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

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

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

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

Voltage transformers types: TJC; TDC; TDO; TJO; TJP; TDP; KGUG; KGUGI; KRED

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 °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 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°C and +40 °C. The average value of the ambient temperature, measured over a period of 24 hours, should not exceed 35°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:

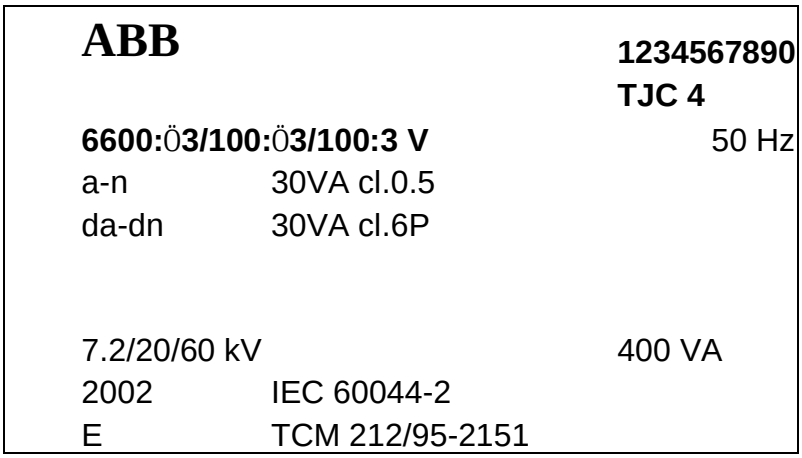
Current transformers

ABB			**1234567890**
			TPU 40.13
200-400/1/1 A			50 Hz
1S1-1S2	200/1A	5VA cl. 0.5 FS 5	
1S1-1S3	400/1A	10VA cl. 0.5 FS 5	
2S1-2S2	200/1A	5VA cl. 5P15	
2S1-2S3	400/1A	10VA cl. 5P15	
12/28/75 kV			50(1s)/125 kA
2002		IEC 60044-1	
E		TCM 212/95-2150	

Where:

1234567890	serial number
TPU 40.13	transformer type code
50Hz	rated frequency
200-400/1/1 A	rated transformer ratio
1S1-1S2	terminal marking for core number 1, first tap
1S1-1S3	terminal marking for core number 1, second tap
5VA	rated output
0.5, 5P	accuracy classes
FS5	instrument security factor
12/28/75 kV	highest voltage for equipment / power-frequency withstand voltage / rated lightning-impulse voltage
IEC 60044-1	referred standard(s)
50(1s)/125kA	rated short time thermal current (thermal time) / rated dynamic current
2002	year of production
E	temperature class
TCM ……	Type approval mark

Voltage transformers



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
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
E	temperature class
TCM……	Type approval mark

3. *Instruction for installation*

General information

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 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 secondary terminal of the transformer, except if the windings are connected to open delta. 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 single 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 feroresonance in Voltage transformers type TJC.
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“
   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 doesn’t warranting the earthing.

Mounting

Following information is 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.

Indoor current and 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 and washers. Fastening must be done on a smooth surface.

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

Outdoor current and 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 (VT) with four screws M10 and washers or two U profiles (CT) with M12 screws. Fastening must be done on a smooth surface.

There is a M12 screw for grounding of current transformer and M8 screw for grounding of voltage transformer.

