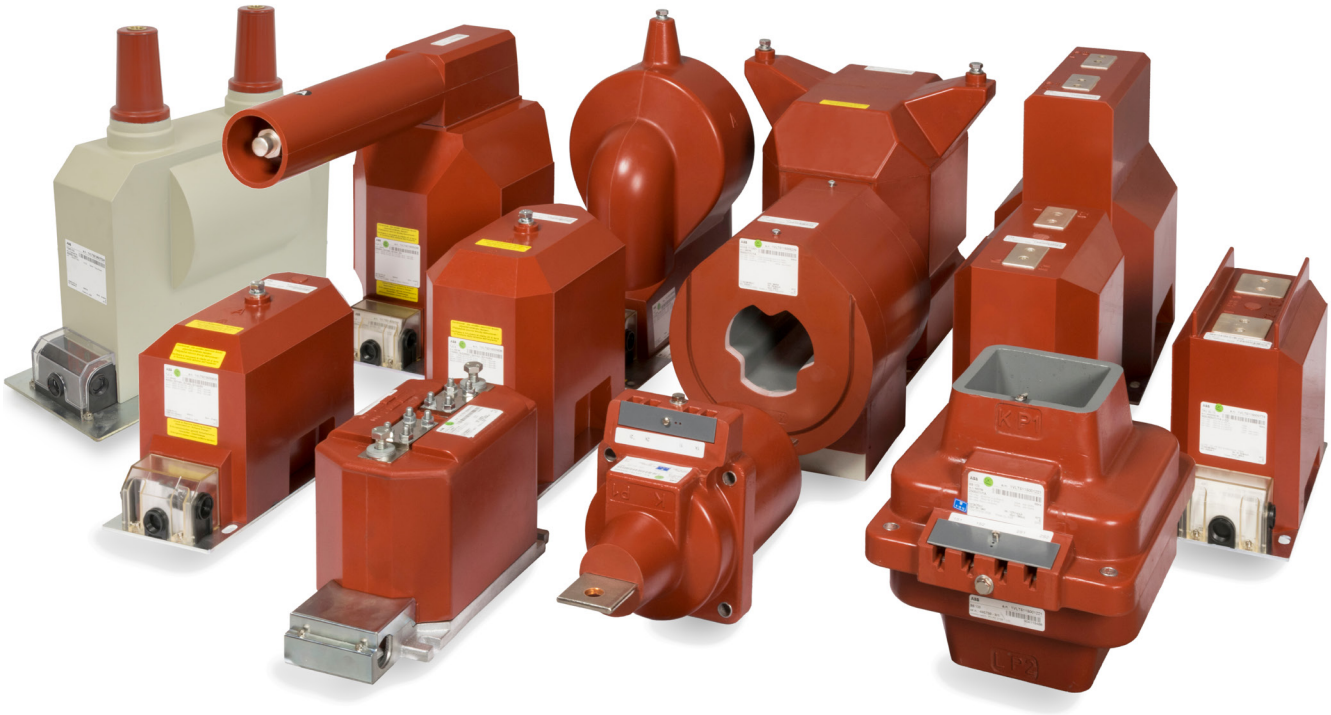
MEDIUM VOLTAGE PRODUCTS

Current and Voltage Instrument Transformers

Instruction for Installation, use and maintenance



Scope of Contents

Instructions for installation, use and maintenance for current and voltage transformers

This installation, use and maintenance guide is valid for current and voltage transformers operating in indoor conditions.

These instructions are valid for
Current transformer type:
TPU; TPE; TTR; BB; BBO; KOKS; KOFA; IHBF

Voltage transformers types:
TJE; TJCL; TJC; TJCH; TDC; TJP; TJPH; TDP; KGUG; KGUGI; TJMC, TDMC

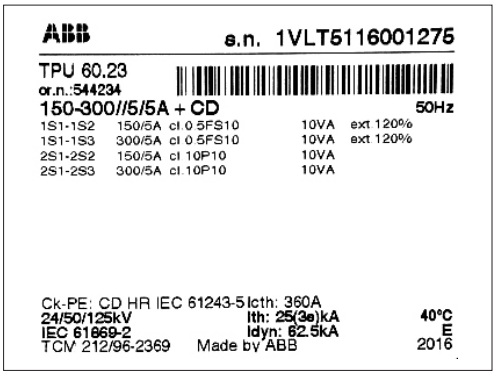
1. Service conditions

The transformers should be mounted in dry indoor conditions where the ambient air is not significantly polluted by dust, smoke, corrosive gases, vapours or salt.

The transformers are designed for standard ambient temperature between –5°C and +40°C. The altitude for use should be lower than 1000 m above the sea level. The transformers may be used also in higher or lower ambient temperatures and higher altitudes when agreed between the manufacturer and purchaser.

2. Technical details

The technical details for each individual transformer are mentioned on the rating plate fastened on the transformer. Values mentioned on the rating plate must not be exceeded. Markings used on the rating plate are as follows:



01

01 Example of current transformer label

Where:

1VLT5116001275	**serial number + barcode**
TPU 60.23	transformer type code
or.n. 544234	order number
150-300//5/5A+CD	rated transformer ratio + capacitive divider
50 Hz	rated frequency
1S1-1S2	terminal marking for core number 1, first tap
1S1-1S3	terminal marking for core number 1, second tap
2S1-2S2	terminal marking for core number 2
2S1-2S3	terminal marking for core number 2
0.5FS10, 10P10	accuracy classes
10 VA	rated output
ext	extension
Ck-PE	capacitive voltage divider specifications (see page 5.)
Icth	rated thermal current
24/50/125 kV	highest voltage for equipment / power-frequency withstand voltage / rated lightning-impulse voltage
Ith	rated short time thermal current (thermal time)
40°C	ambient temperature
IEC 61869-2	referred standard(s)
Idyn	rated dynamic current
E	temperature class
2016	year of production

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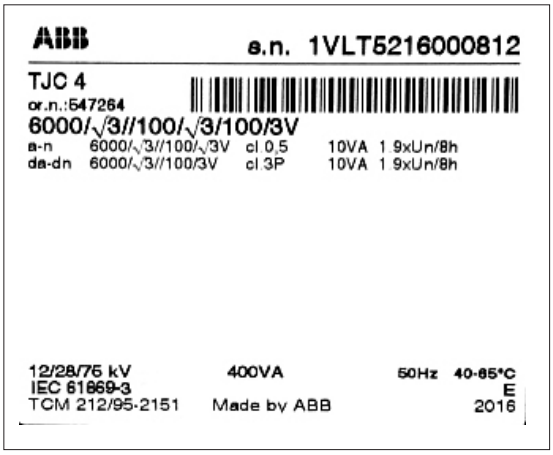
02 Example of voltage transformer label



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02

Where:

1VLT5216000812	serial number + barcode
TJC 4	transformer type code
6000√3//100/ √3/100/3 V	rated voltage ratio
a-n	terminal marking for measuring secondary winding
da-dn	terminal marking for residual (open-delta) winding
0.5; 3P	accuracy classes
10 VA	rated output
1.9xUn/8h	overvoltage factor
12/28/75 kV	highest voltage for equipment / power-frequency withstand voltage / rated lightning-impulse voltage
400 VA	rated output
50 Hz	rated frequency
40°C	ambient temperature
IEC 61869-3	referred standard
E	temperature class
2016	year of production

3. Instructions for installation

General informations

Instrument transformer is an electrical equipment and the electrical installation shall be done by skilled person only. National legislation can set down the minimum age and the criteria for competence of skilled persons working on, with, or near an electrical installation.

Where is not the national legislation requirements for competence, the criteria shall be used at least according to EN 50110-1.

Safety instructions

1. Always consider transformer as a part of the cir cuit to which it is connected, and do not touch the leads and terminals or other parts of the transformer unless they are known to be grounded.
2. Always ground the metallic bases of instrument transformer.
3. Always ground one secondary terminal of the transformer, except if the windings of voltage transformer are connected to open delta. Residual voltage windings connected to open delta must have dn terminal earthed only on one of three transformers (earthing screws at dn terminals of others two transformers have to be removed). When the secondary of transformer is interconnected, there should be only one grounded point to prevent accidental paralleling with system grounding wire. In case of disconnection from the ground, the grounding screw has to be removed from the secondary terminal. Connection between secondary terminal and base plate (ground) is shown on the picture “Crossection of double line terminal box“
4. Always short-circuit the secondary of the current transformer, which is not currently in use to prevent secondary voltages which may be hazardous to personnel or damaging to the transformer’s secondary. The secondary like this must be additionally grounded.
5. Never short-circuit the secondary terminal of a voltage transformer even this is not in use. A secondary short-circuit will cause the unit to overheat and fail in a very short period of time.
6. Protection of single pole insulated voltage transformers against feroresonance phenomena is stated in Appendix 3. – Damping of the ferroresonance in Voltage transformers type range TJx.
7. In case of the current transformer with voltage indication (coupling electrode included) is secondary terminal box equiped with PE terminal, which is connected with earthing screw to the base plate, which must be generally earthed. Connection between secondary terminal and base plate is shown on the picture “Crossection of single line terminal box“

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03 Low ratio
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04 High ratio
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05 KOKS 12, KOKS 17.5 shielding connection

Attention: Terminal PE must be always earthed, this is hold generally, even if the base plate is removed. In case of disassembling the base plate, producer is not warranting the earthing. Coupling electrode terminals Ck and PE are always delivered interconnected. Remove this connection before installation of indication system. Leave the connection if Ck-PE terminals are not in use.

8. All current and voltage transformers are, for safety reasons, shipped with earthed secondary windings. Earthing of the terminals are shown in Appendix 1. Before putting into operation always check whether it corresponds to the earthing scheme involved in the application and remove earthing screws accordingly (simple examples of network connection are in Appendix 2).

Attention: Manufacturer is not responsible for damage, loss and injuries caused by wrong connection of transformers.

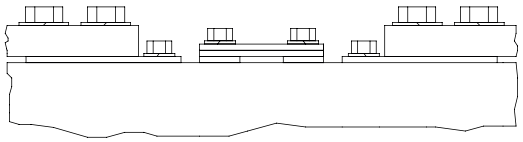
Mounting

Following informations are general and some details can differentiate according to type and variants of transformers. It is necessary to combine it with other technical and marketing specifications like catalogues, dimensional drawings and rating plate for specific transformer type.

The mounting position of the indoor transformer can be freely chosen. The transformer is fixed using the mounting base with four screws M10 and washers. Fastening must be done on a smooth surface. There is a M8 screw for earthing the transformer on the base plate.

Primary connection

Primary terminals of the current transformer are made of copper and they are silver or tin plated. There are M12 (CT) and M10 (VT) screws used for fastening of primary conductor to the terminal. For primary reconnectable transformers the ratio can be reconnected by changing position of the links fixed by M8 screws without removing already fitted primary conductors.



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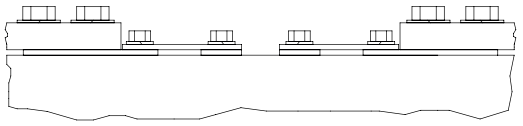

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Screw	Max. torque [Nm]	Min. torque [Nm]
M5	3.5	2.8
M6	4	3
M8	20	16
M10	20	16
M12	70	56

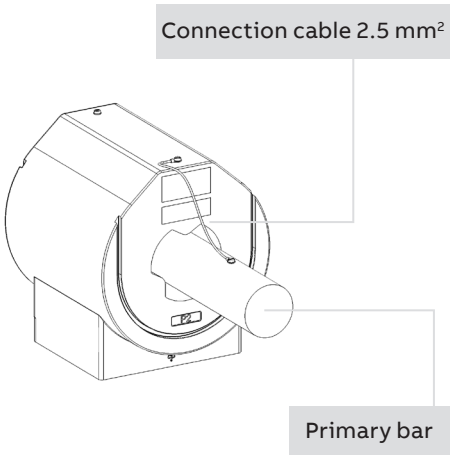
Tab. 1. Maximum allowed torques for screw connections of current transformers

Maximum allowed torque for screw connection of voltage transformer is 20 Nm.

Maximum allowed cantilever strength is:
Voltage transformers 2000 N.
Current transformers 5000 N.

Primary connectors of metal coated transformers (TJMC, TDMC) should be cleaned by pressured air to eliminate all undesired impurities created from unpacking and manipulation. An alcohol can be used in case of any additional pollution caused by manipulation after unpacking.

In case of Bus CT, there must be always connected CT shielding to the primary bar. Connection must be done on one side of the CT. Shielding connection example of KOKS 12, 17.5 described in picture 5 and for KOKS 24 in picture 6.



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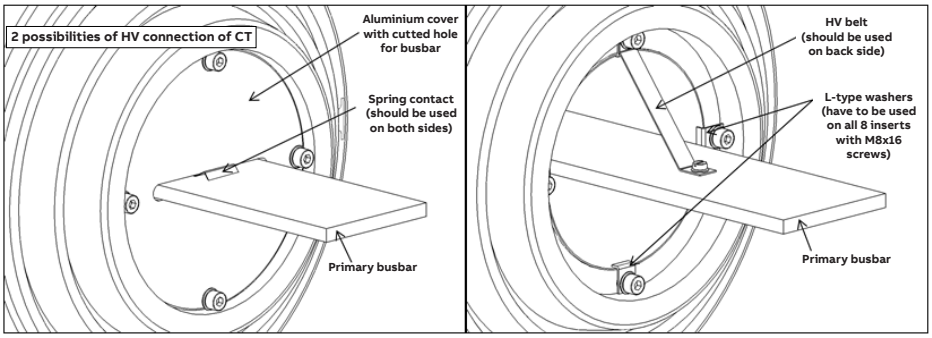
06 KOKS 24 shielding connection

07 Example of current transformer terminal box

08 Example of voltage transformer terminal box

09 Cross section of double line secondary terminal box



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Secondary connections

The terminals, screws, nuts and washers are made of stainless steel. Secondary grounding screws and secondary terminal fastening screws are made of nickel-plated brass.

The secondary terminal cover box used for most types is made from the plastic and provided with three detachable threaded inserts. (Instruction how to provide removing of cable grommet on a secondary terminal cover – please see appendix 5). The terminals are provided with M5 screws for secondary wiring connection and with through going holes for direct earthing of the secondary circuit by M5 screws. The terminal cover is sealable.

Degrees of IP protection

Indoor transformers: IP40 or IP30 for transformers TTR, BB, KOKS

	Max. Tightening torque (Nm)	Min. Tightening torque (Nm)
M5	3.5	2.8
M6	4	3

Tab. 2. The maximum permissible tightening torques for secondary screw connections

Max. diameter of the cable or wire connected to one terminal of the secondary is: 2x Ø 2.5 mm.

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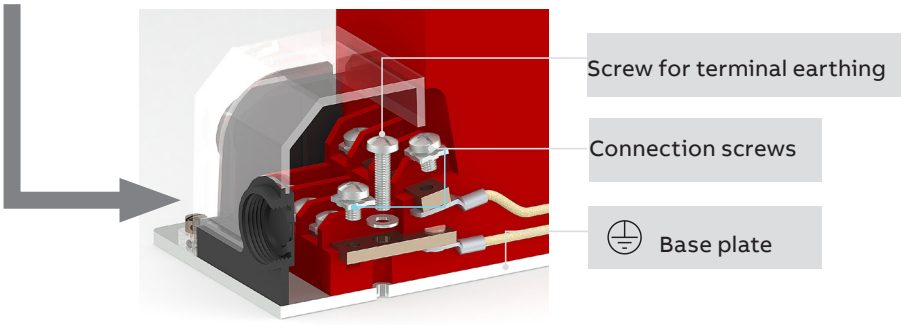

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10 Delivered VT with fixation
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11 Fixation removing

For terminal marking see Appendix 1.

Capacitive voltage indicator (divider)
The transformer can be supplied with the capacitive voltage indicator on the request. Integrated voltage detection system is corresponding to Separable Voltage Detection System according to IEC 61234-5. It is integrated coupling electrode connected to secondary terminal (terminal Ck). **Electrode acts as a capacitor between electrode and primary winding (C1), or electrode and ground (C2).** If the electrode is connected to indication device (not part of delivery – it is part of switchgear) it works as indication of voltage presence – more in IEC 61234-5.

Ub (kV)	C1 (pF) >	C2 (pF) >
3 – 5.4	30	20
5.5 – 7.2	25	20
10 – 13.5	20	20
13.8 – 17.5	15	20
20 – 40	10	20

Tab. 3. CE capacity according to nominal voltage

Note: Recommended min. capacities for nominal voltage.

Fuses
The fuse can be a part of a supply of voltage transformers with fuse. We can supply following fuses:

Rated current (A)	Rated voltage (kV)	Length (mm)	Striker pin
0.5 – 6.3	12/17.5	192	YES*/NO
0.5 – 6.3	24	292	YES*/NO
2 or 4	36	440	NO
0.3 or 0.6	12/24	255	NO

(*) Available only for certain types

Tab. 4. List of offered fuses

Warning: All VT's type TJP 4.0; TJPH 4.0; TJP 5.0; TJPH 5.0; TJP 6.0, have fuse contact equipped with fixation. Fuse contact fixation is used just for transportation. Before installation must be removed. See picture Fig. 9. and Fig. 10.

For safety fuse replacement see Instructions for installation, use and maintenance for Voltage (potential) transformers Fuse replacement (1VLM000614).

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External fuse holder
No special tools are needed for the installation of external fuse holder and It can be installed in any direction. All the necessary mounting accessories are a part of delivery and shall be used for fixing the fuse holder on the top of the VT. Maximum allowed torque for screw connection is 20 Nm.

4. Instructions for use

Current and Voltage instrument transformers are used:

- to convert large currents or voltage in the primary circuit to an appropriate level for secondary circuit equipment (relays and meters);
- to insulate primary and secondary circuit from each other to protect the secondary equipment from the harmful effects of large current or voltage appearing during the operation (short circuits).

The use of current or voltage transformer for other purpose than described above is forbidden if not agreed with the producer.

Routine test report
Together with instrument transformer are delivered:

- routine test report;
- two rating plates (one plastered on the transformer and one free).

The following information can be included on the request. These are free of charge:

- theoretical current/voltage errors and phase displacement values;
- theoretical excitation curves.

There are additional extra paid reports which can be supplied on request:

- accuracy test report;
- magnetizing curve (for current transformers);
- additional labels (if more than 2);
- verification tests.

5. Instructions for maintenance

Visible surface pollution shall be cleaned off the transformer. Polluted transformer can be cleaned by alcohol. In case of surface contamination please contact the manufacturer.

6. Transport and storage

Temperature for transport and storage the indoor transformers is from -25°C to +70°C. During transportation and storage the transformers must be protected from direct sunlight.
The transformers are shipped in wooden boxes or mounted on the pallets. Other temperature must be agreed by the manufacturer.

7. Disposal

Materials used in instrument transformers are considered as materials without dangerous environmental impact and materials are not toxic. Disposal of instrument transformers is controlled by national legislation of communal waste.

8. Handling with the transformers

Handling with the transformer is described in the Appendix 4.

9. Normative references

IEC 61869-1	Instrument transformers – general requirement
IEC 61869-2	Instrument transformers – additional requirements for current transformers
IEC 61869-3	Instrument transformers – additional requirements for voltage transformers
IEC 61243-5	Voltage detectors – Voltage detecting systems (VDS)
IEC 60529	Degrees of protection provided by enclosures (IP Code)
ISO 12100	Safety of machinery — Basic concepts, general principles for design
EN 50110-1	Operation of electrical installa tions

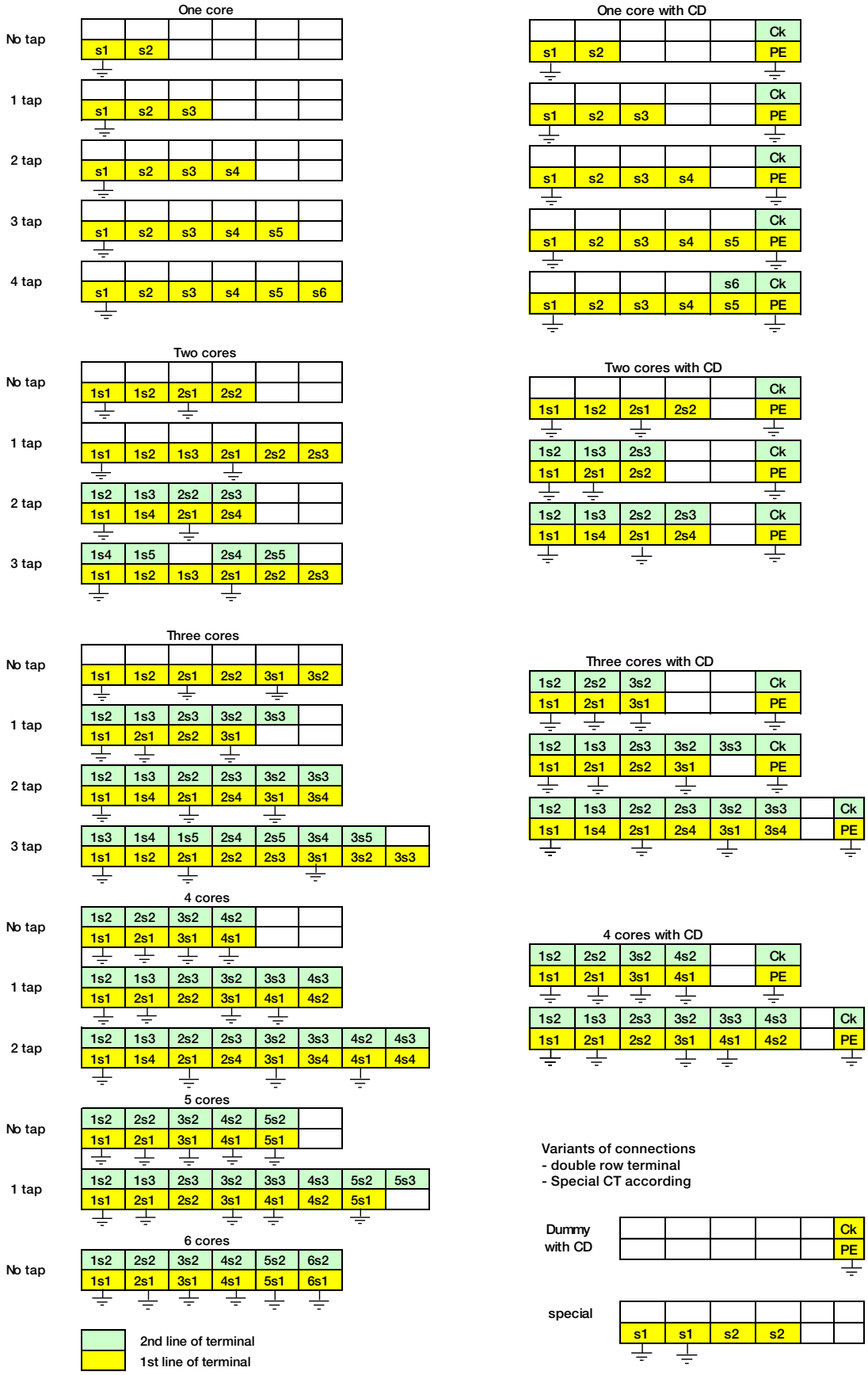
Current and Voltage transformers are designed, tested and produced according to international or national standards required by customers and agreed by producer. Specific standard is always mentioned on the Rating plate of transformer.

For example these standards:

IEC 60044-1; IEC 60044-2; IEC 60044-6; IEC 61869-1, IEC 61869-2; IEC 61869-3
AS 60044-1; AS 60044-2
AS 1243-1982; AS 1675-1986
ČSN 351301; ČSN 351302; ČSN 351361
ČSN EN 61896-1; ČSN EN 61896-2; ČSN EN 61896-6
IEEE Std C57.13.6
CSA Std CAN3-C13-M83
GOST 1516.3-96; GOST 7746-2001
BS 3939:1973; BS EN 61869-2

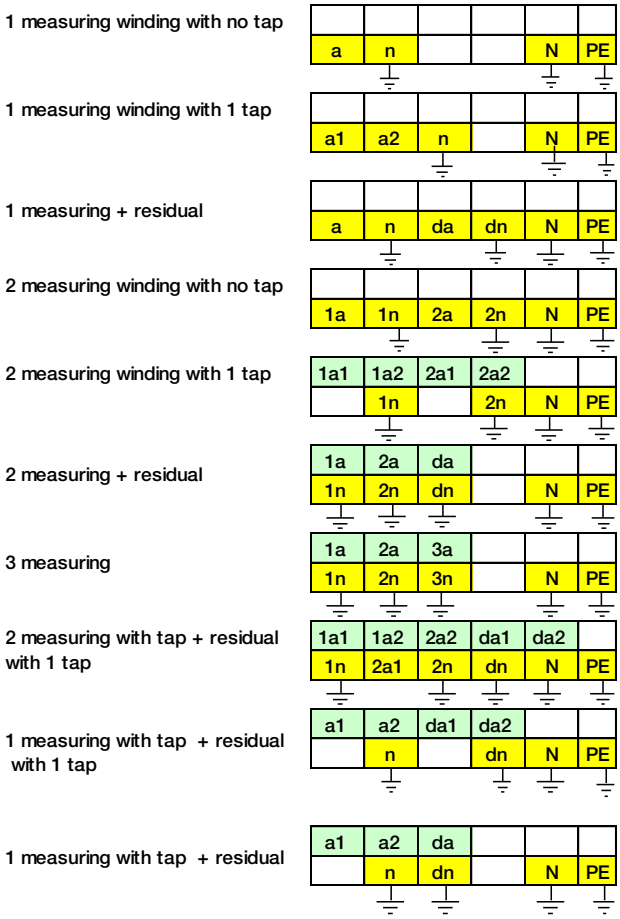
If it is agreed between customer and producer it is possible to deliver also other standard or standards which are mentioned above with different revision.

