

CONTRACT NO.

GUJARAT WATER SUPPLY & SEWERAGE BOARD

GANDHINAGAR

(A WHOLLY OWNED GOVERNMENT OF GUJARAT UNDERTAKING)



Bid documents for “Supply, installation, testing and commissioning of VCB panel with required accessories at Rathadiya, Varnoli, Mahiji na Muvada and Karamadi Head Works, District: Vadodara under Different RWSS.”

VOLUME – II

TECHNICAL SPECIFICATIONS (SITC SECTION)

Name of Division:
Executive Engineer,
P. H. Mechanical Division,
Gujarat Water Supply & Sewerage Board,
205-206,II Floor, JALBHAVAN, Geri Campus,
Vadodara 380 007

GENERAL TECHNICAL CONDITIONS & REQUIREMENTS

1 SCOPE OF CONTRACT:

- 1.1 This specification covers the manufacturing, testing at manufacturer's site, delivery at site, unloading, handling and storage at site, complete erection, final checkup, painting, testing and commissioning of HT VCB panel & accessories at **Rathadiya, Varnoli, Mahiji na Muvada and Karamadi** pumping station with electrical & mechanical equipments like power and control cable wiring and grounding (earthing) systems, lighting systems, safety accessories etc. to be supplied under this contract to achieve a guaranteed performance coordinated with commercial conditions of the contract to the entire satisfaction of GWSSB.
- 1.2 Any minor hidden item of work either supply and / or erection of materials / equipment which have not been specifically mentioned in the specifications but are necessary to complete the work for trouble free and efficient operation and guaranteed performance of the entire plant / system / equipment offered shall be deemed to be included within the scope of this contract and shall be provided by contractor without any extra price to the GWSSB.
- 1.3 The project information is indicated in the enclosed specification. It is advisable that the bidder should visit the site and apprise himself of all the site conditions prior to preparing the bid.

2 EQUIPMENT AND SERVICES TO BE INCLUDED BY CONTRACTOR UNDER THESE SPECIFICATIONS:

- 2.1 Electrical works required at **Rathadiya, Varnoli, Mahiji na Muvada and Karamadi** Pumping Station, District: **Vadodara** under A 4 regional water supply scheme.
- 2.2 HT panel at Pumping Station with all the accessories as per specifications and data sheets.
- 2.3 Power (LT) and control cables etc as per specifications and requirement for the Pumping Station.
- 2.4 Earthing systems for the pumping station as per specification and requirement.
- 2.5 L. T. electrical wiring with required cable etc.
- 2.6 The contractor shall take the responsibility for all the testing and inspections at manufacturers' works to be conducted in manner as specified in this specification in the presence of GWSSB's representative. The inspection will be at the cost of contractor. The third party inspection shall also be carried out in the presence of the GWSSB representative i.e. jointly. Inspection charges shall be initially paid to designated third party inspection agency by the contractor, which shall be reimbursed by GWSSB on production of original bill (s) / money receipt (s) given by the TPI to the contractor.
- 2.7 Transportation of all equipments packed in the specified way from the manufacturer's works to the project site inclusive of all intermediate handling.
- 2.8 Unloading of equipments from railway wagons / trucks at site handling and proper storing at site in the approved way under security.

- 2.9 Opening of package, checking, tallying, sorting out and inspection of equipment received at the site and lodging of insurance claims if any.
- 2.10 Taking delivery of equipments / materials from contractor's site stores, transportation to erection site. If erection is delayed arrange for proper storage of the equipment / material in approval ways.
- 2.11 Erection inspection testing start up and running of the equipment and complete plant at guaranteed performance.
- 2.12 Furnishing all erection and commissioning supervision service. The contractor shall also arrange for maintenance & repairs (if required) of equipment(s) during guarantee and commissioning period.
- 2.13 The contractor shall also arrange technical expert of equipment from proprietary supplier to site as and when felt necessary until the commissioning & trial run of the plant is completed.
- 2.14 Required Nos. of all relevant drawings, data and instruction manuals.
- 2.15 All ancillary work as per price bid.
- 2.16 Any item of work either supply and / or erection of material equipment which have not been specifically mentioned in the specification but if necessary to complete the work for trouble free and efficient operation and performance of the entire plant / system / equipment offered, shall deemed to be included within the scope of his contract and shall be provided by contractor without any extra cost to the GWSSB.

2.27 **RESPONSIBILITY:**

It is the intention of the GWSSB to achieve coordinate effect. The installation erection of machinery is linked up with civil construction of pumping station testing and commissioning work is linked up with the obtaining of electrical connection / power. GWSSB no doubt will be doing his best to see that these inter connected activities are completed at appropriate time. However, contractor is not entitled for any claim, escalation of whatsoever commissioning at a date later than the stipulated time. Necessary extension of time will be granted in case if it is established that the erection / testing / commissioning could not be achieved in stipulated time on account of reasons beyond control of contractor. This factor should be carefully noted as no claim what so ever nature will be entertained on an account of such situations.

2.28 **GUARANTEE:**

The contractor has to furnish guarantee for all the equipments supplied by him and complete pumping station for a period of 12 months from the date of handing over the pumping station to GWSSB.

2.29 **DELIVERY:**

The contractor has to furnish the BAR – Chart & PERT Chart for the pumping station and the same followed strictly so as to commence the pumping station as per the schedule.

2.30 **CO ORDINATION BETWEEN DIFFERENT AGENCIES:**

It is the responsibility of the contractor to coordinate with different agencies i.e. sub supplier and civil contractor so as to commissioning the pumping station in scheduled time.

3.0 **EQUIPMENT & SERVICE TO BE EXCLUDED FROM THIS CONTRACT:**

3.1 Rising main beyond the vendor's scope of supply.

3.2 Construction of the pumping station and M.C.C. Room.

4.0 **THIRD PARTY INSPECTION:**

Inspection and testing of the major electro - mechanical equipments such as VCB Panel shall be carried out by third party inspection agency in the presence of GWSSB's representative (i.e. jointly) at manufacturers' works. QAPs along with manufacturers' cross sectional drawings, characteristic curves (if any), material(s) of construction etc. for all items shall have to be submitted by the bidder & get them approved prior to their procurement invariably. Executive Engineer, P. H. Mechanical Division, Vadodara shall scrutinize all QAPs etc. & approve them as per technical specifications & requirements of the governing standards. In case of deviation from the approved technical specifications, QAPs etc. shall be submitted to the Superintending Engineer, P. H. Mechanical Circle, Vadodara for acceptance & approval if found suitable.

4.1 That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.

4.2 That all items operate efficiently and quietly to meet the specified requirements.

4.3 That all noncurrent carrying metal work is properly and safely grounded in accordance with the specifications.

The contractor shall provide all necessary instruments and labour for testing and shall make adequate records of test procedures and readings, shall repeat any test requested by the consultant / GWSSB and shall provide test certificates signed by a properly authorised personsuch test certificates shall Cover all works.

4.4 If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements, or retesting will be considered. GWSSB's decision as to what constitutes a satisfactory test shall be final. The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

5 GWSSB reserves right to ask for the corporate guarantee from any or all the bidder for the performance and overall completeness in accordance to GWSSB's requirements. Specifically, for in time completion of contractual works in accordance to the technical requirements in best workmanship manner.

5.1 GWSSB reserves the right to spilt the work / distribute the works among bidders.

- 5.2 GWSSB reserves the right to accept or reject the tenders with technical deviation, at the discretion of competent authority.

GENERAL SPECIFICATIONS FOR SUPPLY OF EQUIPMENTS:

1.0 GENERAL:

This part covers conditions pursuant to the contractor and will form an integral part of the contract. The following provisions shall supplement general conditions, detailed specification and requirements.

2.0 LIMIT OF CONTRACT:

Equipments furnished shall be complete in every respect with all mountings, fittings, fixtures and standard accessories normally provided with such equipments and / or needed for erection, completion and safe operation of the equipments as required by applicable codes though they may not have been specifically detailed in the technical specification, unless included in the list of exclusions. All similar standard components / parts of similar standard equipments provided shall be interchangeable with one another.

3.0 ENGINEERING DATA:

- 3.1 The contractor shall furnish complete engineering data of each sets of equipment such as name of manufacturer, the type of model of each principal item of equipment proposed to be furnished and erected in the annexure, standard catalogues design, the specification number and the name of the project. If the standard catalogue pages are submitted the applicable items shall be indicated there in. All titles, noting, markings, and writing on the drawing shall be in English. All dimensions should be in metric units.
- 3.2 All manufacture fabrication works in connection with equipment prior to the approval of the drawing shall be at the contractor's risk. The contractor may make any changes in the design which are necessary to make any equipment conform to the provisions and intent of the contract and such changes will again be subject to the approval by the GWSSB. Approval the contractor's drawing or works by the GWSSB shall not relieve the contractor from any of the responsibility and liabilities under the contract.
- 3.3 Drawings shall include all installation and detailed piping drawings wherever applicable. All piping 100 millimetre and larger shall be routed in detail and smaller pipe shall be shown schematically or by isometric drawings. All drawings shall be fully corrected to agree with actual "As Built" construction.
- ### **4.0 DESIGN IMPROVEMENTS:**
- 4.1 GWSSB may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.

- 4.2 If any such agreed upon change is such that it affects the price and schedule of completion, the party shall agree in writing as to the extent of any change in the price and / or schedule of completion before the contractor proceeds with the change. The following such agreement provision thereof shall be deemed to have been amended accordingly.
- 5.0 The following documents shall be sent by registered post to the GWSSB by contractor within 3 days from the date of dispatch, to enable the GWSSB to make progressive payments to the contractor.
- INVOICE (3 copies)
- PACKING LIST (3 copies)
- TEST CERTIFICATE (3 copies)
- 5.1 The contractor shall prepare detailed packing list of all packages and containers, bundles & loose material forming each and every consignment dispatched to site. The contractor shall further be responsible for making all necessary arrangements or loading, unloading and other handling right from his work till the site and also till the equipment is erected, tested and commissioned. He shall be solely responsibility for proper storage and safe custody of all equipments.
- 5.2 All fine, rental, demurrages, warfare and other expenses incurred due to delayed clearance of the material or any other reason shall be to the account of the contractor.
- 6.0 PROTECTION TO PLANT:**
- 6.1 All coated surface shall be protected against abrasions impact, discolorations and any other damages. All exposed threaded portion shall be suitably protected with either a metallic or non-metallic protecting device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable device to protect them from damage. The parts which are likely to get rusted due to exposure to weather, shall also be properly treated and protected in a suitable manner.
- 7.0 MATERIALS HANDLING AND STORAGE:**
- 7.1 All the equipment furnished under the contract and arriving at the site shall be properly receive, un loaded transported and stored in the storage spaces by the contractor at his cost.
- 7.2 Contractor shall be responsible for examining all the dispatches and notify the GWSSB immediately of any damage, shortage discrepancy etc for the purpose of the GWSSB information only. The contractor shall submit to the GWSSB every week a report detailing all the receipts during the work. However the contractor shall be solely responsible for any shortages or damage in transit, handling and / or in storage and erection of the equipment at the site.

