15.0 INSTALLATION SPECIFICATION AND GUIDELINES:

15.1.1 Installation of equipments:

All the electrical installation shall conform to the Indian Electricity Act, Indian Electricity Rules and regulations in force in the state by Electrical inspector. All the items required as per electrical inspector shall be included in the scope of work. These shall be installed by duly licensed and authorized person only.

The mechanical and other installation shall conform to the applicable Acts and Rules of corresponding Inspector and other relevant authorities, if any.

All the works under this contract, including the installation of the equipment, shall be got inspected and approved by the relevant authorities like Electrical Inspector etc.

15.1.2 Erection and Commissioning Tools and Tackles

The bidder shall provide all tools/tackles, jigs and fixtures, winches, alignment tools, welding sets, testing kits, testing meters/instruments, breaker handling devices, all consumable items and construction equipments as required to install all the equipment and to complete the work in all respects, and shall necessarily include (but not be limited to) bolts, nuts, rivets, welding rods, shims, wedges, packing sheets, packing compounds, oil, flushings oil, protective greases and oils, all materials required for proper installation and protection of individual equipment in storage and during erection, testing and commissioning.

This shall also cover proper alignment, tag welding, tagging, laying, marking of, and connection of cables, fabrication supply and installation of all support structures for installation of various electrical equipments and cables.

Provision of cable glands, ferrules, cable lugs, tags, sealing kits (for HT Cables) shall be arranged.

Supply and installation of first aid boxes, shock treatment charts, rubber mats, etc.

Erection, testing and commissioning of various equipments shall be done strictly as per manufacturer's instructions.

Successful bidder shall submit proposed test procedure to the Board for approval well in advance and shall not commence testing until approval is conveyed.

All plant equipments, painting of which has been damaged during transportation / erection or by corrosion shall be given two coats of paint after removal of scales, rust oil, etc.

All iron frame work erected shall be provided with two coat of primer and two top coats of finish paint light gray shed.

Cables shall be laid in GI, class 'A' pipe of suitable diameter or a support girder/channel up to 2 meters height above the floor in case of vertical run to avoid mechanical damage in the switch yard.

Cables shall be laid in separate racks according to voltage levels. Sufficient Horizontal clearance shall be provided.

Maximum cross section areas of cables passing through conduit shall not exceed 60 % of cross section of conduit.

Approved type of danger boards, in Gujarati, describing "ISOLATED' 'DO NOT CLOSE, MEN AT WORK" shall be provided in sufficient numbers as per the instruction of E.I.C.

Special care shall be taken to make the enclosed equipment worming proofing

Cables supports shall be provided at every 1000 mm along horizontal run and perforated trays shall be provided for control cables.

SOME SPECIFIC INSTRUCTION FOR INSTALLATION

15.2 11 KV VACUUM CIRCUIT BREAKER:

15.2.1 SCOPE :

The work covered under this scope includes installation, connection, testing and commissioning of indoor VCB

15.2.2.1 INSPECTION :

(i) The VCBs shall be inspected on its arrival as per instruction manual of the supplier.
(ii) All mechanical fasteners shall be checked and tightened before installation.
(iii) The operating mechanism of circuit breaker should be checked for any damage.
(iv) All the internal wiring shall be checked upon installation of the panel.

15.2.2.2 INSTALLATION:

(i) The Indoor VCB unit shall be installed as per installation manual of supplier and shall conform to relevant Indian Standards.

(ii) The Indoor VCB unit shall be installed in control room as per the suppliers drawing and instructions.

(iii) Indoor VCB unit shall be earthed by using required size of GI strip as per design and earthing installation shall conform to latest Indian Standard IS : 3043-1987 and detailed specification given under separate heading of "EARTHING" of this specification.

15.2.2.3 TESTING AND COMMISSIONING:

Prior to commissioning of Indoor VCB unit, following tests shall be carried out:

(i) A mechanical endurance test shall be carried out by closing and opening of the switchgear.

(ii) Insulation resistance test shall be carried out between phases and between phase to earth.

(iii) Other tests, required for commissioning the outdoor switchgear unit shall be carried out by the bidder without any extra cost as per instruction of engineer in charge.

15.3 POWER TRANSFORMER:

15.3.1 INSPECTION:

(i) The transformer shall be inspected at site as per the inspection manual of the transformer supplier.

(ii) The transformer shall be examined for any sign of damage and special attention shall be given to following parts :

a. Oil tank and cooling tubes.
b. Oil indicating glass.
c. All mechanical connections and protruding fittings.
d. All insulator terminals and joints.
e. The silica gel colour shall be checked to identify absorption of moisture in the winding.

15.3.2 INSTALLATION:

(i) The transformer shall be assembled and installed as per installation manual of the transformer supplier and installation shall confirm to Indian Standard IS : 1896-1967.

(ii) Necessary arrangement shall be made on channel/Rail for locking of transformer wheels on the platform.

(iii) Oil supplied in separate drums, shall be filled in, up to correct level ensuring that no air bubble remains inside the transformer.

(iv) Wiring for Buchholz Relay, O.T.I., W.T.I., CTs etc. mounted on the transformer shall be carried out, Cables shall be bunched in neat manner and properly clamped.

(v) Other checks necessary in respect of transformer shall be carried out.

15.3.3 Testing and Commissioning:

(i) Prior to commissioning the transformer, following tests shall be performed.

(ii) The insulation resistance and PI value of HV and LV side shall be measured and ambient temperature shall also be recorded

(iii) Electrical break down strength and water content PPM test of transformer oil shall be checked in accordance with IS:335.

(iv) In case the values are below 50/60KV, the oil shall be filtered to achieve the strength of the oil above 50/60KV as per the rated capacity of transformer.

(v) Operation of the Buchholz relay shall be done in conjunction with H.V. switch Board to test Buchholz alarm trip and high temperature alarm.

(vi) Ten delta measurement for bushing and transformer winding
(vii) The transformer breather shall be cleaned and filled with oil and silica gel.
(viii) Voltage ratio test shall be carried out for every tap position.
(ix) Magnetic balance shall be checked and compared with laboratory test results for any damage to core winding assembly during Transportation/erection etc.
(x) P.I. value of transformer should also be derived before commissioning.
(xi) DGA analysis of transformer oil.
(xii) Other test which may be necessary in respect of transformer shall also be carried out, even if the same has been not stated above.

15.4 OUTDOOR / SF6 GAS CIRCUIT BREAKER:

15.4.1 INSTALLATION:

a) Sulphur hexa-fluoride (SF6) gas circuit barker with its support structure shall be installed on foundation. Prior to erection, proper leveling of the foundation shall be checked. The equipment should be in plumb after erection.

b) All the components and sub-assemblies of the SF6 CB shall be assembled together by the bidder. The pressure and dielectric strength shall be checked after installation, if required. SF6 gas shall be filled up to the correct pressure as per supplier's manual. Anti corrosive grease shall be applied at bimetallic connections.

c) Compressor and compressor panel shall be properly installed on the foundation with leveling, if applicable.

d) All tubing work to be complete with proper connection between Air compressor to receiver tank and Breaker (air and gas tubing.), wherever applicable.

e) All control cabling work to be done between control panel and Breaker.

15.4.2 TESTING AND COMMISSIONING:

15.4.2.1 Testing of Breaker shall be done as per requirement of applicable Standard and Specification of GETCO. After successful testing, commissioning will be done. All the commissioning checks and testing shall be done as per the instruction manual or as per the instruction of manufacturer's representative present for commissioning.