Appendix 1
Examples of secondary terminal marking for cast terminal box - Current transformers according to IEC

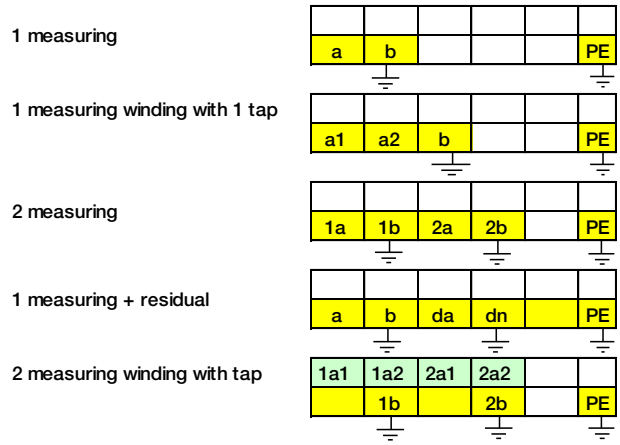


- Voltage transformers according to IEC

Variants of connections of double row terminal - One pole VT according to IEC

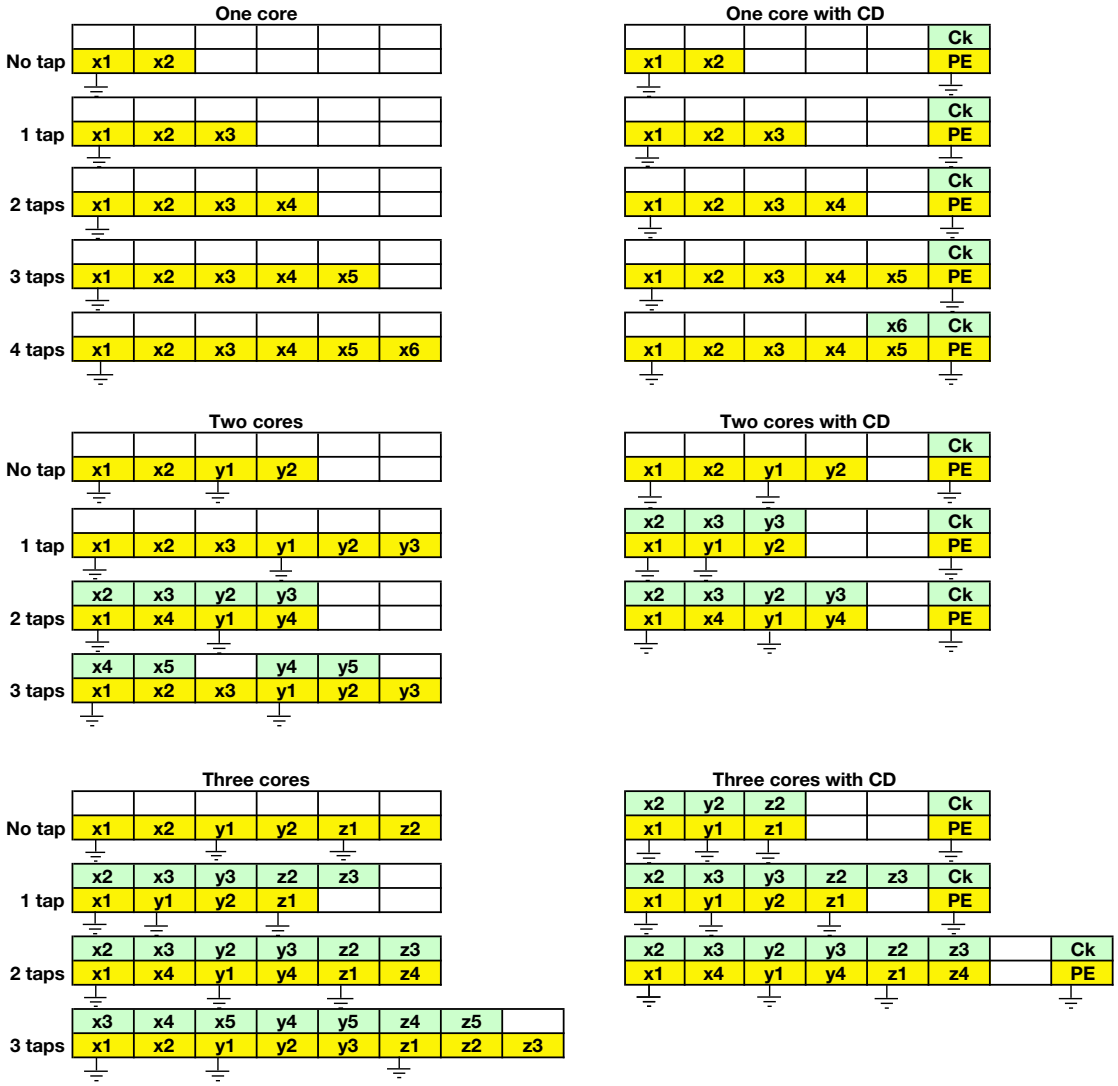


Variants of connections of double row terminal - Double pole VT according to IEC



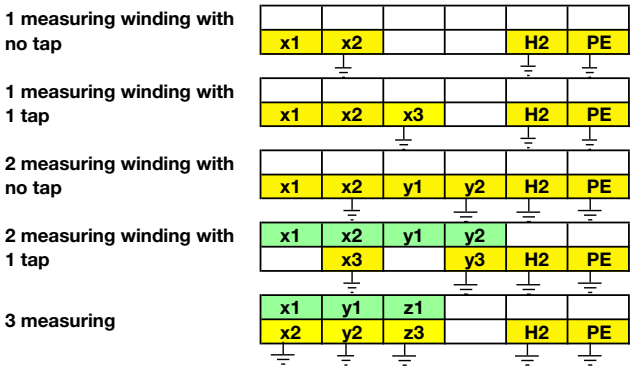
Residual voltage windings connected to open delta must have dn terminal earthed only on one of three transformers (earthing screws at dn terminals of others two transformers have to be removed).

- Current transformers according to IEEE

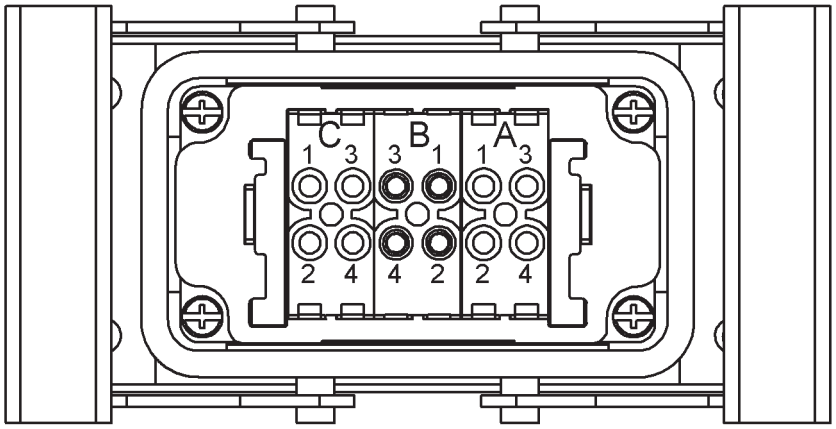


- Voltage transformers according to IEEE

Variants of connections of double row terminal



- Voltage transformers according to IEC TJMC 7.2-W plug in connection

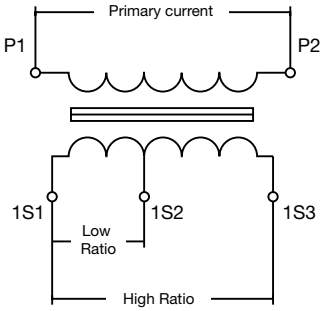


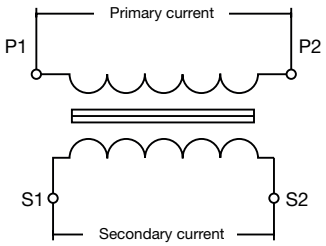
Connection	Female connector				Male connector				Female connector			
	A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4
1 winding (star)	a			n	B4			B1				
2 windings (star / open delta)	a			n	B4			B1	da			dn
2 windings (star / star)	1a	2a		1n	B4			B1			2n	
3 windings (2x star / open delta)	1a	2a		1n	B4			B1	da		2n	dn
3 windings (3x star)	1a	2a		1n	B4			B1	3a		2n	3n
1 winding with tap (star)	a1	a2		n	B4			B1				
2 windings with tap (star / open delta)	a1	a2		n	B4			B1	da1		da2	dn
2 windings with tap (2x star)	1a1	2a1		1n	B4			B1	1a2		2n	2a2

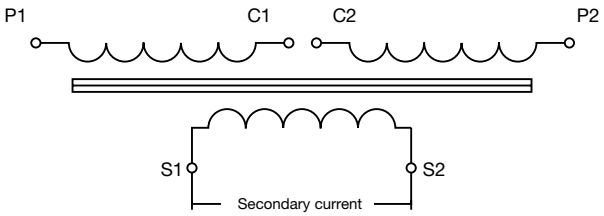
B1-B4 connection bridge inside connector

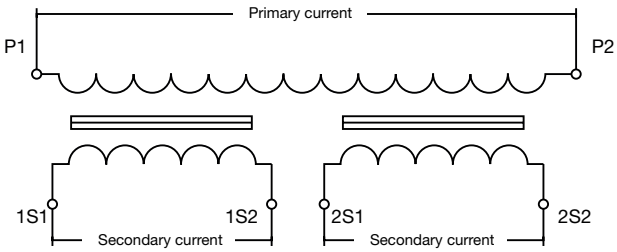
Appendix 2
Wiring diagram examples

Current transformers:

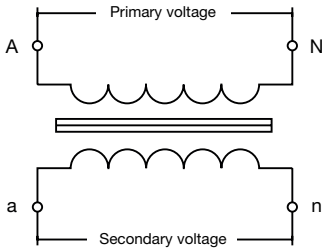


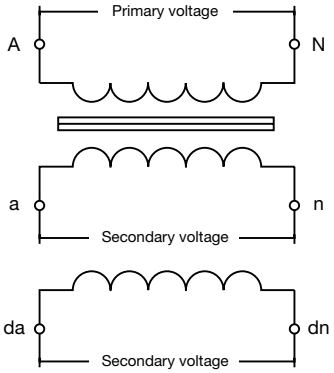


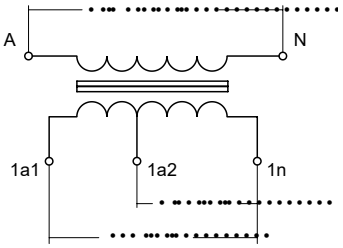




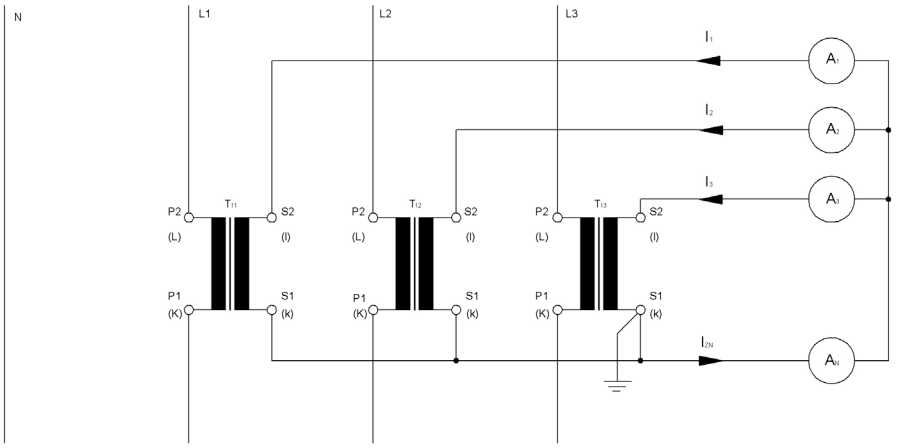
Voltage transformers:

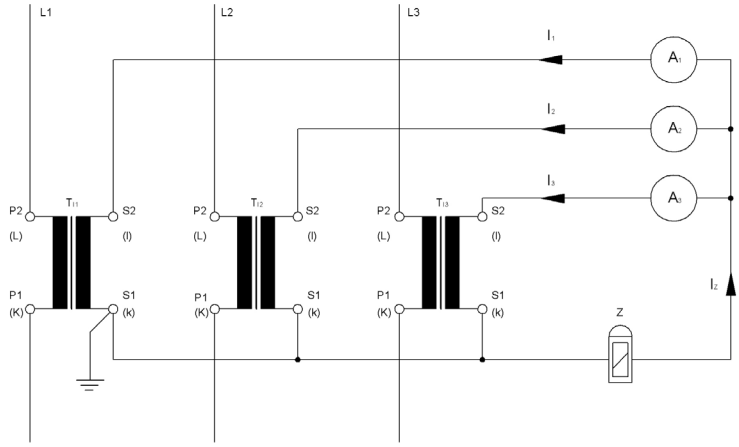


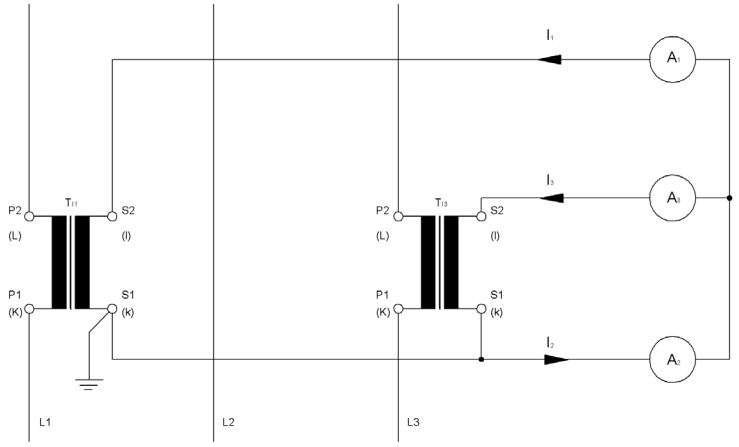




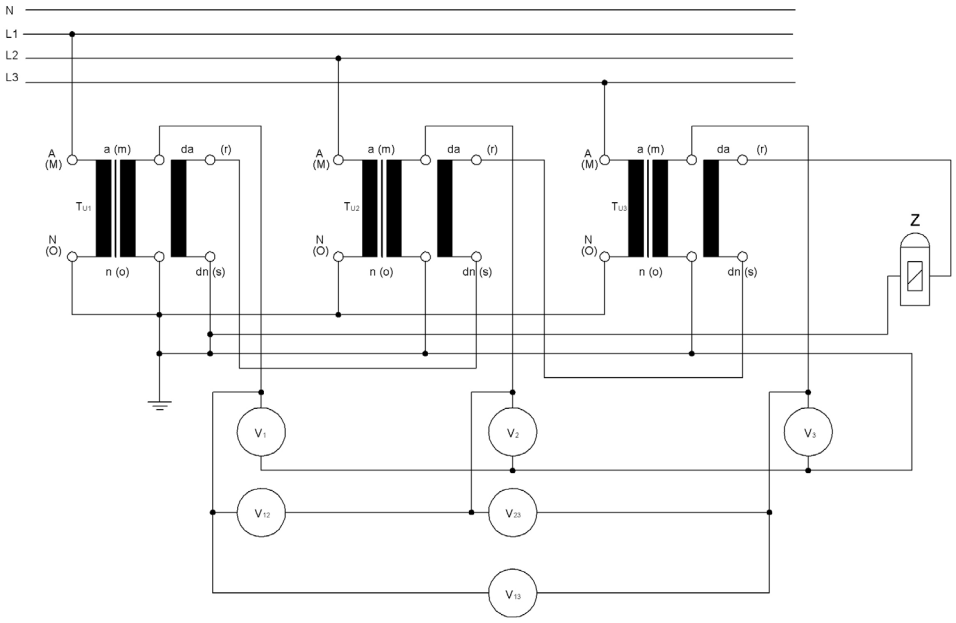
Examples of current transformers connection

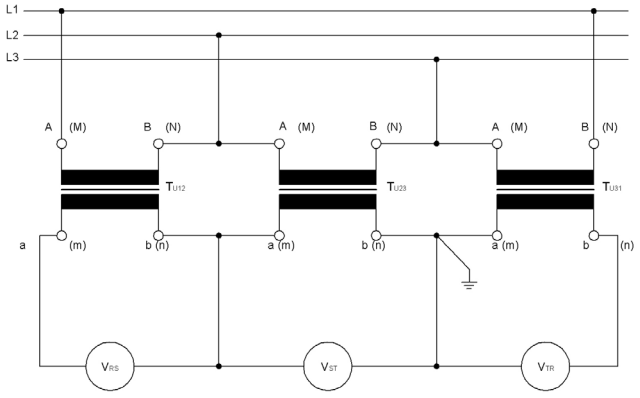


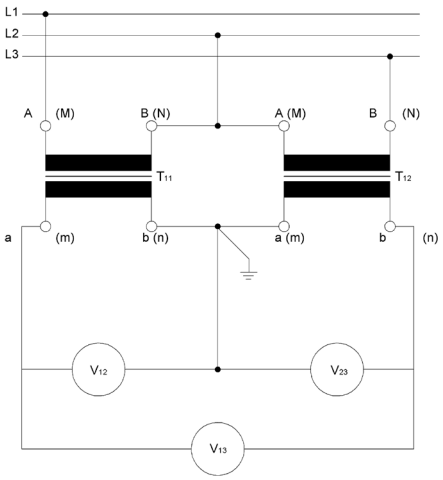




Examples of voltage transformers connection



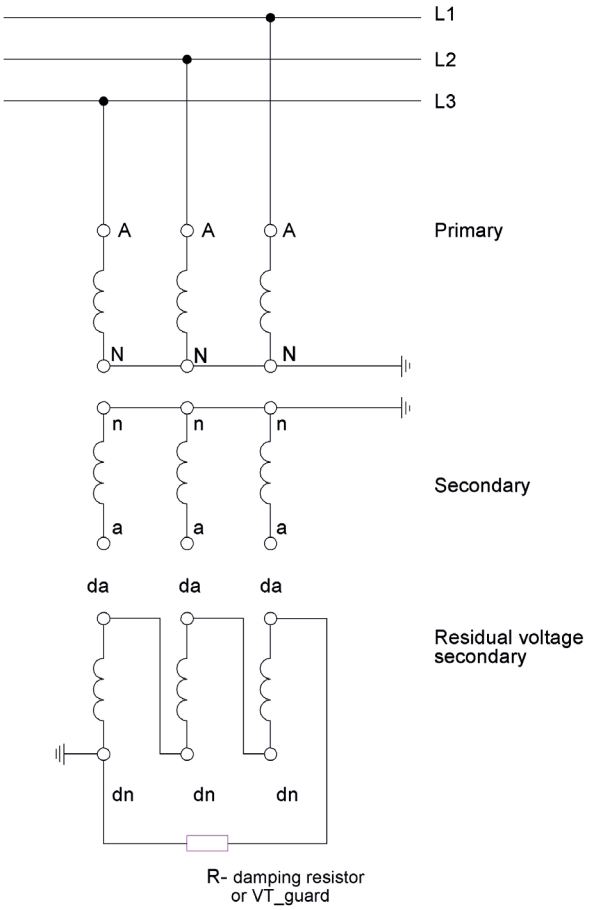




Appendix 3
Damping ferroresonance for voltage transformer type range TJ

Technical background

Ferroresonance is a phenomenon usually characterized by over-voltages and very irregular wave shapes and is associated with the excitation of one or more saturable inductors through capacitance in parallel with nonlinear inductor.
The saturable inductor is usually present in the form of an instrument transformer, power transformer or reactor which utilizes an iron core.
Ferroresonance of single-pole insulated transformers in unearthed network is one of the most common ferroresonance cases. Depending on the supply voltage, capacitance and inductance the oscillation can be either periodic (over- or sub-harmonic or with fundamental frequency) or aperiodic.
Using damping resistor or VT Guard in the residual voltage secondary, shown in figure below, can considerably reduce the risk for ferroresonance.
There is an additional factor that can in some cases reduce or totally eliminate the risk for ferroresonance and it is over-voltage factor. According to IEC standard is the rated over-voltage factor 1.9xUn/ 8h. Higher rated over-voltage factor shifts the operating point towards lower flux values of voltage transformer. It results in smaller sensitivity of transformer. Some kind of transients usually initiates ferroresonance.



Recommendation

Rated voltage factor: We recommend using the voltage transformers with the over-voltage factor in the range (2.5-3) xUn/8h. We cannot guarantee the value of the over-voltage factor if the requirements for the secondary winding are too high.

Voltage of residual winding	Value of Rdamp	Power Dissipation
100:3 V	22 Ω	450 W
110:3 V	27 Ω	450 W

Tab. 5. Recommended values of damping resistor

Appendix 4
Handling with transformers

There are few possibilities of handling:

1) Manual handling
Transformers can be handled by hands in case the weight of the transformer is not higher than 25 kg.
Always use glows during the manual handling. For grasp of the transformers always use handling grip (see the picture), or the base of the transformer.

Note. This system is recommended for metal coated instrument transformers TJMC or TDMC. Types TJP, TDP, never handle by gripping the fuse holder – risk of break.

Transformers heavier than 25 kg can be handled by hands in case the transformer is equipped with baseplate. In this case the transformer must be carried by at least two persons using the baseplate. It is necessary to follow all safety instructions during the manipulation.

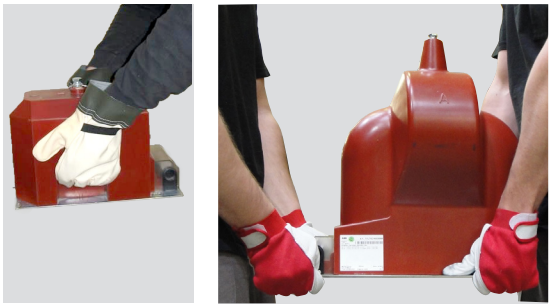
2) Handling by belts
For safety reasons transformers can be handled by hanging on belts when it is possible. Then the handling can be done by hanging of the transformer on the crane.

Note. This system is recommended for types: TTR, TSR, BB(O), KOKS. Hanging systems for those types are visualized on pictures.

Safety warning! Lifting capacity of the belts and the crane has to be at least 200 kg. Always make sure that the belts hold safely on the crane and on the transformer.

3) Handling by the self-locking hooks
It is possible to handle transformers by self-locking hooks hanging on the crane, if the transformer is equipped with handling grips. When the transformer has no handling grips, is it possible to grip the hooks under the base of the transformer.

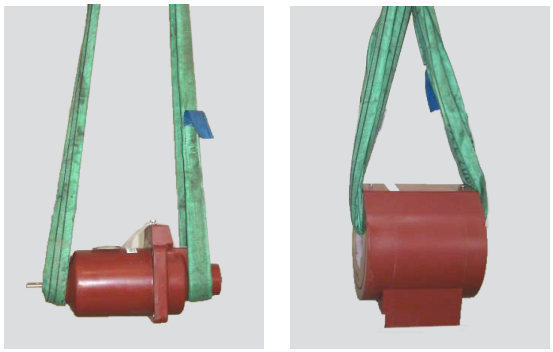
Note. This system is recommended for types: TPU, TPE, TJC, TJCL, TJCH, TJP, TJPH, TDP, TDC, KGUG, KGUGI. This handling system is visualized on the pictures.



11 Manual handling
12 Transformer hanging on belts
13 Self locking hooks attached on the handling grips

11

Safety warning! Lifting capacity of the hooks and the crane has to be 200 kg at least. Always make sure that the hooks hold safely on the crane and on the transformer.



12

13

4) Handling by the self-locking hooks under primary screws

In case of indoor current transformers, which are equipped with primary terminal screws M12, it is possible to hang the transformer on self-locking hooks holding under the primary screws. The handling can be done by hanging of the hooks on the crane.

