**ELECTRIFICATION, AIR CONDITIONING AND FIRE FIGHTING SYSTEM OF CORPORATION STADIUM AT THRISSUR**
**(RE - TENDER)**

| | | |
|---|---|---|
| TENDER NO | : | 25/NGS/2012-13 |
| Owner | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekhar Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| Consultants | : | KITCO LTD. |
| Accepting Authority | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekhar Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| Probable Amount of Contract | : | Rs.6871270/- |
| Earnest Money Deposit | : | Rs.1,71,800/- in the form of crossed demand draft from Nationalised/ Scheduled Bank drawn in favour of The Chief Engineer, National Games Secretariat at Trivandrum. |
| Time of completion | : | 6 months |
| Last Date of Receipt of Tender | : | 14.02.2013 AT 3.00 PM |
| Date of opening of Tender | : | 15.02.2013 AT 11.00 AM |
| Venue of Receipt/opening of Tender | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekhar Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| Issued by | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekhar Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| Issued to | : | |

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# 1. NOTICE INVITING TENDER

## 1.0 NOTICE INVITING TENDER

**1.01** Sealed percentage rate tenders are invited on behalf of National Games Secretariat, Trivandrum (hereinafter called the ACCEPTING AUTHORITY) for Electrification, Air conditioning and Fire Fighting System of Corporation Stadium at Thrissur (Re Tender) from eligible Contractors for executing this work. Partnership firms shall furnish full names of all partners in the tender. It may, however, be signed in the partnership name by one of the partners or by a duly authorized representative, followed by the name and designation of the persons signing.

**Eligibility Criteria**

1. The tenderer should have satisfactorily completed two similar works of value not less than 50% of PAC of the work in a single Contract, during the last 3 years as Prime Contractor (satisfactory completion certificate from the Client for the work done should be submitted along with the application for issue of tender document).
2. The tenderer should have a valid Service tax Registration Certificate (A copy of the same shall be submitted along with the application for issue of tender document)
3. The tenderer should have valid B' grade electrical contractors license issued by KSEI or should associate a contractor with the above license. (Copy of the Contractors license shall be submitted along with the application for issue of tender document)

The schedule of quantities, tender drawings, specifications and commercial conditions of the Contract are appended.

1.02 The general information of the project is given in Annexure to this NIT. The information is only indicative. The tenderers are required to visit the site and familiarise themselves with the site conditions, nature of strata, availability of construction materials, etc., before quoting. The drawings, general & special conditions of Contract, schedule of quantities and the specifications may be carefully studied before they offer their quote. No claims for extra compensation over and above the quoted rates will be entertained by ACCEPTING AUTHORITY on the ground that the tenderer have misjudged site conditions, nature of strata, tender conditions or any item of tender. The tender documents can be obtained from the office of Chief Engineer, National Games Secretariat, Palayam, Thiruvananthapuram on cash payment of Rs.10,400/- + tax 5% on any working days during office hours from 01.02.2013 up to 12 Noon 14.02.2013 or download from the official website of the National Games Secretariat, www.35thnationalgames.in. Those who download the bidding documents from the website shall enclose a separate Demand Draft along with the bidding document towards the cost of the tender form mentioned. This payment is not refundable.

1.03 The quoted tender documents signed and completed in all respects shall be forwarded so that it reaches the office of the Chief Engineer, National Games Secretariat,

Palayam, Thiruvananthapuram on or before 3.00 PM on 14.02.2013. Any tender received after the due time on this date will be rejected.

1.04 Tender shall be deposited in a sealed envelope superscribing Tender No. and name of work and shall contain:

1. Earnest Money Deposit as specified
2. Tender Drawings
3. Tender documents
4. Preliminary agreement duly executed on non-judicial stamp paper of value not less than Rs.100/- as per proforma attached.
5. Cost of tender documents in the form of DD.

1.05 Tender will be opened in the presence of tenderers or their authorized representatives who are present at 11.00 AM on 15.02.2013 at the venue specified. In the event of the specified date of Bid opening being declared a holiday for the ACCEPTING AUTHORITY, the tender will be opened at the same location at same time on the next working day.

1.06.01 After the public opening of the tenders, the information relating to the examination, clarification, evaluation and comparison of tenders and recommendations concerning the award of Contract shall not be disclosed to the tenderer and other persons not officially concerned with such process.

.02 Subject to ACCEPTING AUTHORITY's right to accept any tender and reject any or all tenders; the work will be awarded to the tenderer whose bid has been determined to be substantially responsive to the tender documents and who has offered the lowest Evaluated Tender Price provided further that the tenderer has the capability and resources to carry out the Contract effectively.

.03 Prior to the expiry of the period of validity of the tender ACCEPTING AUTHORITY will notify the successful tenderers in writing their name the sum which ACCEPTING AUTHORITY will pay to the Contractor in consideration of the execution, completion, operation, maintenance and guarantee of the work by the Contractor as specified by the Contract (hereinafter called the Contract price). This letter of acceptance will constitute the formation of a Contract.

.04 Before commencing the work and within fourteen days after the letter of acceptance of the tender has been intimated to him, the tenderer shall make a security deposit as given in clause 1.10 of this notice and furnish the same for the proper fulfillment of the Contract and shall execute an agreement for the work in required non-judicial stamp paper of value not less than Rs.100 in the prescribed format.

.05 If the tenderer fails to execute the agreement as stated above within the specified period, the earnest money deposit shall be forfeited to ACCEPTING AUTHORITY and fresh tenders called for or the matter otherwise disposed off. If as a result of such measures due to the default of the tenderer to pay the required deposit, execute the agreement or take possession of the work site, any loss to ACCEPTING AUTHORITY results, the same will be recovered from the tenderer by deducting from

any amount due to him from other works or revenue recovery or by suitable course of action including legal proceedings.

.06 Tenders not properly filled, mutilated with incorrect calculations or generally not complying with the conditions are susceptible to be rejected.

1.07 In the case of percentage rate Contract only a single rate as an overall percentage above or below or at par with the rate given in the schedule by a single entry at the bottom of the schedule under the head quoted rate, may be made. The overall percentage rate accepted and specified in the agreement shall not be varied on any account whatever. The rate thus quoted will deemed to include the cost of all materials, labour, hire charges for all machinery's, cost of fuel, power, all leads and lifts, taxes, levies, royalties all over heads contingencies, profits, etc. and the quoted price is all inclusive. The total Contract price shall also be worked out and entered in.

1.08 If the tender is made by an individual it shall be signed with his full name and his complete address shall be given. If it is made by partnership firm it shall be signed with the co-partnership name by a member of the firm who shall sign his own name and give the name and address of each partner of the firm and attach a copy of 'Power of Attorney' with the tender authorising him to sign on behalf of the other partners. A certified copy of the 'Registered Partnership Deed' shall also be submitted along with the tender. A certified copy of the registered deed shall also be submitted along with the tender. The tender should be in a sealed cover.

1.09 **EMD**

.01 Earnest Money Deposit is Rs 1,71,800/- It shall be drawn from Nationalsed/Scheduled bank in the form of crossed demand draft in favour of The Chief Engineer, National Games Secretariat, Trivandrum.

.02 EMD of the unsuccessful tenders will be refunded without any interest on finalisation of the Contract with the successful Tenderer or on the expiry of the validity period whichever is earlier.

.03 EMD deposited with ACCEPTING AUTHORITY will be forfeited,

i) if a bidder withdraws his bid during the period of validity specified.
ii) if the successful bidder fails within the time limit to sign the Contract document or fails to furnish the required security deposit.

1.10 **SECURITY DEPOSIT**

.01 The successful tenderer on receipt of the letter of acceptance will deposit an amount equal to 5% of the Contract Price subject to a maximum of Rs.2,00,000/- in the form of a crossed demand draft drawn in favour of National Games Secretariat, Trivandrum payable at Trivandrum. If the Probable Amount of Contract is more than Rs.2 crore the security deposit will be 10% of the PAC without any limit.

.02 EMD will be refunded to the Contractor after remittance of the security deposit and execution of the agreement.

## 1.11 RETENTION MONEY

.01 Retention Money at the rate of 10% of the value of work done from each running bill will be deducted from first and following part bills until such time as the cumulative total of such deductions including security shall amount to 10% of the Contract value.

.02 Provided that when the Retention money reaches above 1% of the Contract value or Rs.5 lakh, whichever is higher, subject to the discretion of Accepting Authority, if the Contractor so demand may convert the amount coming above the said value, on its accumulation to a minimum amount of Rs.5 lakh into one of the Government securities or Bank guarantee from any nationalised bank; the bank guarantee being valid till the completion of the defect liability period and subject to the condition that such bank guarantee shall be for a minimum amount of Rs.5 lakh; except for the last one.

.03 All the deposits of EMD, SECURITY DEPOSIT and RETENTION MONEY will not bear any interest whatsoever.

.04 No retention money will be paid if the contract value is more than Rs.2 crore.

## 1.12 REFUND OF SECURITY DEPOSIT & RETENTION MONEY

1.12.1 On satisfactory completion of the work and on recording of completion certificate, the retention money will be released based on the report from the Engineer-in-charge.

1.12.2 On expiry of the defects liability period or on payment of the amount of the Final Bill which ever is later, the Engineer-in-charge, shall recommend on demand from the Contractor to refund to him the security deposit (i.e. amount retained as per clause 1.10 above) and the same will be refunded by the Accepting Authority provided that the Engineer-in-charge is satisfied that there is no demand outstanding against the Contractor.

## 1.13 STATUTORY DEDUCTIONS

1.13.1 Income-tax at the rate prevailing at the time of payment will be deducted from each running account bill and final bill.

1.13.2 All statutory payments in connection with the employment of the workmen for this work will be borne by the Contractor.

1.13.3 The Contractor is the employer of all the worker's engaged for this work and should therefore take all required registrations and pay premium correctly to labour welfare funds constituted by the Union Government and Government of Kerala from time to time as per the existing rules.

1.13.4 All statutory deductions shall be made from the amount eligible to the Contractor in each part bill at current rates. The deduction towards the work Contract tax shall be as per the prevailing rates of Kerala Government Sales Tax Rules. Any tax omitted, to be deducted in any part bill shall be deducted in the subsequent bills/final bill.

## 1.14 QUANTUM OF WORK

1.14.01 A schedule of approximate quantities for various items accompanies this tender. It shall be definitely understood that ACCEPTING AUTHORITY do not accept any responsibility for the correctness or completeness of this schedule in respect of items and quantities and this schedule is liable to alteration by deletions, deductions or additions at the discretion of ACCEPTING AUTHORITY without affecting the terms of the Contract.

1.14.02 ACCEPTING AUTHORITY reserves the right to increase or decrease the quantum of work at site without assigning any reason.

1.14.03 Variations in the quantities put to tender will not be the basis of any claim or disputes. The rates agreed by the Contractor shall hold good for any amount of variation in the quantities and no claims whatsoever will be entertained on this amount. The Contractor shall carry out all works as directed by ACCEPTING AUTHORITY at the same agreed rates.

## 1.15 ALL INCLUSIVE RATES

The Contractor's rate must be firm and include the cost of transportation of material to the site, all taxes such as Sales Tax, Service tax, Excise and octroi, etc. and the fixing or placing in position for which the item of work is intended to be operated. The rates quoted by the Contractor shall be firm throughout the Contract period and there shall be no up ward revision of the rates quoted by the Contractor for any reasons whatsoever. It should be clearly understood that any claims for extra Sales Tax, Service Tax, Excise duty, Construction Tax or any Additional tax, etc., shall not be entertained in any case whatsoever once the tenders are opened.

## 1.16 INTERPRETING SPECIFICATIONS

1.16.01 In interpreting the specifications, the following order or decreasing importance shall be followed:

a. Specification mentioned in Schedule of Quantities
b. Unit Rate Specifications and Technical Specifications,
c. Special Conditions of Contract,
d. Drawings,

1.16.02 Matters not covered by the specifications given in the Contract, as a whole shall be covered by the relevant Indian Standard Codes. If such codes on a particular subject have not been framed, the decision of ACCEPTING AUTHORITY shall be final.

## 1.17 ALTERATIONS

No alterations shall be made by the tenderer in the Notice Inviting Tender, Instructions to the Contractors, Contract form, General Conditions of the Contract, Special Conditions of Contract, drawings and specifications and if any such alterations are made or any conditions attached, the tender is liable to be rejected.

## 1.18 ACCEPTANCE OF THE TENDER

1.18.01 The acceptance of a tender rests with the Authorised Representative of ACCEPTING AUTHORITY who does not bind himself to accept the lowest tender and reserves to himself the authority to reject any or all the tenders received without assigning any reason(s) whatsoever.

1.18.02 The authorised representative of ACCEPTING AUTHORITY reserves the right of accepting the whole or any of the tenders received and the tenderer shall be bound to perform the same at the rates quoted.

1.18.03 The work shall be carried out under the direction and supervision of ACCEPTING AUTHORITY or their representative at site. On acceptance of the tender, the Contractor shall intimate the name of his accredited representative who would be supervising the construction and would be responsible for taking instructions for carrying out the work.

1.18.04 ACCEPTING AUTHORITY's decision with regard to the quality of the material and workmanship will be final and binding, any material rejected thus shall be immediately removed by the Contractor and replaced by materials as per specifications and standards.

## 1.19 DEFECTS LIABILITY PERIOD

Defect Liability Period will be 12 months from the date of completion of work. Any defect developed within 'Defect Liability Period' will have to be rectified by the Contractor at their own cost and in case the defects are not rectified by the Contractor, ACCEPTING AUTHORITY or their representative shall get the work done at the risk and cost of the Contractor.

## 1.20 DELAYS IN COMMENCEMENT

The Contractor shall not be entitled to any compensation for any loss suffered by him on account of delays in commencing or executing the work, whatever the cause for such delays may be including delays in procuring Government Controlled or other materials.

## 1.21 OCCUPATION IN PART & CO-OPERATION

1.21.01 If ACCEPTING AUTHORITY wants to occupy areas in part, the Contractor shall complete the work of these areas in conjunction with ACCEPTING AUTHORITY

and hand over the same to ACCEPTING AUTHORITY without affecting any of the clause of Contract agreement.

1.21.02 The Contractor must co-operate and co-ordinate with other Contractors involved in other works at the site. The Contractor should also note that they shall have to clear the site of vegetation, debris, etc. before the commencement of the work and that no extra payment is permissible on this account.

## 1.22 ISSUE OF MATERIALS, TOOLS AND PLANT

1.22.01 The Contractor should inspect the source of materials, their quality, quantity and availability. All materials must strictly comply with the relevant B.I.S. specifications.

1.22.02 ACCEPTING AUTHORITY shall issue the following material or Tools and Plants required for the execution of the works.

a) Materials **Nil**
b) Tools and Plants **Nil**

## 1.23 PERIOD OF CONSTRUCTION

Time is the essence of this contract. The construction period shall be 6 months. Commencement of the work shall be considered from the date of receipt of letter of acceptance and handing over possession of the site. The Contractor shall draw a detailed schedule of programme in the form of a Bar Chart on whole work, within one week of award of work and submit to the Consultants for their approval.

## 1.24 INSURANCE

The successful tenderer shall take out Contractor's All Risk (CAR) insurance policy, jointly in the name of ACCEPTING AUTHORITY and the Contractor, and the original policy shall be deposited with ACCEPTING AUTHORITY.

1.25 This Notice Inviting Tender will form part of the tender document and the agreement executed by the successful tenderer.

**The Chief Engineer**
**National Games Secretariat.**

## ANNEXURE TO NIT

## GENERAL INFORMATION OF THE PROJECT

| | | | |
|---|---|---|---|
| 1. | Name of Project | : | Electrification, Airconditioning and FireFighting System of Corporation Stadium at Thrissur (Re Tender) |
| 2. | Site and location | : | Thrissur |
| 3. | Nature/scope of work | : | Electrification, Airconditioning and Fire Fighting System of Corporation Stadium at Thrissur (Re Tender) |
| 4. | Nearest Railway Station | : | Thrissur |
| 5. | Nearest Airport | : | Nedumbassery |
| 6. | Owner/Client | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekharan Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| 7. | Consultants | : | M/s KITCO,P.B No. 1820, Ravipuram, M.G Road, Kochi-682016 |
| 8. | Accepting Authority | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekharan Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| 9. | Payment Authority | : | The Chief Engineer<br>National Games Secretariat<br>Chandrasekharan Nair Stadium<br>Trivandrum 695 033<br>Tel: 0471 2302287 |
| 10. | Period of completion of work | : | 6 months. |
| 11. | Schedule taken | : | KPWD Schedule of Rates 2010 revised |

## 2. GENERAL CONDITIONS OF CONTRACT

## 2.00 GENERAL CONDITIONS OF CONTRACT

2.01.00 Definitions

2.01.01 In the contract (as hereinafter defined) the following words and expressions shall have the meaning hereby assigned to them except where the contract otherwise requires.

2.01.02 The "Owner/Client" shall mean the Corporation/Board/Department/Person for whom the work is being arranged.

2.01.03 The ACCEPTING AUTHORITY shall mean the Accepting Officer/Firm with whom the Contractor executes the Agreement and this shall be mentioned in NIT.

2.01.04 The "Contractor" shall mean person or persons, firm or company whose tender has been accepted and includes the contractor's legal representatives, successors and permitted assigns.

2.01.05 The "Consultants" shall mean KITCO LTD. who are consultants to the Owner for this project and having their office at M/s KITCO, P.B No. 4407, Femith's, Puthiya Road, NH By Pass, Vyttila, Kochi-28, for the present or any other competent agency duly appointed by OWNER/CLIENT to act as consultants for the purpose of the contract. The words "Consultants" "Consulting Engineers" appearing elsewhere in the tender shall also mean consultants.

2.01.06 "Tender" shall mean the tender submitted by the contractor for acceptance before the ACCEPTING AUTHORITY.

2.01.07 The "work" shall mean and include all works to be executed in accordance with the contract or part thereof as the case may be and shall include all extras, additional, altered or substituted works required for the purpose of the contract.

2.01.08 The "Contract Document" shall mean the agreement between ACCEPTING AUTHORITY and the contractors for the execution of the work including therein all documents such as the Notice Inviting Tender, Tender Forms, General Conditions of Contract, Technical Specification, Schedule of Quantities, Special Conditions of Contract, Letter of Acceptance, Agreed variation if any, drawings, work orders, and / or any other / correspondences or negotiations, etc.

2.01.09 "Specifications" shall mean all directions, various technical specifications, provisions and requirements attached to the contract which pertain to the method and manner of performing the work, and the materials to be furnished under the contract for the work as may be amplified or modified by ACCEPTING AUTHORITY/Consultant, drawings for the performance of the contract in order to provide the unforeseen conditions or in the best interest of the work. It shall also include the latest revised version of the relevant B.I.S. specification and other relevant codes.

2.01.10 "Site" shall mean the land allotted by the Owner/Client under in or through which the work is to be carried out.

2.01.11 "Letter of Acceptance/Award of Work" shall mean an intimation by letter, telegram, telex or fax to the tenderer that the tender has been accepted in accordance with the provisions contained therein.

2.01.12 "Engineer" shall mean the Engineering Personnel representing ACCEPTING AUTHORITY/Consultant and entrusted with work of supervision of work at the site.

2.01.13 "Contract sum/price" shall mean the total sum referred to in the schedule of quantities and rates and accepted by ACCEPTING AUTHORITY.

2.01.14 The 'Probable Amount of Contract' (PAC) shall mean the Estimated amount/ Tendered amount of the work.

2.01.15 The "Payment Authority" shall mean the Officer/Firm who makes payments of the bills for the work done and this shall be mentioned in NIT.

2.02.00 **SITE**

2.02.01 Location and details of site are specified in NIT.

2.02.02. Entry into the project area will be restricted. Passes and permits will have to be obtained from Owners for entry of all persons and vehicles into the project area. During working, the contractor shall provide barricades and screens and working place shall be isolated from other places. Working place shall be visible from other areas.

2.03.00 **SCOPE OF WORK**

2.03.01 The scope of work is described in the NIT.

2.03.02 The scope of work further includes variation or modification of design, quantity or quality of work, addition, omissions or substitution of any work, under the instruction of ACCEPTING AUTHORITY/Consultant. Such instructions shall be complied forthwith.

2.03.03 The Contractor shall provide all necessary labour, materials, equipments and management and supervisory personnel to complete the works provided under this contract in time.

2.04.00 **ASSIGNMENT AND SUB-CONTRACTING**

2.04.01 **ASSIGNMENT**

The contractor shall not assign the contract or any part thereof or any benefit or interest therein or thereunder without the written permission of ACCEPTING

AUTHORITY; not shall transfers be made by Power of Attorney authorizing others to carry out the work or receive payment on behalf of the tenderer.

**2.04.02 SUB-CONTRACTING**

The contractor shall as soon as practicable, after signing the contract, notify to the Engineer-in-Charge, in writing, the names of the subcontractors proposed for the work.

The Contractor shall be fully responsible to ACCEPTING AUTHORITY for the acts and omissions of his subcontractors and of persons directly or indirectly employed by them, as he is for the acts and omissions of persons employed by him.

Nothing contained in the contractual documents shall create any contractual relation between any subcontractor and the ACCEPTING AUTHORITY.

Subcontracting shall be limited to NOT exceeding 40% of the total amount of contract. In case of specialised nature of work requiring very high quality stipulations, such works shall not be subcontracted unless:-

a) The subcontractor firm has sufficient expertise, equipment/plant back up and experience in the similar nature of work.

b) The subcontractor firm has sufficient financial background. The firm should have atleast 20% of the value of work to be sublet as net assets.

c) The subcontractor firm has a track record of completing the works on time and to the quality stipulations.

d) The subcontractor firm has not run into litigation/ arbitration in the past three years with the clients.