Primary connection

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

Maximum allowed torques for screw connections of current transformers:

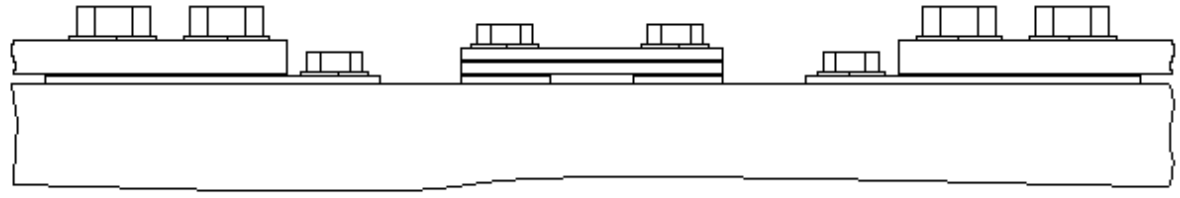
Screw	Max. torque [Nm]	Min. torque [Nm]
M5	3.5	2.8
M6	4	3
M8	20	16
M10	20	16
M12	70	56

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

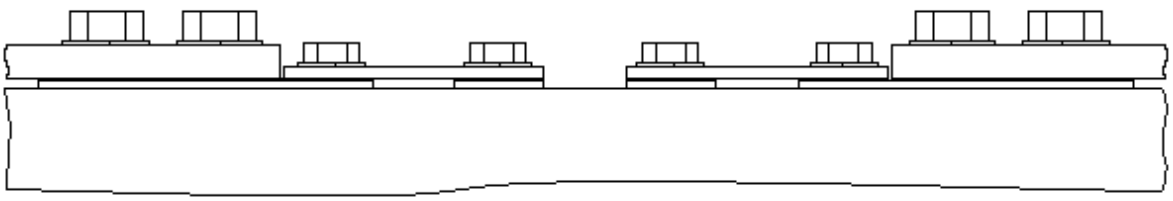
Maximum allowed cantilever strength is: Voltage transformers 2000 N.
Current transformers 5000 N.

Primary reconnectable transformers
PRIMARY CONNECTION

LOW RATIO



HIGH RATIO



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 CT is made of epoxy resin and provided with one insert Pg21. The secondary cover for outdoor VT is made of plastic and provided with two insert Pg21.

Degrees of IP protection

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

Outdoor transformers: IP54

For terminal marking see appendix 1.

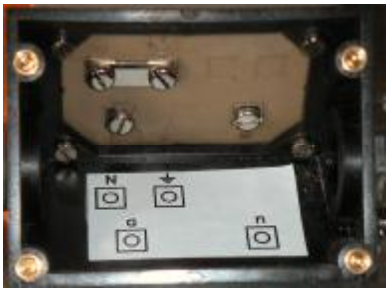
Details of current transformers casted terminal boxes

TJC,TDC

TJC7

TJC,TDC

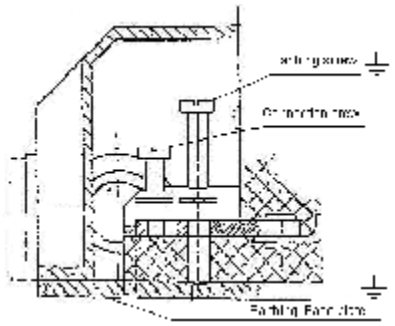
TJP,TJC,TDC



TJO7

TJO6,TDO6

Details of voltage transformers casted terminal boxes



Cross section of single line secondary terminal box

Capacitive voltage indicator (divider)

The transformer can be supplied with the capacitive voltage indicator on the request. There are two possible solutions:

a. HR – Indicator complies with the IEC 61234-5 standard for high resistive voltage indicators
b. CE – Where the values of capacity C1 and C2 are measured. C1 is the capacitance between primary winding and Ck terminal and C2 is the capacitance between grounded parts and CK terminal. These values are mentioned on the rating plate.

CE capacity according to nominal voltage

Ub (kV)	C1 (pF)	C2 (pF)
3 – 5,5	28 – 55	20 - 90
5,5 – 7,2	23 – 40	
10 – 13,8	19 – 33	
13,8 – 17,5	13 – 23	
20 – 24	10 - 18	

Fuses

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

0.3A – 12 and 24 kV products… fuse type JT6 specially designed for voltage transformers
0.6A – 12 kV products …… …fuse type JT6 specially designed for voltage transformers
2A – 6.3A all products up to 36 kV …IEC fuses manufacturer SIBA
2A products up to 36kV …….. IEC fuses manufacturer BUSSMANN

8. Instruction for use

Current transformers are used:

- to convert large currents in the primary circuit to an appropriate level for secondary circuit equipment (relays and meters)

- to insulate primary and secondary circuit from each otherto protect the secondary equipment from the harmful effects of large current appearing during the operation (short circuits)

The use of current transformer for other purpose then described above is forbidden in 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 then 2)
- verification tests

9. 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.