Note. This system is recommended for types: TPU, TPE, IHBF, KOFA. This handling system is visualized on the picture.

Safety warning! Lifting capacity of the hooks and the crane has to be 200 kg at least. Always make sure that the hooks hold safely on the crane and on the transformer.

SAFETY WARNING: During the manipulation with transformer it is necessary to follow safety work instructions. Never stand under the freight. Always make sure that the freight is safely locked on the crane and make sure that there is no risk of unexpected release or turnover of the freight.

Note. Holding jigs, described in these chapters, are not a part of delivery.

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14

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14 Self-locking hooks attached under primary screws

Appendix 5
Removing of cable grommet on a secondary terminal cover

1) Step drill procedure
In case of use of a step drill, it is necessary to dismount a secondary terminal cover to prevent a damage of a transformer body. Maximal drill bit size is 20 mm.

A drilled plastic part shall be fully fixed to avoid any injuries. The pictures are for illustration purpose only.

It is recommended to clear the edges of all new holes immediately after drilling these holes. For these purposes, a rasper or a knife can be used. Cleaned secondary terminal cover can be mounted back to a body of transformer.

2) Screwdriver procedure
It is recommended to use a screwdriver to puncture a hole in a secondary terminal cover.

A screwdriver shall be placed to a weakened place close to a pre-perforated ring. Two dimensions of hole can be punctured.

1/ an inner diameter

2/ an outer diameter

If necessary, a plastic mallet can be used. The plastic mallet shall be used with ease.

It is recommended to clear the edges of all new holes immediately after puncturing these holes. For these purposes, a rasper or a knife can be used.

Note: Whole procedure must be realized with all caution, to avoid damage of a secondary terminal.

Appendix 6
Repair kit for metal coated voltage transformers

The repair kit contains material for 10 individual repairs. It is intended for ABB products only.

The repair kit includes:
Paint roller brush

10 pieces of roller covers wide 5 cm

Brush

Thinner S6300

Zinc spray ZINCOSIL 400 ml

Hempadur 15570 light grey coating

Hardener 95570

Fine filling putty for sealing 200 g POLYKAR Super Plus

Sandpaper 230x280 mm, grit 150

Repairing according to next steps:

1) Clean the damaged area with sandpaper, the surface must be as smooth as possible.

2) Mix both components of the filling putty in the ratio given by the manufacturer on the packaging.

3) Apply the prepared sealant to the damaged area and let it harden for 25-30 minutes.

4) Remove excess sealant with sandpaper. The surface must be smooth after sanding,

without any noticeable transition.

5) Shake the zinc spray thoroughly, then apply it to the damaged area.

6) Always apply the spray from a distance of approx. 25 cm to achieve an even layer.

7) Prepare a mixture of Hempadur and hardener in the ratio:

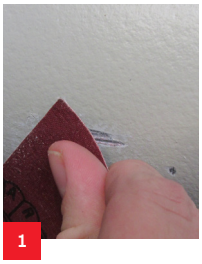
- Hempadur 15570 - 3 parts
- Hardener 95570 - 1 part

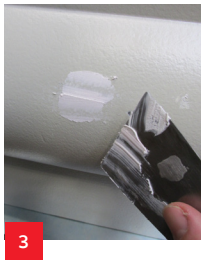
8) Mix both components thoroughly and then apply with a roller to the damaged area. Apply the mixture around the damaged area until proper color transition is achieved.

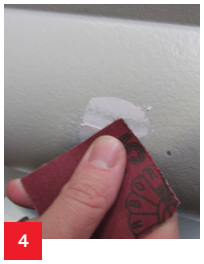
9) Apply the first layer of coating, allow to dry and then apply the second layer of coating. Apply the layers until the repaired area has the same shade as the undamaged surface of the transformer.

10) Clean all used tools with S6300 thinner.

Note:
This kit can be used to repair minor surface damages at your own risk and responsibility.
In case of major damage, contact the supplier.







Appendix 7
Assemble the PT Sheet

Clean VT cones with the duster (ideally with Staubfix super, 80x50cm which does not leave its parts on the surface of the cones) and grease them (1) with insulating vaseline/paste (3, 4, 5). The surface must be clean. Use a brush (2) to apply the insulating vaseline/paste.

1

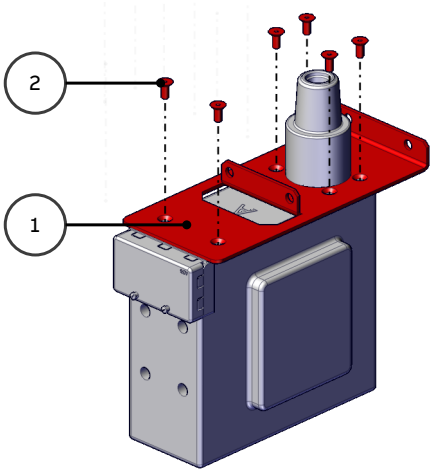
2

3

4

5

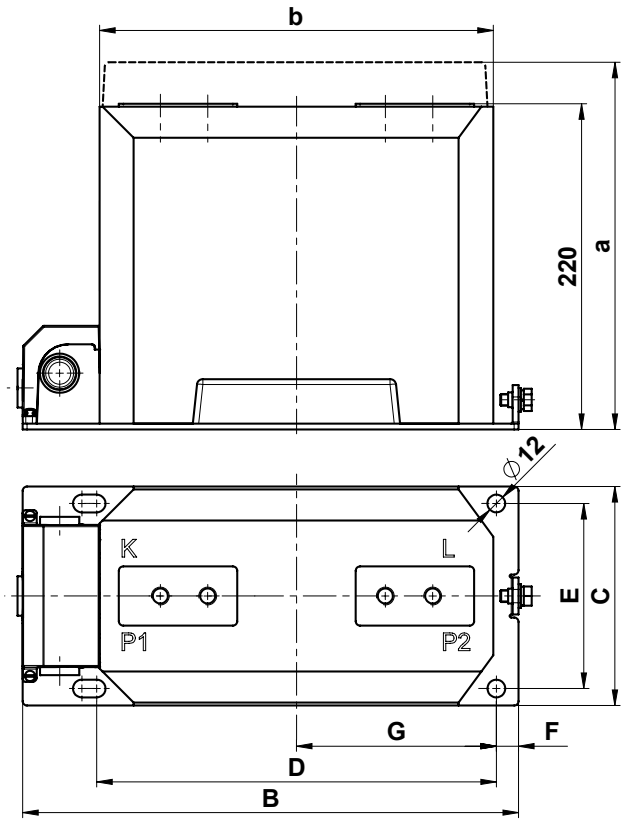
The example of mounting on a board for mounting in the switchboard panel.



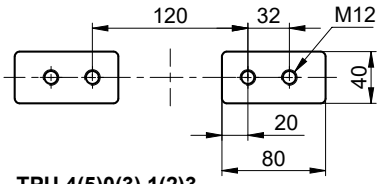
Components from 2R...		
Name	**Nr.**	**Amt.**
PT Sheet	2RJA024422P0001	**1**
SCR-CTSK_ISO10642_ M8X20-10.9	9ABA450064P4206	6

The screw tightening torque is defined 12 Nm.

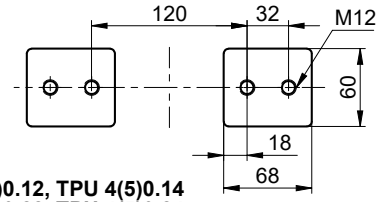
Appendix 8
Dimensional Drawing TPU 4x.xx and TPU 5x.xx



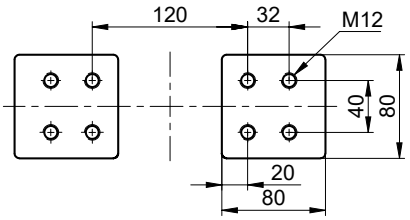
TPU 4(5)0.11, TPU 4(5)3.11
TPU 4(5)0.21, TPU 4(5)3.21



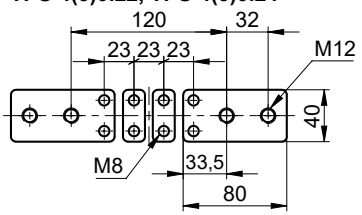
TPU 4(5)0(3).1(2)3
TPU 4(5)0(3).31(3)
TPU 4(5)0(1,2,3).41(3)
TPU 4(5)0(3).53



TPU 4(5)4.1(2,3,4)1(3)
TPU 4(5)5.1(2,3,4)1(3)
TPU 4(5)6.1(2,3,4)1(3)
TPU 4(5)7.1(2,3,4)1(3)
TPU 4(5)8.1(2,3,4)1(3)

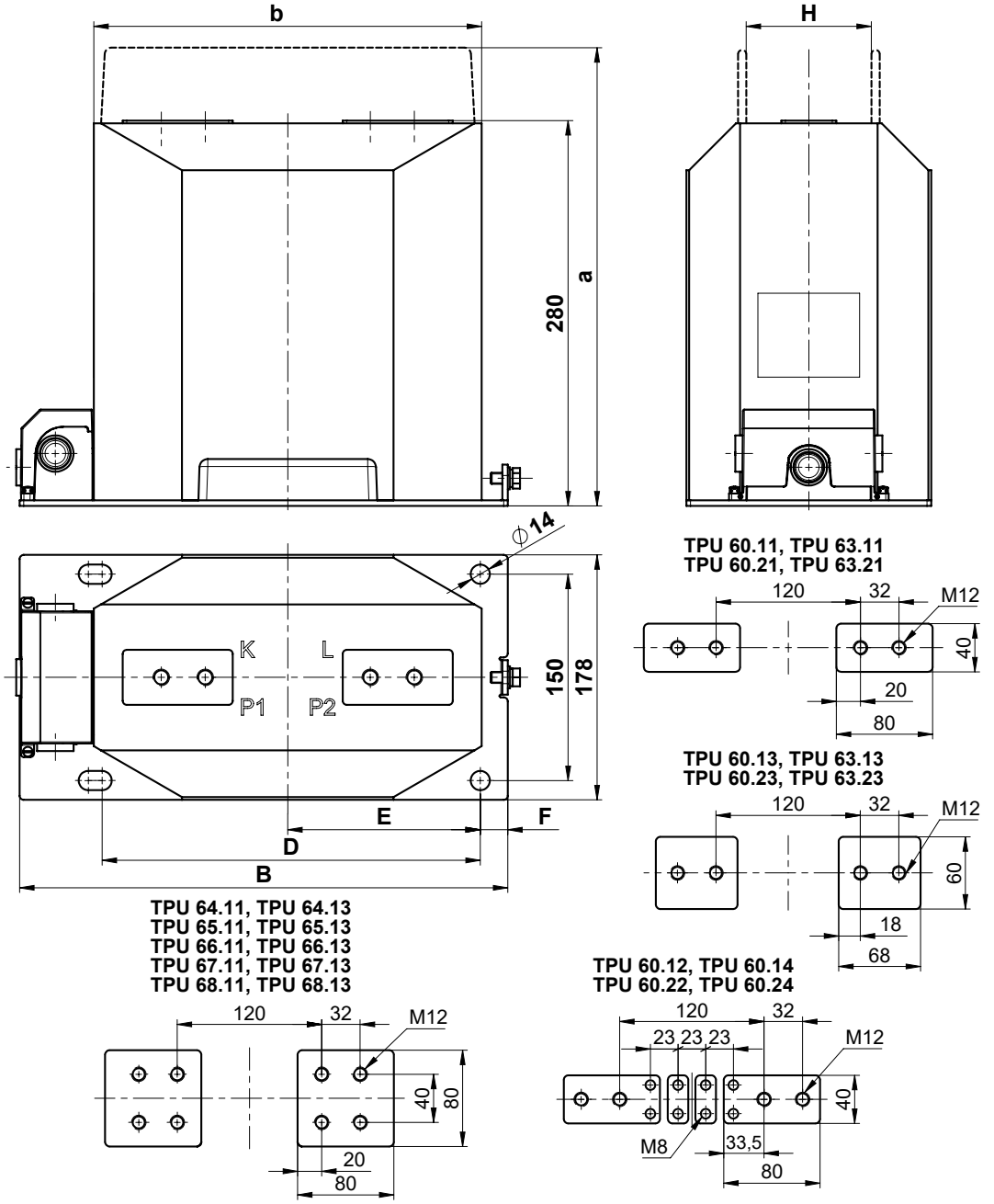


TPU 4(5)0.12, TPU 4(5)0.14
TPU 4(5)0.22, TPU 4(5)0.24



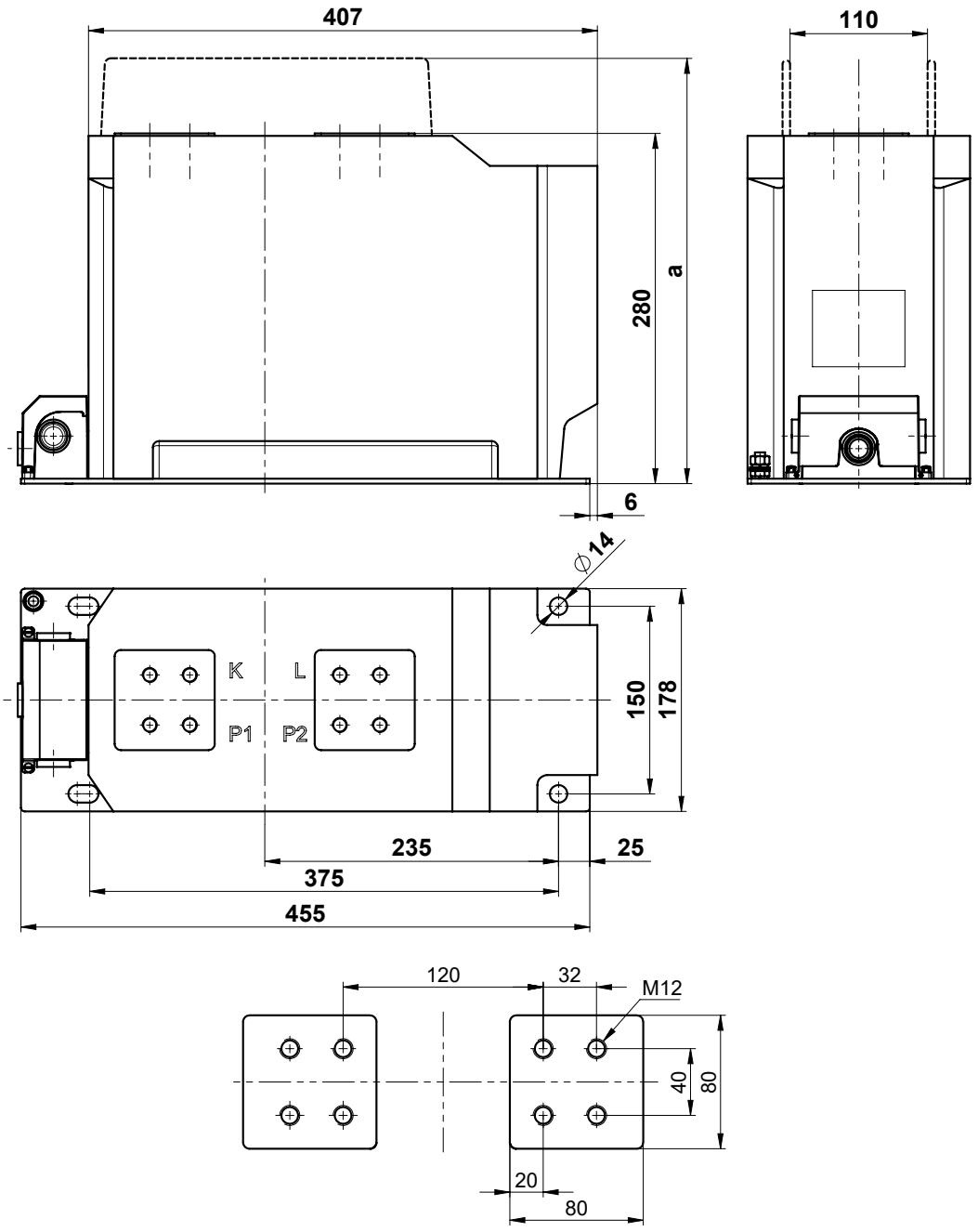
	TPU 4(5)0(3).11 TPU 4(5)0.12 TPU 4(5)4(5,6,7,8).11	TPU 4(5)0(3).13 TPU 4(5)0.14 TPU 4(5)4(5,6,7,8).13	TPU 4(5)0(3).21 TPU 4(5)0.22 TPU 4(5)4(5,6,7,8).21	TPU 4(5)0(3).23 TPU 4(5)0.24 TPU 4(5)4(5,6,7,8).23	TPU 4(5)0(3).31 TPU 4(5)4(5,6,7,8).31	TPU 4(5)0(3).33 TPU 4(5)4(5,6,7,8).33	TPU 4(5)0.53	TPU 4(5)0(1,3).41 TPU 4(5)4(5,6,7,8).41	TPU 4(5)0(1,3).43 TPU 4(5)4(5,6,7,8).43
a [mm]	-	340	-	248	-	280	248	-	280
B [mm]	355	355	455	455	355	355	335	465	465
b [mm]	266	266	386	386	285	285	283	395	395
C [mm]	148	148	148	148	184	184	148	184	184
D [mm]	270	270	390	390	270	270	270	390	390
E [mm]	125	125	125	125	160	160	125	160	160
F [mm]	15	15	15	15	25	25	15	15	15
G [mm]	135	135	255	255	135	135	135	255	255
H [mm]	-	86	-	86	-	110	86	-	110

Dimensional Drawing TPU 6x.xx



	TPU 60(3).11, TPU 60.12 TPU 64(5,6,7,8).11	TPU 60(3).13, TPU 60.14 TPU 64(5,6,7,8).13	TPU 60(3).21 TPU 60.22	TPU 60(3).23 TPU 60.24
a [mm]	-	340	-	340
B [mm]	355	355	455	455
b [mm]	282	282	382	382
D [mm]	275	275	375	375
E [mm]	140	140	235	235
F [mm]	20	20	25	25