In no event can any delay or unsatisfactory work conducted by the subcontractor can either be accepted or can be contractor adduce such delay or unsatisfactory work attributable to subletting of work. The main contractor shall be fully responsible for the contract and Management of subcontractors.

2.05.00 **DRAWING**

2.05.01 **ISSUE OF DRAWINGS**

Drawings approved for construction will be issued to the Contractor progressively during the contract period and the Contractor shall arrange for the execution of the works and the procurement of materials accordingly. The Contractor shall give adequate notice in writing to ACCEPTING AUTHORITY or his representative of any further drawings or specifications that may be required for the execution of the works or otherwise under the contract.

2.05.02 **COPIES OF DRAWINGS TO BE KEPT AT SITE**

One copy of the drawings furnished to the Contractor as aforesaid shall be kept at the site and the same shall at all reasonable times be available for inspection and use by ACCEPTING AUTHORITY or their representative and by any other person authorised by ACCEPTING AUTHORITY in writing.

2.05.03 **ISSUE OF FURTHER DRAWINGS AND INSTRUCTIONS**

ACCEPTING AUTHORITY shall have full power and authority to supply to the Contractor from time to time through his representative, during the progress of the works such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of the works and the Contractor shall carry out and be bound by the same.

2.05.04 **OWNERSHIP OF DRAWINGS**

All drawings supplied to the Contractor are deemed to be the property of KITCO. The Contractor should not divulge or use, expect for the purpose of this contract, any information contained in the drawings.

2.05.05 **EXECUTION AS PER DRAWINGS**

The Contractor must not vary or deviate from the drawings in any respect while executing the work or executing any extra work of any kind whatsoever unless authorised by ACCEPTING AUTHORITY.

2.05.06 **PLANS AND DRAWINGS TO BE SUBMITTED BY CONTRACTOR**

The Contractor shall submit the following information in triplicate to ACCEPTING AUTHORITY for approval within the time stipulated: each item below:-

a) A general tentative layout plan of construction plant and equipments for the execution of work within 7 days from the date of receipt of work order.

b) Drawings or prints showing the location of major plants and other facilities which he proposes to put up at the site, including any changes in the general layout, at least 7 days prior to the commencement of the respective work.

Layout and details of temporary works that the contractor wants to carry out to fulfil his obligation under the contract. Within 15 days ACCEPTING AUTHORITY will give their approval/comments sufficient to proceed with the work or objections/instructions to the Contractor based on which the drawings shall be revised and submitted again for approval by the Contractor.

All these plans and drawings submitted by the Contractor and approved by ACCEPTING AUTHORITY shall become part of the contract.

## 2.05.07 ROYALTIES AND PATENT RIGHTS

All royalties or other sums payable in respect of the supply and use in carrying out the work as desired by or referred to in the schedule of quantities of any patented articles, process or inventions shall be deemed to have been included in the contract sum and the Contractor shall indemnify ACCEPTING AUTHORITY from and against all claims, proceedings, damages, costs and expenses which may be brought or made against ACCEPTING AUTHORITY or to which he may be put by reason of the Contractor infringing or being held to have infringed any patent rights in relation to any such articles, process and inventions.

## 2.06.00 GENERAL OBLIGATIONS

## 2.06.01 INSPECTION OF SITE ETC. BEFORE SUBMISSION OF TENDER

The Contractor shall inspect and examine the site and its surroundings, and shall satisfy himself before submitting his tender, as to the nature of the ground, form and nature of the site, the quantities and nature of work and materials and its availability required for the completion of the works, the means of access to the site, the local labour conditions, the accommodation he may requires and in general shall obtain all necessary information as to the risks, contingencies and other circumstances which may influence or affect his tender. He must go through all the drawings, specifications and other tender documents. Any further clarifications in the drawings and documents can be had from ACCEPTING AUTHORITY at the above mentioned address.

## 2.06.02 SUFFICIENCY OF TENDER

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates and prices stated in the priced bill of quantities and the schedule of rates and prices, if any, with tender rates and prices shall cover all is obligations under the contract and all matters and things necessary for the proper completion and maintenance of the work.

## 2.06.03 DISCREPANCY OR ERROR IN TENDER DOCUMENT

Should the Contractor notice any discrepancy or error in the tender document, in the statement made, or quantities or units shown against items, he shall immediately bring to the notice of ACCEPTING AUTHORITY and obtain the clarification before submitting the tender. The tender shall be based on such clarifications received and shall be recorded as such in the covering letter to the tender, failing which ACCEPTING AUTHORITY shall have the right to ask the Contractor to execute the work according to the corrected statement made or quantities or units shown in the tender, without any compensation; when the same has come to the notice of the ACCEPTING AUTHORITY.

2.06.04 **RATES QUOTED FOR FINISHED WORK**

The rates quoted in the tender by the Contractor must be for the finished work as per the drawings and specifications.

2.06.05 **LOCATION OF WORK**

Unless specifically mentioned in the item, the work described there-in may be at any location or elevation.

2.06.06 **FIRM PERIOD**

The tender shall remain open for acceptance for a period of **120 days** from the date of opening of the tender. If any tenderer withdraws his tender before the said period or makes any modifications in terms and conditions of the tender, then Accepting Authority has the liberty to forfeit the said Earnest Money Deposit.

2.06.07 **COMMENCEMENT OF WORK**

The Contractor shall commence the work at site, within 14 days from the date of receipt of letter of award of work or handing over of the site whichever is later and shall proceed with the same with due expedition.

2.06.08 **PROGRAMME OF WORK**

As per the clause in special conditions of contract.

2.06.09 **CONTRACTOR'S EMPLOYEES**

The Contractors shall provide and employ sufficient qualified personnel at site in connection with the project management.

Only such technical assistants as are skilled and experienced in their respective fields and such-agents, foreman and leading hands as are competent to give proper supervision to the work they are required to supervise and,

Such skilled, semi-skilled and un-skilled labour as is necessary for the proper and timely execution and maintenance of works.

2.06.10 **REMOVAL OF WORKMEN**

ACCEPTING AUTHORITY shall be at liberty to object to and require the Contractor to remove forthwith from the works any person employed by the Contractor in or about the execution or maintenance of the works who in the opinion of ACCEPTING AUTHORITY misconduct himself or is incompetent or negligent in the proper performance of his duties or whose employment is otherwise considered by ACCEPTING AUTHORITY to be undesirable and such person shall be replaced by the Contractor without delay by a competent substitute approved by ACCEPTING AUTHORITY.

2.06.11 **COMMUNICATIONS TO BE IN WRITING**

All references, communications, correspondences made by ACCEPTING AUTHORITY, ACCEPTING AUTHORITY's representative or the Contractor concerning the works shall be in writing and no reference, communication, or complaint which is not in writing, shall be recognised.

2.06.12 **OCCUPATION AND USE OF LAND**

No land, building belonging to or in the possession of the Owner/Client/ Consultant shall be occupied by the Contractor. The Contractor shall not use, or allow to be used, the site for any purpose other than that for executing the works.

2.06.13 **CONTRACTOR'S STORE AND SITE OFFICE**

Any site-shed, proposed to be temporarily constructed by the Contractor for his office work, storage of materials, etc. shall conform to the standard sketch, or to the plan approved by ACCEPTING AUTHORITY. Permission for the construction of such sheds shall be obtained in writing. Suitable area in the site of work shall be allowed to the contractor free of cost for constructing company structures for storing his tools and plants, materials site office and cement Godown. However, the structure will be provided by him at his own expense and he will be solely responsible for guarding his property with requisite insurance against theft, fire, etc. The contractor however will have to dismantle the sheds and vacate the land of all debris, etc. at his own expense after completion of work.

2.06.14 **MATERIALS, TOOLS AND PLANT**

All materials required for the execution of the works other than those mentioned in the Notice Inviting Tender shall be supplied by the Contractor. Materials so supplied shall have the approval of ACCEPTING AUTHORITY before using on the works. All the rejected materials shall be removed at once from the site of work at the Contractor's own cost.

2.06.15 **TOLLAGES, ETC.**

The Contractor shall pay all tollages and other royalties, rent and other payments or compensations, if any, for getting stone, gravel, sand, clay and all other materials required for the works.

2.06.16 **SETTING OUT**

The Contractor shall be responsible for the true and proper setting out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of the works any error shall appear or arise in the position, level, dimensions or alignment of any part of the works, the Contractor on being required to do so by ACCEPTING

AUTHORITY or ACCEPTING AUTHORITY's representative, shall at his own cost rectify such error to the satisfaction of ACCEPTING AUTHORITY or his representative. The checking of any setting out or of any way relieve the Contractor from the responsibility of true and proper setting out of the works. The Contractor shall provide all necessary instruments, appliances and labour required by ACCEPTING AUTHORITY or his representative for checking if any, of the setting out. The Contractor shall carefully protect and observe all bench marks, site levels, pegs and other things used in setting out the works. The rates quoted for the work shall also include the cost of reference and level pillars and other dismantling, when no longer required.

2.06.17 **DAMAGE TO PERSONS AND PROPERTY**

The Contractor shall identify and keep indemnified ACCEPTING AUTHORITY against all losses and claims for injuries or damages to any person or property whatsoever which may arise out of or in consequence of the construction and maintenance of works and against all claims, demands proceedings, damages, costs, charges, expenses, whatsoever in respect thereof in relation thereto.

2.06.18 **CO-OPERATION WITH OTHER AGENCIES**

The Contractor shall co-operate with the work of other agencies or Contractors that may be employed or engaged by ACCEPTING AUTHORITY/ CONSULTANT and as far as it relates to the Contractor's work. The sequence of work shall be so arranged that the work of other agencies are also in progress simultaneously.

2.06.19 **BARRICADING AROUND EXCAVATED TRENCHES, ETC.**

The Contractor shall at his own cost provide around excavation, temporary barricading with bellies and bamboo with warning signals during day and night and shall maintain it so long as the trenches are not filled up. Similar barricades shall also be provided at all dismantling work, erection of structural, sheeting work, etc. No extra claim shall be entertained for providing, maintaining and removing such barricades.

2.06.20 **FABRICATION DRAWINGS**

Contractor shall prepare at his own cost all fabrication drawings of all structural steel works and bar bending schedule for R.C.C. works and submit them to ACCEPTING AUTHORITY for their approval at least before 15 days of commencing the fabrication. All the details like sizes, capacities, dimensions, arrangement of fabrication, etc. should be clearly indicated on these drawings.

2.06.21 **PROTECTION OF UNDERGROUND SERVICES**

The contractor must take precautionary measures to protect the underground and other services lines viz. Cables, water and sewer lines, etc. and observe any specific instructions which may be given in this regard by ACCEPTING AUTHORITY.

2.06.22 **DEWATERING TRENCHES AND PITS**

The tendered rates shall always be deemed to have taken into account the cost of removal of silt and materials that may slip in the trenches and pits and dewatering the trenches or pits of water accumulated or collected through seepage or subsoil water or rain water. The contractor shall in no case be entitled to claim any extra amount for the above work. The contractor shall remain prepared with necessary pumps and equipment for dewatering the trenches or pits so as to avoid unnecessary delay and possible damage to the property, etc.

2.06.23 **WORK IN OR AROUND OPERATING PLANT OR OFFICES ETC.**

Where the work is being carried out in or around an operating plant where the plant must run uninterrupted, the contractor shall work only at specified place and times as mutually arranged between the Contractor and ACCEPTING AUTHORITY. Similar arrangement must be made while executing works inside the offices, buildings, etc. without causing disturbance to the office work. For this the work may be required to be done during off-hours and Sundays. No extra will be allowed beyond the rates quoted for doing work in the manner described above.

2.06.24 **WORK IN SHIFTS AND ON OFF-DAYS**

The Contractor shall work in one or more shifts as also on Sundays and off days to complete the work on time, if so required by ACCEPTING AUTHORITY for which ACCEPTING AUTHORITY shall not be liable to pay any extra. If instructed by ACCEPTING AUTHORITY, the Contractor should carry out the work in the night also.

2.06.25 **SITE ORDER BOOK AND CEMENT REGISTER**

A site order book must be maintained and always be available at site to record the instructions by ACCEPTING AUTHORITY or their representative. The Contractor must see that the instructions noted therein are properly carried out.

A register showing the stock, receipts, daily issue/consumption of cement and balance quantity available etc. should be maintained at site and made available on demand by the ACCEPTING AUTHORITY.

2.06.26 **DELAY IN OBTAINING MATERIALS SUPPLIED BY ACCEPTING AUTHORITY**

If ACCEPTING AUTHORITY has undertaken to supply any material specified in the special conditions at rates and conditions cited therein, the contractor shall keep himself in touch with day-to-day position regarding the supply of materials from ACCEPTING AUTHORITY and so adjust the progress of the works that labour may not remain idle nor there by any other claim due to or arising from delay in obtaining the materials.

2.06.27 **RECORD OF MATERIALS SUPPLIED BY ACCEPTING AUTHORITY**

The contractor shall maintain an account of different materials obtained from ACCEPTING AUTHORITY for executing the works under the contract. ACCEPTING AUTHORITY shall have the right to check the position of materials at all times.

2.06.28 **SAFE STORAGE OF MATERIALS**

The contractor shall be responsible for the safe storage of materials supplied by ACCEPTING AUTHORITY for executing of the works. Surplus materials lost or damaged or unaccounted for or made unserviceable by the Contractor shall be charged at penal rates.

2.06.29 **TRANSPORT OF MATERIALS**

Unless otherwise specified, all the materials supplied by ACCEPTING AUTHORITY shall be transported by the Contractor from ACCEPTING AUTHORITY's store/yard, to the site of work at no extra cost.

2.06.30 **SITE TO BE KEPT CLEAN**

The surplus spoil and dismantled debris shall be removed to a place as directed by ACCEPTING AUTHORITY/CLIENT and stacked, levelled and dressed as directed. Rehandling charges will not be allowed.

2.06.31 **CONFLICT IN MEANING BETWEEN SCHEDULE OF QUANTITIES AND SPECIFICATIONS**

The schedule of quantities shall be read in conjunction with the specification, and in the event of conflict in meaning between the two the corresponding item in the unit rate specification shall always have precedence over the specifications.

2.07.00 **LABOUR**

2.07.01 **LABOUR RULES**

In respect of all labour directly or indirectly employed on the works by the Contractor, the Contractor shall comply with the provisions of the contract labour (Regulation and Abolition) Act 1970, Minimum Wages Act 1948, Payment of Wages Act 1936, Employees Provident Funds and Miscellaneous Provision Act 1952, The Employees State Insurance Act, 1948 and any amendments thereof and all legislation and rules of the State and/or Central Government or other local authorities, framed from time to time, governing the protection of health, sanitary arrangements, wages, welfare and safety for labour employed on building and construction works and for bonus, retirement benefits, retrenchment/lay off, compensation and all other matter liabilities of ACCEPTING AUTHORITY to employees. The rules and the other statutory obligations with regard to fair wages, welfare and safety measures, maintenance of register, etc. will be deemed to be part

of the contract. The contractor shall produce documentary evidence for compliance of above Acts.

2.07.02 **REPORTING ACCIDENT OF LABOUR**

The Contractor shall be responsible for the safety of all employees and/or workers employed or engaged by him on and in connection with the works and shall forthwith report all cases or accidents to any of them, however caused and whenever occurring, to ACCEPTING AUTHORITY or his representative and shall make every arrangement to render all possible assistance and aid to the victims of the accident.

2.07.03 **PROVISION OF WORKMEN'S COMPENSATION ACT**

The Contractor shall at all times indemnify and keep indemnified ACCEPTING AUTHORITY against all claims for compensation under the provisions of the workmen's Compensation Act 1923 or any other law for the time being in force by or in respect of any workmen employed by the Contractor in carrying out the contract and against all cost and expenses or penalties incurred by ACCEPTING AUTHORITY in connection therewith. In any case in which, by virtue of the provision of the said act, ACCEPTING AUTHORITY is obliged to pay compensation to a workman employed by the Contractor in executing the works, ACCEPTING AUTHORITY shall recover from the Contractor the amount of the compensation so paid and without prejudice to the rights of ACCEPTING AUTHORITY under the said Act. ACCEPTING AUTHORITY shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any amount due by ACCEPTING AUTHORITY to the Contractor, whether under this contract or otherwise without prejudice to any other remedy that may be available to ACCEPTING AUTHORITY, in law. ACCEPTING AUTHORITY shall not be bound to contest any claim made against it under the said Act, except on the written request of the Contractor and upon his giving to ACCEPTING AUTHORITY full security for all cost for which ACCEPTING AUTHORITY might become liable in consequence of contesting such claim.

2.07.04 **ACCIDENT OR INJURY TO WORKMEN**

ACCEPTING AUTHORITY shall not be liable for, in respect, or any damages or compensation payable as per regulations or in consequence of any accident or injury to any workmen or other person in the employment of the Contractor shall indemnify and keep indemnified ACCEPTING AUTHORITY against all such damages and compensation and against all claims, demands, proceedings costs, charges and expenses whatsoever in respect thereof or in relation thereto.

2.07.05 **PRESERVATION OF PEACE**

The Contractor shall take requisite precautions to prevent any riotous or unlawful behaviour by or amongst his workmen and/or others employed on the works by him, for the preservation of peace and protection of the inhabitants and security of property in the neighbourhood of the works.

2.07.06 **AGE LIMIT OF LABOUR**

The age limit for employment of labour shall be in strict accordance with the existing labour legislation.

2.07.07 **RETURN OF LABOUR EMPLOYED**

The Contractor, if required by ACCEPTING AUTHORITY, shall submit return in detail in such form and at such interval as ACCEPTING AUTHORITY may prescribe showing number of different classes of labour employed on the work from time to time by the Contractor.

2.07.08 **OBSERVANCE BY SUB-CONTRACTOR**

The Contractor shall be responsible for the observance of the provisions of aforesaid clauses by the sub-contractors employed by him in the execution of the contract.

2.08.00 **MATERIAL TESTS AND WORKMANSHIP**

2.08.01 **QUALITY OF MATERIALS, WORKMANSHIP AND TESTS**

All materials and workmanship shall be of the respective kinds described in the contract and in accordance with ACCEPTING AUTHORITY or their representative's instructions and shall be subject, from time to time, to such tests as ACCEPTING AUTHORITY or his representative may direct at the place or any of such places. The contractor shall provide such assistance instruments, machines, labour and materials, as are normally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the works for approval as may be required by ACCEPTING AUTHORITY.

2.08.02 **CONSTRUCTION OF PROTOTYPES OR SAMPLES OF WORK**

The Contractor shall construct prototypes or samples of work as laid down in the contract or as instructed by ACCEPTING AUTHORITY. Such prototypes or samples or work, after approval by ACCEPTING AUTHORITY, shall serve as the standards to be achieved in the final construction.

2.08.03 **COST OF SAMPLES**

All samples shall be supplied by the Contractor at his own cost.

2.08.04 **COST OF TESTS**

The cost of making any test as per specifications shall be born by the Contractor, and the Contractor should arrange for all facilities like meters, instruments as required for carrying out such tests.

2.08.05 **INSPECTION OF OPERATION**

ACCEPTING AUTHORITY or their representative shall at all times have access to the works and to the site and to all workshops and places where materials, manufactured articles or machinery are being obtained for the works and the Contractor shall afford every facility for every assistance in obtaining the right to such access.

2.08.06 **EXAMINATION OF WORK BEFORE COVERING UP**

No work shall be covered up or put out of view without the approval of ACCEPTING AUTHORITY or ACCEPTING AUTHORITY's representative and the Contractor shall afford full opportunity to ACCEPTING AUTHORITY or ACCEPTING AUTHORITY's representative to examine and measure any work which is about to be covered up or put out of view and to examine foundations before permanent work is placed thereon. The contractor shall give due notice to ACCEPTING AUTHORITY's representative wherever any such work or foundations is or are ready or about to be ready for examination and ACCEPTING AUTHORITY's representative shall without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such work or of examining such foundations.

2.08.07 **UNCOVERING AND MAKING OPENINGS**

The Contractor shall uncover any part of parts of the works or make opening in or through the same as ACCEPTING AUTHORITY may, from time to time, direct and shall reinstate and make good such part of parts to the satisfaction of ACCEPTING AUTHORITY. If any such part of parts have been covered up or put out of view and found to be executed in accordance with the contract, the expenses of uncovering, making openings in or through, reinstating and making good the same shall be borne by ACCEPTING AUTHORITY but in any other case all such expenses shall be borne by the Contractor and shall be recoverable from him by ACCEPTING AUTHORITY and deducted by ACCEPTING AUTHORITY from any money due, which may become due to the Contractor, without prejudice to any other remedy that may be available to ACCEPTING AUTHORITY, by law.

2.08.08 **REMOVAL OF IMPROPER WORK AND MATERIALS**

ACCEPTING AUTHORITY or his representative shall during the progress of the works have power to order the following in writing from time to time of which no extra payment will be made to the Contractor.

a) The removal from the site within such time or times as may be specified in the order of any materials which in the opinion of ACCEPTING AUTHORITY or his representative are not in accordance with the contract.

b) The substitution of proper and suitable materials.

c) The removal and proper re-execution notwithstanding a previous test thereof or interim payment thereof of a work which in respect of materials or workmanship is not in the opinion of ACCEPTING AUTHORITY or his representative in accordance with contract.

2.08.09 **SUSPENSION OF WORK**

The Contractor shall, on the written order by ACCEPTING AUTHORITY suspend the progress of the works or any part thereof for such time or times and in such manner as ACCEPTING AUTHORITY may consider necessary and shall during such suspension, properly protect and secure the work, so far as is necessary in the opinion of ACCEPTING AUTHORITY.

