



INSTRUCTION FOR INSTALLATION, USE AND MAINTENANCE FOR VOLTAGE (POTENTIAL) TRANSFORMERS



Instruction for installation, use and maintenance for Voltage (potential) transformers

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

These instructions are valid for

Indoor voltage transformer type: TJC 4, TJC 5, TJC 6, TDC 4, TDC 5, TDC 6, TJC 7
TJP 4.x, TJP 5.x, TJP 6.x, TJP 7.x , KGUG, KGUGI

Outdoor voltage transformer type: TJO 7, TJO 6, TDO 6

1. Operating conditions

Indoor transformers

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

The transformers are designed for standard ambient temperature between $-5\text{ }^{\circ}\text{C}$ and $+40\text{ }^{\circ}\text{C}$. The altitude for use should be lower than 1000 m above the sea level. The transformers may be used also in higher or in lower ambient temperatures and higher altitudes when agreed upon with the manufacturer.

Outdoor transformers

The transformers should be mounted in outdoor conditions where the ambient air may be polluted by dust, smoke, corrosive cases, vapours or salt.

The transformers are designed for standard ambient temperature between $-40\text{ }^{\circ}\text{C}$ and $+40\text{ }^{\circ}\text{C}$. The average value of the ambient temperature, measured over a period of 24 hours, should not exceed $35\text{ }^{\circ}\text{C}$.

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:

Example of the label:

ABB		1234567890
		TJC 4
6600:√3/100:√3/100:3 V		50 Hz
a-n	30VA cl.0.5	
da-dn	30VA cl.6P	
7.2/20/60 kV		400 VA
2002	IEC 60044-2	
E		

Where:

1234567890

serial number

TJC 4

Transformer type code

50Hz

rated frequency

6600:√3/100: √3/100:3 V

rated voltage ratio

a-n

terminal marking for first secondary winding

da-dn

terminal marking for residual (open-delta) winding

30VA

rated output (burden)

0.5, 6P

accuracy classes

12/28/75 kV

highest voltage for equipment / power-frequency
withstand

voltage / rated lightning-impulse voltage

IEC 60044-2

referred standard

2002

year of production

400 VA

thermal limiting output

E

temperature class

3. *Instruction for installation*

Safety instructions

1. Always consider transformer as a part of the circuit 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 terminal of each secondary winding of the transformer. However, when the secondary of transformer is interconnected, there should be only one grounded point to prevent accidental paralleling with system grounding wire.
4. 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.
5. For the protection of the one pole insulated voltage transformers against the ferroresonance see the appendix 3. – Damping ferroresonance for voltage transformers type TJC

4. Mounting

Indoor voltage transformers

The mounting position of the indoor transformer can be freely chosen. The transformer is fixed using the mounting base with four screws M10 or M12 and washers. Fastening must be done on a smooth surface.

There is a M8 screw for earthing the transformer on the base plate.

Outdoor voltage transformers

The mounting position of the outdoor transformer is only horizontal. The other position can be agreed with the supplier. The transformer is fixed using the mounting base with four screws M10 and washers or two U profiles with M12 screws. Fastening must be done on a smooth surface.

There is a M8 screw for grounding of voltage transformer.

Primary connection

Primary terminals of the voltage transformer are made of copper and they are silver or tin plated. There are M10 screws used for fastening of primary conductor to the terminal. For voltage transformers with fuse there is M8 thread contact or spring point contact on the primary side.

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

Maximum allowed torques for other screw of voltage transformers:

Screw	Max. torque [Nm]	Min. torque [Nm]
M5	3.5	2.8
M8	20	16
M10	35	20
M12	70	56

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 for indoor use is made from the plastic and provided with three detachable threaded inserts Pg16. 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 seal able.

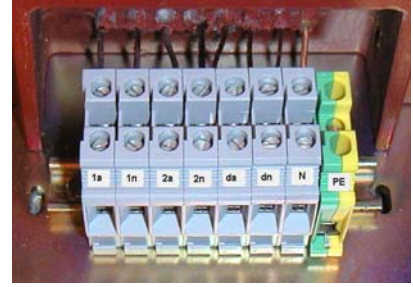
The secondary cover for outdoor VT are made of plastic or epoxy resin and provided with insert Pg21.

