# CURRENT TRANSFORMER

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# Engineering Department

WEST BENGAL STATE ELECTRICITY TRANSMISSION COMPANY LIMITED
পশ্চিমবঙ্গ রাজ্য বিদ্যুৎ সংবহন কোম্পানি লিমিটেড
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TECHNICAL SPECIFICATION FOR CURRENT TRANSFORMER

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Updates for WBSETCL / TECH SPEC / Rev.-9.1

1. The Table - CORE DETAILS OF CURRENT TRANSFORMER (FOR GIS SUB-STATION ONLY) Accuracy class i.r.o. The metering core of all CTs for GIS is changed to 0.2S from 0.2

2. The Clause 9 : Point added “The Metering CT cable must lay over the ground, not in the cable trench” for Bulk Consumer.

1. SCOPE :

This specification covers the design, manufacture, assembly, testing at the manufacturer's works of $SF_6$ filled current transformers of 400KVvoltage class & Oil filled Current Transformers of400KV, 220KV, 132KV & 33KV voltage class

2. STANDARD :

The current transformers and accessories covered by this specification shall comply with the requirement of the latest edition of the following standards unless otherwise stated in this specification.

IS: 16227 (2016) : Specification for current Transformers.
IS: 4201 : Application guide for current transformers.
IS: 5621/2099 : Specification for Bushings/hollow insulators for alternating voltages above 1000V.
IS: 335 : Specification for insulation oil for transformers and switchgears IEC: 60044-1 : Current Transformer.
IEC: 60815 : Guide for selection of Insulators in respect of polluted condition.
IEC: 60296
IEC: 60376 : SF6 gas
IEC: 61462 : Silicon Composite Insulator

3. DEVIATION :

Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the Deviation Schedule with reasons duly supported by documentary evidence. Such deviations suggested may or may not be accepted by the Board. Deviations not mentioned in Deviation schedule will not be considered.

4. DESIGN & CONSTRUCTION OF SF6 FILLED CURRENT TRANSFORMERS:

The design features and construction details of current transformer shall be in accordance with the requirement stipulated in this specification and as per relevant IS.

i) The CT's shall be single phase, Live tank, SF6 filled, Hermetically sealed outdoor type withsilicon composite insulator.
ii) The SF6 current transformers shall be complete in all respects and shall conform to the modern practice of design and manufacture.
iii) The SF6 current transformers shall be of low Reactance outdoor type, single phase, 50 Hz, with Silicon composite Insulators suitable for operation under the service conditions and site requirement as described in this technical specification.
iv) The maximum permissible temperature rise of the SF6 current transformer winding when carrying a primary current equal to the rated continuous current at rated frequency and with rated burden over an ambient temperature (not exceeding 50$^{o}$C) and daily
average not exceeding 40$^{o}$C shall not exceed the limits as specified in case of Class E insulation.
v) The SF6 current transformers shall be suitable for up right mounting on steel structures. Necessary flanges, bolts, clamp fittings etc. for base of SF6 CT shall also be supplied by the Manufacturer/Contractor. vi) The metal tanks shall have bare minimum no. of welded joints so as to minimize possible locations of gas leakage.
vii) The head of the CT shall be made of Aluminium alloy. A steel rupture disc with suitable bursting pressure shall be provided on the top of the head to prevent any abnormal rise in the internal pressure due to any internal fault & avoid an explosion of the CT.
viii) The SF6 CT shall be complete with all accessories like primary & secondary terminals, weather proof terminal box for secondary connection, lifting lugs, terminal connector, grounding terminals,

name plate, SF6 filling valve, Silicon composite insulator, rupture disc, SF6 Pressure Gauge with two N/C contact for alarm purpose, Spacer, Head housing, outlet tube etc. Separate valve shall be provided on the equipment for connecting vacuum pump or gas filling device for topping up or removal of gas inside the equipment. Two nos. of complete gas filling device shall be within the scope of supply of the contractor for each substation without any additional price. Supply of terminal connectors shall be guided by the technical specification of Clamps & Connectors.

ix) The CT shall be provided with class - E insulation. It shall be of hermetically sealed type construction to prevent air & moisture from entering the tank. The design and construction of CTs shall be sufficient to withstand the thermal and mechanical stresses resulting from the specified short circuit currents and specified duration as mentioned in Specific Technical Parameters.

x) The core of the SF6 CTs shall be high grade non-ageing, electrical, CRGO silicon steel laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over current.

xi) The exciting current shall be as low as possible and the SF6 CTs shall be capable of maintaining its rated accuracy at different burdens and within saturation limits.

xii) Rating plate marking shall be provided as per relevant clause of IS:16227 & relevant IEC. xiii) CT Characteristics shall be such as to provide satisfactory performance as per IS:16227 forburdens ranging from at least 25% to 100% of rated burden over a range of 5% to 120% of rated current in case of metering CT cores and upto knee point voltage in case of protection CT cores.

xiv) The SF6 CT secondary terminals shall be brought out in a weather proof terminal box. The terminal box shall be provided with glands suitable for 1.1 KV grade, steel armoured PVC insulated, PVC sheathed multicore 4 Sq.mm stranded copper conductor cable Connection between CT to CT Junction Box is to be done with 4 core copper control cable for individual core Connection between CT Junction Box to C&R Panel is to be done with 4 sq mm copper cable for individual core..

