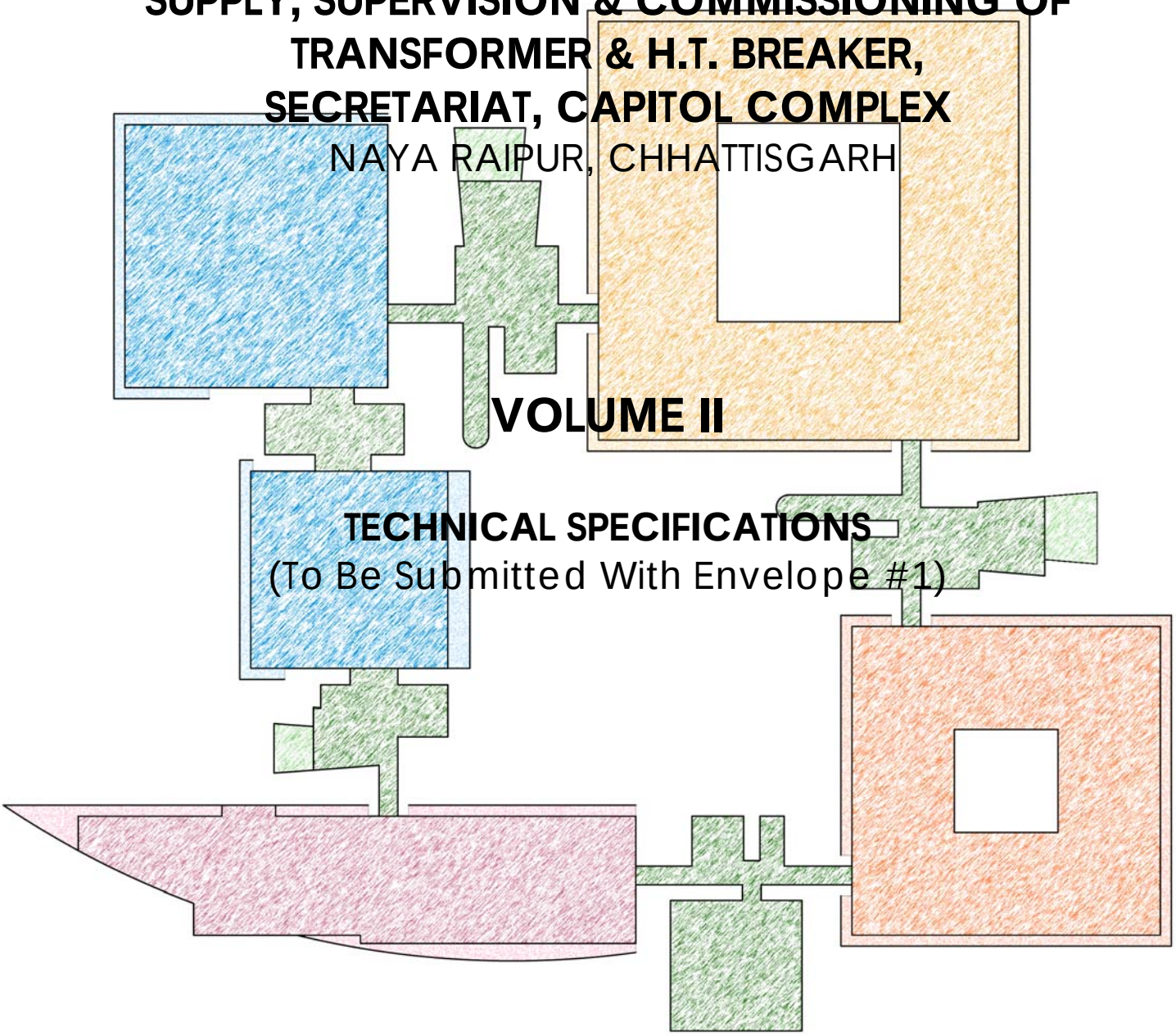
NAYA RAIPUR DEVELOPMENT AUTHORITY

TENDER

FOR

SUPPLY, SUPERVISION & COMMISSIONING OF TRANSFORMER & H.T. BREAKER, SECRETARIAT, CAPITOL COMPLEX

NAYA RAIPUR, CHHATTISGARH



VOLUME II

TECHNICAL SPECIFICATIONS

(To Be Submitted With Envelope #1)

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architecture & environment

TECHNICAL SPECIFICATIONS

1. DRY TYPE AUXILIARY TRANSFORMER

1.1 SCOPE

This specification covers performance, shop drawings, material, construction, manufacture, inspection, testing, packing forwarding & delivery at site of resin cast Dry Type Auxiliary Transformer with all accessories complete in all respects as described in this specification.

The CONTRACTOR shall supply, test at factory and commission, the following transformers along with accessories in accordance with the specification.

Sl. No.	Transformer Designation	KVA Capacity	Location	Qty.
1.	Dry Type Distribution Transformer	AS PER BOQ	AS PER DRG	AS PER BOQ

Whether called for specifically or not, all accessories required for normal operation of equipment are deemed to be considered as a part of the CONTRACTOR'S scope of supply. Hardware required for mounting and installation of the transformers is within the scope of work.

It is not the intent to specify completely herein, all details of design and construction of the equipment. However, the equipment shall conform in all respects to high standard of engineering, design and workmanship and be capable of performing in continuous commercial operation up to the Contractor's guarantees in a manner acceptable to the CLIENT, who will interpret the meaning of the drawings and specifications and shall be entitled to reject any work or material which is not full accordance therewith.

1.2 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

The design, material, construction, manufacture, inspection, testing and performance of dry type auxiliary transformer and associated equipment/accessories shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. Nothing in this specification shall be construed to relieve the CONTRACTOR of his responsibility. Where no standards are available, the supply items shall be of good quality and workmanship and backed by test results. Any supply items which are brought out by the CONTRACTOR shall be procured from approved MANUFACTURER acceptable to the CLIENT.

Equipment shall conform to the latest applicable standards and codes of practice as mentioned in this specification. In case of conflict between the standards, stringent specifications out of these standards shall govern, whereas in case of

conflict between the standards and this specification, requirements of this specification shall govern.

Other national standards are acceptable, if they are established to be equivalent to or superior to the listed standards. The CONTRACTOR shall provide English Version of Standards and codes applicable.

The Dry type auxiliary transformer shall conform to the currently applicable standards and codes of practice and reports as listed below:

SL. NO.	CODE NO.	TITLE
1.	IS-5	Colours of ready mixed paints and enamels
2.	IS-694	PVC insulated cables for working voltages upto and including l IOOV.
3.	IS-1271	Thermal evaluation arid classification of electrical insulation.
4.	IS-1893	Criteria for earthquake resistant design of structures.
5.	IS-2026	Power Transformers
6.	IS-2062	Steel for general structural purposes.
7.	IS-2099	Bushings for alternating voltages above l000 V
8.	IS-2147	Degrees of protection provided by enclosures for low voltage switchgear and control gear.
9.	IS-2707	Current transformers
10.	IS2848	Industrial platinum resistance thermometer sensors.
11.	IS-3043	Code of practice for earthing
12.	IS-3144	Mineral wool thermal insulation method of test.
13.	IS-3639	Fittings and accessories for power transformers
14.	IS-3716	Application guide for insulation co ordination.
15.	IS-6005	Code of practice for phosphating of iron and steel
16.	IS-6160	Rectangular conductors for electrical machines.
1 7.	IS-7421	Porcelain bushings for alternating voltage upto and including 1000V.
18.	IS-8183	Bonded mineral wool
19.	IS-10028	Code of practice for selection, installation and maintenance of transformers.
20.	IS-I 1171	Dry type power transformers.
21.	IS-14000	Quality Systems — Guidelines for selection and use of

		standards on Quality Systems.
22.	IEC-76	Power Transformers
23.	IEC-216	Guide for determination of thermal endurance properties of electrical insulating materials
24.	IEC-270	Partial discharge measurements.
25.	IEC-5511	Determination of transformer and reactor sound levels
26	IEC-606	Application guide for power transformers.
27.	IEC-616	Terminal and tapping markings for power transformers.
28	IEC-726	Dry-type power transformers.
29	IEC-344	IEEE recommended practice for seismic qualification of class-IE equipment for nuclear power generating stations.
30.	IEC-9000	International standard for quality management
31.	Indian Electricity Rules 1956	

1.3 SPECIFICATION OF MAIN EQUIPMENT AND ACCESSORIES

This section covers the brief specifications and parameters of dry type auxiliary transformer.

The transformer shall be dry type with cast resin two winding, three phase, 50Hz, indoor type, 1250 / 1600 / 2000 KVA rated, 33.0/ 0.415KV, two winding, having app 6 – 6.5% impedance respectively connected in Dyn11 with off circuit tap changer ranging from ± 7.5% in steps of 2.5%.

HV side termination shall be designed for connecting 33 KV (earthed)/ 22KV (unearthed system) XLPE insulated cables.

LT side terminations shall be designed for connecting to switchgear by means of the direct connection through inter-cubicle busbars/ bus duct. The neutral of the star connected winding shall be in two branches and shall be brought out to two separate bushing terminals. The neutral CT shall be located in the common portion of the neutral i.e. before bifurcation.

Technical parameters for the transformer and accessories are indicated in data sheets enclosed under this section.

1.4 EQUIPMENT CONSTRUCTION AND DESIGN DETAILS:

This section covers the specification of Dry Type Auxiliary Transformer. The transformer shall be dry type with cast resin. The transformer will be located outdoor and shall be suitable for site service conditions and the electrical system requirements as specified in DATA SHEETS of this section.

1.5 GENERAL CONSTRUCTION FEATURES

All material used shall be of best quality and of the class most suitable for working under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over excitation, short circuits as per specified standards, without distortion or deterioration or the setting-up of undue stresses in any part and also without affecting the strength and suitability of the various parts of the work which they have to perform. Transformer shall be provided with suitable enclosure/ cubicle. It shall be possible to withdraw the transformer from the enclosure after disconnecting the terminations without disturbing busbars and cables.

Nuts, bolts and pins used inside the transformer shall be provided with lock washers or locknuts.

1.6 CORE:

The magnetic circuit shall be constructed from high grade cold-rolled, non-ageing grain oriented low loss silicon steel laminations and shall be of 'Core' type. The core shall be painted with suitable resin to protect it against corrosion and other parts shall be hot dip galvanized. The lamination shall be free of all burrs and sharp projections. The lamination Grade shall be indicated in the Technical Data and shall be subject to the CLIENT's approval.

The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand a voltage of 3000V for one minute.

All steel sections used for supporting the core shall be non-magnetic. They shall be thoroughly shot or sand blasted, after cutting, drilling and welding.

The design of the magnetic circuit shall be such as to avoid static discharges development of short circuit paths within itself or to the earthed clamping structure and production of flux component at right angles to the plane of laminations which may cause local heating.

The finally assembled core with all the clamping structures shall be free from deformation and shall not vibrate during operation.

The core clamping structure shall be designed to minimize eddy current loss and bolts shall not pass through the lamination for any purpose whatsoever. Fiber glass or equivalent tapes of adequate strength shall be used for clamping the core through and approved procedure.

The core shall be provided with lugs suitable for lifting the complete core and coil assembly.

1.7 WINDINGS

Winding shall be of high conductivity annealed copper conforming to IS-6160. The conductors shall be transposed at intervals in order to minimize eddy currents and equalize the distribution of currents and temperatures along the windings. The insulation class for the windings shall be at least Class-F having high tensile and dielectric strength. Low voltage windings are two layer helical type of spiral type employing number of strips in parallel. High voltage windings can be cross over coils or disc type coils separated from each other by keyed radial spacers.