- 7.3 The contractor shall maintain an accurate and exhaustive record detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the GWSSB at any time.
- 7.4 All equipment shall be handled very carefully to prevent any damage or loss. No bare wire ropes, string etc shall be used for unloading and/or handling of the equipment. Stored equipment shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the store shall be moved to the actual location of the appropriate time so as to avoid damage of such equipment at site.
- 7.5 All electrical panels, control gears and such other devices shall be properly dried by heating before they are installed and energised.
- All the electrical equipments shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and record of such measured insulation values maintained by the contractor. Such records shall be kept open for inspection by the GWSSB.
- 7.6 The consumables and other supplies likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality by storage.
- 7.7 All the materials stored in the open or dusty location must be covered with suitable water proof and flame proof covering material wherever applicable.
- 7.8 The contractor shall be responsible for making suitable indoor storage facilities to store all equipments which require indoor storage. Normally all the electrical equipment, such as motors, control gears, generators, exciters and consumable like electrodes, lubricants, etc shall be stored in the closed storage space. The GWSSB in addition may direct the contractor to move certain other materials which in GWSSB opinion will require indoor storage, to indoor storage areas which the contractor shall strictly comply with.
- 8.0 CONTRACTOR'S MATERIALS AT GWSSB SITE(s):**
- 8.1 The contractor shall bring to site all equipment, component, parts, materials, including construction equipments, tools and tackles for the purpose of the works under intimation to the GWSSB. All such goods from the time of their being brought shall not on any account be removed or taken away by the contractor or his subcontractor without the written permission of the GWSSB. The contractor shall nevertheless be solely liable and responsible for any loss or destruction thereof and damage thereto.
- 8.2 The GWSSB shall have the lien on such goods for any sum or sums which may at any time be due to owing to him by the contractor, under in respect of or by reasons of the contract. After giving a fifteen (15) days notice in writing of his intention to do so, the owner shall be at liberty to sell and

dispose of any such goods in such as be shall think fit including public auction or private treaty and to apply the proceeds in or towards the satisfactions of such or sums due as aforesaid After the completion of the works, the contractor shall remove from the site under the direction of the purchaser the materials such as construction equipments, erection tools, and tackles scaffolding etc with the written permission of the GWSSB if the contractor fails to remove such materials GWSSB to do so then the GWSSB shall have the liberty to dispose of such materials and credit the proceeds thereof to the account of the contractor.

9.0 FACILITIES TO BE PROVIDED BY THE GWSSB:

9.1 SPACE:

The contractor shall advise GWSSB within fifteen (15) days from the date of acceptance of the letter of intent, about his exact requirements of space for his office, mess rooms, storage area, pro-assembly and fabrication areas, labour colony area, toilets, etc the above requirement shall be reviewed by the GWSSB and land if available will be given to the contractor for construction of his temporary structures like office, storage sheds, labour and staff colony and other utilities, etc for his own as well as his sub use. It will not be binding to owner GWSSB to spare the land if not available. In that case contractor shall have to make his own arrangements. The material once supplied shall have to be stored and preserved by agency up till the commission Agency may deploy the person to protect the materials supplied by agency at their own cost.

10.0 CONSTRUCTION MANAGERMENTS:

10.1 Time is the essence of the contract and the contractor shall be responsible for performance of his works in accordance with the specified construction schedule. If at any time the contractor is falling behind schedule, he shall make necessary action to make good for such delays by increasing his work force or by working overtime or over wise accelerate the progress of the work to comply with the schedule and shall communicate such action in writing to the GWSSB satisfying that his action will compensate for the delay . The contractor shall not be allowed any extra compensation for such action.

11.0 CONTRACTOR'S COOPERATION WITH THE GWSSB:

In case where the performance of the erection work by the contractor the operation of the system facilities of the GWSSB such erection work of the contractor shall be scheduled to be performed only in the manner stipulated by GWSSB and the same shall be acceptable at all times to the contractor. The GWSSB may important such restrictions on the facilities if provided to the contractor such as electricity, water etc as the GWSSB may think fit in the interest of the itself and the contractor shall strictly adhere to such restrictions and cooperate with the GWSSB it will be the responsibilities of the contractor to provided all necessary

temporary instrumentation and other measuring devices required during the start-up and operation of equipment systems which are erected by him. Before commission of any machine all old lubricants, greases etc shall be thoroughly removed, the part cleaned of all deleterious material and shall be freshly lubricated by sealed lubricants, of exact pacifications.

12.0 COOPERATION WITH OTHER CONTRACTORS & FOR GWSSB:

The contractor shall agree to cooperate with the GWSSB other contractor and consultants of GWSSB and freely exchange with them such technical information and economical design features to avoid unnecessary duplication of efforts .The contractor shall attend design coordination meetings at his own cost whenever required.

13.0 FIELD OFFICE RECORDS:

- 13.1 The contractor shall maintain at his site office up to date copies of all drawings specifications and other contract documents and any other supplementary data complete with all the latest revisions thereto. The contractor shall also maintain in addition, the continuous records of all changes to the above contract documents, drawings, specifications, supplementary data etc. affected at the field and on completion of his total assignment under the contract shall incorporate all such changes on the drawings and other engineering data to indicate as installed conditions of the equipments furnished and erected under the contract. Such drawings and engineering data shall be submitted to the GWSSB in required number of the copies.

14.0 DESIGN COORDINATION:

- 14.1 The contractor shall be responsible for the selection and design of appropriate equipments to provide the basic coordinated performance of the entire system They also design requirement are detailed out in technical specifications. The design of various components, sub assemblies and assemblies shall be not got done, such that it facilities easy field assembly and maintenance. All the relating components shall be so selected that the natural frequency of the compact unit is not critical at or close to the operating range of the unit.

15.0 QUALITY ASSURANCE PROGRAMME:

To ensure that the equipment and services under scope of this contract whether manufactured or performed within the contractor's work or at his sub contractor's premises or at the owner's site or at any other place of work are in accordance with the specifications. The contractor shall adopt suitable quality assurance programme to such activities at all points, necessary such programme shall be outlined by the contractor and shall be finally accepted by the purchaser after discussions before the start of contract, and such agreed programme shall form part of the contract.

16.0 DEFECTS IN WORK OF OTHER CONTRACTOR:

- 16.1 The GWSSB shall be notified promptly by the contractor of any defects in the other contractor works, the GWSSB shall determine the corrective measures if any required to rectify this situation after joint inspection work and such decision by the GWSSB shall be binding on the contractor.

17.0 UNFORSEEN WORKING CONDITIONS:

- 17.1 The contractor shall confirm all his field operations to those works which can be performed without subjecting the equipment and materials to adverse effects, during inclement weather conditions, monsoon, storms, etc and during other unfavorable construction condition. No field activities shall be performed by the contractor under conditions which might adversely affect the quality and efficiency thereof, unless special precaution or measures are taken by the contractor in a proper and satisfactory manner in the performance of such works and with the concurrence of the purchaser. Such unfavorable construction conditions will in no way relive the contractor of his responsibility to perform the works as per schedule.

18.0 PROTECTIVE GUARDS:

- 18.1 Suitable guards shall be provided for protection of personal on all exposed rotating and / or moving machine parts. All such guards with necessary spaces and accessories shall be designed for easy installation and removal for maintenance purposes.

19.0 WELDING:

- 19.1 If the manufacture has special requirement relating to the welding procedures for welds at the terminals of the equipment to procedure procured by the owned separate specifications. The requirement shall be submitted to the GWSSB in advance of commencement of erection work.

20.0 NOISE AND VIBRATIONS:

- 20.1 The equipment supplied and erection by the bidder will comply with best design and erection and its working shall within permissible noise and vibration levels.

21.0 EQUIPMENT BASES:

- 21.1 A cast iron or welded steel base plate shall be provided for the equipment which is to be installed on a concrete base unless otherwise agree by the GWSSB each base plate shall support the unit and its drive assembly shall be of a neat design with anchoring the units.

24.0 PAINTING:

All exposed metal parts of the equipments including piping, structures railings etc. Wherever applicable after installation unless otherwise specified shall be surface protected and shall be first painted with at least primer paint used, after thoroughly cleaning all such parts of all

dirt, rust Axles greases, oils and other foreign materials by wire brushing, scraping or sand blasting and the same being inspected and approved or sand blasting and the same being inspected approved by the board for painting. Afterwards the above parts shall be finished with two coats of alloyed resin machinery enamel paints The quality of the finished paints shall be as per standards of I.S.I or equivalent and shall be of the colour as approved by the GWSSB

27.0 FIRST FILLING OF CONSUMABLES OIL AND LUBRICANTS:

All the first fill of consumables such as oils, lubricants and essential chemicals etc. which will be required to put the equipment covered under the scope of the specifications into successful trial operation. They shall be furnished by the contractor unless specifically excluded under the in these specification and documents.

CHECKOUT CONTROL SYSTEMS:

After completion of wiring and cable furnished under separate specifications and laid as per the terms noted by the board the contractor shall check out the operation of all control system for the equipments furnished and installed under these specification and documents.

28.0 EQUIPMENT PERFORMANCE GUARANTEE:

The performance guarantees of the equipments under the scope of the contract are detailed separately in the technical specifications. These guarantees shall supplement the general performance guarantee provisions covered under general terms and conditions.

29.0 GUARANTEE:

In the event of any emergency where in the judgment of the board delay would cause serious loss or damage, repairs or adjustments may be made by the GWSSB or a third party chosen by the GWSSB without notice to the contractor or by surety. In the event such action is taken by the purchaser the contractors will be notified promptly and he shall assist whenever possible in making the necessary corrections. This shall not extinguish the contractor's liability under the terms and conditions of the contractor.

The cost of any special or general overhaul rendered necessary during the maintenance period due to the defect in the plant or defective work carried out the contractor the same shall be borne by the contractor.

In case of this effective parts which are not repairable at site but are essential for the commercial operation of the equipment, the contractor and the GWSSB shall naturally agree to a programme of replacement of renewal which will minimise interruption to the maximum extent, in to operation of the equipment. At the end of guarantee period the contractors liability except for the latest defects in respect of goods supplied by sub contractor to the contractor where a longer guarantee (More than 12 months) is provided

by sub - contractors, the owner shall be entitled to the benefit of such longer guarantee. Then provisions contained in this clause will not be applicable.

If the owner has not operated the equipment according to generally approved industrial practices and in accordance with the conditions of operation specified and in accordance the operating manuals, if any.

30.0 RECOMMISSIONING TRIALS - TESTS START – UP:

On completion of erection of the equipment and before start up each items of the equipment shall be thoroughly cleaned and then inspected jointly by the GWSSB and the contractor for correctness and completion of installation and acceptability for start up, loading to initial pre-commissioning tests at site.

The list of pre-commissioning tests to be performed shall be as mutually agreed and include in the contractor's quality assurance programme. The contractors commissioning / start up board specifically identified as far as possible and the contractor shall be responsible for carrying out all pre-commissioning tests. On completion of inspection checking after pre-commissioning tests are satisfactorily over, the complete shall be placed on initial operation during which period the complete equipment shall be operated integral with sub systems and supporting equipments as complete plant.

31.0 TRIAL RUN & OPERATION:

The plant shall then be on trial operation during which period all necessary adjustments shall made while operating over the full load range enabling the plant to be made ready for performance and guarantee tests.

The duration of trial operation of the complete equipment should be **30 days** of initial operation or any other duration as may be agreed to between the contractors. The trial operation shall be considered successful provided that each item of equipment can operate continuously at the specified operating characteristics, for the period of trial operation.

For the period of trial operation, the time of operation with any load shall be counted. Minor interruptions not exceeding four (4) hours at a time caused during the continuous operation shall not affect the total during of trial operation.