xv) The CT secondary to be used for metering and instruments shall be of accuracy class and ISF as specified. The saturation factor of this core shall be low enough so as not to cause any damage to measuring instruments in the event of maximum short circuit current. xvi) The CT secondary to be used for protective relaying purposes shall be of accuracy class and Knee Point Voltage as specified. The magnetisation curve of the cores shall be furnished with tender.

xvii) The ratio changing arrangement shall be provided on secondary side of CT. Terminal markings for connections shall be marked on both primary and secondary terminals of each CT.

xviii) Secondary winding of 400kV CT shall be of copper only. However Primary winding of 400kV CT shall either be Aluminium or Copper.

xix) The CT shall be provided with Gas Density Monitor with separate potential free Alarm & Trip contact.

xx) Arrangement of remote monitoring for alarm or tripping shall also be provided.

xxi) Due to opening & closing of SF6 gas filling & draining valve hermetic sealing of CT shall not be disturbed.

xxii) Facility shall be provided for short circuiting & grounding of the CT sec terminals inside the terminal box.

xxiii) The CT shall provide freedom from Capacitance & tanδ measurement.

xxiv) If any auxiliary CT's are to be used in the current transformer then all parameters specified shall have to be met treating auxiliary C.T.s as an integral part of the current transformer. The auxiliary C.T. shall preferably be of inbuilt construction of the CTs or to be mounted inside secondary terminal box of Main CT.

## 5. DESIGN & CONSTRUCTION OF OIL FILLED CURRENT TRANSFORMERS :

The design features and construction details of current transformer shall be in accordance with the requirement stipulated in this specification and as per relevant IS.

i) The current transformers shall be complete in all respects and shall conform to the modern practice of design and manufacture.

ii) The current transformers shall be of low Reactance outdoor type, single phase, 50 Hz, selfcooled oil filled with shaded porcelain bushing/Insulators suitable for operation under the service conditions as specified in the general condition of site suitable for outdoor operation.

iii) The maximum permissible temperature rise of the current transformer winding when carrying a primary current equal to the rated continuous current at rated frequency and with rated burden over an ambient temperature (not exceeding 50°C) and daily average not exceeding 40°C shall not exceed the limits as specified below :

| Class of insulation | | Maximum Temperature Rise (°C) |
|---|---|---|
| a) All classes immersed in oil (Measured by Resistance method) | : | 55°C |
| b) Oil at the top of the tank or housing (Measured by Thermometer) | | |
| i) With Conservator/Inert Gas | : | 50°C |
| ii) Without Conservator/Inert Gas | : | 45°C |

iv) The current transformers shall be suitable for up right mounting on steel structures. Necessary flanges, bolts, clamps fittings etc. for base of CT shall also be supplied by the Manufacturer/Contractor.

v) The CT shall be complete with all accessories like primary & secondary terminals, terminal connectors, weather proof terminal box for secondary connection, lifting lugs, grounding terminals, oil sight glass, filling and draining valves and name plate.

vi) The CT shall be oil immersed type provided with class - A insulation. It shall be of hermetically sealed type construction to prevent air & moisture from entering the tank. The design and construction of CTs shall be sufficient to withstand the thermal and mechanical stresses resulting from the specified short circuit currents and specified duration as mentioned in General Technical Specification.

vii) The core of the CTs shall be high grade non-ageing, electrical, CRGO silicon steel laminated steel of low hysteresis loss and high permeability to ensure high accuracy at both normal and over current.

viii) The exciting current shall be as low as possible and the CTs shall be capable of maintaining its rated accuracy at different burdens and within saturation limits.

ix) Rating plate marking shall be provided as per relevant clause of IS:16227.

x) CT Characteristics shall be such as to provide satisfactory performance as per IS:16227 forburdens ranging from at least 25% to 100% of rated burden over a range of 5% to 120% of rated current in case of metering CT cores and upto knee point voltage in caseof protection CT cores.

xi) The CT secondary terminals shall be brought out in a weather proof terminal box. The terminal box shall be provided with glands suitable for 1.1 KV grade, steel armoured, PVC insulated, PVC sheathed multicore 4 Sq. mm stranded copper conductor cable Connection between CT to CT Junction Box is to be done with 4 core copper control cable for individual core Connection between CT Junction Box to C&R Panel is to be done with 4 sq mm copper cable for individual core.

xii) The CT shall be hermetically sealed. Each CT shall be provided with oil level gauge and a pressure releasing device to just release the abnormal internal pressure.

xiii) The CT secondary to be used for metering and instruments shall be of accuracy class and ISF as specified. The saturation factor of this core shall be low enough so as not to cause any damage to measuring instruments in the event of maximum short circuit current. xiv) The CT secondary to be used for protective relaying purposes shall be of accuracy class and Knee Point Voltage as specified. The magnetisation curve of the cores shall be furnished with tender.

xv) Upto 33 KV level the CTs must be Dead Tank type and from 132 KV onwards the CTs shall be of either Live Tank or Dead Tank type. For 132KV and onwards current transformer STUD arrangement should be in horizontal configuration.

xvi) The ratio changing arrangement shall be provided on secondary side of CT. Terminal markings for connections shall be marked on both primary and secondary terminals of each CT.

xvii) Primary winding shall be of copper for 33KV, 132KV. For 220KV& 400KV current transformer primary winding may be Aluminum or copper considering current density for primary winding max 1.75 A/sq. mm for copper and 0.75 A/Sq.mm for aluminium.

xviii) Secondary winding of all voltage class CT shall be made of Copper.

xix) If any auxiliary CT's are to be used in the current transformer then all parameters specified shall have to be met treating auxiliary C.T.s as an integral part of the current transformer. The auxiliary C.T. shall preferably be of inbuilt construction of the CTs or to be mounted inside secondary terminal box of Main CT.