Both HV and LV windings of one phase shall be separately cast on one rigid tubular coil co-axially arranged with no mechanical connection between their arrangement. The complete coil assembly shall be cast under vacuum into moulds, which forms the insulation system. The coil shall be casted in epoxy resin with fiber glass covering on the conductor to form a compact tubular spools for achieving high mechanical strength.

The resin used for winding insulation shall be non-hygroscopic to prevent the penetration of moisture into windings. It should be possible to energize the transformer without pre-drying even after a long period of service interruption. The resin used shall be self-extinguishing and void free and shall be suitable for tropical climate and 100% air humidity.

The transformer shall free of partial discharges atleast upto 1 .2 times of the rated voltage and shall be able to withstand short circuits as well as switching and atmospheric impulse as specified.

1.8 TEMPERATURE SENSORS

Two nos. sensing elements (RTDs) shall be provided in each phase. The RTDs shall be embedded at the hottest spot. The type of RTD shall be simplex and the material shall be platinum.

1.9 CORE AND COIL ASSEMBLY

The cast coils are inserted on to the core limbs. The resin cast spacer blocks, end blocks and separators are used as required. The end frames are then assembled.

1.10 EARTHING

All internal metal plates of the transformer shall be earthed at one point only. The magnetic circuit shall be connected to the clamping structure at one point only. The frame work and clamping arrangements of core and coil shall be securely earthed by copper strip connection to the main frame and enclosure. Two earthing terminals shall be provided on the frame for external earthing. The terminals shall be suitable for the earthing conductor of size indicated in the Data Sheets.

1.11 TERMINATIONS

The HV side termination facility to be provided on the transformer shall be designed for connecting 6.6KV XLPE insulated cables terminated with crimping type lugs. The cable entry shall be from the bottom. HV bushing terminals shall be extended upto the cable terminals by means of busbars. These busbars shall be located in the upper side of the transformer at a convenient height. Busbars shall be supported by supporting insulators from the top frame of the enclosure, clearing the ventilation hood. HV line end busbar terminals shall facilitate termination of cables with heat shrinkable sleeves or premoulded cast resin push on type terminations. Formation of delta on the HV side is in the scope of transformer manufacturer.

Phase to phase and phase to ground clearances within the enclosure shall be such as to enable either the transformer or cable to be subjected separately to LIV tests. Minimum clearances shall be as specified in data sheets.

The LT side terminals for the transformer shall be connected directly to switchgear bus by direct bus bars. Horizontal/Vertical connections to busbars shall be straight and without unnecessary joints. Where bus connection is required, the LV terminals shall be extended upto the switchgear by bus bars. These bus bars will be connected to the switchgear bus bars through copper flexible. Formation of star on the LV side is in the scope of transformers manufacture. The LV terminals shall be located in such a manner to suit the level of LT switchgear bus bars.

The neutral of the star connected winding shall be in two branches and shall be brought out to two separate bushing terminals. One neutral bushing shall be provided to facilitate leading the earth conductor down to the ground level. The

terminal shall be suitable for connecting to two separate earthing pads. Suitable lugs shall be supplied by the CONTRACTOR for connecting the earthing conductors. The second bushing shall be provided by side of the phase terminals for connecting neutral to neutral bus bar in the switchgear buses. Location of the CTs for the earth fault protection shall be in the common portion of the neutral i.e. before bifurcation of the neutral in two branches.

1.12 BUSHING/SUPPORT INSULATORS:

Bushing/Support Insulators shall be designed and tested to comply with the applicable standards.

Bushings rated for 400A and above shall have non-ferrous and non-magnetic flanges and hardware.

Fittings made of steel or malleable iron shall be galvanized.

All bushings/ support insulators shall be supplied with terminal connector clamp suitable for supporting the bushing terminal & the conductor as specified in the data sheet.

Minimum air clearance and minimum creep age distance shell be as per data sheet.

Bushing/ Support insulators material shall be porcelain.

1.13 CURRENT TRANSFORMER:

Dry type current transformers epoxy cast under vacuum shall be provided in the common portion of the LV neutral. (Before branching to 415 V neutral bus earthing connection). Class of insulation of these CTs shall be C-F.

Secondary leads shall be brought to a marshalling box.

CT details shall be indicated on the name plate of the transformer.

CTs shall be Siemens, Voltas, Automatic Electric, Meco, Prayog & Pragati.

1.14 WINDING TEMPERATURE INDICATORS:

A device for measuring the hot spot temperature of the winding shall be provided winding temperature indicators consisting of :

Temperature sensing elements. The no. of sensing elements shall be provided as indicated above in temp. sensors.

Local indicating instrument with four adjustable electrically independent ungrounded contacts brought out to separate terminals for winding temperature high alarm and trip. One indicating instrument shall be provided for each phase.

1.15 MARSHALLING BOX

The CONTRACTOR shall provide a marshalling box and shall mount the winding temperature indicators in the marshalling box and shall marshalling to it all the contacts/terminals of CT secondary and winding temperature indicators required for the transformer. The CONTRACTOR shall provide the interconnection cabling between the above equipment and the marshalling box. The winding temperature indicator shall be flush mounted on the marshalling box door. This interconnection shall be through wires in GI conduits or through armoured cables. The insulation for the wires/cables shall be consistent with the ambient temperature in the housing. Compression type brass cable glands required for these interconnections shall be supplied by the CONTRACTOR.

The marshalling box shall be mounted on the transformer housing. All doors, covers and plates shall be provided with neoprene gaskets. Bottom of the marshalling box shall be at least 600mm above floor level and provided with removable bolted, un-drilled gland plate.

All contacts for alarm, trip and indication circuits shall be electrically free, wired for auxiliary supply as specified and brought out to separate terminals at the terminal block in the marshalling box. Terminal blocks shall be preferably of GE power controls/Elmex. Terminals shall be rated for 10A. Wiring shall be with PVC insulated, stranded, copper, conductor of sizes not smaller than 1.5 Sqmm for control and 2.5 Sqmm of CT circuits. CT terminals shall be provided with shorting facility. Engraved identification ferrules, marked to correspond with the approved wiring diagrams shall be fitted to each wire. Ferrules shall be of yellow colour with black lettering.

1.16 ENCLOSURE FOR TRANSFORMERS

The core and coil assembly shall be enclosed on the four sides and as well as on the top by a sheet metal enclosure. The purpose of having the enclosure is to provide safety from live parts and prevent ingress of dust, vermin and rodents. Sufficient louvers may be provided on the side enclosure for cooling purposes. No louvers should be covered with galvanized iron wire mesh having holes that are not greater than 2.5mm size. The enclosure should have structural steel frame work with lockable hinged door on front and back of the transformer. Width of the back door shall be restricted to one meter. The doors shall be provided to facilitate the inspection of the transformers. Door should be gasketted.

The enclosure frame shall be fabricated using suitable mild steel structural sections or pressed and shaped sheet steel of thickness not less than 2.5mm for hot rolled or 2mm for cold rolled.

Frames shall be enclosed by sheet steel of thickness not less than 2mm for hot rolled and 1.6mm for cold rolled smoothly finished, levelled and free from flaws. Doors and covers shall be made of sheet steel of thickness not less than 2mm for hot rolled and 1.6mm for cold rolled. Stiffeners shall be provided wherever necessary.

All panel edges and door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members.

The complete structure shall be rigid, self-supporting, free from vibration, twists and bends and shall be suitable for connecting ventilation hood on the top. At the top of enclosure flanged throat connection, suitably drilled with gasket shall be provided for connection with ventilation duct. Size will be furnished at drawing approval stage. A wire mesh shall be provided on the top of the enclosure where ventilation hood is to be connected. The type of wire mesh shall be either brass or stainless steel.

The enclosure provided shall be with a degree of protection not less than IP-23 as per IS-2147.

The enclosure shall be provided with a metal sill frame made of structural steel channel section properly drilled for mounting the enclosure with the transformer along with necessary mounting hardware.

The CONTRACTOR shall ensure the arrangement and orientation of the LV and HV terminals, bus bars and cable termination such that whenever required, it shall be possible to draw-out the transformer without disturbing either the bus bars or the cables.

A door switch with 2N0 + 2NC auxiliary contacts shall be provided, It will be used for providing interlock in the HV breaker circuit.

1.17 PAINTING:

The inside of the enclosure shall be treated with matt paint of semi-glossy white. The outside of the enclosure shall be painted with finish paint of air craft grey shade 693 as per IS-5

1.18 PERFORMANCE REQUIREMENT

Transformer shall operate without injurious heating at the rated KVA at any voltage within $\pm$ 10% of the rated voltage of that particular tap.

Transformer shall be designed for 110% continuous over fluxing withstand capability.

The continuous and short time over loading capacities shall be furnished in detail. Overloads shall be allowed within the conditions defined in the loading

guide of the applicable standard. Terminal bushings tap changers or any other auxiliary equipment shall not limit such over loading.

The neutral terminal of windings with star connection shall be designed for the highest over current that can flow through this winding.

Every care shall be taken to ensure that the design and manufacture of the transformers shall be such as to reduce noise and vibration to the level obtained in good modern practice. The CONTRACTOR shall ensure that the noise level of the transformer, with its enclosure in position does not exceed Neema + 5 dB when measured in accordance with IEC-551

The transformer shall deliver full power at all tapings.

The transformer shall be designed such that when mounted inside its enclosure, it shall be capable of delivering its rated output with temperature rise within limits specified with natural air cooling and at an ambient temperature of 50^0C outside the transformer cubicle. All other performance requirements as called for in this specification and as per the relevant standards and codes shall also be met with the conditions specified above.

1.19 FITTINGS AND ACCESSORIES:

Following fittings shall be provided.

Terminals complete suitable for the CLIENT'S external conductors as specified.

Rating and terminal marking plates.

Two earthing terminals, for earthing the body of the transformers and its enclosure (Size of earthing conductor will be furnished to successful bidder).

Lifting lugs for lifting complete transformer (core and coil assembly) and separately for enclosure.

Jacking pads (Transformers weighing above 3000 Kg.)

The base provided with channels etc.

Four bi-directional flat tread rollers in base frame with stopper arrangement to lock the transformer in the required position either from the wheel or from the base frame.

1.20 TAP CHANGING ARRANGEMENT

Off circuit tap changing links shall be provided with total tapping range of ± 7.5% insteps of 2.5% each.

1.21 REJECTION

CLIENT may reject the transformer if during tests or service any of the following conditions arise

No load loss exceeds the guaranteed value by 20% or more

Load loss exceed the guaranteed value by 20% or more

Impedance value differs the guaranteed value by ± 10% or more

Winding temperature rise exceeds the specified value by 5^0C

Transformer fails on power frequency voltage withstand test or induced over voltage test.

Transformer is proved to have been manufactured not in accordance with the agreed specifications.

The CLIENT reserves the right to retain the rejected transformer and take it into service until the CONTRACTOR replaces, at no extra cost to CLIENT, the defective transformer by a new acceptable transformer.

The CONTRACTOR shall repair or replace the transformer within a reasonable period to the CLIENT's satisfaction at no extra cost to the CLIENT.

1.22 INSPECTION AND TESTING

The equipment covered by this contract shall be subjected to inspection and testing. The CONTRACTOR shall provide all services to establish and maintain quality of workmanship in his works and that of his SUBCONTRACTORS to ensure the mechanical/electrical performance of components, compliance with drawings, identification and acceptability of all material parts and equipment.