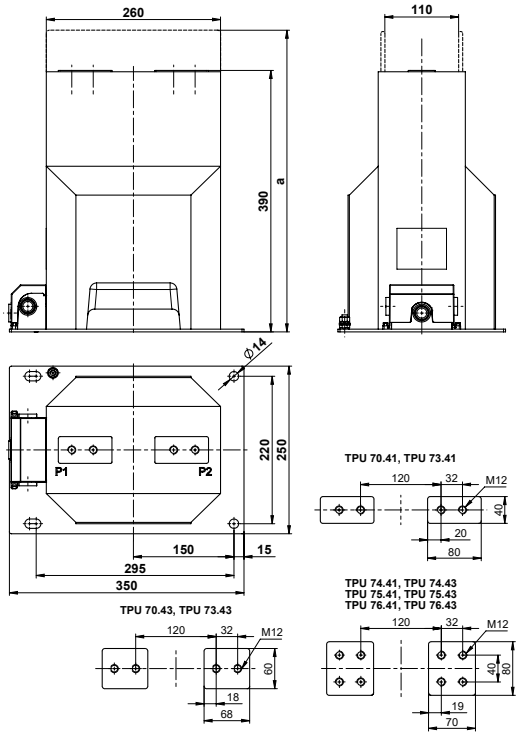
Dimensional Drawing TPU 6x.xx



	TPU 64-68.21	TPU 64-68.23
a [mm]	-	340

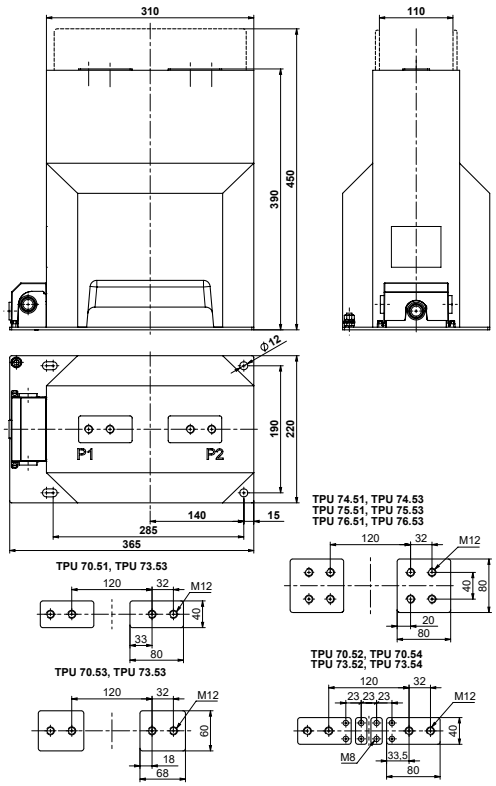
Dimensional Drawings TPU 7x.xx

TPU 7x.4x

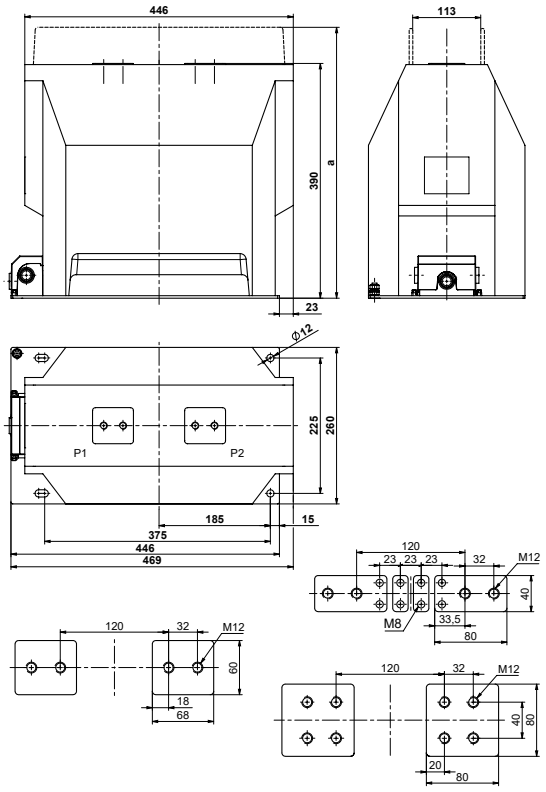


	TPU 70(3).41 TPU 74(5,6).41	TPU 70(3).43 TPU 74(5,6).43
a [mm]	-	450

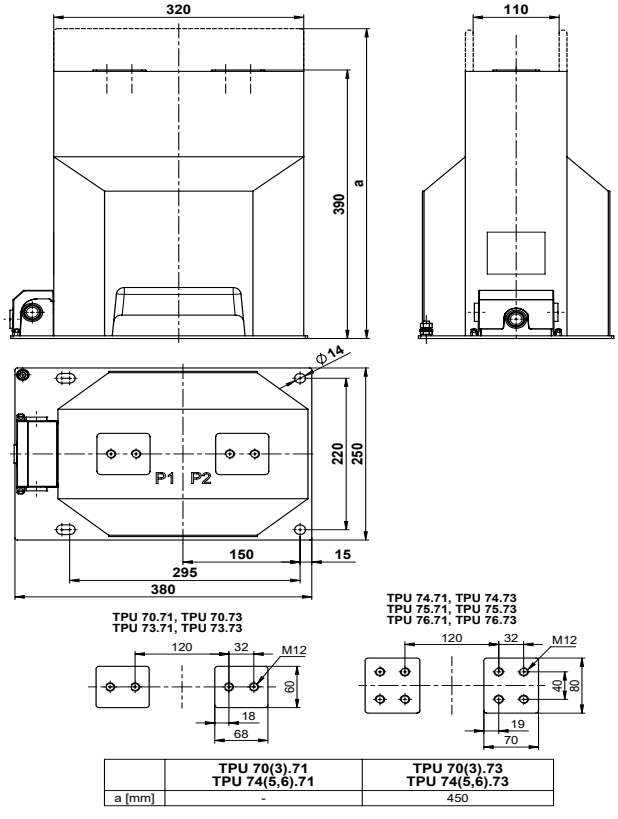
TPU 7x.5x



TPU 7x.6x

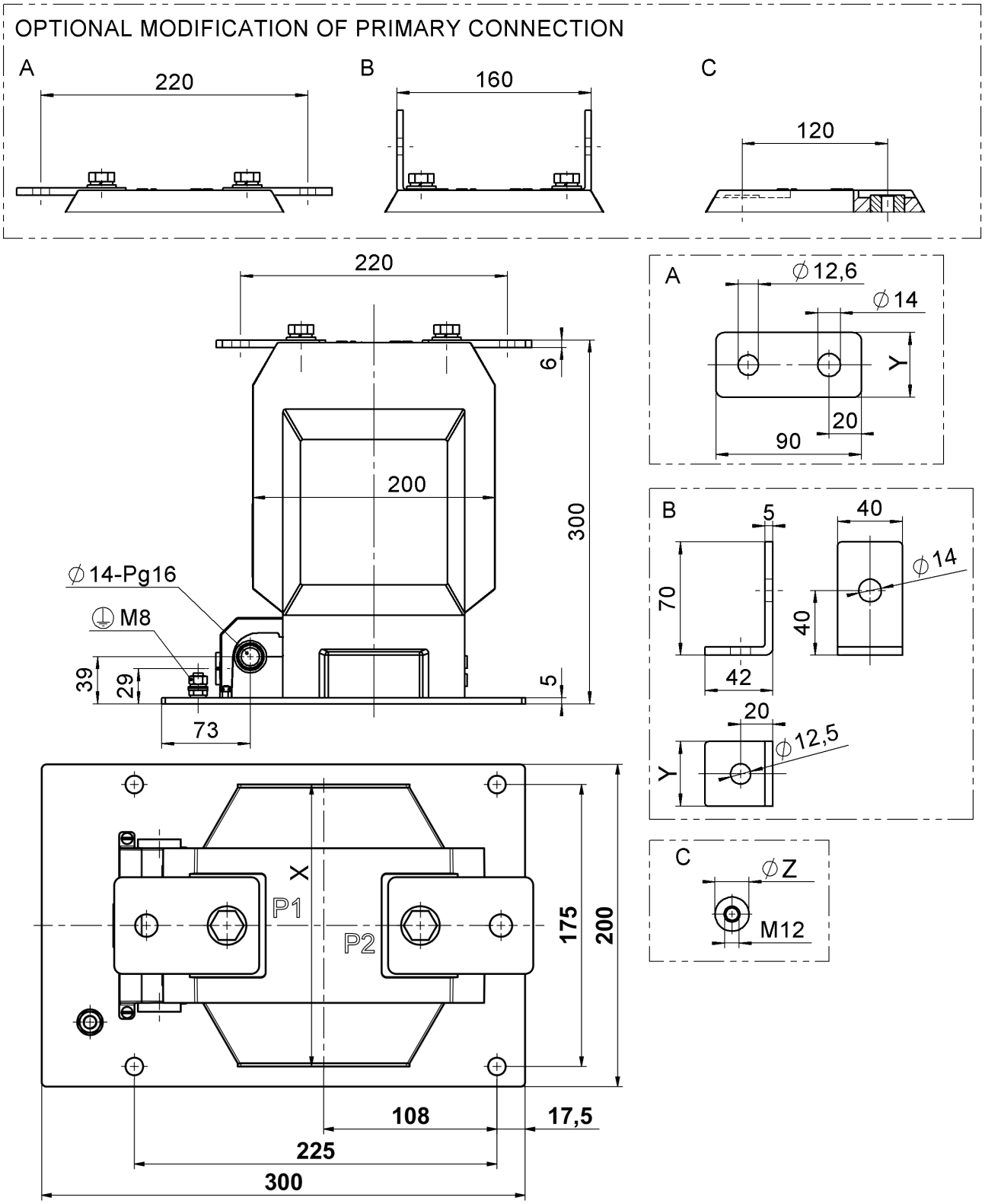


TPU 7x.7x



	TPU 70(3).71 TPU 74(5,6).71	TPU 70(3).73 TPU 74(5,6).73
a [mm]	-	450

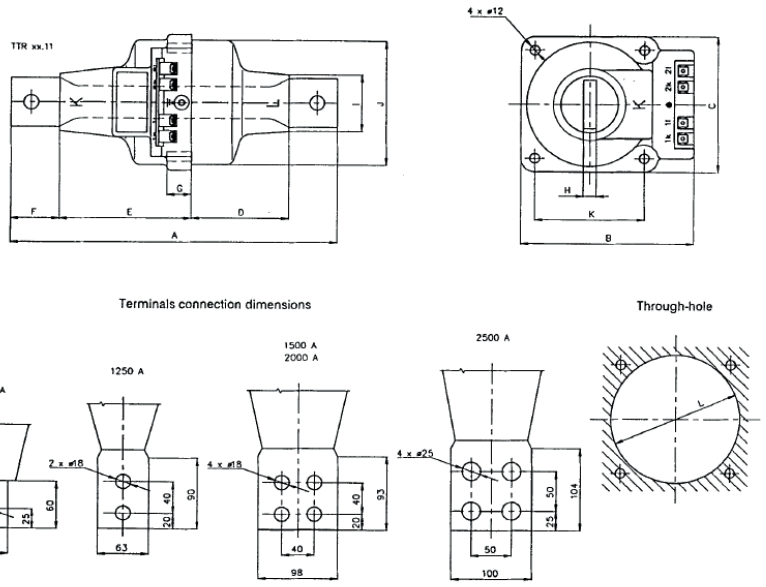
Dimensional Drawings TPE



	TPE 60.11	TPE 60.31	TPE 63.31
X [mm]	150	175	175
Y [mm]	40	40	60
Z [mm]	28	28	40

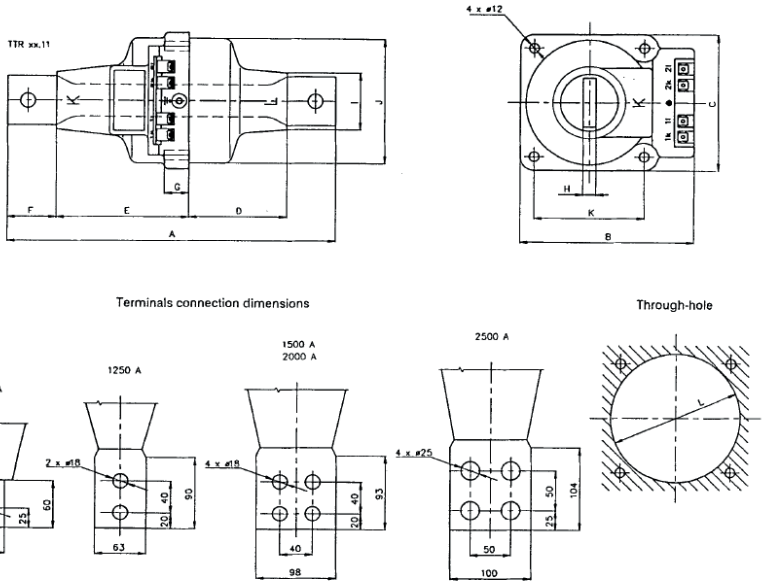
Dimensional Drawings TTR

TTR 4x.xx



Insulation voltage [kV]	Type	Rated current [A]	Dimensions														Weight [kg]
			A	B	C	D	E	F	G	H	H∞	øI	øJ	K	øL		
12	TTR 41.11	to 600	402	214	170	120	162	60	30	16	6	71	156	136	160		10.0
	TTR 42.11	to 300	500	214	170	220	162	60	30	16	6	71	156	136	160		17.0
	TTR 43.11	750-1250	472	214	170	120	162	95	30	20	10	71	156	136	160		11.0
	TTR 44.11	1500	482	252	208	120	162	100	30	16	20	110	192	174	196		15.0
	TTR 45.11	2000	482	252	208	120	162	100	30	20	20	110	192	174	196		21.0
	TTR 46.11	2500	502	252	208	120	162	110	30	20	20	110	192	174	196		24.0

TTR 6x.xx

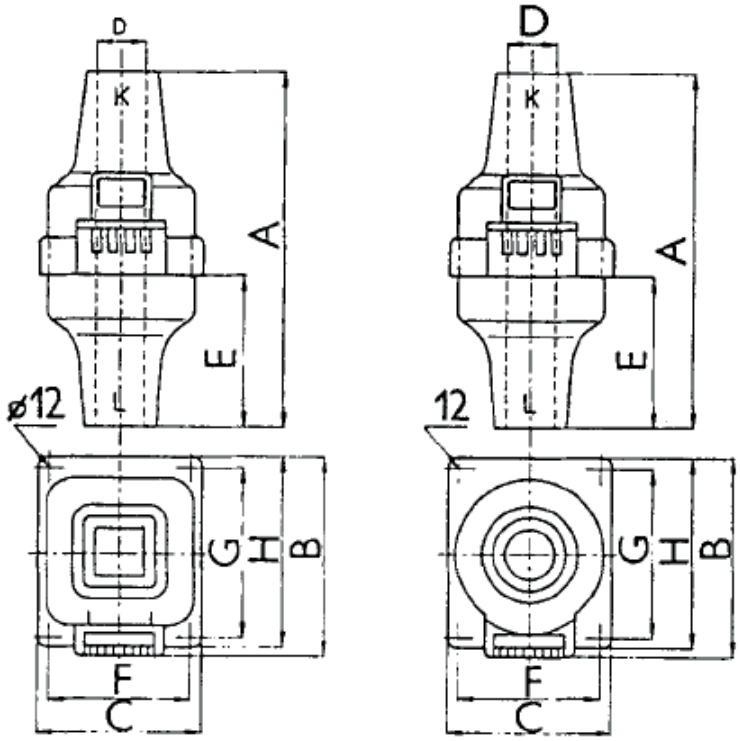


Insulation voltage [kV]	Type	Rated current [A]	Dimensions														Weight [kg]
			A	B	C	D	E	F	G	H	H∞	øI	øJ	K	øL		
25	TTR 61.11	to 600	620	224	180	238	262	60	30	16	6	71	166	146	170		14.0
	TTR 62.11	to 300	680	224	180	298	262	60	30	16	6	71	166	146	170		21.0
	TTR 63.11	750-1250	690	224	180	238	262	95	30	20	10	71	166	146	170		15.0
	TTR 64.11	1500	700	274	230	238	262	100	30	16	20	110	216	190	220		23.0
	TTR 65.11	2000	700	274	230	238	262	100	30	20	20	110	216	190	220		32.0
	TTR 66.11	2500	720	274	230	238	262	110	30	20	20	110	216	190	220		35.0

Dimensional Drawing BB

—

BB 103
BB 104
BB 223

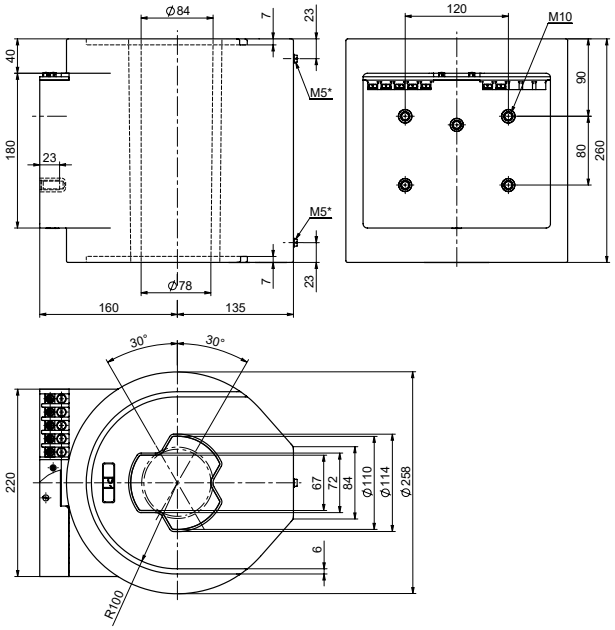


Type	Dimension								Weight kg
	A	B	C	D	E	F	G	H	
BB 103	280	341	262	□ 116 x116	132	212	278	328	22,0
BB 104	465	389	322	ø 132	216	276	300	346	45.0
BB 223	500	351	274	□ 116 x116	238	224	290	340	28.0

Dimensional Drawings KOKS xx A xx

KOKS 17.5 A 31
KOKS 12 A 31

WEIGHT: 35kg

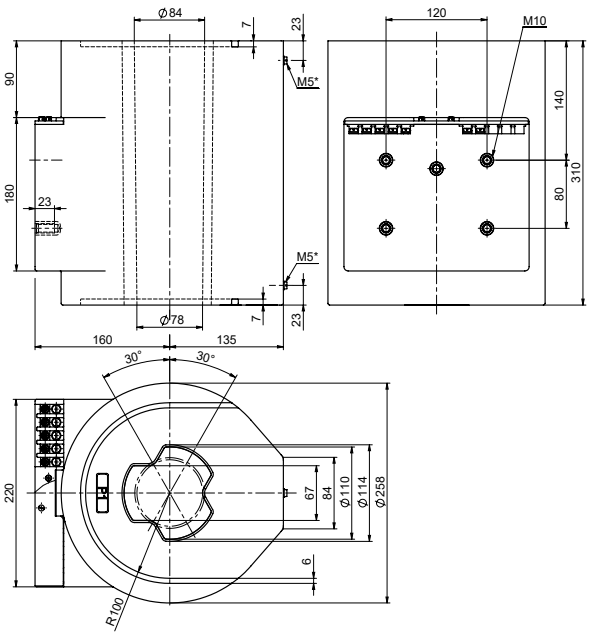


* M5 TERMINAL MUST BE CONNECTED TO THE PRIMARY BAR

Drawing n.	Polarity
44402520	P1 to secondary terminal
44402530	P2 to secondary terminal

KOKS 17.5 A 41
KOKS 12 A 41

WEIGHT: 42kg

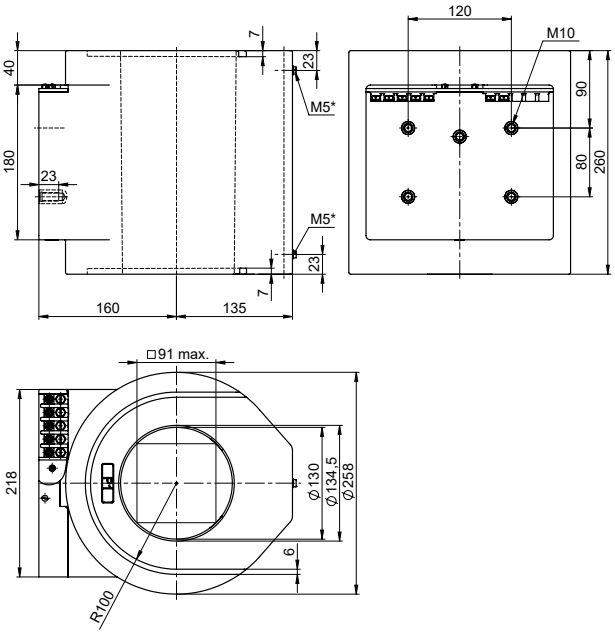


* M5 TERMINAL MUST BE CONNECTED TO THE PRIMARY BAR

Drawing n.	Polarity
44402540	P1 to secondary terminal
44402550	P2 to secondary terminal

KOKS 17.5 C 31
KOKS 12 C 31

WEIGHT: 34kg

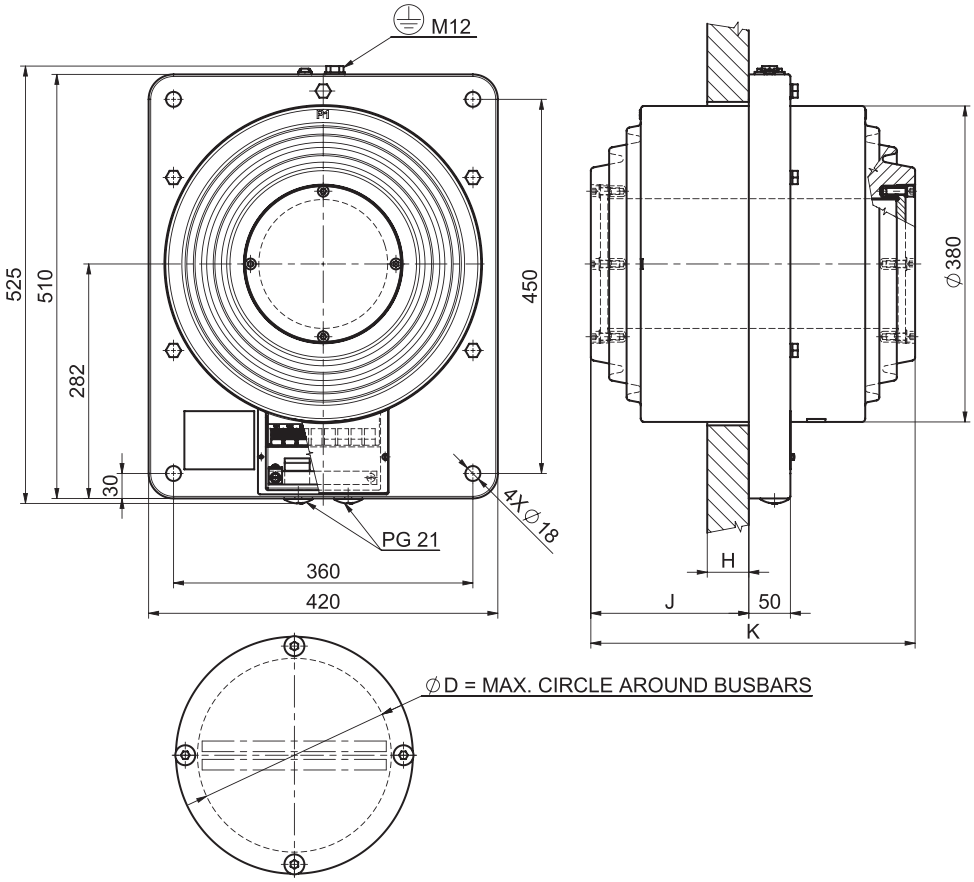


* M5 TERMINAL MUST BE CONNECTED TO THE PRIMARY BAR

Drawing n.	Polarity
1VL4400076R0101	P1 to secondary terminal
1VL4400076R0102	P2 to secondary terminal

Dimensional Drawing KOKS 24

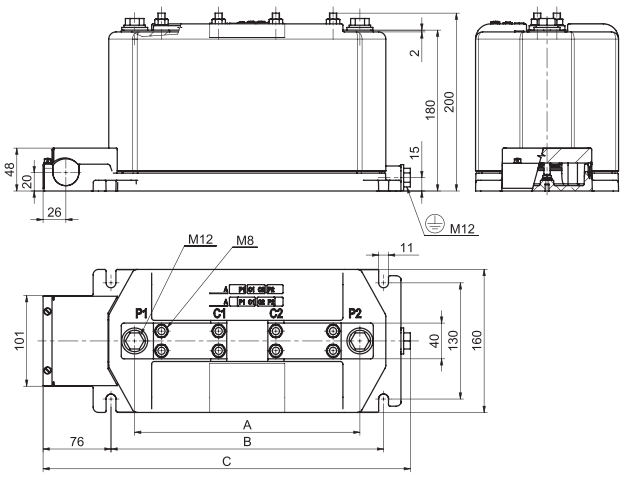
KOKS 24



Drawing n.	Type	D [mm]	H [mm]	J [mm]	K [mm]	Weight [kg]
1VL4600900R0101	KOKS 24 D 11	150	35	190	390	80
1VL4600900R0102	KOKS 24 D 21	150	75	245	500	115
1VL4600900R0103	KOKS 24 F 11	205	35	195	400	65
1VL4600900R0104	KOKS 24 F 21	205	75	250	510	90

Dimensional Drawings KOFA

KOFA 12 B1, D1 Weight: appr. 18 kg
KOFA 12 B2, D2, F2 Creepage distance: 160 mm
KOFA 12 B3, D3, F3 Arcing distance 150 mm

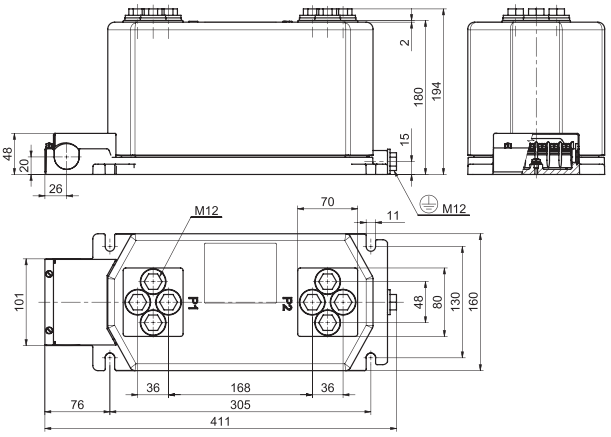


Drawing n.	Transformer type	A [mm]	B [mm]	C [mm]	Weight [kg]
1VL4600866R0101	KOFA 12 B1	132	185	292	13
1VL4600866R0102	KOFA 12 D1	132	185	292	13
1VL4600866R0103	KOFA 12 B2	192	245	352	17
1VL4600866R0104	KOFA 12 D2	192	245	352	17
1VL4600866R0105	KOFA 12 F2	192	245	352	17
1VL4600866R0106	KOFA 12 B3	252	305	412	24
1VL4600866R0107	KOFA 12 D3	252	305	412	24
1VL4600866R0108	KOFA 12 F3	252	305	412	24

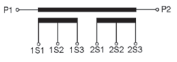
Terminal markings

E.g. 2 cores

KOFA 12 A3 Weight: appr. 20 kg
KOFA 12 C3 Creepage distance: 165 mm
KOFA 12 E3 Arcing distance 150 mm



Terminal markings when secondary reconnectable for two primary currents:



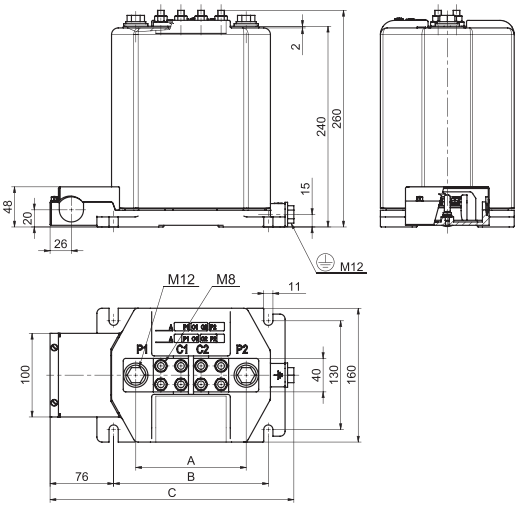
Terminal markings

E.g. 3 cores

Connect between S1 and S2 for the lower primary current.
Connect between S1 and S3 for the higher primary current.

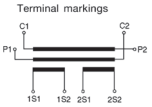
Drawing n.	Transformer type	Weight [kg]
1VL4600868R0101	KOFA 12 A3	23
1VL4600868R0102	KOFA 12 C3	23
1VL4600868R0103	KOFA 12 E3	23

KOFA 24 B1, D1 Weight: appr. 18 kg
KOFA 24 B2, D2, F2 Creepage distance: 220 mm
KOFA 24 B3, D3, F3 Arcing distance 210 mm



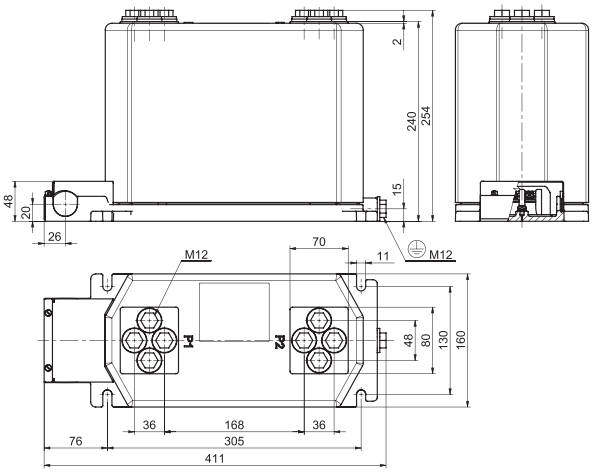
Drawing n.	Transformer type	A [mm]	B [mm]	C [mm]	Weight [kg]
1VL4600867R0101	KOFA 24 B1	132	185	292	17
1VL4600867R0102	KOFA 24 D1	132	185	292	17
1VL4600867R0103	KOFA 24 B2	192	245	352	20
1VL4600867R0104	KOFA 24 D2	192	245	352	20
1VL4600867R0105	KOFA 24 F2	192	245	352	20
1VL4600867R0106	KOFA 24 B3	252	305	412	23
1VL4600867R0107	KOFA 24 D3	252	305	412	23
1VL4600867R0108	KOFA 24 F3	252	305	412	23

Terminal markings



E.g. 2 cores

KOFA 24 A3 Weight: appr. 24 kg
KOFA 24 C3 Creepage distance: 225 mm
KOFA 24 E3 Arcing distance 210 mm



Terminal markings when secondary reconnectable for two primary currents:

Terminal markings

E.g. 3 cores

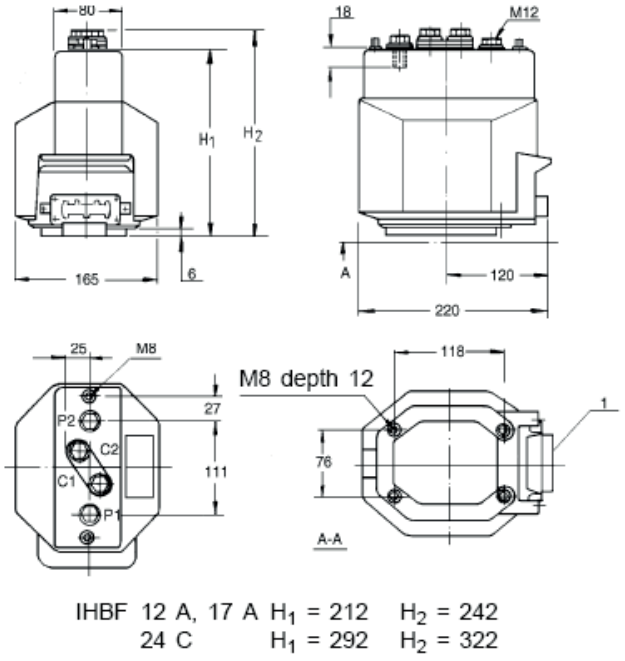
Connect between S1 and S2 for the lower primary current.
Connect between S1 and S3 for the higher primary current.