6. INSULATOR HOUSING (FOR SF6 CT) :

i) The Silicon Composite Insulator shall be of Manufacturer's make.

ii) Silicon composite insulator is to be used for SF6 filled CT as per relevant IS & IEC. The insulator housing shall be of shatter proof.

iii) The insulation of silicon composite insulator shall be co-ordinate with that of the SF6 current transformer such that the flashover, if any will occur only external to the CT.

iv) Each of the silicon composite insulators shall have creepage distance suitable for different voltage class as per specific technical parameters.

v) Cantilever strength of silicon composite insulators of SF6 CT is to be furnished.

vi) The insulator housing shall be of 'Shatter proof' high quality Silicon Composite material. The Silicon sheds shall exhibit hydrophobic property and also should be able to transfer the property of pollution layer.

vii) The insulator housing shall be of a single piece construction without any joints or coupling.

7. BUSHING (FOR OIL FILLED CT):

viii) Oil filled condenser type porcelain bushing/Insulator conforming to latest edition of IS:2099/IS:5621 shall be used for the CTs above 33KV class and up to 220KV class. The Silicon Composite Insulator shall be used for 400KV CT.

ix) Oil expansion chamber and bushing clamp shall be of high strength. They shall have smooth surface to prevent discharge taking place between the metal parts and porcelain as a result of ionisation. Ferrous Parts only shall be hot dip galvanised.

x) The insulation of bushings shall be co-ordinated with that of the current transformer such that the flashover, if any will occur only external to the CT.

xi) Each of the bushings porcelain shall have creepage distance suitable for different voltage class as specified in specific technical parameters.

xii) Cantilever strength of Bushing/insulator shall be as per Cl. No. 5.5 of IS:2099 (latest edition) for all voltage classes.

8. GROUNDING TERMINALS :

Two grounding terminals on diagonally opposite sides suitable for connecting G.S. Flat of 50×10mm for all voltage classes shall be provided.

9. SECONDARY TERMINAL BOX :

i) All secondary terminals shall be brought out in a compartment on one side of each current transformer for easy access. CT sec. terminal box shall be made of sheet steel having minimum thickness of 3 mm. However, 2 mm. thickness having power coated painting is acceptable.

ii) The exterior of this terminal box shall be hot-dip galvanized or painted. iii) Arrangement for shorting of CT secondary terminals shall be provided in the CT secondary terminal box with supply of shorting link made of copper.

iv) The terminal box shall be provided with removable cable gland plate with provision of punching at bottom for mounting required number of cable glands of 1.1 KV grade steel wire armoured, PVC

insulated PVC sheathed 4 sq.mm multicore stranded copper conductor cables. The cable glands shall be included within the scope of supply.

v) The terminal box shall be provided with a door in front so as to have easy access of secondary terminals. The door shall have a sealing/ locking arrangement and shall be suitable to prevent penetration of moisture and rain water. Degree of protection shall not be less than IP 55 as per relevant IS.

vi) All terminals shall be clearly marked with identification number to facilitate connection to external wiring with sufficient space in between.

vii) The Metering CT cable must lay over the ground, not in the cable trench. [R 9.1]

10. PAINTING :

i) The tank and top metallic cover shall be hot-dip galvanized or painted. All steel surfaces shall be cleaned by sand blasting or chemical process as required to produce a smooth surface, free of scale, grease and dirt. However Aluminium casting CT tank with PU paint is also acceptable. ii) Steel surface in contact with insulating oil shall be painted with heat resistant oil insoluble insulating varnish.

iii) External surfaces shall be given a coat of high quality red or yellow chromate primer and finished with two coats of synthetic enamel paints (light grey as per shade 631 of IS:5)

iv) Paints shall be carefully selected to withstand tropical heat, rain etc. The paints shall not scale off or crinkle or be removed by abrasion due to normal handling.

11. SF6 GAS:

The SF6 gas shall comply with IEC 60376; 60376A and 60376B and shall be suitable in all respect for use in the switchgear under operating condition.

12. INSULATING OIL:

Insulating oil to be used for current transformer shall be of EHV grade and shall confirm to IS:335 (required for first filling).

13. TESTS AT FACTORY AND TEST CERTIFICATES :

i) Each C.T. shall comply with the requirements of routine test as specified in IS:16227. ii) All Routine test at manufacturer's works on all CTs shall be carried out and Test Reports are to be submitted to WBSETCL alongwith inspection call letter. For 66KV & above voltage class CT's Dielectric Dissipation Factor (tanδ) is to be measured at manufacturer's works for all CTs wherever applicable. The measured tanδ values indicating sl. No. of CTs are to be submitted along with submission of inspection offer. During physical inspection ofCTs at the manufacturer's works officers of WBSETCL shall witness Routine/Acceptance test i.r.o 10% or more as per IS/IEC for all voltage class CTs (33KV to 400KV). However tanδ value is to be measured for all CTS of 132KV & above voltage class during routine/acceptance test at the manufacturer's works in presence of representative of WBSETCL.

iii) All Acceptance tests shall be carried out at the manufacturer's works on every lot offered for inspection as per relevant IS. Selection of samples for acceptance test as well as rejection and retesting shall be guided by relevant IS& IEC. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price of Current Transformer. Three (3) copies of test reports shall be submitted for approval and adequate extra copies for distribution to site. iv) The contractor shall give at least 15 (fifteen) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