10. Transport and storage

The permissible transport and storage temperature is from –40 °C to +70 °C. During transport and storage the transformers must be protected against direct sunshine. The transformers are delivered fastened to a transport pallet.

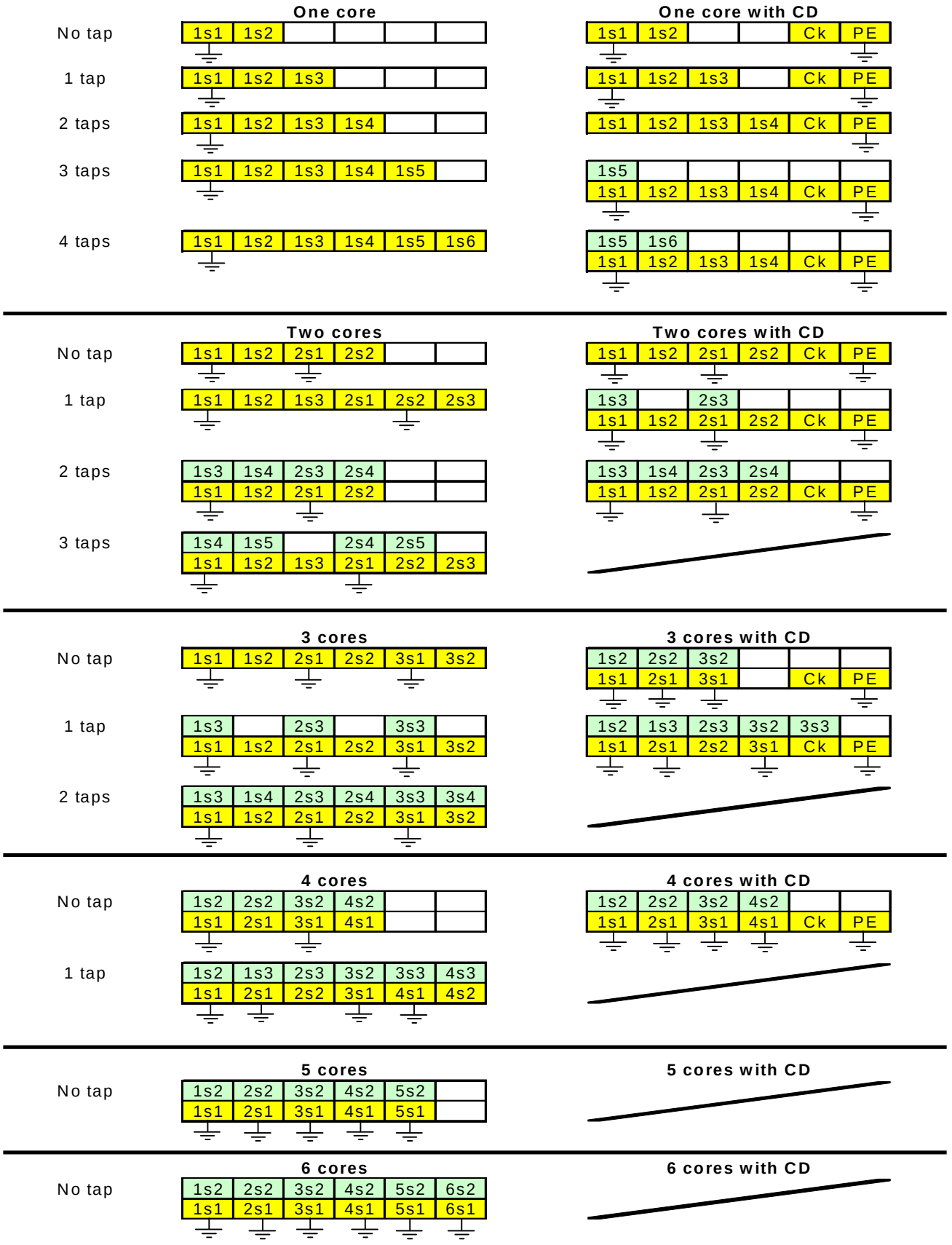
11. Disposal

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.

12. Normative references

IEC60044-1… Instrument transformers – Current transformers
IEC60044-2… Instrument transformers – Voltage transformers
IEC61243-5… Voltage detectors – Voltage detecting systems (VDS)
IEC60529…… Degrees of protection provided by enclosures (IP Code)
ISO12100…… Safety of machinery — Basic concepts, general principles for design
EN 50110-1 …Operation of electrical installations