Maximum allowed torques for secondary screw connections

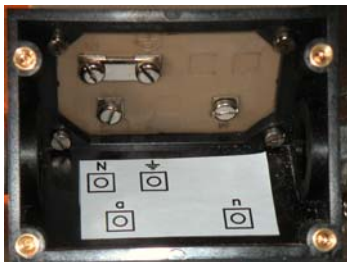
Screw	Max. torque [Nm]	Min. torque [Nm]
M5	3.5	2.8

Max. diameter of the cable or wire connected on one secondary terminal: 2x Ø2,5mm.

For terminal marking see appendix 1.



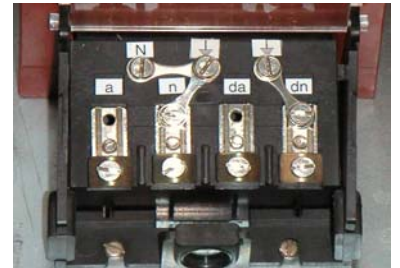
TJC x, TDC x , TJP x.x



TJO 7

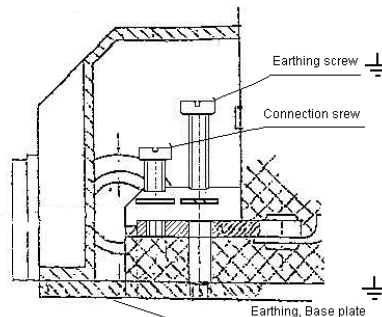


TJO 6, TDO 6



TJC 7

Details of voltage transformers cast terminal boxes



Cross section of secondary terminal box

Fuses

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

0.3A – 12 and 24 kV products...JT 6 fuse, special design for VTs

0.6A – 12 and 24 kV products .. JT 6 fuse, special design for VTs

1A -product up to 17,5kV fuses without indication according to IEC type SIBA

2A -products up to 12 and 24kV fuses without indication according to IEC type SIBA

6,3A -all products up to 24kV fuses with indication according to IEC type SIBA

2A -products up to 36kV fuses without indication according to IEC type BUSSMANN

6. *Instruction for use*

Instrument transformers are used:

- to convert large voltages 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 (voltage) appearing during the operation
- The use of instrument transformer for other purpose then described above is forbidden in not agreed with the producer.

Routine test report

Test report of the **voltage transformers** includes:

- a) Verification of terminal markings
- b) Power-frequency withstand tests on primary windings
- c) Partial discharge measurement
- d) Power-frequency withstand tests on secondary windings
- e) Power-frequency withstand tests between sections
- f) Determination of errors

- there are two rating plates with transformer (one plastered on the transformer and one free)

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

- theoretical voltage errors and phase displacement values

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

- accuracy test report
- additional labels (if more then 2)
- verification tests for metering cores (classes 0,2, 0,5)

7. Instruction for maintenance

Excessive dust or other kind of pollution must be brushed off the transformer. Polluted transformers can be cleaned with spirit, petrol or toluene.

Traces of arcs and minor surface damages can be easily removed with sandpaper after which the surface is to be treated by applying a thin layer of silicone paste on it.

Instruction for repairing greater surface damages must be requested from the manufacturer.

8. Transport and storage

The permissible transport and storage temperature is from $-40\text{ }^{\circ}\text{C}$ to $+70\text{ }^{\circ}\text{C}$. During transport and storage the transformers must be protected against direct sunshine. The transformers are delivered in wooden boxes or fastened to a transport pallets

Appendix 1.

Examples of secondary terminal marking for cast and assembled terminal box for voltage transformers

One pole insulated voltage transformer

2 measuring windings	1a	1n	2a	2n	N	PE
----------------------	----	----	----	----	---	----

measuring and residual winding	a	n	da	dn	N	PE
--------------------------------	---	---	----	----	---	----

2 ratios measuring winding	a1	a2	n		N	PE
----------------------------	----	----	---	--	---	----

One measuring winding	a	n			N	PE
-----------------------	---	---	--	--	---	----

Assembled secondary terminal

2 measuring and residual winding	1a	1n	2a	2n	da	dn	N	PE
----------------------------------	----	----	----	----	----	----	---	----