14. TEST REPORTS AND TYPE TESTS :

Only type tested Current transformers from the maker's list of WBSETCL are to be offered for 400KV, 220KV, 132KV and 33KV class CT's conforming to our technical specification, and relevant IS and IEC. Current Transformer offered should be similar with ones on which type testing has been carried out as per relevant IS and IEC. Three sets of complete test report of all test (including Type Test of CT as well as for Silicon composite insulator),as stipulated in the relevant IS & IEC, carried out in Govt. recognized Test House or Laboratory /NABL accredited laboratory shall have to be submitted by successful bidder positively along with submission of drawings during detailed Engineering. Successful bidder may be required to produce original copies of type test reports at the time of detail engineering, if asked by WBSETCL. Each type test report shall comply with the following information with test result: - i) Complete identification, date and serial no.

ii) Relevant drawings as documented with test report.

iii) Method of application, where applied, duration and interpretation of each test.

iv) All Type tests report which have been carried in accordance with IEC:44-1/IS:16227 including "Fast Transient Test" report to assess the CT performance having 300KV or higher voltage class in service to withstand high frequency over voltage generated due to closing &opening of isolators & Breaker

15. GURANTEE :

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering along with submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

16. CONTRACT DRAWINGS AND MANUALS :

In the event of placement of order the following drawings and manuals shall be submitted in six (6) copies for approval.

a) General outline dimension drawing of current transformers furnishing front and side elevation, top and bottom plan, views showing all accessories, mounting arrangement on steel structures, spacing and size of the bolts, total creepage distance of bushing, electrical diagram for primary and secondary connections with polarity mark, terminal arrangement for secondary terminal box, size of primary terminals, grounding terminals and lifting lugs, quantity of insulating oil, net and shipping weight, shipping dimension etc.

b) Name and rating plate diagram of CT.

c) Marked erection point identifying the component parts of SF6 CT

d) Detail view of core, winding assembly, winding connections and tappings.

e) Guaranteed Technical particulars

After approval, four (4) sets of approved drawings and operating and maintenance manual including the instruction manual both in soft and hard format shall be submitted for our record and distribution to site.

Instruction manual should contain :

a) A brief description of C.T. furnishing the constructional features.

b) Instruction for handling, storing, erection, commissioning and operation and maintenance of C.Ts

c) General outline drawing of the C.Ts along with all components and accessories.

d) Marked erection points identifying the component parts of C.T.

e) Detailed dimensions of assembly and description of all accessories.

f) Detailed views of Core, winding assembly, winding connections and its tapping.

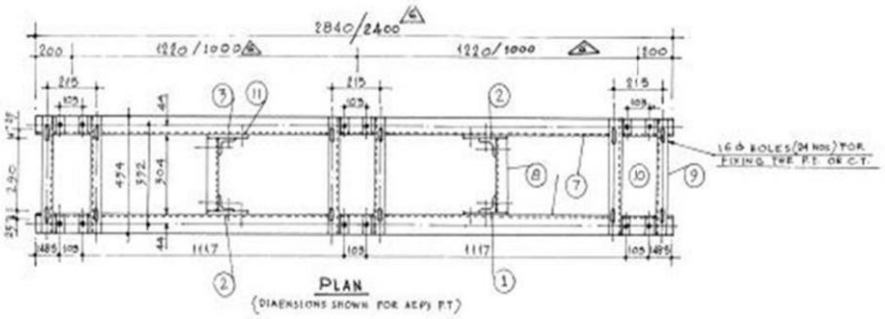
g) List of spares and other necessary information for C.Ts.

h) A set of approved test certificate.

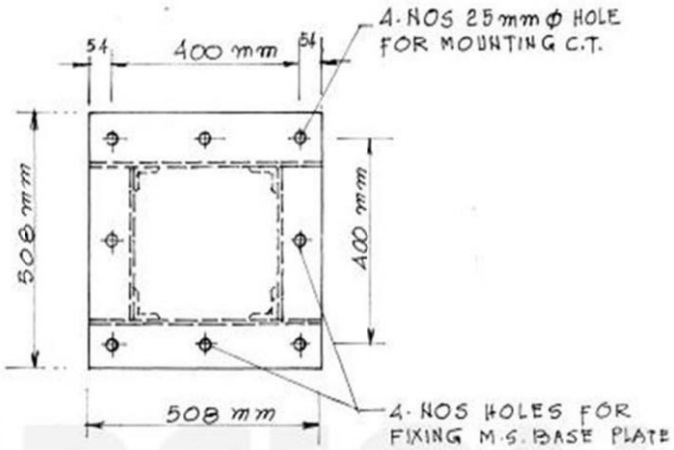
i) All notes and legends of the drawings shall be furnished in English and all dimensions shall be marked in metric units.