2.09.00 **TIME OF COMPLETION AND TAKING OVER**

2.09.01 **POSSESSION OF SITE**

Save in so far the contract may prescribe the extent of portions of the site of which ACCEPTING AUTHORITY is to be given possession from time to time and the order in which such portions will be available to his and subject to any such portions will be available to him and subject to any requirement in the contract as to the order in which the work shall be executed, ACCEPTING AUTHORITY shall give to the Contractor possession of so much of the site as may be required to enable the Contractor to commence with such reasonable proposals of the Contractor as he will make in writing to ACCEPTING AUTHORITY and shall, from time to time as the work proceeds give the Contractor possession of such further portions of the site as may be required to enable the Contractor to proceed with the construction of the works in accordance with the said programme or proposal.

2.9.02 **TIME OF COMPLETION**

Time is deemed to be the essence of this contract and the whole of the works shall be completed within the time stipulated or within such extended time as has been allowed under Clause 2.9.3 and 2.9.4.

2.9.03 **EXTENSION OF TIME OF COMPLETION DUE TO EXTRA/ ADDITIONAL WORKS**

Should the amount of extra or additional work of any kind or changes in scope of work or other special circumstances of any kind whatsoever which may occur, be such as fairly to justify the Contractor's request for extension of time for the completion of the works, the Consultants shall determine the amount of such extension and with the approval of the Client shall intimate the Contractor in writing provided that the Consultants is not bound to take into account any extra or additional work or other special circumstances unless the Contractor has within 28 days, after such work has been commenced or such circumstances have arisen, submit to the Consultants full and detailed particulars of any request for the extension of time to which he may consider to be justified. The Contractor is bound to complete the work at the same rates, terms and conditions.

2.9.04 **EXTENSION OF TIME OF COMPLETION DUE TO FORCE MAJEURE CONDITIONS**

If in the opinion of the Consultants the progress of the work has at any time been delayed due to force majeure conditions like strikes, fire, inclement weather, un-avoidable casualities, acts of god or any cause whatsoever beyond the control of the Contractor, continuously for more than one month, then the time of completion of the work may be extended for such reasonable time as the Consultants may decide and this will be indicated in writing. The Contractor shall complete the work at the accepted rates, terms and conditions.

2.09.05 **LIQUIDATED DAMAGES**

If the contractor fails to complete the work within the period of completion or within any extended time allowed the contractor shall pay or allow to the ACCEPTING AUTHORITY the sum equivalent to 1% of the PAC per month of delay calculated on each day basis and upto a maximum of 10% of PAC as liquidated and ascertained damages for the period of stipulated completion or such extended time as the case may be during which the work shall remain unfinished. Such damages may be deducted by the ACCEPTING AUTHORITY from any money due or that may become due.

2.09.06 **WORK TREATED AS COMPLETE**

The works shall not be treated as complete until:

i) The site is clear from all materials, site shed, etc. and ACCEPTING AUTHORITY is satisfied with the job done by the Contractor.

ii) The Contractor has submitted the reconciliation statement regarding the stores received from ACCEPTING AUTHORITY, and all the surplus and salvaged materials are returned to the stores.

iii) All equipment, tools, plant taken from ACCEPTING AUTHORITY have been returned by the Contractor.

iv) Any other material, taken on loan/transfer from other agency have been returned by the Contractor.

v) All power and water supply connections taken for the execution of the works have been disconnected by the Contractor.

vi) Rectification of any damage done by the Contractor to the work executed have been completed by the Contractor.

vii) The works shall not be considered as completed until ACCEPTING AUTHORITY has certified in writing that they have been virtually completed and the Defects Liability Period shall commence from the date of such certificate.

2.09.07 **TAKING OVER**

After completion of works or any substantial part of the works before the completion of the whole of the works, the Contractor shall notify ACCEPTING AUTHORITY in writing, who within 15 days of receipt of the said notice shall give such certificate with respect to any substantial part of the works which has been both completed to the satisfaction of ACCEPTING AUTHORITY and occupied or used by ACCEPTING AUTHORITY or refuse to issue the same stating the reasons thereof in writing. When any such certificate is given in respect of a part of the works, such part shall be considered as completed for the purpose of taking over and computation of the period of maintenance of such part, that is such period of the work as certified. The works in whole or part shall not however, be treated as completed for the purpose of other relevant clauses hereof unless and until the provision of clause 2.09.07 hereof are fully complied with.

2.09.08 **MAINTENANCE**

For a period of TWELVE MONTHS commencing immediately after taking over of the work by ACCEPTING AUTHORITY, the Contractors liability shall be to replace the defective parts, rectify/ reconstruct the defective work that may develop of his own construction or those of his sub-contractor approved by ACCEPTING AUTHORITY arising solely from faulty materials or workmanship.

If it is necessary for the Contractor to rectify/reconstruct any defective portions of the work under the contract, the provision of this condition shall apply to the portions of work so replaced or renewed until the expiration of three months from the date of such replacement or renewal or until the end of the above mentioned period of twelve months, whichever may be later. If any defects be not remedied within a reasonable time ACCEPTING AUTHORITY may proceed to do the work at Contractor's risk and expense, but without prejudice to any other rights which ACCEPTING AUTHORITY may have against the Contractor in respect of such defects.

The Contractor shall bear the cost of such repair/rectification carried out on his behalf at site. Immediately upon expiry of the maintenance period the Company shall issue a final certificate indicating that the Contractor has completed his obligation under the contract.

2.10 **TERMINATION AND BACK CHARGING OF CONTRACT**

2.10.01 **TERMINATION**

If the Contractor has abandoned the contract or has failed to proceed with the work due to negligence or the progress on any particular item, items is slow or has failed to execute the work in accordance with the terms and conditions of the contract, is persistently or frequently neglecting to carry out his obligation under the contract, then it shall be lawful for ACCEPTING AUTHORITY to terminate the contract forthwith under written notice and to proceed with the balance of the work through

any other agencies. During the course of execution of the job, in case the Contractor has done any substandard work, he shall be asked in writing to dismantle and redo the same at his own expenses. If the Contractor fails to comply with the above instructions immediately, then ACCEPTING AUTHORITY shall proceed with the above rectification work, through another agency or agencies. Similarly, if the Contractor goes slow on any particulars item or items of work, ACCEPTING AUTHORITY shall have the right to execute this item or items through another agency or agencies, including its own department.

### 2.10.02 **BACK CHARGING THE CONTRACTOR**

Extra cost and expenses incurred for completing the work of balance work or carrying out the rectification of any work as mentioned above through another agency or agencies including its own department, shall be debited to Contractor's account and shall be recovered from any money due or that may become due to the contractor without prejudice to any other remedy that may be available to ACCEPTING AUTHORITY in law. If there is any savings in cost due to re-arrangement or supplementing through other agencies the original contractor will not have any claim on this.

## 2.11.00 **ALTERATIONS, ADDITIONS AND OMISSIONS**

### 2.11.01 **VARIATION**

CONSULTANT with the approval of ACCEPTING AUTHORITY/OWNER shall be entitled to make any variation of the quality or quantity of the works or any part thereof that may in his opinion, is necessary and for that purpose, or if for any other reason it shall, in his opinion be desirable, he shall have power to order the Contractor to do and the Contractor shall do any of the following:

a) Increase or decrease the quantity of any work included in the contract.

b) Omit any portion of work.

c) Change the character or quality or kind of any such work.

d) Change the levels, lines, position and dimensions of any part of the works and

e) Execute additional work of any kind necessary for the completion of the works, and no such variation shall in any way vitiate or invalidate the contract by the value, if any, of all such variations shall be taken into account in ascertaining the amount of the contract price.

### 2.11.02 **ORDER FOR VARIATIONS TO BE IN WRITING**

No such variation shall be made by the Contractor without an order in writing of ACCEPTING AUTHORITY, provided that no order in writing shall be required for increase or decrease in the quantity of any item or work where such increase or decrease is the result of the actual quantities exceeding or being less than those

stated in the bill of quantities which are estimates. In such cases, the Contractor shall be paid only for the actual quantity of work done as certified by ACCEPTING AUTHORITY at the accepted unit item rate and no compensation shall be allowed. Provided also that if for any reason ACCEPTING AUTHORITY shall consider it desirable to give any such order verbally, the Contractor shall comply with such order but it must be followed by confirmation in writing of such verbal order given by ACCEPTING AUTHORITY, which shall be deemed to be an order writing within the meaning of this clause.

2.11.03 **EXTRA ITEMS**

.01 Any item of work that do not find a place in the schedule of quantities, in the original tender or in the accepted tender or contract as has been directed by ACCEPTING AUTHORITY to execute is deemed as an extra item of work. All such works that are necessary to be carried out under the direction of ACCEPTING AUTHORITY shall be carried out by the contractor. No such variation will violate the Contract.

.02 Extra items of work thus carried out by the contractor will be paid at the rates worked out by ACCEPTING AUTHORITY in the following manner.

.03 In the case of all extra items whether additional, altered or substituted, if accepted rates for identical items are provided for in the contract such rates shall be applicable.

.04 In the case of extra items whether altered or substituted, for which similar items exists in the contract, the rates shall be derived from the original item by appropriate adjustment of cost of affected components. The percentage excess or deduction of the contract rate for the original item with reference to the estimated rate shall be applied in deriving the rates for such items.

.05 In the case of extra items, whether altered or substituted, for which similar items do not exist in the contract, the rates shall be arrived at on the basis of provisions of standard data book and schedule of rates followed in arriving rates in original work/ agreement. Tender excess/ deduction will also be applied.

.06 In the case of extra items, whether additional altered or substituted, for which the rates cannot be derived from similar items in the contract, and only partly from similar items in the contract and only partly from the public work department rates, the rates for such part or parts of items as are not covered in the schedule of rates shall be determined by ACCEPTING AUTHORITY on the basis of the prevailing market rates giving due consideration to the analysis of the rate furnished by the contractor with supporting document including contractor's profit. No tender excess will be applied on market rates.

.07 In the case of extra item whether additional, altered, substituted, for which the rates cannot be derived either from similar items of work in the contract or from the departmental schedule or rates, the contractor after execution of the work as mentioned in 2.11.03.01 above and shall within 14 days of the receipt of order to

carry out the said extra item of work, communicate to the Engineer the rate which he proposes to claim for the item, supported by analysis of the rate claimed and ACCEPTING AUTHORITY shall be within one month thereafter, determines, the rate on the basis of the market rate giving due consideration to the rate claimed by the Contractor.

2.11.04 **REBATE/EXTRA OVER ORIGINAL ITEM**

If there is a deviation in the specification of particular item of the tender, rebate/extra over the quoted rate shall be generally derived as follows:

a) For items not covered in the schedule, rebate/extra shall be derived based on observation/ analysis of labour and materials involved in such items.

2.11.05 **ITEMS OF AD-HOC NATURE**

The Contractor shall procure necessary materials and carry out miscellaneous work of ad-hoc nature specifically provided with necessary tools and tackles as may arise during execution of the contract. The actual quantum of work shall be certified and settled by ACCEPTING AUTHORITY and payment for the same shall be fixed on the basis of actual cost plus overheads, profits and establishments taken at 15% of the cost.

2.11.06 **CLAIMS**

The contractor shall send to ACCEPTING AUTHORITY's representative an account, giving full and detailed particulars with proper analysis of all claims for any additional expenses to which the Contractor may consider himself entitled to authorise payment to be made for any such work not withstanding the Contractor's failure to comply with this condition if the Contractor has at the earliest practicable opportunity notified ACCEPTING AUTHORITY in writing, that he intends to make a claim for such work.

2.12.00 **MEASUREMENTS**

2.12.01 **QUANTITIES**

The quantities set out in the bill of quantities are the estimated quantities of the work. They are not to be taken as the actual and correct quantities of the works, to be executed by the Contractor in fulfillment of his obligations under the contract.

2.12.02 **WORKS TO BE MEASURED**

.01 ACCEPTING AUTHORITY or their Representative shall, except as otherwise stated, ascertain and determine by measurement the value in terms of the contract. He shall when he requires any part or parts of the works to be measured, give notice to the Contractor's authorised agent or representative, who shall forthwith attend or send a qualified agent to assist ACCEPTING AUTHORITY or his representative in making such measurement, and shall furnish all particulars required by either of

them. Should the Contractor not attend or neglect or omit to send such agents, then the measurement made by ACCEPTING AUTHORITY or their representative and approved by him, shall be taken to be the correct measurement of the work. For the purpose of measuring such permanent work as is to be measured by record and drawings, ACCEPTING AUTHORITY 's representative shall prepare records and drawings month by month and the Contractor, as and when called upon to do so in writing, shall within fourteen days, attend to examine and agree such records and drawings with ACCEPTING AUTHORITY's representative and shall sign the same when so agreed. If the Contractor does not so attend to examine and agree such records and drawings they shall be taken to be correct if, after examination of such records and drawings, the contractor does not agree to the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor shall, within fourteen days of such examination, lodge with ACCEPTING AUTHORITY 's representative for decision by ACCEPTING AUTHORITY, notice in writing of the respects in which such records and drawings are claimed by him to be incorrect.

.02 The contractor shall raise bills once a month or for a minimum payment of 10% of contract amount, unless otherwise agreed by the Chief Engineer, National Games Secretariat.

.03 Payment towards all interim bills will be made by ACCEPTING AUTHORITY within 21 days of presentation by the contractor.

.04 Period of final measurement shall be three months from the time of completion of the project.

2.12.03 **METHOD OF MEASUREMENT**

The works shall be measured in accordance to relevant IS codes not withstanding any general or local custom, except where otherwise specifically described or prescribed in the contract.

2.13.00 **PROVISIONAL SUMS**

2.13.01 "Provisional sum means a sum included in the contract and so designated in the bill of quantities for execution of works or the supply of goods, materials or services or for contingencies, which sum may be used, in whole, or in part or not at all, at the direction or discretion of ACCEPTING AUTHORITY. The contract price shall include only such amounts in respect of the work, supply or services to which provisional sums relate as ACCEPTING AUTHORITY shall approve or determine.

2.13.02 The contractor shall when required by ACCEPTING AUTHORITY, produce all quotations, invoices, vouchers and accounts or receipts in connection with expenditure in respect of provisional sums.

2.14.00 **FURTHER INSTRUCTIONS**

2.14.01 In this tender item specifications are given in the following sections:

A. **TECHNICAL SPECIFICATIONS**
B. **SCHEDULE OF QUANTITIES**
**with Unit Rate Specifications**

Technical specifications are the general instructions for carrying out the works.

2.14.02 The Contractor has to work out his rate as an overall percentage above or below or at the rate given in the Schedule by a single entry. The contractor's over all percentage shall be worked out based on the unit rate specification and rates provided against each specification.

2.14.03 The rate has to be entered by a single entry at the end the schedule both in words and in figures.

2.14.04 Every contractor should furnish along with his tender income-tax clearance certificate and information regarding the income-tax circle of Ward of the District in which he is assessed by income-tax, the reference No. of assessment and the assessment year.

2.14.05 The rates should be quoted in decimal coinage system.

2.14.06 Certified copies of Registration Certificate, Partnership Deed and Power of Attorney or Articles of Agreement in case of Limited companies will have to be furnished for considering the acceptance of the tender.

2.14.07 Should the contractor notice any discrepancy or error in the statement made, or quantities or units shown against items, he shall immediately bring it to the notice of ACCEPTING AUTHORITY and obtain the clarification before submitting the tender. The tender shall be based on such clarifications received and shall be recorded as such in the covering letter to the contractor to execute the work according to the corrected statement made for quantities or units shown in the tender, without any compensation.

2.14.08 The tender of the Contractor not complying with the above instructions may be rejected.

2.14.09 The tenderer should put the signature on all pages of the tender documents.

2.14.10 **MATERIALS OBTAINED FROM EXCAVATION**

The contractor shall treat all materials obtained during dismantling of a structure, excavation of the site for a work, etc. as property of the OWNER and such materials shall be disposed off to the best advantage of the OWNER according to the instructions issued by the Engineer-in-Charge.

2.14.11 **TREASURE TROVE, FOSSILS, ETC.**

All fossils, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall be the absolute property of the OWNER and the Contractor shall take reasonable precautions to prevent his workmen or any other person from removing or damaging any such article or thing. The Contractor shall immediately upon discovery thereof and before removal, acquaint the Engineer-in-Charge with such discovery and carry out the Engineer-in-Charge's directions as to the disposal of the same at the expense of the OWNER.

The Chief Engineer,
NATIONAL GAMES SECRETARIAT

I/We have carefully read the above said instructions and shall comply with the same.

Signature of the tenderer.

Place:
Date :

## TENDER FORM

**TENDER NO : 25/NGS/2012-13**

To

The Chief Engineer,
National Games Secretariat,
Trivandrum.

Dear Sirs,

**Sub: ELECTRIFICATION, AIR CONDITIONING AND FIRE FIGHTING SYSTEM OF CORPORATION STADIUM AT THRISSUR (RE TENDER)**

With reference to the tender invited by you for the above proposed work, I/We do hereby Tender for the same after having:

a) Examined the designs, drawings, details, specifications schedule of quantities, instructions to tenders, agreement and the conditions of contract annexed thereto (hereinafter called the Contract Documents).

b) Visited the site of work, studied the site conditions, nature of strata, availability of construction materials etc., and

c) Acquired the requisite information on all prevailing factors affecting the tender.

I/We undersigned hereby offer to construct the proposed work in strict accordance with the Contract document for the consideration to be calculated in terms of the priced schedule of quantities.

I/We have noted that time is the essence of the contract and ready to undertake and complete the whole of the works as per the attached schedule from the date of issue of an intimation by you that our tender has been accepted and upon receiving possession of site. I/We further undertake that on failure subject to the conditions of the contract relating to extension of time, I/We are willing to pay the agreed Liquidated Damages/Penalty for the period during which the work remains incomplete beyond the due date of completion.

I/We further agree to the deduction of retention money and security deposit amounting to a total of 10 percent of value of work which will be returned to me/us as per the relevant clauses in the agreement. The deduction will be as explained in clause 1.12.01 of Notice Inviting Tender.

I/We undertake the execute the work of electrification of various facilities if any, through a licensed electrical contractor of appropriate class as given in the tender condition. All the requirements of supervision, testing, commissioning and energizing will be fulfilled by us.

We have also executed the preliminary agreement as is enclosed.

Further we undertake the execute the works which will be entrusted to us in the most workman like manner within the stipulated completion period. If our Tender is found acceptable, we agree to enter into a contract as specified by you within one week of this receipt of intimation of acceptance of our tender.

Our Bankers are:

1.....

2.....

Place:
Date :

Signature of tenderer

Name of the partners of the firm
OR
Name of the person having power of
Attorney to sign the contract.

Postal Address :

Telephone Number
i) Land :
ii) Mobile :
Email:
Income Tax PAN No. :
VAT TIN :
Service Tax Registration No. :

# 3. SPECIAL CONDITIONS OF CONTRACT

## 3.0 SPECIAL CONDITIONS OF CONTRACT

### 3.01 MOBILISATION ADVANCE

No mobilization will be paid to the Contractor

### 3.02 SECURED ADVANCE

No secured advance will be paid to the Contractor

### 3.03 BANK GUARANTEE

3.03.01 Additional bank guarantee as performance guarantee has to be remitted by the Contractor who quote very low rates as below:

i. If the quoted rate is below 50%, the same will be rejected

ii. If the quoted rate is between 25% and 50% below PAC, the Contractor will remit performance guarantee equal to the difference between PAC and the quoted amount and the same will be released after the satisfactory completion of the work.

iii. Performance security for specialized items of work like antitermite treatment, glass work etc. shall be retained by the Company at the rate of 10% of the value of such items, for a period of 5 years. No interest shall be paid for the security so retained.

3.04 Works to be done by Contractor

Unless and otherwise mentioned in the tender document, the following works shall be done by the contractor, and therefore their cost shall be deemed to be included in their tendered cost:

a) Foundation and brackets and components wherever required, including foundation bolts, etc. wherever specified.

b) Excavation and refilling of trenches in soil wherever the pipes/cables are to be laid directly in ground, including necessary base treatment and supports for pipes, bricks, etc, as specified.

c) Sealing of all opening provided for pipes and cables, from fire safety point of view, after laying of the same.

d) Painting of all exposed metal surfaces of equipment and components.

e) Fixing of danger notice boards wherever required.

f) Making good all damages caused to the structure, walls, floors, slabs, etc., during installation and restoring the same to their original finish.

g) Consumables, fuels, cement, etc. required for the work, testing, trial runs and commissioning.

h) Testing and commissioning of the completed installation.

i) For any item of work, not covered in particular specification, the same shall be done as per latest relevant BIS codes of practice.

j) For any item of work not covered in particular specification, the same shall be done as per sound engineering practice as directed/approved by Engineer-in-Charge.

**3.05 Important Note**

The rate for all items of works shall be considered all inclusive of pumping out or bailing out water due to rain, flood or other cause, if applicable, and no extra payment shall be made on this account.

No payment/compensation will be made to the Contractor for damage caused by rains, floods, cyclones, earthquakes, subversion, riots or other natural calamities during the execution of the Works. The damage to work shall be made good by the Contractor at his own cost and no claim on this account shall be entertained.

**3.06 General Requirements and Arrangement of Materials**

3.06.1 All sundry fittings, assemblies, accessories, hardware items, foundation bolts, termination lugs for electrical connections as required, and all other sundry items which are useful and necessary for proper assembly and efficient working of the various components of the work shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender document or not.

3.06.2 **Busway/Cable Layout**

Prior to the laying of the busbar trunking and cables, the contractor shall submit to the Engineer-in-charge detailed layout plan and get it approved. The layout plan shall contain particulars regarding size & routes of the busbar system/cables, number of supports, pipes carried and the tap-off points, inspection chambers provided along the route.