15.5 220KV & 66KV ISOLATORS SWITCH:

15.5.1 INSTALLATION:

(a) Isolators along with supporting structure shall be installed on RCC foundation. Adequate supports for the down rod shall be provided.
(b) All isolator insulators shall be installed in proper level.
(c) All contact alignment to be checked for proper contact pressure.
(d) Proper greasing to be done on movable contacts.
(e) Isolator and earthing switch interlocking to be properly checked.
(f) Complete assembly shall be checked for satisfactory 50 operations.

15.5.2 TESTING AND COMMISSIONING:

15.5.2.1 Testing of Isolator shall be done as per requirement of applicable Standard and Specification of GETCO. At least 50 nos. of open & close operations to be done after complete installation of isolator. After successful testing, commissioning will be done. The supplier's manual shall be referred to.

15.6 220KV & 66KV CT, PT AND PI:

15.6.1 INSTALLATION:

(a) Outdoor CTs and PTs with supporting structures shall be installed on R.C.C. foundations after checking the leveling of the foundation. The Polarity of primary terminals shall be checked and verified as per instruction of Engineer in Charge.

(b) Accessories supplied loose shall be fitted on the equipments. Oil level shall be checked and if required, oil shall be filled up to the correct level.

(c) Wiring of the CTs and PTs secondary box shall be checked and fuses provided shall be checked for continuity.

15.6.2 TESTING AND COMMISSIONING:

15.6.2.1 Testing of 220kV & 66 KV CT, PT and PI shall be done as per requirement of applicable Standard and Specification of GETCO. After successful testing, commissioning will be done.

15.7 SWITCH YARD STRUCTURE AND SWITCH YARD ANCILLARY EQUIPMENT:

15.7.1 DRAWINGS:

The fabrication drawings prepared by the bidder shall indicate the size and weight of sections shown in the design drawings. All structure design shall be got approved by Engineer-in-charge, consulting engineer and their weights with reference identification (erection) marks shall be provided for purpose of dispatch and erection etc. in form of Bills of materials including quantity and length of various sizes of Bolt, Nuts, Anchor Bolts required to complete structure erection.

15.7.2 FABRICATION

a. The fabrication and erection of the works shall be carried out generally in accordance with the IS - 800 as well as the stipulation contained in these specifications.

b. All steel materials shall be straight and free from bend or twists. The edges of all plates shall be perfectly straight and uniform through shearing, cropping and gas cutting.

15.7.3 BOLTING:

Every bolt shall be provided with a steel washer under the nut so that no part of the threaded portion is bolted together. All bolts and nuts shall be of steel with well formed hexagonal heads unless specified or otherwise forged from the solid as they are made. Flat washer shall be circular and of suitable thickness. Spring washers of suitable size shall also be included for each Bolt confirming to relevant IS.

15.7.4 GALVANIZING:

a. All structural steel works shall be galvanized after fabrication. All burrs and irregular edges will be ground smooth before galvanizing.

b. The galvanized surface shall consist of a continuous and uniform thick coating of zinc, firmly adhering to the surface to steel. Members embedded in concrete shall be galvanized from the top to a point at least 300 mm below the proposed elevation of the concrete foundation. Before galvanizing, the steel section shall be thoroughly cleaned. Picking shall be very carefully done and shall be proper.

c. Galvanizing of each member shall be carried out in one complete immersion. When the steel section is removed from galvanizing kettle, excess spelter shall be removed by pumping process.

d. All members and accessories shall be treated with sodium dichromate or an approved equivalent solution after galvanizing so as to prevent white storage stains.

15.7.5 SWITCHYARD ANCILLARY EQUIPMENTS

a. Insulator hardware shall conform to the requirement, stipulated for clamps and connectors. Insulator hardware assembly shall be designed for tensile load for 1000 Kg tensile load for each phase of switchyard with factor of safety two (2).

Hardware shall be subject to all routine tests in accordance to IS-731 and IS-2486 respectively and routine and acceptance test certificates shall be submitted.

b. Required A.C.S.R. Panther or any other Conductors as per the final lay out shall be provided by the bidder.

Clamp & Connector :-

(i)	For connecting ACSR conductors A-6	:	Aluminium casting confirming to designation of IS ; 617.
(ii)	For connecting equipment terminals made of copper to ACSR conductor	:	Bimetallic connectors made from aluminium oil casting conforming to relevant standard with 4 mm thick cast copper liner.

(iii)	For connecting G.I shield wire	:	Malleable iron casting.
(iv)	Bolts nuts, plain & spring steel washer	:	Galvanized High tensile washer etc.

All casting shall be free from blow holes, cracks and cavities. All sharp edges and corners shall be blurred and rounded off. No part of a clamp or connector shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanized, confirming to IS : 2633.

For bimetallic clamps or connectors, copper alloy liner of minimum thickness 4 mm shall be cast integral with aluminium alloy body.

Flexible connectors shall be braided or laminated. Strip shall be made from tinned copper sheets or aluminium laminated depending on the clamps. The terminal clamps for bus supports shall be suitable for ACSR Panther conductor.

Size of the terminal/conductor for, which the clamp connector is suitable shall be embossed / punched on each components of the clamp / connector, except on the hardware. Clamps shall be designed to carry the same current as the conductor & the temperature rise shall be equal to / less than that of the conductor at the specified ambient temperature. All current carrying parts shall be designed and manufactured to have minimum contact resistance. Clamps and connectors shall be designed corona controlled.

15.8 BATTERY AND BATTERY CHARGER:

As specified in supply specification maintenance free batteries of lead acid type or Ni – Cad. type is required to be supplied, as such over and above the below mentioned clauses the additional necessary provisions required for this type of batteries are to be made.

(a) Each cell shall be inspected for breakage and condition of cover seals as soon as received at site. Each cell shall be filled with electrolyte in accordance with manufacturer's instructions. All safety precautions shall be taken while handling sulphuric acid.

Contact surface of the battery terminals and inter cell connector shall be cleaned, coated with protective grease and assembled. Each connection shall be properly tightened. Each cell should be tested with hydrometer and thermometer.

(b) Bidder shall arrange for necessary charging and discharging equipments and carry out the charging and discharging process as per manufacturer's instruction. The readings during charge and discharge test shall be recorded by bidder as per the manufacturer's instruction and test result shall -be submitted to site engineer-in-charge.

15.8.1 INSTALLATION SPECIFICATION OF LT PANEL :

15.8.1.1 INSPECTION:

(i) The switchboard shall be checked for any damage.
(ii) Meters, relays etc. shall be checked and fixed before installation.
(iii) All mechanical fasteners shall be checked and tightened before installation.

15.8.1.2 INSTALLATION:

(i) The distribution switchboard panel shall be assembled and aligned together and installed on the M.S. frame properly.
(ii) The switchboard shall be erected and leveled on the foundation as per the suppliers drawing.
(iii) Busbar connections between the L.V. side of the transformer and incoming feeder shall be checked after installation.
(iv) Busbar connections between the panels shall be checked and tightened as per the supplier's drawings.
(v) Meters including two nos. of static energy meters and relays shall be fixed in positions and connected as per the supplier's drawings.
(vi) All earthing connections of earthing system shall be visible for periodical checking.
(vii) The entire equipment earthing shall be done as per drawing and shall confirm to Indian Standard IS : 3043-1987 and detailed specification given under separate heading of "EARTHING" of these specifications.