Appendix 1. Examples of secondary terminal marking for casted terminal box for current transformers



2nd line of terminal
1st line of terminal

-terminal not earthed
-terminal earthed

Examples of secondary terminal marking for casted and assembled (phoenix) 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 (Phoenix)

2 measuring and residual winding	1a	1n	2a	2n	da	dn	N	PE
2 measuring double rations winding	1a1	1a2	1n	2a1	?a2	2n	N	PE
2 ratios measuring and residual winding	a1	a2	n	da1	?a2	dn	N	PE

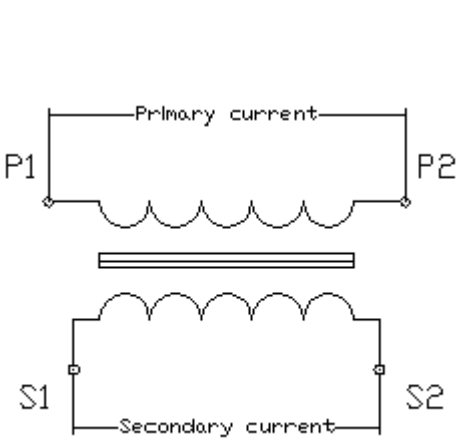
Double pole insulated transformer

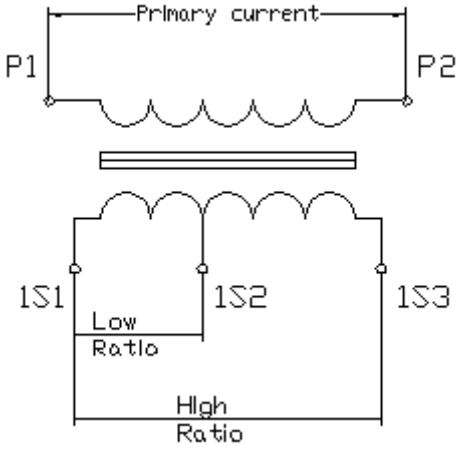
2 measuring windings	1a	1b	2a	2b		PE
2 ratios measuring winding	a1	a2	b			PE
One measuring winding	a	b				PE

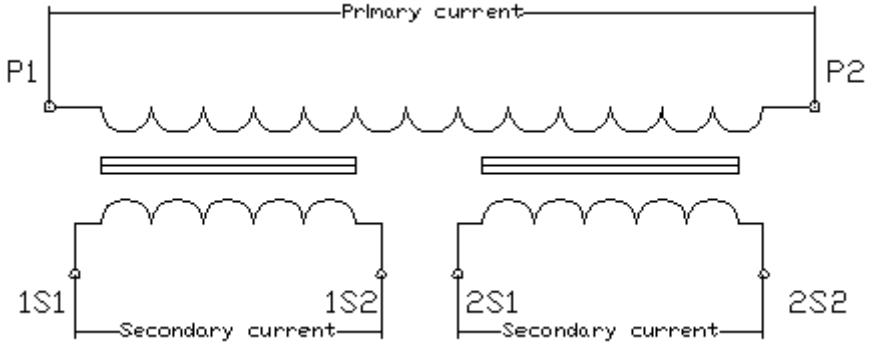
Appendix 2.