3.06.3 **Centre of gravity**

The centre of gravity of the assembled equipment shall be low and as near the vertical centre line as possible. If the centre of gravity is ex-centric relative to track, its location shall be shown on the outline drawing.

3.06.4 **Quality of materials**

All the materials and equipment supplied by the contractor for this work shall be new and should confirm to relevant BIS Specifications. They shall be of such design, size and material as to function satisfactorily under the rated conditions of operation and to withstand the environmental conditions at site. The copies of purchase vouchers & gate passes should be produced along with the materials.

The type test certificates, routine test certificates and acceptance test certificates are also to be submitted.

3.06.5 **Inspection of material and Equipment**

The materials should be inspected/ tested prior to the despatch from the manufacturer by Purchaser/Consultant. The inspection call should be given at least fifteen days in advance so as to depute the officials of Purchaser/Consultant for the inspection.

Such inspection will be of the following categories:

1. Inspection of materials/equipment to be witnessed at the manufacturers' premises in accordance with relevant BIS/Agreement Inspection Procedure.
2. To receive materials at site with manufacturers' Test Certificate(s).
3. To receive materials after physical inspection at site.

Similarly, for fabricated equipment, the contractor will first submit dimensional detailed drawings for approval before fabrication is taken up in the factory. Suitable stage inspection at factory also will be made to ensure proper use of materials, workmanship and quality control.

3.06.6 **Rating of components**

All current carrying components in an installation shall be of appropriate rating of voltage, current and frequency as required at the respective sections of the electrical installation in which they are used, without their respective ratings being exceeded.

3.06.7 **Fabrication of Panels in a CPRI approved workshop**

Unless otherwise specified, switch boards/HT/LT panels etc. will be fabricated by a fabricating workshop preferably having a CPRI Certificate for short circuit withstand capability for manufacture/fabrication for the rating of Switchboards specified. The workshop also should have reasonable quality control, and testing facilities, besides, having a proper 7-tank process for treatment and painting of metal parts.

3.06.8 **Storage of materials**

The storage of materials brought to site is the full responsibility of the contract. The contractor should construct necessary storerooms. The land required for stores will be provided by the Purchaser free of cost. The storeroom should be with double lock arrangement and key of one lock will be with Engineer-in-charge or his authorised representative and other one will be with the contractor.

3.06.9 Procurement of Materials

Contractor shall make his own arrangements for the procurement of all materials required for the work.

**3.07 Turnover Taxes/Works Contract Taxes**

Deductions will be as per clause no. 3.22.

**3.08 Samples**

3.08.1 The Contractor shall be required to produce samples of all the materials sufficiently in advance to obtain approval of the Engineer-in-charge.

3.08.2 Approved samples shall be retained by the Engineer-in-charge until the completion of the work and all materials and workmanship incorporated in the work are to conform to the approved samples in all respects. Rejected materials shall be removed from the site immediately under the supervision of Engineer-in-charge.

3.08.3 If on handing over the site or at any time thereafter during the execution of work, the contractor considers that any drawing or information necessary for the execution of the work has not been provided, he shall inform the Engineer-in-charge in writing giving full details required. All materials or workmanship, which in the opinion of the Engineer-in-charge is defective or is unsuitable shall be removed immediately from the site within a reasonable time to be fixed by the Engineer-in-charge depending on the requirement in each case, failing which, the same shall be removed at the risk and cost of the Contractor. No claim whatever shall be entertained on this account.

3.08.4 Whenever B.I.S. codes are referred to in other particular specifications attached, the latest B.I.S. codes prevalent at the time of execution shall be followed.

**3.09 Contract Documents**

The Contract document is confidential and must strictly confined to the contractor's own use (except so far as confidential disclosure to sub-contractors or suppliers, if necessary) and to the purpose of the contract.

All tenderers shall sign a declaration under the Official Secrets Act for maintaining secrecy of the tender documents, drawings or other records connected with the work given to them. The unsuccessful tenderers shall return all drawings given to them.

**3.10 Bye-laws**

The Contractor shall comply with all bye-laws and regulations of local and statutory authorities having jurisdiction over the works and shall be responsible for obtaining prior approval, if any, and payment of all fees and other charges, giving and receiving of all necessary notices and keeping the Engineer-in-charge informed of the said compliance with the bye-laws payments made, notices issued and received.

The Contractor shall indemnify Purchaser against all claims in respect of royalties, patent rights, design trade marks of name or other protected rights in respect of any plant, machine, work or materials used for or in connection with work or temporary work and from and against all claims, demands proceeding, cost, charges and expenses whatsoever in respect of or in relation thereto. The

Contractor shall defend all actions arising from such claims and shall himself and any every sort that may be legally incurred in respect thereof.

The Electrical work shall be carried out as per local Electrical Inspectorate / Central Electrical Authority, which even is concerned. standards/ specifications/ guidelines and the Contractor shall get the approval and safety certificate from the Inspectorate after the completion of work and before energisation.

**3.11 Consumption of Materials**

Proper record of daily consumption of materials shall be maintained at the site of work for each item as directed by the Engineer-in-charge. This is required to be done even if the contractor arranges these materials.

**3.12 Co-ordination**

The Contractor shall co-operate with other agencies working in the same project, compare plans, specifications and the time schedules and so arrange his work that there will be no interference. The Contractor shall forward to the Engineer-in-charge all correspondence and drawings exchanged. Failure to check plans for conditions will render the Contractor responsible for bearing the cost of any subsequent change found necessary or damages done.

However, the Contractor shall afford necessary facilities to execute the work simultaneously with other agencies executing the works for the same project. The Purchaser shall entertain no claim on this account.

**3.13 Safety**

Only properly tested and marked material handling equipment shall be used.

All important connections/assembly of sound design related to pulley/guide etc., including the supporting arrangement and fixing details shall be checked periodically and necessary rectifying actions are to be taken in order to ensure safe handling of loads during different operations.

All plant and machinery of the contractor shall observe the safety regulations needed for working in a project where other contractors/sub-contractors/agencies might also be working on the project, so as not to interfere with the work of the other contractors or foul with their constructions shall be taken by the contractor and nothing extra is payable on this account.

The Contractor shall take all precautions to avoid all accidents by exhibiting necessary caution boards day and night, speed limit boards, red flags, red lights and providing barriers. He shall be responsible for all damages and accidents caused due to negligence on his part. No hindrances shall be caused to traffic during execution of work.

The rates quoted by the Contractor for all items except those where specific provisions indicated in the schedule of Requiurements shall include all leads, lifts, and nothing extra shall be paid on this account.

The Contractor shall adjust his labour, staff, plant, machinery. etc., according to the requirement of work from time to time with particular regard to approved

phases of work and no claim shall be entertained on account of idle labour, plant, machinery, etc., due to any reason whatsoever.

The Contractor shall clear the site thoroughly of all shuttering materials and rubbish etc., left out of his work and dress the site around the area to the satisfaction of Engineer-in-charge upon completion of the work and before release of payment of the last running bill. He will remove the labour huts on completion of the work. The payment of final bill will be subject to the compliance of this condition by the contractor.

**3.14 Testing and Measuring Equipments**

Equipment for measurement of work and testing the installation shall be procured by the Contractor for his use at his own cost. The same shall also be made available to the Engineer-in-charge without any charges for use of this work.

**3.15 Tests**

The Contractor shall produce samples of all the materials well in advance so that there is sufficient time for testing of the materials and clearance of the same before incorporation in the work.

All the materials to be used in and on every part of the work shall be subjected, from time to time, to such tests as the Engineer-in-charge may direct. Such tests shall be performed at the expense of the Contractor. The samples for tests shall be in all cases selected by the Engineer-in-charge and supplied by the Contractor as part of the contract. If at any time, any material so tested, fails to meet the acceptance criteria, the same shall be removed from the site of works and other materials substituted therefore, but in the absence of any specified test/acceptance criteria, the decision of the Engineer-in-charge shall be final and binding as to whether the said material or materials shall be used on the works, or removed forthwith and other suitable, approved material substituted.

The contractor shall produce on demand from the Engineer-in-charge, the necessary test certificates, Manufacturers' Authorization form certifying that the materials conform to the technical specifications. However, this clause will not apply to routine testing of materials at the site laboratory of the Contractor.

All tools, instruments, plants and labour/operating personnel for the test shall be provided by the Contractor at his own cost. For any tests as directed by the Engineer-in-charge, that has to be carried out at an outside laboratory, the same should be carried out by the Contractor without any extra cost

3.16 **WATER**

Water required for the construction will have to be provided by the Contractors at their own cost. It will be the responsibility of the Contractor to make arrangements for drawing and bringing it to the various construction points. Non availability of water from the owner's property will not be ground for any delay in work or any claim for any compensation whatsoever.

## 3.17 ELECTRICITY

Electricity required for the construction and general lighting of the site will have to be provided by the Contractors at their own cost. Non availability of power from KSEB will not be a ground for any delay in work or any claims for any compensation whatsoever.

## 3.18 DRAINAGE ARRANGEMENTS

The contractor shall control the grading in the vicinity of the buildings and trenches, so that surface water is prevented from running into excavated areas. The contractor shall also be responsible to see that no area around his works becomes flooded during the rainy season because of his piled up material, etc. and subsequently for another buildings. At the discretion of the Engineer-in-charge the contractor shall take steps to prevent flooding. It shall be the contractor's responsibility to keep areas around his work dry. The cost of repairing flood damage shall be the sole responsibility of the contractor.

## 3.19 APPROACH ROAD

The contractor will be required to construct suitable approach roads leading to the construction site from the main road Engineer-in-Charge and shall maintain it at his own cost.

## 3.20 FABRICATION WORKS

The contractor shall furnish to the Engineer-in-Charge 3 copies of detailed fabrication/erection drawing showing clearly all the joint details, two weeks before the commencement of actual fabrication/erection works. The Engineer-in-charge will have the right to suggest such modification to these details as found necessary by them, which shall be duly incorporated in the works by the Contractor. For the purpose of this clause, the two weeks period shall be deemed to begin from the date of the said drawings are received in the Engineer-in-charge office.

## 3.21 TAXES & DUTIES

Royalty charges & taxes if any on account of supply of materials for all works shall be paid by the Contractor at his own cost. No extra claim in this regard shall be admissible.

## 3.22. TURNOVER TAXES/WORKS CONTRACT TAXES:

Deductions will be made from the bills towards Sales Tax as per the K.G.S.T Act. As per the existing provisions.

a. Cess for the construction of works under building and other Construction Workers Welfare Cess Act-1996. The Contractor shall remit the building and other Construction Workers Welfare Cess at 1% on the total cost of construction including the cost of materials and shall produce the certificate of

remittance of Cess to ACCEPTING AUTHORITY. In case the Contractor fails to remit the Cess the applicable Cess will be recovered from the final bill of the contractor.

b. The Contractor shall engage an authorised agent experienced and qualified technical personnel for managing and supervising the work and shall see that all of them are always at the workspot during the working hours, personally checking all items of work. He shall take such orders as may be given to him by the Engineer-in-charge from time to time and shall be responsible to carry them out properly. In case contractor fails to provide an agent as per terms given above, ACCEPTING AUTHORITY reserves the right to deduct a reasonable amount from the contractor's bill, subject to a maximum of Rs.25,000/- per month, for every month of absence.

c. All plumbing and sanitary works shall be executed by a qualified and licensed plumber. The Contractor shall satisfy the Engineer-in-charge as to the competence and qualification of the workmen employed for plumbing and sanitary works.

d. All shuttering used in the work shall be either steel shuttering or of plywood with smooth surfaces so as to give a smooth finish to the concrete.

e. All fixtures & fittings (plumbing fixtures, sanitary materials, doors & window fixtures etc.) have to be got approved by the Engineer-in-charge in writing before fixing the same. However samples of all these fixtures & fittings have to be got approved well in advance of bulk procurement action.

## 3.23 SITE OFFICE

A site office of size 4mx3m to be provided by the Contractor for the use of Consultant. The Office should have with required furniture toilet facility, water and power.

The following minimum furniture shall be provided.

| | | | |
|---|---|---|---|
| a. | Executive tables | - | 1 No |
| b. | Chairs | - | 3 Nos |
| c. | Steel Almirah | - | 1 No |

The Contractor has to dismantle and remove the temporary office after the completion of the Project.

## 3.24 SUPERVISORY STAFF

The Contractor shall appoint sufficient number of experienced and qualified technical and supervisory staff at the site as per the direction of CE, NGS for supervising the work and shall see that all of them are always at the work spot during the working hours, personally checking all items of work. He shall take such orders as may be given to him by the Engineer-in-charge from time to time and shall

be responsible to carry them out properly. In case Contractor fails to provide sufficient person as per terms given below, Owner/Client reserves the right to deduct a reasonable amount from the Contractor's bill, subject to a maximum of Rs.25,000/- for every month of absence.

## 3.25 PROGRAMME OF WORKS AND PROGRESS REPORTS

a) The entire work is scheduled to be completed as stipulated in NIT. The Contractor shall programme the different items of work in accordance with the detailed time schedule approved by the Engineer-in-charge.

b) CONTRACTOR TO SUBMIT PROGRAMME

After the acceptance of his Tender, the Contractor shall, within fifteen days, submit to the Engineer-in-Charge for his approval, a detailed programme taking into account the total time period stipulated in the contract showing the order, the procedure and method in which he proposes to carry out the works.

He shall furnish the particulars in writing of his arrangements of manpower, plant and machinery, shuttering and all other resources owned and dedicated to this work. Cash flow during the execution of project for procurement of materials and for carrying out of the works including temporary works which the Contractor intends to construct shall also be furnished.

In support of this programme, the Contractor shall submit a work schedule in the form of a CPM/PERT Chart. The Engineer-in-Charge shall if necessary modify the programme submitted by the Contractor and approval shall be given by the Engineer-in-Charge indicating the major milestones. The programme approved by the Engineer-in-Charge shall be final and binding on the Contractor. The approval by the Engineer-in-Charge of such programme, or furnishing of such particulars shall not relieve the Contractor of any of his duties or responsibilities under the contract.

During the progress of work, the Contractor shall be required to furnish the resource mobilisation plan as required by Engineer-in-Charge to keep up the target date of completion.

This CPM/PERT programme will be required to be updated every three months or more frequently as directed by the Engineer-in-Charge, based on the actual progress, resource mobilisation and other field conditions actually prevailing.

c) PROGRESS REPORTS AND SCHEDULES

The Contractor shall submit to the Engineer-in-Charge by the third day of every fortnight, six (6) copies of a report in a duly approved format showing the progress made in construction of the works mobilisation of resources etc. during the previous fortnight.

d) The Contractor shall also submit by the end of every month his anticipated progress schedule for all items of work for the following month in six (6) copies in an approved proforma to the Engineer-in-Charge.

e) The Contractor shall also submit Photographs of completed works along with Monthly Progress Report and Two copies of Photographs (both soft copy &hard copy of approved size) of the completed project with the final bill

## 3.26 DOCUMENTATION

The Contractor shall prepare the detailed documentation of all the structures by means of Photography (hard copy and soft copy), Video by a professional photographer covering various views of the project up to the satisfaction of the Consultant/Client and as built drawings after the execution of the work.

## 3.27 Insurance

The Contractor shall arrange, secure and maintain insurance as may be necessary and for all such amounts to protect his risks as detailed herein. The form and the limit of such insurance as defined herein together with the under written thereof in such case shall be as acceptable to the Purchaser.

However, irrespective of such acceptance, the responsibility to maintain adequate insurance coverage on comprehensive all risks basis at all times during the period of contract shall be of the Contractor. The Contractor's failure in this regard shall not relieve him of any of his contractual responsibilities and obligations. Any loss or damage to the construction equipment or materials during handling, transporting, storage and erection, till such time as the work is certified by the Engineer-in-charge as having been completed in all respects & is taken over by the Purchaser: shall be to the account of the Contractor and his responsibility preferring all claims and make good for the damage or loss by way of repairs and/or replacement of the portion of the work damaged or lost. The completion of work shall not, in any, way relieve the Contractor of the above responsibilities during the period of the contract. The Contractor shall provide the Purchaser with a copy of all insurance policies and documents taken out by him in pursuance of this contract.

Such copies of documents shall be submitted to the Purchaser immediately after such insurance coverage. The Contractor shall also inform the Purchaser in writing at least twenty (20) days in advance regarding the expiry/cancellation and/or change in any of such documents and insurance revalidation/renewal, etc., well in time as may be necessary. The risks that are to be covered under the insurance shall include but not be limited to the loss or damage in transit, theft, pilferage, riot, civil commotion, weather conditions, accidents of all kinds, fire, etc. The scope of such insurance shall cover the entire value of the work from time to time. All costs on account of insurance liabilities covered under the contract will be on the Contractor's account and will be included in contract price. However, the Purchaser, may from time to time during the pendency of the contract, ask the Contractor in writing to limit the insurance coverage risks and in such a case the parties to the contract will agree for a mutual settlement for reduction in contract price to the extent of reduced premium account.

**3.28 Insurance for Staff**

The Contractor shall insure all his staff working at site against injury, loss of life etc., and the Purchaser will entertain no claims of compensation in this regard. The Contractor shall indemnify the Purchaser against all such claims as above, by his staff.

3.29 **PAYMENT TERMS FOR THE SUPPLY AND INSTALLATION OF ELECTRICAL WORKS**

On progress of supply: Upto 75% of the supply value as assessed by the Engineer-in-Charge, for the materials supplied shall be paid as on account payment on the strength of certificate issued by the Engineer-in-charge.

On progress of erection: Upto 90% of the contract amount, less the initial payments till date, shall be paid on final completion of the entire supplies & installation work under contract, for which payments are claimed.

On taking over: 100% of the contract amount, less amount already paid and security deposits due, if any, shall be paid on completion of testing, trial run and satisfactory commissioning of the installation and issue of the final completion certificate, and on acceptance of the same by NGC, after obtaining the clearance from the statutory authorities.

3.30 Approval form statutory Authorities

3.30.1 All the equipment to be supplied and works to be executed shall conform to the State Electrical Inspectorate / Central Electrical Authority Standards including all protection and metering accessories. Nothing extra will be paid in this regard.

3.30.2 Contractor has to obtain necessary scheme approval, if any, from the statutory authorities concerned immediately after the award of work.

3.30.3 All testing/calibration etc., are to be carried out as per the requirements of statutory authorities concerned.

3.30.4 On completion of work, the contractor has to obtain necessary safety/energization certificate from the statutory authorities concerned by submitting necessary completion certificate, drawings, equipment details, load details, test results etc., before energization.

3.30.5 All costs incurred in obtaining such approval/certificates are to be borne by the contractor. Statutory fees paid shall be reimbursed on presentation of documents.

3.30.6 If the current rating of any of the switchgears including circuit breakers mentioned in the Schedule of requirements is not available or is not in conformation to the Inspectorate standards then it shall be rated to the nearest higher rating available with the current rating/fuse rating as specified.

3.31 Structural Alterations to Building

No structural member in the building shall be damaged/altered, without prior approval from the Engineer-in-charge.

Structural provisions like openings, if any, provided by Purchaser for the work, shall be used. Where these require modifications, such contingent works shall be carried out by the contractor, at his cost.

All cut out openings in floors provided by Purchaser shall be closed, after installation, in accordance with the schedule of work.

All cuttings made by the contractor in connection with the works shall be filled by him at his cost to the original finish.

3.32 Completion Drawings and Certificate

For all work completion report as given in the pro-forma for test results shall be submitted to the Engineer-in-charge, after completion of work.

On completion of work, the Contractor shall submit "As fitted drawings" drawn to a suitable scale in tracing sheet indicating the following along with three copies and one set of computer floppy diskettes/CD ROMS of the same to the Engineer-in-charge before the submission of the final bill.

1. The Schematic diagram of LT & control wiring showing all protective schemes, if applicable.
2. General layout of the site showing therein routes of cables and equipment position.
3. Schedule of lengths, types and sizes of cables.
4. Position of all cable joints type wise, supports, stays, struts, lightning arrestors, feeder pillars, structures, earthing and pipes or closed ducts.
5. Position of cable route markers and joint markers with respect to permanent land marks available at site.
6. Name of work, job number, accepted tender reference, actual date of completion, names of Division/Sub-Division, and name of the firm who executed the work with their signature(s).
7. Routine and type test certificates (3 sets)
8. Detailed Operation and Maintenance Manuals (3 sets)
9. Detailed erection, testing and commissioning manuals (3 sets).

3.33 Deviations from Purchaser's Specification

Deviations from the purchaser's specification, if any, proposed by the bidder will be considered, provided they meet with the purchaser's requirements and are necessary to improve utility, performance and efficiency. The deviations proposed by the bidder shall include the technical merits and the financial implications.

3.34. Conformity to IE Act, IE Rules and Standards

3.34.1 The work shall be carried out in the best workmanlike manner in conformity with this specification, the relevant specification/codes of practice of the Bureau of Indian Standards or IEC recommendations (Except where specified otherwise) and other relevant standards with latest amendments, approved drawings and the instructions issued by the Engineer-in-charge or his authorised representative, from time to time. Equipment meeting any other authoritative standard, which ensures an equal or better quality than the above standards, will also be acceptable.

3.34.2 In addition to the standards, all works shall also conform to the requirements of the followings:

a) All Electrical works shall be carried out in accordance with the provisions of Indian Electricity Act- 1910, Indian Electricity Rules 1956 amended upto date (Date of call of tender unless specified otherwise)

b) The works shall also conform to relevant Bureau of Indian Standards' Codes of practice (COP) for the type of work involved.

c) Materials to be used in work shall be ISI marked wherever applicable.

d) In all electrical installation works, relevant Safety codes of practices shall be followed.

e) Fire Insurance Regulations/Tariff Advisory Committee.

f) Regulations laid down by the Chief Electrical Inspector of the State Electrical Inspectorate/State Electricity Board/ Central Electrical Authority or any other agencies concerned.

g) Regulations laid down by the Factory Inspector of the State.

h) Any other regulations laid down by the local authorities.

i) Installation & operating manuals of original manufacturers of equipment.