15.8.1.3 TESTING AND COMMISSIONING:

Prior to commissioning the L.T. panel. Following tests shall be carried out by the bidder.
i. Insulation resistance test.
ii. High voltage tests – 2500 volts.
iii. Tripping of breaker by applying secondary source and setting of relay and as per instruction of engineer-in-charge.
iv. Testing meters and calibration of all meters.

15.9 INSTALLATION SPECIFICATION FOR CABLING :

(a) GENERAL:
H.T./ L.T. cables shall be laid, tested and commissioned in accordance with specification, relevant Indian Standard Specification and manufacturer's instructions.

15.9.1 LAYING OF CABLES:

Cables shall be laid by skilled and experienced workmen using adequate rollers to minimize stretching of the cable. The cable drums shall be placed on joint before unwinding the cable. Great care shall be exercised in laying cables to avoid forming kinks. The drums shall be unrolled and cabling over wooden rollers in trenches at intervals not exceeding 2 meters. Cables shall be laid at depth of 1000 mm below

ground level in the case of MV cables. A cushion of sand not less than 80 mm shall be provided both above and below the cable, joint boxes and other accessories. HV and MV. Cables shall not be laid in the same trench and / or along side of water main. The cable shall be laid in excavated trench; 80 mm layer of sand shall be spread over the cable. The cable then shall be lifted and placed over the sand. The relative position of the cables laid in the same trench shall be preserved and the cables shall not cross each other as far as possible. In case of changes in direction in horizontal and vertical planes, the cable shall be bent smooth with a radius of bend not less than 12 times the diameter of cable. Minimum 3 meter long loop shall be provided at both sides of every straight joint and 5 meters at each end of the cable. Distinguishing marks shall be made on the cable ends for identification. Insulation tapes of appropriate voltage and in red, yellow and blue colours shall be wrapped just below the sockets for phase identifications.

15.9.2 CABLES TERMINATION:

Cable termination shall be done in terminal cable box using cable glands and the cable ends sealed with seating compound. The cable end terminations of HT cables shall strictly be done as per instructions of cable termination kit suppliers in consultation with engineer-in-charge.

15.9.3 JOINTING OF CABLES:

15.9.3.1 GENERAL:

The bidder shall take care to see that all the cables are laid at various locations to ensure no straight joints in the cable run. If the straight joint in cable is unavoidable due to any specified reasons, prior permission shall be obtained from the engineer-in-charge before the use of such straight joints in cable.

All end, straight and T-joints shall be of epoxy resin cast / heat shrinkable / cold push on type with jointing kits of Raychem / M-Seal/

Denson makes or of approved equivalent make. All the jointing accessories used shall be of approved jointing kit manufacturer's only. All terminal ends of conductors shall be heavily crimped to avoid unnecessary heating.
All same coloured cables shall be jointed and tested for insulation resistance and continuity before jointing commences. The seals of cables mustn't be removed until preparations for jointing are completed. Joints shall be finished on the same day as commenced and sufficient protection from the weather shall be arranged. Joints shall be made by means of suitable solder less crimping method for conductors, the conductor being firmly bottled into the connections.
The conductors shall be efficiently insulated with high voltage insulating tape and use of separators of approved size and pattern.

15.9.3.2 JOINTING BOX:

Cable jointing boxes shall be of appropriate size, suitable for cables of particular voltage ratings and shall be manufactured by approved make.

15.9.3.3 CABLE TERMINATION:

Before making a cable end or straight joint, put the cables in proper position with support below the cable. If required, cut the top insulation in proper manner after measuring the length required for jointing. After insulation cutting, bind the cable armoured with wire binder over the armour. Turn back the armoured wire over the top insulation of the cable. Before turning of armoured wire, slip one hose clip over the outer PVC insulation of cable. Apply three layers of PVC adhesive tape over the inner PVC sheath just above the armour. Remove the inner sheath up to the PVC tape. Spread out the core. Apply three layers of PVC tape lightly over the copper tape screen at the top end of the core to present loosening of the screen. Solder one small earth braid to the copper tape screen of each core as per requirement. Connect large earth braid to the armour. Insert the hose clip from on the earth braid and tighten fully. Remove the copper tape screen as per requirement and clean the core insulation with solution given in KIT by kit supplier. Insert the jointing sleeves on the core insulation gradually and push it down. Start shrinking from down and proceed upward for end termination. Crimp the lugs, file off burrs. Bidder has to follow all instruction and special instruction given by cable end / straight joint kit manufacturer.

The entire work of the cable jointing should be carried out through a skilled and competent trained cable jointers.

15.9.4 BONDING OF CABLES:

Where a cable enters any piece of apparatus, it shall be connected to the casing by means of an approved type of armoured clamp and gland. The clamps must grip the armouring firmly to the gland or casing, so that in the event of ground movement, no undue stress is passed on to the cable conductors.

15.9.5 PROTECTION OF CABLES:

The cable shall be protected by placing burnt bricks on two side and over the cables on the top layer of sand for the full length of underground cable. Where more than one cable is running in the same trench, the bricks shall cover all the cables and shall project a minimum of 80 mm on either side of the cables.

Cables under road crossings and any surfaces subjected to heavy traffic shall be protected by running them through Hume pipes of suitable size and proper grade.

15.9.6 CABLE INSIDE BUILDINGS:

Cables, inside buildings shall be laid either in masonry trenches or carried on cable trays, racks or brackets. Where cables run in ducts inside the building, the cables shall be adequately clamped to angle iron brackets / iron cable trays, secured to the wall as directed and approved by the engineer-in-charge. Where cables are suspended from ceilings they shall be carried over cable trays or racks as directed and approved by the engineer-in-charge. The supports shall be placed not more than

600 mm apart. All cables passing through walls shall run through stoneware pipes or Hume pipes of adequate diameter. Cables running along walls shall be supported and clamped to saddles, or hanger, rigidly anchored at close intervals. Where called for cable trenches they shall be filled with fine sand. The bidder shall ensure that hangers, brackets and other supporting arrangements for cables are placed in proper position at the time of building the walls, concrete may be carried out only with prior permission of the consultants.

15.9.7 EXCAVATION AND BACK FILLING:

Trenches shall be dug true to line and grades. Back fill for trenches shall be filled in layers, not exceeding 250 mm. Each layer shall be properly rammed and consolidated before laying the next layer. The bidder shall restore all surfaces, roadways, side walks, curbs, walls or other works cut by excavation to their original condition satisfactory to the engineer-in-charge.

15.9.8 MARKERS AND WARNING PLATES:

Approved CI cables markers shall be provided along the route of the cables at every 30 meter distance and at both ends of road crossing, indicating HV cables and MV cables as applicable. Special CI marker shall be provided at all buried cable joints indicating “Electrical Cable Joints”.

15.9.9 TESTING OF CABLE:

Prior to burying cable following tests shall be carried out:

Insulation test between phase to phase and phase to earth for each length of cable before and after jointing, shall be carried out.

On completion of cable laying work and jointing, the following test shall be conducted in the presence of the engineer-in-charge.

(a) Insulation resistance test.
(b) Continuity test.
(c) Earth test
(d) High voltage test.

All tests shall be carried out in accordance with relevant Indian Standard code of practice and Indian Electricity Rules. The bidder shall provide necessary instruments, equipment, engineers and labour for the above test and shall bear all expenses in connection with such tests. All tests shall be carried out in the presence of the engineer-in-charge.