Special Notes –

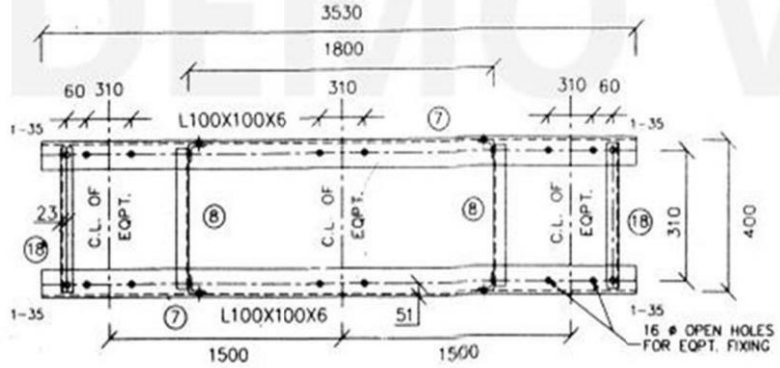
- For 132KV and above rated CTs, tanδ value of a new CT should not exceed 0.4% at 10KV & rated voltage. And it should not go beyond 0.7% during the 5 years guarantee period. During maintenance period, rate of increase of tanδ should not be more than 0.1% per year or 0.2% biannually. No temperature correction factor shall be considered. If these conditions are not maintained within guarantee period, free of cost replacement of CT will have to be done by manufacturer / turn-key contractor, as applicable.
- For 33KV CTS, horizontal Stud is to be provided, vertical stud is not acceptable.
- For 33KV and 132KV CTs, common Baseplate suitable for all the structures of that voltage class is to be designed and supplied for mounting arrangement. Reference structure drawings are given under.