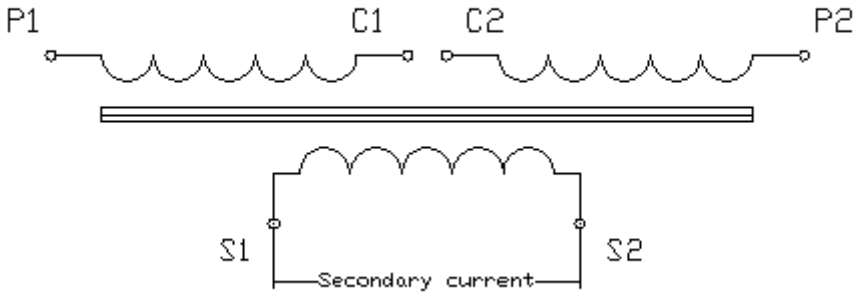
Wiring diagrams

Current transformers:



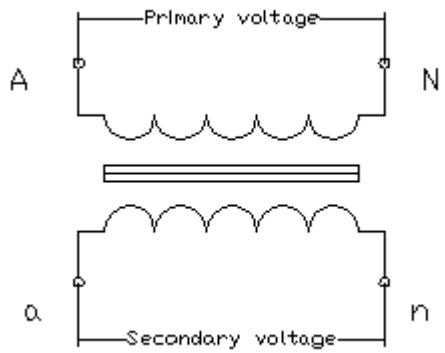


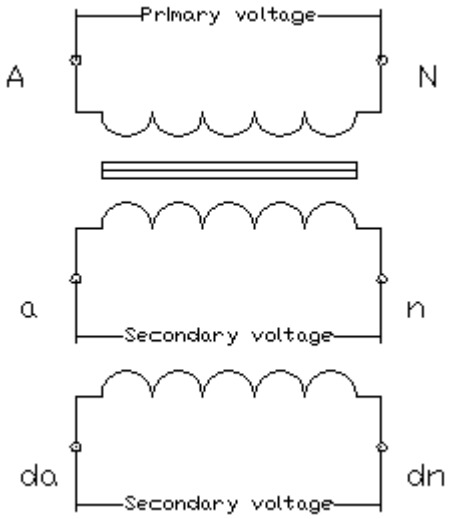


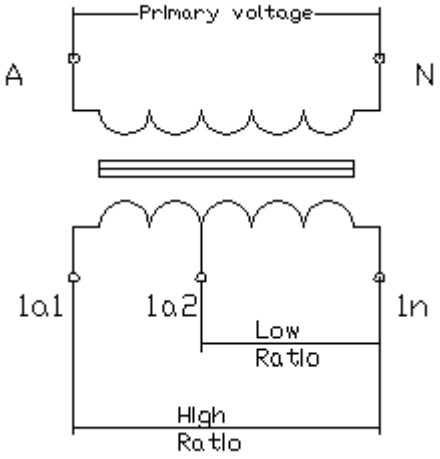


Wiring diagrams

Voltage transformers:







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 witch 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 or VT guard 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 1.9xUn/ 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) xUn/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 Rdamp	Damping power
100:3 V	22 Ω	450 W
110:3 V	27 Ω	450 W

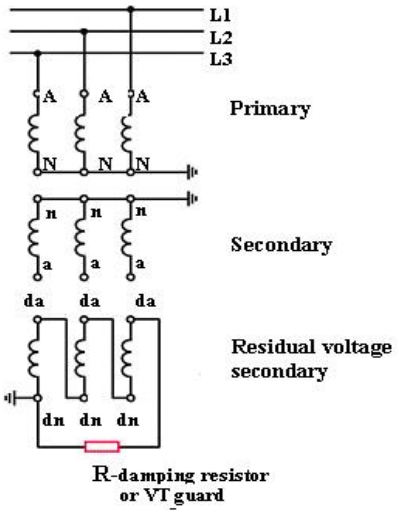


Fig.1.