On award of the contract, the CONTRACTOR shall prepare Quality Control Plan identifying the various stages of manufacture, quality checks performed at each stage and the customer hold points. The document shall also furnish details of method of checking, inspection and acceptance standards/values and get the approval of CLIENT or his representative before proceeding with manufacturing. However, CLIENT or his representative shall have the right to review the inspection reports, quality checks and results of CONTRACTOR'S in house inspection department which are not customer hold point and the CONTRACTOR shall comply with the remarks made by CLIENT or his representative on such reviews with regards to further testing, rectification or rejection etc.

The CONTRACTOR shall perform his internal inspection/testing before offering the equipment for CLIENT'S inspection. Only after ensuring that his inspection/test results are satisfactory, CONTRACTOR shall offer the equipment for CLIENT'S inspection However this clause is not applicable in case of such tests which are remained to be done only once in the life time of the equipment.

The minimum inspection equipment for all components/equipment shall conform to the design and fabrication requirements as defined in the codes and standards referred to in the specification document. The type of inspection shall be as prescribed in Quality Control plan and as agreed upon by the CLIENT, and shall include, if applicable, inspection procedures prescribed by codes and regulations recognized by the Governmental Authority having jurisdiction over the installed goods.

Wherever required, getting approval of Government bodies under jurisdiction is the sole responsibility of CONTRACTOR for his design, drawings, manufacturing, testing and inspection by such bodies. In such cases approval by Government bodies under jurisdiction will not relieve the CONTRACTOR FROM HIS RESPONSIBILITY of making good of defective material/equipment/system. However, CONTRACTOR shall keep the CLIENT/his representatives informed in writing of any approval or otherwise any comments of such government bodies. CONTRACTOR shall take the concurrence of CLIENT or his representative before proceeding with rectification procedures as called by the Government bodies.

Approval or passing of any such inspection by the CLIENT or his authorized representative shall not, however, prejudice the right of the CLIENT to reject the equipment if it does not comply with the specification when erected or give complete satisfaction in service.

The CONTRACTOR shall intimate to the CLIENT of any material being ready for testing. Such tests shall be to the CONTRACTOR's account except for the CLIENT's expenses. The CLIENT or his representative unless the inspection of the tests is virtually waived, shall attend such tests within a reasonable period of the date on which the equipment is notified as being ready for test/inspection failing which, the CONTRACTOR may proceed with the tests which shall be deemed to have been made in the CLIENT's presence and contractor shall forward the duly certified copies of tests along with observation readings to the CLIENT in triplicate.

The CLIENT shall give notice in writing to the CONTRACTOR of any objection to any drawings and, all or any equipment and workmanship which in his opinion is not in accordance with the contract. The CONTRACTOR shall give due consideration to such objection and shall either make the modifications that may be necessary to meet the said objection or shall confirm in writing to the CLIENT giving reasons therein that no modification are necessary to comply with the contract. However CLIENT has the final authority to accept or reject the CONTRACTOR views. The equipment/material after rectification by the CONTRACTOR shall be offered to the CLIENT for his final inspection and acceptance without any additional cost to CLIENT.

When the factory tests have been completed at the CONTRACTOR's or his SUB-CONTRACTOR's works to the satisfaction of the CLIENT, the CLIENT shall issue a certificate to this effect within fifteen (15) days after completion of tests, but if the tests are not witnessed by the CLIENT's representative, the certificate shall be issued within fifteen (15) days of the receipt of the CONTRACTOR' S test certificate by the specified parameters. Failure of the CLIENT to issue such certificate shall not prevent the CONTRACTOR from proceeding with the subsequent work. The completion of these tests, or the issue of the certificate shall not bind the CLIENT to accept the equipment should it. On further tests after erection, be found not to comply with the Contract.

In all cases where the contract provides for tests whether at the premises or Works of the CONTRACTOR or of any SUB-CONTRACTOR the CONTRACTOR, except where otherwise specified shall provide free of charge such items as

labour, materials, electricity, fuel, water, stores. apparatus and instruments as may be reasonably demanded by the CLIENT or his authorized representative to carry out effectively. Such tests of the equipment in accordance with the 'Contract' and shall give facilities to the CLIENT or to his authorized representative to accomplish testing.

The inspection by the CLIENT and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the CONTRACTOR in respect of agreed quality assurance program forming a part of the 'contract'.

In the case of stage inspection, the CONTRACTOR shall proceed from one stage to another only after the component is inspected by the CLIENT or his representative and permission given to proceed further. The same procedure shall be adopted for any rectification/repairs suggested by the CLIENT or his representative. At all customer hold points the CONTRACTOR shall compulsorily offer for inspection to CLIENT and, if any waiver by CLIENT, shall be obtained in writing for record purposes.

None of the equipment to be furnished or used in connection with the contract shall be dispatched until shop inspection, satisfactory to the CLIENT or his representative has been made and specific Dispatch Instructions for the equipment is issued by the CLIENT. However, such shop inspection shall not relieve the CONTRACTOR of his responsibility for furnishing the equipment conforming to the requirement of the contract no prejudice any claim, right or privilege which the CLIENT or his representative may have because of the use of defective or unsatisfactory items of the equipment. Should the CLIENT or his representative waive the right to inspect any item of the equipment, such waiver shall not relieve the CONTRACTOR in any way from his obligation under the contract. In the event of the CLIENT on inspection revealing poor quality of goods, the CLIENT or his representative shall be at liberty to specify additional inspection procedures, if required, to ascertain the CONTRACTOR's compliance with the equipment specifications.

All principal mill test reports, test certificates and test curves shall be supplied for all tests carried out including other records such as stress relieving charts, radiographic charts and other non-destructive testing records in accordance with the provisions of the contract. The CLIENT or his representative shall reserve the right to call for certificates of origin and test certificate for all raw material and equipment at any stage of manufacture.

1.23 SUB—ORDERS

To ensure getting good quality product from SUB-CONTRACTOR, the main CONTRACTOR shall get the approval of CLIENT by furnishing details of capability, experience, manpower, manufacturing, facility, quality control facilities etc. of the SUB-CONTRACTORS before placement of order. The CLIENT may visit the SUB-CONTRACTOR'S works to evaluate their capacity and capability to do quality job to meet specification control requirements stipulated in the main

specification and all required quality checks and tests shall be conducted as per the specification.

In order to facilitate the inspection of brought-out materials and equipment, the CONTRACTOR shall submit for approval, three (3) copies of all sub-orders placed by him as soon as they are issued. Copies of any drawings referred to in the sub-order shall also be submitted, unless otherwise agreed by the CLIENT or his representative.

The Sub-orders and drawings referred to above shall cover all components which are subjected to electrical and mechanical pressure or stress when the plant is in operation, and also auxiliaries and spares which are to be directly dispatched to site from the SUBCONTRACTOR'S works.

All sub-orders shall clearly be marked with the main CONTRACTORS name and CLIENT' S reference. They shall include a statement advising the SUB-CONTRACTOR that items being ordered will also be subjected to inspection and test by the PURCI-LASER or his representative.

It is important that all copies of sub-orders be clearly marked with the main CONTRACTOR'S name and the name of the CLIENT and Contract' reference.

The SUB-CONTRACTORS are to comply with all the applicable requirements of this specification and in particular with this section. Order issued by the Sub-Contractor are also to include the main Contractor's name on their sub-order in addition to the above mentioned heading.

1.24 MATERIAL TESTS:

In the event of the CLIENT or his representative being supplied with the particulars of tests which have been carried out for the contractor by the suppliers of material, he may, at his own discretion, accept the same as proper evidence of compliance with the requirements of appropriate specifications for the materials.

In case the correlating test certificates are not available the Contractor at no extra cost to the CLIENT will get all the tests done to establish conformity of the material to its relevant code/specification.

1.25 TESTS AT MANUFACTURES WORKS

1.25.1 GENERAL

The tests at works shall include electrical mechanical and hydraulic tests in accordance with the appropriate clauses of statutory Regulation, relevant codes and Standards and in addition any test called for by the CLIENT or his representative to ensure that the equipment being supplied fulfils the requirements of the specification. The Contractor shall carry out all the shop tests and inspections specified in the following clauses in addition to those normally carried out by him. For equipment not covered by any code or specifically mentioned in this specification, the test are to be agreed with the CLIENT. If

considered necessary by the CLIENT or his representative, multi part assemblies shall be fully erected and tested in the works prior to packing and dispatch to the site.

1.25.2 **ROUTINE TESTS:**

All routine tests shall be carried Out on all equipment as per latest IS and IIEC standards in the presence of CLIENT'S representative.

The routine tests to be carried out by the CONTRACTOR shall include but not be limited to the following,

(a) Measurement of winding resistance for all windings at all taps, corrected to 120^0C

(b) Measurement of voltage ratio at all taps

(c) Check of voltage vector relation ship.

(d) Measurement of impedance voltage at all taps. This test shall be carried out on all taps before and after the impulse test on principal tap on the transformer which is subject to impulse.

(e) Short circuit impedance and load loss at all taps.

(f) Measurement of no load loss and current at 90%, 100% and 1100 0 rated voltage and at rated frequency

(g) Dielectric tests:
  (i) Separate source voltage withstand test.
  (ii) Induced over voltage withstand test.

(h) Measurement of insulation resistance and polarization index.
  (i) 2KV power frequency withstand test (for one minute) on all wiring.
  (ii) insulation power loss factor and capacitance for each winding and between windings.

1.25.3 **TYPE TESTS & SPECIAL TESTS**

Contractor shall submit the test reports of following type & special tests carried out on similar transformer to CLIENT

(i) Temperature rise test at lowest tap.

(ii) Full wave lighting impulse test for line terminals on all the three limbs.

(iii) Measurement of acoustic sound level (as per IEC-551)

(iv) Measurement of zero-sequence impedance on three phase transformers (as per IEC-76)

However the following special test shall be carried out on transformer.

(i) Partial discharge test (as per IEC-270) partial discharge should not exceed 40 pico coulombs at 1.1 times the maximum system voltage. The test shall be done after completing all dielectric tests.

1.25.4 **CURRENT TRANSFORMERS**

The following tests shall be conducted on current transformers as routine tests.

a) JR test
b) Polarity test
c) Ratio test
d) Accuracy

1.25.6 **RESISTANCE TEMPERATURE DETECTORS**

The following tests shall be conducted on RTD's as routine tests.

a) Calibration tests
b) Material tests
c) Continuity tests
d) Insulation withstand test.

All indicating instrument shall be checked for calibration by comparing it with substandard meter.

1.25.7 **TEST CERTIFICATES**

All routine and type test certificates including test records, performance curves, etc. shall be supplied according to the distribution schedule. All the tests shall be carried out in accordance with the provisions of this contract.

Certified reports of all the tests carried out at the works shall be furnished in three (03) copies for approval of the owner.

Type test certificate on any equipment if so desired by the owner, shall be furnished otherwise the equipment shall have to be type tested, free of change to prove the design.

1.26 **PENALTY**

The bidder shall offer iron & cu losses as per data sheet without any tolerance. The losses indicated are maximum losses. In case of non-achievability of the losses at the time of testing, the contractor shall be penalized at the rate of Rs. 75,000 per KW for iron losses & Rs. 1,50,000 per KW for Cu loss.