15.10 INSTALLATION SPECIFICATION FOR EARTHING:

15.10.1 GENERAL:

All the non-current metal parts of electrical installation shall be earthed properly. All metal conduits, trucking, cable sheaths, switchgear, distribution fuse boards, lighting fittings & fixtures and all other parts made of metal shall be bonded together and connected by means of specified earthing system. All earthing will be conformed to Indian Standard Specifications IS : 3043 – 1987. The bidder shall measure the resistivity of various places in the proposed sub stations and design suitable earthing system as per IEEE Standard 80-2000 and get it approved from GETCO.

Installation of Earthing System for S/S under consideration

1.0 General

1. 1 Earthing Mesh for 220KV switchyard and 66KV switchyard may be designed as per IEEE Std 80-2000 considering the resistivity and fault level given in S/S Data and laid at a depth of min.0.6 meter below the normal earth surface. Along the periphery of the mesh, at all the junction points of parallel conductors, adequate size (as design permits) of steel vertical rods should be driven 3.0 meters into the soil below the mesh.

1. 2 Suitable size of risers brought out from the earth mesh to outside (above ground) for connection to structures and equipments.

1. 3 Body of each equipments should be connected to its respective structure with at least one no. of 75x10 or 50x6 GI strip (as per approved earthing philosophy) and at least one no. to risers with fully welded and bolted with 12x25 mm double nut bolts.

1. 4 Each and every structure should be connected to risers with at least two nos. of 75X10 or 50x6 GI strip (as per approved earthing philosophy) and fully welded and bolted with 12x25 mm double nut bolts.

1. 5 Steel rods of the foundations should also be connected to the mesh with a 75X10 or 50x6 GI strip (as per approved earthing philosophy).

1. 6 All the neutrals of transformers, LA s, CVTs, Panels should be provided with pipe type earthing as per design.

1. 7 Power transformer neutrals should be earthed through 50x6 copper strips.

1. 8 Check pit (Quantity as per schedule) should be provided at the suitable points jointly decided by successful bidder and GETCO Site-In-Charge at a junction points with extended vertical ground rods-raisers.Masonary chamber should be provided to these check pits.

1. 9 Resistance value should be recorded for each check pits to verify the grid resistance with the designed value.

2.0 Pipe Electrodes

2.1. Standard pipe type earthing as per IS:3043 with 100 mm (dia) CI pipe of 13 mm thickness should be carried out for the equipments stated hereunder and these electrodes shall be connected to earth mat with the help of 75x10 GI flat.

2.3.1 Neutrals of 220KV class Power Transformer - 02 Nos. for each neutral.

2.3.2 Body of 220KV class Power Transformer- 02 Nos. for each Transformer (if permitted in schedules).
2.3.3 Neutral of Power Transformer 66/11 KV - 02 Nos. for each neutral.
2.3.4 Body of 66/11 KV Power Transformer - 02 Nos. for each Transformer (if permitted in schedules).
2.3.5 Each Distribution Transformer neutrals - 01 No. for each neutral.
2.3.6 220KV LAs -01 No. for each.
2.3.7 220KV CVTs - 01 No. for each .
2.3.8 66 KV LAs - 01 No. for each.
2.3.9 Control & Relay Panels (220KV) -1No. common for all the panels
2.3.10 Control & Relay Panels (66KV) - 1No. common for all the panels.
2.3.11 Control & Relay Panels (11KV) - 1 No. common for all the panels.
2.3.12 Control Room , Chargers and Computers etc. - 1No. common for all

15.10.2 EARTHING CONDUCTORS:

All earthing conductors shall be of high conductivity G.I. / Aluminium / Copper and shall be protected against mechanical injury or corrosion.

15.10.3 CONNECTION OF EARTHING CONDUCTORS:

(i) Main earthing conductors shall be taken from the earth connections at the main switchboards to an earth electrode with which the connection is to be made. Sub-main earthing conductors shall run from the main switchboard to the sub-distribution boards. Final distribution boards earthing conductors shall run from sub-distribution boards.

(ii) Circuit earthing conductor shall run from the exposed metal of equipment and shall be connected to any point on the main earthing conductor or its distribution boards or to an earth leakage circuit breaker. Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to switchboards at which they originate or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing. Where equipment is connected by flexible cord, all exposed metal parts of the equipment shall be earthed by means of an earthing conductor enclosed with the current carrying conductors within the flexible cord. Switches, accessories, lighting fitting etc. which are rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered as a part of earthing conductor for earthing purposes, even though the run of metallic conduit is earthed.

(iii) All metal clad switches and other equipment carrying single phase current, shall be connected to earth by a single connection. All metal clad switches, carrying medium voltages and high voltage shall be connected with earth by two separate and distinct connections. The earthing conductors inside the building, wherever exposed, shall be properly protected from mechanical injury by running the same in GI pipe of adequate size.

(iv) Earthing conductors, outside the building, shall be laid 600 mm below the finished ground level.

(v) In case of copper earthing strips, the cover lapping at joints (wherever required) shall be of minimum 75 mm. Sweated lugs of adequate capacity and size shall be used for ail termination of wires above 6 sq. mm size and bare copper wire above 2.5 mm dia. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance and properly tinned.

(vi) Neutral conductor, sprinkler pipes or pipes conveying gas, water or flammable liquid, structural steel work, metallic enclosures for cables and conductors, metallic conduits and lightning protection stem conductors shall not be used as a means of earthing an installation or even as a link in an earthing system. The electrical resistance of metallic enclosures for cables and conductors measured between earth connections at the main switchboard shall be low enough to permit the passage of current necessary to operate fuse or circuit breakers and shall not exceed one ohm.

15.10.5 PROTECTION FROM CORROSION:

Connections between copper and galvanized equipment shall be made on vertical face and protected with paint and grease. Galvanized fixing clamps shall be used for fixing earth conductors. When there is evidence that the soil is aggressive to copper, buried earthing conductors shall be protected by suitable serving and sheathing.

15.10.6 PIPE ELECTRODE EARTHING:

The pipe electrode earthing is specified in Schedule B1. The electrode shall be in one piece and no joints shall be allowed in the electrode. Wherever possible, earth electrodes shall be located close to water tap, water drain or a down take pipe. Earth electrode shall not be located in proximity to a metal fence. It shall be kept clear of the building foundations and in no case, it shall be nearer than 2 meters from the outer face of the wall.

15.10.7 EARTH RESISTANCE:

The earth resistivity result of the soil where the earthing stations are located shall be submitted to the engineer-in-charge before the earthing work starts. If the earth resistance is too high and multiple electrode earthing does not give adequate low resistance to earth, the soil resistivity immediately surrounding the earth electrodes shall be reduced by adding sodium chloride, calcium chloride, sodium carbonate, copper sulphate, salt and soft coke or charcoal or other better earth reactivating compound in suitable proportions as required in consultation with Engineer in Charge.

15.10.8 RESISTANCE TO EARTH:

The resistance of each earth system shall not exceed 1 ohm.

15.11 INSTALLATION SPECIFICATION FOR LIGHT POINT WIRING:

15.11.1 SYSTEM OF WIRING:

The system of wiring shall consist of single core PVC insulated copper conductor wires in GI conduit in case of control room and PVC conduits in case of staff quarters. The complete wiring in control room shall meet with the standards for Industrial grade wiring.

15.11.2 GENERAL:

Prior to the laying of conduits, the bidder shall submit the shop drawings for conduit layout indicating the route of the conduit, number and size of conduits, location of junction / inspection / pull boxes, size and location of the switch boxes, point outlet boxes and other details. These shop drawings shall be got approved by the Engineer-in-charge before the laying of the conduits.