3.35 Data/Drawings/Documents

The bidder shall submit the following data/information/drawings/documents as indicated below:

i) List of deviations clause by clause and reasons.
ii) Descriptive literature of the various equipment offered with catalogues, if any.
iii) Guaranteed technical particulars of the equipment and performance particulars
iv) Approximate dimensions and weights and preliminary G.A drawings.
v) List of optional features with extra price.
vi) Make of various equipment and associated components/accessories.
vii) Where applicable, preliminary schematic of the equipment/ system offered in the tender.

Within 4 weeks of order, Contractor shall submit 4 sets of following documents for purchaser/Consultant's approval.

i) G.A Drawings with dimensions and weight, plan and sections and fixing/foundation details.

ii) Where applicable, control scheme drawings with write-up and all terminal numbers for external hook up.

Subsequently, 4 sets of the revised documents shall be submitted incorporating Consultants comments as Final Drawings for Purchaser's reference and records before the equipment is offered for inspection.

**Liaison with all statutory authorities including KSEB for getting sanction/approval/safety certificate/ power connection including submission of necessary forms to KSEB/ Electrical inspectorate as required is included in the scope of this work. Necessary fee for the above will be reimbursed from National Games Secretariat on production of actual bills.**

## 3.36 SETTLEMENT OF DISPUTES

3.36.1 Arbitration shall not be a means of settlement of disputes arising out of this contract. In case of any dispute or difference between the parties to the contract either during the progress or after the completion of the works or after the determination, abandonment or breach of the contract as to the interpretation of the contract or as to any matter or thing arising there under except as to the matters left to the sole discretion of the Chief Engineer, or to the holding by the Chief Engineer of payment of any bill to which the Contractor may claim to be entitled, then either party shall forthwith give to the other notice of such dispute or difference, and such dispute or difference shall be referred to the Secretary to Government, Sports & Youth Affairs, Government of Kerala and the award of the Secretary to Government, Sports & Youth Affairs shall be final and binding on the parties. Provided however that in cases whether the Chief Engineer has entered into the contract on behalf of the C.E.O and Secretary, the dispute or difference shall, in the first instance, be referred by or through the Chief Engineer to the C.E.O and Secretary and his/her decision thereon obtained before referring such dispute or difference to the Secretary to Government, Sports & Youth Affairs, under this clause. Progress of the work shall not be suspended or delayed on account of the reference of any dispute or difference to the Chief Executive Officer & Secretary, National Games Secretariat and his/her decision thereon obtained before referring such dispute or difference to the Secretary to Government, Sports & Youth Affairs, under this clause. Either party may within a period, which shall be fixed by the Secretary, file before the Secretary to Government, Sports & Youth Affairs a statement of the case and also all the documents relating to or having a bearing in the case. The Secretary to Government, Sports & Youth Affairs, shall see that a decision is made if reasonably possible, within a period of one month from the date of his entering upon the reference, but if any, extension of the period is considered by him to be necessary, such extension shall forthwith be communicated by him in writing to each of the parties hereto. The Secretary to Government, Sports & Youth Affairs shall not be bound to observe the ordinary rules of procedure applicable to trials before judicial tribunals and not to hear or receive formal evidence but may pass an order on the documents of statements of the case filed by both the parties and/or on personal inspection. The Secretary to Government, Sports & Youth Affairs shall have power to view the subject matter of the dispute with or without the parties or their agents. The Secretary to Government, Sports & Youth Affairs shall also have power to open up, review and revise any certificate, opinion, decision, requisition or notice, save in regard to the matters expressly excepted and determine all matters in dispute which shall be submitted to him and of which notice shall have been

aforesaid, in the same manner as if no such certificate, opinion, decision, requisition or notice had been given. Provided that Government shall not be liable to any claim in respect of any such dispute or difference until the liability and the amount thereof shall have been referred to and decided by the Secretary to Government, Sports & Youth Affairs. If the contractor(s) do/does not make any demand for reference of dispute to the Secretary to Government, Sports & Youth Affairs in respect of any claim(s) in writing within 30 days of receiving the intimation from the Employer that the bill is ready for payment, the claim of the contractor(s) will be deemed to have been waived and absolutely barred and the Employer shall be discharged and released of all liabilities under the contract in respect of those claims.

3.36.2 Legal jurisdiction

All litigations relating to the subject matter of the agreement can only be filed before the appropriate courts having jurisdiction in the respective district of construction.

**The Chief Engineer**
**National Games Secretariat**

# 4. FORMS FOR DIFFERENT DEEDS

## 4. PROFORMA OF PRELIMINARY AGREEMENT

(To be executed on stamp paper of value Rs.100/- and submitted along with tender).

Preliminary agreement entered into on this ..... day of ..... Between (name of Accepting Authority) (Hereinafter called ACCEPTING AUTHORITY on one part and Shri..... (name and address of the Contractor) (Hereinafter called the Contractor) on the other part for the execution of the agreement as well as the execution of the (NAME OF WORK) And where as the notice inviting tenders it is stated as follows. Before commencing the work of within a week of the date when the acceptance of tender has been intimated to him, the tenderer shall deposit a sum of Rs……..(2.5% of PAC) which shall be treated as security for the proper fulfillment of the same and he shall execute an agreement for the work in the scheduled form of agreement. If he fails to do this or fail to maintain a specified rate of progress, the security deposit shall be forfeited to ACCEPTING AUTHORITY and fresh tenders shall be called for or the matter otherwise disposed. If as a result of such measures due to the default of the tender to pay the requisite deposit sign contracts to take possession of the work any loss to the ACCEPTING AUTHORITY results, the same will be recovered from him as arrears of revenue but should it be a saving to ACCEPTING AUTHORITY the original contractor shall have no claim whatever to the difference. Recoveries to this or any other account will be made from the sum that may be due to contractor on this or any other contracts or under the Revenue Recovery Act or otherwise as ACCEPTING AUTHORITY may decide.

Now therefore these present witness and it is mutually agreed as follows:

1. The terms and condition for the said contract having been stipulated in the said tender form to which the contractor has agreed, a copy of which is appended, and which forms part of this agreement, it is agreed that the terms and conditions stipulated there in shall bind the parties to this agreement, except to the extent to which they are abrogated or altered by express terms and conditions herein, agreed to and in which respect the express provisions herein shall supercede those of the said tender form.

2. The Contractor hereby agree and under take to perform and fulfil all the operation and obligations connected with the execution of the said contract work viz. – (NAME OF WORK)

3. If the Contractor does not come forward to execute the original agreement after the said work is awarded and letter of acceptance issued in his favour or commits breach of any of the conditions of the contract as stipulated in clause 1.06.4 of the Notice inviting Tenders as quoted above within the period stipulated, ACCEPTING AUTHORITY may rearrange the works otherwise or get it done otherwise at the risk and cost of the contractor and the loss so sustained by ACCEPTING AUTHORITY can be realising from the contractor under the Revenue Recovery Act as if arrears of land revenue as assessed, quantified and fixed by an adjudicating authority consisting of ACCEPTING AUTHORITY or any other officer or officers authorised by ACCEPTING AUTHORITY taking into consideration the prevailing rates and after giving due notice to the Contractor. The decision taken by such authorised officer or officers shall be final and conclusive and shall be binding on the contractor.

4. The contractor further agrees that any amount found due to ACCEPTING AUTHORITY under or by virtue of this agreement shall be recoverable from the Contractor from the Contractor from his EMD and his properties, movable and immovable as arrears of land revenue under the provision of the Revenue Recovery Act for the time being in force or in any other manner as ACCEPTING AUTHORITY may deem fir in this regard.

In witness where of Sri....., NAME OF ACCEPTING AUTHORITY and Sri.....……

Contractor, have set their hands on the day and year first above written,

Signed by Sri.....……. NAME OF ACCEPTING AUTHORITY

In the presence of witness

1. .....

2. .....

Signed and delivered by Sri....., Contractor in the presence of witness.

1.....

2.....

## FORM OF BANK GUARANTEE

(To be executed in non-judicial stamp paper)

1. In consideration of the Chief Engineer, ……(Name of accepting authority) (hereafter called ACCEPTING AUTHORITY) having demanded from Shri.....(here hereafter called "Contractor") the production of a Bank Guarantee for Rs.....(Rupees.....) as…….for the due fulfillment by the Contractor of the terms and conditions in clause ….. of …….. for the work of "..... .....) on demand by ACCEPTING AUTHORITY.

2. We.....do hereby undertake to pay

   (indicate the name of Bank)

   The amounts due and payable under this guarantee without any demure, merely on a demand from the ACCEPTING AUTHORITY stating that the amount claimed is required to meet the recoveries due or likely to be due from the said contractor (s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.....

3. We undertake to pay to ACCEPTING AUTHORITY any money so demanded not withstanding any dispute or disputes raised by the contractor (s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal.

   The payments so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the contractor (s) shall have no claim against us for making such payment.

4. We .....(indicate the name of Bank.) further agree that the guarantee here in contained shall remain in full force and effect during the period that would be taking for the performance of the said agreement and that it shall continue to be enforceable till all the dues of ACCEPTING AUTHORITY under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till the ACCEPTING AUTHORITY certifies that the terms and conditions of the said agreement have been fully and properly carried out by the said contractor (s) and accordingly discharges this guarantee.

5. We .....(indicate the name of Bank) further agree with the ACCEPTING AUTHORITY that the ACCEPTING AUTHORITY shall have the fullest liberty without our consent and without affecting in any manner our obligations here under to vary any of the terms and conditions of the said contractor (s) from time to time or to postpone for any time or from time to time any of the powers exercisable by ACCEPTING AUTHORITY against the said contractor (s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said contractor (s) or for any forbearance, act or omission on the part of ACCEPTING AUTHORITY or any indulgence by ACCEPTING AUTHORITY to the said contractor (s) or by any such

manner or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

7. We.....(indicate the name of Bank) lastly undertake not to remove this guarantee except with the previous consent of ACCEPTING AUTHORITY in writing.

8. This guarantee shall be valid upto ..... unless extended on demand by ACCEPTING AUTHORITY. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs.....(Rupees .....only and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee, all our liabilities under this guarantee shall stand discharged.

Dated the.....day of.....20.....

For.....

.....

(indicate the name of the Bank)

Seal and signature of the authorised signatories of the Bank.

**THE KERALA VALUE ADDED TAX RULES, 2005**

***FORM NO.20***

**Declaration**

**(To be filed before the Awarder by Contractor)**

(See Rule 42 (1))

Sl.No. DATE D D M M Y Y

TIN*

PIN*

CIN*

**TO** **Status** VAT Presumptive Compounded Tax

Payer Payer Tax Payer

M/s……. (`√' as appropriate)

(Address of the Awarder)

Gentlemen,

I/We request you to kindly effect deduction of tax at source (TDS) in respect of the Works Contract executed/being executed by me/us as per particulars furnished hereunder:

| | | | |
|---|---|---|---|
| 1. | Work Order No. & date | : | |
| 2. | Work site address | : | |
| 3. | Gross value of contract | : | |
| 4. | Payment relating to this declaration | : | |
| 5. | Progressive payment already received including this declaration | : | |
| 6. | Total assessable value of works contract relating to this declaration | : | |

Tenderer Chief Engineer

| | | | |
|---|---|---|---|
| 7. | Taxable value of works contract relating to this declaration | : | |
| 8. | VAT due @ 4% | : | Rs. |
| 9. | VAT due @ 12.5% | : | Rs. |
| 10. | Total VAT due and deductible as TDS | : | Rs. |
| 11. | Total compounded tax @ 2% deductible on total assessable value | : | Rs. |
| 12. | Total compounded tax @ 4% deductible on total assessable value | : | Rs. |

DECLARATION

**I/We ……..… S/o …… on behalf of M/s …….. hereby affirm and declare that the particulars furnished herein are true, correct and complete to the best of my knowledge and belief and that nothing is concealed therein. I/We do hereby under take to obtain and provide to you the Quarterly Certificate in Form No.20A and Certificate in Form No.20B in relation to final payment promptly.**

Signature of authorised person

## 5.0 TECHNICAL SPECIFICATION

## 5. 0 TECHNICAL SPECIFICATION-ELECTRICAL WORKS

### 5.1 General

The bidder should note that the specifications furnished in the tender is of general nature only and it is the responsibility of the bidder to design, supply, install and commission the equipment and services required for the satisfactory performance of the installation. All the items of equipment required for the safe and satisfactory operation of the installation shall be supplied and installed by the bidder.

The intent of this specification is to define the requirements for the design, manufacture, supply, installation, testing and commissioning of the electrical system like Power cables, internal electrification, earthing network etc. Requirement shall be as specified in schedule of requirements/approved drawing of the Purchaser/Consultant or as per the battery limits fixed by the Purchaser/Consultant. The bidder shall furnish complete details of the equipment with all necessary drawings.

### 5.2 Details of Tender

The tender specifications consists of 8 sub heads as shown below:

1. Diesel Generating Sets & Ancillaries
2. LT Panel Board
3. Wiring System
4. MCB distribution boards
5. Cables and Cabling
6. Earthing
7. Installation.
8. Measurement.
9. Approved Makes of Equipment and Materials

The items involved along with the quantities and units are shown in the bill of quantities (Schedule of Requirements) attached.

### 5.3 Diesel Generating Sets & Ancillaries

5.3.1 Scope

**Diesel Generating will be supplied by the purchaser**

The scope of these specifications covers the installation, testing and commissioning of 125 kVA prime rated, 415 volts, 3ph, 4 wire diesel alternator set as specified and given in Bill of Quantity and single line diagram. The synchronous speed of the set shall not be more than 1500 RPM.

It is the responsibility of the contractor to provide the Accepting Authority with all drawings, design calculations, etc. well in advance as per the manufacturer's specifications and meeting statutary standards and requirements. Contractor shall provide skid mounting with common base plate and all mounting structure, shims, etc., for the diesel alternator set. Contractor has to mount the engine with alternator on the base plate and align and assemble the set. Suitable anti-vibration mountings as approved for the complete set shall be provided. Coupling (both halves) with guards shall be provided. Contractor shall provide insulated exhaust piping with Aluminium cladding for each set and there should be hood on top of the exhaust pipe and the work should be as per electrical inspectorate rules and pollution Control specification. The stack and stack fundation shall be provide as pollution Control specification.

m) Insulation of the exhaust pipe shall be carried out as follows

i) Surface shall be thoroughly cleaned with wire brush and rendered free from all foreign matter and grease.

ii) 75 mm thick insulation fixed tightly to the surfaces butting all joints and tightened with lacing wire. (Type of insulation to be got approved by the Engineer-in-charge).

iii) Insulation to be wrapped with aluminium sheet 26 guage and joints overlapped and sealed with adhesive tape and in addition fixed with cadmium coated steel screws.

n) Instrumentation & Controls

Instrumentation shall be housed in the control panel of the DG set.

### 5.3.2 LT Panel Boards

5.3.2.1 General

The switch boards are to be factory built or to fabricated by a firm preferably having CPRI test certificate for short circuit rating and IP classification.

5.3.2.2 Statutory Requirement:

Switch Distribution Boards are to be manufactured/ assembled as per the latest BIS Specifications, IP 42 classification for Indoor application and IP 54 for outdoor applications, Indian Electricity Rules, including special requirements of State Electrical Inspectorate and the detailed specifications mentioned. The panel board shall be floor mounted, free standing type suitable for indoor installation in dust and vermin proof construction.

5.3.2.3 Housing Details:

The panel board shall be fabricated out of 14 SWG CRCA sheet steel and shall consist of free standing front and back openable panels arranged to form a continuous line-up of uniform height. Cold rolled sheets shall be used for doors and front covers. Front doors shall be concealed hinged type and bus bars and cable alleys covers shall be bolted type. The switch board shall be totally enclosed, dust, weather and vermin proof Gaskets of durable material shall be provided for doors and other openings. Suitable hooks shall be provided for lifting the boards. These hooks when removed shall not leave any opening in the board. All hardware shall be corrosion resistant. All joints and connections shall be made by galvanised zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers secured against loosening.

The switch board shall be in cubicle design (each feeder components are housed in individual cubicle) and fully compartmentalized. Suitable cable and busbar alleys as well as separate metering and relaying compartments shall be provided. All components of the switch board shall be approachable from front. The maximum and minimum operating handle/push button height of any feeder shall not be more than 1800mm or less than 400 mm with reference to panel bottom. Supporting arrangement for dressing of power and control cables in cable alleys also shall be provided.

5.3.2.4 Painting:

All metal sheets shall undergo 7 tank metal treatment, thorough derusting-rinsing-degreasing-rinsing- phosphating-rinsing and then passivation. All metal surfaces shall be thoroughly cleaned and degreased to remove all scales, rust, grease and dirt. Fabricated structures shall be pickled and treated to remove any trace of acid. The under-surface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The undersurface shall be made free from all imperfections before undertaking the final coat.

After preparation of the under surface, the panel shall be spray painted with final two coats of approved enamel paint. Contractor shall obtain details of approved paint from the Engineer-in-charge before final painting.

The finished panels shall be dried in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run-off paint, etc.

All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust, corrosion, etc.

5.3.2.5 Name Plates:

Name plates for all incoming and outgoing feeders shall be provided on doors for each compartment. Name plates shall be fixed by screws only and not by adhesives. Special danger plates shall be provided as per requirement.

Inside the panels, stickers should be provided for all components giving identification no. as per detailed wiring diagram.

5.3.2.6 Busbar sizing connection and supports:

The busbars shall be made from high conductivity electrolytic grade aluminium alloy conforming to IS 5082. The busbars and supports shall be capable of withstanding the rated and short circuit current as per the single line diagram/ feeder details. Minimum size of main power bus bars shall be 200 Amps. rating. Maximum current density permissible for aluminium bus bars shall be 0.8 Amps/Sq.mm. An earthing busbar of minimum 150 sq.mm section copper shall be provided outside panel at bottom throughout the length of the panel.

The busbars shall be provided with heat shrinkable PVC insulating sleeve. Supports for busbars shall be made of suitable size cast resin ribbed insulators and these should be adequate in number so as to avoid any sag in the busbars. (Hylam supports may not be used)

Minimum clearance between phase to phase shall be 32mm and that between phase to neutral/ earth shall be 26 mm.

5.3.2.7 Power Connection:

a) For power interconnections within the panel board

Rigid Aluminium conductor, with PVC insulation, of adequate cross section i.e., current carrying capacity not less than the outgoing fuse rating shall be used. Cable lugs/ sockets of suitable size and type shall be used for all interconnections.

For incoming and outgoing feeders of the switch boards, aluminium conductor cable will be used and hence the panel has to be designed for receiving these and wherever required cable boxes shall be provided in panel by removable gland plates and shall be provided on top/bottom of panel, for cable entries.

To prevent accidental contacts, all interconnecting cables/ busbars and all terminals also shall be shrouded.

Standard colour code of red, yellow and blue for phases and black for Neutral to be followed for all busbars/conductors.

b) Auxiliary wiring and Terminals

Wiring for all controls, protection, metering, signaling, etc. inside the switchboard shall be done with 650 volts grey colour PVC insulated copper conductors. **Minimum size of these conductors shall be 2.5 sq.mm**. Control wiring to components fixed on doors shall be flexible type.

The complete panel would be sub-divided into different sections and each section shall have its own control circuit with fuse and indication.

All control wiring should be provided with necessary cable sockets/ lugs at both ends. Conductors shall be terminated using compression type lugs. Each termination shall be identified at both the ends by PVC ferrules.

The identification termination numbers should match with those on the drawings.

5.3.2.8 Component of switch boards

The panel shall be provided with MCCBs, SDFUs, Isolators, meters and instruments etc. of size, capacity as specified in schedule of requirements.

5.3.2.9 **Moulded case Circuit Breakers**

**General**

Moulded case circuit breakers (MCCBs) shall be incorporated wherever required and shall be of **current limiting type** and preferably **double break**. MCCBs shall confirm to IS 13947-1/IEC 947-1 for general rules and IS 13947-2/IEC 947-2 for circuit breakers in all respects. MCCB shall be suitable for single phase 240V or three phase 415 V, 50Hz, AC and shall have a rated insulation voltage of 750 V AC. All the breakers shall have tropicalisation as a standard feature. MCCBs rated from 250A and above shall be of plug in type.

**Construction:**

The MCCB case & cover shall be made of high strength heat resistant and flame retardant thermosetting insulating material.

The operating handle shall be quick make, quick break trip free type. The operating handle shall have suitable 'ON','OFF','TRIPPED' indicators.

In order to ensure suitability for isolation complying with IS13947-2/IEC947-2, the operating mechanism shall be designed such that the toggle or handle can only be in 'OFF' position.

Three phase MCCBs shall have a common operating handle for simultaneous operation and tripping of all the three phases.

Rating & Breaking Capacity:

The rating of the circuit breaker shall be as per the drawings and schedule of quantities.

The MCCB shall have minimum Service Breaking Capacity (Ics) equal to Ultimate Breaking capacity (Icu).

The Service S/c Breaking Capacity (Ics) in kA for different ratings at 415V AC, 50Hz, 0.2 p.f shall preferably be as follows:

25kA for ratings upto 100A

35KA for ratings above 100A and upto 250A

50KA for ratings above 250A and upto 630A.

Protection:

Unless specified all breakers upto 125A shall have thermal-magnetic trip unit with adjustable overload protection from 80% to 100% of rated current (Ir) and adjustable short circuit protection from 3 to 6 times of Nominal Current (In).