2 measuring double ratios winding	1a1	1a2	1n	2a1	2a2	2n	N	PE
-----------------------------------	-----	-----	----	-----	-----	----	---	----

2 ratios measuring and residual winding	a1	a2	n	da1	da2	dn	N	PE
---	----	----	---	-----	-----	----	---	----

Double pole insulated transformer

2 measuring windings	1a	1b	2a	2b		PE
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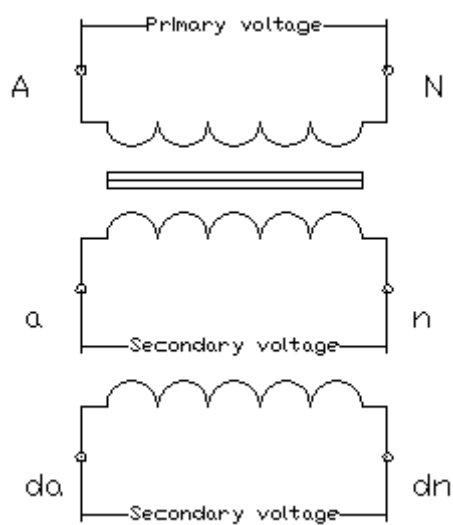
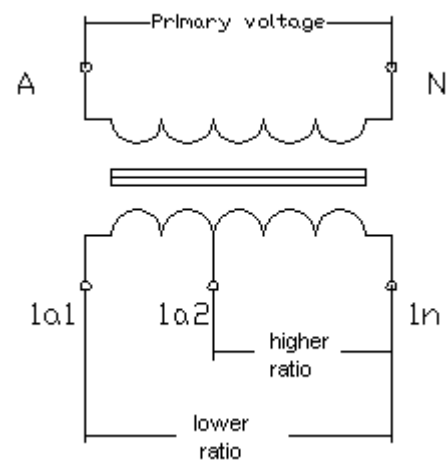
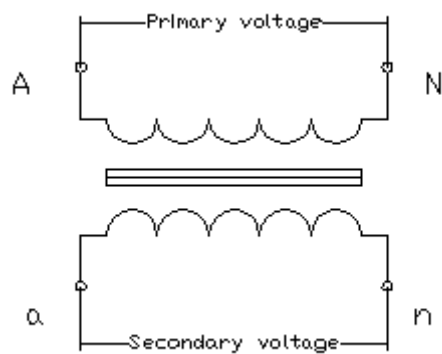
2 ratios measuring winding	a1	a2	b			PE
----------------------------	----	----	---	--	--	----