1.27 TECHNICAL DATA FOR EQUIPMENTS :

Sr. No.	Description		Technical Parameters
1.0	**GENERAL**		
	Application / designation	:	Distribution transformer
	Service	:	Step down transformer
	Type	:	Dry type cast resin
	Installation	:	Indoor
	Degree of protection for transformer with enclosure as per IS : 2417	:	IP – 43 - special requirement
	Applicable standard and codes.	:	As listed in specs
2.0	**RATINGS**		
	Ratings	:	2000 /1600 / 1250 kva
	Rated primary voltage	:	33000 V
	Rated no load secondary voltage		415V
	No. of phases	:	3 – phase on HV, 3 – phase and neutral on LV
	Frequency	:	50 Hz
	Vector group	:	DYn11
	%age impedance	:	6 % - 6.5%
	System fault current for 1 second duration	:	HV Wdg : 62.5KA (r.ms.) LV Wdg : 50.5 KA (r.m.s.)
	Type of cooling	:	Natural air–cooling
	Losses	:	Total losses shall be app. 1% of the rating at full load Full load losses at 100% load - 2000KVA – 21KW / 1600KVA – 17.6KW / 1250KVA – 15KW No load losses – 2000KVA – 5.2KW / 1600KVA – 5.0KW / 1250KVA – 4.8KW
3.0	**SYSTEM VOLTAGE**		

	Nominal system voltage	:	HV Wdg : 33000V LV Wdg : 415 V
	Highest system voltage	:	HV Wdg : 35000V LV Wdg : 457V
4.0	**NEUTRAL EARTHING**		
	System Neutral Earthing	:	HV Winding : Non effectively earthed through resistance (earth fault current limited to 400 A) LV Winding : Effectively earthed
	Transformer neutral Earthing	:	HV Winding : Not applicable LV Winding : Effectively earthed
5.0	**INSULATION WITHSTAND VOLTAGE**		
	Impulse (1.2/50 -sec, wave)	:	HV Winding : 95 KV peak
	One minute power frequency	:	HV Winding : 38 KV
	Class of insulation	:	F
6.0	**TEMPERATURE RISE**		
	Reference Ambient	:	50^0C
	Winding by Resistance at all taps	:	90^0C
	On enclosure by thermometer	:	75^0C
	External connection	:	90^0C
	Enclosure parts not accessible to the operator.	:	80^0C
	Permissible Noise Level	:	Neema + 5 Db
7.0	**TAP CHANGING LINKS**		
	Taps required	:	Off-circuit full MVA rating at each tap
	Type	:	Bolted link
	Tapings on windings	:	HV

	Total tapping range	:	+/-7.5%
	Steps	:	2.5%
	Parallel Operation		Momentary with similar transformer
8.0	**BUSHING/SUPPORT INSULATORS**		
	Voltage Class	:	a) HV line end – 33KV b) LV line end – 3.3KV c) LV neutral – 3.3KV
	Impulse (1.2/50µ-sec, wave)	:	HV Winding : 95 KV peak
	One minute power frequency	:	a) HV line end – 38KV b) LV line end – 3.0KV c) LV neutral – 3.0KV
	Minimum creep age distance	:	HV line end – 276mm LV line end – 26mm Neutral – 26mm
9.0	**MINIMUM CLEARANCE IN AIR**		
	HV phase to phase	:	230mm
	HV phase to earth	:	180mm
	LV phase to phase	:	25.4mm
	LV phase to earth	:	25.4mm
10.0	**CT DETAILS**		
	Neutral CT a) Class b) Rated current c) Nominal voltage d) Insulation level e) Frequency f) CT secondary resistance g) Knee point voltage h) Excitation current i) Short time thermal current and duration j) Service conditions k) Class of insulation l) Quantity m)	:	PS Will be furnished later 415V 3KV for 1 min. 50 Hz. Will be furnished later Will be furnished later Will be furnished later 50 KA for 1 Sec. Mounted on transformer neutral Class – F As required

11.0	**TERMINAL CONNECTIONS**		
	HV Line end terminal	:	Suitable for termination 33KV XLPE unearthed grade cable
	LV line end terminal	:	Suitable for direct connection to 415V switchgear through flexible copper connection/bus duct arrangement.
	LV neutral bushing.	:	LV neutral bushings as specified
	Colour finish shade of enclosure Interior Exterior	:	 Semi-Glossy white Aircraft grey shade 693 (IS-5)
	Cable/bus entry (top/bottom)	:	Arrangement furnished by supplier
12.0	**ENCLOSURE**		
	Details of enclosure material And thickness		

Any other information, if not specified above, but necessary for the evaluation of offer shall be furnished by the supplier.

LIST OF ESSENTIAL SPARES TO BE SUPPLIED BY OEM AS A PART OF THIS CONTRACT:

S.NO.	ITEM DESCRPTION	QUANTITY
1.	HV bushings	1 No.
2.	LV Bushings	1 No.
3.	Support Insulators for Terminal	1 Sets
4.	Current Transformer	1 No.

2 H. T. BREAKER –

2.1 SCOPE

This specification covers the requirements of supplying of **HT INDOOR** metal clad cubicle switch gear having Vacuum Circuit Breakers. These are general requirements of switchgear panel.

2.1.1 APPLICABLE STANDARDS:

The switch gear panel and components mounted shall confirm to the following latest revisions of relevant Indian or equivalent British or International standards. In case of any conflict between the following standards and this specification, the requirements of this specification shall prevail.

IS: 2516(Part1 sec.2)	Specifications for circuit breakers. General & Definitions (for voltages above 1000V A.C.).
IS: 2516(Part1 sec.3)	Specifications for Alternating (circuit breakers requirements (voltage above 33KV).
IS: 2516(Part 2 sec.2)	Circuit breaker tests voltage (range 1 KV to 33 KV).
IS: 4710	Switches and switch isolators (above 1 KV but not exceeding 33 KV.)
IS: 375	Marking and arrangement of switch gear bus bars.
IS: 2707 (Part 1 to 4)	Current Transformers.
IS: 3156	Voltage Transformers.
IS: 1248	Electrical Indicating Instruments.
IS: 3231	Electrical relays for power system protection.
IS: 6875h	Control switches and push buttons.
IS: 4483	Preferred panel cutout for relays.
IS: 9046	HT Vacuum contactors.

IS: 3427	Degree of protection provided for metal enclosed switchgear and control gear.
IS: 5578	Guide for marking of insulated conductors.
IS: 5082	Material for data for Aluminum conductors.
IS: 3618	Phosphate treatment of iron and steel for protection against corrosion.
IS: 6005	Code of practice of phosphating of iron and steel.
IS: 5	Painting.
IS: 722	Integrating meters.
IS: 2544	Specifications for HV post insulators.

2.1.2 CONSTRUCTION:

2.1.2.1 The switch gear panel shall be metal enclosed, rigid, free standing, floor mounted, draw out, dead front type and fabricated from standard prefabricated, cold rolled sheet steel units. The vertical units shall be assembled in such away that uniform height can be achieved while line up of each vertical units on floor.

2.1.2.2 The minimum thickness of the sheet steel shall not be less than 2.5 mm. Necessary stiffeners shall be provided.

2.1.2.3 The switchboard shall be totally enclosed, vermin -proof, except bus bar compartment. Degree of protection of enclosure shall be minimum IP56 as per IS: 3427. If necessary, openings for natural ventilation louvered with wire mesh shall be provided. For bus bar compartment wire mesh shall be such as to protect against object of 1.0 mm size and above.

2.1.2.4 All doors, removable covers, gland plates and other openings shall be gasket all round the perimeter with neoprene gaskets.

2.1.2.5 Switch gear shall be provided with an ISMC channel as a base frame. Minimum height of the base frame shall be of 100 mm.

2.1.2.6 All doors shall be supported by strong hinges of concealed type and braced in such a manner as to ensure freedom from sagging, bending and general distortion of panel or hinged parts.

2.1.2.7 Switchboards shall be suitable for site conditions as specified in the Technical Data Sheet.

2.1.2.8 Each unit of the switch gear shall be provided with necessary internal sheet metal barrier to form separate components for buses/Indicating instruments/protective relays/control and power cable connection etc. Compartment for cable connection shall allow adequate space for cable pulling, termination and connection work with energised switch gear. Suitable arc propagation barrier shall also be provided. Preferably independent pressure release valves shall be provided for different compartments. Terminal strips for outgoing control cable connection should be accessible to facilitate working and testing with breaker in test/service condition with the energised switchboard.

2.1.2.9 After isolation of the power and control connection of a circuit, it shall be possible to safely carry out maintenance or a repair work in a compartment with the bus bars and adjacent circuits alive.

2.1.2.10 At a future date, it shall be possible to extend the switch gear in either direction. Ends of the bus bars shall be suitably drilled for this purpose. Panels at the extreme ends shall have openings which shall be covered with plate screw to the panel with necessary gaskets.

2.1.2.11 Switch gear shall be vertical isolation and horizontal draw out type.

2.1.2.12 All draw out circuit breaker trucks/trolley of the same rating for all outgoing breakers shall be identically wired/equipped for complete interchangeability at site. `Service', `Test', `Draw Out' positions of the draw out carriage of the switchboard shall be provided. Automatic safety shutters shall be provided to ensure the inaccessibility of all live parts after the breaker is drawn out.

2.1.2.13 Dummy panels required for rear extensions for cable terminations or to mount the components shall be included in the offer and details of each type of such panels shall be furnished along with offer.

2.1.3 SAFETY INTERLOCKS:

It shall not be possible to draw out the carriage with circuit breaker closed. The breaker feeder trolley shall remain inside the cubicle even in the `drawout' position. There shall be distinct overall door for the breaker compartment and it should be

lockable. Suitable interlocks to prevent following faulty operations shall be provided.

2.1.3.1 `Plugging in' or `drawing out' of a closed breaker.

2.1.3.2 `Plugging in' a breaker with earthing isolator closed.

2.1.3.3 `Closing' of earthing isolator with breaker `Plugged in

2.1.3.4 Pulling out of auxiliary circuit plug with breaker in service position.

2.1.3.5 Pushing in breaker to service position with auxiliary circuit plug not in position.

2.1.3.6 Opening of compartment door with isolating switch in ON position and vice versa.

Necessary mechanical and electrical interlocks between H.T. and L.T. switch gears shall be provided in closing and tripping circuits of breakers which shall be a part of the specification. The total bill of material and scheme designed by the manufacturer will be subject to client/consultant's approval and any addition or deletion shall be binding to the manufacturer on the basis of unit rates available in the offer.

2.1.4 ACCESSIBILITY:

2.1.4.1 Checking and removal of components shall be possible without disturbing adjacent components. All components shall be easily accessible. It shall be possible to set all `measuring' and `protective' relays without de- energizing the switchboard. All mounted equipment shall have painted identification labels at the front & rear also. In addition to that identification numbers shall be painted on the panel wall to give permanent identification mark. Mounting of the relays for a particular breaker panel shall be limited to that particular panel.

2.1.4.2 Unused CT secondary terminals must be short circuited and wired to the terminal block. All terminals shall be shrouded with plastic covers to prevent accidental contact.

2.1.5 BUS BAR ARRANGEMENT

2.1.5.1 The switchboard shall comprise 3 phase bus bars as indicated in the Technical Data Sheet or SLD which shall extended through all units of the switch gear. All phase bus bars shall be of uniform cross section throughout the switch gear and shall be sized to carry continuously the current specified in the Technical Data Sheet or SLD. Bus bars shall be housed in a separate air insulated chamber and shall be accessible

for inspection only with special tools. Wire guards/mesh shall be provided inside the sheet steel enclosure to allow visual inspection of bus bars, CT's, PT's and cable terminations and to avoid accidental touch when rear cover is removed.

2.1.5.2 Bus bars shall be made of electrolytic aluminum/copper as indicated in the Technical Data Sheet or SLD and shall be sleeved and joints shall be shrouded. Fiber glass/metal sheet with cast resin bushing partitions shall be provided at every junction between two adjacent cubicles. All bus bar joints shall be shrouded with shrouds having sufficient insulation level suitable for nominal system voltage.

2.1.5.3 Bus bars shall be supported at regular intervals and both, bus bars and the supports shall be adequately sized and braced to withstand the specified short circuit level without permanent deformation. Dynamic stresses shall be calculated on the basis of the specified peak short circuit currents. All bus supports shall be of non carbonizing material resistant to acids and alkalis and shall have non hygroscopic characteristics such as SMC, DMC epoxy bonded fiber glass.

