



OIL COOLED INSTRUMENT TRANSFORMERS

CURRENT TRANSFORMERS

APPLICATION

Direct measurement of current in High Voltage System is Not possible because of insulation problem of measuring instruments. It is also not possible to use current flowing through the system directly for protection purpose due to its high insulation problem.

BASIC FUNCTIONS OF CURRENT TRANSFORMERS ARE:

1. To reduce the line current to a value which is suitable for standard measuring instruments relays etc.
2. To isolate the measuring instruments, meters, relays etc. from high voltage side an installation.
3. To protect measuring instruments against short circuit currents.
4. To sense abnormalities in current and give current signals to protective relays to isolate the defective system

There are four main factors which determine the capability of current transformer i.e.

- ◆ Insulation Level (Service Voltage)
- ◆ Rated primary current
- ◆ Short time withstand current
- ◆ Burden and Accuracy

THE CURRENT TRANSFORMER MUST:

1. Withstand operational voltage and over voltage in the network
2. Withstand rated primary current in continuous operation without exceeding maximum allowed temperature rise.
3. Be capable o sustain thermal and mechanical stresses developed due to system fault current
4. Feed current to external circuit with specified accuracy at specified primary currents.

CONSTRUCTION :

CORE & SECONDARY WINDING :

High permeability, CRGO silicon steel is used as core material. Toro dial cores from continuous strips are made and annealed in controlled atmosphere to achieve best quality secondary

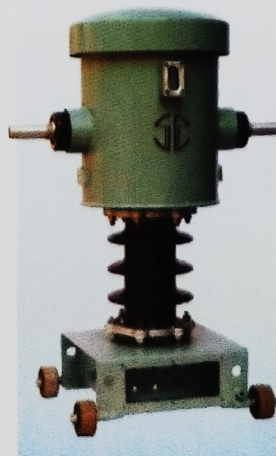
cores. Secondary winding is done on automatic winding machine and is distributed equally on the periphery of the core to minimize leakage reactance. Best quality enameled wire with adequate inter-layer insulation is provided to avoid secondary winding short circuiting in most adverse condition .

PRIMARY WINDING :

Primary winding is braided electrolytic copper conductor with double cotton covering. Varnishing fiberglass sleeve is provided as an additional insulation on this conductor. Incase of Live Tank ,the Primary is wound on insulated secondary. The Primary is positioned properly to sustain dynamic forces developed during short circuit condition. In case of DEAD TANK ,the primary is encapsulated in circular rigid fibre glass ring and aluminum pipe to form EYE BOLT construction.

INSULATION :

Crape Paper of High quality is used to build up main insulation of the CT. In live tank design, insulation is built up on secondary core and secondary leads are brought out through a metallic galvanized pipe. In dead Tank CT primary Winding is encapsulated in fibre glass ring and Aluminum Pipe Main Insulation is built up on primary winding with fine grading of insulation. Semi conducting shield is used give linear distribution of Electric stress along the length of the bushing. The paper insulation is dried in oven under very high vacuum and strictly controlled conditions. Filtered and de-aerated EHV grade oil is filled in CT while CT is under vacuum. To seal it, the space left for expansion on the top is filled with dry and pure nitrogen through non-returnable valve at pre-determined pressure.



11 kV C.T.



33 kV C.T.



66 kV C.T.



PORCELAIN INSULATOR :

Porcelain Insulator (Bushings) with different shed profiles to suit different pollution conditions are used. These Bushings are hollow cylindrical type conforming to IS5621/IEC 815. Bushings with color at both the ends are clamped using M.S. Fabricated Clamp .

Nitrile and Neoprene Gaskets are used at both sides of collar to form flexible joint. This joint can sustain vibrations without damaging bushing. Bushings with cemented Flanges are also used.

TANKS & BASES :

Top tank of the CT having current less than 1200 Amps. are made of MS Sheet. Stainless Steel Tanks are used for CTs with primary current of 1200 Amps and above. Bases are fabricated from MS Plates and Channels. All MS Tanks and Bases are painted with oven baked paint, after cleaning by seven tank process. All surfaces which come in contact with oil are painted with oil Insoluble paint. All MS parts can be supplied with Hot Dip Galvanized on request.

TESTING :

Our Testing laboratory is well equipped with all facilities to conduct Routine Tests on our products. These tests shall be conducted in accordance with relevant Indian and International standard specifications as also inline with specifications committed by us to our customer.

All the CTs pass through a standardized quality assurance plan to ensure requisite top quality at every stage and in the final product.

PACKING & TRANSPORTATION :

All CT's are packed with strong jungle wood to take care of most adverse conditions of transportation all over the country. Special seaworthy packing is done for the CTs for Export.