One measuring winding	a	b				PE
-----------------------	---	---	--	--	--	----

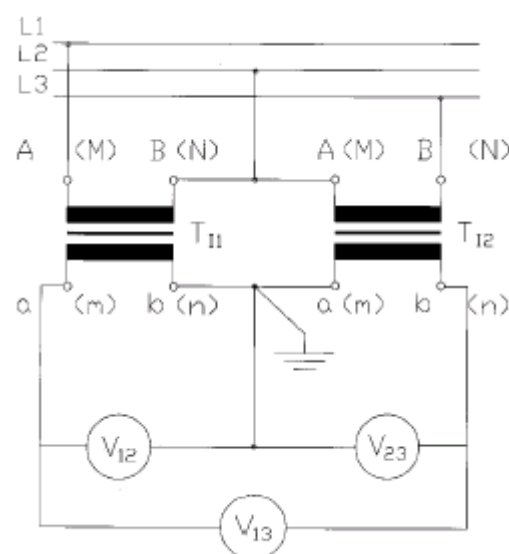
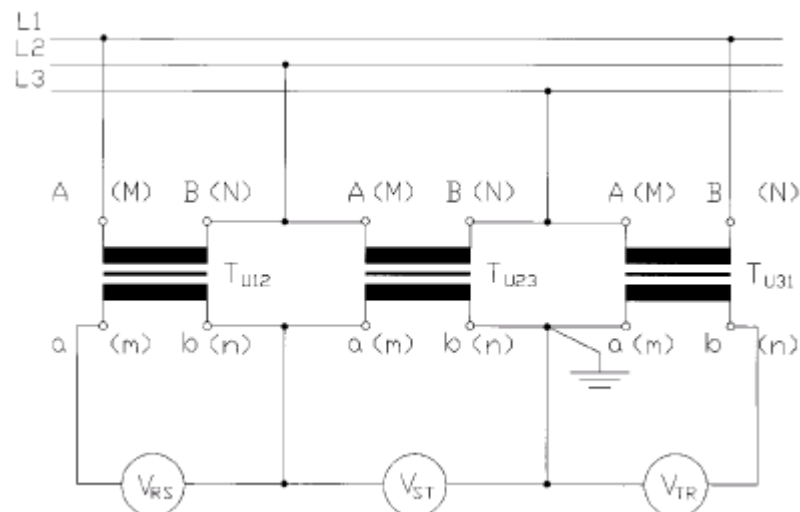
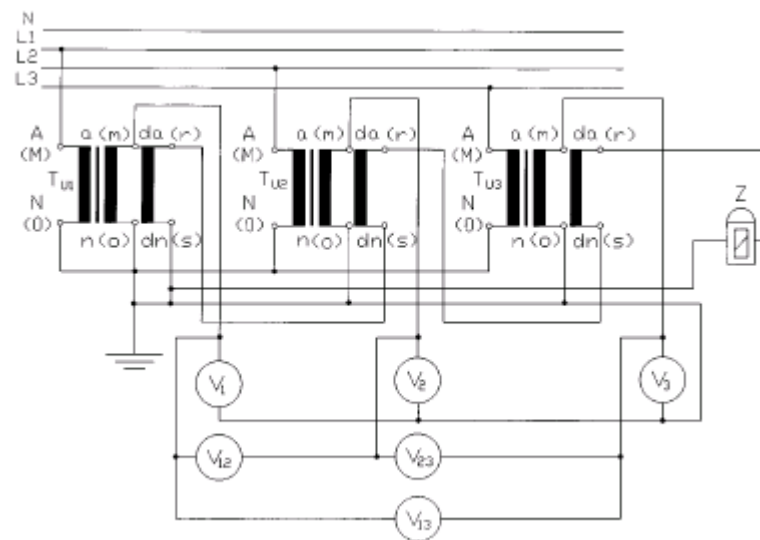
Appendix 2.

Examples of wiring diagrams

Voltage transformers:



Examples of the voltage transformers connections



Appendix 3.

Damping ferroresonance for voltage transformer type TJC

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 usually is 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 case. 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 in the residual voltage secondary, shown in Fig.1, can considerably reduce the risk for ferroresonance.

There is additionally 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 $1.9xU_n/8h$. Higher rated over-voltage factor shift the operating point towards lower flux values of voltage transformer. It results in smaller sensitivity of transformer to some kind of transients usually initiate ferroresonance.

RECOMMENDATION

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

Damping resistor: See the recommended value of damping resistor below:

Voltage of residual winding	Value of R_{damp}	Damping power
100:3 V	22 Ω	450 W
110:3 V	27 Ω	450 W

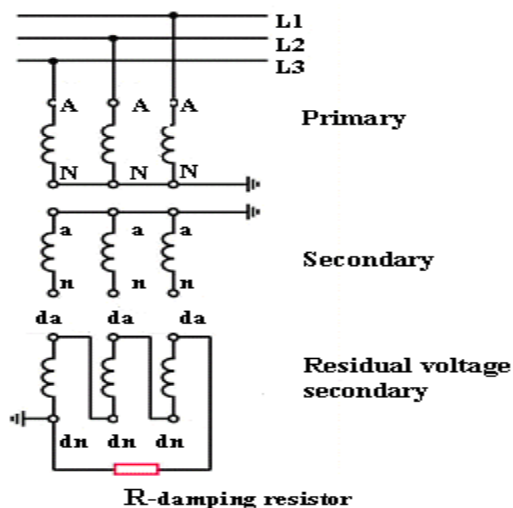


Fig.1

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Highest voltage for equipment	[kV]	36 - 40.5
Power frequency test voltage, 1 min.	[kV]	70 - 95
Lightning impulse test voltage	[kV]	170 - 200
Max. rated burden, classes	[VA/cl]	50/0.2 - 150/0.5 - 250/1
Residual winding	[VA/cl]	50-200/6P

Description

The TJC 7 single-pole insulated voltage transformers are casted in epoxi resin and designed mostly for insulation voltages of 36 kV to 40.5 kV.