15.11.3 MATERIALS:

PVC conduits shall be used for concealed and exposed conduit work in staff quarters while Galvanised steel conduit in case of control room wiring.

PVC CONDUITS :
PVC Conduits shall be solid drawn of lap welded conduits. Stove enameled inside and outside with minimum wall thickness of 1.5 mm for conduits up to 25 mm dia. and 2.0 mm wall thickness for conduits above 25 mm dia. The conduits shall be delivered at site of construction in original bundles of each length with the original labels of the manufacturer. The numbers of insulated copper wires to be drawn into the conduits of various sizes are given below & the fill shall not exceed 40 %.
Steel conduits shall meet with the standards as per IS-9537.

15.11.4 MAXIMUM PERMISSIBLE NUMBER OF WIRES FOR CONDUITS:

(1100 Volts grade either single/Multi core PVC insulated wires that may be drawn in rigid nonmetallic or metallic conduits)

Size of wire (Nominal cross section area of conductor sq. mm).	Size of conduits (mm)		
	19	25	32
1.5	6	10	18
2.5	5	8	14
4.0	3	6	10
6.0	2	5	6
10	-	2	6
16	-	-	3
25	-	-	3
35	-	-	2

15.11.5 CONDUIT CONNECTION:

Conduit connections for PVC conduits shall be screwed metal to metal and be painted with one coat of self etching zinc chromate primer and two coats of enamel paint. The threads and sockets shall be free from burs, grease and oil. The connections between screwed conduit and sheet metal boxes shall be by means of a non metallic smooth bore bush, fixed inside the box checknuted inside and outside box and
connected through a coupler to the conduit. The joints in conduits shall be free of burrs to avoid damage to insulation of conductors while pulling them through the conduits. Connections between PVC and MS conduits shall be through a junction box. Direct connections between PVC and MS conduits are not allowed

15.1.6 BENDS IN CONDUIT:

Where necessary, bend or diversions may be achieved by means of bend or circular inspection boxes with adequate and suitable inlet and outlet screwed joints. In case of recessed system, each junction box shall be provided with cover properly secured and flush with the finished wall surface, so that the conductors inside the conduits are easily accessible. No bends shall have radius less than 2.5 times the outside diameter of the conduit.

15.11.7 FIXING OF CONDUITS:

Conduits and junction boxes shall be kept in position while the wall, slabs and floors are under construction and proper holdfast shall be provided. Conduits shall be so arranged as to facilitate easy drawing of wires through them. Adequate junction boxes of approved shape and size shall be provided. Where conduits crosses expansion joints in the building, adequate expansion fitting or other approved devices shall be used to take care of any relative movement. All conduits shall be installed such so as to avoid steam and hot water pipes. Conduits shall not come in contact with any wooden members, unless otherwise stated. Conduits state in floor / stabs shall be kept as short as possible above the finished floor level in order to avoid any damage to them. After the conduits junction boxes, outlet boxes and switch boxes are installed in position; their outlets shall be properly plugged or covered so that water, mortar, insects or any other foreign matter does not enter into the conduit system. Exposed conduit shall be fixed by means of space bar, saddles at intervals not more than 1000 mm in normal run and 500 mm from both sides of fitting or accessories. The saddles shall be of 3 mm x 19 mm galvanized mild steel flat, properly treated with primer and painted and fixed to support by means of nuts and bolts / raw / bolts and brass machined screws as required.

Conduits shall be laid in a neat and organized manner as directed and approved by the Consultant. Conduit runs shall be planned such that it does not conflict with any other service pipe lines / Ducts.

Where exposed conduits are suspended from the structure, they shall be clamped firmly and rigidly to hangers of design to be approved by the Consultant. Where hangers are to be anchored to reinforced concrete, appropriate inserts and necessary devices for their fixing shall be left in position at the time of concreting. Making

holes or opening in the concrete will generally not be allowed. In case, it is unavoidable prior permission of the Consultant shall be obtained.

15.11.8 PROTECTION

To minimize condensation or sweating inside the conduit pipes, all outlets of conduit system shall be adequately ventilated as directed and approved by the Consultant. All screwed and socketed connections shall be adequately made fully water tight by the use of proper jointing materials.

15.11.9 SWITCH OUTLET BOXES AND JUNCTION BOXES:

All outlet boxes for switches, sockets and other receptacles shall be fabricated from 1.5 mm thick mild steel sheets, duly painted with rust proof paint as called for finish. Junction boxes and outlet boxes in contact with earth or installed in areas exposed, to the weather, shall be of 2 mm thick mild steel and hot dip galvanized after fabrication. Where called for outlet boxes for receiving switches, telephone outlets power plugs etc. they shall be fabricated to the approved shape and size to suit the cover plates of specified make for different utilities. The cover plates shall be of best Perspex sheet cut to shape and size wherever regular piano switches used and for brass toggle switches the cover plates of the switches shall be of 3 mm thick powder coated aluminium sheet as approved by the Engineer-in-charge. Proper supports shall be provided in the outlet boxes to fix the cover plates of switches as required. Wherever the specified make of switch and its other connected utilities is MK or equivalent make, the switch boxes shall be suited to receive MK or equivalent make switches, plugs etc. only and the cover plate of the boxes housing the switches shall be of MK or equivalent make suitable for receiving MK or equivalent make logic modular kind of design of switches and its other utilities. Separate screwed earth terminal shall be provided inside the box for earthing purposes. All boxes shall have adequate number of knock out holes of required diameter for conduit entry. Where called for outlet boxes for receiving switches and fan regulators in one box, the boxes shall be fabricated to approved shape and size so as to accommodate fan regulators switches. All junction boxes, pull boxes and outlet boxes shall be provided with 3 mm thick Perspex sheet cover. The box cover shall be secured to the box with adequate number of round head brass screws of approved make. Outlets exposed to the weather shall be fully weather tight, complete with rubber gasketed covers, glass where used shall be fully heat resistant for its duty. The outlet boxes shall be painted with two coats of bitumastic paint before they are fixed in position. Outlet boxes fixed in concrete shall be in position and shall be of a minimum depth of 65 mm.

15.11.10 INSPECTION BOXES

Rust proof inspection boxes shall be of 1.5 mm thick mild steel sheet and of required size, having smooth external and internal finish and shall be provided to permit periodical inspection and to facilitate removal and replacement of wires, when required. Inspection boxes shall be mounted flush with ceiling / walls finished

surface and shall be provided with screwed covers of 3 mm thick Perspex sheet cover secured to the box with brass screws.

15.11.11 CONDUCTORS:

All PVC insulated conductor wires shall confirm, in all respects, of the relevant IS codes & they shall bear an ISI mark.

15.11.12 BUNCHING OF WIRES:

Wires carrying current shall be so bunched in the conduit that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.

15.11.13 DRAWING OF CONDUCTORS:

The drawing and jointing of insulated conductor wires shall be executed with due regard and precautions. Care shall be taken so as to avoid scratches and kinks which may cause damage to insulation and also breakage of conductors. There shall be no sharp bend.

Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing.

PVC insulated copper conductor wire ends before connection, shall be properly crimped by means of standard solder less crimping method. Strands of wires shall not be cut for connecting to the terminals. All strands of wires shall be properly crimped at the end before connection. The connecting brass screws shall have flat ends. The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. At all bolted terminals, brass flats washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections.

Only certified wiremen and cable jointers shall be employed to do jointing work. All wire shall bear the manufacturer's fable and shall be brought to site in new and original packages.