2.1.5.4 Thermal design of the bus bars shall be based on installation of the switch gear in ventilated conditions. The cooling air volume shall take into account only the bus enclosure.

2.1.5.5 The maximum operating temperature of the bus bars at the maximum design temperature inside the panel shall be as per IS: 1272 and IEC 298

2.1.5.6 Bus bars shall be sleeved with colour coded type sleeve having insulation level suitable for nominal system voltage. If the insulating sleeve is not coloured bus bar shall be colour coded with coloured bands at suitable intervals.

2.1.5.7 All bus bars joints and bus tap joints shall be of the bolted type and shall be shrouded. Spring washers shall be provided to ensure good contact at the joint locations and suitable contact grease shall be applied just before making a joint.

2.1.5.8 Positive/live terminal or bus bar shall be located at the top or on the left for vertical and horizontal layout respectively.

2.1.5.9 Sequence of Red, Yellow, Blue phases shall be left to right and top to bottom for horizontal and vertical layout respectively.

2.1.6 POWER CABLE CONNECTION:

2.1.6.1 The incoming and outgoing power cable connection shall be through PILC/XLPE/PVC cables of various sizes as indicated in the Technical Data Sheet or SLD. Ample space for connection for these cables shall be provided at the rear of

the switchboard. In order to avoid accidental contact in the cable compartment while carrying out inspection by opening the back cover, a removable expanded metal barrier shall be provided in the cable compartment.

2.1.6.2 The cable entry of the switchboard shall be from the bottom.

2.1.6.3 Cable lugs and the requisite bushes for sealing power cable entries shall be supplied along with the switchboard.

2.1.6.4 `Cupal' washers shall be provided for copper busbar to aluminum cable terminations.

2.1.6.5 The switchboard shall be supplied complete with supports for clamping outgoing and incoming cables. Terminal blocks shall not be used to support cables. The distance available between cable gland plate and terminal lug shall not be less than 750 mm for switchgear upto 33 KV. cables.

2.1.6.6 In case, cable termination cannot be accommodated in side the panel, a suitable box for mounting at the rear side and at the bottom of panel shall be supplied. Earth strip shall also be brought to this box. In lieu of this a dummy panel may be provided.

2.1.6.7 The individual switchgear panel shall have adequate space and terminal busbar clearance for accommodating no. of cables as specified in Technical Data Sheet and SLD. The type of cable termination units to be considered shall be heat shrinkable type.

2.1.7 CONTROL WIRING AND TERMINALS:

2.1.7.1 Inside the cubicle the wiring for control, indication, signaling, protection and instrument circuits shall be done with PVC insulated stranded conductors. The insulation grade shall be 1.1 KV. The wiring shall preferably be enclosed in plastic channels or neatly bunched together.

2.1.7.2 10% spare terminals shall be provided on each terminal block. Conductors shall be terminated with adequately sized compression type copper lugs for connection to equipment terminal block. Terminal block shall be of Elemex/Connect well make. All auxiliary equipments terminals shall be made with pressure type terminals. Sufficient terminals shall be provided on each terminal block to ensure that not more than one outgoing wire is connected per terminal. Terminal strips shall preferably be separated from power circuits by metal barriers or enclosures. All spares contacts of aux. relays, timers etc. shall be wired upto the terminals.

2.1.7.3 Each wire shall be identified at both the ends by, correctly sized PVC ferrules. Shorting links shall be provided for all CT terminals.

2.1.7.4 For CT circuits 2.5 sq. mm copper conductor shall be used. Other control wiring can be with 1.5 sq. mm copper conductors.

2.1.7.5 Control cables shall enter the switchgear from the bottom/ top. It shall be possible to have the control cable entry from both the left and right side corners at the front portion of the switchgear without cutting any standard part of for these cables are also included in the scope of supply of the switchboard. The cable glands shall be compression type, supporting facilities shall be provided for clamping the control cables. All control cables shall be with 2.5 sq. mm Cu stranded conductors.

2.1.7.6 All inter panel control wiring shall be done by the switchgear supplier. The inter panel wiring shall be taken through PVC sleeves or suitable grommets. Multi pin plug shall be provided and should have scraping earth terminal.

2.1.7.7 Control cable cutout and gland plate shall be provided preferably at the place where the power cable cutout will be provided. Gland plate for the control cables shall be separate from those provided for the power cables.

2.1.8 CONTROL AND INDICATION:

Breaker tripping and closing devices shall be operated on D.C. supply. The rated D.C. voltage shall be as specified in the Technical Data Sheet. The supply for breaker opening, closing and indication devices shall be provided as under:

a) One D.C. feeder shall be provided for each bus section. The Bus coupler panel may be fed from any of the two supplies.

b) One separate 240 V AC supply shall be provided for space heater etc.

Mechanical indication for breaker positions such as ON, OFF, spring charged, test position/Service position shall be provided. Various Electrical indications with colours are indicated below shall be provided.

a) Breaker `ON' - Green lamp

b) Breaker `OFF' - Red Lamp

c) Breaker `Auto Trip' - White lamp

d)	Trip circuit healthy	-	White lamp
e)	DC fail	-	Blue lamp.
f)	Red phase ON	-	Red
g)	Yellow phase ON	-	Yellow
h)	Blue phase ON	-	Blue

2.1.9 EARTHING CONNECTIONS:

2.1.9.1 Continuous earth bus-bar running throughout the length of the switchboard shall be provided. All doors and movable parts shall be connected to the earth bus with flexible copper connections. Provision shall be made to connect the earthing busbar to the plant earthing grid at two ends. All non-current carrying metallic parts of the equipment shall be earthed . Earth bus shall be brought back to cable compartment and earthing bolts shall be provided to ground cable Armour. Mating surfaces of all bolted parts shall be specifically zinc passivated to ensure continuity between them.

2.1.9.2 The material of the earth bus shall be copper or equivalent size of aluminum. The earth bus size shall be minimum 180 mm2 copper upto short circuit withstand capacity of 31.5 KA and 300 mm2 above 31.5 KA.

2.1.9.3 All instruments, relays and other components shall be connected to earth busbar by means of 650 V grade, PVC insulated, stranded tinned copper conductor of 2.5 sq.mm.

2.1.10 LABELS AND NAMEPLATES:

2.1.10.1 A nameplate with the switchgear designation at the top of the central panel and separate nameplate giving feeder details shall be provided at front and rear side of each panel.

2.1.10.2 Name plates shall be provided for each equipment (Lamps, PBs, Switches, Relays, Auxiliary contactors etc.) mounted on the switchboard. Special warning plates shall be provided on all removable covers or doors giving access to high voltage cables, bus bars. Special warning label shall be provided inside the switchboard also, wherever considered necessary. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram.

2.1.10.3 Engraved nameplates shall preferably be of 3-ply (Red-white- red or Black-white-Black lamicoid sheets or anodized aluminum or back engraved Perspex sheet nameplates shall be provided. Engraving shall be done with square groove cutters. Hard paper nameplates will not be acceptable. Name plates shall be fastened by Screws and not by adhesives.

2.1.11 SHEET STEEL TREATMENT AND PAINT:

2.1.11.1 All metal surfaces shall be thoroughly cleaned and digressed to remove mill scale, rust, grease and dirt. Fabricated structure shall be pickled and then rinsed to remove any trace of acid . The under surface shall be prepared by applying a coat of phosphate paint, and a coat of yellow zinc chromate's primer. The under surface shall be made free from all imperfections before undertaking the finishing coat.

2.1.11.2 After preparation of the under surface, the switchboard shall be spray painted with two coats of final paint. Colour shade of final paint shall be smoke gray shade no. 631 as per IS: 5 unless otherwise specified. The finished panels shall be dried in stovings ovens in dust-free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff, paint etc. The supplier shall furnish painting procedure details along with the offer.

2.1.11.3 All unpainted steel parts shall be cadmium plated or suitable treated to prevent rust corrosion. If these parts are moving elements, then these shall be greased.

2.1.12 SPACE HEATERS:

2.1.12.1 Each vertical cubical shall be provided with space heater to prevent moisture condensation and maintain required temperature. The space heaters shall be located at the bottom of the switchboard and shall be controlled through a thermostat with an adjustable setting with single pole MCB with overload and short circuit release in the phase, link in the neutral. The thermostat shall preferably be located in the metering/ relay chamber.

2.1.12.2 Space heater shall be of strip type rated for operation on a 240 V, single phase, 50 Hz., A.C. supply system.

2.1.13 BASE FRAME:

2.1.13.1 The switchboard shall be suitable to be installed on a base frame supplied in one piece along with foundation bolts. These base channels shall be dispatched two months in advance from the date of dispatch of switchboard so that they can be buried and grouted in the concrete floor. Ample dimensioned oblong holes shall

be provided at the bottom of all the switchboards for their installation of base frame. In addition, the switchboard shall have an additional base channel at the bottom with smooth surface.

2.1.14 BREAKERS:

2.1.14.1 Vacuum circuit breaker shall be used in the switchboard. Exact type and rating shall be as indicated in the Technical Data Sheet.

2.1.14.2 10% spare VCB bottles of each ratings shall be supplied along with the switchboard.

2.1.14.3 Vacuum circuit breaker shall be designed with low switching over voltage level and long switching life. The interrupter shall be leak free with a target value of vacuum life as 25 years.

2.1.14.4 The breakers shall have at least 6 NO + 6 NC spare auxiliary contacts. If these are not available an auxiliary contactor shall be used to multiply the auxiliary contacts of the breakers. All auxiliary contacts shall be wired to the terminal block. Auxiliary contacts and limit switches shall be in dust tight enclosures.

2.1.14.5 The breaker shall have motor operated spring charged mechanism. In addition to this, it shall be possible to charge the springs manually, if required. In case the limit spring fails to cut out the spring charging motor when the springs are fully charged the motor shall be automatically decoupled and annunciation for this shall be provided. The control circuit shall be suitable for local as well as remote control. Breaker shall trip free and shall have an anti pumping device. Breaker operating duty shall be 0-3'-CO-3'-CO except for switchgear line up having motor feeders stage wise, receleration feature in which case the duty shall be 0-0.3"- CO-3'-CO. Whenever a PT is mounted on the breaker carriage all auxiliary wiring shall be done in PVC flexible conduits.

2.1.14.6 Adequate provision shall be made in Vacuum circuit breaker for motor switching to limit the over voltage.

2.1.14.7 Mechanical trip push buttons shall be provided for all the breakers. Mechanical closing device will not be acceptable for motor feeders. Complete motor assembly should have interchangeability with identical rating of the breaker. Each motor breaker feeder shall be provided with an operation counter.

2.1.14.8 All integral earthing system or separate earthing carriage be provided. After withdrawing the circuit breaker, this can be inserted to facilitate earthing of the cables. Unit rate in the panel shall be furnished.

2.1.15 SWITCHBOARD COMPONENTS:

2.1.15.1 CURRENT TRANSFORMER:

Current transformers shall generally conform to IS: 2075. and of cast resin type and shall be mounted on the switchgear stationary part. The C.T. ratings shall be as shown in the Technical Data Sheet or SLD. For general guidance, the protective current transformers shall have an accuracy class `5P' and an accuracy limit factor greater than `10'. Low reactance C.T.s shall be used for protection. Current transformers for instruments shall have an accuracy class 0.5 and an accuracy limit factor less than 5.0. If a metering load is fed from a protection C.T., suitable 1/1 or 5/5 ratio interposing C.T.s shall be used.