33 KV CT STRUCTURE (SST/33/167)

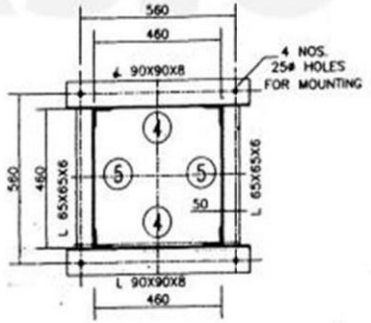



132 KV KV CT STRUCTURE (SST/141/141)




33 KV 3PH CT STRUCTURE ( JBIC)

DRG.NO. ABC/33/DWG/3CTL




132 KV 1PH CT STRUCTURE ( JBIC)

ABC/132/DWG/CT3/LOT-IV

DEMO VERSION

A. CORE DETAILS OF CURRENT TRANSFORMER (for AIS Sub-Station)

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. a) | 400 KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer, Bus Reactor, Bus Coupler & Bus Transfer Bay | 5 | 1 | Protection | 2000-1000/1A | | | PX Class | 2000/1000 | 10/5 | 30/60 |
| | | | 2 | Protection | 2000-1000/1A | | | PX Class | 2000/1000 | 10/5 | 30/60 |
| | | | 3 | Metering | 2000-1000/1A | 15 | 5 | 0.2S | | | |
| | | | 4 | Protection | 2000-1000/1A | | | PX Class | 2000/1000 | 10/5 | 30/60 |
| | | | 5 | Protection | 2000-1000/1A | | | PX Class | 2000/1000 | 10/5 | 30/60 |
| b) | 400kV CT (One & a Half Breaker) | | | | | | | | | | |
| i | Line side CT | 6 | 4 cores | Protection | 3000-2000/1A | | | PX Class | 3000/2000 | 15/10 | 30/45 |
| | | | 2 cores | Metering | 3000-2000-1000/1A | 15 | 5 | 0.2S | | | |
| ii | Tie & Bus side CT | 4 | 4 cores | Protection | 3000-2000/1A | | | PX Class | 3000/2000 | 15/10 | 30/45 |
| c) | Bushing CT (Transformer) | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| i | 400KV side, 220kV side & Neutral of 315 MVA, 400/220/33KV Transformer | 1 | 1 | Protection | 1000/1A | | | PX Class | 1000V | 2.5 | 30 at Vk/2 |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| d) | Bushing CT (Bus Reactor) | | | | | | | | | | |
| i | 400KV line side of 80MVAR Bus Reactor | 4 | 1 | Protection | 200/1A | | | PX Class | 200V | 1 | 40 at Vk/4 |
| | | | 2 | Protection | 200/1A | | | PX Class | 200V | 1 | 40 at Vk/4 |
| | | | 3 | Protection | 200/1A | | | PX Class | 200V | 1 | 40 at Vk/4 |
| | | | 4 | Metering | 200/1A | 10 | 5 | 1 | | | |
| ii | Neutral side of 80MVAR Bus Reactor | 4 | 1 | Protection | 2000-1000/1A | | | PX Class | 2000/1000V | 10/5 | 30/60 |
| | | | 2 | Protection | 2000-1000/1A | | | PX Class | 2000/1000V | 10/5 | 30/60 |
| | | | 3 | Protection | 200/1A | | | PX Class | 200V | 1 | 40 at Vk/4 |
| | | | 4 | WTI | | 10 | | | | | |
| 2. a) | 220 KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer & | | 1 | Metering | 1000-800-400/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/ 600V | 5/4/2 | 30/37.5/75 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bus Transfer Bay | 5 | 3 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/ 600V | 5/4/2 | 30/37.5/75 |
| | | | 4 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/ 600V | 5/4/2 | 30/37.5/75 |
| | | | 5 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/ 600V | 5/4/2 | 30/37.5/75 |
| ii | Bus Coupler | 3 | 1 | Metering | 2000-1600/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 10/8 | 30/37.5 |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 10/8 | 30/37.5 |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| iii | Feeder, Transformer & Bus Transfer Bay (if mentioned in BOQ) | 5 | 1 | Metering | 2000-1600/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 2000/1600 | 10/8 | 30/37.5 |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 2000/1600 | 10/8 | 30/37.5 |
| | | | 4 | Protection | 2000-1600/2A | | | PX Class | 2000/1600 | 5/4 | 30/37.5 |
| | | | 5 | Protection | 2000-1600/2A | | | PX Class | 2000/1600 | 5/4 | 30/37.5 |
| b) | Bushing CT (Transformer) | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| i | 220KV side, 132KV side & Neutral of 160MVA Transformer | 1 | 1 | Protection | 800/1A | | | PX Class | 1000V | 2.5 | 30 at Vk/2 |
| ii | 220KV side & Neutral of 50MVA Transformer | 1 | 1 | Protection | 400/1A | | | PX Class | 800V | 1.5 | 30 at Vk/2 |
| c) | 33 KV CT for Tertiary Loading | | | | | | | | | | |
| i | 220/132/33 KV Transformer Bay | 3 | 1 | Metering | 200-100/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 200-100/1A | | | PX Class | 1200/600V | 4/2 | 30 |
| | | | 3 | Protection | 200-100/1A | | | PX Class | 1200/600V | 4/2 | 30 |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3. a) | 132KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer & Bus Transfer Bay | | 1 | Metering | 1000-800-400/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/600V | 5/4/2 | 30/37.5/75 |
| | | | 3 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/600V | 5/4/2 | 30/37.5/75 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 4 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/600V | 5/4/2 | 30/37.5/75 |
| | | | 5 | Protection | 1000-800-400/1A | | | PX Class | 1500/1200/600V | 5/4/2 | 30/37.5/75 |
| ii | Bus Coupler Bay | 3 | 1 | Metering | 2000-1600/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 8/6.4 | 30/37.5 |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 8/6.4 | 30/37.5 |
| iii | If mentioned in BOQ | 5 | 1 | Metering | 2000-1600/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 8/6.4 | 30/37.5 |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 8/6.4 | 30/37.5 |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 8/6.4 | 30/37.5 |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 2000/1600V | 8/6.4 | 30/37.5 |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance(W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b) | Bushing CT (Transformer) | | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| i | 132KV side & Neutral of 50MVA Transformer | 1 | 1 | Protection | 400-300/1A | | | PX Class | 800-600V | 1.5 | 30 at Vk/2 |
| ii | 33KV side of 50MVA Transformer | 1 | 1 | Protection | 1000/1A | | | PX Class | 500 | 2.5 | 30 at Vk/2 |
| iii | 132KV side & Neutral of 31.5MVA Transformer | 1 | 1 | Protection | 150/1A | | | PX Class | 600 | 1.5 | 30 at Vk/2 |
| iv | 33KV side of 31.5MVA Transformer | 1 | 1 | Protection | 800/1A | | | PX Class | 400 | 2.5 | 30 at Vk/2 |
| c) | 132KV CT for Railway Traction Sub-Stations& for Bulk (only for Metering purpose) | | | | | | | | | | |
| i | Feeder – without Circuit Breaker | 2 | 1 & 2 | Metering | 200-100/1A | 15 | 5 | 0.2S | | | |
| ii | Feeder – as Special | 2 | 1 & 2 | Metering | 50-25/1A | 15 | 5 | 0.2S | | | |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4. a) | 33KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer, Capacitor Bank & Bus Transfer Bay | 3 | 1 | Metering | 1000-800-400/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 1000-800-400/1A | | | PX Class | 1000/800/400 | 4/3.2/1.6 | 30/37.5/75 |
| | | | 3 | Protection | 1000-800-400/1A | | | PX Class | 1000/800/400 | 4/3.2/1.6 | 30/37.5/75 |
| ii | If mentioned in BOQ | 3 | 1 | Metering | 2000-1000/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 2000-1000/1A | | | PX Class | 2000/1000 | 8/4 | 30 at Higher Ratio at Vk/2 |
| | | | 3 | Protection | 2000-1000/1A | | | PX Class | 2000/1000 | 8/4 | 30 at Higher Ratio at Vk/2 |
| iii | If mentioned in BOQ | 3 | 1 | Metering | 400-200/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 400-200/1A | | | PX Class | 800/400 | 4/2 | 30 at Higher Ratio at Vk/2 |
| | | | 3 | Protection | 400-200/1A | | | PX Class | 800/400 | 4/2 | 30 at Higher Ratio at Vk/2 |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance(W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| b) | 33KV CT (Indoor Switchgear including GIS) | | | | | | | | | | |
| i | Transformer (In comer) | 3 | 1 | Metering | 2000-1000/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 2000-1000/1A | | | PX Class | 500/250 | 10/5 | 30 @ Highest Ratio |
| | | | 3 | Protection | 2000-1000/1A | | | PX Class | 500/250 | 10/5 | 30 @ Highest Ratio |
| ii | Feeder, Capacitor Bank & Bus Transfer Bay | | 1 | Metering | 800-400/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 800-400/1A | | | PX Class | 500/250 | 10/5 | 30 @ Highest Ratio |
| | | | 3 | Protection | 800-400/1A | | | PX Class | 500/250 | 10/5 | 30 @ Highest Ratio |
| iii | Bus Coupler Bay | 2 | 1 | Metering | 2000-1000/1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection (O/C & E/F) | 2000-1000/1A | | | PX Class | 500/250 | 10/5 | 30 @ Highest Ratio |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5a) | 11KV CT (Bay) | | | | | | | | | | |
| i | Incomer | 4 | 1 | Metering | 600-400/ 1A | 15 | 5 | 0.2S | | | |
| | | | 2 | Protection | 600-400/ 1A | | | PX Class | 300/200 | 4/2 at 75°C | 30 at Vk/2 at higher ratio |
| | | | 3 | Protection | 600-400/ 1A | | | PX Class | 300/200 | 4/2 at 75°C | 30 at Vk/2 at higher ratio |
| | | | 4 | Protection | 600-400/ 1A | | | PX Class | 300/200 | 4/2 at 75°C | 30 at Vk/2 at higher ratio |
| ii | | 2 | 1 | Metering | 400-200/ 1A | 15 | 5 | 0.2S | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Outgoing Feeder | | 2 | Protection | 400-200/ 1A | | | PX Class | 200/100 | 2 at 75°C | 30 at Vk/2 at higher ratio |