Drawing n.	Transformer type	Weight [kg]
1VL4600869R0101	KOFA 24 A3	27
1VL4600869R0102	KOFA 24 C3	27
1VL4600869R0103	KOFA 24 E3	27

Dimensional Drawings IHBF

IHBF 12 A
IHBF 17 A
IHBF 24 C

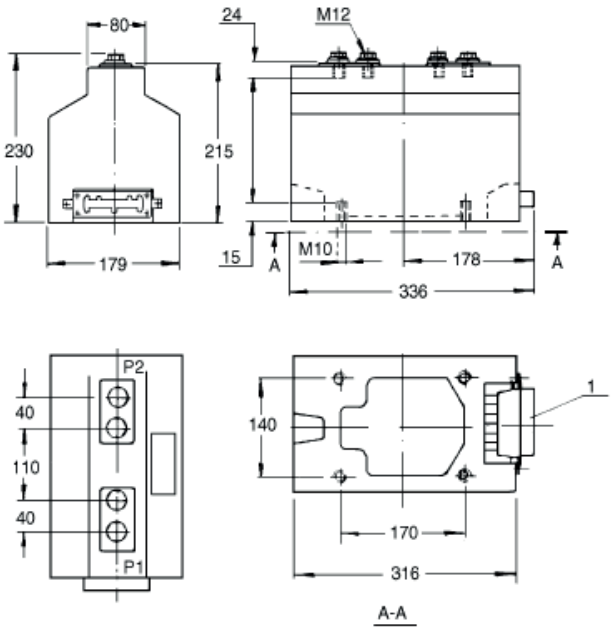
Weight: appr. 19 kg



IHBF 12 A, 17 A H_1 = 212 H_2 = 242
24 C H_1 = 292 H_2 = 322

IHBF 12 B
IHBF 17 B

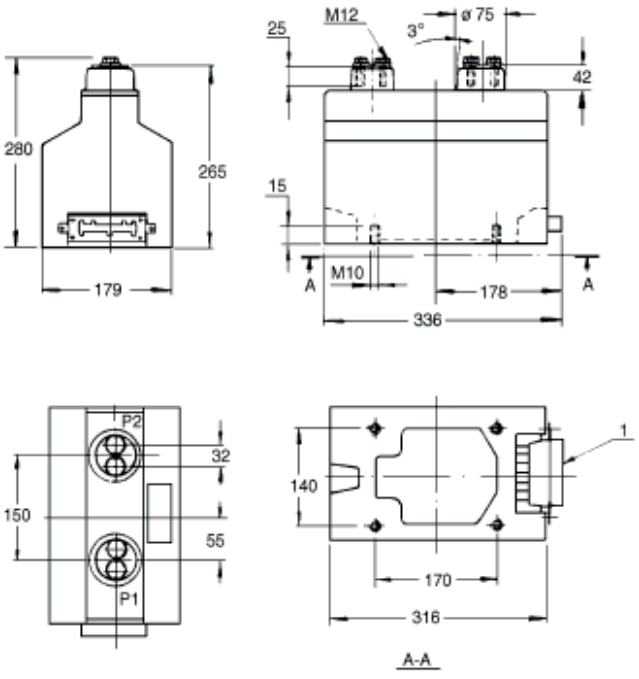
Weight: appr. 27 kg



1. Plug-in contact

IHBF 24 B

Weight: appr. 14 kg



1. Plug-in contact

Transformers with base plate, clamp type secondary terminals

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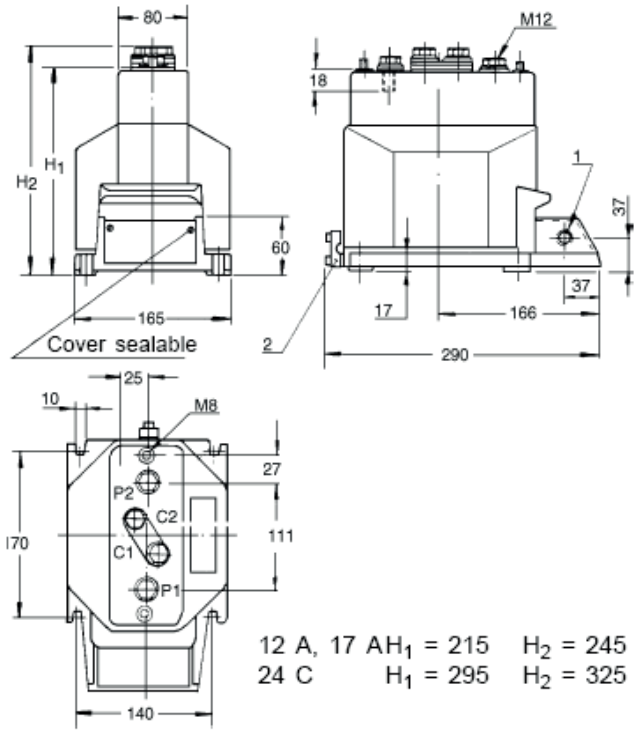
IHBF 12 A
IHBF 17 A
IHBF 24 C

Weight: appr. 14 kg

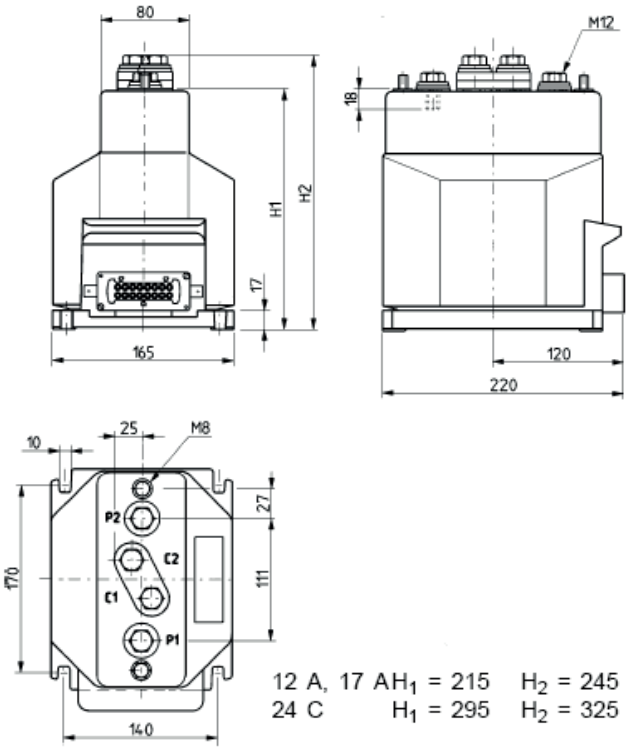


12 A, 17 A H_1 = 215 H_2 = 245
24 C H_1 = 295 H_2 = 325

—

IHBF 12 A
IHBF 17 A
IHBF 24 C

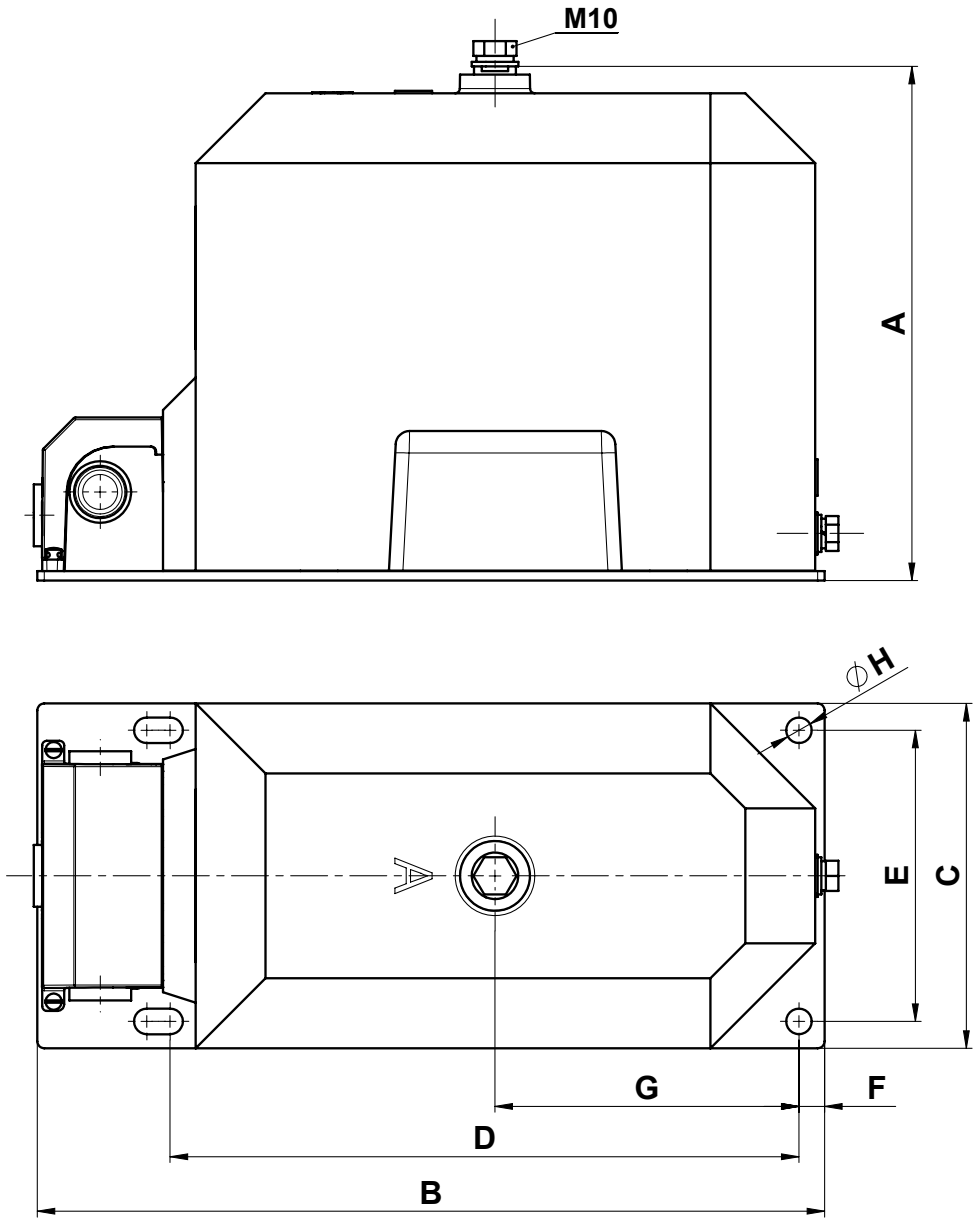
Weight: appr. 14 kg



12 A, 17 A H_1 = 215 H_2 = 245
24 C H_1 = 295 H_2 = 325

Dimensional Drawings TJC

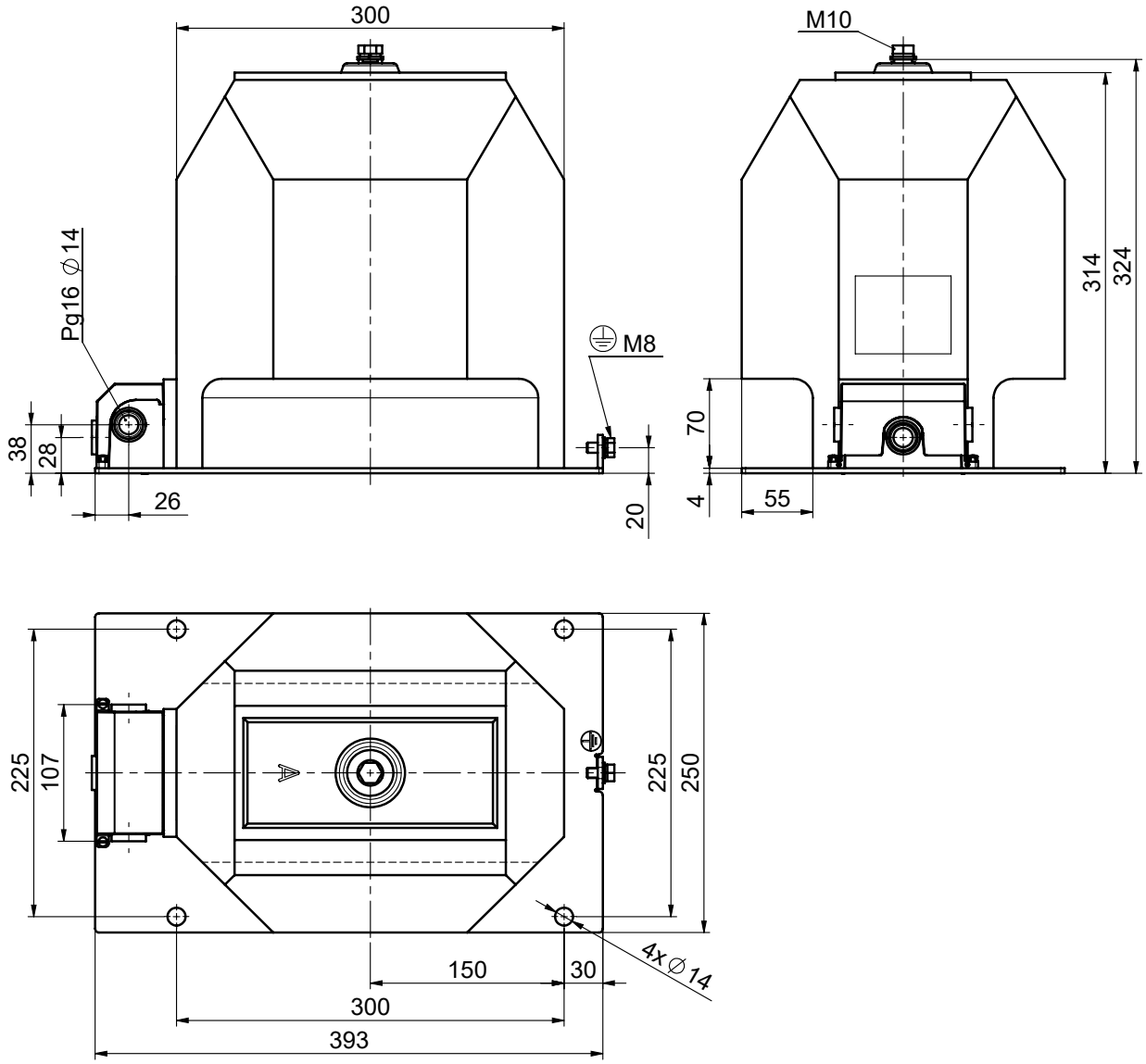
TJC(H) 4(5,6,7)



	TJC 4(5), TJCH 4(5)	TJC 6	TJC 7.1
A [mm]	220	282	324
B [mm]	338	352	393
C [mm]	148	178	250
D [mm]	270	275	300
E [mm]	125	150	225
F [mm]	11	11	30
G [mm]	130	143	150
H [mm]	11	14	14

TJC 7.1

Weight:48 kg
Creepage distance: 398 mm



Drawing n.
44204010

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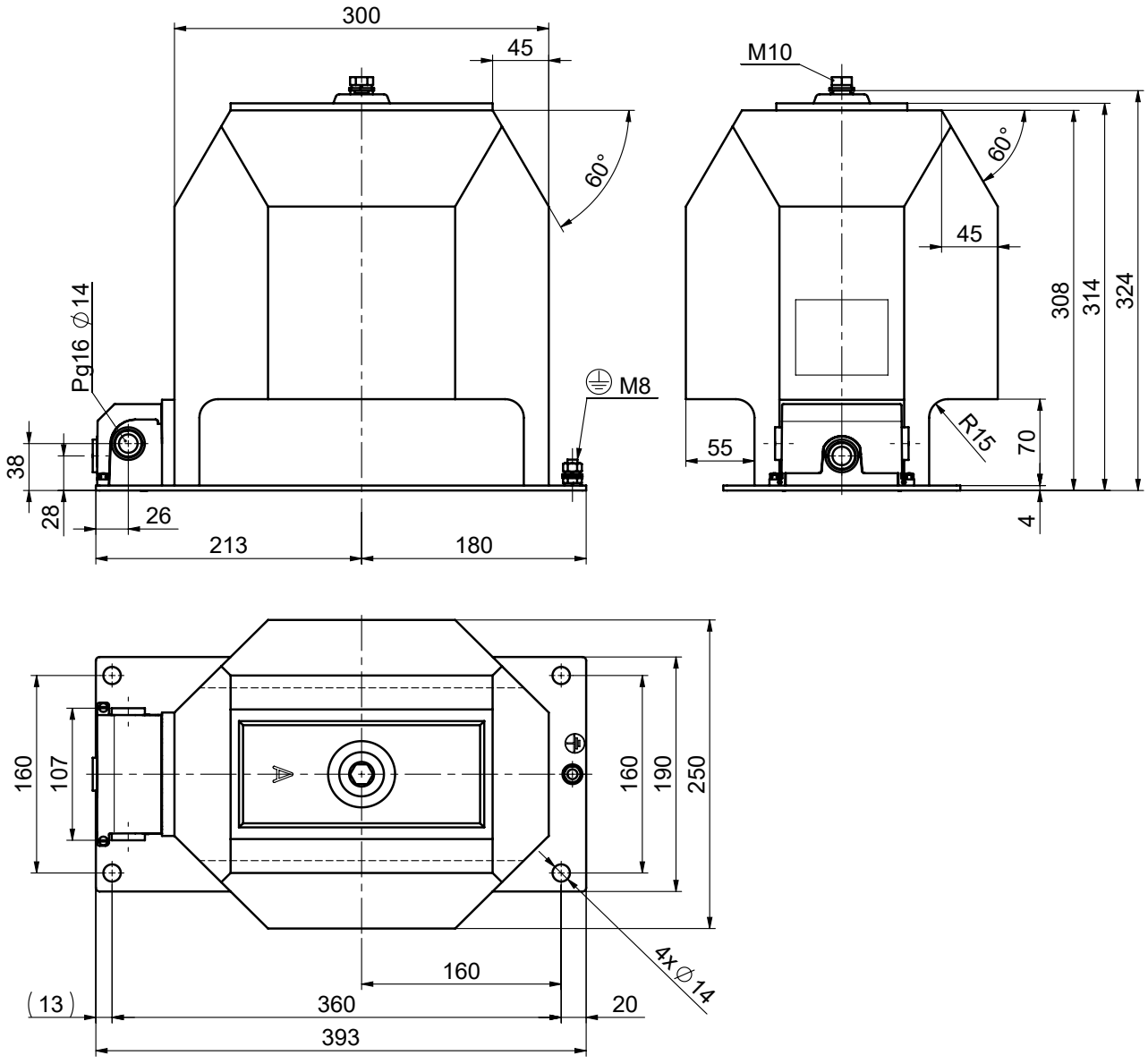
TJC 7.1
medium baseplate

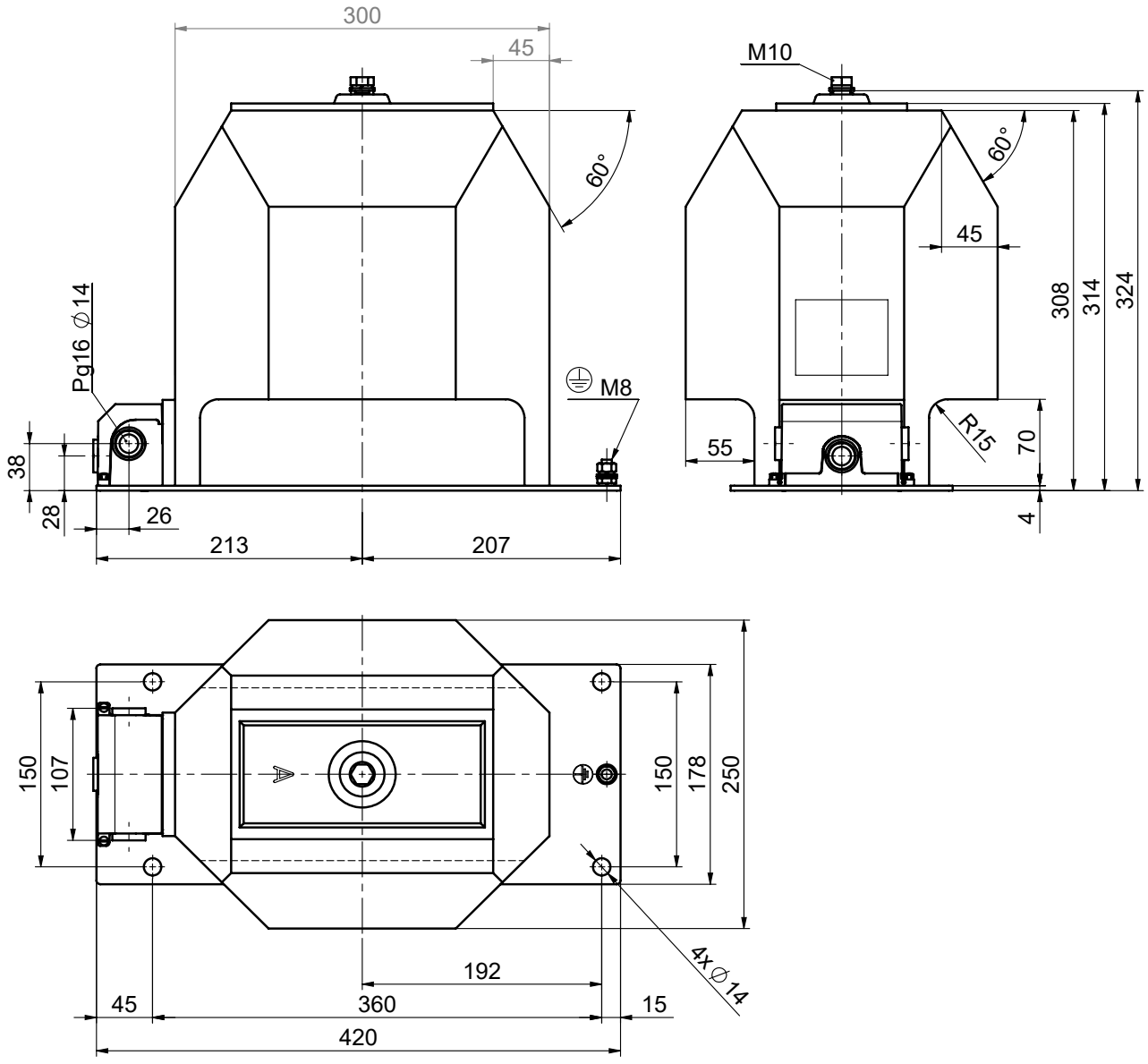
Weight:47 kg
Creepage distance: 398 mm



Drawing n.
1VL4200541R0101

TJC 7.1
narrow baseplate

Weight:48 kg
Creepage distance: 398 mm



Drawing n.
1VL4200515R0101

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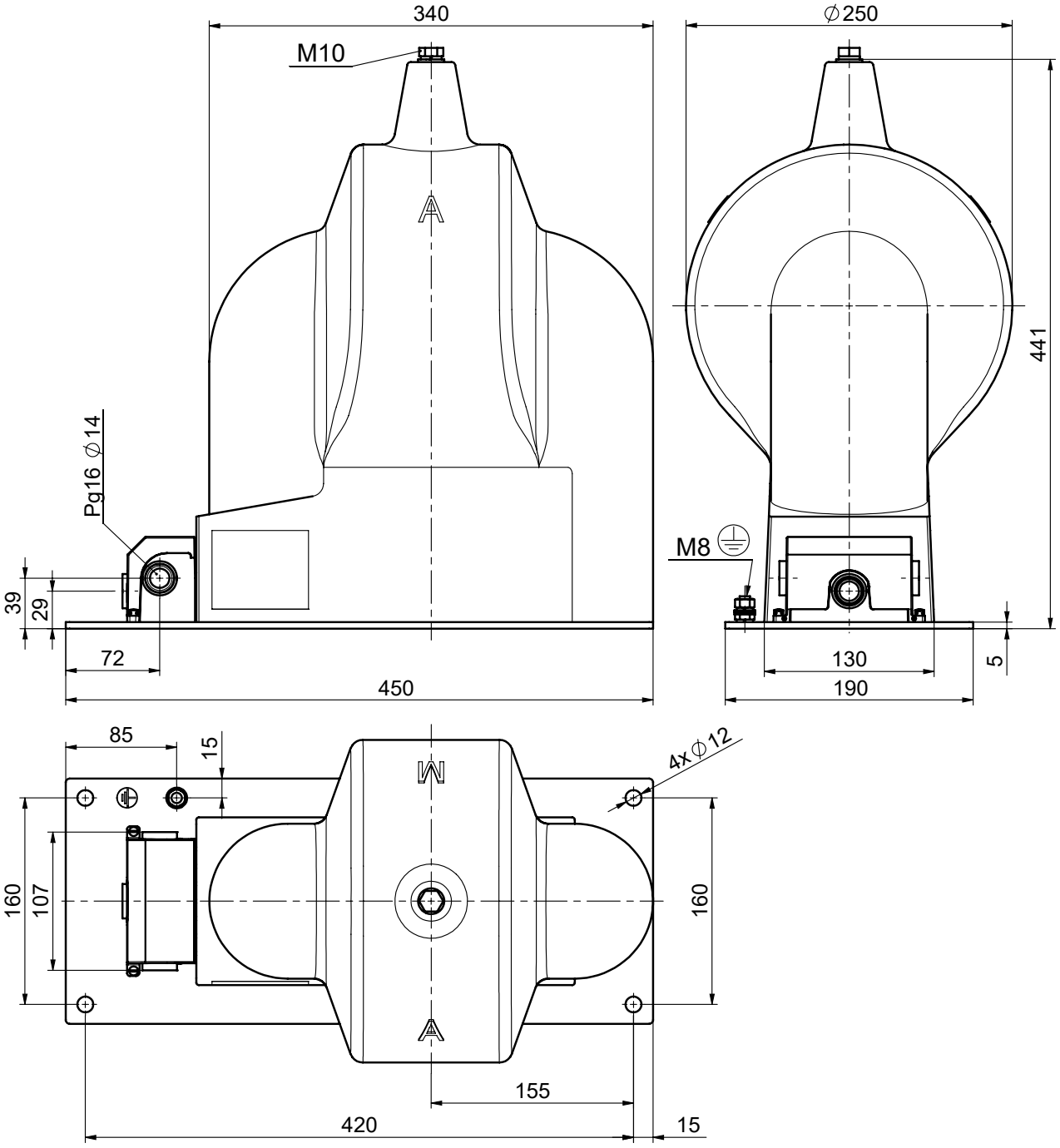
TJC 7