VT Guard – function

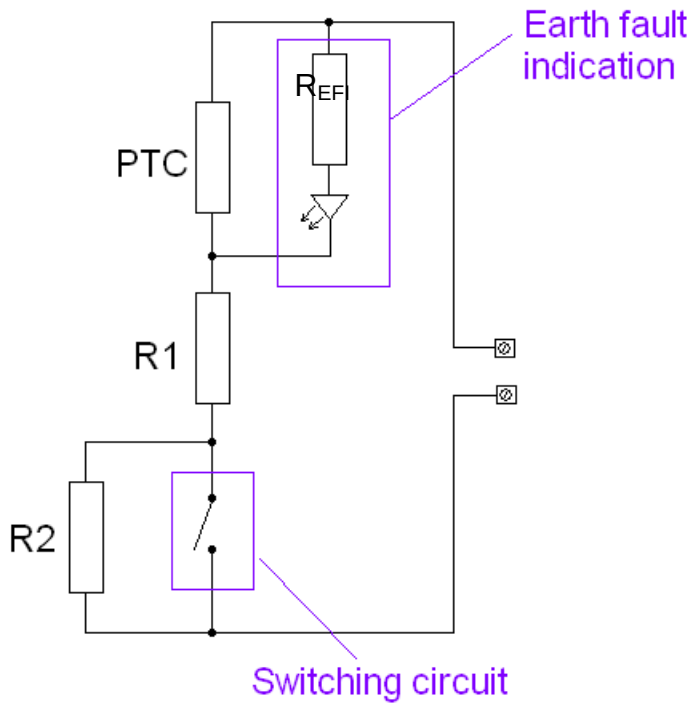
1. VT-Guard description:

VT Guard is a preventive device against the ferroresonance phenomenon which may be triggered in power networks with ungrounded or not directly grounded neutral point. VT Guard should be used in cooperation with voltage transformers connected in open delta – more in **User's manual**.

Important: Read the User's manual before use.

2. Basic operating states:

Simpl diagram



a) In case of full balance in a three-phase network, there is zero voltage on an open delta winding (VT Guard terminals) Uo=0. No current flows through VT Guard. The device isn't active.

b) In case of unbalance in a three-phase network, there is voltage on VT Guard terminals Uo>0.

If the Uo is lower than threshold voltage Ut (Ut =20-24V), then current $I = \frac{Uo}{(R_{PTC} // R_{EFI}) + R1 + R2}$ flows through the device.

Total resistance value is higher then 100ohm and voltage Uo is max 24V in this case. Current flowing thorough the device has very low value.

c) In case Uo is higher then treshold voltage **(ferroresonance)**, the „switching circuit" is switched on and current flows trough R_{PTC}//R_{EFI} and R1. Because of low values of these resistors there is steep increase of current and fast ferroresonance dumping. High current flows trough the device for short time, the PTC resistors arn't warm up significantly.

d) In case Uo is higher then treshold voltage(**earth fault**), the „switching circuit" is switched on and current flows trough R_{PTC}//R_{EFI} and R1. Because of low values of these resistors there is steep increase of current. High current flows trough the device and cause to warm up PTC resistors. PTC resistor increase their resistance (The resistance is proportional to flowing current). Current is limited. Time needed for worming up PTC resistors for Uo = 100V is approximately 1.4s. After earth-fault is removed, the PTC resistors cool-down (approximately 3 min). **It is necessary to mount VT Guard in vertical position far from other thermal sources.**

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