B. CORE DETAILS OF CURRENT TRANSFORMER (FOR GIS SUB-STATION ONLY)

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. a) | 400 KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer, Bus Reactor, Bus Coupler & Bus Transfer Bay | 5 | 1 | Protection | 2000-1000/1A | | | PX Class | 800@ Lowest ratio | 10/5 | 30 @ Highest Ratio |
| | | | 2 | Protection | 2000-1000/1A | | | PX Class | 800@ Lowest ratio | 10/5 | 30 @ Highest Ratio |
| | | | 3 | Metering | 2000-1000/1A | 15 | 5 @ all ratio | 0.2S[R9.1] | | | |
| | | | 4 | Protection | 2000-1000/1A | | | PX Class | 800@ Lowest ratio | 10/5 | 30 @ Highest Ratio |
| | | | 5 | Protection | 2000-1000/1A | | | PX Class | 800@ Lowest ratio | 10/5 | 30 @ Highest Ratio |
| b) | 400kV CT (One & a Half Breaker GIS) | | | | | | | | | | |
| i | Line side CT | 6 | 4 cores | Protection | 3000-2000/1A | | | PX Class | 1000@ Lowest ratio | 15/10 | 30 @ Highest Ratio |
| | | | 2 cores | Metering | 3000-2000-1000/1A | 15 | 5@ all ratio | 0.2S[R9.1] | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ii | Tie & Bus side CT | 4 | 4 cores | Protection | 3000-2000/1A | | | PX Class | 1000@ Lowest ratio | 15/10 | 30 @ Highest Ratio |
| c) | Bushing CT (Bus Reactor) | | | | | | | | | | |
| i | Neutral side of 80MVAR Bus Reactor | 4 | 1 | Protection | 2000-1000/1A | | | PX Class | 800 @ Lowest ratio | 10/5 | 30 @ Highest Ratio |
| | | | | | | | | | | | |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2 | Protection | 2000-1000/1A | | | PX Class | 800 @ Lowest ratio | 10/5 | 30 @ Highest Ratio |
| | | | 3 | Protection | 200/1A | | | PX Class | 200V | 1 | 40 at Vk/4 |
| | | | 4 | WTI | | 10 | | | | | |
| 2. | 220 KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer & Bus Transfer Bay | 5 | 1 | Metering | 1600-800-400/1A | 15 | 5 | 0.2S[R9.1] | | | |
| | | | 2 | Protection | 1600-800/1A | | | PX Class | 800 @ Lowest ratio | 8/4 | 30 @ Highest Ratio |
| | | | 3 | Protection | 1600-800/1A | | | PX Class | 800 @ Lowest ratio | 8/4 | 30 @ Highest Ratio |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 4 | Protection | 1600-800/1A | | | PX Class | 800 @ Lowest ratio | 8/4 | 30 @ Highest Ratio |
| | | | 5 | Protection | 1600-800/1A | | | PX Class | 800 @ Lowest ratio | 8/4 | 30 @ Highest Ratio |
| ii | Bus Coupler | 3 | 1 | Metering | 2000-1600/1A | 15 | 5 @ all ratio | 0.2S[R9.1] | | | |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 800 @ Lowest ratio | 10/8 | 30 @ Highest Ratio |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 800 @ Lowest ratio | 10/8 | 30 @ Highest Ratio |

| Sl. No. | Description | No of Core | Core No. | Application | Current Ratio | Output Burden (VA) at Lower Ratio | ISF (Max) | Accuracy class as per IS 16227 | Min Knee point Voltage (V) | Max CT Secy Winding Resistance (W) | Max excitation current (mA) at Knee point Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3. | 132KV CT (Bay) | | | | | | | | | | |
| i | Feeder, Transformer & Bus Transfer Bay | 5 | 1 | Metering | 1000-800-400/1A | 15 | 5 | 0.2S[R9.1] | | | |
| | | | 2 | Protection | 1000-800/1A | | | PX Class | 800 @ Lowest ratio | 5/4 | 30 @ Highest Ratio |
| | | | 3 | Protection | 1000-800/1A | | | PX Class | 800 @ Lowest ratio | 5/4 | 30 @ Highest Ratio |
| | | | 4 | Protection | 1000-800/1A | | | PX Class | 800 @ Lowest ratio | 5/4 | 30 @ Highest Ratio |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 | Protection | 1000-800/1A | | | PX Class | 800 @ Lowest ratio | 5/4 | 30 @ Highest Ratio |
| ii | Bus Coupler Bay | 3 | 1 | Metering | 2000-1600/1A | 15 | 5 @ all ratio | 0.2S[R9.1] | | | |
| | | | 2 | Protection | 2000-1600/1A | | | PX Class | 600 @ Lowest ratio | 8/6.4 | 30 @ Highest Ratio |
| | | | 3 | Protection | 2000-1600/1A | | | PX Class | 600 @ Lowest ratio | 8/6.4 | 30 @ Highest Ratio |
| | | | | | | | | | | | |