Insulation voltages different from the above are to be the subject of an agreement between the manufacturer and the customer.

If no a different value is required the transformers are manufactured with a overvoltage factor of $1.9 \times U_n/8$ hrs.

One outlet of the primary winding, including the respective terminal is insulated from the earth to a level which corresponds to the rated insulation value. The other outlet of primary winding with terminal is earthed during the operation. Most of the transformers are equipped with two secondary windings, the first one for either measuring or protection purposes, the other for being connected into an open-delta connection in a three-phase system. One terminal of each secondary winding and one of the open-delta connected terminals have to be earthed during the transformer operation.

The transformer can be mounted in any position. The transformer are fixed by four screws. The secondary terminal board is covered with sealable cover made of plastic material.

Rated primary voltages ... $30/\sqrt{3}$ kV; $33/\sqrt{3}$ kV; $35/\sqrt{3}$ kV

Other primary voltages can also be supplied on request.

Rated secondary voltages... $100/\sqrt{3}$ V; $110/\sqrt{3}$ V – accuracy classes 0.2; 0.5; 1 (measuring winding) or 3P; 6P (protection winding).

Other secondary voltages can also be supplied on request.

Rated voltages for open-delta connection: ... $100/3$ V; $110/3$ V- class 6P

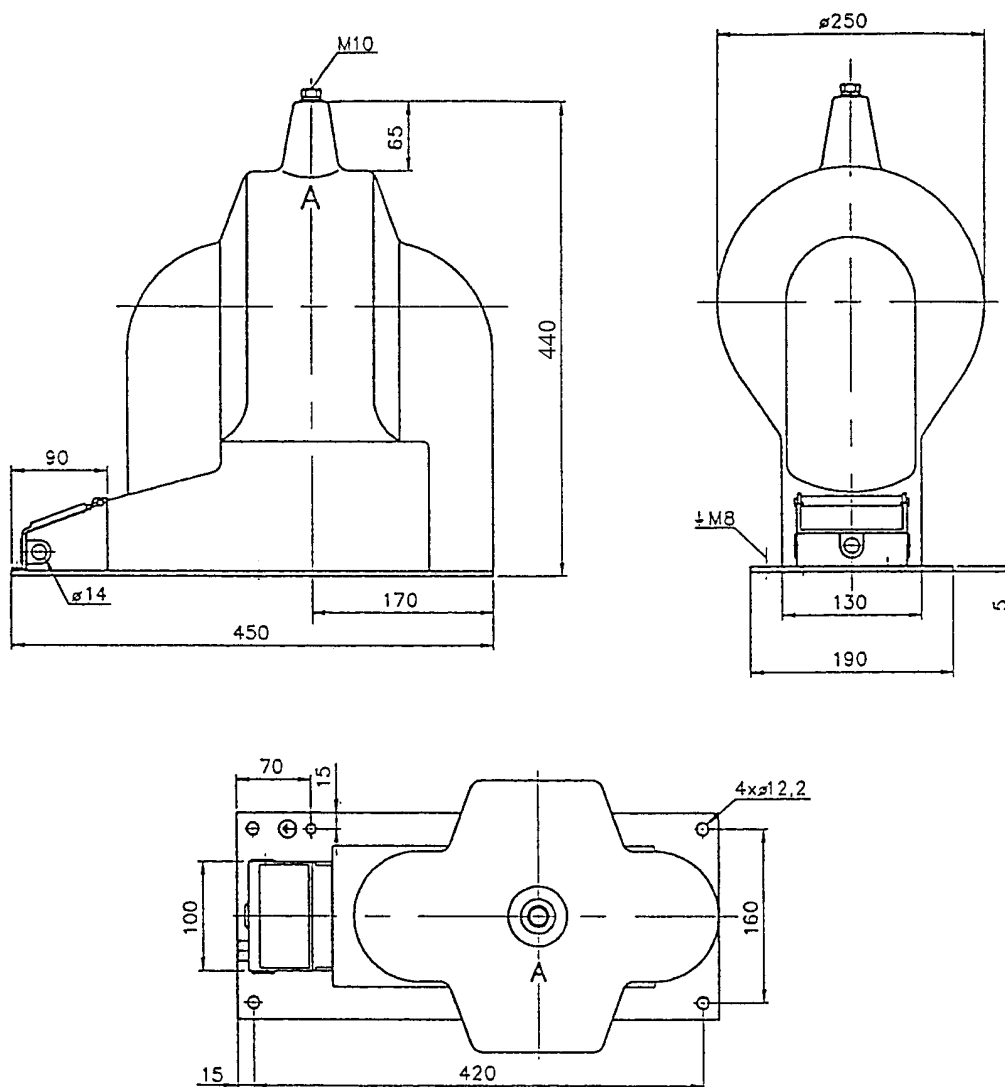
Other voltages for open-delta connection can also be supplied based on customer requirement.