However, if in the opinion of the, purchaser, the interruption is long, the operation shall be prolonged for the period if interruption. A trial report comprising of observations and recordings of various parameters to be measured in respect of the above trial operation shall be prepared by contractor. This report, besides recording the details of the observation during trial run shall also including the dates of starts and finish of the trial operation and shall be signed by the representative of both the parties.

The report shall have sheets, recording all the details of interruptions occurred adjustment made and any minor repairs done during the trial operation, based on the observation necessary modification/repairs to the plant shall be carried out by the contractor to the full satisfaction of the GWSSB, to enable the latter on to accorded permission to carry out performance and guarantee tests on the plant.

32.0 PERFORMANCE AND GUARANTEE TEST:

- 32.1 The final test as to the performance and guarantees shall be conducted at site by the GWSSB. The contractor's shall make the equipment ready for such tests and assist by the GWSSB conducting such tests free of cost, such test shall be commenced after the successful completion of trial operation.
- 32.2 These trends shall be binding on both the parties of the contract to determine compliance of the equipment with the performance guarantee.
- 32.3 The available instrumentation and control equipment will be used during such tests and the GWSSB will be calibrate, all such measuring equipment and devices as far as practicable. However, immeasurable parameters shall be taken into account in a reasonable manner by the G.W.S.S.B, for the requirement of these tests. The tests will be conducted for the specified duty and as near to the specified conditions as practicable. The GWSSB will apply proper correction in calculation to take into account condition, which should not correspond to the specified condition.
- 32.4 Any special equipment, tools tackles required for the successful completion of the performance and guarantee tests shall be provided by the contractor, free of cost.
- 32.5 The guaranteed performance figure of the equipments shall be provided by the contractor during these performance and guarantee cost should the results of these tests show any depressed from the guaranteed values, the contractor shall modify the equipments as required to enable them to meet the guarantees. In such case performance and guarantee tests shall be repeated one month, from the date of equipment is ready for re-tests and all cost for modification including labour materials and the cost of additional testing prove that the equipment meets the guarantees shall be borne by the contractor.
- 32.6 The specific tests to be conducted on equipments have been brought out in the technical specifications.
- 32.7 Performance and guarantee tests shall make allowance for instrumentation error as may be decided by the GWSSB.

33.0 REGISTRATION AND STATUTORY INSPECTION:

- 33.1 All registration and statutory inspection fees if any in respect of this work pursuant to this contract shall be to the account of the contractor. However, any registration statutory inspection fees lawfully payable under the provision of statutory laws and it's amendments from time to time

during erection in respect of the plant equipment ultimately to be owned by the owner shall be to account of the owner. Should any such inspection or registration need to be rearranged due to the fault of the contractor or his sub-contractor the additional fees for such inspection and /or registration shall be borne by the contractor.

34.0 WORKS AND SAFETY REGULATION:

34.1 The contractor will notify the GWSSB of his intention to bring on the site any equipment or any container with liquid or gaseous fuel or other substance which may create hazard. The GWSSB shall have the right to prescribe the conditions for un keep of such hazardous equipments.

Before the contractor connects any electrical appliances to any plug or socket belonging to the other contractor or owner he shall:

- (a) Satisfy the Engineer in charge of GWSSB that the appliance is in good working conditions.
- (b) Inform the GWSSB of the maximum current rating voltage and phases power factor the appliances.
- (c) Obtain permission of the Board detailing the sockets to which the appliances may be connected.

34.2 The GWSSB shall not grant permission to connect until it is satisfied that

- (a) The appliance is in good condition and is fitted with suitable plug
- (b) The appliance is fitted with a suitable cable having two earth conductors, one of which shall be an earthed metal sheet surrounding the cores.

34.3 No electrical cable in use by the contractor / GWSSB shall be disturbed without prior permission. No weight of any description will be placed on any such cable and no ladder or similar equipment will rest against or be attached to it, under which such equipment or container may be handled and used during the performance of the work and the contractor shall strictly adhere to such instruction. The GWSSB shall have the right to inspect any construction plant and to forbid its use if in its opinion it is unsafe. No claims due to such prohibition shall be entertained by the GWSSB.

34.4 Where it is necessary to provide and / or store petroleum products petroleum mixtures and explosives, the contractor shall be responsible for carrying out such provision and / or storage in petroleum Act explosives Act 1948 and petroleum inspector of Explosives of India. All such storage shall have prior approvals of the GWSSB in case any statutory authority the contractor shall be responsible for obtaining the same.

35.0 ELECTRICAL SAFETY REGULATIONS:

- 35.1 In no circumstances shall the contractor interfere with fuse and electrical equipment belonging to the GWSSB or other contractors.
- 35.2 No work shall be carried out on any live equipment. The equipment shall be made safe by the GWSSB and a permit to work be issued before work is carried out.
- 35.3 The contractor shall employ the necessary number of qualified full time electricians to maintain temporary electrical installation.

GENERAL REQUIREMENTS (ADDITIONAL)

1. Employer's Drawings (if any):

- 1.1. The drawings listed in the tender document are the Employer's drawings and are provided by the Employer as illustrative of the specification.
- 1.2. All data and information furnished in the drawings by the Employer is given in good faith but the Employer does not accept the responsibility for the completeness and accuracy thereof. The same shall be verified by the contractor promptly pointing out errors or discrepancies thereof to the Engineer.

2. Drawings Furnished by the Employer:

- 2.1. The contractor shall carefully check all drawings and / or instructions furnished by the Engineer in charge before commencing any Work, and shall inform the EIC in writing, within a day from the receipt of the same, of any errors or omissions discovered, or of the difficulty to execute any works or part thereof in compliance with these drawings and / or the written instructions received from the EIC. Failing to do this, he shall be liable to execute at his own cost the necessary alterations to any works resulting from these errors or omissions.
- 2.2. The contractor will be furnished with 2 copies of any such drawings prepared by the Engineer. The contractor will also be furnished with two copies of all instructions as may be issued by the Engineer. One copy of all such drawings and instructions issued to the contractor shall be kept in his office at the site. No drawing or instruction shall be considered valid unless it has been signed by the Engineer.

3. Drawing Sheet Format:

- 3.1. All drawings provided by the contractor shall be on standard size sheets, prepared on computer with Auto Cad 14 and shall show the following particulars in a title block located in the lower right hand corner, in addition to the name of contractor and equipment manufacturer, date, scale, drawing number, revision number (R0 for drawings submitted initially, R1, R2, etc. for drawings submitted subsequently) and title:

Gujarat Water Supply & Sewerage Board / Name of Project: A-4 Regional Water Supply Scheme

A blank space of 90 mm x 100 mm shall be provided for the Engineer's approval stamp and provision shall be made for details of revisions to be recorded.

- 3.2. All drawings submitted by the bidder / contractor shall use the English language and preferably SI units. All drawings shall be clearly and fully cross referenced to the other drawings as relevant.

4. Tender / Contract Drawings:

- 4.1. Drawings submitted by the bidder shall show all the essential items of the plant offered together with sufficient details to enable the general arrangement of the Plant to be determined.
- 4.2. The outline dimensional drawings submitted by the contractor shall include the following in addition to overall dimensions:
 - Parameters of equipment
 - Load details
 - Support details
 - Foundation pocket details

5. Submission and Approval of Drawings:

- 5.1. The following shall be the procedure for submission and approval of drawings:
 - 5.1.1. The contractor shall submit 3 copies of the drawings to the Employer. All the drawings are to be signed by the contractor or his authorized representatives
 - 5.1.2. The Engineer in charge's (EIC) representative will review the drawings and, if found fit for approval, the Employer will return 2 copies to the contractor duly approved.
 - 5.1.3. In case the drawings / documents are not fit for approval but worth for review, the EIC's representative will mark the comments on the drawings and return 2 copies to the contractor. In such case, the contractor shall resubmit the revised drawings within two weeks as per sub clause 5.1.1 above and the same shall be repeated till the drawings are finally approved as per sub clause 5.1.2 above.
 - 5.1.4. If the submitted drawings / documents are not worth for review, the contractor will be informed accordingly.
 - 5.1.5. On receipt of the approved drawings as per sub clause 5.1.2 above, the contractor shall submit floppy and documents to the employer.
 - 5.1.6. After tests on completion, the contractor shall submit, within 15 days of the conclusion of the tests, CD's of the "As Built Drawings" to the Employer.
- 5.2. When the drawings are received by the EIC's representative after revision by the contractor, he will only review the revision made and hence the contractor shall carefully identify all the revised details / dimensions and also describe the revisions in the revision block.
- 5.3. No drawings, with corrections made after taking the prints, will be accepted.
- 5.4. Approval of drawings by the Engineer shall not relieve the contractor of his responsibility in terms of the contract.

7. Protection and Packing for Transportation:

- 7.1. Before any plant is dispatched from manufacturer's works it shall be properly prepared and packed and the contractor shall give the Employer at least 14 days notice that these preparations are to commence.
- 7.2. Prior to dispatch the plant shall be adequately protected by painting or by other approved means for the whole period of transit, storage and erection, against corrosion and incidental damage, including the effects of vermin, sunlight rain, high temperatures and humid atmospheres. The contractor shall be responsible for the plant being so packed and / or protected as to ensure that

it reaches the Site intact and undamaged. The plant shall be packed to withstand rough handling in transit and all packages shall be suitable for storage including possible delays in transit.

- 7.3. The contractor shall be deemed to have included in the schedule of prices for all materials and packing cases necessary for the safe package, conveyance and delivery and storage of the plant with all protective and preservation measures.
- 7.4. Cases containing rubber rings, bolts and other small items shall not normally weigh more than 50 kg gross per case. No one package or bundle shall contain items of plant intended for incorporation in more than one section of the works. All items of plant shall be clearly marked for identification against the packing list.
- 7.5. Eye bolts, lifting hooks and brackets shall be provided for lifting the boxes, crates and packages. Every crate or package shall contain a packing list in a waterproof envelope. A duplicate copy of the packing list shall be sent by post to the EIC's representative at site.
- 7.6. All crates, packages, etc. shall be clearly marked with a waterproof material to show the weight and where the slings should be attached, and shall also have an indelible identification mark relating them to the packing lists. Packing cases shall be nonreturnable. Contractor shall have to clear the site including packing material.
- 7.7. Electrical equipment shall be enclosed in sealed airtight package with hygroscopic material, before being placed in packing cases on shock absorbent materials and secured by means of battens.

8. Delivery, Unloading and Storing at Site(s):

- 8.1. The Contractor shall be responsible for checking all materials delivered to Site and shall keep the EIC or his representative fully informed of the state of deliveries. The contractor shall carry out, at his cost, all instructions of EIC or his representative for proper unloading, preservation, maintenance, storage and security of materials delivered to site until he fulfils all his obligations under the contract.
- 8.2. The contractor shall erect and maintain on the Site any temporary storage facility as required and approved by the EIC. If built up shed or area is provided by the Employer depending upon availability, the contractor shall have to pay rent as finalised by the EIC.
- 8.3. Multiple handling and movement of materials during storage and retrieval shall be avoided.

DETAILED TECHNICAL SPECIFICATIONS

PART I: ELECTRICAL

HV 11 KV SWITCHGEARS PANEL

Applicable Standards

- a) The design, material, construction, manufacture, inspection and testing of switchgear shall conform to the latest applicable standards & comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed.
- b) The equipment shall also conform to the latest standards specified below. In case of conflict between the standards and this specification, this specification shall govern.

