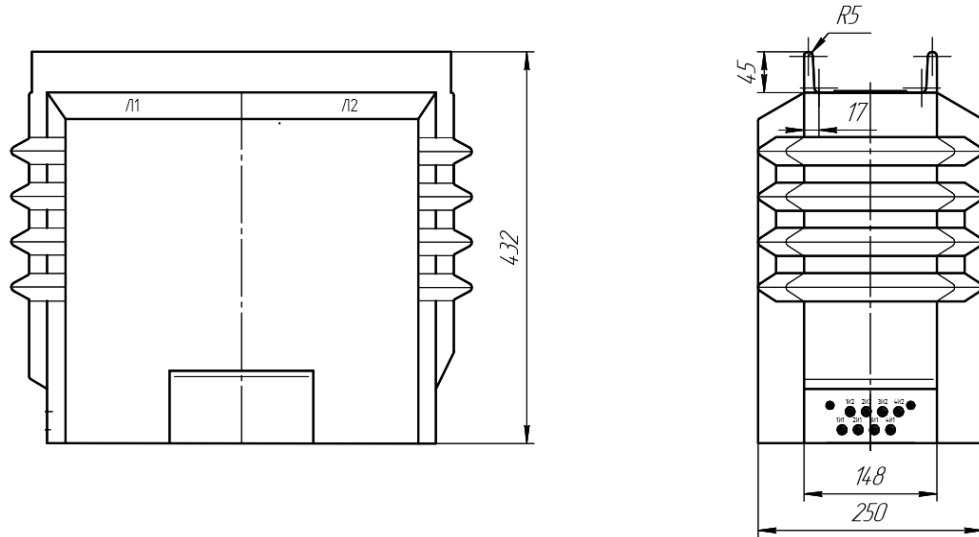
Version with switching over on the primary tap (Version F)



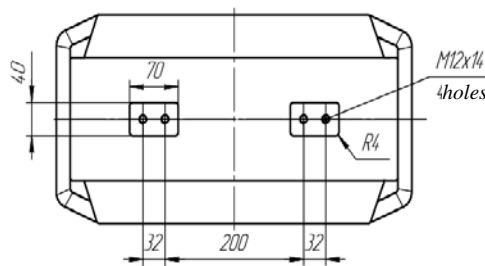
Version M7



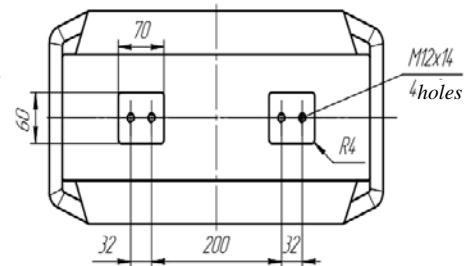
**Version M8**



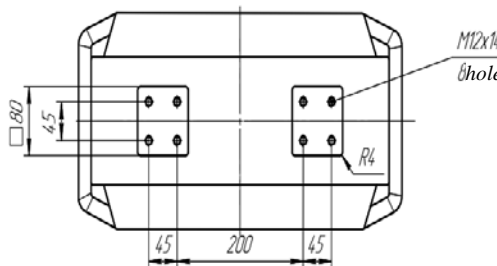
**Installation and Mounting dimensions for TLO-35 Current Transformer for versions M7, M8**



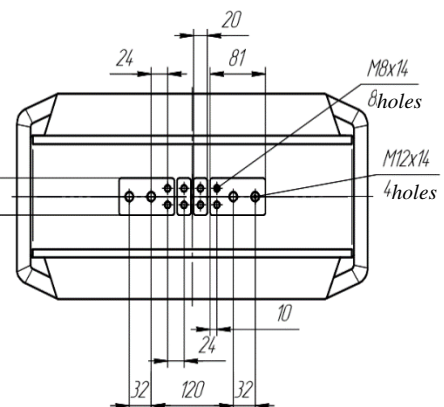
**For rated primary currents from 5A to 600A**



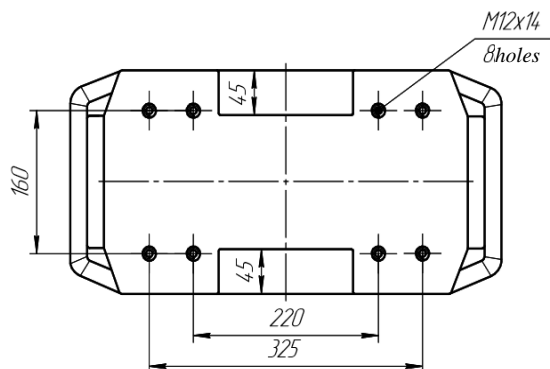
**For rated primary currents from 600A to 1500A**