For all internal wiring PVC insulated wires of 660/1100 volts grade shall be used. The sub-circuit wiring for points shall be carried out in looping system and no joint shall be allowed in the length of conductors. No wire shall be drawn into any conduit, until any work, that may cause injury to wire, is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits the conduits shall be thoroughly cleaned of moisture dust, and dirt or any other obstruction by forcing compressed air through tide conduits. The minimum size of PVC insulated copper conductor wires for all sub circuit wiring i.e., from switch boards to point outlet for lights, exhaust

fans and ceiling fan points shall be 1.5 sq. mm. In case of power circuit not more than one.

20 / 1 5 amp power outlets shall be in one circuit, wiring for the power outlet shall be carried out with 4 / 2.5 sq. mm PVC insulated copper wires. All 20 / 15 amp. power outlet shall be connected with 2.5 /1.5 sq. mm copper wire to the earth terminal of outlet. Separate circuit shall run with 4 sq. mm PVC insulated 7 / 0.029" copper conductor wires for each water heaters, Kitchen equipment, window air conditioners and similar outlets.

The minimum size of copper conductor PVC insulated wire from final distribution board to first tapping point in the circuit shall be 2.5 sq. mm Maximum lighting points to be connected in a circuit shall be 10 (800 Watts maximum).

15.11.14 JOINTS:

All joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joint shall be made inside conduits and junction boxes. Conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any specified reasons, prior permission shall be obtained from the Engineer-in-charge making such connections.

15.11.15 MAINS AND SUB-MAINS:

Mains and sub-mains wires, where called for, shall be of the rated capacity and approved make. Every main and sub-main shall be drawn into an independent adequate size conduit. Adequate size draw boxes shall be provided at convenient locations to facilitate easy drawings of the mains and sub-mains. An independent earth wire of proper rating shall be pro vided. Each phase shall be provided with separate current transformer of accuracy Class I and suitable VA burden for operation of associated metering. Current transformers shall be in accordance with IS: 2705-964.as amended up to date.

15.11.16 MINIATURE CIRCUIT BREAKER DISTRIBUTION BOARD:

The bidder has to use ready-made MCBDBs of approved make only. Fabricated MCBDBs will not be permitted.

15.11.17 LABELS:

Engraved PVC labels shall be riveted / screwed on all incoming and outgoing feeder switches. Circuit diagram, showing the arrangements of the circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

15.11.18 EARTHING:

Copper / G.I. earthing strips of adequate size shall be connected to the MCBDBs at minimum two earth terminals from the main earthing grid.

16.0 SITE TEST AND CHECKS:

16.1 General:

16.1.1 All the equipment shall be tested at site to know their condition and to prove suitability for required performance. The list of tests / indicated to be conducted, and all required equipment / instrument shall have to be arranged by the bidder. Any other test which is considered necessary by the manufacturer of the equipment, bidder or as mentioned in commissioning manual, shall have to be conducted at site.

In addition to the tests on individual equipment, some tests / checks are to be conducted / observed from overall system point of view to develop confidence for charging of the system / equipment. Such checks are highlighted under miscellaneous tests but these shall not be limited to as indicated, and shall be finalized in consultation with Engineer-in-charge.

All cheeks and tests shall be conducted in the presence of client's representative and test results shall be submitted in three copies, to client and one copy to Electrical Inspector. Test results shall be filled in proper Performa.

After clearance from Electrical inspector, system equipments shall be charged in step by step method..

Based on the test results clear cut observation shall be indicated by testing engineer with regard to suitability for charging of the equipment or reasons for not charging, are to be brought out by the bidder.

16.2 HT SWITCHGEAR

1. IR test
2. HV one-minute test
3. Measurement of BDV of oil for Transformer, CT, PT etc.
4. Test to prove inter changeability of similar parts (including breaker module).
5. Testing of relays as per supplier's commissioning manual.
6. Testing and calibration of all meters.
7. Operation of all relays by secondary injection method.
8. Testing of CT polarities and CT ratio by primary injection test.
9. IR and voltage ratio test for PTs.
10. Functional test of all circuit components for each panel / feeder.
11. Test to prove closing / tripping operation at minimum and maximum specified voltage in test and service position.
12. Check for draw out test and service position of breakers for all feeders.
13. Check for covering of all openings in the panel – check for continuity and operation of aux. contracts of breaker.
14. Check for pressure of SF6 gas and air (for SF6).

16.3 ISOLATOR:

1. IR test before and after HV test.
2. Operational test.
3. Checking of interlocking with earth switch.
4. Checking of operation of earth switch.
5. Checking for tightness of earth connections.
6. Check for continuity of aux. contacts.

16.4 HT CABLES

1. IR measurement before and after HT test.
2. HV test.
3. Checking tightness of bolts with torque wrench.
4. Checking for phase sequence marking.
5. Check for clearances between phase to phase and phase to earth.
6. Check for-minor damages of Insulation after laying.
7. Checking for inspection openings and accessibility for replacement of cables.
8. Check for tightness for earthing connection for armour.

16.5 LT SWITCHGEAR

1. IR test.
2. HV test with 2.5 KV megger.
3. Functional test for all feeders.
4. Testing and calibration of all meters and relays.
5. Checking and calibration of overload relays.
6. Checking the local and remote operation of the contactors.
7. Checking of interlocking between incomers / and other feeders. Wherever required.
8. Test to prove interchangeability of similar parts.
9. Tests to prove correct operation of breakers at minimum and maximum specified control voltages.
10. Checking of earthing connection for neutral-earth bus, cable armour, and location of EIF CT etc. as per the scheme.

16.6 TRANSFORMER :

1. IR test on each vending to ground, and between windings.
2. Turns ratio test on each tap.
3. Polarity and vector group test.
4. IR, wiring and operational tests on all control devices in control cabinet, oil level indicator, winding and oil temp. indicators, etc.
5. Checking of earthing with respect to transformer tank (flexible from top cover to tank) other parts, neutral and tank to electrodes etc.
6. Testing of buchholz relay for alarm and trip conditions.
7. For bushing CTs, tests applicable shall be as for current transformers.
8. Setting of oil / winding temperature indicators, level gauge and checking of alarm / trip circuits.
9. Checking of OLTC operation.
10. Checking of insulators for cracks.

11. Checking for oil leakage and arresting of leakages (if there)
12. Checking of operation of all valves.
13. Checking for open position of all the valves (except drain and filter valves).
14. Filtration of oil by using line filter and heater set, If required.
15. BDV test on oil samples from top, bottom, and from OLTC tank.
16. Checking of oil for acidity, water content, tan delta etc. as per IS : 335-1983, If required.
17. Measurement of magnetizing current and no load loss.
18. Checking of silica-gel breather.
19. Checking of other points given in the manufacturer's commissioning manual.
20. Checking and calibration of remote vending / oil temp. indicators, tap position indicators, annunciation system (where RTCC panel is there).
21. Checking of oil resistivity, surface tension and dissolved gas analysis. If required.
22. Stability test.

16.7 BATTERY:

1. Checking for completion of civil / ventilation requirement of battery room.
2. Checking of adequacy of charger output / requirement with respect to current required for battery charging as per the manual.
3. Checking for availability of safety devices, water and first aid box.
4. Checking the polarity of connections between battery and charger.
5. Visual inspection test for level and leakages.
6. Checking of layout as per approved drawing.
7. Checking of IR value from positive to earth and negative to earth.
8. Checking of voltage per cell and total voltage between positive negative and earth to positive / negative.
9. Checking of tightness of connectors on each cell.
10. Checking of capacity test and hourly measurement of specific gravity and voltage for each cell.
11. Charging – discharging cycle as per standard practice and as per instruction of Engineer-in-charge.