Rated frequency ... 50 Hz; 60 Hz

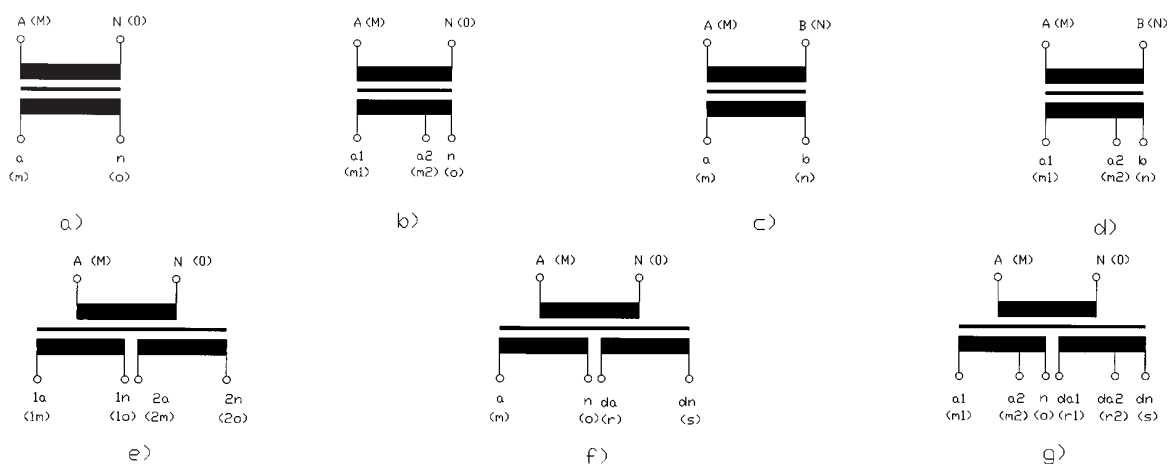
Based on a discussion with the manufacturer the transformer can also be provided with primary winding designed for two different primary voltages (with changeover secondary side).

The transformers are manufactured according to the requirements and recommendations of the following standards and regulations: IEC, ANSI, VDE, BS, GOST and ČSN.

Dimensions



Marking of the voltage transformer outlets



- a) Single-pole insulated transformer
- b) Single-pole insulated transformer with a tap
- c) Double-pole insulated transformer
- d) Double-pole insulated transformer with a tap

- e) Single-pole insulated transformer with two secondary windings
- f) Single-pole insulated transformer with two secondary windings, with one of which being the auxiliary (residual) winding
- g) Single-pole insulated transformer with two secondary, tapped windings, with one which being the auxiliary (residual) winding.