The MCCBs ratings above 125A shall be microprocessor based fitted with electronic trip unit. The overload setting adjustable from 40% to 100**%** of the nominal current(In). The short circuit protection should be adjustable from 1.5 to 8 times the rated current(Ir) with tripping time fixed. The Instantaneous Short Circuit protection to be fixed,without any time delay at 12 times the nominal current(In).

**The Earth fault protection** , if specified in schedule, shall have **adjustable** sensitivity with adjustable time delay settings.

The MCCBs shall be **possible to fully co-ordinate** the over-load & short-circuit tripping of the circuit breakers with the upstream and downstream circuit breakers **to provide Total Discrimination.**

**There should be no line load restriction for MCCBs**

Accessories:

MCCBs shall be provided with the following accessories,

Shunt trip, if specified in the BOQ

Extended terminals.

Rotary operating handle

Interlocking:

MCCBs shall be provided with the following interlocking devices for interlocking the door of the switchboard.

Handle interlock to prevent unnecessary manipulations of the breaker.

Door interlock to prevent door being opened when breaker is in ON or OFF position

Door-interlock defeat to open the door even if the breaker is in ON position.

Front operated rotary handle should have OFF-position pad-locking facility.

Testing:

Test certificate

Original Test certificate of the MCCB as per IS13947-2/IEC947-2 shall be provided.

5.3.2.10 **Measuring instruments**

These shall be of square pattern having approximate dimensions 144mmx144mm, flush mounting type in the case of main LT panel and 96x96 mm in sub switch boards. Necessary auxiliary instruments like CTs, etc. are also included in the scope of supply.

All AC meters shall be of moving iron type having class 1.0 accuracy.

Voltmeter shall be suitable for direct line connection. Voltmeters shall be connected through fuses only.

All voltmeters and ammeters shall be provided with selector switches.

Ammeters shall be CT operated.

5.3.2.11 **Current Transformers (CTs)**

CTs shall be cast resin insulated type. Primary and secondary terminals shall be marked indelibly. CTs shall preferably be mounted on stationery parts. CT rating and ratios shall be as per feeder ratings. These shall be capable of withstanding momentary short circuit and symmetrical short circuit current for 1 second. Neutral side of CTs shall be earthed. Protection CTs shall have low reactance, accuracy class "PS" and an accuracy limit factor greater than "10". Instrument CTs shall be of accuracy class "1.0" and accuracy limit factor less than "5.0".

5.3.2.12 Indicating Lamps

| | | |
|---|---|---|
| Type | : | Panel mounting LED type (Immune to electromagnetic interference and over voltage. |
| Standards applicable | : | IEC 947-5-1 |
| Diameter | : | 22mm |
| Operating voltage | : | 230V AC |
| Current consumption | : | 15 mA |
| Colour of lamps | : | as per standards |

5.3.2.13 Connection

Connections to the busbars shall be made by drilling holes. However, no holes shall be left in the busbars. The bolts & nuts used for connections to busbars shall be of Aluminium alloy of tinned forged brass. For tapping of connections from busbars suitable size PVC insulated copper conductor (minimum size 4.0 Sq.mm) shall be used with suitable size and type of crimped lugs/cable sockets. For connection of feeder above 63 Amps only busbar links with PVC tapes/heat shrinkable PVC shall be used. Suitable size cable boxes shall be provided for incoming/outgoing cables. For all outgoing cables, cable alleys of suitable sizes in sides and tops, as required for proper cable connections/laying inside the panel,

shall be provided. Switch board shall be suitable for Aluminium conductor PVC insulated incoming and outgoing cables. Removable gland plates shall be provided for cable entries.

5.3.2.14 Earthing

Two independent earthing points shall be provided outside the panel near bottom and these shall be inter-connected with Cu earthing busbars of size 25 x 6 mm. All earthing points inside the distribution board shall be interconnected to these earthing points with suitable size copper conductor.

5.3.2.15 Name plates

Switch board/distribution board shall be provided with danger plate and name plates for all incoming and outgoing feeders. These name plates shall be of PVC (black colour base & white letters engraved) screwed to panel. PVC identification ferrule numbers shall be used for all internal wiring.

5.3.2.16 Approvals

The drawing showing general arrangements and detailed wiring diagram for the Panels shall be submitted to the Engineer-in-charge for approval, prior to manufacture and the same shall be got inspected, prior to despatch to project site. The complete switch board and its component shall conform to Indian Electricity Rules & Relevant BIS. Prior approval is required from Electrical Inspector and shall be obtained by contractor and changes if desired by Electrical Inspector, shall be carried out by the contractor.

**5.3.2.17 Bus Bar Chambers**

5.3.2.17.1 Construction

**Enclosure**

i) Bus bar chamber shall be fabricated with MS angles for frame work and covered all rounds with sheet steel of thickness not less than 2 mm (14 gauge) in a box form. Front covers of the busbar chambers shall be detachable and cover(s) on the remaining sides may or may not be detachable as may be specified. The covers shall be fitted with dust excluding gasket, secured with sufficient number of cadmium plated iron screws to ensure that the covers are dust tight. Suitable openings shall be provided for cable/conduit entries as required. Busbar chambers for busbar of more than 90 cm length shall have horizontal and vertical stiffeners welded to the main frame.

ii) Alternatively, the busbar chamber shall be made of sheet steel of thickness not less than 2 mm (14 gauge), with detachable covers and dust excluding gasket. The

joints shall be continuous welded. The detachable cover(s) shall be secured to the box with sufficient number of cadmium plated iron screws. This type of busbar chamber shall be restricted for busbar upto 90 cm length.

iii) Bus bar chambers for busbars upto 90 cm length shall have detachable end covers so that the same can be extended.

iv) Two numbers of GI earth studs of appropriate size with double washers shall be provided on the body of the enclosure. The terminals shall be permanently marked 'E'.

v) The enclosure shall be painted with two coat of primer paint after cleaning the surfaces, and after derusting and degreasing. Two coats of finish paint shall thereafter be applied by spray painting process. This shall be done in the works before bringing the material to site.

5.3.2.17.2 Supports

Busbars shall be rigidly fixed to the supports, if not porcelain or of SMC/DMC solid block type base. Busbars shall be firmly held within the slots in sheet type supports, which in turn shall be rigidly fixed to the chamber.

5.3.2.17.3 Clearances

The minimum clearances to be maintained for enclosed indoor air insulated busbars for medium voltage applications shall be as follows:

| Between | Min. clearances |
|---|---|
| Phase to earth | 26 mm |
| Phase to phase | 2 mm |

5.3.2.17.4 Arrangement of busbars and main connections

Busbars and main connections, which are substantially in one plane, shall be arranged in the order given below:

i) AC. System

a) The order of phase connections shall be red, yellow and blue.

b) When the run of the conductors is horizontal, the red shall be on the top, or farthest away as viewed from the front.

c) When the run of the conductors is vertical, the red shall be on the left, or farthest away as viewed from the front.

d) When the system has a neutral connection in the same plane as the phase connections, the neutral shall occupy the bottom position if horizontal and extreme right if vertical, or nearest position when viewed from the front.

e) Unless the neutral connections can be readily distinguished from the phase connections, the order shall be red, yellow, blue and black.

5.3.2.18 **Data/Drawings/Documents**

The bidder shall submit the following data /information /drawings /documents as indicated below:

i) List of deviations clause by clause and reasons.

ii) Descriptive literature of the various equipment offered with catalogues, if any.

iii) Guaranteed technical particulars of the equipment

iv) Approximate dimensions and weights and preliminary G.A drawings.

v) List of optional features with extra price.

vi) Make of various equipment and associated components/ accessories.

vii) Where applicable, preliminary schematic of the equipment/ system offered in the tender.

viii) Brief write-up on control scheme and features.

Within 4 weeks of order, Contractor shall submit 4 sets of following documents for purchaser/Consultant's approval.

i) Guaranteed technical and performance particulars.

ii) G.A Drawings with dimensions and weight, plan and sections and fixing/ foundation details

iii) Where applicable, control scheme drawings with write-up and all terminal numbers for external hook up.

Subsequently, 4 sets of the revised documents shall be submitted incorporating Consultants comments as **Final Drawings** for Purchaser's reference and records before the equipment is offered for inspection.

At Final Execution Stage

The following shall be submitted after inspection but before dispatch of the equipment.

i) "As Built" drawings (one set of film reproducible)

ii) Routine and type test certificates (8 sets)

iii) Detailed Operation and Maintenance Manuals (4 sets)

iv) Detailed erection, testing and commissioning manuals (4 sets).

**5.3.3 Wiring Systems**

Rigid PVC Conduit Wiring System as per IS: 9537

5.3.3.1 Materials

A. Conduits

i) All rigid conduit pipes shall be of PVC and be ISI marked. The wall thickness shall be not less than 1.6 mm for conduit upto 32 mm dia and not less than 2 mm for conduits above 32 mm dia.

ii) The maximum number of PVC insulated cables conforming to IS:694-1990 that can be drawn in one conduit is given size wise in Table 1, and the number of cables per conduit shall not be exceeded. Conduit sizes shall be selected accordingly in each run.

iii) No conduit less than 20 mm in diameter shall be used.

Flexible conduits will only be permitted for interconnections between switchgear, DB's and conduit terminations in wall.

B. Conduit Accessories

i) The conduit wiring system shall be complete in all respects, including their accessories.

ii) All conduit accessories shall be of solvent cement plastering type, and under no circumstances pin grip type of clamp grip type accessories shall be used.

iii) Bends, couplers, etc. shall be solid type in recessed type of works and may be solid or inspection type as required.

iv) a) Saddles for surface conduit work on wall shall not be less than 0.55 mm (24 gauge) for conduits up to 25 mm dia. and not less than 0.9 mm (20 gauge) for larger diameter.

b) The minimum width and the thickness of grider clips used for fixing conduits to steel joists, and clamps shall be as per Table II.

C. Outlets

i) The switch box or regulator box shall be made of metal on all sides, except on the front. In the case of cast boxes, the wall thickness shall be at least 2 mm and in case of welded mild steel sheet boxes, the wall thickness shall not less than 1.2 mm (18 gauge) for boxes upto a size of 20 cm x 30 cm, and above this size 1.6 mm (16 gauge) thick MS boxes shall be used. The metallic boxes shall be duly painted with anticorrosive paint before erection.

ii) An earth terminal with stud and 2 metal washers shall be provided in each MS box for termination of protective conductors and for connection to socket outlet/metallic body of fan regulator etc.

iii) Clear depth of the box shall not be less than 60 mm, and this shall be increased suitably to accommodate mounting of fan regulators in flush pattern.

iv) The fan regulators can also be mounted on the switch box covers, if so stipulated in the tender specifications, or if so directed by the Engineer-in-charge.

v) Except where otherwise stated, 3 mm thick phenolic laminated sheets as per clause shall be fixed on the front with brass screws, or cadmium plated iron screws as approved by the Engineer-in-charge.

5.3.3.2 Wires

Wires shall comply the following features:

- PVC insulated bright annealed copper stranded conductors.
- 660 V grade wires for single phase circuits and 1000 V grade for 3 phase circuits.

- Colour coded as below:

Phase – R -Red

Phase – Y -Yellow

Phase – B -Blue

Neutral- Black

Earth - Green

5.3.3.3 Installation

a) Common aspects for recessed and surface conduit works

i) Conduit joints

a) The conduit work of each circuit or section shall be completed before the cables are drawn in.

b) Conduit pipes shall be joined by means of couplers and accessories only.

c) Cut ends of conduit pipes shall have neither sharp edges, nor any burrs left to avoid damage to the insulation of the conductors while pulling them through such pipes.

ii) Bends in conduit

a) All necessary bends in the system, including diversion, shall be done either by neatly bending the pipes without cracking with a bending radius of not less than 7.5 cm, or alternatively, by inserting suitable solid or inspection type normal bends, elbows or similar fittings, or by fixing cast iron inspection boxes, whichever is most suitable.

b) No length of conduit shall have more than four bends from outlet to outlet.

Additional requirements for recessed conduit work

i) Making chase

a) The chase in the wall shall be neatly made, and of ample dimensions to permit the conduit to be fixed in the manner desired.

b) In the case of buildings under construction, the conduits shall be buried in the wall before plastering, and shall be finished neatly after erection of conduit.

c) In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in position along with the building work.

ii) Fixing conduits in chase

a) The conduit pipe shall be fixed by means of staples, hooks, or by means of saddles, not more than 60 cm part, or by any other approved means of fixing.

b) All joints of conduit pipes shall be treated with some approved preservative compound to secure protection.

iii) Fixing conduits in RCC work

a) The conduit pipe shall be laid in position and fixed to the steel reinforcement bard by steel binding wires before the concreting is done. The conduit pipes shall be fixed firmly to the steel reinforcement bars to avoid their dislocation during pouring of cement concrete and subsequent tamping of the same.

b) Fixing of standard bends or elbows shall be avoided as far as practicable, and all curves shall be maintained by bending the conduit pipe itself with a long radius which will permit easy drawing in of conductors.

c) Location of inspection/junction boxes in RCC work should be identified by suitable means to avoid unnecessary chipping of the RCC slab subsequently to locate these boxes.

iv) Fixing inspection boxes

a) Suitable inspection boxes to the minimum requirement shall be provided to permit inspection, and to facilitate replacement of wires, if necessary.

b) These shall be mounted flush with the wall or ceiling concrete. Minimum 65 mm depth junction boxes shall be used in roof slabs

and the depth of the boxes in other places shall be as per IS:2667-1977.

c) Suitable ventilating holes shall be provided in the inspection box covers.

v) Fixing switch boxes and accessories.

Switch boxes shall be mounted flush with the wall. All outlets such as switches, socket outlets, etc. shall be flush mounting type, unless otherwise specified in the Additional Specifications.

vi) Fish wire

To facilitate subsequent drawing of wires in conduit, GI fish wire of 1.6 mm/1.2 mm (16/18 SWG) shall be provided along with the laying of the recessed conduit.

vii) Bunching of cables

a) Cables shall always be bunched so that the outgoing and return cables are drawn into the same conduit.

b) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.

c) In case of three phase loads, separate conduits shall be run for each phase from the distribution boards to the load points, or outlets as the case may be.

5.3.3.4 Earthing requirements

i) Protective (loop earthing) conductor (s) shall be laid along the runs of the conduit between the metallic switch boxes and the distribution boards/switch boards, terminated thereto. These conductors shall be of such size and material as specified. Depending upon their size and material, the protective earth conductors shall be either drawn inside the conduits. When laid external to the conduits, this shall be properly clamped with the conduit at regular intervals.

ii) The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be.

iii) Gas or water pipe shall not be used as protective conductor (earth medium).

iv) The size of the earth wire shall be of size 50% of phase conductor subject to a maximum and minimum shown below:

| | **Copper** | **Aluminium** | **GI** |
|---|---|---|---|
| Minimum (sq.mm) | 1.5 | 2.5 | 4 |
| Maximum (sq.mm) | 150 | 175 | 350 |

5.3.3.5 Wiring

The wiring in conduit shall comply the following:

- Single core PVC insulated copper wire as specified below or as shown on drawings and schedule of requirements.
- Wire sizes

| | **Copper conductor** |
|---|---|
| Light point | 1.5 sq.mm |
| Light Circuit Point | 2.5 sq.mm |
| Power points | 4.0 sq.mm |
| Machinery requirements | As per Schedule of |

A maximum 3 circuits of same phase can be taken per conduit and each circuit shall have independent neutral and earth wire from DB.

Jointing of wires is not permissible, however looping may be done from point (same circuit) or using a terminal strip in junction box where site condition warrants, prior permission from Consultant shall be obtained.

Control switches to be connected to phase conductor only.

Metallic/non-metallic trunking may be used if number of conduits are many. The metallic trunking shall be earthed security at DB end and throughout the length. Single trunking with metallic partition may be used for wiring different services.

**TABLE I**

MAXIMUM NUMBER OF PVC INSULATED 650/1100 V GRADE ALUMINIUM/COPPER CONDUCTOR CABLE CONFORMING TO IS: 694-1990

| Nominal cross sectional area of conductor in sq.mm | 20 mm | | 25 mm | | 32 mm | | 38 mm | | 51 mm | | 64 mm | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S | B | S | B | S | B | S | B | S | B | S | B |
| 1.50 | 5 | 4 | 10 | 8 | 18 | 12 | - | - | - | - | - | - |
| 2.50 | 5 | 3 | 8 | 6 | 12 | 10 | - | - | - | - | - | - |
| 4 | 3 | 2 | 6 | 5 | 10 | 8 | - | - | - | - | - | - |
| 8 | 2 | - | 5 | 4 | 8 | 7 | - | - | - | - | - | - |
| 10 | 2 | - | 4 | 3 | 6 | 5 | 8 | 6 | - | - | - | - |
| 16 | - | - | 2 | 2 | 3 | 3 | 6 | 5 | 10 | 7 | 12 | 8 |
| 25 | - | - | - | - | 3 | 2 | 5 | 3 | 8 | 6 | 9 | 7 |
| 35 | - | - | - | - | - | - | 3 | 2 | 6 | 5 | 8 | 6 |
| 50 | - | - | - | - | - | - | - | - | 5 | 3 | 6 | 5 |
| 70 | - | - | - | - | - | - | - | - | 4 | 3 | 5 | 4 |

Note:

1) The above table shows the maximum size of conduits for a simultaneous drawing of cables.

2) The columns headed **S** apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not deflect from the straight by an angle of more than 15 degrees. The columns headed **B** applies to runs of conduit which deflect from straight by an angle of more than 15 degrees.

3) Conduit sizes are the nominal external diameters.

**TABLE II**

**GIRDER CLIPS CLAMPS**

| Size of conduit | Width | Thickness |
|---|---|---|
| 20 mm | 19 mm | 0.9 mm (20 SWG) |
| 25 mm | 19 mm | 0.9 mm (20 SWG) |
| 32 mm & above | 25 mm | 1.2 mm (18 SWG) |

### 5.3.4 M C B Type Distribution Boards (MCB DBs)

All TPN MCB DBs are to be suitable for flush mounting with double door having acrylic front door and to be provided with inbuilt additional compartment for looping of loose wires/adapter boxes for entry of armoured cables and conform to IS: 8623.

i) Material

The DBs are to be fabricated out of SWG MS sheets suitable for all weather operation. The current carrying parts are to be made of electrolytic grade copper and are to be rated for the duty intended.

ii) Painting

The DBs are to be subjected to seven tank phosphating processes (Degreasing, pickling, surface activation, phosphating and passivation) and to be powder coated ensuring rust prevention and scratch resistant.

iii) Accessories

Following accessories are to be provided: -

a) Copper bus bars of rated current capacity per phase.

b) Special brass terminals to ensure perfect connections of incoming cable with the bus bars.

c) Brass neutral bars isolated and insulated from the enclosures with suitable cross sectional area.

d) Earth bars for firm earthing and for facilitating individual earthings for each outgoing terminal.

e) Sufficient number of blanking plates.

5.3.4.1 **Miniature Circuit Breakers (MCBs)**

All MCBs should conform to IS:8828(1996), BS: 3871, IEC:898(1995) and rated for 10kA category of short circuit duty and tested for breaking capacity upto 10 kA. **B** curve type MCBs should be used for resistive loads, **C** curve type for inductive loads and **D** curve type for UPS loads. MCBs shall be suitable for use in frequency range 40 Hz to 60 Hz and shall accommodate AC/DC supply according to requirements. It should have inverse time overload and short circuit tripping mechanism with trip free operation and toggle shall give positive contact indication. Arc chutes should be provided for effective quenching of arc during operations and fault conditions. Terminals should be provided with proper shrouding arrangement. Silver cadmium Oxide tipped contacts should be provided in MCBs. Pressure clamp terminals for users upto 4 sq.mm and bolted lugs for higher rating should be provided. Multipole MCBs should be provided with common operating handle and integral tripping. The MCBs shall be of IP 20 degree of protection. The power loss per pole shall be in accordance with IS:8828(1996) and shall be furnished by the manufacturer.

MCB casing shall be made of self extinguishing tropicalised material. It shall be suitable for mounting on 35 mm DIN rail/surface mounting. Line supply may be connected to either top or bottom terminals i.e there shall be no line load restriction. Degree of protection, when the MCB is flush mounted, shall be IP 40. MCB shall be supplied with clamping terminals fully open. Contact closing shall be independent of the speed of the operator. The MCB shall be capable of being used as incomer circuit breaker and shall be suitable for use as an isolator. In case of multiple MCBs in a single location (DB), it shall be possible to remove MCB without having to disturb other MCBs in the vicinity.

5.3.4.2 **Miniature Circuit Breaker and Residual current Circuit Breaker (RCBO)**

Miniature Circuit Breaker-and- Residual current Circuit Breakers based on residual current operation should provide complete protection against Earth leakage faults, overloads and short circuits. The breakers should conform to IS: 12640-1988, IEC 601008-1 and IS: 8828-1996 should be rated for 10 kA. The RCCB shall have threshold sensitivities (non-user adjustable) of 30mA, 100 mA & 300 mA with inbuilt time delay of 200 ms for discrimination with downstream RCCB. The short circuit withstand capacity of the RCCB without the associated short circuit/overload protection shall not be less than 3 kA. It shall be operationally independent of line voltage. There should be clear identification of earth fault or overload and short circuit fault on the RCCB. The breaker should be maintenance free. The breaker should be capable of detecting earth leakage currents and disconnecting the faulty lines. The RCCBs should be capable of preventing the risk of unwanted

tripping due to transient voltages (lightning, line disturbances on other equipment) and transient currents (from high capacitive circuits). The RCCB should be unaffected by the DC pulsated components, present if any in the circuit, and should not give nuisance tripping. A test devise should be incorporated to check the integrity of the system and tripping mechanism. Terminals should ensure easy termination of cables and should provide covers to shield incoming and outgoing terminals with IP 20 degree of protection. The breaker should be suitable for DIN rail mounting.