16.8 BATTERY CHARGER

1. IR test.
2. Checking the voltage ratio of boost and float mode transformers
3. Checking for charging mode of batteries, constant current and constant voltage mode.
4. Load test on charges by running of DC drives (if there and by liquid resistance system.
5. Checking of tightness of earthing connections.
6. Check for all alarm conditions.
7. Checking and calibration of alt indicating meters.
8. Cheek for functional operation of charger, auto manual change over from float to boost to float etc.
9. Checking and setting of all relays.
10. Cheek for AC ripple in boost and float mode after charging.
11. Check for polarity of cables connected to battery.

16.9 ACDB / DCDB :

1. IR test before and after HV test.
2. HV test by HV megger (2.5 KV).
3. Checking for functions of components for each module.
4. Checking for interchangeability of similar components.
5. Checking of tightness of earth connections.
6. Testing and calibration of all indicating meters.
7. Cheek for output of each feeder after energisation.

16.10 CABLES AND CABLE SUPPORTING STRUCTURES:

1. Checking of continuity and IR values for all the cables before and after HV test.
2. HV test and measurement of leakage current after termination of cable kits (for HT cables).
3. Checking of earth continuity for armour and fourth core (If applicable).
4. Check for mechanical protection of cables.
5. Check for identification (tag number system) placement of cable marker, cable joint etc. as per the cable layout drawing.
6. Check for earthing of cable structures.
7. Check for proper fixing of cable structures.
8. Check for proper drainage and removal of water (if any).

16.11 EARTHING:

1. Check for tightness of all earth connections.
2. Check for earthing of all metallic equipments, cable trays, busbar supporting structures, yard fencing steel structures of yard, rails, gates, building columns (if steel) all electrical equipments, gas / oil / water pipe lines etc. as per the drawing / specification.
3. Measurement of earth resistance for each electrode.
4. Measurement of total earth resistance.
5. Measurement of earth loop resistance for E/F path of biggest LT drive.

16.12 MISCELLANEOUS:

1. Checking of continuity of the system.
2. Checking of phase sequence from overhead line to sub-station.
3. Checking for safe accessibility of all operating points.
4. Cheek for availability of emergency lighting.
5. Check for availability of control / aux. supply.
6. Ensure availability of first aid box, fire-fighting equipments, earth discharge roads, rubber mats, rubber glove.
7. Check for oil drainage system for transformer oil in each transformer.
8. Check for filling of gravels in yard and in transformer pits.
9. Cheek the working of ventilation system for battery room-switchgear room etc.

10. Check for safe movement of operators from yard to control room switchgear etc. with respect to proper illumination, escape light, uncovered openings, provision of hand railings in stairs etc.
11. Check for proper covering of cable channels.
12. Placement of shock treatment chart, danger, boards, provision of boards indicating "Man on Work, Do not switch ON", "Do not switch OFF", "EARTHED" etc.
13. Check for proper dressing of cables, mechanical protection of cables, and placement of cable markers.
14. Check for sealing of all cable openings including conduit opening with fire resistance material.
15. Checked for sealing of all openings at bottom of elect., panels.

17.1 COMPLETION OF ERECTION WORK (GENERAL)

Equipment shall be considered to have been completely erected when following activities have been completed:

- Moving of all structures and equipments with respective foundations.
- Fixing of anchor bolts or tech welding as required.
- Erection of all structures and equipment on respective structures.
- Leveling and alignment of equipments.
- Jumpering of equipments and bus.
- Assembling all accessories such as relays, CTs and PTs, meters, instruments etc.as per related standards/specifications.
- Drying of equipments as required and testing of oil for dielectric strength.
- Filtration and filling of oil as required.
- Cable laying, termination with continuity checks.
- Applying of finishing coat of paint wherever required.
- Mounting of lighting fixtures and connections.
- Testing of all system with operation of all protection system.

17.2 ERECTION OF SWITCHYARD STRUCTURES

17.2.1 The erection of switchyard structures shall mean erection of gantry, column, beams, equipment support structure and lighting masts, VHF masts (if any) etc. strictly as per the approved set of structural drawings of GETCO. The foundation work of switchyard structures is in the scope of bidder and hence foundation with concreted anchor bolts shall be made available before start of erection of structures.

17.2.2 The erected column shall be truly vertical well aligned and no pre-stress shall be applied to the erected column for bringing the structure in alignment/plumb. The erection of beams shall be done in phased manner on already erected columns. The elevation faces of the beams should be first fastened to the column one by one and thereafter plan bracings should be provided one by one to complete the beam geometry. The cross-connected beams should be perfectly at right angle and matching with respective phases of the column. There should not be any missing member on column or beam. After erection of columns and beams, the bolts and nuts should be properly tightened and punched. The thread of the protruding bolt

should be dented in the contact surface of nut at 3 point 120 degrees apart to eliminate loosening of bolt due to vibration.

17.2.3 The equipment support structures should also be erected as above. They should well be in plumb with all members fitted as per approved drawings and bolt nuts are properly tightened.

17.3 STRINGING OF BUS BAR AND JUMPERING

17.3.1 After completion of erection of gantry structures and equipments support structures; the bidder shall take up the work of stringing bus bar and Jumpering of various feeders and transformers bays. It should be ensured by the bidder that bus bar stringing is completed at a stretch and jumpering shall be carried out after erection of all equipments in switchyard. No joint or use of repair sleeve will be permitted in the bus bar and jumpering.

17.3.2 All the insulator strings to be used on the structure shall be properly cleaned with cloth. Compression dead end joints of the conductor shall be made after proper marking without any difference in the position amongst three phases.

17.3.3 After completion of the bus bar stringing work, the bidder shall undertake erection of all the switchyard equipments. Thereafter the bidder shall provide jumpers/droppers for the equipment connections to the bus bar or line conductors by using prescribed clamps and connectors. For bus bar connection only bolt less clamps shall be used.

17.4 ERECTION OF SECONDARY EQUIPMENTS

- The secondary equipments like CT, PT, LA, PI and all other equipments like circuit breaker, isolators, battery set and battery charger, 220kV & 66kV C&R panels, 11kV VCBs, LT panel etc. shall be received by the bidder directly from the manufacturer since the supply of all equipments and materials is in scope of the contractor. The bidder is required to keep the same in his custody at his site store center and shall transport the same to the erection site at the cost of bidder. The loading and unloading of these equipments shall be done by the bidder at his cost as indicated in general conditions volumes.
- After transporting the equipments at site, packing shall be gently removed without causing any damage to the equipment. The equipment shall be checked for its correctness of dimension, make etc. as per the approved drawing and shall be cleaned by cloth to make it ready for erection.
- The equipment shall be mounted on structures and to be checked for its vertical alignment (in plumb).
- All the clamp connectors and fitting shall be provided as per the approved drawing. The junction box of the equipment shall be opened, cleaned and all the connections should be checked for CTs and PTs. Fuse, links provided in the secondary box of CT/PT shall be checked for their position and continuity and any lacuna observed shall be set right. The arcing horns or corona control rings and all other fittings shall be provided as per the approved drawing for LA.