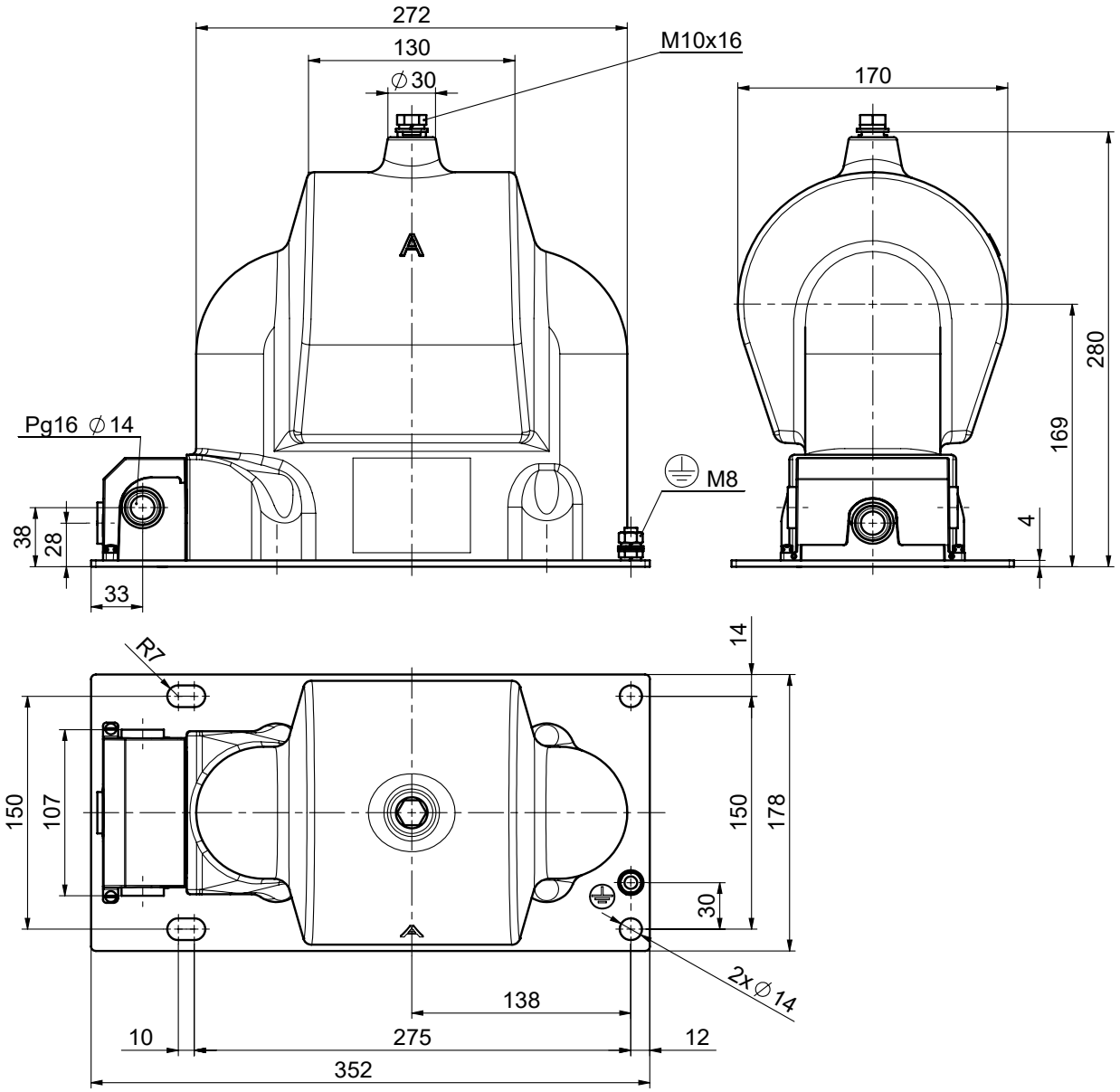
Weight:50 kg
Creepage distance: 480 mm



Drawing n.
44203800

TJCL 6

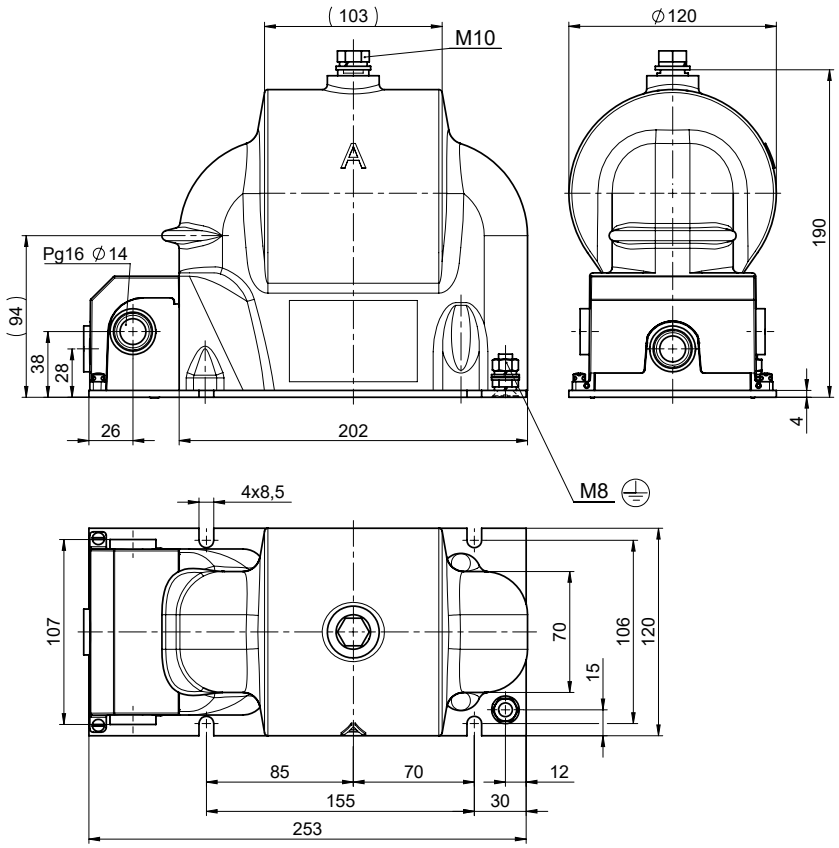
Weight: appr. 25 kg
Creepage distance: 326 mm



Drawing n.
1VL4200396R0101

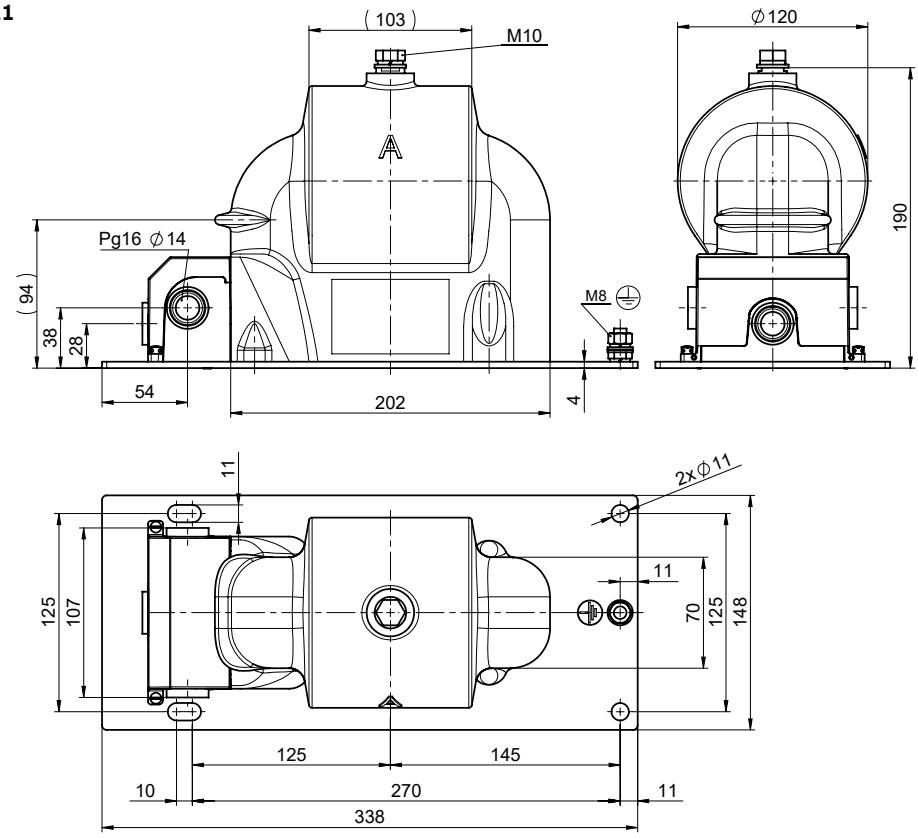
Dimensional Drawings TJE

TJE 3



Weight: 10 kg
Creepage distance: 245 mm

TJE 3.1

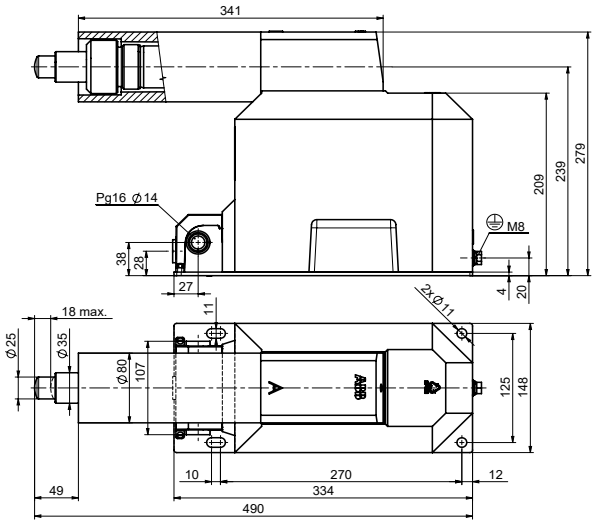


Weight: 11,5 kg
Creepage distance: 245 mm

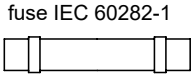
Dimensional Drawings TJP

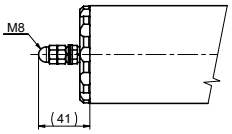
TJP 4.0, TJPH 4.0
TJP 5.0, TJPH 5.0
fuse IEC 60282-1

Weight: 24 kg
Creepage distance: 400 mm



OPTIONAL FOR CABLE CONNECTION
CREEPAGE DISTANCE: 418mm



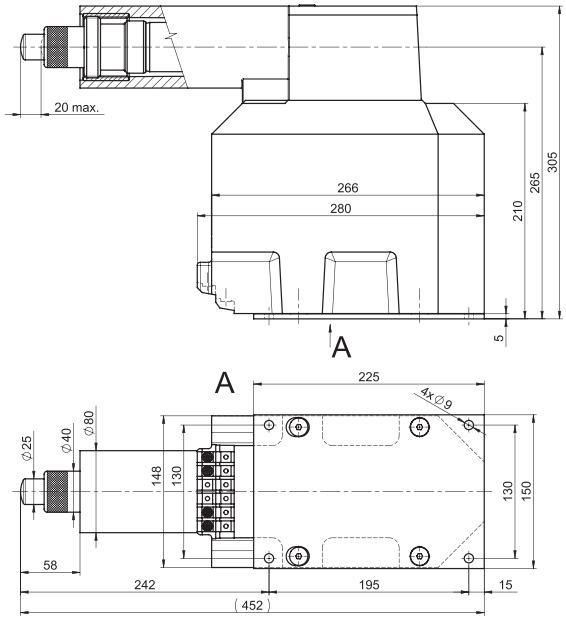


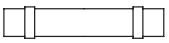
Drawing n.
44204060

Drawing n.
1VL4200418R0101

TJP 4.3
TJP 5.3

Weight: appr. 28 kg
Creepage distance: 385 mm

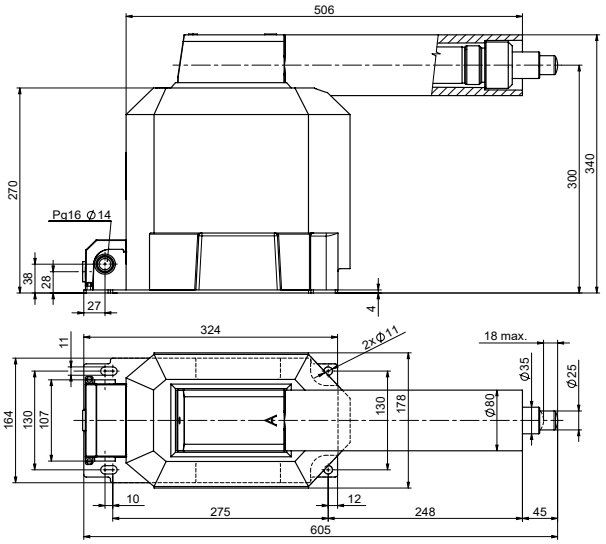




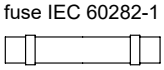
Drawing n.
1VL4200314R0101

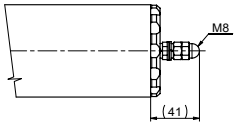
TJP 6.0

Weight: 42 kg
Creepage distance: 548 mm



OPTIONAL FOR CABLE CONNECTION
CREEPAGE DISTANCE: 566mm



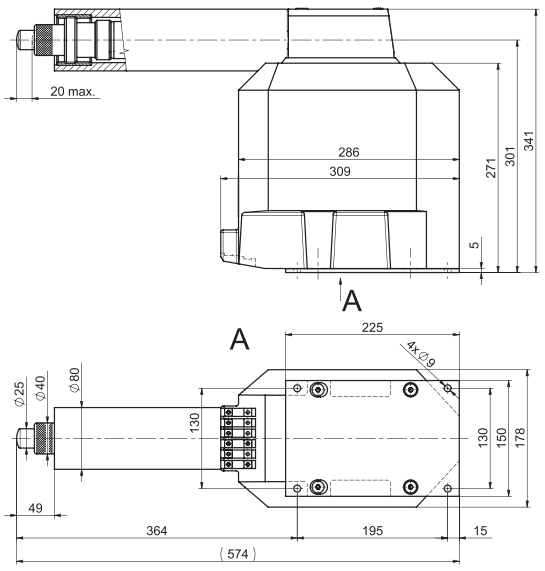


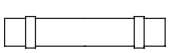
Drawing n.
44204070

Drawing n.
1VL4200419R0101

TJP 6.3

Weight: 42 kg
Creepage distance: 547 mm





Drawing n.
1VL4200315R0101

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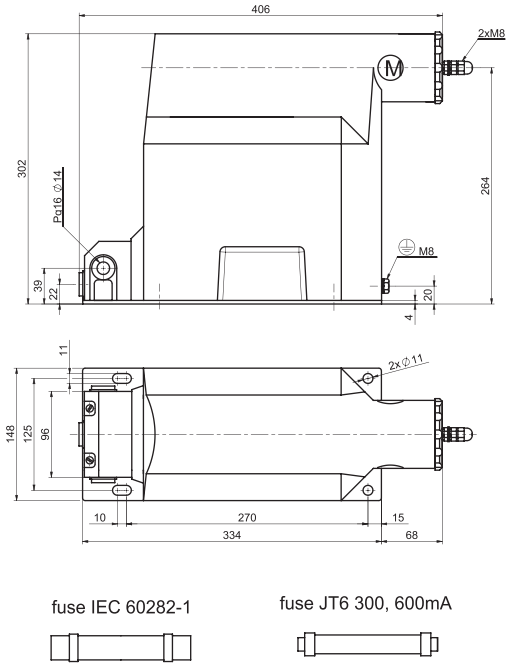
TJP 4.1
TJP 5.1
fuse JT6 300 mA
fuse JT6 600 mA

TJP 4.2
TJP 5.2
fuse IEC 60282-1

Weight: 24 kg
Creepage distance: 296 mm



fuse IEC 60282-1

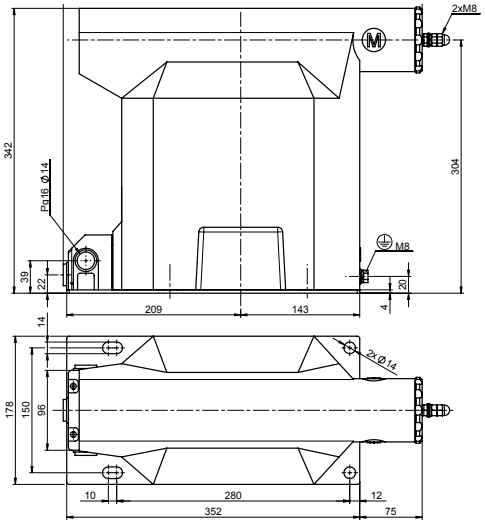
fuse JT6 300, 600mA

—

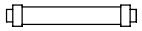
TJP 6.1
fuse JT6 300 mA
fuse JT6 600 mA

TJP 6.2
fuse IEC 60282-1

Weight: 42 kg
Creepage distance: 342 mm



fuse JT6 300, 600mA



Drawing n.
44203980

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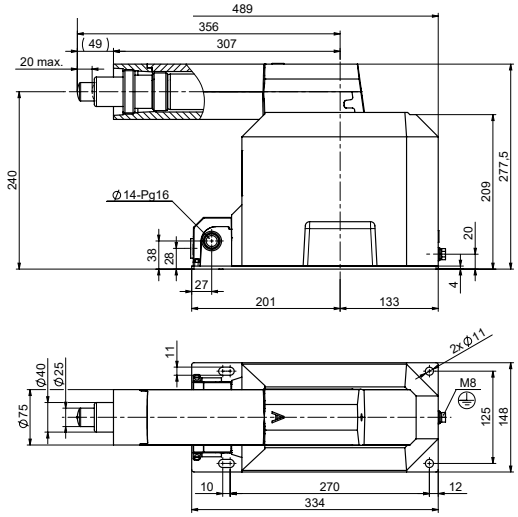
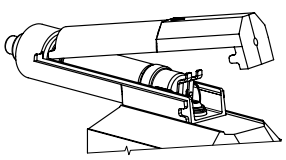
TJP 4.0-F
TJP 5.0-F
fuse IEC 60282-1

Weight: 24 kg
Creepage distance: 403 mm





Drawing n.
1VL4200251R0101

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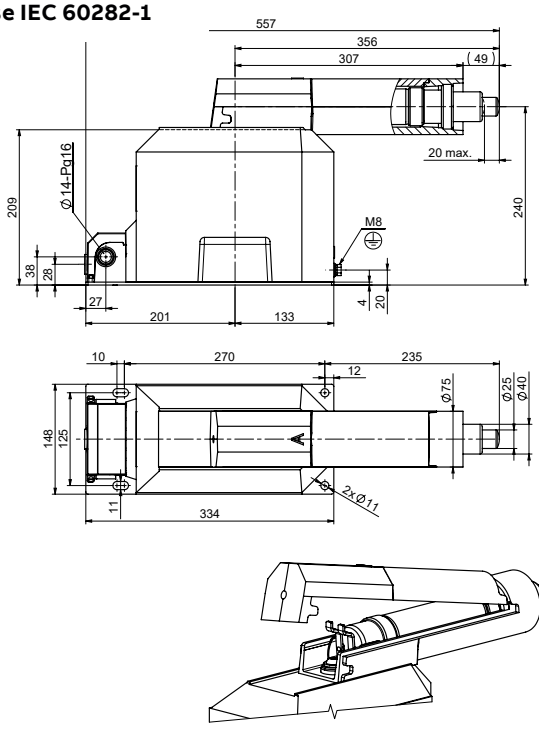
TJP 4.0-F
TJP 5.0-F
fuse IEC 60282-1

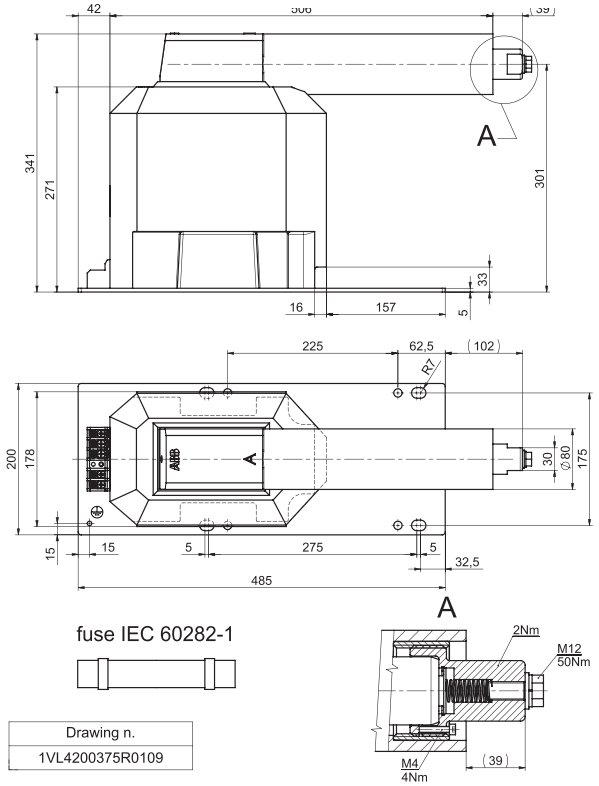
Weight: 24 kg
Creepage distance: 403 mm



Drawing n.
1VL4200300R0101

TJP 6.0-G
with long baseplate

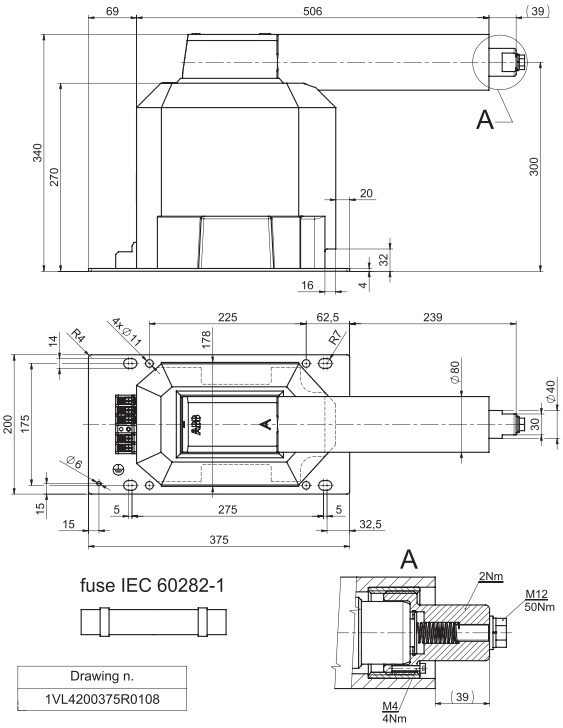
Weight: 43 kg
Creepage distance: 536 mm



Drawing n.
1VL4200375R0109

TJP 6.0-G

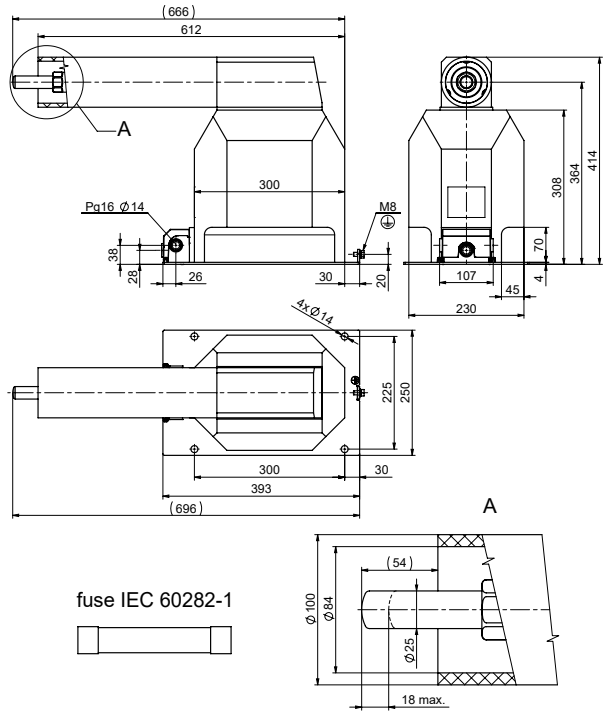
Weight: appr. 42 kg
Creepage distance: 536 mm