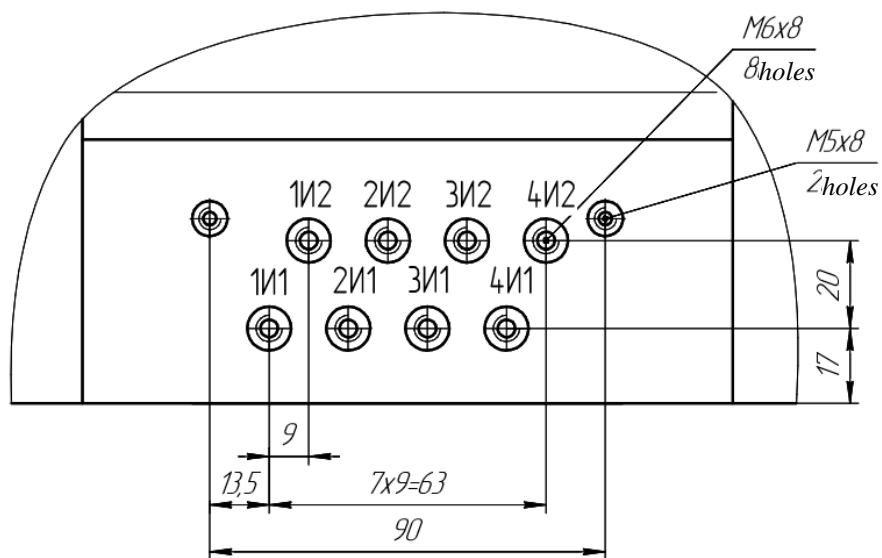
**For rated primary currents from 2000A to 3000A**



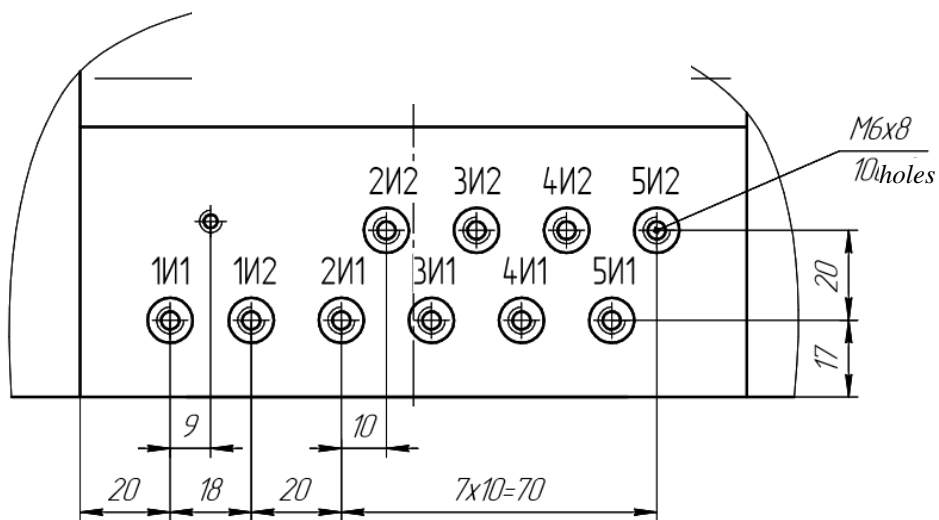
**Version with switching over on the primary tap (Version F)**



**Location options for secondary terminals of TLO-35 current transformer for versions M3, M4, M5, M6, M7, M8**

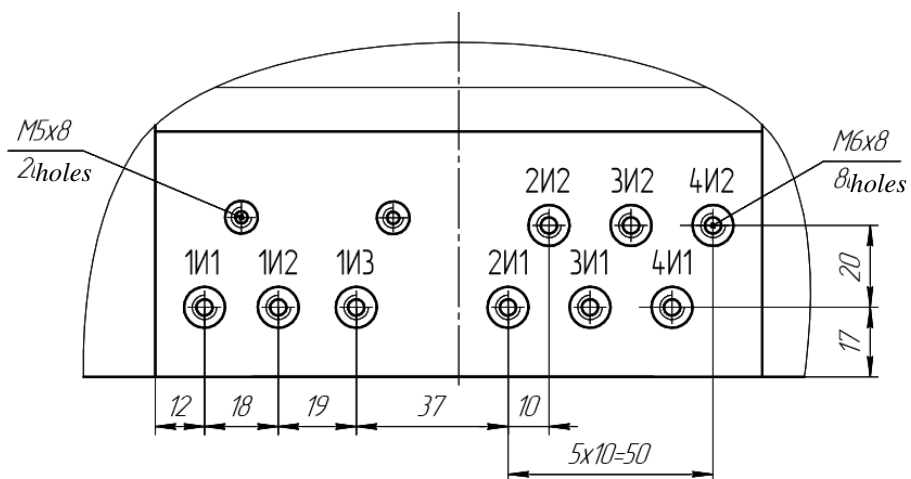


**Transformer with secondary windings from one to four**



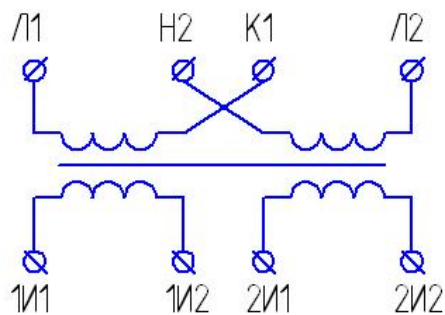
**Transformer with secondary windings from one to five**





**Transformer with secondary windings from one to four and with switching over on the secondary winding**

**Connection diagram for TJO-35 current transformer**



## Annex D

### **List of current values for TLO-35 current transformers when ИТТ 3000.5 (А) current transformer used as reference current transformer**

3000; 2900; 2800; 2750; 2700; 2650; 2600; 2550; 2500; 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; 450; 400; 375; 300; 275; 250; 225; 200; 175; 150; 125; 100; 90; 80; 75; 70; 65; 60; 55; 50; 45; 40; 37,5; 35; 32,5; 30; 27,5; 25; 22; 20; 18; 16; 15; 14; 13; 12; 11; 10; 7,5; 5.