- The electrical connection of the equipments through jumpers shall be carried out, along with the cable connection of respective equipment to the marshaling kiosk or to the control relay panel. Bus bar connections shall be made with bolt less clamps.
- All equipments mounted on structures shall be earthed by 75x10 or 50x6 mm size (as per approved earthing philosophy) mild steel galvanized earthing stripes, running from top to bottom of the structure and to the earthing pit or earth grid.
- Polarity of the equipment to be connected on HV side should be checked prior to erection. The oil level (if any) of the equipment should be checked for its totality. If the level is inadequate, toping of oil should be carried out by availing oil from GETCO free of cost.

17.5 ERECTION OF CIRCUIT BREAKER

- 220kV & 66kV SF6 circuit breaker to be supplied by the bidder shall be received by the bidder him self and arrange to keep in safe custody at site store. From site store bidder shall transport to the erection site at bidder's cost. The crates containing the insulators, parts and accessories shall be opened carefully. Insulator parts and other accessories shall be thoroughly cleaned with cloth.
- The breaker shall be erected on its structures in up right position without any inclination. Main parts of the breaker shall be assembled as per drawing. The services of the commissioning engineer of breaker manufacturer shall be arranged by GETCO, if required. However the bidder will not remain contended with the instructions and guidelines given by the manufacturer's engineer and shall also use his own judgment.
- After erection of breaker on structure, it should be thoroughly inspected in MK box and any lacuna shall be reported to GETCO.
- The operating mechanism in the breaker MK box, as well as the contacts and power supply circuits shall be properly checked for its operation. All piping for gas/air shall be fixed as per approved drawing. The air receiver or compressor shall also be positioned as per relevant drawing. In case of breaker with spring charging mechanism, the trials of the mechanism should be done by actuating to ensure its proper functioning.
- The earthing points of the breaker and MK box shall be connected to earth grid.

17.6 ERECTION OF POWER TRANSFORMER

- The power transformer of 220/66KV 100MVA ,66/11 10 MVA and other transformer (as the case may be) to be supplied by the bidder shall be unloaded on the rails of the RCC plinth at the sub-station site. All the accessories/spares and transformer oil shall be transported by bidder at this location and unload at site of erection at his own cost.. Contactor shall ensure that the transformer plinth with rail is made ready well in time to receive the transformer at site.
- The bidder shall carefully open the casings/covers etc. and erect and commission the transformer as per standards.

- After the completion of erection of above-mentioned accessories, filling of oil under vacuum should be started. Random sampling and testing of oil should be carried out before filling. The oil level in the conservator tank, condenser bushing should be checked for its desired mark. After completion of oil filling work, final filtration of oil should be done to obtain PPM and BDV values as per the requirement of IS. The filter machine of sufficient capacity and reputed make approved by Engineer-in-charge shall be arranged by the bidder at his cost.
- The final testing and commissioning of the transformer should be done as per the instruction of GETCO Engineer.

17.7 ERECTION OF ISOLATORS

- 220kV & 66kV isolators with structures to be supplied by the bidder including transportation the sub-station site by bidder at his own cost. All the spare parts shall be properly unpacked and cleaned.
- 220kV & 66kV isolator with EB shall be erected on the gantry structure and isolator without EB shall be erected on isolator structure already erected as per the final lay out.
- The bidder shall check the erected support structure for their alignment vertically with tightness of nut bolts, before mounting the isolators. The mounting arrangement for the operating mechanism shall be verified for the structures provided. Any modification of the structures or isolator mechanism shall be carried out free of cost by the bidder.
- The parts of the isolator like insulators, fixed and moving contacts, earthing rod, operating rod shall be handled carefully to avoid breakage or distortion during the erection. The inter locking between operating rod and earthing rod of isolator with EB should be checked.
- During the erection of isolator it should be ensured for proper alignment with respect to bus conductor or line conductors. The erected isolator shall be in plumb and its operating mechanism rod, isolator blade and rotating insulators shall be checked for their proper function. It should be ensured that movement of fixed and moving contacts and their reach is within permissible limit.
- 50 close-open operations in presence of GETCO representative should be carried out after erection.

17.8 ERECTION OF C&R PANELS, LT PANEL AND BATTERY CHARGER, IN THE CONTROL ROOM

- The bidder shall transport all above equipments to site store. They shall be unpacked carefully in up side position and cleaned. After visual inspection, the panel door shall be opened and checked up for circuit connection, terminal connector, power connection etc.
- The front side of the panel shall be verified for meter, relay, semaphore indicator, hooter etc. for their position, rating and dimension by comparing them with the approved drawing. Any short coming in the panel shall be informed to Engineer-in-charge.

- The panels shall be shifted in the control room and shall be erected/grouted in the space provided on the floor of the control room as per the instruction of Engineer-in-charge and approved drawing of control room.

17.9 CABLING WORK

- The bidder shall first prepare cable schedule after studying the various control, metering and protection schemes as per the approved drawing for laying control cables. Similarly the cable schedule shall be prepared for laying LT cables from station transformer to LT panel and further to switchyard, colony, pump room, battery room, panels etc. All the schedules shall be got approved from Engineer-in-charge.
- The size and number of cores of cables shall be brought from the outdoor equipment like breaker, CT/PT to the control and relay panel as per predetermined study through cable trench and shall be laid very gently on the cable racks provided in the cable trench. Utmost care shall be taken to prevent damage to outer insulation and the armours of the cables. No mid joint shall be permitted to the cable.
- The required size of XLPE power cable shall be laid from power transformer to 11 KV transformer panel through cable trench and from 11 KV feeder panels to the double pole structures and station transformer.
- The ends of the control cables shall be terminated using correct size of lug and ferrules giving the identification number of various cores of the cables. The proper tools shall be used for termination to have a rigid connection of the control terminals. The LT cable shall be terminated with lug of proper size. The XLPE power cable shall be terminated with the special type of joints like heat shrinkable of any standard acceptable make or push on type. In no case compound type joint for power cable should be used.

17.10 ERECTION OF BATTERY AND BATTERY CHARGER

- The battery charger and the battery set with acid solution shall be transported by the bidder at his own cost at sub-station site. The battery set with all accessories and acid solution shall be shifted to battery room after painting the later with anti acid paint on walls and washing the floor and platform.
- The battery cells and other accessories shall be unpacked carefully to prevent any damage and then shall be cleaned to remove any dust/deposition. The battery rack shall be placed in such a fashion that rows of battery cell can be easily connected to each other.
- As per the drawing, the battery cells shall be provided on the rack with insulator support below it. The battery cells shall be connected in series by inter cell connectors and inter row connectors and shall be terminated to LT panel and charger. The battery cell shall be filled with requisite quantity of electrolyte and with proper specific gravity, up to the mark of maximum level indicated on the cell. The individual cell shall be checked for their voltage across the terminal and polarity before series connection and for total voltage of 220/110 Volt DC after completion of inter connections of cells. The racks and battery cells shall be cleaned for any deposition of electrolyte and other particles. The entire battery room shall be completely cleaned.

- The charge – discharge cycle shall be given to the battery set as per the instruction manual or as per the general practice for initial charging of the battery. After completion of this load test, the voltage and its specific gravity of each cell and total voltage shall be measured to achieve correct required values. The test load then shall be removed and battery shall be ultimately connected to LT panel and charger for its commercial use.
- The battery charger shall be grouted on the specified place on the floor, cleaned with air blower by opening the door / shutter on back side and all the cable connections to be made with LT panel, battery set and 220KV,66 KV and 11 KV panels etc. The working of all the meters, switches, relays on the front of the charger shall be checked along with fuses and links and transformer connections inside the charger. The functional operation of the charger for auto and manual mode from floor to boost and vice a versa shall be checked.