Circuit Breakers Vacuum Contactors above 1 KV and up to 12 KV	IS: 13118/ IEC: 56, 694, 62271 IEC: 60470, 529, 721
Metal Enclosed Switchgear	IS: 3427/ BSEN: 60298/ IEC: 298/ IEC 265
Current Transformers	IS: 2705/ BS: 7626
Voltage Transformers	IS: 3156/ BS: 7625/ IEC: 186
Arrangement for switchgear bus bars, main connections and auxiliary wiring	IS: 5578, 11353
Busbar Support Insulators	IS: 2544/ BS: 3297/ IEC: 273
Degree of Protection	IS: 13947 (Part 1)/ IEC: 947-1/ IEC: 60529
Electrical Relays for power system protection	IS: 3231, 3842/ BS: 142/ IEC: 255
Electrical Indicating Instruments	IS: 1248/ BS: 89/ IEC: 51
High Voltage Fuses	IS: 9385/ BS: 2692/ IEC: 282
AC Electricity Meters	IS: 722, 8530/ BS: 5685/ IEC: 145, 211
Specification for copper rods and bars for electrical purposes	IS: 613
Code of practice for phosphating iron and	IS: 6005/ BS: 3189

steel	
Alternating current switches for voltages above 1000 V	IS: 9920/ IEC: 129, 265 & 298
Low Voltage Fuses	IS: 13703/ BS: 1362/ IEC: 269
Toggle Switches	IS: 3452/ BS: 3676
Code of practice for selection, installation and maintenance of switchgear and control gear	IS: 10118
Control Switches HV Cable Termination	IS: 6875/ BSEN: 60947/ IEC: 947 IEC: 62329

The switchgear shall be metal enclosed, indoor type with vacuum circuit breakers fully draw out type. Circuit breakers of same ratings shall be completely inter-changeable with one another. Separate metal enclosed compartments for (a) control, metering & relaying devices, (b) circuit breaker, (c) phase bus bars, (d) Instrument transformers & (e) input/ out power cable terminations and each section shall be in conformance with Loss of Service Continuity LSC 2B.

The rated capacity of the breaker & switchgear configuration (no. of incomer & outgoing breakers, minimum ratings, protections, indications, annunciations, instruments etc.) shall be as per reference electrical Single Line Diagram & this specification given in table below:

Sr. No.	Description	Rating
a)	Rated Voltage (KV)	11
b)	Bus Bar Rating (A)	As per data sheet & specifications
c)	Short Circuit Rating(kA for 1 sec)	26.2
d)	Type of breakers	VCB
e)	One-minute power frequency withstand capacity(KV rms)	28
f)	Lightening Impulse withstandvoltage (kVp)	75

g)	Bus Bars Material	Electrolytic Copper (Silver plated at Joints)
h)	Degree of Protection (Indoor/ Outdoor)	IP 4 X / IP 5 X (as minimum)

Auxiliary relays for multiplication of contacts for following transformer protections shall be provided for oil type Transformer feeders

- a) Buchholz Protection Alarm & Trip
 - b) Winding Temperature Alarm & Trip
 - c) Oil Temperature Alarm & Trip
 - d) Pressure Relief Device Trip
 - e) Oil level gauge (MOG) Alarm
- f) Surge arrestor of suitable capacity Oil Surge Relay (OSR) Trip: The circuit breakers should be able to carry the rated current continuously under site conditions without exceeding the permissible temperature rise for design ambient temperature outside the switchgear cubicle as specified.

Bus bar material for switchgear panel shall be electrolytic Copper. Bus bars shall be fully insulated, supported on insulators capable of withstanding dynamic stresses due to short circuit. Maximum temperature of the main bus bars and bus bar connections, under operating conditions, when carrying rated normal current at rated frequency shall not exceed 90⁰/ 105⁰C for non-silver plated/ silver plated joints as per IEC: 60694. Bus bar temperature limits shall be adhered to without forced cooling method. The continuous current ratings of the droppers in each switchgear cubicle shall at least be equal to the corresponding breaker rating. However short time current rating shall be same as the short time current rating of the bus-bars.

The circuit breaker shall be fully drawn out type in horizontal with test, service and isolated positions. In test position, the circuit breaker shall be capable of being tested for operation without energizing power circuits. Additional 2 (Two) normally open (NO) contacts of test and service positions shall be available for Client's use, after meeting all the interlocks/ permissive.

Switchgear shall comprise rigid welded structural frame enclosed completely by sheet steel - minimum 2.5 mm thick (hot rolled) or 2.0 mm thick (cold rolled), smooth finished, levelled and free from flaws. Switchgear cubicles shall be provided with bottom sheet steel plates of 2.5 mm thickness. Cable compartments shall be fitted with removable plates of minimum 2.5 mm

thickness for fixing cable glands. Cable gland shall be double compression type. For single core cable, removable plates of non-magnetic material shall be provided.

The switchgear panel shall be powder coated with shade RAL-7032 with minimum thickness 80 microns with structured finish and height not exceeding 2300 mm.

For vacuum circuit breakers necessary hardware for surge suppression shall be provided to take care of switching surge.

Circuit breaker shall be provided with a minimum of 6NO + 6NC contacts per pole exclusively for the GWSSB's use. All spare contacts of the circuit breaker shall be wired up to the terminal block.

The breaker closing coils, tripping coils, indications, annunciations shall be rated for 24/ 30V or 110V DC. The spring charging motor shall be suitable for 240V AC. Space heater, power socket, panel illumination lamp shall be fed from 240V, 50 Hz, 1 phase raw power supply. All lamp test facility shall be provided with push button.

The current transformers shall be mounted in the fixed portion of the switchgear expansion panel. The CTs shall withstand momentary and short time current ratings of the associated switchgear. CTs & VTs shall be of the cast resin type and completely encapsulated. Adequate space shall be available for termination using heat shrinkable type cable termination in CT compartment.

The switchgear shall have complete interlocking arrangement at the fully inserted and fully drawn out position of the breaker. Withdrawal of circuit breaker shall not be possible unless it is in open position and operation of circuit breaker shall not be possible unless it is fully in-service position, or is fully drawn out. Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Breaker trolley as required shall be provided with breaker.

Automatic safety shutters shall cover live parts when the breaker is withdrawn and all other standard safety features shall be provided.

All the high voltage compartments i.e. Circuit Breaker, Bus Bar, and Cable Compartments shall be separated from each other by metallic partitions in line with IEC: 62271-100/200. These compartments must have pressure relief flaps for exit of gas due to internal arc to ensure operators safety. All the HV design must ensure conformity to IEC: 62271-100/200 and must be type tested for internal arc tests.

All non-current carrying metal work of the switchgear panel shall be effectively bonded to the earth bus. Earth bus-bar shall be extended outside the switchboard at the ends. All hinged doors & bolted joints in the body of switchgear shall be earthed through flexible copper earthing braid of adequate cross section.

Terminal blocks shall be of stud & nut type, 1100V volts grade, 10 amps rated complete with insulated barriers. Terminal blocks for CTs and VTs shall be provided with test links and isolating facilities and CT terminals with short circuiting and earthing facility. All spare contacts and terminals of cubicle mounted equipment and devices shall be wired to terminal blocks with 20% spare terminals. All terminals of different control voltages shall be separate from each other. Stud type terminals and ring type lugs shall be used for control cables.

The sizes of wire for CT circuit shall be minimum 2.5 mm² multi-stranded copper conductor PVC insulated and for others minimum 1.5 mm² multi-stranded copper conductors PVC insulated. Ring type lugs suitable for termination of 2.5 sq. mm copper wires shall be used. Colours of the secondary/ auxiliary wiring should conform to IS: 375/ 1963 and latest amendments thereof.

All wiring shall be neatly run and group of wiring shall be securely fixed with clips so that wiring can be checked without necessity of removing the clamps. Ferrules with number shall be provided on both end of the wiring i.e. straight + cross ferruling shall be done. Printed ferrules (tubular type- cut to size after printing) white with black lettering shall be provided. Printing shall be done with the indelible ink.

All protective relays shall be in draw out cases with built in test facilities. All auxiliary relays and timers shall be supplied in non-draw out cases. Externally operated hand reset indicators shall be provided on all electro-mechanical relays and timers. Timers shall be of electromagnetic or electronic type only. All spare contacts of all relays/ timers shall be wired to terminal block. All relays shall be of self-reset type, unless otherwise specified.

Main protection relays shall be **microprocessor based** with latest version software without any extra cost. **Relays and protection shall be enabled for PLC based system / SCADA with IEC: 61850 protocol & Modbus RS485.**

- 3.1.2 Breaker control switches shall be of pistol grip type and selector switches shall be oval or knob. Breaker control switches shall be 3 position spring returns to neutral.
- 3.1.3 Indicating lamps shall be panel mounting type of the colour specified and of multi-chip/ cluster LED type only.
- 3.1.4 Each circuit breaker panel shall be complete with the following:

- a) T-N-C control switch, spring return to neutral position.
- b) Key operated local/ remote selector switch stay put type.
- c) Red, green, amber, white and blue coloured clustered type LED indicating lamps for breaker- ON, OFF, auto trip, trip circuit healthy and spring charged and breaker in Test/ Service position shall be provided.
- d) Push Button for all lamp test facility.
- e) 8 window (for Incomer Panel) or ICOG/ 16 window (for each Outgoing (transformer feeder panel) annunciator with all associated accessories as per detailed in data sheet & specifications.
- f) Double pole control supply switch with MCB.
- g) Electrical anti pumping relay.
- h) Panel illumination lamp (CFL) with MCB/ switch.
- i) Space heater with adjustable thermostat& MCB.
- j) 5/ 15A 1 Phase receptacle with MCB.
- k) Potential indicating multichip/ clustered type LED lamps (R, Y, and B) for incomer/ ICOG breakers.
- l) Components as per electrical SLD.
- m) Emergency trip push button (ETPB- Mushroom type, Red coloured latch-able type)
- n) Test Terminal Block (TTB)
- o) Mechanical trip push button to trip the breaker when control supply is lost. The push button shall be shrouded type. Mechanical close push button provided shall be accessible only after opening of the front door.
- p) The panel front of the circuit breaker truck shall have following devices/ indications
 - i. Mechanical push button for breaker open
 - ii. Mechanical indications for spring charge / discharge
 - iii. Mechanical indications for breaker test/ service position
 - iv. Mechanical indication for breaker ON/ OFF
 - v. Operation Counter
 - vi. Device for manual charging of closing spring

All analogue indicating meters shall be 144 x 144 mm size taut band with 240° Scale. All indicating meters shall be provided as per enclosed electrical Single Line Diagram. Multi-Function Meter (MFM) shall be micro-processor based electronic meter and shall have facility for on line monitoring, reading display of each parameter and shall be provided with RS485 communication port. Analogue

Ammeter & Voltmeter shall also be provided as per data sheet & specifications.No extra charges shall be payable to Contractor in the event of any change in the contact configuration of relays i.e. from normally open (NO) to normally closed (NC) and vice versa. All wiring and necessary hardware for the completeness of the schemes shall be included in the scope of Contractor.All operating switches shall be accessible without opening the compartment door.All transformer outgoing feeders shall be suitable for interrupting transformer magnetizing currents. The breaker shall be electrically interlocked with downstream LV breaker such that if HV breaker trips, LV breaker shall also trip, and LV breaker cannot be closed until HV breaker is closed.Withdrawal or engagement of circuit breakers or disconnecting switch shall not be possible unless it is in the open position.Operation of circuit breaker or disconnecting switch shall not be possible unless it is fully in- service position, or in test position or in fully drawn-out.It shall be entirely responsibility of the Contractor to ensure that characteristics of CTs, VTs and all other devices offered by him/ her are such as to be suitable for the purpose for which they are intended.Switchgear shall be suitable for easy extension on both the sides. It shall be possible at a later stage to add cubicles on both the sides of the switchgear by extending the bus-bars.All power and control cables entry shall be from bottom or as to suit the site condition. The cable compartment shall house all power cable connections along with associated cable terminations.All control cabling/ wiring shall be done using 1.1 KV grade, multi-stranded, Cu conductor, PVC insulated FRLS cables. Panel wiring shall be securely supported, neatly installed by lacing, and tying, readily accessible and connected to equipment terminals and terminal blocks. All the accessories such as cable troughs, cable ties, covers etc. shall be of fire-retardant material.Breaker handling trolley shall be provided as required. This shall be complete with all necessaryaccessories.Earthingswitch shall be provided for bus-bar earthing for incomer panel and for cable earthing on the outgoing breaker panel with necessary interlocks. The panel earthing shall be extended up to cable alley for armour earthing.Required suitable cable/ extension adopter boxes for power cables shall be a part of HV panel. The termination kit shall be heat shrinkable type only. Cable lugs for all power,control & instrumentation cables

connections shall be supplied. The lugs shall be tinned copper/ Aluminium depending on cable conductor and of solder less crimping type.