2.1.15.2 VOLTAGE TRANSFORMERS:

a. The voltage transformers shall be cast resin and draw out type and provided with primary and secondary fuses.

b. The draw-out mechanism shall disconnect the bus bars and V.T. primary and secondary terminals shall be earthed. The primary connection shall be disconnected before the V.T. or its primary fuses become accessible.

c. The voltage transformers shall have an accuracy class 1.0 from 10% to 120% of normal voltage.

d. Secondary and tertiary windings of voltage transformer shall be rated for a three phase line to line voltage of 110 V except as noted.

2.1.16 MEASURING INSTRUMENTS:

All measuring and recording instruments shall be of square pattern 144 mm x 144 mm flush mounted type. Instruments shall be provided wherever specified in the Technical Data Sheet or SLD. All auxiliary equipment such as shunts, transducers C.T.s, V.T.s that are required shall be included in the supply of switchboard.

2.1.16.1 AMMETERS, VOLTMETERS, KW METERS

These shall be of moving iron type. The accuracy class shall be 1.0 as per IS: 1248. The range shall be as indicated in the Technical Data Sheet or on the SLD. Ammeters for motor feeders shall have non linear compressed scale at the end to indicate motor starting current.

The KW meter shall be suitable to measure unbalanced loads on a 3 phase 3 wire system. The KW and the voltmeter shall operate of a V.T. secondary of 110 volts.

2.1.16.2 RECORDING INSTRUMENTS:

Unless stated otherwise these shall be of direct writing type with automatic chart by means of a synchronous motor. The minimum chart length shall be of 24 hours. The chart speed shall be 30 mm/hour.

2.1.16.3 TRIVECTO METERS: (DIGITAL)

The KWH meter shall be 144 mm x 144 mm square, flush mounted, preferably in a draw-out case. It shall be suitable for operation on 3 phase 3 wire system.

2.1.16.4 FREQUENCY METERS:

These shall be direct reading or digital type square pattern 144 mm x 144 mm size, suitable for flush mounting and shall operate off a V.T. secondary voltage of 110 volts. The standard range shall be 45-50-55 Hz.

2.1.16.5 POWER FACTOR METER:

The power factor meter shall also be square pattern 144 mm x 144 mm size, suitable for flush mounting and of digital type. The meter shall operate off 110 volts C.T. secondary voltage. The C.T. secondary current shall be as shown on the SLD or Technical Data Sheet. The standard range shall be 0.5-1.0-0.5.

2.1.17 AUXILIARY EQUIPMENTS:

2.1.17.1 AUXILIARY RELAYS/CONTACTORS:

Auxiliary relays/contactors shall generally be used for interlocking and multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum estimated current. In any case their rating must not be less than 5A - for 230 volts A.C. at a power factor between 0.3 and 1, and 2A for 110 volts D.C.(inductive load).

2.1.17.2 TRIPPING RELAYS:

All tripping relays shall be lockout type with hand reset contacts and shall be suitable to operate off the specified d.c. voltage. These relays shall have self coil cut - off contacts and shall be provided with hand reset operation indicators.

Tripping relays will be acceptable in non draw-out cases. The number of contacts shall be as shown on the approved schematic drawings.

2.1.17.3 PROTECTIVE RELAYS:

All protective relays shall be back connected, draw-out type, suitable for flush mounting and fitted with dust tight covers. Alternatively, `plug in' type of relays will also be acceptable. The relay cases shall have provision for insertion of test plug at the front for `testing' and calibration' using an external power supply, without disconnecting the permanent wiring. It shall be possible to short the C.T.'s through the test plugs. Non protection relays can be in fixed execution.

All relays shall preferably be mounted in front of the panel and shall be as specified in the Technical Data Sheet or SLD. The cur rent and voltage coils shall be rated as specified.

All measuring relays shall have `built in' flags to indicate relay operation. It shall be possible to reset the flag without opening the relay case. Anti fungus treatment shall be provided for all relays.

2.1.17.4 PUSH BUTTONS:

Push button colours shall be as follows:

Stop, Open, Emergency - Red

Start - Close - Green

Trip circuit `Healthy' check-Black

Red push buttons shall be on the left side and green push buttons on the right side. Push button ratings shall be 5A at 240 V AC or 2A at 110 V DC (inductive load). Emergency stop push buttons shall be lockable in the operated position.

The key shall be released from the push button in both `Released' and `Operated' positions and operation of the push button shall be possible in the key release position. Push button knobs for emergency stop push buttons shall be released to prevent accidental operation.

2.1.17.5 CONTROL SWITCHES:

All control switches shall be rotary, back connected type having a cam operated contact mechanism. Phosphor bronze contacts shall be used on the control switches. Unless otherwise stated, circuit breaker control switches shall be 3 position spring return to `neutral' from both `ON' and `OFF' positions. They shall have `pistol grip' handle. Number of ways, locking system, lost motion device if required etc. Two spare ways shall be provided on these switched.

Ammeter and Voltmeter selector switches shall have ` make before break' feature on its contacts. The selector switch shall generally have four positions, three for reading three phase currents and phase to phase voltages respectively and the fourth as off position.

2.1.17.6 INDICATING LAMPS:

Switchboard type low consumption indicating lamps shall be used. Indicating lamps shall be suitable for the voltage indicated in the Technical Data Sheet. Lamps shall be supplied complete with the necessary current limiting resistor duly tested for its rating. Aging test for the resistors shall have been carried out. Lamps shall be provided with translucent lamp covers to diffuse light.

2.1.17.7 CUBICLE LIGHTING:

Each cubicle of switchgear shall be provided with interior lighting by means of a 20 W fluorescent tube lighting fixture with ON - OFF switch. The lighting fixture shall be suitable for operation from a 240 V, single phase, 50 Hz, A.C. supply. A 240 V, single phase, 15 A A.C. plug point shall be provided in the interior of each cubicle with an ON - OFF switch for connection of hand lamps.

2.1.18 TESTS AND INSPECTION:

2.1.18.1 During fabrication, switchgear shall be subject to inspection by Owner/Consultant or by an agency authorized by the Owner. Manufacturer shall furnish all necessary information concerning the supply to inspectors.

The client/ Contractor has right to witness the test carried out on all the equipment.

2.1.18.2 Tests shall be carried out at the manufacturers' works under his care and expense.

2.1.18.3 All routine tests as specified by the applicable standard code shall be conducted. Type test certificates for the switchgear panel and CB from a recognized testing organization shall be furnished with the offer. If client / consultant wishes type test

shall be carried out at laboratory in the suppliers region in clients / consultants presence. The supplier shall also submit a list of guaranteed technical particulars with the offer.

2.1.18.4 In addition specific tests shall be conducted to check mechanical and electrical operation and switchboard wiring to this specification and approved schematic drawings.

2.1.18.5 These tests shall be provisionally conducted at manufacturer's works by providing temporary connection to switchgear units in order to simulate the actual conditions.

2.1.18.6 Shop tests shall be witnessed by an inspector of Owner / Consultant or of an agency authorized by owner.

Acceptance tests shall be as follows:

a) A general visual check. This shall cover measurement of overall dimensions, location, number and type of devices, terminal boxes, location and connection of terminals etc.

b) Manual and electrical operation of CB/Relays shall be checked under the worst conditions of auxiliary supply voltage.

c) Dry insulation test with power frequency voltage shall be conducted for the main and auxiliary circuits.

d) Insulation resistance of the main and auxiliary circuits shall be checked.

e) Operation check shall be carried out for every control function as per the approved schematic diagrams by manually stimulating the fault conditions and operation of control switches/relays etc.

f) Preferably, relays shall be tested with secondary injection test equipment.

For equipment bought from other sub - suppliers certified test reports of tests carried out at the manufacturer's works shall be submitted. Normally, all routine tests as specified in the relevant standards shall be conducted by the sub - supplier at his works.

List of tests shall be as follows :

Routine tests : power frequency tests, manual operating mechanism tests, functional tests of L.V. auxiliaries and relays, making and breaking capacity for switches and breaker, short time withstand current tests, making and breaking capacities for earth switch.

Type tests : impulse dielectric tests, power frequency dielectric tests, temperature rise tests, mechanical operating tests, verification of degree of protection, verification of electromagnetic compatibility.

2.1.19 DRAWINGS:

2.1.19.1 The manufacturer shall develop his own general arrangement and schematic drawing adding necessary auxiliary devices, accessories, components particular to supplied equipments etc. which are required for safe, convenient, efficient and proper operation of the HT switchgear.

2.1.19.2 Manufacturer shall submit for owner/consultant's approval the single line diagrams, general arrangement drawings, flooring and mounting detail drawings and schematic diagrams.

2.1.19.3 Owner's/consultant's approval of GA drawings is required before the fabrication of the cubicle is started. Approval of the schematic drawings is required before the manufacturer proceeds with the cubicle wiring. The owner/consultant's approval as the manufacturer's drawings shall not relieve the manufacturer of his responsibility for supplying equipment conforming with the relevant specifications and standards or for any other mistakes, errors or omissions in drawings.

2.1.19.4.1 Once manufacturer's schematic diagrams have been finally approved by owner/consultant, the manufacturer shall prepare wiring connection diagrams for each cubicle. These diagrams shall show any wiring inside the cubicle starting from the cubicle terminal strips. These diagrams shall be used by the owner for troubleshooting and shall show any device, terminal and wire number.

2.1.19.4.2 The manufacturer shall submit all the drawings in four copies for owner/consultant's approval.

2.1.19.5.1 Manufacturer shall submit four prints and reproducible of schematic, GA and wiring diagrams in final.

2.1.20 GUARANTEE:

The switchboard shall be guaranteed for trouble free operation for a period of 36 months from the date of commissioning. Any defects discovered during this period shall be rectified free of charge.

3.0 TECHNICAL DATA FOR EQUIPMENTS : 33KV

Sr. No.	Item Description	Data Designed by Consultant	Data Furnished by Supplier
1.0	Ambient Temperature	50°c	
2.0	Maximum Ambient Temperature	50°c	
3.0	Design Ambient Temperature	50°c	
4.0	Rated Voltage, Phase and Frequency	33KV, 3pH, 50 Hz.	
5.0	Maximum system voltage	36 KV	
6.0	One minute power frequency withstand voltage	70 KV (rms)	
7.0	1.2 / 50 / usec. Impulse withstand voltage	170 KV (peak)	
8.0	Short circuit withstand		
8.1	Rated symmetrical breaking capacity – 3 sec	400 MVA, 26.2 KA	
8.2	Peak withstand current	80KAp	
9.0	Continuous rating of busbars under site reference ambient temp. of 50° C	630 A	
10.0	One minute dry withstand power frequency voltage	70 KV	
11.0	Impulse withstand voltage	170 KV	
12.0	Auxiliary supply for using shunt trip at power pack	30 V DC through	
13.0	Auxiliary supply for motor	240 VAC, 50 Hz.	
14.	Maximum temperature of busbars, droppers, connectors and contact at continuous current rating under site reference temperature	85°C	