Drawing n.
1VL4200375R0108

TJP 7.0

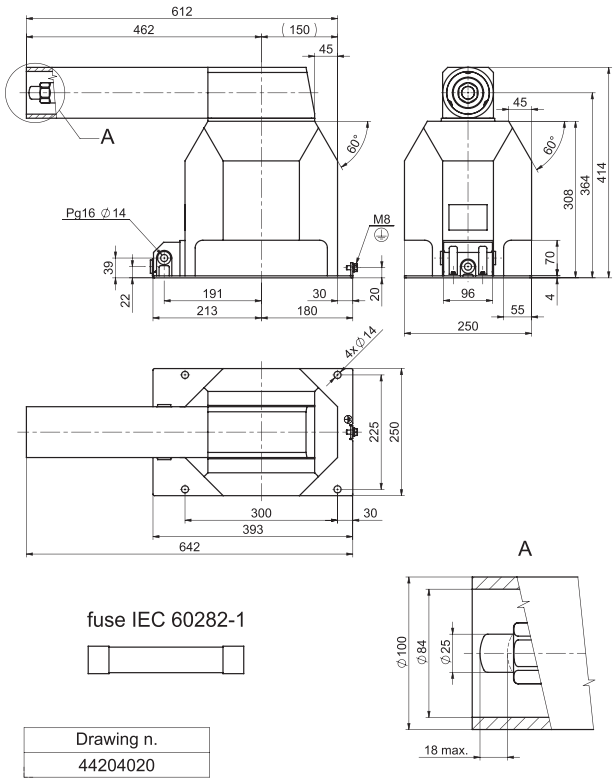
Weight: appr. 53 kg
Creepage distance: 745 mm



Drawing n.
1VL4200508R0101

TJP 7.1

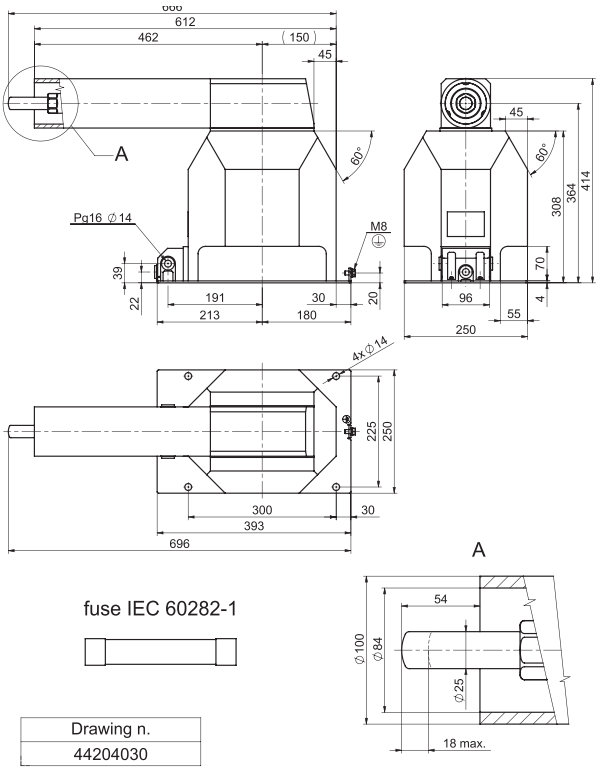
Weight: appr. 54 kg
Creepage distance: 745 mm



Drawing n.
44204020

TJP 7.2

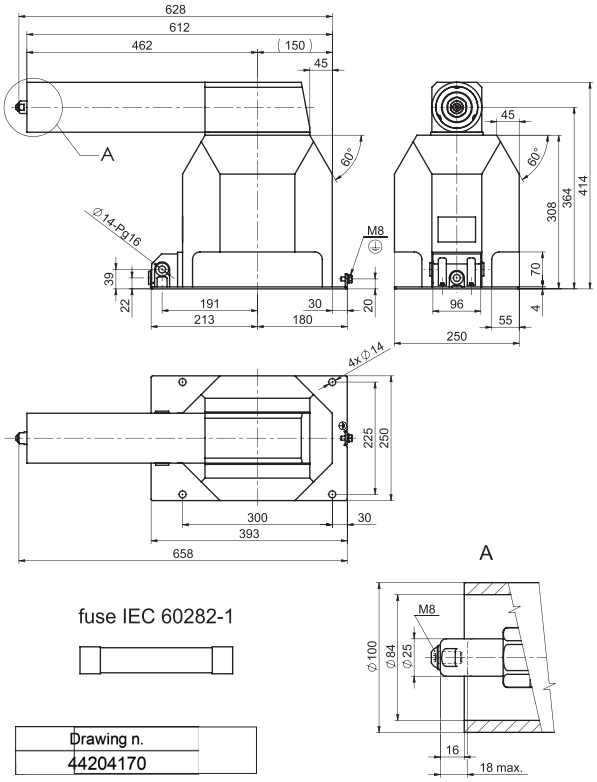
Weight: appr. 54 kg
Creepage distance: 745 mm



Drawing n.
44204030

TJP 7.3

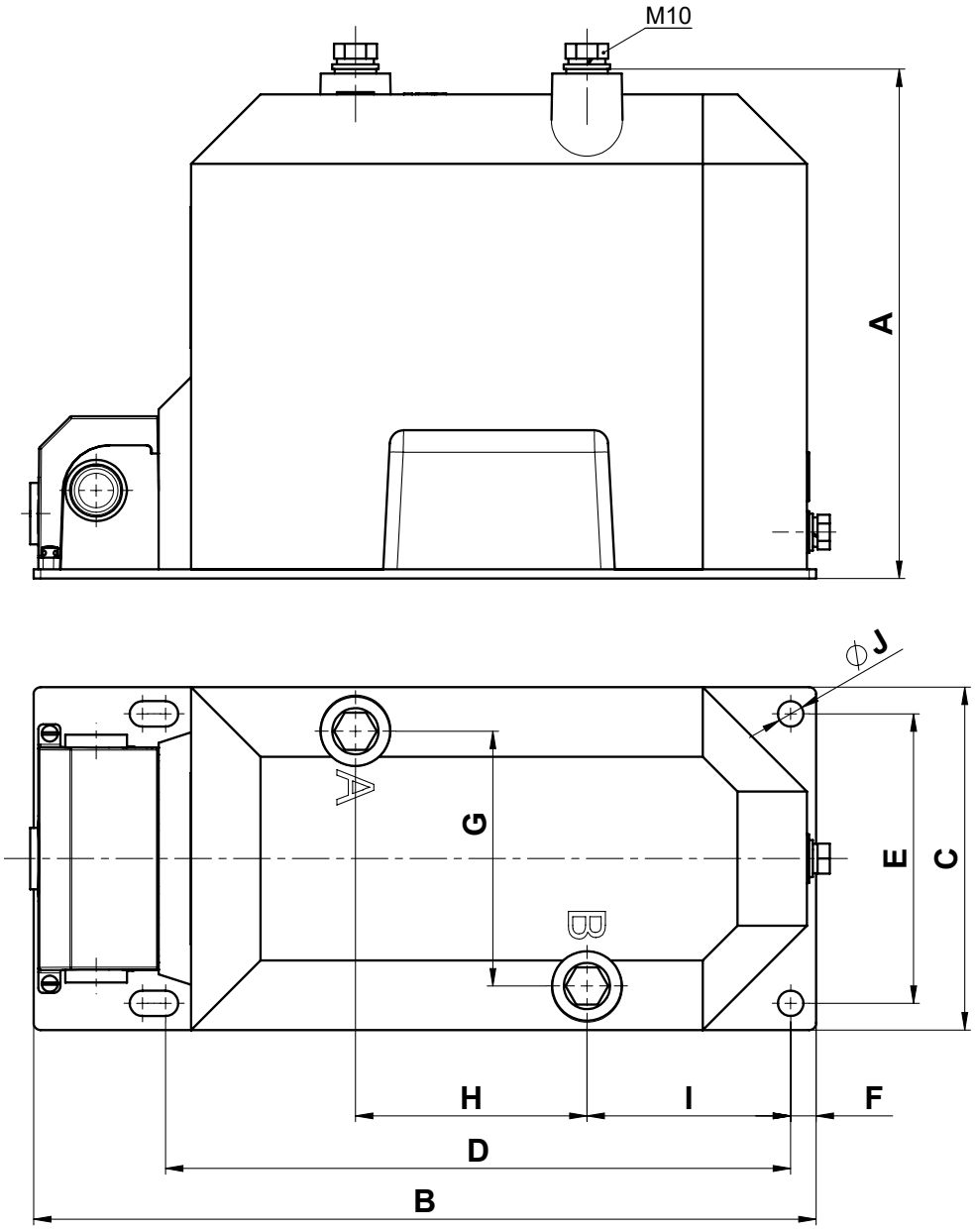
Weight: appr. 54 kg
Creepage distance: 745 mm



Drawing n.
44204170

Dimensional Drawings TDC

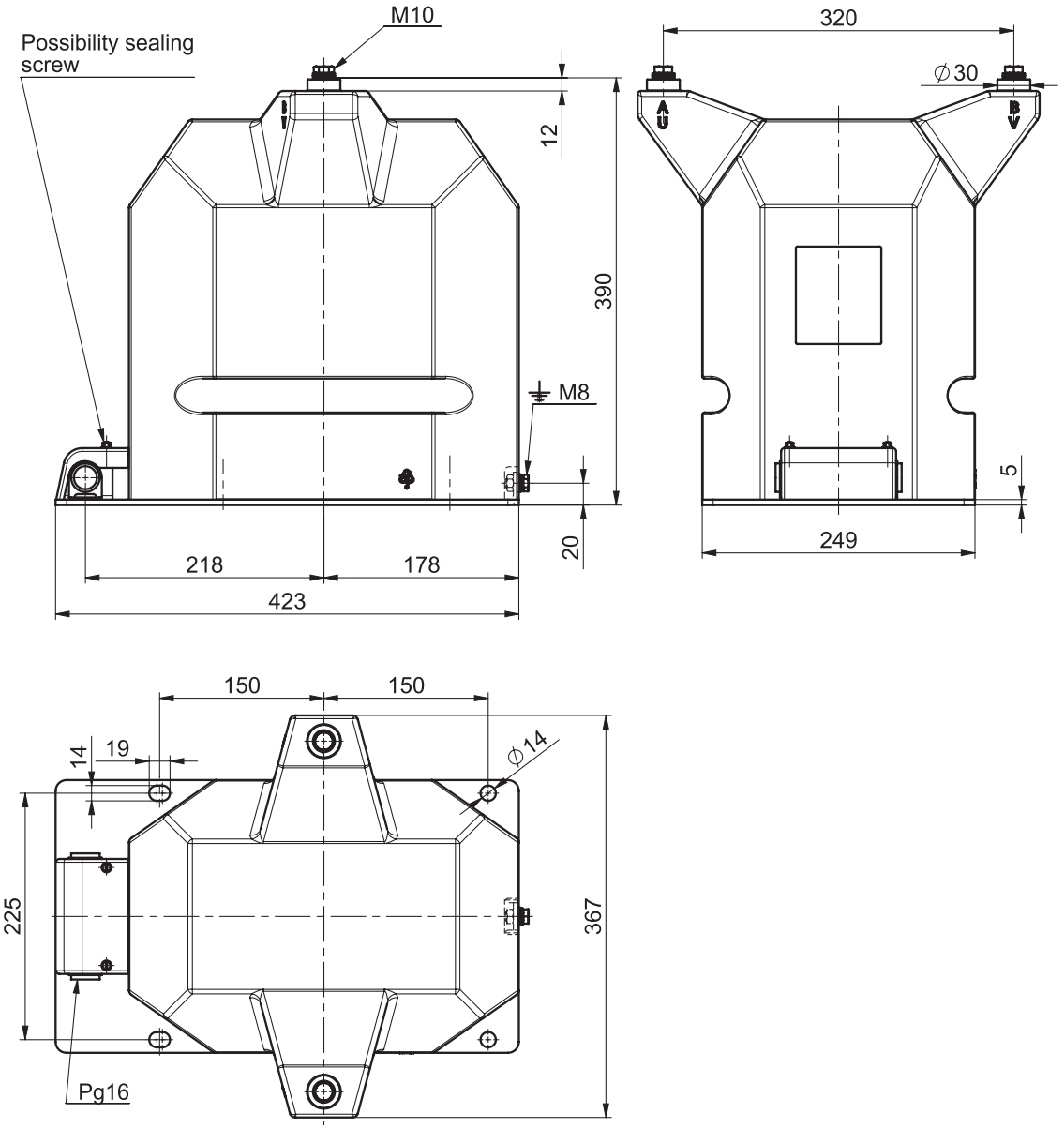
TDC 4(5,6)



	TDC 4(5)	TDC 6
A [mm]	220	280
B [mm]	338	352
C [mm]	148	178
D [mm]	270	275
E [mm]	125	150
F [mm]	11	11
G [mm]	110	130
H [mm]	100	165
I [mm]	88	60
J [mm]	11	14

TDC 7

Weight: 72 kg
Creepage distance: 334 mm

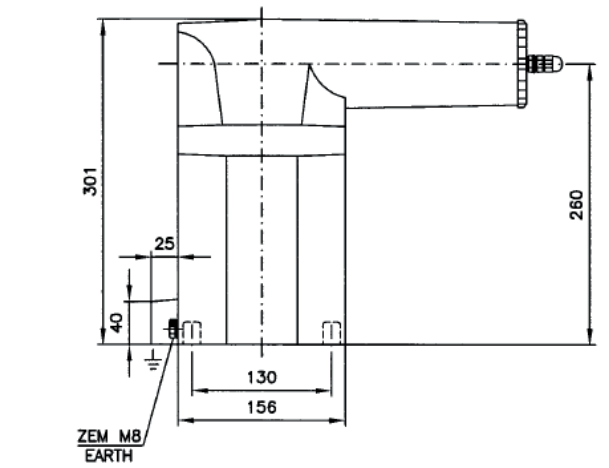


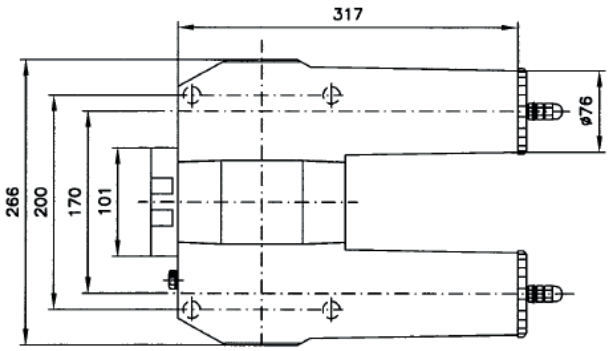
Drawing n.
44616400

Dimensional Drawings TDP

TDP 4.1
fuse JT6 300 mA
fuse JT6 600 mA

Weight: 29 kg



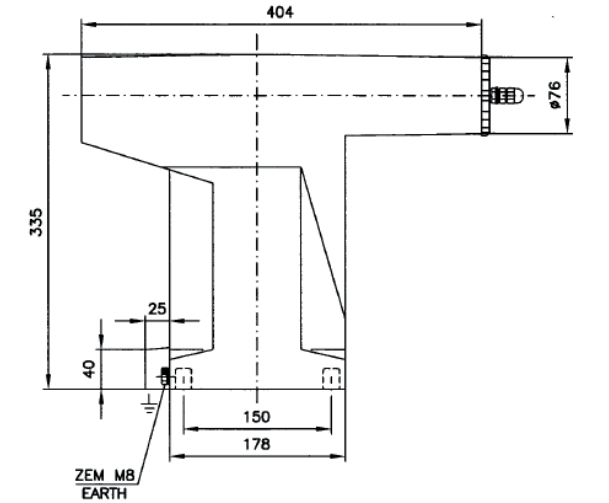


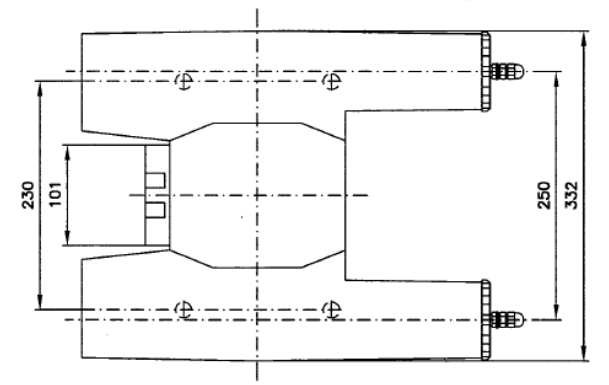
TDP 4.2
fuse IEC 600282-1

Weight: 29 kg

TDP 6.1
fuse JT6 300 mA
fuse JT6 600 mA

Weight: 38 kg





TDP 6.2
fuse IEC 600282-1

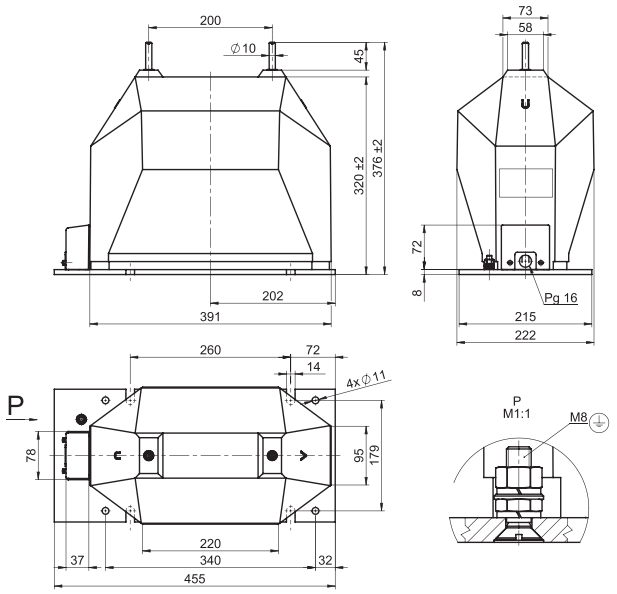
Weight: 38 kg

Dimensional Drawings KGUGI and KGUG

KGUG 24
KGUG 36

KGUG 24

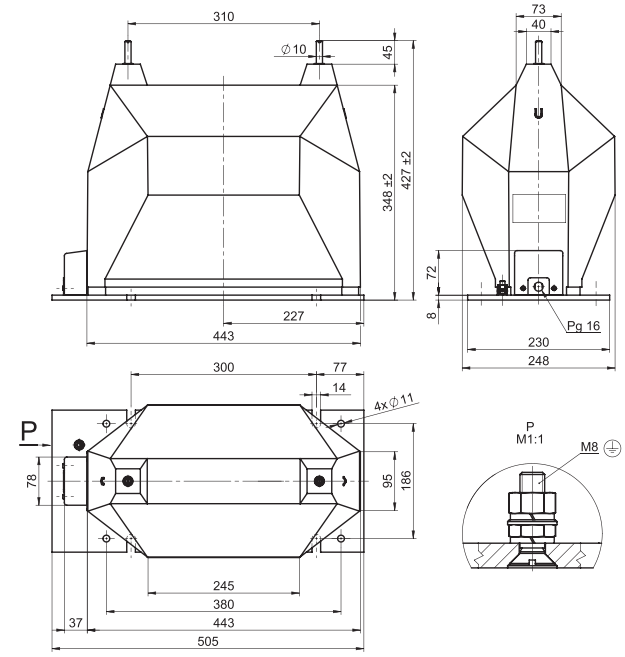
WEIGHT: 60kg



Drawing n.
1VL4200393R0101

KGUG 36

WEIGHT: 80kg



Drawing n.
1VL4200395R0101

Type	A	B	C	D	E	F	G	H	J	K	L	m/kg
KGUG 24	391	202	455	376	320	200	222	215	260	179	72	approx. 60
KGUG 36	443	227	505	427	348	310	248	230	300	186	72	approx. 80

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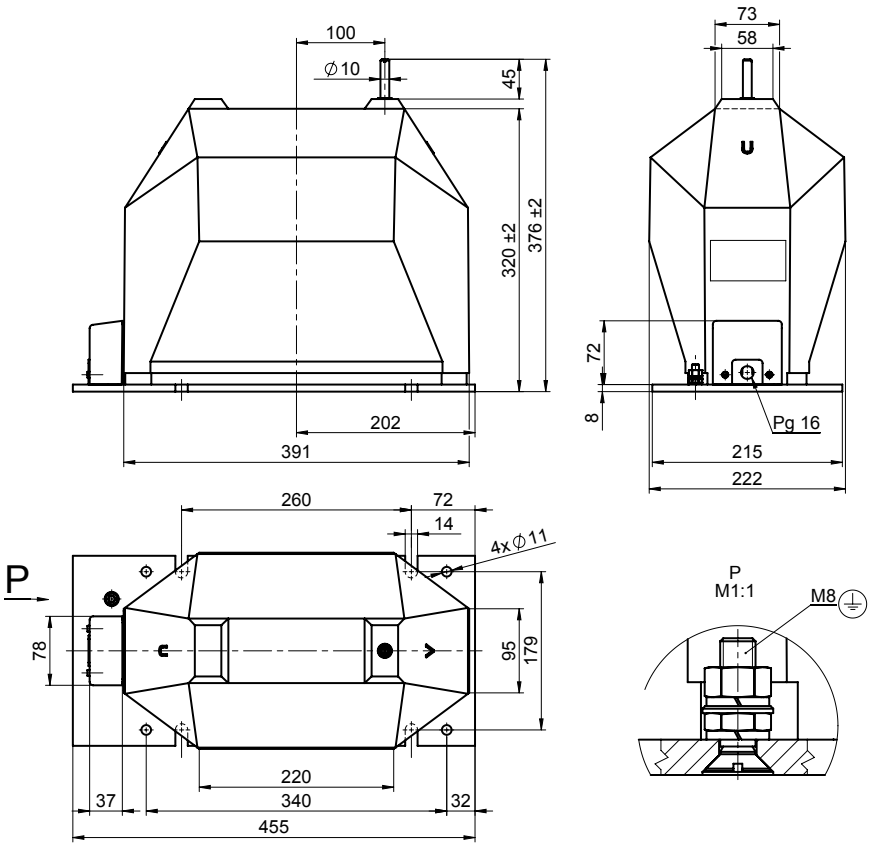
KGUGI 24