Padlocking facilities shall be provided for locking the shutters positively in closed position in all the panels. All door locks shall be provided with special keys to ensure opening by authorized personal only.

Caution name plate, "Caution Live Terminal" shall be provided at all the points where the terminals are likely to remain live and isolation is possible only at remote end i.e. incomer to the switchboard.

Danger notices in three languages (Hindi, English & Gujarati) and in line with the requirements of IS: 2551 shall be riveted & not pasted at appropriate locations of the switchgear.

Feeder and board name plates to be provided at front and rear of switchboard.

Panel illumination lamp shall be 9/ 11W LED with fixture & shall be provided with door limit switch.

Relays

- a) All relays as indicated in data sheet, specifications & as per requirement shall be mounted on the switchgear panels. The relays shall be in draw-out case, flush mounted type.
- b) All the unit protection relays such as 51NS shall be separate relays & elements (50/ 50N, 51/ 51N, 51NS etc.) available in numerical relays shall not be used for this purpose.
- c) In case the primary protection relays offered by Contractor do not have adequate number of contacts for protection/ interlock schemes. Contractor shall supply suitable contact multiplying auxiliary relays as required. All necessary auxiliary relays as required to meet the GWSSB's final control/ protection/ interlock schemes shall also be provided by the Contractor.
- d) Relays shall be microprocessor based. Test terminal block for testing shall be provided. Relays shall be suitable for 1/ 5A CT secondary rating as indicated in respective Single Line Diagram. Relays shall be suitable for PLC based system / SCADA with IEC: 61850 protocol & Modbus RS485.
- e) Relay & Metering used shall be as per following Make & model Nos. "OR equivalent" shall be construed as Equivalent from the approved Makes mentioned elsewhere in the specifications.

RELAYS

Microprocessor based relay with historical data logging facility with Over-current & earth fault protection	GWSSB Approved Make / Standard & Reputed
Master Trip/ Lock out Relay (86)	GWSSB Approved Make
Stand by Earth Fault Relay (51NS)	GWSSB Approved Make
Contact multiplication relay	GWSSB Approved Make
Trip Circuit Supervision Relay	GWSSB Approved Make
Comprehensive Motor Protection Relays	GWSSB Approved Make
METERING	
Analogue Ammeter	GWSSB Approved Make
Analogue Voltmeter	GWSSB Approved Make
Multi-Function Meter (MFM)	GWSSB Approved Make

Lockout relay-86 shall be having minimum 6 NO + 6 NC contacts.

All relays shall have clear identification on the associated panel by well-written inscription plates. Where indications are provided by flag relays or LEDs, these shall also be specifically identified by permanently fixed inscription adjacent to them.

The final relay ranges of each relay shall be decided at detailed engineering stage, if it is found that the offered relay range is not suitable for the intended application, the Contractor shall change the relay of appropriate range without any commercial / delivery implications whatsoever. The relay shall be subject to approval of GWSSB's representative.

Contractor shall furnish recommended relay settings with backup calculations & approval for the same has to be obtained from GWSSB. Entire Relay co-ordination shall be carried out in ETAP 12.5 version or latest available during detailed engineering. The Contractor shall obtain all interface data from all concerned.

- f) All relay/ auxiliary relay coils shall operate satisfactorily between 85% and 115% of the rated control voltage range.

- g) It is responsibility of the Contractor to include accessories like auxiliary CTs, VTs and all other necessary devices as required for satisfactory performance of relay and protection scheme even if not indicated in drawings/ data sheets. Testing facilities like test switches / test plugs shall be provided for testing of each individual relays.
- h) Performance tests shall be conducted at site and also supervised by Contractor for all the equipment's to prove the guarantee.
- i) Prices quoted shall include the cost of all routine tests specified in relevant standard & as mentioned below. As regards type tests, copies of the earlier test certificates carried out on equipment of similar or higher ratings but not older than five (5) years shall be furnished along with the offer.

Current Transformer

Current Transformers shall satisfy following requirements

- a) Current transformers for metering & protection shall be cast resin (class of insulation B or better). The CT ratios/ protection class shall be as per data sheet & specification.
- b) Rated VA burden for metering/ protection CTs shall not be less than 15VA or 120% of total VA burden whichever is higher.
- c) The accuracy class for metering CT shall be 1.0 or better.
- d) It shall be responsibility of Contractor to ensure that CTs are suitable for correct and satisfactory operation of the instruments/ relays connected across them.
- e) Short time current rating and momentary withstand rating of CTs shall be as per breaker short time current withstanding capacity.
- f) All CTs shall have secondary rating of 1A or 5A.

Voltage Transformers

Voltage Transformers shall satisfy following requirements

- a) Potential transformers for metering/protection shall be suitable for operation on 11 KV, 50 Hz system. The VT ratios shall be as shown in respective electrical Single Line Diagram.
- b) Rated VA burden for metering/ protection VTs shall not be less than 100VA or 120% of total VA burden whichever is higher.
- c) The accuracy class for metering VT shall be Class 1.0/ 5 P as required.
- d) It shall be responsibility of Contractor to ensure that VTs are suitable for correct and satisfactory operation of the instruments connected across them.
- e) Fuses on primary side shall have rupturing capacity equal to the switchgear rating.

- f) For VT's MCB shall be provided on secondary. MCB trip contact to be wired up for annunciation.

Maintenance Requirements

- a) Contractor shall supply maintenance tools including special tools (as required) for attending to the equipment supplied at no extra cost. As far as practicable, the equipment and accessories shall be so designed that no special tools are necessary for installation and maintenance of the equipment. However, if special tools are required, the Contractor shall supply one complete set for each type of equipment for the purpose.
- b) Contractor shall include supply of start-up and essential spares.
- c) Contractor shall furnish detailed inter-panel diagrams, terminal connection wiring diagram, and detailed component layout drawings to carry out maintenance work.
- d) Contractor shall ensure the use of calibrated test equipment having valid calibration test certificates from standard laboratories traceable to national standard.

Earthing

- a) An earthing bus shall be provided at the bottom and extend throughout the length of the switchgear. It shall be bolted / welded to the frame work of each unit and each breaker earthing bus.
- b) All non-current carrying metal work of the switchgear shall be effectively bonded to the earth bus. Hinged doors shall be earthed through flexible earthing braid of adequate size.
- c) Positive earthing of the circuit breaker frame shall be maintained both in service and test position.

Annunciators

- a) Microprocessor based alarm annunciators shall be provided for generating audio visual alarms for each abnormal condition. Facia annunciators, suitable for operation on 24/ 30V or 110V DC (as applicable) shall be provided.
- b) Each alarm shall initiate the operation of both visual and audible devices equipped with 'Mute', 'Acknowledge' and 'Reset' push buttons common to annunciators on all switchgear aligned together and a 'Lamp test' push button for each annunciator on individual panels.
- c) Annunciator shall be of facia type with translucent plastic window for each alarm point. Annunciator facia plates shall be engraved in block lettering with respective alarm inscriptions. The inscriptions shall be clearly readable and visible when the respective facia light is lighted provided with two lamps connected in parallel on each facia window with series resistors. Lamps shall be clustered LED type.

- d) All facia annunciator points shall be suitable to accept external contacts of either 'NO' or 'NC' self or hand reset type for initiating the annunciation sequence.
- e) Annunciators shall be suitable for accepting fleeting faults of duration as less as 15 milliseconds annunciating subsequent faults with the specified sequence immediately after acknowledging the previous fault.
- f) Facia Window shall be of minimum size of 35 mm x 50 mm.
- g) During lamp test, if a fault occurs, the corresponding lamp circuit shall be automatically disconnected from the "lamp test" circuit and shall start flashing.
- h) The sound intensity of each audible device shall be suitable for the maximum sound level of its environment.
- i) The sequence of alarm should be user selectable by dip switch. The operation or acceptance of one alarm shall not inhibit the operation of the audible device or the flashing of the appropriate alarm indicator if a future alarm condition occurs
- j) Annunciator shall be designed for an operating sequence indicated below

Alarm Condition	Fault Contact	Audible Alarm	Visual Alarm
Normal	Open	Off	Off
Abnormal	Closed	On	Flashing
Acknowledge	Open	Off	Steady on
Reset	Open	Off	Off
Lamp Test	Open	Off	Steady on

Cable Terminations

- a) Necessary number of cable glands shall be supplied for terminating auxiliary power and control cables. Glands shall be of heavy-duty brass castings, machine finished and complete with check nut, washers, neoprene compression ring.
- b) Cable lugs for all power and control cable connections shall be supplied. The lugs shall be tinned Copper/ Aluminium depending on cable conductor and of solder less crimping type.
- c) All necessary materials required for terminating the power cables such as tapes, fillers, binding wires, armour clamps, brass glands etc., shall be supplied.

Tests

- a) Routine tests and acceptance tests as per the applicable IS/ IEC standards shall be carried out in the presence of GWSSB's representative.

- b) Type test certificates for internal arc test, SC withstand & Impulse test shall be furnished with the Bid (not older than five (5) years) from CPRI or any other independent agency
- c) The test equipment, meters, instruments etc. used for testing shall be calibrated at recognized test laboratories at regular intervals and valid certificates shall be made available to the GWSSB's representative at the time of testing. The calibrating instruments used as standards shall be traceable to national/international standards.

Drawings/ Documents Required

The following drawings/ documents to be furnished by the Contractor for GWSSB's approval

- a) Technical Data Sheet
- b) General Arrangement Drawing
- c) Wiring Schematic
- d) Bill of Quantities
- e) Quality Assurance Plan

INSTALLATION, TESTING AND COMMISSIONING:

1. Erection - General

- 1.1. The Contractor's staff shall include adequate and competent erection engineers with proven, suitable, previous experience on similar contracts to supervise the erection of the works and sufficient skilled, semi skilled and unskilled labour to ensure completion of works in time. The contractor shall not remove any representative, erector or skilled labour from the site without prior approval of the Engineer-In-Charge (EIC) or Engineer-In-Charge's representative.
- 1.2. The Contractor shall ensure that no installation or erection work shall commence until full and unconditionally approved working drawings, signed and stamped by the EIC are available at site.
- 1.3. The Contractor's erection staff shall arrive on the site on dates to be agreed by the EIC. Before they proceed to the site, however, the contractor shall first satisfy himself, as necessary, that sufficient plant of his (or his sub contractor's) supply has arrived on site so that there will be no delay on this account.
- 1.4. One erection engineer who shall be required to be the contractor's representative shall be conversant with the erection and commissioning of the complete works. Should there be more than one erector, one shall be in charge and the contractor shall inform the EIC in writing which erector is designated as his representative and is in charge. Erection engineer is to report to project manager.
- 1.5. The Contractor shall be responsible for setting up and erecting the plant to the line and levels of reference and of the positions, levels dimensions and alignment, appliances and labour in connection therewith. The checking of setting out of any line or level by the EIC or EIC's representative shall not in any way relieve the contractor of his responsibility for the correctness thereof.