Standartized transformers

Primary voltage,V	Secondary winding			Residual winding		
	voltage,V	accuracy	burden, VA	voltage,V	accuracy	burden, VA
30000/√3	100/√3	0,2	15,25,50			
30000/√3	100/√3	0,2	15,25,50	100/3	6P	50
30000/√3	100/√3	0,2	15,25,50	100/3	6P	100
30000/√3	110/√3	0,2	15,25,50			
30000/√3	110/√3	0,2	15,25,50	110/3	6P	50
30000/√3	110/√3	0,2	15,25,50	110/3	6P	100
30000/√3	100/√3	0,5	50,100,150			
30000/√3	100/√3	0,5	50,100,150	100/3	6P	50
30000/√3	100/√3	0,5	50,100,150	100/3	6P	100
30000/√3	110/√3	0,5	50,100,150			
30000/√3	110/√3	0,5	50,100,150	110/3	6P	50
30000/√3	110/√3	0,5	50,100,150	110/3	6P	100
30000/√3	100/√3	1	100,150,200			
30000/√3	100/√3	1	100,150,200	100/3	6P	50
30000/√3	100/√3	1	100,150,200	100/3	6P	100
30000/√3	110/√3	1	100,150,200			
30000/√3	110/√3	1	100,150,200	110/3	6P	50
30000/√3	110/√3	1	100,150,200	110/3	6P	100
33000/√3	100/√3	0,2	15,25,50			
33000/√3	100/√3	0,2	15,25,50	100/3	6P	50
33000/√3	100/√3	0,2	15,25,50	100/3	6P	100
33000/√3	110/√3	0,2	15,25,50			
33000/√3	110/√3	0,2	15,25,50	110/3	6P	50
33000/√3	110/√3	0,2	15,25,50	110/3	6P	100
33000/√3	100/√3	0,5	50,100,150			
33000/√3	100/√3	0,5	50,100,150	100/3	6P	50
33000/√3	100/√3	0,5	50,100,150	100/3	6P	100
33000/√3	110/√3	0,5	50,100,150			
33000/√3	110/√3	0,5	50,100,150	110/3	6P	50
33000/√3	110/√3	0,5	50,100,150	110/3	6P	100
33000/√3	100/√3	1	100,150,200			
33000/√3	100/√3	1	100,150,200	100/3	6P	50
33000/√3	100/√3	1	100,150,200	100/3	6P	100
33000/√3	110/√3	1	100,150,200			
33000/√3	110/√3	1	100,150,200	110/3	6P	50
33000/√3	110/√3	1	100,150,200	110/3	6P	100
35000/√3	100/√3	0,2	15,25,50			
35000/√3	100/√3	0,2	15,25,50	100/3	6P	50
35000/√3	100/√3	0,2	15,25,50	100/3	6P	100
35000/√3	110/√3	0,2	15,25,50			
35000/√3	110/√3	0,2	15,25,50	110/3	6P	50
35000/√3	110/√3	0,2	15,25,50	110/3	6P	100
35000/√3	100/√3	0,5	50,100,150			
35000/√3	100/√3	0,5	50,100,150	100/3	6P	50
35000/√3	100/√3	0,5	50,100,150	100/3	6P	100
35000/√3	110/√3	0,5	50,100,150			
35000/√3	110/√3	0,5	50,100,150	110/3	6P	50
35000/√3	110/√3	0,5	50,100,150	110/3	6P	100
35000/√3	100/√3	1	100,150,200			
35000/√3	100/√3	1	100,150,200	100/3	6P	50
35000/√3	100/√3	1	100,150,200	100/3	6P	100
35000/√3	110/√3	1	100,150,200			
35000/√3	110/√3	1	100,150,200	110/3	6P	50
35000/√3	110/√3	1	100,150,200	110/3	6P	100

Customer		Date	
Address		Delivery required	
Country		Tel.	Fax.
Contact person		E-mail	

Voltage transformers			
Project ref.:		Date	
		Inquiry No.:	
		Offer No.:	
Um:	kV	Insulation level (BIL):	kV
Un:	kV		kV
freq.:	Hz		kV
Standard No. (IEC):		Routine test certificates	
		Additional name plate	
Indoor		Remarks:	
Outdoor			
Pos.:		No.:	
Ratio:			Additional (residual) winding
			Voltage:
			Class:
			Burden:
Burden:	VA	VA	With fuse
Class:			Without fuse
Supplier's remarks		Single pole	
Type		Double pole	
Unit price	Comment		
Total price			
Pos.:		No.:	
Ratio:			Additional (residual) winding
			Voltage:
			Class:
			Burden:
Burden:	VA	VA	With fuse
Class:			Without fuse
Supplier's remarks		Single pole	
Type		Double pole	
Unit price	Comment		
Total price			



A 3440-527-I/2000

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