15	Busbar material	Copper (tinned Electolytic)	
16	Cable entry	Side	
17	Thickness of sheet in mm		
a.	cold rolled	Frame : 3	
b.	frame enclosure	2.5	
c.	Doors / Covers / Partitions	2.5	
18	Colour finish shade	2.5	
a.	Interior	Glossy white	
b.	Exterior	Light gray semi grade glossy shade, epoxy type 631, IS : 5	
19	Earthing Bus		
19.1	Material	Copper	
19.2	Size	Suitable for 93.5 KA for 1 sec.	
20	Earthing conductor		
21.1	Material	Copper	
21.2	Size	30 x 6 mm	
22	Bus bar insulation	Air insulated, PVC heat shrinkable type sleeved	
23	Circuit Breakers		
23.1	Type	Vacuum	
23.2	Voltage, frequency and no. of phases	33 kv, 50 Hz., 3 ph	
23.3	Rated Operating duty	0-3'-CO-3'-CO	
23.4	Rated current at site (reference ambient temp)	400A	
23.5	Rated breaking capacity	400 MVA, 93.5 KA (rms)	
23.6	Short time current withstand 4 for 1 sec. duration	93.5 KA (rms)	
23.7	Total break time	Less than 5 cycles	
23.8	Type of operating suitable for manual	Manually and motor mechanism charged spring and remote trip and	

		close operations	
23.9	Minimum no. of auxiliary	6NO, 6 NC on fixed contacts part of breaker for owner's use.	
23.10	Withstand test voltage One minute power	48	
23.11	Frequency KV(rms) 1.2/50 u sec impulse KV (peak)	115	
24	Auxiliary control voltage		
24.1	For closing coil for tripping coil 30 V DC through power pack	240V, pph, 50 Hz.	
24.2	For space heaters and lighting AC with MCB and thermostat unit	240V, 1 Ph, 50 Hz.	
24.3	Motor type	Universal	
24.4	Anti Pumping feature	Both electrical and mechanical shall be provided	
24.5	Circuit breaker operation	Local control switch for trip and close. Remote electrical trip and close for testing manual	
24.6	Protection required panel	As per single line diagram / Requirement of breaker	
25	Current Transformers		
25.1	Type	Cast resin, bar primary	
25.2	System voltage and frequency	33 KV, 50 Hz.	
25.3	Class of insulations	Class "E" or better	
25.4	Rated primary current ratio	As per the enclosed burden and accuracy single line diagram / requirement of Breaker panel	
25.5	Short time 1 sec. current rating	93.5 KA (rms)	
26	Voltage Transformers		

26.1	Type	Cast resin	
26.2	Rated voltage – primary	33000 / 3 volts	
	Rated voltage – secondary	415 / 3 volts	
26.3	Method of connection		
	Primary	Star	
	Secondary	Star	
26.4	Rated Voltage factor	1.1 constant 1.5 for 30 sec.	
26.5	Class of insulation	Class “E” or better	
26.6	VA burden and accuracy	As per the single line dia / specs requirement of breaker panel	
26.7	Withstand test voltage one minute power frequency	48	
	1.2 / 50 / u impulse KV (peak)	115 KV (peak)	
27	Make of material		
27.1	HRC Fuse	Siemens, L&T, Schneider,	
27.2	Fuse base	Siemens, L&T, Schneider,	
27.3	Voltmeter	AE, rishabh, enercon, trinity	
27.4	Ammeter	AE, rishabh, Conserv	
27.5	Indication lamps	Teknic or approved equivalent	
27.6	Relays	Siemens, L&T, Schneider,	
27.7	Power factor meter (Electronic type)	AE, rishabh, conserv	
27.8	Frequency meter (Electronic type)	AE, rishabh, conserv	
27.9	Selector switch	Kaycee or approved equivalent	
27.10	Breaker control switch	GEC Alsthom or approved equivalent.	
27.11	L – R Swithc	Kaycee or approved	

		equivalent	
27.12	Terminal Block	Elmex / Connect well / Technoplast	
27.13	Wires	Finolex or approved equivalent	
27.14	Trivector	AE, rishabh, conserv	
27.15	Digital KWH meter	AE, rishabh, conserv	
27.16	CT / PT	AE . Indcoil / Kappa	
27.17	Push Buttons	Teknic or approved equivalent	
28	Cable Box arrangement		
	Incomer	1 No. 33 KV 3c x 240 mm² XLPE Armoured Al. cable	
	Outgoing	1 No. 33 KV 3c x 240 mm² XLPE Armoured Al. cable	
29	Requirements of Breaker Panel		
29.1	Panel description	Incomers and buscouplers for 6850KVA / outgoing 2 for 2000KVA / 1 for 1600 KVA and 1 for 1250 KVA	
29.2	Quantity	1 No.	
29.3	Basic rating of breaker	400 Amps.	
29.4	Type of Breaker	VCB	
29.5	Red, Amber, Green indicating lamps	1 set	
30	Potential transformer, three phase, Epoxy cast resin type, 1100 volts / root 3/110 volts / root 3, 100 VA burden, Accuracy class 0.5h	1 set	
31	A44 mm² 0- 15 KV voltmeter	1 No.	
32	Voltmeter selector switch	1 No.	
33	144 mm² 0 – 100 A ammeter	1 No.	
34	Ammeter selector switch	1 No.	
35	Electronic type power factor meter	1 No.	

36	Trivector meter (digital) with KVA / KVARH / KVAH with maximum demand indication in KVA	1 No.	
37	Electronic type frequency meter	1 No.	
38	Epoxy cast resin type current transformer having details as under		
38.1	120/5/5 ratio of Class 1 and burden of 15 VA.	1 No.	
38.2	Accuracy class of metering core – 1	0.5	
38.3	Accuracy class of protection core – 24	5 P 10	
39	Relays		
39.1	T.P. IDMTL relay with 2 O/C + 1E/F Element type equivalent to CDG-61 of EE make	1 No.	
39.2	D.C. fail alarm relay equivalent to VAA-21 of EE	1 No.	
39.3	High speed tripping relay equivalent to VAJH -13 of EE	1 No.	
39.4	Antipumping relay equivalent to VAA-11 of EE 4	1 No	
39.5	Auxiliary relay for buccholtz alarm and trip relay equivalent to VAA - 21 of EE make	1 No.	
39.6	Auxiliary relay for winding temperature alarm and trip relay equivalent to VAA-21 of EE make	1 No.	
40	30 Volts DC shunt trip coil	1 No.	
41	D.C. fail indication lamp with ACCEPT and RESET push buttons	1 set	
42	Emergency trip lockable push button with keys P	1 No.	
43	Trip circuit healthy indication lamp with push button	1 set	
44	Auto trip indication	1 No.	
45	Spring charged indication	1 No.	
46	Common alarm trip and non trip scheme with ACCEPT, RESET push	1 No.	

	buttons, relays and hotter for audio indication		
47	Space heater with ON-OFF MCB, HRC fuses and thermostat	1 set	
48	Power pack unit for 30 volts D C Output – combined for all breakers	1 set	
49	Cubicle illumination with 20 W tube & ON-OFF switch	1 set	
50	15 A plugs / socket with ON-OFF switch	1 set	

4.0 FACTORY ACCEPTANCE TEST:

Client, his consultant and their authorized representative shall have the right to inspect and test or get inspected and tested the goods at the works of the Seller or its sub suppliers any time during manufacture and prior to dispatch and to inspect within a reasonable time after arrival of goods at the ultimate destination and during and after erection, testing and commissioning. The goods shall not be deemed accepted until after the said inspection, testing and commissioning and signing of the Acceptance Certificate. Failure to make any inspection of or payment for or acceptance of goods shall in no way impair client's right to reject non-conforming goods or to avail itself of any other remedies to which UCJ/NRDA may be entitled, notwithstanding client's knowledge of the nonconformity, its substantiality in the case of its discovery. In the event of failure of Seller to remove the rejected goods within the time allowed, client shall have the right to dispose of the same at the seller's risk and cost. During the time the rejected goods lie with client awaiting removal by the seller, they will so lie at the seller's risk. All goods rejected by client after receipt at the destination shall be removed by the seller within a reasonable time allowed by client, not exceeding 30 (thirty) days at seller's expense and risk.

The Seller will permit client's Inspectors, Consultant and their authorized representatives free access during normal working hours to his works, godown, storage or loading spot etc. and will give them all necessary assistance to perform their task including free use of all accessories, testing and control instruments. The seller shall ensure that the same facilities are granted by his sub-suppliers.

Unless specifically stated to the contrary in the order, all expenses relevant to the preparation and performance of testing, inspection and preparation of any test reports or certificates shall be borne by the Seller

The sellers shall carry out tests related to performance tests as described in the specifications and specified in the order. All such performance tests shall be at supplier costs. Supplier shall also provide all the tests certificates and documents as demanded by the Inspector for his satisfaction that the order has been executed as per PO specifications. All such certificates, documents in original shall be submitted to the Client before dispatch of material. The goods shall be dispatched from suppliers shop only after written confirmation from clients/ or its authorized representative.

5.0 DRAWING AND DOCUMENTS:

The vendor, on award of work, shall submit the following drawing and documents to Client / Consultant.

1.Technical Specifications	:	4 sets
2.G.A./ Foundation Drawing (specifying point load & size of foundation)	:	4 sets
3.Tests Certificates	:	1 + 3
4.O & M Manual	:	2 sets
5.List of Spare Parts	:	3 sets
6.Design Qualification Report	:	4 sets
7.Preventive maintenance schedule	:	3 sets
8.Any Other documents as per requirements	:	4 sets

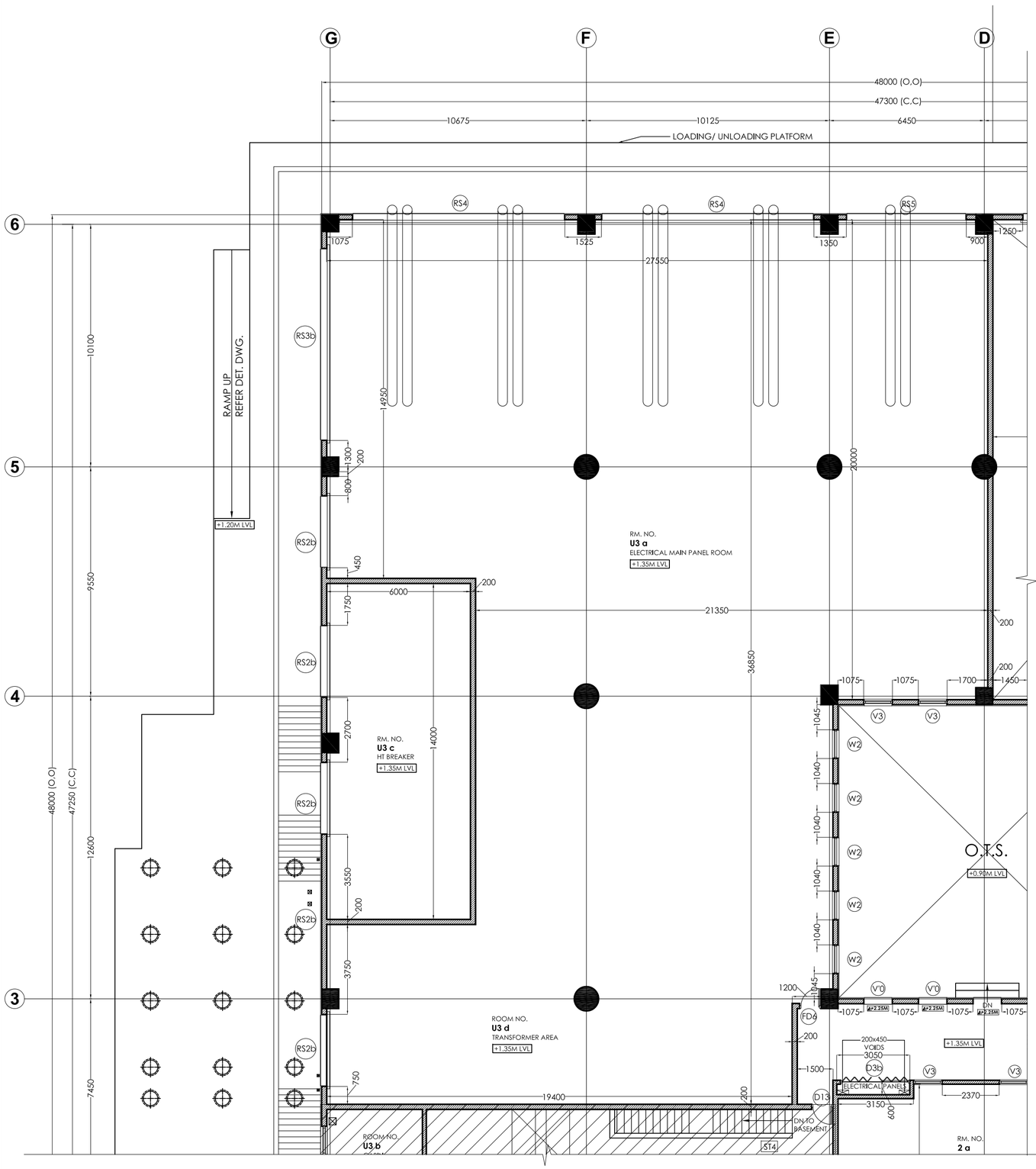
6.0 TERMS OF PAYMENT:

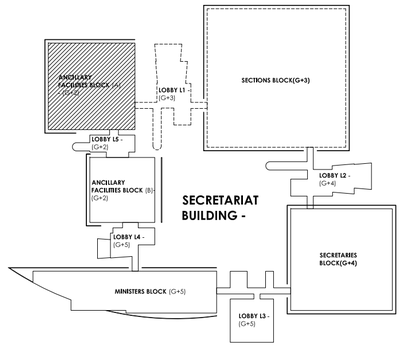
The terms of payment shall be as follows:

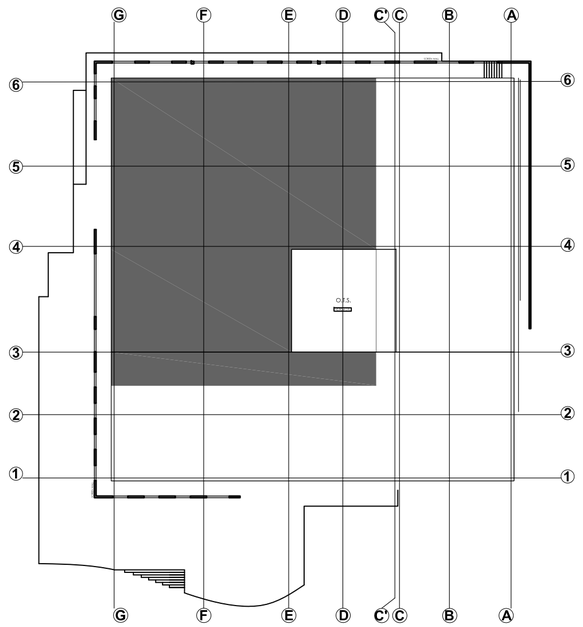
a. 15% advance against receipt of bank guarantee (in approved proforma) for equivalent amount.
b. 5% on approval of shop drawings.
c. 65% after delivery of all equipments at site.
d. 15% on commissioning of equipments by third party or 90 days from the date of delivery whichever is earlier and receipt of performance bank guarantee (in approved proforma) for equivalent amount valid for 36 months.

7.0 STATUTORY APPROVAL:

The unit supplied shall be duly approved as per latest IS / IEEE / CPCB etc norms and regulations which ever applicable. The supplier shall submit all the documents along with all the dispatch documents.







KEY PLAN : ANCILLARY BLOCK A

NOTE : ACTUAL SITE CONDITIONS/ CONSTRAINTS TO BE VERIFIED THROUGH SITE INSPECTION.

GENERAL NOTES

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No	DESCRIPTION	DATE

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LANDSCAPE CONSULTANT

KISHORE D. PRADHAN
LANDSCAPE CONSULTANT

NAYA RAIPUR DEVELOPMENT AUTHORITY
CLIENT

TITLE **SECRETARIAT BLDG, CAPITOL COMPLEX, NAYA RAIPUR**

ANCILLARY BLOCK 'A' GROUND FLOOR PLAN
DESCRIPTION

NORTH

DATE 18 NOV 09
DEALT BY SAVIN
CHKD BY CUJ
SCALE 1:200
350/CCR/2006
INDEX

TENDER DRAWING
REMARKS

ST 139/T39
DRG.NO.

ST

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408 REGENT CHAMBERS, 208 NARIMAN POINT, BOMBAY 400021, INDIA
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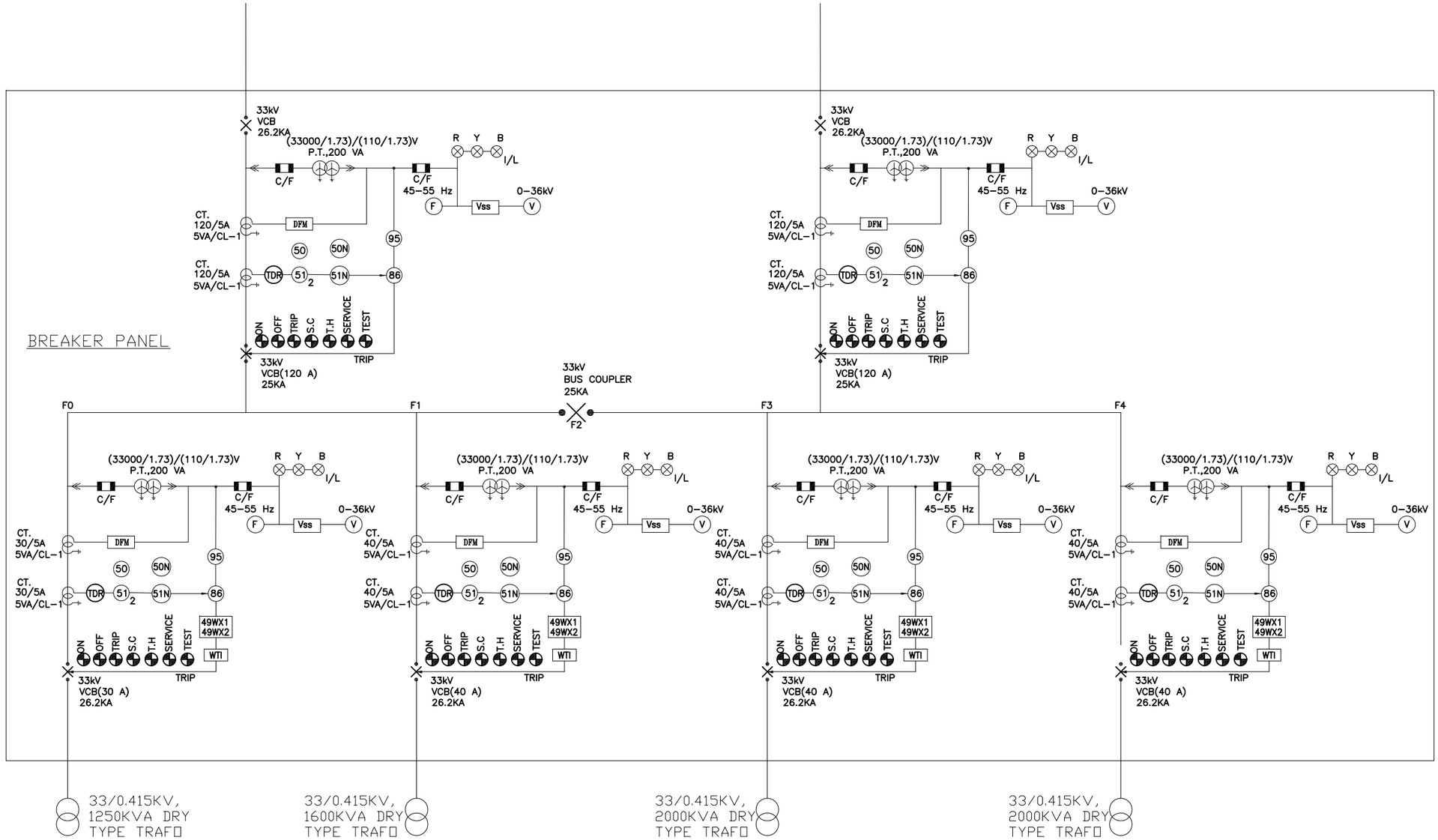
E-MAIL: ucjain@ucjain.com WEB: www.ucjain.com

HT PANEL FOR SECRETARIAT BLOCK



QTY:- 1No.

NOTES:
- TDR TIME DELAY RELAY
- 27 UNDER VOLTAGE RELAY
- 86 MASTER TRIP RELAY
- 50 INST. S/C. RELAY
- 50N INST. EARTH FAULT RELAY
- 51 IDMT PHASE OVER CURRENT RELAY
- 51N IDMT EARTH FAULT RELAY
- 95 P.T. FUSE FAILURE RELAY
- 49WX1 49WX2 AUX. RELAY FOR TRANSFORMER WINDING INDICATOR (ALARM & TRIP)
- WTI WINDING TEMPERATURE INDICATOR

LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CURRENT TRANSFORMER		VACCUM CIRCUIT BREAKER
	CONTROL FUSE		TRANSFORMER
	INDICATING LAMP		SWITCH FUSE UNIT
	VOLT METER SELECTION SWITCH		MCB
	AMPERE METER SELECTION SWITCH		MOULDED CASE CKT. BRAKER
V	VOLT METER		AIR CIRCUIT BREAKER
A	AMPERE METER		KWH METER

NOTES :-
1) POWER REQUIREMENTS ARE INDICATIVE ONLY.
2) THE ELECTRIC SUPPY SCOPE OF CONSIDERED IN THE SCHEME IS 415V.
3) THE DRAWING SHALL BE READ IN CONJUNCTION WITH SPECIFICATION.
4) CONSTRUCTION --> CUBICAL TYPE, DOUBLE DOOR
5) MOUNTING ARRANGEMENT:- FLOOR STANDING
6) ENCLOSURE INDOOR --> IP-52
7) THICKNESS OF STEEL :-
A) STRUCTURE :- 2.0 MM (CRCA)
B) DOOR,COVERS,SHROUDS ETC.1.6MM(CRCA)
C) GLAND PLATE :-3.0 MM
D) UNDRILLED (CRCA) TOP/BOTTOM FOR CABLE ENTRY.
8) POWER COATING
A) TYPE : EPOXY WITH 7 TANK PROCESS
B) SHADE : SIEMENS GRAY-631
9) DOOR EARTHING SHALL BE PROVIDED WITH 2.5 SQMM FLEXIBLE CU WIRE.
10) ALL MCBS SHALL BE OF 10 KA BREAKING CAPACITY.
11) ALL MCCBS SHALL HAVE ELECTRONIC BASE RELEASE.
12) ALL NEW PANELS SHALL HAVE INDICATING LAMPS AND CONTROL FUSES.
13) ALL ACB'S SHALL HAVE MICRO PROCESSOR RELEASES.

ALL C.T'S SHALL BE CLASS-1,10VA
ALL ACBS ARE EDO TYPE.
ALL MCBS FOR A.C. UNITS SHALL HAVE D CURVE CHARACTERISTICS

KEY PLAN / LEGEND

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	ARCHITECT	OWNER'S APPROVAL
SIGN		
DESIGNATION		

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KISHOR D. PRADHAN — LANDSCAPE CONSULTANT

NAYA RAIPUR DEVELOPMENT AUTHORITY
CLIENT.
TITLE CAPITOL COMPLEX, NAYA RAIPUR

HT PANEL SLD FOR SECRETARIAT BLOCK
DESCRIPTION
NORTH

DATE	07JULY2008
DEALT BY	JCR
CHKD BY	SGS
SCALE	NTS
	TENDER DRAWING
	REMARKS
350/CCR/2006	ST ELE-MP-008A
INDEX	DRG.NO.

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