Weight: 60 kg



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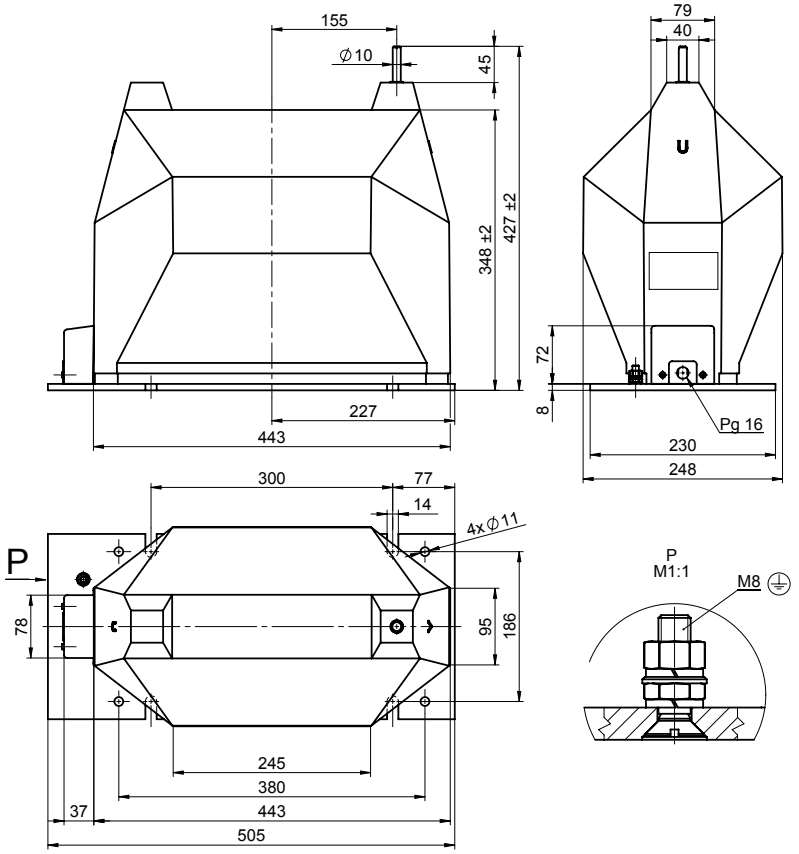
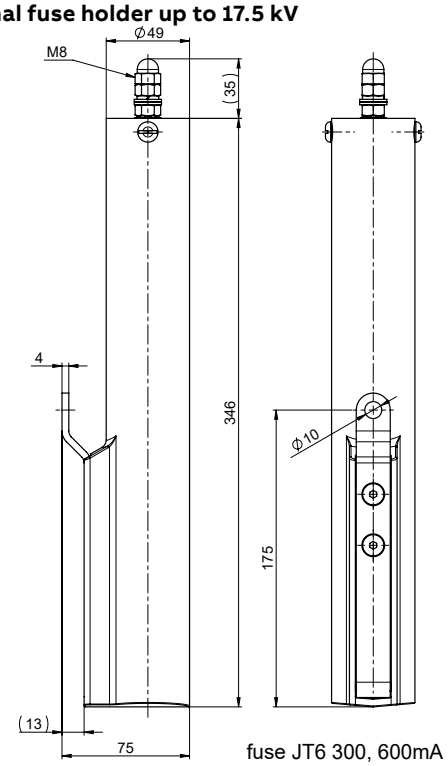
KGUGI 36

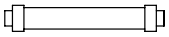
Weight: 80 kg



External fuse holder up to 17.5 kV

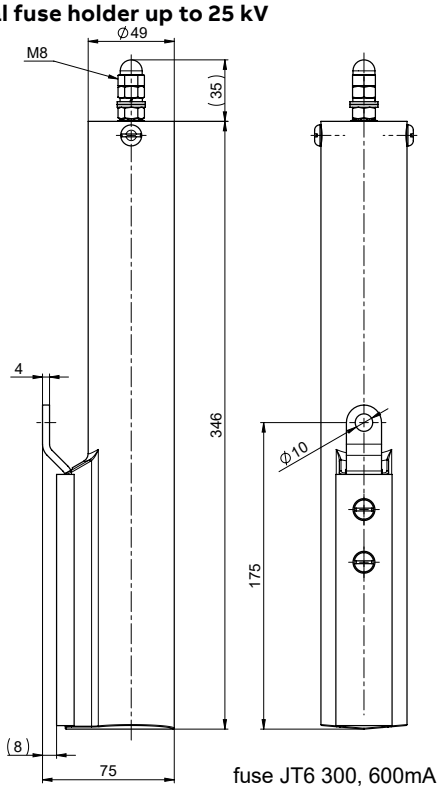


fuse JT6 300, 600mA

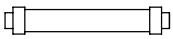


fuse JT6 300 mA	1VL4200499R0101
fuse JT6 600 mA	1VL4200499R0102

External fuse holder up to 25 kV



fuse JT6 300, 600mA



fuse JT6 300 mA	1VL4200499R0201
fuse JT6 600 mA	1VL4200499R0202

Dimensional drawing metal coated types

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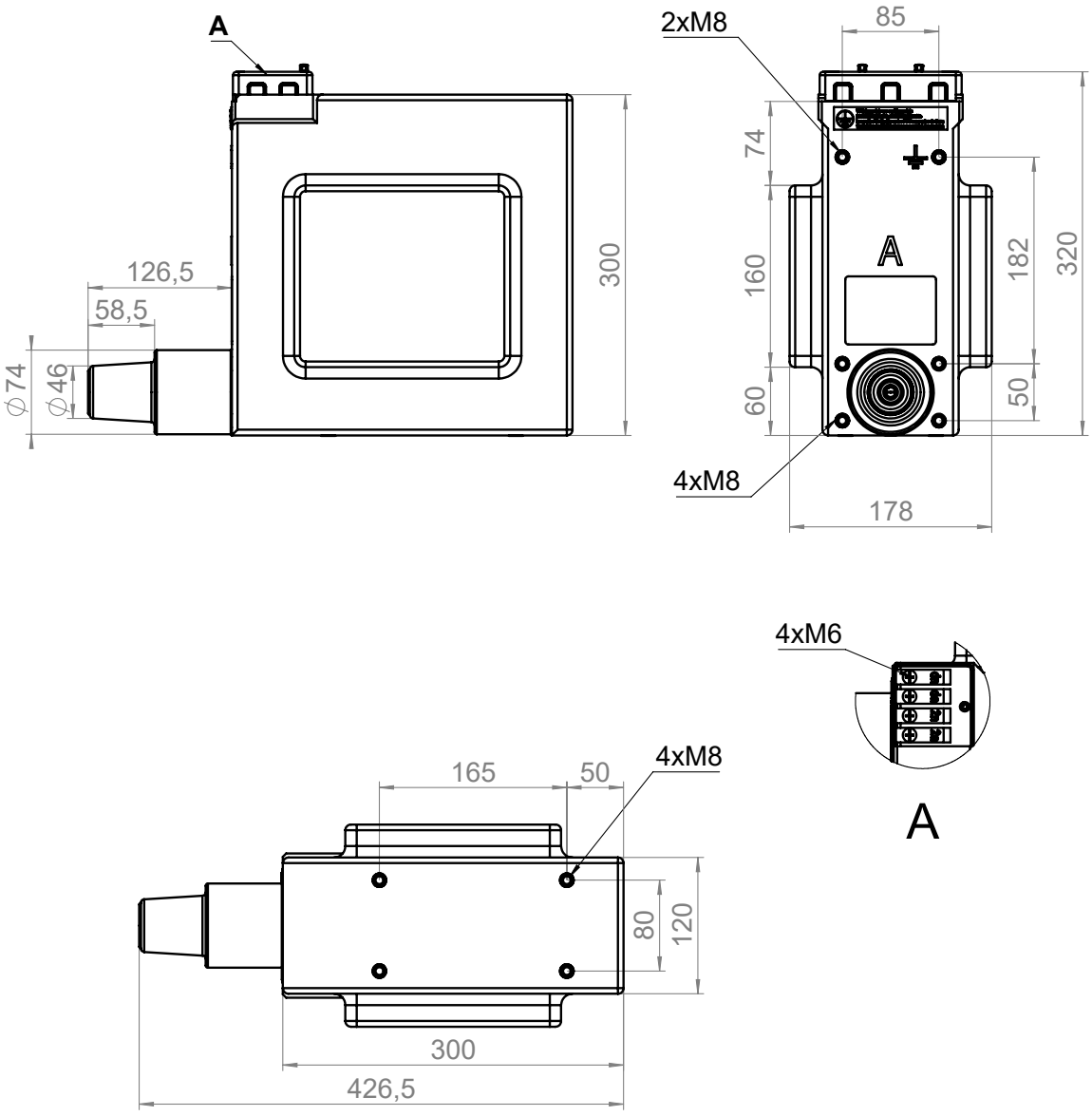
TJMC 6.1

Weight: appr. 40 kg



DRAWING NUMBER	TYP / TYPE
2RKA027320	TJMC 6,1

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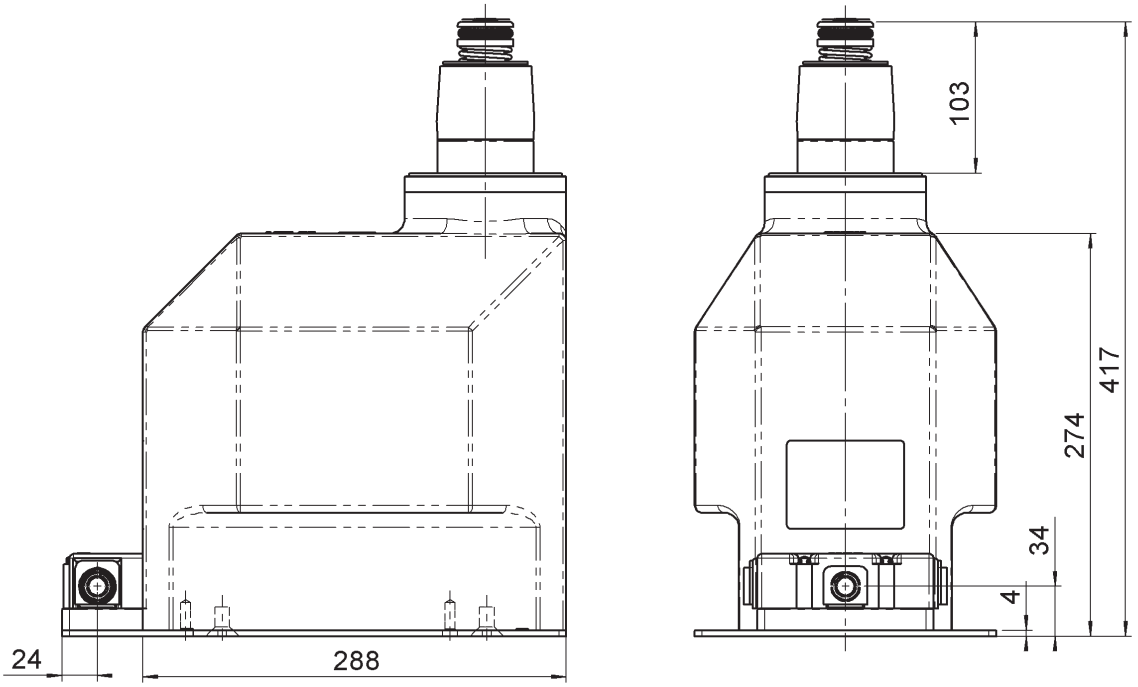
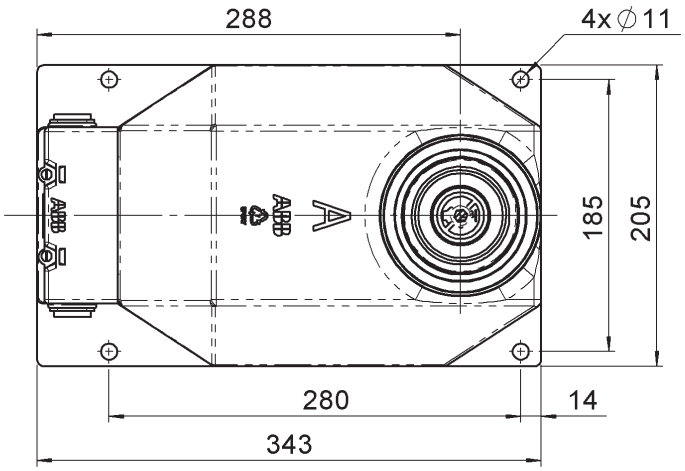
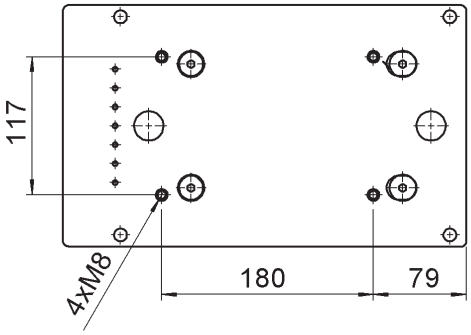
TJMC 7.1

Weight: appr. 40 kg







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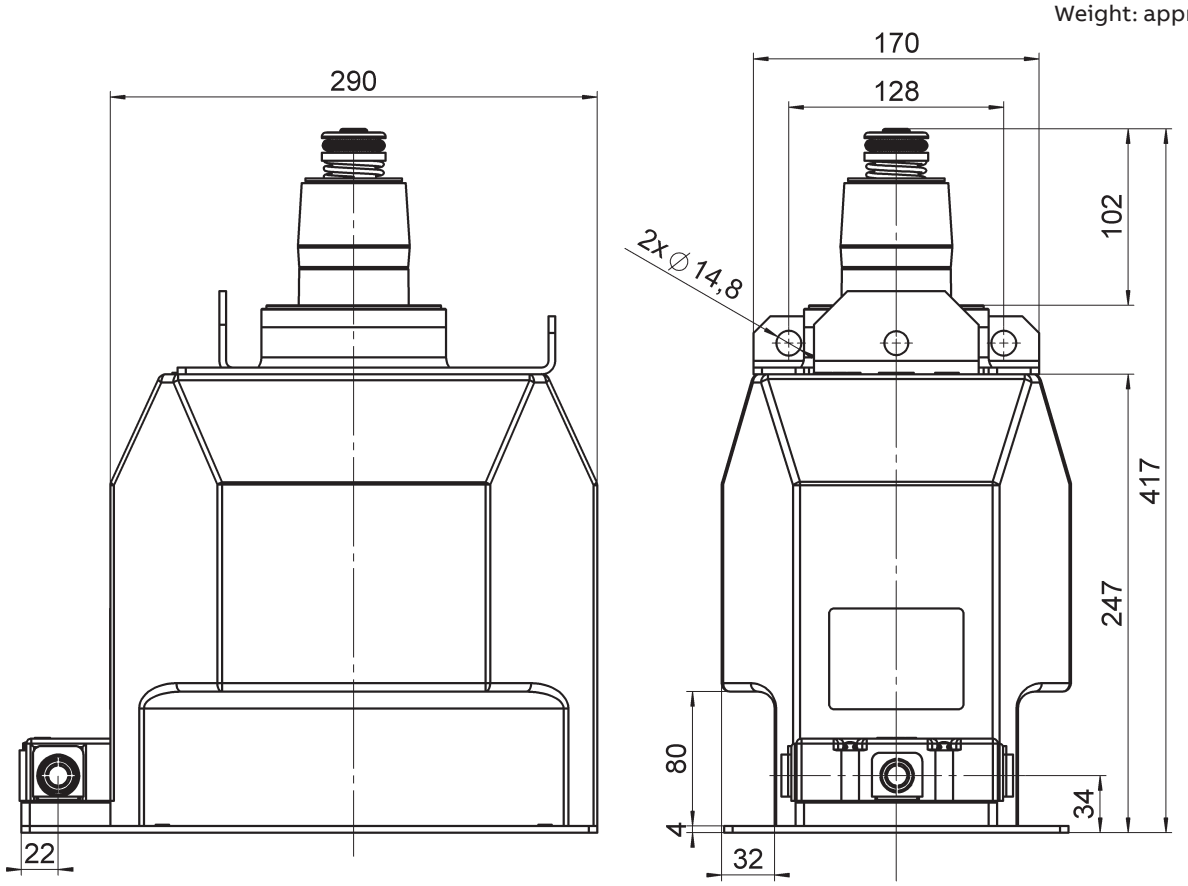
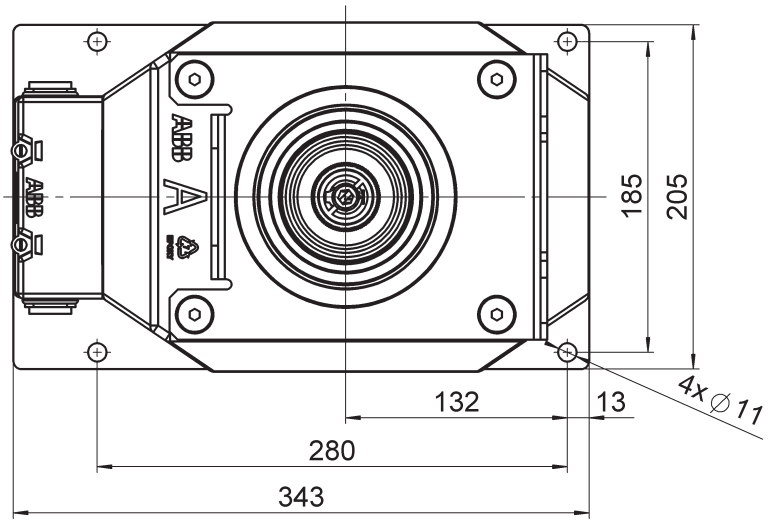
TJMC 7.2

Weight: appr. 41 kg





Drawing n.
2RKA023050A0001

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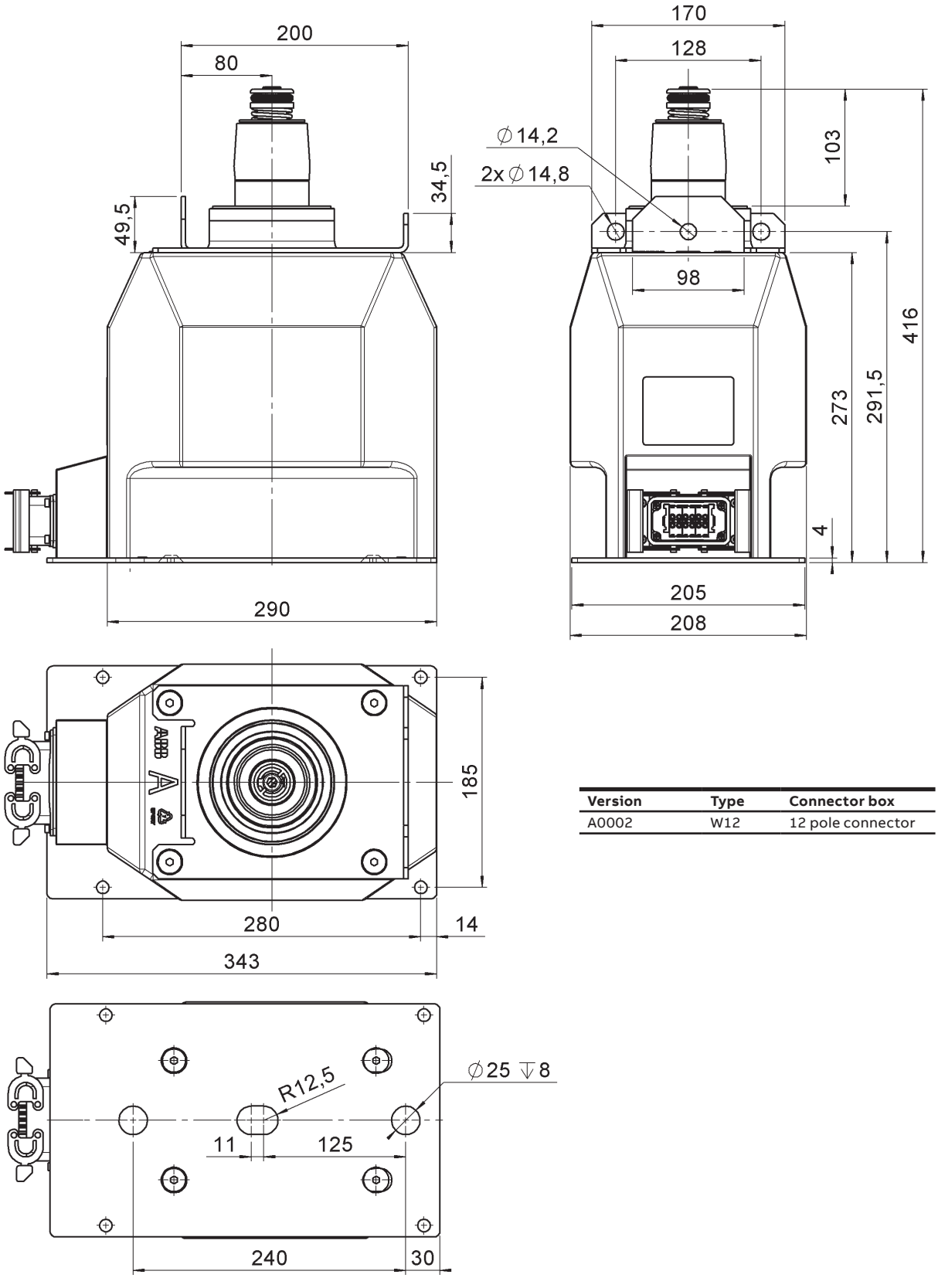
TJMC 7.2-W
Plug-in secondary terminal



Version	Type	Connector box
A0002	W12	12 pole connector

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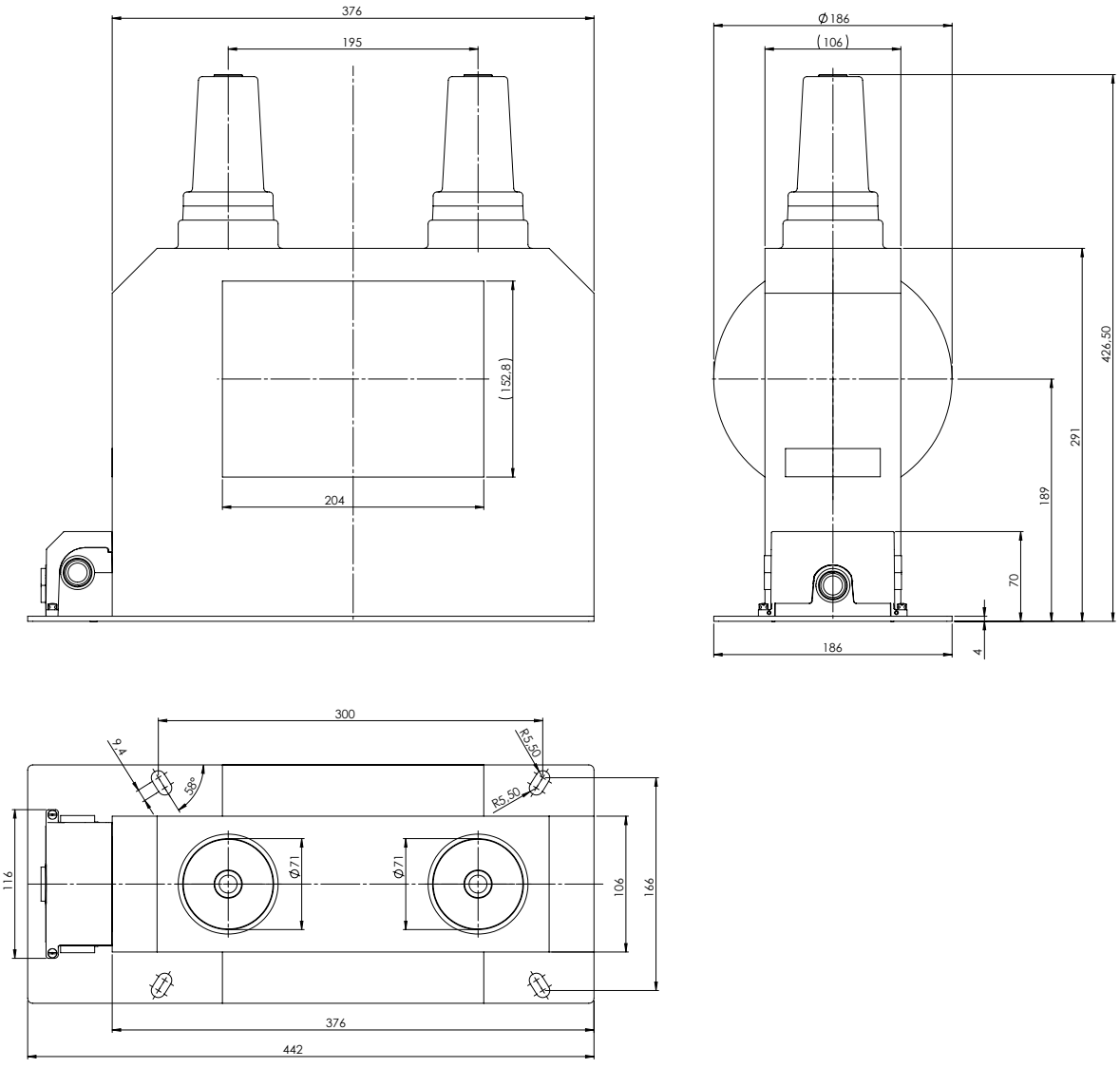
TDMC 6.0 C

Weight: appr. 38 kg
Creepage Distance A-B: 210 mm
Creepage Distance A(B)- ⏚: 285mm

Primary connection acc. to EN 50181:2010 - interface C



Drawing n.:
026554

CONTACT US
ABB s.r.o.
ELDS Brno
Videnska 117, 619 00 Brno,
Czech Republic
Tel.: +420 547 152 021
+420 547 152 854
Fax: +420 547 152 626
E-mail: kontakt@cz.abb.com

www.abb.com

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