### 5.3.5 Cables & Cabling

5.3.5.1 Scope

The scope under this section covers the following:

a) Power cables (LV)

b) Control cables

5.3.5.2 Armouring and Serving

All multicore cables liable for mechanical damage shall be armoured.

PVC Cables, when armoured, shall have galvanised steel wire (flat or round) for armouring.

Steel wire armouring is preferred where the cables are liable to tensile stresses in applications such as vertical runs, suspended on brackets or laid in soil that is likely to subside.

5.3.5.3 Storage and handling:

1. Storage:

(i) The cable drums shall be stored on a well drained, hard surface, so that the drums do not sink in the ground causing rot and damage to the cable drums. Paved surface is preferred, particularly for long term storage.

(ii) The drums shall always be stored on their flanges, and not on their flat sides.

(iii) Both ends of the cables should be properly sealed to prevent ingress/absorption of moisture by the insulation during storage.

(iv) Protection from rain and sun is preferable for long-term storage for all types of cables. There should be enough ventilation between cable drums.

(v) Damaged battens of drums etc. should be replaced, as may be necessary.

5.3.5.4 Handling:

(i) When the cable drums have to be moved over short distances, they should be rolled in the direction of the arrow marked on the drum.

(ii) For manual transportation over long distances, the drum should be mounted on cable drum wheels, strong enough to carry the weight of the drum, and pulled by means of ropes. Alternatively, they may be mounted on a trailer or on a suitable mechanical transport.

(iii) For loading into and unloading from vehicles, a crane or a suitable lifting tackle should be used. Small sized cable drums can also be rolled down carefully on a suitable ramp or rails, for unloading, provided no damage is likely to be caused to the cable or to the drum.

5.3.5.5 Standards

The following standards shall be applicable:

1. IS: 1753 : Specification for aluminium conductors for insulated cables.

2. IS: 2982 : Specification for copper conductors in insulated cables.

3. IS: 5831 : Specification for PVC insulated and sheath of electric cables.

4. IS: 6474 : Polythene insulation and sheath of electric cables.

5. IS: 3975 : Specification for mild steel wires, strips and tapes for armouring of cables.

6. IS: 694 : PVC insulated cables.

6. IS: 7098 : Specification for XLPE insulated PVC sheathed cables.

8. IS: 3961 : Recommended current ratings of cables.

9. IS: 5819 : Recommended short circuit ratings for high voltage PVC cables.

5.3.5.6 Power cables (LV) 415 V gradeXLPE / PVC insulated cable

Power cables for use on 415 V system shall be of 1100 volt grade, aluminium conductor, XLPE/PVC insulated, PVC sheathed, armoured and overall PVC sheathed (PVCAPVC), strictly as per IS : 1554 (Part I) - 1976.

Unarmoured cable to be used only if specifically mentioned in schedule of requirements.

The size of these cables shall be as specified in schedule of requirements or as per erection drawings. No cable of size less than 4 sq.mm shall be used.

5.3.5.7 Control Cables

Control cables for use on 415 V system shall be of 1100 volts grade, copper conductor, PVC insulated, PVC sheathed, armoured and overall PVC sheathed, strictly as per IS : 1554 (Part I) - 1976. Unarmoured cables to be used only if specifically mentioned in schedule of requirements.

The size of these cables shall be as specified in schedule of requirements or as per erection drawing. No cable of size less than 2.5 sq.mm. shall be used.

5.3.5.8 Cable Glands

Cable glands shall be of heavy duty compression type of brass, chrome plated. These shall have a screwed nipple with conduit electrical thread and check nut. These shall be suitable for armoured/unarmoured cables, which is being used.

5.3.5.9 Cable Connectors

Cable connectors, lugs/sockets, shall be of copper/aluminium alloy, suitably tinned, solderless, crimping type. These shall be suitable for the cable being connected and type of function (such as power, control or connection to instruments, etc.)

5.3.5.10 Cable Indicators

These shall be self-sticking type and of 2 mm thick lead strap for overall cable. PVC identification numbers, ferrule shall be used for each wire.

5.3.5.11 Cable Route Markers

These shall be galvanised Cast Iron plate with marking (LT) diameter 150 mm with 600 mm long 25x25 mm MS. angle riveted/bolted with this plate.

5.3.5.12 G.I. Pipes for Cables

For laying of cables under floor, G.I. class ‘B’ pipes shall be used. MS. conduits is not acceptable for this purpose. All accessories of pipes shall be threaded types. Size of pipe shall depend upon the overall outer diameter of

cable to be drawn through pipe. No G.I pipe less than 40 mm dia. shall be used for this purpose. To determine the size of pipe, assume that 40% area of pipe shall be free after drawing of cable.

5.3.5.13 Cable entry adaptor boxes/ remote pushbutton stations

All outdoor cable entry adaptor boxes made of MS are to be coated with FRP coating to prevent corrosion. All the welded joints, cutting etc. also should be coated with FRP after erection. Thermoplastic box made of high quality unbreakable, self extinguishing thermoplastic material can also be used for the above purpose. All the outdoor remote push buttons should be housed in self-extinguishing thermoplastic enclosure or FRP coated MS enclosure having IP65 degree of protection.

## 5.3.6 Earthing

A) Types

The type of earth electrode shall be any of the following, as specified.

Pipe earth electrode; as per IS:3043

Plate earth electrode; as per IS:3043

General

All cladding or steel work should be bonded to the earthing system, as should all structural steel work. A main earth bar should be provided, so disposed as to allow of the shortest subsidiary connections to all major equipment, such as DG set, VCB Panels, Substations, circuit breakers and electrical panel boards. When piles are used they should be bonded by welding and connected to earth bonding bars. All earth connections shall be visible for inspection.

i) Electrode materials and dimensions

a) The materials and minimum sizes of earth electrodes shall be as per fault level calculation.

b) GI pipe electrodes shall be cut tapered at the bottom, and provided with holes of 12 mm dia, drilled not less than 7.5 cm from each other upto 2 m of length from the bottom.

c) Pipe electrode shall be buried in the ground vertically with its top not less than 20cm below the ground level. The installation shall be carried out as per IS:3043 and as directed by the engineer in charge.

d) Plate electrode shall be buried in ground with its face vertical, and its top not less than 2m below the ground level. The installation shall be carried out as per IS:3043 and as directed by the engineer in charge.

e) When more than one electrode is to be installed the distance between the pipe electrode shall be 5m and that between plates shall be 8m.

f) The strip or conductor electrode shall be buried in trench not less than 0.5m deep.

g) If the conditions necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible, in a single straight trench where feasible, or preferably in a number of trenches radiating from one point or as directed by the Engineer-in-charge.

h) All joints in copper conductor should be tinned properly.

B) Earthing Conductor

a) The earthing conductor (protective conductor from earth electrode upto the main earthing terminal/earth bus, as the case may be) shall be of the same material as the electrode, viz. GI or copper, and in the form of wire or strip as specified.

b) Protective (Earth continuity/Loop earthing) Conductor)

c) The material and size of protective conductors shall be as specified by the Engineer-in-charge.

C) Location for Earth Electrodes

i) Normally an earth electrode shall not be located closer than 1.5 m from any building. Care shall be taken to see that the excavation for earth electrode does not affect the foundation of the building; in such cases, electrodes may be located further away from the building, with the prior approval of the Engineer-in-Charge.

D) Protective (Loop earthing/earth continuity) Conductor:

i) Earth terminal of every switchboard in the distribution system shall be bonded to the main earth bus.

ii) Two protective conductors shall be provided for a switchboard.

iii) A protective conductor shall securely connect the earth connector in every distribution board (DB) to the earth bus.

iv) All metallic switch boxes and regulator boxes in a circuit shall be connected to the earth connector in the DB by protective conductor.

v) Provision should be given for the testing of earth electrodes by connecting a group of rod driven electrodes to the main earth grid through a bolted link adjacent to the electrodes in a sunken concrete box. Simpler disconnecting arrangements are not acceptable.

E) Marking

i) Earth bars/terminals at all switch boards shall be marked permanently as **E**

Main earth terminal shall be marked **Safety Earth – Do Not Disconnect**.

**NOTE:-The specifications indicated above are minimum requirement only. The contractor should design, supply, erect and commission the equipment according to latest editions of IEC and EI/IS standards.**

### 5.3.7 INSTALLATION

#### 5.3.7.1 Scope

The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical items mentioned in the schedule of requirements. The work shall, however at all times carried out strictly as per the instructions of the Engineer-in-Charge.

The Contractor shall furnish all tools, welding equipment, rigging materials, testing equipment, test connections and kits etc. Required for complete installation, testing and commissioning of the items included in the Contract.

The Contractor shall carry out touch-up painting on any equipment indicated by the Engineer-in-Charge, if the finish paint on the equipment is soiled or marred during installation handling.

The interconnecting cables between Meter board, MCBDB etc. should be done by the contractor as required.

The installation shall conform in all respects with Indian Standard Code of Practice.

### 5.3.7.2 LT Panel Boards

Switchgears shall be installed in accordance with specified code of practice and the Consultants instructions. The panels shall be delivered in convenient shipping section by the contractors. The Contractor shall be responsible for final assembly and inter-connection of busbars/wiring. Foundation channel shall be grouted in the flooring by the Contractor. Switchgear panels shall be aligned and levelled on their base channels and bolted or tack welded to them as per the instructions of the Engineer-in-charge. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall be mounted and connected on the switchgear. Wherever the instruments and relays are supplied separately, they shall be mounted only after the associated control panel have been erected and aligned.

After erection the switchboard shall be inspected for dust and vermin proofness. Any hole, which might allow dust or vermin etc. to enter the panel, shall be plugged suitably at no extra cost.

If the instrument transformers are supplied separately they shall be erected as per the direction of the Engineer-in-charge. The Contractor shall fix the cable glands after drilling the bottom top plates of all switch boards with suitable holes at no extra cost.

Range of overload relays/timers etc. shall be checked with requirement of purchaser actually to be connected at site and if the same is under-sized/over-sized, it shall be brought to the notice of Engineer-in-charge and shall arrange procurement of correct rated components. However, the Contractor shall not charge anything extra for cost/labour for such replacements.

5.3.7.2.1 Testing

The Contractor shall perform operating tests on all switchgear and panels to verify operation of switchgear/panels and correctness of the interconnections between various items of the equipment. This shall be done by applying normal ac or dc voltage to the circuits and operating the equipment for functional checking of all control circuits, eg. closing, tripping, control interlock, supervision and alarm circuits.

All connections in the switchgear shall be tested from point to point for possible grounds or short circuit.

All electrical equipment alarms shall be tested for proper operation by causing alarms to sound under simulated abnormal conditions.

The Contractor shall arrange testing and calibrations of relays. The testing equipment including primary and secondary injection sets (if required) etc. shall also have to be arranged by the Contractor. Payment for above work shall be deemed to have been included in the erection of switch boards/control panels.

Insulation resistance tests shall be carried out by following rating meggers:

a) Control circuits upto 220 V :by 500 V megger

b) Power circuits, busbars, connections Upto 11kV :by 1000V meggar

c) Power circuits, busbars, connections above 33kV :by 5000V motor operated meggar

Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in operating positions and contact open. Before switchgear is energised, the insulation resistance of all DC control circuits shall be measured from line to ground.

The following tests shall be performed on all circuit breakers during erection:

i) Contact alignment and wipe shall be checked an adjusted where necessary in accordance with the breakers manufacture's instructions.

ii) Each circuit breaker shall be closed manually and its insulation resistance measured from phase to phase and phase to ground before erection.

iii) All adjustable direct acting trip devices shall be set using values given by the Engineer-in-charge/manufacturer.

iv) The dielectric strength of insulating oil wherever applicable shall be checked

Before switchgear is energised the following tests shall be performed on each circuit breaker in its test position.

i) Close and trip the circuit breaker from its local & remote control switch, push button or operating handle. Switchgear control bus may be energised to permit test operation of circuit breaker with AC closing with prior permission of the Engineer-in-charge.

ii) Test operation of circuit breaker latch, check carriage limit switch if provided.

iii) Test proper operation of lockout device in the closing circuit, wherever provided by simulating conditions, which would cause a lockout to occur.

iv) Trip breaker either manually or by applying current or voltage to each of its associated protective relays.

Before switchgear is energised, the test covered above shall be repeated with each breaker in its normal operating position.

All electrical equipment alarms shall be tested for proper operation by causing alarms to sound under simulated abnormal conditions.

The Contractor shall arrange testing and calibrations of relays. The testing equipment including primary and secondary injection sets (if required) etc. shall also have to be arranged by the contractor. Payment for the above work shall be deemed to have been included in the erection of switch boards/control panels.

**Performa for Panels**

a) Circuit (breaker or Supplier module designation/bus no.)

b) Insulation resistance tests (contacts open, breaker racked in position).

a) Between each phase of bus : Mega ohm

b) Between each phase and earth : Mega ohm

c) DC and AC control & auxiliary circuits : Mega ohm

d) Between each phase of CT/PT and CT & PT circuit if any : Mega ohm

c) CT checks:

i) CT ratio

ii) CT secondary resistance

iii) CT polarity check

d) Check for contact alignment and wipe.

e) Check/test all releases/relays.

f) Check mechanical interlocks.

g) Check switchgear/control panel wiring.

h) Check electrical interlocks.

i) Checking of breaker/control circuits for

i) Closing-local and remote (wherever applicable)

ii) Tripping-local and remote (wherever applicable)

j) Opening time of breaker/contactor.

k) Closing time of breaker/contactor.

(This Performa shall be jointly signed by the Engineer-in-charge and the Contractor.)

5.3.7.2.2 Completion tests

After supply and installation of complete project or a particular building/area, the contractor shall carry out following tests before switching on the power to installation and the results shall be recorded and submitted to the engineer-in-charge. If results are not satisfactory/as per the standard, the contractor shall identify the defects/short coming and shall rectify the same. Nothing extra shall be paid for carrying out these tests and contractor has to arrange all necessary instruments.

5.3.7.2.3 Insulation resistance to earth

This to be measured with all fuse links in place all switches on all lamps and appliance in position by applying a voltage not less than twice the working voltage (subject to a limit of 500V). Insulation resistance of the whole or any part of the installation to earth must not be less than 50 Megaohms divided by the number of outlets (points and switch positions) except that it need not exceed 1 Megaohm for the whole installation.

5.3.7.2.4 Insulation resistance between conductors

Test to be made between all the conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply. For this test, all lamps shall be removed and all switches put on. The result of the test must be 50 Megaohms divided by the number of outlets (point and switch positions) but need not exceed one Megaohm for the whole installation.

5.3.7.2.5 Polarity of single pole switches

Test shall be made to verify that all non-linked single pole switches are on phase conductor (Live) and not on the neutral or earthed conductor.

5.3.7.2.6 Resistance of metal conduits/sheaths (Earth continuity test)

In case of cables encased in metal conduit or metallic sheathing, the total resistance of the conduit or sheathing from the earthing point to any other position in the completed installation shall not exceed 2 ohms.

5.3.7.2.7 Bus bar chamber

Bus bar chambers shall be installed on fixed type switch boards with GI bolts and nuts.

5.3.7.2.8 Connections

i) Connections to bus bars shall be made either by clamping arrangement, or by bolts and nuts as required. Tapped holes with studs may be permitted only for copper bus bars for tapping conductor size upto 16 sq.mm.

ii) All connections shall be made such that there is a clear metal to metal area contact at the tappings so that the current density of the bus bars at the point of connection does not exceed permissible limits, avoiding local heating.

iii) For tap-off connections from bus bars, PVC insulated wiring cables may be used for current capacity upto 100A. and for higher current capacities, solid conductors/strips suitably insulated with PVC sleeve/tape shall be used.

iv) The bolts and nuts used for connections to bus bars shall be of aluminium alloy, tinned forged brass or galvanised iron. Suitable precaution shall be taken against heating due to bi-metallic contact, spring washers and plate washers, shall be used with the studs/nuts to ensure proper contact pressure.

**5.3.7.3 Cabling**

Cable network shall include power, control and lighting cables, which shall be laid in underground trenches, Hume pipes, open trenches, cable trays, GI pipes, or on building structure surfaces as detailed in the relevant drawings. Cable schedules or as per the Engineer-in-charge's instructions. Supply and installation of cable trays, GI pipes/conduits, cable glades sockets at both ends, isolators, junction boxes, remote push buttons stations, etc. shall be under the scope of the Contractor.

5.3.7.3.1 General requirements for handling of cables

a) Before laying cables, these shall be tested for physical damage, continuity absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 500/1000 volt Megger.

b) The cables shall be supplied at site, wound on wooden drum as far as possible. For smaller length and sizes, cables in properly coiled form can be accepted. The cables shall laid by mounting the drum of the cable on drum carriage. Where the carriage is not available, the drum shall be mounted on a properly supported axle, and the cable laid out from the top of the drum. In no case the cable will be rolled on, as it produces kinks which may damage the conductor.

c) Sharp bending and kinking of cables shall be avoided. The bending radius for PVC insulated and sheath armoured cable shall not be less than 10 D Where 'D' is overall diameter of the cable.

d) While drawing cables through GI pipes, conduits, RCC pipe, ensure that size of pipe is such that, after drawing cables, 40 % area is free. After drawing cable, the end of pipe shall be sealed with cotton/bituminous compound.

e) High voltage (11 kV and above), medium voltage (230 V and above) and other control cables shall be separated from each other by adequate spacing or running through independent pipes/trays.

f) Armoured cables shall never be concealed in walls/floors / roads without GI pipes, conduits RCC pipes.

g) Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin type joint shall be made, without any additional cost.

h) A minimum loop of 3 M shall be provided on both ends of the cable, or after every 50 M of unjointed length of cable and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying.

i) Cable shall be neatly arranged in the trenches/trays in such a manner so that criss-crossing is avoided and final take off to the motor/switchgear is facilitated. Arrangement of cables within the trenches/trays shall be the responsibility of the Contractor.

j) All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings is indicative only and the same may be rechecked with the Engineer-in-charge before cutting of cables. While selecting cable routes, interference with structures, foundations, pipe line, future expansion of buildings, etc. should be avoided.

k) All temporary ends of cables must be protected against dirt and moisture to prevent damage to the insulation. For this purpose, ends of all PVC insulated cables shall be taped with an approved PVC or rubber insulating tape. Use of friction type or other fabric type tape is not permitted. Lead sheathed cables shall be plumbed with lead alloy.

l) Wherever cable rises from underground/concrete trenches to motors/switchgears/push buttons, these shall be taken in GI pipes of suitable size, for mechanical protection upto 300 mm distance of concerned cable gland or as instructed by the Engineer-in-charge.

m) Where cables pass through foundation/walls of other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures the electrical Contractor shall determine their

location and obtain approval of the Engineer-in-charge before cutting is done.

5.3.7.3.2 Installation of Cables

Wherever cables are taken through masonry works and road crossings etc., they shall be protected by running through GI pipes and Hume pipes respectively. Depth shall be 1200 mm from top of finished road surface and it shall extend for about 1070 mm on both sides of the roads.

Utmost care shall be taken to avoid scratches, kinks and cuts on the conductor while transporting the cables to site or during installation. Suitable inhibiting grease shall be liberally applied to bare conductors, wherever they exist.

The junction boxes, cable end boxes etc. wherever required to be provided shall have sufficient wiring spaces with regard to the sizes of cables indicated in the drawings. Wherever required, the items to be supplied for electrification shall be complete with requisite type of cable glands, cable boxes, termination etc. and other accessories which are necessary for the satisfactory installation/operation of the installations as per relevant statutory rules and regulations.

Installation of all cables should be as per E.I. Standards. Fuses should be graded properly and should be selected based on the rating of cables. The cables shall be laid in trenches/overhead racks wherever available. The cables from cable trenches to the switcher shall be buried (as per standard practices and or taken through GI pipes to 1.2 m above ground/racks floor level. The cables taken over racks/ walls/ columns/ trusses shall be properly clamped using aluminium clamps of 16 SWG 1/4 hard or 3/4 hard sheet, the width varying from 12.5 to 25 mm at intervals of 750 mm. 225 mm minimum horizontal interaxial spacing shall be maintained when more than one cable is laid in same trench. Suitable and permanent type of cable markers is to be provided indicating the route and position of joints of cable. Loops should be provided at either ends of the cable. Identification tags should be provided for each cable in the trench at a distance of 3 metres.

Supply and installation of danger notice boards, where required, and other provisions under the statutory rules and regulations shall be included in the scope of this work.

The Contractor has to provide materials and carry out the wiring work including earthing according to IS 3043 unless otherwise specified and get it approved before using for work, by the authorised engineer of the Purchaser.

Sufficient number of earth pits shall be provided, if found necessary and inter-connected so as to have the resistance of the earthing installations not more than 0.5 ohm. In case the soil resistivity is found to be very high, a

high sensitive relay may be used to co-relate the relay setting with high earth resistance.

The complete installation work shall be conforming to NEC-1985 and complying with the Indian Electricity Rules and to meet the approval of the State Electrical Inspector etc. Installation of all switch boards and distribution boards should be in conformity with Rule 51(1)(c) of I.E.R. 1956. MV installation should conform to I.S. 7732.

The cable terminations and earth terminations, wherever required, shall only be using compression type cable glands and suitable lugs.

All the materials to be supplied for this work shall be got approved by the concerned engineer at site.