MAINTENANCE

The CTs do not require maintenance apart from occasional cleaning of Bushings and checking of Nitrogen pressure. For more details refer Manual supplied with the CT.

HOW TO SELECT THE C.T.

It is important to specify correct parameters of CT while ordering for optimum design. Following are main factors for selecting current transformer

1. **SERVICE VOLTAGE:** System voltage in which CT is to be installed e.g. 11kV, 22kV, 33kV, 66 kV, ETC.
2. **INSTALLATION:** Whether OUTDOOR or INDOOR
3. **ATMOSPHERIC CONDITIONS:** Such as condition of Pollution, Altitude Ambient Temperature etc.

4. **INSULATION LEVEL:**

If insulation level other than associated with service voltage is required, it should be specifically mentioned

5. **RATED PRIMARY CURRENT:**

Specify rated primary current / currents (if required more than one value). Also indicate if different primary current is required for different cores.

6. **CONTINUOUS PRIMARY CURRENT:**

Max. Primary current that can be withstood continuously by current transformer e.g. 120% of primary current

7. **RATED SECONDARY CURRENT :**

Whether 1 Amp. or 5 Amps.

8. **SHORT TIME CURRENT & ITS DURATION :**

Specify fault current of the system in which CT is to be installed along with its duration. It is most important to specify realistic value of S.T.C. as at lower primary current, higher S.T.C. value necessitates bulky & costlier design. Also specify dynamic current if other than 2.5 times S.T.C. is required.

9. **NO. OF CORES THEIR BURDENS, ACCURACY :**

Basis of application, No. of cores, their burdens and accuracy class should be specified. It is advisable to specify minimum required Burden for metering core as unnecessary high burden will necessitate bulky and costlier design.

Specified accuracy is guaranteed for 100 % to 25% of rated burden only. Current transformer offers minimum error if 75% to 60% burden is connected to secondary, Therefore, ideally rated burden higher than 1.5 time actual burden should be specified. Also, it is important to specify correct burden in context of instrument Security Factor (I.S.F.). The I.S.F. indicates the over current as multiple of rated current at which the metering core will saturate, thus limiting the secondary current flowing through meter and protect it from damage. If actual burden connected is half of the rated burden, the I.S.F. will increase two-fold of its rated value.

10. **KNEE POINT VOLTAGE, SECONDARY RESISTANCE AND EXCITATION CURRENT :**

For differential protection, R.E.F. Protection, Bus Bar Protection, C.T. with accuracy class PS is required. The Knee Point Voltage, Secondary resistance and excitation current should be for this core. It is always better to specify Formula for Knee Point Voltage related to relay used for the protection. This will help designer to optimize the design.



OIL COOLED INSTRUMENT TRANSFORMERS

VOLTAGE TRANSFORMERS

APPLICATION

Direct measurement of voltage in High Voltage System is not possible because of insulation problem of measuring instruments. It is also not possible to use direct voltage for the system protection purpose due to its high value and high insulation problem protective relays. Therefore voltage transformers are used to step-down the high system voltage to low standard value accurately in proportion to their ratio.

BASIC FUNCTIONS OF VOLTAGE TRANSFORMERS ARE

To reduce the line voltage to a value which is suitable for standard measuring instruments relays etc.

To isolate the measuring instruments, meters, relays etc. from high voltage side an installation.

To sense abnormalities in voltage and give signals to protective relays to isolate the defective system.

CONSTRUCTION VOLTAGE TRANSFORMER

MAINLY CONSISTS OF :

1. Primary & Secondary winding
2. Electromagnetic Core
3. Bottom Tank & Oil Expansion Chamber
4. Porcelain Bushing

PRIMARY & SECONDARY WINDING :

Copper enamelled wire is used for winding. Primary is wound with multilayer and graded insulation. The diameter and length of each layer is selected such that Surge voltage is distributed equally in all layers of the Winding. Multilayer Kraft Paper insulation is provided between winding layers. Stress equalizing shield is provided on last layer of the winding. H.T. Connection is brought out through metallic pipe. Secondary is separately wound and inserted in the primary winding as per the requirement. Winding and tapping of V.T. is done in dust-free atmosphere.