- 1.6. Erection of plant shall be phased in such a manner so as not to obstruct the work being done by other contractors or operating staff who may be present at the time. Before commencing any erection work, the contractor shall check the dimension of structures where the various items of Plants are to be installed and shall bring any deviations from the required position, lines or dimensions to the notice of the EIC. Plant shall be erected in a neat and workmanlike manner on the foundations and at the locations shown on the approved drawings. Unless otherwise directed by the EIC, the contractor shall adhere strictly to the aforesaid approved drawings. If any damage is caused by the contractor during the course of erection to new or existing plant or buildings or any part thereof, the contractor shall, at no additional cost to the Employer, make good, repair or replace the damage, promptly and effectively as directed by the EIC and to the EIC's satisfaction.
- 1.7. The contractor shall align all equipment and holding down bolts and shall inform the Employer before proceeding with grouting in the items concerned. The contractor shall ensure that all equipment is securely held and remains in correct alignment before, during and after grouting in.
- 1.8. The approval by the Employer of the contractor's proposals for rigging and hoisting any items of the plant into final positions shall not relieve the contractor from his responsibility for damage to completed structures, parts or members thereof or other installed equipment. He shall at his own cost make good, repair or replace any damaged or injured items, whether structural, electrical, architectural, or of any other description, promptly and effectively to the satisfaction of the Employer.
- 1.9. No plants or other loads shall be moved across the floors of structures without first covering the floors with timber of sufficient size so that applied loads will be transferred to floor beams and girders of steel or concrete. If it is required to reduce bending stresses and deflection, the beams and girders shall be provided with temporary supports.
- 1.10. During erection of the plant the EIC will inspect the installation from time to time in the presence of the contractor's site representative to establish conformity with the requirements of the specifications. Any deviations and deficiencies found or evidence of unsatisfactory workmanship shall be corrected as instructed by the EIC.
2. Levelling and Grouting of Machinery
- 2.1. He shall undertake sufficiently in advance chipping of any unevenness of concrete on foundations, anchor bolt pockets, cutouts etc. to achieve uniform level of reference for erection. All concrete surfaces receiving grout shall be hacked as required to ensure better bonding with grouting.
- 2.2. Contractor shall undertake the inspection of all components to be erected sufficiently in advance to check their soundness and conformity to drawings and the inspection records shall be signed by the Engineer as approval for undertaking the installation of the components. Any damage, shortfalls etc. shall be made good to the satisfaction of the EIC.

2.3. All grout for equipment shall be carried out using non shrinkable continuous grout materials with suitable frame work of at least 12 mm thickness. Surfaces to receive the grout shall be hacked and roughened and laitance shall be removed by wire brushing or blast of air. Concrete surface shall be blown off by compressed air before commencing grouting. Grouting shall be done in one continuous operation from one side such that grout flows in a single wave until grout reaches all confined spaces with no air pockets and air from all confined spaces is expelled. A hydro static head of 150 mm shall be maintained during grouting operations. All grouting shall be carried out in the presence of the EIC's representative. All lines and levels shall be checked up after grout is set. Block outs shall be closed using cement concrete of the same grade as that of the parent structure.

3. Records, Procedures and Reports

3.1. The Contractor shall maintain records pertaining to the quality of installation / erection work and inspection, testing, compliance with all technical requirements in respect of all his works as described in the previous paragraphs. The reporting formats shall be in the approved formats. The contractor shall submit such records to the Engineer after the completion of any particular work before submitting the bill of supply / progress of work. Such report shall comprise shop inspection reports, shop testing reports, material test reports, based on which dispatch clearances are provided, all the quality control reports of welding, erection and alignment records.

3.2. All the above mentioned records shall be submitted in the final form duly countersigned by the EIC's representative attesting conformity to specifications and his approval of installation, and duly incorporating all the additions, alternations, and information as required by the EIC on the basis of preliminary reports giving the progress of the work. Such records notwithstanding, any records submitted earlier with bill of supply / progress etc. shall be duly bound and submitted to the EIC in six copies by the contractor on his notification of the mechanical completion of erection.

4. General Preparations before Completion of the Plant

4.1. The following documents should be completed in accordance with the contract schedule before completion of erection. The Employer and the contractor shall preserve and control these documents in a safe and appropriate place on Site in order the both parties personnel can make use of them at any time.

4.1.1. Technical Documents

- a) Operation and Maintenance manual
- b) Design documents including the contractor's design data, drawings and specifications.
- c) Tools and test equipment list
- d) Spare parts list
- e) Lubricant list

4.1.2. Procedures

- a) Mechanical testing procedure
- b) Electrical testing procedure
- c) Instrumentation testing procedure
- d) Detailed Pre commissioning and commissioning procedure
- e) Detailed Performance Test procedure

4.1.3. General and Coordination Documents.

- a) Detailed organisation charts for pre commissioning and commissioning showing lines of authorities and responsibility and functions of all key personnel.
- b) The job description of the members of the team.
- c) The scheduled dates of assignment of each member to pre commissioning and commissioning Organisation.
- d) A detailed schedule showing the time sequence which the contractor anticipates to follow for the various steps in completion of erection, pre commissioning and commissioning of each unit and equipment.
- e) The regulations for safety, hygiene and discipline.
- f) The practical organisation of the relationship (meetings, reports, etc.) between the contractor and the Employer at the phases of pre commissioning and commissioning.
- g) Emergency communication route.

4.2. Manpower

- 4.2.1. Required manpower shall be provided as agreed between the contractor and the Employer in a manpower mobilisation plan which shall include the number and qualifications of the operator and maintenance personnel to be furnished by the Employer for the plant.

5. Completion of Erection

- 5.1. The completion of plant under erection by the contractor shall be deemed to occur, if all the units of the plant are structurally and mechanically complete and will include among other such responsibilities the following:
 - 5.1.1. Plant in the scope of the contract has been erected, installed and grouted as per specifications.
 - 5.1.2. Installation checks are completed and approved by the EIC.
 - 5.1.3. The erected plants are totally ready for commissioning checks.
- 5.2. At the stage of completion of erection, the contractor shall ensure that all the physical, aesthetic and workmanship aspects are totally complete and the Plant is fit and sound to undergo tests on completion and subsequent pre commissioning checks.
- 5.3. Upon achieving the completion as described above the contractor shall notify the EIC by a written notice intimating completion of erection and notify the EIC for inspection. The EIC / EIC's representative shall proceed with the inspection of such units within 14 days of such a notice.

- 5.3.1. The EIC shall certify completion when there are no defaults in the works or
- 5.3.2. The EIC shall inform the contractor list of deficiencies for rectification hereinafter referred as Punch list and the contractor shall complete the rectification work within a jointly agreed period before pre commissioning activities and obtain the EIC's acceptance or approval of the same before proceeding with the same.
- 5.3.3. The EIC may inform the contractor that the works are accepted with the 'Punch' list (items which do not hamper operability, safety or maintainability) and allow the Contractors to proceed with the pre commissioning checks when the contractor undertakes to complete such outstanding works within an agreed time during defects liability period. Taking over shall be based on rectification of all deficiencies as advised by Punch lists.
- 5.4. The erection period indicated by the contractor would be deemed to cover all the activities up to completion as stipulated in previous paragraphs, notice of completion by the contractor, inspection by the EIC for completion and contractor rectification of all deficiencies as noticed by the deficiency / Punch list, and acceptance by the EIC of such rectification's prior to tests on completion.
- 5.5. Minor defects, which in the opinion of EIC which do not hamper operability and maintainability will not be taken into account for deciding mechanical completion. Such defects shall be rectified concurrent to commissioning checks before tests on completion. However, the EIC's decision in this regard is final.
- 5.6. The commissioning period as notified by the contractor shall be deemed to occur beyond the date of completion and shall include all periods of pre commissioning, trials and tests on completion.
- 5.7. It is in the contractor's interest to offer the sections / units / systems progressively under identified milestones within overall erection period, duly completed for rectification of any deficiencies pointed out by the Engineer and to achieve mechanical completion before undertaking the tests on completion within the specified erection period. The EIC also reserves the right to withhold the cost as estimated to be equivalent to the rectification of deficiencies pointed out to the Contractor until such a time such deficiencies are rectified to the satisfaction of the EIC.

6. Pre commissioning

- 6.1. After the completion of erection, pre commissioning activities listed below shall be carried out to make the plant ready for commissioning. All instruments, materials and provisions necessary for conducting site tests shall be provided by the contractor at his own cost.
- 6.2. Upon completion of erection of each piece of equipment, facility or discrete part of the plant, mechanical checks and tests shall be carried out according to the contractor's check list. The mechanical checks and tests shall be to establish that:
- 6.2.1. The Plant is erected in accordance with the contractor's construction drawings, pipe work drawings, instrument diagrams, etc. issued for the plant.

- 6.2.2. The materials are installed and mechanically function in accordance with the contract and
- 6.2.3. Applicable codes as listed in the contract are followed for materials and workmanship.
- 6.3. Items such as painting, thermal insulation and final clean up which do not materially affect the operation or safety of the Plant will be excluded. All these items shall be listed and completed after pre commissioning or commissioning at the discretion of the contractor but before acceptance.
- 6.4. The contractor shall prepare and maintain at site test forms and records which shall include:
 - 6.4.1. Description of type of test or check
 - 6.4.2. Date and times of test or check
 - 6.4.3. Identification of equipment and facilities
 - 6.4.4. Test pressure, test data and results, including remarks, if any
 - 6.4.5. Signature of the contractor's personnel attesting to data recorded, if any, checks, tests and records thereof shall be carried out by the contractors' construction forces.
- 6.5. Wherever the Employer's witness or attesting of the check or test is required, the Employer's personnel shall attend such check and test. For this purpose, the contractor shall keep the Employer informed of a day to day test plan schedule. The test plan schedule may be revised from time to time to reflect the actual progress of the work and test.
- 6.6. Any items found incomplete or requiring repair or adjustment shall be marked as such on the test records and then reported by the contractor to the Employer and the contractor's personnel in charge of the relevant construction area.
- 6.7. Checking procedures shall be repeated until all the items on the check list are cleared.
- 6.8. A complete set of test records shall be handed over to the Employer on completion.
- 6.9. The tests on the different mechanical and electrical equipment shall include but not limited to:

7. Commissioning

- 7.1. After the completion of pre commissioning activities the final checks and preparations necessary for start up of the plant shall be carried out. The contractor shall submit to the Employer a written notice of mechanical completion which shall include:
 - 7.1.1. Identity of a part of the plant considered mechanically complete,
 - 7.1.2. A copy of all relevant completed test reports,
 - 7.1.3. The date on which the completion of the tests was achieved,
 - 7.1.4. Check list and
 - 7.1.5. A request for issuance of a mechanical completion certificate in respect of that part.
- 7.2. Within fourteen (14) days from the date of receipt of the contractor's written notice, the Employer shall:
 - 7.2.1. In the case of acceptance, issue a mechanical completion certificate.

