## Current Transformers

### Application:
GR Current Transformers are manufactured to meet indoor or internal equipments for Switch gear, Distribution Systems, Generator Sets and control panels. Current Transformers are custom-built product supplied in Ring/Rectangular type in a wide range of ratios and accuracies. CTS have single, dual or multi-ratio windings are capable of accuracy levels to meet IS-2705.

### Fabrication:
The accuracy of CT is a function of the magnetic performance of the steel core. Toroidally wound cores with high permeability and low loss are used to optimize performance and physical size of the transformers. High grade insulation is used to insulate between the windings and the core and between winding layers. Maximum mechanical and electrical performance is achieved by distributing all windings evenly around the periphery of core. The exterior of the transformer is finished with ABS cover which provides an excellent external mechanical protective body & look and long term dielectric performance.

### Accuracy Class:
In the case of metering CT s, accuracy class is typically, 0.2, 0.5, 1 or 3. This means that the errors have to be within the limits specified in the standards for that particular accuracy class. The metering CT has to be accurate from 5% to 120% of the rated primary current, at 25% and 100% of the rated burden at the specified power factor. In the case of protection CT s, the CT’s should pass both the ratio and phase errors at the specified accuracy class, usually 5P or 10P, as well as composite error at the accuracy limit factor of the CT.

### Composite Error:
The rms value of the difference between the instantaneous primary current and the instantaneous secondary current multiplied by the turns ratio, under steady state conditions.

### Accuracy Limit Factor:
The value of primary current up to which the CT complies with composite error requirements. This is typically 5, 10 or 15, which means that the composite error of the CT has to be within specified limits at 5, 10 or 15 times the rated primary current.

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The rms value of the difference between the instantaneous primary current and the instantaneous secondary current multiplied by the turns ratio, under steady state conditions.

### The following factors affect CT prices:
Specifying a higher VA or CLASS than necessary usually results in a higher cost. The cost generally increases as the CT internal diameter increases. 1A CTS are usually more expensive than 5A.

### Instruments security factor:
To protect the instruments and meters from being damaged by high currents during fault conditions, a metering core must be saturated typically between 5 and 20 times the rated currents. The rated Instrument Security Factor (ISF) indicates the over current as a multiple of the rated current at which the metering core will saturate. It is thus limiting the secondary current to IS times the rated current. ISF for GR meter CTS are deigned to less than 5. The safety of the metering equipment is greatest when GR CTS are used.

### Testing:
Every CT is tested in accordance with IS-2705 for ratio accuracy and phase angle errors with microprocessor based automatic instrument
transformer test set with facilities for an automatic print out of test results. Test comparisons are made with standard traceable NPL to validate ratio accuracy performance for all CTS. For protection class CT the performance is verified by excitation measurements.

### Metering Class CTS:

In general the following applies:

**Accuracy Class Requirements:**
- 0.1 or 0.2 for precision measurements.
- 0.5 for high grade kilowatt hour meters.
- 1.0 for commercial grade kilowatt hour meters
- 1 or 3 for general industrial measurements.
- 3 or 5 for approximate measurements

**Burden Requirements:**
- Ammeter: 1VA
- Current coil of Watt/Var meter: 1.5 VA
- Current coil of energy meter: 2.0 VA
- Current coil of p.f. indicator: 2.5 VA
- Current coil of Trivector meter: 3.0 VA
- Leads between CT & meter: 2.0 VA

### Protection Class CTS:

In addition to general specification required for CT design, protection CTS require an Accuracy Limit Factor (ALF). This is the multiple of rated current up to which the CT will operate while complying with the accuracy class requirements. In general the following applies:

- Instantaneous over current relays & trip coils – 2.5VA class 10P5
- Thermal inverse time relays: 7.5VA Class 10P10
- Low consumption Relay: 2.5VA class 10P10
- Inverse definite min. time relays (IDMT) Over current: 15VA Class 10P10/15
- IDMT earth fault relays with fault stability or accurate time grading required: 15VA 5P10

### Knee Point Voltage:

That point on the magnetizing curve where an increase of 10% in the flux density (voltage) causes an increase of 50% in the magnetizing force (current).

### Interposing CTs:

These CTs are used in conjunction with main CTs to alter the ratio of main CT or to provide isolation to meters or relays from main CTs secondary circuit. Primary current of these CTs are generally lower than 1 0 amp. Due to which they are always wound primary types.

### Summation CTs:

In electrical supply practice, it may become necessary to obtain sum of currents in a number of feeders. To achieve this, Summation C.Ts. are used. Summation C.Ts. are used with feeder C.Ts. which may or may not have the same ratios. Each feeder is provided with its own C.T. and the secondary windings of these are connected to the appropriate primary windings of the summation C.T. The summation C.T. has a single secondary winding which is connected to the burden. It is essential that summation C.Ts. are used on currents of same frequency and phase. Summation current transformers are generally manufacture-confirming to IS 6949

### Bushing Type Or Bus Duct Type CTs

These CTs are fiber glass tapped Ring type construction & can be mounted on Bus duct or Bushing turret of power transformer. These CTs are widely used by transformer manufacturers for use in oil.

### Special Type Current Transformers

**Class PS(X) CTS:**

Class PS CTs are special CTs used mainly in balanced protection systems (including restricted earth fault) where the system is sensitively dependent on CT accuracy. Further to the general CT specifications, we now need to know:

- Vkp - Voltage knee point
- Io – Maximum magnetizing current at Vkp
- Rs – Maximum resistance of the secondary winding.
Core Balance Current Transformers are used with suitable relays for the earth leakage protection purposes. C.B.C.T. encircles a 3 Phase, 3 core cable or 3 single core cables. During healthy conditions i.e. when there is no earth leakage current, the secondary of C.B.C.T. does not carry, any current as there is no magnetic flux in the core. In the event of occurrence of earth leakage an unbalance current sets up flux in the core of the C.B.C.T. and current flows through the secondary winding, causing the relay to operate.

<table>
<thead>
<tr>
<th>Ring Size</th>
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<th>Ratio</th>
<th>Burd. VA</th>
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**Protection Class Ring Type CTs Data**

**Precision Grade Current Transformer:**

These CTs are of accuracy of 0.1, 0.2 or 0.5 and used as a standard current transformer to check accuracies of other transformer. These current transformers are either wound primary or ring type and manufactured in teakwood cases.

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