ELECTROMAGNETIC CORE :

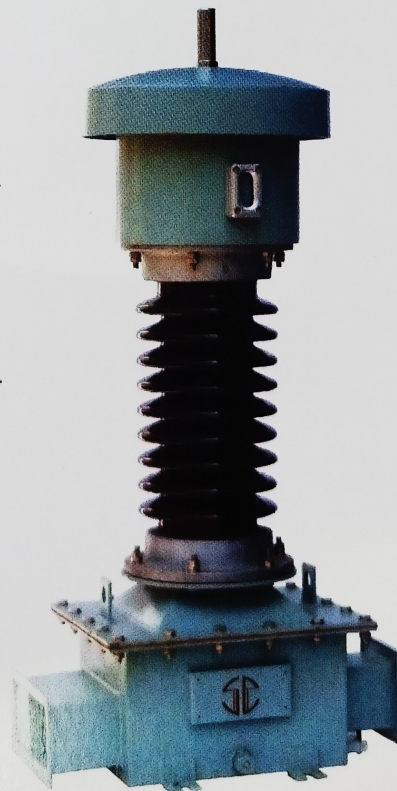
C.R.G.O. Silicon Steel is used for building up Electromagnetic core. Shell type construction is used to minimize leakage reactance.

BOTTOM TANK & OIL EXPANSION CHAMBER :

Bottom tank and oil expansion chamber are made of M.S. Sheet. All tanks and chambers are painted with Oven baked paint, after cleaning by seven tank process. All surfaces which come in contact with oil are painted with oil insoluble paint. M.S. parts can be hot dip galvanized on request.

PORCELAIN BUSHING :

Brown Glazed Porcelain Bushing with different shed profiles to suit different pollution conditions is used. These Bushings are Hollow Cylindrical Type conforming to I.S. 563/IEC 815. Bushing with collar at both the ends is clamped using Aluminum Flanges. Nit rile and Neoprene Gaskets are used at both sides of collar to form flexible joint. This joint can sustain vibrations without damaging bushing. Bushing with Cemented Flanges are also used.



33 kV V.T



66 kV V.T



INSULATION :

High Quality Electrical Grade Kraft Paper crepe paper is used for insulating primary and secondary winding of V.T. The high voltage connection is brought out through paper condenser formed on metallic pipe using fine grading of insulation. Semi conducting shield is used to give linear distribution of electric stress along the length of the bushing. The paper insulation is dried in oven under very high vacuum and strictly controlled conditions. Filtered and de-aerated EHV grade oil is filled in V.T. While V.T. is under vacuum. To seal it, the space left for expansion on the top is filled with dry and pure nitrogen through non-returnable valve at pre-determined pressure.

PACKING & TRANSPORTATION :

All VT's are packed with strong jungle wood to take care of most adverse conditions of transportation all over the country. Special seaworthy packing is done for the VTs for Export.

MAINTENANCE

The VTs do not require maintenance apart from occasional cleaning of Bushings and checking of Nitrogen pressure. For more details refer Manual supplied with the VT.

HOW TO SELECT THE V.T. :

It is important to specify correct parameters of V.T. while ordering for optimum design.

Following are main factors for selecting Voltage Transformers.

1. SERVICE VOLTAGE : System Voltage in which V.T. is to be installed e.g. 11kv, 22kv, 33kv, 66kv etc.

2. INSULATION : Whether OUTDOOR OR INDOOR

3. ATMOSPHERIC CONDITIONS :

Such as condition of Pollution, Altitude, Ambient Temperature etc.

4. INSULATION LEVEL :

If insulation level other than associated with service voltage is required, it should be specifically mentioned.

5. RATED PRIMARY VOLTAGE :

Rated primary voltage is generally rated system voltage for unearthed type V.Ts and rated system voltage divided by square root of three for earthed type V.Ts the V.Ts. can be manufactured suitable for more than one system voltage. In such case, different primary voltages required may be indicated.

6. RATED SECONDARY VOLTAGE :

Standard values of secondary voltages are 110v or $110\sqrt{3}$ depending on application of the secondary winding. V.Ts. with different secondary voltages other than those mentioned above can be manufactured and supplied.

7. VOLTAGE FACTOR:

All V.Ts are manufactured suitable for continuous voltage factor 1.2 As per I.S. / I.E.C. Specification, short time voltage factor is different for different ear thing systems. Therefore appropriate system ear thing conditions may be specified.

8. NUMBER OF SECONDARY WINDINGS, THEIR BURDENS & ACCURACY CLASSES

Number of secondary windings, their burdens and accuracy classes are selected on the basis of application. Two types of classes are available, one for metering and other for protection.

Unlike current transformers, accuracy of one winding is influenced by loading of other winding. Due to this reason burden of each winding should be correctly mentioned.

Accuracy of V.T. is guaranteed at the secondary terminals of the V.T. the impedance of cable connecting secondary terminals to load (Relay or Meter) offers series drop in output voltage. The caused additional errors of cable and is proportional to the load on the secondary. Therefore, it is advisable to select separate metering and protection winding. Alternatively, single winding can be used for metering and protection if separate cables are used for connections. (Cable of 4 sq. mm. cross section offer 2% voltage drop at 100 meters distance with 100 VA burden of secondary voltage of $110\sqrt{3}$).