- 7.2.2. In the case of objection, submit a rejection statement setting forth remaining items to be completed or defects or deficiencies to be corrected before mechanical completion status can be accepted. When the Employer rejects the contractor's notice the contractor shall take any necessary action to complete or correct the items marked and give the Employer a second notice of mechanical completion.
- 7.3. After the issuance by the Employer of a mechanical completion certificate, commissioning activities listed below shall be carried out to enable the start up and operation of the plant. Procedures are described as below:
- 7.3.1. Commissioning Procedure shall be carried out in a methodical sequence as follows
- a) Warming up
 - b) Start up
 - c) Initial running
 - d) Operability adjustment
 - e) Stable operation
 - f) Final adjustment
- 7.3.2. At all stages of commissioning sequence, the plant shall be operated at optimum plant conditions. To ensure this, the contractor may make minor adjustment to the conditions indicated in the operation and maintenance manual as necessary.
- 7.3.3. The contractor shall check the operating conditions of the plant by constantly monitoring operating data.
- 7.3.4. The contractor shall specify for each discrete part of the plant the operational data to be recorded and the manner in which the data is to be taken.
- 7.3.5. All the operating data shall be recorded by the Employer on the forms to be mutually agreed. A copy of the operating log and analytical data from initial operation through to the completion of performance test shall be made available by the Employer to the contractor for evaluation.

INSTALLATION, TESTING & COMMISSIONING – ELECTRICAL EQUIPMENT

6.1 Equipment Installation, Testing & Commissioning

Installation of Equipment

- a) In accordance with the specific installation instructions, as shown in contractor's drawings or as directed by the EIC's representative the contractor shall unload, erect, install, wire, test and place into commercial use of all electrical equipment included in the contract. Equipment shall be installed in a neat, workmanlike manner so that it is level, plumb, square, and properly aligned and oriented.

- b) The contractor shall furnish all supervision, labour, tools, equipment, rigging materials and incidental materials such as bolts, wedges, anchors, concrete inserts etc. required to completely install, test and adjust the equipment.
- c) Drawings, instructions and recommendations shall be correctly followed in handling, settling, testing and commissioning of all equipment and care shall be exercised in handling to avoid distortion to stationary structures, the marring of finish or damaging of delicate instruments or other electrical parts.
- d) The contractor shall erect and commission the equipment as per the instructions of the EIC representative and shall extend all cooperation to him.
- e) In case of any doubt / misunderstanding as to correct interpretation of drawings or instructions, necessary clarification shall be obtained from the EIC's representative. The contractor shall be held responsible for any damage to the equipment consequent to not following instructions correctly.
- f) The contractor shall move all equipment into the respective buildings through regular doors or floor openings provided specifically for the equipment. The contractor shall make his own arrangement for lifting of equipment.
- g) Where assemblies are supplied in more than one section, the contractor shall make all necessary mechanical and electrical connections between sections including the connections between bus bars / wires. The contractor shall also carry out the adjustments / alignments necessary for proper operation of the circuit breakers. All insulators and bushings shall be protected against damage during installation. Insulators or bushings chipped, cracked or damaged due to negligence or carelessness shall be replaced by the contractor at his own expenses.
- h) The contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments or relays are supplied separately, they shall be mounted only after the associated control panels have been erected and aligned. The blocking material / mechanism employed for the safe transit of the instruments and relays shall be removed after ensuring that the panels have been completely installed and no further movement of the same would be necessary. Any damage to relays and instruments shall be immediately reported to the EIC's representative.
- j) Switchgear control panels shall be installed in accordance with the latest Indian Standard Code of Practice 10118. The switchgear panels shall be installed on finished surface or concrete or steel sills. The contractor shall be required to install and align any channel sills which form part of the foundations. Tape or compound shall be applied where called for. The base of outdoor type units shall be sealed in an approved manner to prevent ingress of moisture.

- k) After installation of all power and control wiring, the contractor shall perform operating tests on all switchgear and panels to verify the proper operation of switchgear / panels and the correctness of the interconnections between various items of equipment. This shall be done by applying normal ac or dc voltage to the circuits and operating the equipment. Megger tests for insulation, polarity checks on the instrument transformers, operation tests on equipment, and installation tests shall be carried out by the contractor who shall also make all necessary for proper functioning of the equipment.
- m) Equipment furnished with finished coats of paint shall be touched up by the contractor if their surface is spoiled or marred while handling.
- r) Foundation work and grouting in of fixing bolts or channels for all ~~transformers~~, HT panels will be carried out by the contractor.

6.2 Installation Work for Earthing and Lightning Protection System

- a) The Contractor shall install copper /steel conductors, braids, etc. required for the system and individual equipment earthing. All work such as cutting, bending, supporting, painting / coating, drilling, brazing /soldering / welding, clamping, bolting and connecting onto structures, equipment frames, terminals, rails or other devices shall be in the contractor's scope of work. All incidental hardware and consumables such as fixing cleats / clamps, anchor fasteners, lugs, bolts, nuts, washers, bituminous compound, welding rods, anti corrosive paint as required for the complete work shall be deemed to be included by the contractor as part of the installation work.
- b) The quantities, sizes, material of earthing conductors and electrodes to be installed as per requirement. Routes of the conductors and locations of electrodes shall be as shown on the project drawings.
- c) The work of embedment of earthing conductor in RCC floors / walls along with provision of earth plate inserts / pads / earth risers shall be done by the civil contractor when the floors are cast or during construction of walls. However when required to do so in those areas where flooring will be done after the Contractor is at site, the Contractor shall coordinate with civil contractor and shall install the earthing conductors before the commencement of the concrete work. In such cases the contractor's scope of installation shall include laying the conductors in position with 50 mm concrete cover, making welded connections to inserts / pads / risers above the floor near the equipments. The embedded conductors shall be connected to reinforcing rods wherever necessary.
- d) If the tap connections (earthing leads) from the floor embedded main earthing grid to the equipment are more than 500 mm long then the same shall be embedded in floor by the Contractor where required, together with associated civil work such as excavation / chipping,

concreting and surfacing, if not already done by the civil contractor. The concrete cover over the conductor shall not be less than 50 mm.

- e) Installation of earth conductors in outdoor areas, buried in ground, shall include excavation of earth up to 600 mm deep 450 mm wide, laying of conductors at 600 mm depth, brazing / welding as required, of main grid conductor joints as well as risers of length 500 mm above ground at required locations and then backfilling material to be placed over buried conductor shall be free from stones and other harmful mixtures. Back fill shall be placed in layers of 150 mm, uniformly spread along the ditch, and tampered utilising pneumatic tampers or other approved means. If the excavated soil is found unsuitable for backfilling, the contractor shall arrange for suitable material from outside.
- f) Installation of earth connection leads to equipment and risers on steel structures / walls shall include laying the conductors, welding / cleating at specified intervals, welding / brazing to the main earth grids risers, bolting at equipment terminals and coating welded / brazed joints by bituminous paint. Galvanized conductors shall be touched up with zinc rich paint where holes are drilled at site for bolting to equipment / structure.
- g) Electrodes shall be installed (a) directly in earth or (b) in constructed earth pits, and connected to main buried earth grid, The scope of work shall include excavation, construction of the earth pits including all materials required for construction of earth pits, placing the rod and fixing test links on those pipe / rod / plate electrodes in test pits and connecting to main earth conductors.
- h) Installation of lightning conductors on the roofs of buildings shall include laying, anchoring, fastening and cleating of horizontal conductors, grouting of vertical rods wherever necessary, laying fastening / cleating / welding of the down comers on the walls/columns of the building and connection to the test links to be provided above ground level.
- i) Installation of the test links shall include mounting of the same at specified height on wall/column by suitable brackets and connections of the test link to the earth electrode.
- j) Whenever main earthing conductor crosses cable trenches, they shall be buried below the trench floor.
- k) Suitable earth risers shall be provided above finished floor/ground level. If the equipment is not available at time of laying of the main earth conductors. The minimum length of such riser inside the building shall be 200 mm and outdoors shall be 500 mm above ground level. The risers to be provided will be marked in project drawings.
- l) Earth leads and risers between equipment earthing terminals and the earthing grid shall follow as direct and short a path as possible.

- m) An earthing mat shall be provided under each operating handle of the isolator and operating mechanism of H.V. breakers. Operating handle of the isolator and supporting structure shall be bonded together by a flexible connection and connected to the earthing grid.
- n) A separate earth electrode bed shall be provided adjacent to structure supporting lightning arrestors. Each connection shall be as short and as straight as practicable. For arrestors mounted near transformers, earth conductors shall be located clear off the tank and coolers.
- o) Wherever earthing conductors pass through walls galvanized iron sleeves shall be provided for the passage of earthing conductor. The pipe ends shall be sealed by the contractor by suitable water proof compound.

6.3 Earthing Connections

- a) All connections in the main earth conductors buried in earth / concrete and connection between main earthing conductor and earth leads shall be of welded type.
- b) Connection between earth leads and earthing terminal provided on the equipment shall be bolted type.
- c) All bimetallic connections shall be treated with suitable compound to prevent moisture ingress.
- d) Metallic conduits and pipes shall be connected to the earthing system.
- e) Lightning protection system down conductors shall not be connected to other earthing conductors above ground level. Also no intermediate earthing connection shall be made to lightning arrester and transformer earthing leads which shall be directly connected to pipe electrode.

6.4 Earth Electrodes

- a) Electrodes shall as far as practicable be embedded below permanent moisture level.
- b) Test pits with concrete covers shall be provided for periodic testing of earth resistance. Installation of pipe electrodes in test pits shall be suitable for watering. The necessary materials required for installation of test pits shall be supplied and installed by contractor. The installation work shall also include civil work such as excavation and connection to main earth grid.
- c) Earth pits shall be treated with salt and charcoal if average resistivity of soil is more than 20 ohm metre.
- d) Soil, salt and charcoal placed around the electrode shall be finely graded, free from stones and other harmful mixtures. Back fill shall be placed in layers of 250 mm thick uniformly spread and compacted. If excavated soil is found unsuitable for backfilling, the contractor shall arrange for a suitable soil from outside.

6.5 Lightning Protection System

- a) The lightning protection air termination rods and/or horizontal air termination conductors shall be fixed in such a way that they remain in their installed position even during severe weather conditions. The necessary accessories such as cleats, clamps, welding materials, bolts, nuts, shall be supplied by contractor.
- b) Air termination systems shall be connected to earthing system by down conductors as shown in project drawings. The down conductors shall follow a direct path to earth. There shall not be any sharp bends, turns and kinks in the down conductors.
- c) All joints in the down conductors shall be of welded type. All metallic structure within 2 metres of down conductors shall be bonded to lightning protection system.
- d) Every down conductor shall be provided with a 'test link' at about 1000 mm above ground level housed in a suitable GI enclosure made of adequate thickness steel sheet and hot dip galvanised. The test joint shall be directly connected to the earthing system electrode.
- e) The lightning protection system shall not be in direct contact with underground metallic service ducts, cables, cable conduits and metal enclosures of electrical equipment. However, all metal projections, railings, vents, tanks, etc. above the roof shall be bonded together to form a part of roof grid.