SPECIFIC TECHNICAL PARTICULARS OF CURRENT TRANSFORMER

| Sl. NO | DESCRIPTION | TECHNICAL PARAMETERS | | | |
|---|---|---|---|---|---|
| | | 400 KV | 220KV | 132 KV | 33 KV |
| 1. | Rated system voltage KV(rms) | 400KV | 220 | 132 | 33 |
| 2. | Highest system voltageKV(rms) | 420KV | 245 | 145 | 36 |
| 3. | Rated current(Amp)/Burden(VA) | As per schedule of requirements | | | |
| 4. | System frequency (Hz) | 50 | | | |
| 5. | System neutral earthing | Effectively Earthed | | Effectively Earthed | Earthed through grounding transformer for 220/132/33KV & 132/33KV substation |
| 6. | Installation | Outdoor | | | |
| 7. | Extended current rating | 120 % Max. | | | |
| 8. | Rated short time thermal current for 1 second/3 second (KArms) | 50 for 1 sec. | 40 (3 sec) | 31.5 (3 sec) | 31.5 (3 sec) |
| 9. | Rated Dynamic current KA (peak) (should be at least 2.5 times of above rating | 125 | 100 | 78.8 | 78.8 |
| 10. | Rated Insulation level :<br>a) 1.2/50 microsecond impulse withstand voltage (KVpeak)<br>b) One minute power frequency withstand voltage (KVrms) on primary winding | 1425<br>630 | 1050<br>460 | 650<br>275 | 170<br>70 |
| 11. | Power frequency over voltage withstand requirements for secondary winding for one minute (KVrms) | 3 | | | |
| 12. | Over voltage interturn test | As per clause 9.5 of IS:16227 & relevant IEC | | | |
| 13. | Creepage Distance(Heavily polluted atmosphere) Total | 10500 | 6125 | 3625 | 900 |

| | | |
|---|---|---|
| 14. | Limit of temp. rise of windings $^{O}C$ at rated current | $55^{O}C$ |

| | | | | | |
|---|---|---|---|---|---|
| 15. | Type of mounting | Pedestal Type | | | |
| 16. | Insulation medium | SF6 Gas / Oil (as per schedule) | Oil | | |
| 17. | Type of Tank | Live Tank / Dead Tank | | | Dead Tank |
| 18. | Insulator | Silicon Composite Insulator | Oil filled condenser type porcelain bushing/Insulator | | |
| 19. | Instrument security factor | Less than 5 for metering core | | | |
| 20. | Type of connectors suitable for | 4" Al. pipe/ACSR Conductor. | 3" Al.Pipe/ ACSR conductor | 2.5" Al.Pipe/ ACSR conductor | 1.5" Al.Pipe/ACSR conductor |
| 21. | Minimum visible Corona discharge voltage (KVrms) | 320 | – | – | – |
| 22. | RIV test rms. (micro volts) | Not exceeding 1000 (at 266 KV rms) | Not exceeding 500 (at 156 KV rms) | Not exceeding 500 (at 92 KV rms) | - |
| 23. | Partial discharge level (PC) | Not exceeding 10 PC excluding 33KV. | | | |
| 24. | 250/2500 micro Sec. Switching impulse withstand dry & wet (between line terminals and ground) | □ 1050 KVp | | | |
| 25. | Class of insulation | E or A (as per schedule) | | A | |

GUARANTEED TECHNICAL PARTICULARS OF CURRENT TRANSFORMERS

(To be filled in and signed by the Bidder)

| | | |
|---|---|---|
| 1 | CT : GENERAL | |
| a) | Name of Manufacturer | |
| b) | Type & Model of the Manufacturer | |
| c) | Conforming Standard | |
| d) | Date of Last Type Test | |
| e) | Dead Tank or Live Tank Construction | |
| f) | Diameter of High Voltage Stud (mm) x Length (mm) | |

| | | |
|---|---|---|
| g) | Total Height of the CT | |
| h) | Total Weight of the CT | |
| i) | Material Used in Primary Winding | |
| j) | Material Used in Secondary Winding | |
| k) | Rated voltage (KV) | |
| 2 | CT INSULATION LEVEL | |
| a) | 1.2/50 micro second Impulse withstand voltage (dry) on primary winding (KV peak) | |
| b) | One minute power frequency withstand voltage(Dry) on primary winding (KV rms) | |
| c) | One minute power frequency withstand voltage(Wet) on primary winding (KV rms) | |
| d) | One minute power frequency withstand test voltage in secondary winding (KV rms) | |
| 3 | CT CURRENT | |
| a) | Rated primary current (Amp) | |
| b) | Rated secondary current (Amp) | |
| c) | Extended current rating (Amp) | |
| d) | Short time thermal rating of primary current for | |
| e) | 1 sec and 3 sec | |
| f) | Rated dynamic current of primary (KAp) | |
| g) | Rated continuous thermal current (KA rms) | |
| h) | Temperature rise at rated continuous thermal current over 50oC Ambient Temp. (oC) | |
| 4 | CT Bushing | |
| a) | Minimum creepage distance (mm) | |
| b) | Whether CT bushing is hermetically sealed or not | |
| c) | Cantilever Strength (Kgf) | |
| 5 | CT :Details of Cores | |
| a) | Current ratio | |
| b) | Accuracy Class/ALF/ISF | |
| c) | Kn/Ie/RCT at highest ratio | |