6.6 Installation of Cable Racks and Trays

- a) Lines and grade for trays may be measured from building steel and finished floor elevations. Change in line or grade, or the addition of offsets by means of cutting standard tray sections and inserting additional tray fittings to match with the existing arrangement shall be considered as a normal part of the work.
- b) Where embedded steel inserts in concrete floors / walls for welding the supports for cable racks / trays are not available, Contractor shall provide suitable anchor fasteners at no extra cost.
- c) Cable shall be clamped to the cable trays at regular intervals.
- d) Flexible metallic conduits shall be used for termination of connection to equipment such as motors, limit switches and other apparatus.

6.7 Installation of Cables

- a) The installation of cable shall be on tray and other support as per standard engineering practice.
- b) The contractor shall install, test and commission the cables specified in the specification in accordance with drawings and instructions issued by the EIC's representative. Cables shall be laid directly buried in earth, on cable racks, in built up trenches, on cable trays and supports, in conduits and ducts or bare on walls, ceiling etc. as per drawings. Contractor's scope of work includes unloading, laying, fixing, jointing, bending, and termination of the cables. The contractor shall also supply the necessary materials and equipment required for jointing and termination of the cables.

- c) All apparatus, connections and cable work shall be designed and arranged to minimise risk of fire and any damage which might be caused in the event of fire. Wherever cables pass through floor or wall openings or other partitions, suitable bushes of an approved type shall be supplied and put into position by the contractor.
- d) Standard cable grips and reels shall be utilised for cable pulling. If unduly difficult pulling occurs, the contractor shall check the pull required and suspend pulling until further procedure has been approved by the EIC's representative. The maximum pull tension shall not exceed the recommended value for the cable measured by the tension dynamometer. In general, any lubricant that does not injure the overall covering and does not set up undesirable conditions of electrostatic stress or electrostatic charge may be used to assist in the pulling of insulated cables in conduits and ducts.
- e) After pulling the cable, the contractor shall record cable identification with date pulled neatly with waterproof ink in linen tags. Identification tags shall be attached securely to each end of each cable with non corrosive wire. The said wire must be non ferrous material on single conductor power cable. Tags shall further be attached at intervals on long runs of cables on cable trays and in pull boxes. Cable and joint markers and RCC warning covers shall be provided wherever required.

All cables shall be allocated a unique number which shall be fixed to each end of the cable using a corrosion resistant label. Cables of different categories shall be tagged with the following subscripts and three digit numbers.

LV power	P
Control	C
Instrumentation	I
Protection	PR

- f) Sharp bending and kinking of cables shall be avoided. The bending radii for various types of cables shall not be less than those specified below:

650 / 1100 V PVC insulated	12 times the overall armoured cables dia of the cable
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If shorter radius appears necessary, no bend shall be made until clearance and instructions have been received from the EIC's representative.

- g) Power, control and instrumentation cables shall be laid in separate cable racks / trays.
- h) Where groups of HV, LV and control cables are to be laid along the same route, suitable barriers to segregate them physically shall be provided.

- i) Cables of different categories shall be installed so as to maintain satisfactory clearances for safety and in order to reduce the possibility of electrical interference. The following table gives the distances in mm that shall be maintained between the different categories of cable.

Cable Category	HV Power	LV Power	C & I Protection
LV Power	275	N/A	275
C & I / Protection	550	275	N/A

- j) Where cables cross roads and water, oil, gas or sewage pipes, the cables shall be laid in reinforced spun concrete or steel pipes. For road crossings the pipe for the cables shall be buried at no less than one metre depth.
- k) Cables laid in ground shall be laid on a 50 mm riddled earth bed. The cables shall then be covered on top and at their sides with riddled earth of depth of about 150 mm. This is then gently filled up to a depth of about 100 mm above the top of uppermost cable to provide bedding for the protective cable covers which are placed centrally over the cables. The protective cable covers for LV cables may be of earthenware and for HV cables of reinforced concrete. The RCC covers shall have one hole at each end, to tie them to each other with GI wires to prevent displacement. The trench is then backfilled with the excavated soil and well rammed in successive layer of not more than 300 mm in depth, with the trenches being watered to improve consolidation wherever necessary. To allow for subsidence, it is advisable to allow a crown of earth not less than 50 mm in the centre and tapering towards the sides of the trench.
- l) In each cable run some extra length shall be kept at a suitable point to enable one or two straight through joints to be made, should the cable develop a fault at a later date.
- m) Cables on cable racks, on cable trays and conduits shall be formed to avoid bearing against edges of trays, racks, conduits or their supports upon entering or leaving trays, racks or conduits. Cables shall be racked or laid directly into cantilevered cable trays where practicable, but in some cases it may be necessary that cables are pulled or threaded into trays. To facilitate visual tracing, cables in trays shall be laid only in single layers and unnecessary crossing of cables shall be avoided. Cables on trays shall finally be clamped in an approved manner.
- n) Cable splices will not be permitted except where permitted by the EIC's representative. Splices shall be made by contractor for each type of wire or cable in accordance with the instructions issued by cable manufacturer's and the EIC's representative. Before splicing, insulated cables shall have conductor insulation stepped and bound or pencilled for recommended distance back from splices to provide a long leakage path. After splicing, insulation equal to that on the spliced conductors shall be applied at each splice.

- o) Jointing of cables shall be in accordance with relevant Indian Standards Codes of Practice. Materials and tools required for cable jointing work, including cold setting bituminous compound shall be supplied by the contractor. Cables shall be firmly clamped on either side of a straight through joint at a distance of not more than 300 mm away from the joints. Identification tags shall be provided at each joint at all cable terminations.
- p) At cable terminal points where the conductor and cable insulation will be terminated, terminations shall be made in a neat, workmanlike and approved manner by men specialised in this class of work.
- q) Control cable termination shall be made in accordance with wiring diagrams, using colour codes established by the EIC's representative for the various control circuit, by code marked wiring diagram.
- r) When control cables are to be fanned out and cabled together with cord, the contractor shall make connections to terminal blocks, and test the equipment for proper operation before cables are corded together. If there is any question as to the proper connection, the contractor shall make a temporary connection with sufficient length of cable so that the cable can be switched to another terminal without splicing. After correct connections are established through operating the equipment, cables shall be cut to their correct lengths, connected to terminals in the specified manner, and corded together where necessary to hold them in place in a workmanlike manner.
- s) Cable seals shall be examined to ascertain if they are intact and that cable ends are not damaged. If the seals are found to be broken the cable ends shall not be jointed until after due examination and testing by the EIC's representative. Insulation resistance of both sections of cables to be jointed shall be checked by megger before jointing is commenced.
- t) After installation and alignment of motors, the contractor shall complete the conduit installation, including a section of flexible conduit between motor terminal box and trench / tray. The contractor shall install and connect the power, control and heater supply cables as per equipment manufacturer's drawings, if any.
- u) Metal sheath and armour of the cable shall be bonded to the earthing system of the station. The size of conductor for bonding shall be appropriate with the system fault current.

DATA SHEETS

Sr. No.	Particular	Details	Confirm/Data to be filled by the bidder
1.0	General:		
1.1	Make	As per Approved vendor list	
1.2	Model and Type no.	Pl.furnish	
1.3	Design Ambient temperature	50°C	
1.4	Atmosphere	Corrosive, Humid, Dusty	
1.5	Location	Indoor/Outdoor	
1.6	Degree of Protection	IP-5X	
2.0	Electrical Data:		
2.1	Type of breaker	Vacuum Circuit Breaker	
2.2	Service	Continuous	
2.3	Voltage	11kV \pm 10%	
2.4	System Earthing	Solidly earthed	
2.5	Frequency	50Hz.+5%to-5%	
2.6	No.ofphase	3	
2.7	Systemfaultlevel	350MVA	
2.8	Ratedshorttimecurrent	18.37kA(1sec.)	
2.9	Max.systemvoltage	12kV	
2.10	Auxiliary supply: (BatterybackupPowerPack required)	110V D.C derived from Power Pack connected on 110VACP.T.supply.	
2.11	Making capacity	46KA(peak)	
2.12	Busbarmaterialandcurrent rating	Aluminum and As per approved CDR	
2.13	Cableentry	Bottom	
2.14	Cablesizes	3C , XLPE armoured cable (UE) ,size as per approved CDR	
2.15	Breakerparticulars:		
	(a)Operatingduty	Pl.furnish/showcatalogue /IS	
	(b)Operatingmechanism	Motor charged spring /manualtripandclose	
	(c)Springchargingmotor	230VAC,200W	
	(d)Trip/Closingcoil	110VDC,180W	

Sr. No.	Particular	Details	Confirm/Data to be filled by the bidder
	(e) Anti pumping feature/relay	Required.	
	(f) Latching requirement	Trip free	
	(g) Emergency trip push button	Required.	
	(h) Space heater and cubicle lamp	Required.	
2.16	Constructional requirements		
	(a) Thickness of sheet steel for frame, enclosure, doors, covers and partitions	CRC sheet - 2mm, hinge type door with neoprene rubber gasket	
	(b) Colour	Epoxy powder coating Light Gray RAL 7035 or Two coat epoxy primer and two coats of epoxy paint Shade 631 as per IS:5	
	(c) Earth bus size	50x6mm GI Strip/Cu	
	(d) Foundation frame	ISM C-100, Suitable for three breakers or as per BOQ, with necessary bed plate and foundation bolt.	
	(e) Overall dimension	Provided dimensions	
	(f) Overload of equipment	Provide as per tender	
	(g) Minimum clear space required (i) front side as well as (ii) rear side	Provided dimensions	
2.17	Annunciation Provided	To be Provided as per tender	
2.18	Relays	As per Specifications	
	(a) Relay no. and detail	Shall be as per tender	
	(b) Type of relay	Shall be as per tender	
	(c) Make of relay	Shall be as per tender	
	(d) Model no of relay	Provided details	
2.19	Current Transformer		
	(a) Type of CT	Cast Resin	
	(b) Accuracy class	Provide details as per tender	
	(c) VA burden	Provide details as per tender	

Sr. No.	Particular	Details	Confirm/Data to be filled by the bidder
	(d)CTratio	Provide details as per tender	
2.20	PotentialTransformer		
	(a)TypeofPT	CastResin	
	(b)Accuracyclass	Provide details as per tender	
	(c)VAburden	Provide details as per tender	
	(d)PTRatio	Provide details as per tender	
2.21	PanelAccessories		
1	Toggle switch for space heaterandsocket	230VA.C,6A	
2	(b)Socket	6pin5/15AwithDPMCB	
3	(c)MCBforspringcharging motorcircuit	6A,DPMCB	
4	(d)MCBforON/OFF	Doublepole,16A,110V D.CforD.Cckt. Doublepole,16A,230V A.CforA.Cckt.	
5	Local / Remote selector switch	4 ways, 2 positions, lockablein anyposition, angular movement, stayput,levertypehandle.	
6	Trip–Neutral–Close(TNC) Switch.	6ways, 3position, springreturnto neutral,angular movement,lockable pistol griptypehandle.	
7	SpaceHeater	230 VA.C , 100 W (LT Supply fromLTPanel)	
8	Limit switch for test and serviceposition.	Required	

APPROVED VENDOR LISTS

(Electrical Items)

- **The make of HT panel-VCB shall be GETCO approved only.**
- **The lists of approved vendors as prevailing on the date of submission of the BID will hold true. However subsequent addition / deletion in above vendors' lists by the competent authority of GETCO shall also be applicable at the time of approval of QAPs. However, decision of the competent authority of GWSSB shall be final & binding in this regard.**