The work will be considered complete only if the following tests are conducted, by the contractor at his own cost, satisfactorily in the presence of the site Engineer and are:

a) Insulation test

b) Earth resistance test and

c) Continuity test

5.3.7.3.3 Laying of Cables (underground system)

a) Cables shall be so laid in ground that these will not interfere with other underground structures. All water pipes, sewage lines or other structures, which become exposed by excavation, shall be properly supported and protection from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded diverted as directed by the Purchaser.

b) Cables shall be laid at minimum depth of 750 mm in case of LT & 1200 mm in case of HT, from ground level. Excavation will be generally in ordinary alluvial soil. The width of the trench shall be sufficient for laying of required number of cables.

c) Sand bedding 75 mm thick shall be made below and above the cables. A layer of bricks (full size) shall be laid on the edge, above sand bedding on the sides of cables and a flat brick to cover cable completely. More than one cable can be laid in the same trench by providing a brick on edge between two cables. However the relating location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction to the Engineer-in-charge.

d) For all underground cables, route markers should be used.

i) Separate cable route markers should be used for LT, HT and telephone cables.

ii) Route markers should be grounded in ground with with 1:2:4 cement concrete pedestal size 230 x 230 x 300 mm.

iii) Cable markers should be installed at an interval not exceeding 50 M along the straight routes of cables at a distance of 0.5 M away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

e) RCC hume pipes for crossing road in cable laying shall be provided by Contractor. RCC hume pipe at the ends shall be sealed by bituminous compound after laying and testing of cable by electrical Contractor without any extra charge.

5.3.7.3.4 Laying of Cables under Floors

a) GI class A pipe shall be used for laying of outgoing cables from distribution boards to various equipment. Preferably one cable shall be drawn through one pipe. Size of pipe shall be such that after drawing of cable 40 % area is free. If length of pipe is more than 30 M, free area may be increased to 50 %.

b) Use of elbows is not allowed at all and number of bends shall be kept minimum. Instead of using bends with sockets, pipe bending machine shall be used for making long smooth bends at site.

c) Ends of pipe shall be sealed temporarily while laying with cotton/jute/rubber stopper etc. to avoid entry of building material.

d) Exact locations of equipment shall be ascertain prior to laying of pipe.

5.3.7.3.5 Laying of Cable in Masonry Trenches

a) Masonry/concrete trenches of laying of cable shall be provided by Contractor. However steel members such as MS angles/flats etc. shall be provided & grouted by electrical Contractor to support the cables. Cables shall be clamped to these supports with aluminium saddles/damps. More than one tier of cables can be provided in the same trench if the number of cables is more.

b) Entry of cables in trenches shall be sealed with bituminous MASTIC compound to stop entry of water in trenches.

5.3.7.3.6 Laying of Cables in Cable Racks

Cable Racks to be used for cables laid indoors except for single cables. The cable racks shall be of ladder type fabricated out of structural steel, MS, GI

or aluminium perforated as indicated. The cable racks shall be of adequate strength to carry the weight of cables with out sagging. Structural bracket grounted in the build up trenches to support the cable such supports shall be at intervals of not less than 750 mm centres. All the structural steel work shall be finished with two coats of paint over primer.

a) Cables shall be fixed in cable trays in single tier formation and shall be clamped with aluminium flat clamps and galvanised bolts/unit.

b) Earthing flat/wire can also be laid in cable tray along with cables.

c) After laying of cables minimum 20 % area shall be spare.

5.3.7.3.7 Laying of Cables on Building Surface/Structure

a) Such type of cable laying shall be avoided as far as possible and will be allowed only for individual cables or small group of cables which run along structure.

b) Cables shall be rigidly supported on structural steel/masonry using individual cast/malleable iron galvanised saddles and these supports shall be approximately 400 to 500 mm for cables upto 25 mm overall diameter and maximum 1000 mm for cables larger than 25 mm. Unsightly sagging of cables shall be prevented. Only aluminium/GI clamps with GI bolts/nuts shall be used.

c) If drilling of steel structure must be resorted to, approval must be secured from the Engineer-in-charge and steel must be drilled where the minimum weakening of the structure will result.

5.3.7.3.8 Termination and Jointing of Cables

a) Use of Glands

All PVC cable upto 1.1 kV grade, armoured or unarmoured shall be terminated at the equipment/junction box/ isolators/push buttons/control accessories, etc. by means of suitable size compression type cable glands armour of cable shall be connected to earth point. The Contractor shall drill holes for fixing glands wherever necessary. Wherever threaded cable gland is to be screwed into threaded opening of different size, suitable galvanised threaded reducing bushing shall be used for approved type.

In case of termination of cables at the bottom of the panel over a cable trench having no access from the bottom, a close fit holes should be drilled in the bottom plate for all the cables in one line, then bottom plate should be split in two parts along the centre line of holes. After installation of bottom plate and cables with glands, it shall be sealed with cold sealing compound.

b) Use of Lugs/Sockets

All cable leads shall be terminated at the equipment terminals, by means of crimped type solder less connectors unless the terminals at the equipment ends are suitable for direct jointing without lugs/sockets.

The following is the recommended procedure for crimped joints and the same shall be followed:

i) Strip off the insulation of the cable end with every precaution, not to severe or damage any stand. All insulation to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

ii) The cable should be kept clean as far as possible before assembling it with the terminal/socket. For preventing the ingress of moisture and possibility of re-oxidation after crimping of the aluminium conductors, the socket should be fitted with corrosion inhibiting compound. This compound should also be applied over the stripped portion of the conductor and the palm surface of socket.

iii) Correct size and type of socket/ferrule/lug should be selected depending on size of conductor and type of connection to be made.

iv) Make the crimped joint by suitable crimping tool.

v) If after crimping the conductor in socket/lug, same portion of the conductor remains without insulation the same should be covered sufficiently with PVC tape.

c) Dressing of Cable inside the Equipment

After fixing of cable glands, the individual cores of cable shall be dressed and taken along the cableways (if provided) or shall be fixed to the panels with polyethylene straps. Cable shall be dressed in such a manner that small loop of each core is available inside the panel.

For motors of 20 HP and above, terminal box if found not suitable for proper dressing of an aluminium cables, the Contractor shall modify the same without any additional cost.

Cables inside the equipment shall be measured and paid for.

d) Identification of Cables/Wires/Cores

Power cables shall be identified with red, yellow & blue PVC tapes for trip circuits identification, additional red ferrules shall be used only in the particular cores of control cable at the termination points in the switchgear/control panels and control switches.

In case of control cables all cores shall be identified at both ends by their wire numbers by means of PVC ferrules or self sticking cable markers, wire numbers shall be as per schematic/connection drawing.

For power circuit also wire numbers shall be provided if required as per the drawings of switchgear manufacturer.

5.3.7.3.9 Testing of Cables

a) Before energising, the insulation resistance of every circuit shall be measured from phase to phase and from phase to ground. This requires 3 measurements if one side is grounded and 6 measurements for 3 phase circuits.

b) Where splices or terminations are required in circuits rated above 650 volts, measure insulation resistance of each length of cable before splicing and/or terminating. Report measurements after splices and/or terminations are complete.

c) DC High Voltage test shall be made after installation on the following:

i) All 1100 Volts grade cables in which straight through joints have been made.

ii) All cables above 1100 V grade.

For record purposes test data shall include the measured values of leakage current versus time.

The DC High Voltage test shall be performed as detailed below:

Cables shall be installed in final position with the entire straight through joints complete. Terminations shall be kept unfinished so that motors, switchgear, transformer etc. are not subjected to test voltage.

The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

5.3.7.3.10**Proforma for Testing Cables**

**Proforma - A**

Date of Test

a) Drum No. from which cable taken

b) Cable from to

c) Length of run of this table metre

d) Insulation resistance test :

Voltage of Megger ..... Volts

i) between core-1 to earth..... Megaohm

ii) between core-2 to earth..... Megaohm

iii) between core-3 to earth..... Megaohm

iv) between core-1 to core-2..... Megaohm

v) between core-2 to core-3..... Megaohm

vi) between core-3 to core-1..... Megaohm

e) High voltage test Voltage Duration

i) between cores and earth

ii) between individual cores

Signature of Signature of

Engineer-in-Charge Contractor

**Proforma - B**

Cable Laying

(To be shown for each cable separately, voltage wise)

Date(s) of Test:.....

Voltage of Megger used:.....

---

| Continuity of cores | IR value (mega ohm) | |
|---|---|---|
| | Before laying | Before back filling |
| | Between value | Between Value |
| 1) From.....……To.....PVC/XLPE.……x.…….sq.mm LV/MV/HV cable.……..m in length. | | |
| | R-N | R-N |
| | Y-N | Y-N |
| | B-N | B-N |
| | R-Y | R-Y |
| | B-R | B-R |
| | Y-B | Y-B |
| | R-E | R-E |
| | Y-E | Y-E |
| | B-E | B-E |

Signature of Engineer-in-Charge

Signature of Contractor

Tenderer

Chief Engineer

**Proforma – C**

Cable Jointing

(To be shown for each cable separately, voltage wise)

Date(s) of Test:.....

Voltage of Megger used:.....

| | 1 | 2 | 3 |
|---|---|---|---|
| Number of Joint | | | |
| Location | | | |
| Type of cable(s) | | | |
| Type of joint (Indoor/Outdoor, straight through/termination, LV/MV/HV) | | | |

Insulation resistance (Mega ohm) before jointing

| | | |
|---|---|---|
| Cable I - | (a) Between | R & Y |
| | | Y & B |
| | | B & R |
| | (b) Between | R & N |
| | | Y & N |
| | | B & N |

(c) Between R & E

Y & E

B & E

N & E

Cable II - (a) Between R & Y

Y & B

B & R

(b) Between R & N

Y & N

B & N

(c) Between R & E

Y & E

B & E

N & E

Insulation resistance (Mega ohm) of Jointed cable

Cable I - (a) Between R & Y

Y & B

B & R

(b) Between R & N

Y & N

B & N

(c) Between R & E

Y & E

B & E

N & E

Signature of
Engineer-in-Charge

Signature of
Contractor

Tenderer Chief Engineer

**Proforma - D**

Testing Before Commissioning

(a) Cable Work Date(s) of Test:.....

(i) Details of high Voltage test conducted

System of supply.....

Test Voltage applied…….....kV…….....Minutes

Result of test-Satisfactory/Unsatisfactory.

Voltage of Megger used:-

Result of Megger testing:-

| | |
|---|---|
| Between | R & Y |
| | Y & B |
| | B & R |
| Between | R & N |
| | Y & N |
| | B & N |
| Between | R & E |
| | Y & E |
| | B & E |
| | N & E |

b) FEEDER PILLAR:-

i) Pillar Number:

ii) Voltage of megger used:

iii) Result of megger testing:

## 5.3.8 Earthing

5.3.8.1 Scope

The scope of this section shall cover the following:

a) Earthing station

b) Earthing conductors

c) Earthing of equipment and installation

5.3.8.2 Standards

The following standards shall be applicable:

IS : 3043 COP for earthing

IS : 5216 Safety procedures & practice in electrical work

5.3.8.3 Earth Station

The earth station shall be made by excavating the ground to a depth of not less than 2.5 m and the excess earth after back filling shall be removed from site. Ground with rocky strata, the depth of excavation shall be less. However additional earthing stations or earth matting to be provided to achieve the system earthing less than one ohm.

5.3.8.4 Electrodes

a) Various types of electrodes

i) Pipe electrode shall be buried in the ground vertically with its top at not less than 20 cm below the ground level. The installation shall be carried out as shown in the figure and as directed by the Engineer-in-charge.

ii) ii) Plate electrode shall be buried in ground with its face vertical, and its top not less than 2 m below the ground level. The installation shall be carried out as directed by the Engineer-in-charge.

iii) When more than one electrode is to be installed, the distance between pipe electrodes shall be 5m and that between plates shall be 8m.

iv) a)The strip or conductor electrode shall be buried in trench not less than 0.5 m deep.

b) If conditions necessitate the use of more than one strip or conductor electrode, they shall be laid as widely distributed as possible, in a single straight trench where feasible, or preferably in a number of

trenches radiating from one point or as directed by the Engineer-in-charge.

5.3.8.5 Earthing Conductor (Main earthing lead)

The earth conductors shall be fixed to the wall/columns etc. at every 500 mm centres with 10 mm spacers. The total earthing system shall be mechanically and electrically connected to provide independent path to earth.

i) In the case of plate earth electrode, the earthing conductor shall be securely terminated on to the plate with two bolts, nuts, checknuts and washers.

ii) A double C-clamp arrangement shall be provided for terminating tape type earthing conductor with GI watering pipe coupled to the pipe earth electrode. Galvanised "C" shaped strips, bolts, washers, nuts and checknuts of adequate size shall be used for the purpose.

iii) The earthing conductor from the electrode upto the building shall be protected from mechanical injury by a medium class, 15 mm dia. GI pipe in the case of wire, and by 40 mm dia. medium class GI pipe in the case of strip. The protection pipe in ground shall be buried atleast 30 cm deep to be increased to 60 cm in case of road crossing and pavements). The portion within the building shall be recessed in walls and floors to adequate depth in due co-ordination with the building work.

iv) The earthing conductor shall be securely connected at the other end to the earth stud/earth bar provided on the switch board by bolt, nut and washer.

5.3.9.6 Earth bus and main earthing terminal

i) The Main Earth bus shall be laid as directed by the Engineer-in-charge.

ii) Following conductors shall be terminated into the main earthing terminal/earth bus.

a) Earth connection from the Sub station.

b) Earthing conductor from electrode.

c) Protective conductors;

d) Equi-potential bonding conductors.

5.3.9.7 Protective (Loop earthing/earth continuity) Conductor

i) Earth terminal of every switch board in the distribution system shall be bonded to the main earth bus.

ii) Two protective conductors shall be provided for a switchboard.

iii) A protective conductor shall securely connect the earth connector in every distribution board (DB) to the earth bus.

iv) All metallic switch boxes and regulator boxes in a circuit shall be connected to the earth connector in the DB by protective conductor.

v) The earth pin of socket outlets as well as metallic body of fan regulators shall be connected to the earth stud in switch boxes by protective conductor.

5.3.9.8 Marking

i) Earth bars/terminals at all switch boards shall be marked permanently, either as **E** or as

i) Main earth terminal shall be marked "**Safety Earth – Do Not Disconnect**".

**Proforma for testing Earth Electrodes**

i) Total number of earth electrodes.....

ii) Earth resistance of each earth electrode:

| Sl.No. | Location | Value |
|---|---|---|
| | | |
| | | |

Signature of Engineer-in-Charge

Signature of Contractor

### 5.3.10 Light Fixtures / Fans

5.3.10.1 Installation of Lighting Fixtures

a) Scope of work under this item shall start from light point, ie from the ceiling rose or metal box whichever is applicable with a 15A bakelite connector, 3 core 1sq.mm PVC insulated copper wires from this connector to the connector inside the lighting fixture, connections, fixing of lighting fixture complete with all accessories, lamps on wall/roof/steel truss, etc. testing the lighting fixture and commissioning.

b) Contractor shall clarify from Engineer-in-charge for type of installation (direct on ceiling/hanging) of lighting fixture, if not specifically mentioned on drawings. Length of the suspension rods shall also be decided in consultation with the Engineer-in-charge.

5.3.10.2 Installation of Ceiling Fans

Scope of work under this item shall start from the ceiling rose of the fan point with 3 core 1 Sq.mm PVC insulated copper wires to the connector in the fan, connections, fixing of fan (complete with all accessories) to the fan hook of fan point, testing the fan with regulator and commissioning.

Extension/replacement of hanging rod of fans shall be carried out only if advised by the Engineer-in-charge on drawing/site instruction book. Only GI pipe ('B' class) shall be used for ceiling fan hanging. Screwed joint within the length of fan hanging rod is not allowed and shall never be adopted. Fan hanging rod should be preferably of one piece and if not possible, welded joint can be allowed.

5.3.10.3 Installation of wall fans/air circulators

Specification same as for ceiling fans except that fan has to be fixed on wall with screws/bolts grouting instead of fan hooks.

5.3.10.4 Installation of Exhaust fan

Scope of work under this item shall start from the ceiling rose of exhaust fan point, with PVC insulated copper wire from ceiling rose to connector of exhaust fan, connections, including fixing of exhaust fan complete with accessories and louvers on walls with hold-fasts, testing the exhaust fans and commissioning.

5.3.10.5 Special notes

a) Location of lighting fixtures/fans shall be shown on the working drawings and the same shall be followed. However, if due to site conditions the location can not be adhered to, the same shall be brought out to the notice of the Engineer-in-charge for advice.

b) Maintenance and custody of light fixture/fans after installation/commissioning would be with contractor till that building/area is completed and handed over to Purchaser / Engineer-in-charge in satisfactory working order.

## 5.3.11 MEASUREMENT

### 5.3.11.1 Quantities

The quantities set out in the Schedule of Requirements are the estimated quantities of the work, but they are not to be taken as the actual and exact quantities of the Work to be executed by the Contractor in fulfilment of his obligations under the Contract.

### 5.3.11.2 Works to be measured

The Consultants shall, except as otherwise stated, ascertain and determine by measurement the value in terms of the Contract of work done in accordance with the Contract. He shall, when he required any part or parts of the Work to be measured, give notice to the Contractor's authorised agent or representative, who shall forthwith attend or send a qualified agent to assist the Engineer in making such measurement, and shall furnish all particulars required by either of them. Should the Contractor not attend, or neglect or omit to send such agent, then the measurement made by the Engineer or agent approved by him shall be taken to be the correct measurement of the work. For the purpose of measuring such permanent work as is to be measured by records and drawings, the Consultant shall prepare records and drawing month by month of such work and the Contractor, as and when called upon to do so in writing, shall, within fourteen days, attend to examine and agree such records and drawings with the Consultant and shall sign the same when so agree such records and drawings, they shall be taken to be correct. If, after examination of such records and drawings the Contractor does not agree the same or does not sign the same as agreed, they shall nevertheless be taken to be correct, unless the Contractor shall, within fourteen days of such examination, lodge with the Consultant, for decision by the Consultant, notice in writing of the respects in which such records and drawing are claimed by him to be incorrect.

### 5.3.11.3 Mode of Measurement

The Works shall be measured net, as prescribed in the specification of work, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. Wherever not specifically mentioned in the Contract, the mode of measurement as prescribed in the relevant IS codes shall be applicable and binding to the Contract. Only the latest editions of all the codes of practices including all latest official amendments and revisions shall be applicable.

### 5.3.11.4 Battery Limit

Scope of work includes:

1. Supply, installation, testing and commissioning of meter boards, feeder pillers etc.Cable laying, termination at both ends, testing & commissioning of LT cables from meter boards to LT panel Boards, MCB DBs etc.

2. Earthing system includes supply, installation and testing of earth pits and relevant earth conductors as per specification Meter board, LT panel Boards, MCB DBs etc.

3. Wherever buried cables are envisaged, scope of work includes digging of earth along the cable route, filling up of sand protective covering as per specification, laying of cable, covering the cables with sand bricks, back filling of earth etc., as per specification. Installation of Hume pipes including excavation, erection, back filling etc. Cable markers shall be supplied & installed as per specification.

4. Civil work includes grouting of equipment, complete supply & erection of meter boards, feeder pillers, MCB DBs, fixing of pipes with all necessary supports.

6. The rates quoted for installation should include the charges for painting the conduits & supports as directed by Purchaser/ Consultant.

7. Supply, installation, testing and commissioning of Wiring System, MCB distribution boards, installation of light fixtures and fans, exhaust fans, power plugs, 5A plugs etc.

**8. Liaison with all statutory authorities including KSEB for getting sanction/approval/safety certificate/ power connection including submission of necessary forms to KSEB/ Electrical inspectorate as required is included in the scope of this work. Necessary fee for the above shall be reimbursed on production of actual bills.**

## 6.0 MAKE OF MATERIALS

6.1 Scope

The scope of this section covers the recommended makes of equipment, material components. The final choice of makes shall be indicated at the time of finalization of order.

The makes of material offered by the contractor shall be indicated at the space provided for proper evaluation of the offer and shall be one of the recommend makes. In the absence of such indication, the decision rests with the Purchaser/consultant.

6.2 Makes recommended

The makes of material recommended are exhibited in respective section. The offers shall be strictly on the basis of the makes recommended. However, the bidders can offer alternative makes under deviation. Such deviations shall follow with technical literature of the material/equipment offered. Such deviation shall be considered only if the offer is furnished for the specified make as per the tender.

Where specified make and model nos. are indicated in the schedule of requirements, the bidder should quote for the same items.

## 6.3 LIST OF APPROVED MAKES OF EQUIPMENT AND MATERIALS

| **Sl.No** | Item | **Make of Materials/Equipment** |
|---|---|---|
| 1 | Diesel Engine | Cummins, Caterpillar, Kirloskar Green, |
| 2 | Alternator | Stamford, Leroysomer, Kirloskar green , KEL. |
| 3 | 1.1 kV grade XLPE insulated PVC sheathed Al./ Cu. Cable | CCI, NICCO, Torrent, Universal, Havells, Gloster. |
| 4 | SDFU, Isolator | L&T, Siemens, Schneider Electric, ABB, GE. |
| 5 | Push Buttons | Tecnic, Schneider, Siemens, BCH, C&S |
| 6 | Indicating lamps (LED type) | Tecnic, Schneider, Siemens, BCH, C&S, L&T |
| 7 | Fuses/Fuse carriers | Siemens, L & T, Schneider Electric, ABB, GE |
| 8 | Indicating meters | AE, MECO, Rishab |

| | | |
|---|---|---|
| 9 | Integrating meters | SIMCO, L&T, ABB, HPL |
| 10 | Current Transformer | AE, Intrans, Kappa, Intech, PGR |
| 11 | Selector switches | Reco, Essen, Kaycee, L&T. |
| 12 | Modular type switches, Sockets, bell push, etc | Crabtree Athena, Legrad mosaic, MK blenze, Wipro North West |
| 13 | 660/1100 volt grade stranded unsheathed wire with copper conductor | Finolex, RR Kabel, Lapp Kabel. |
| 14 | Cable glands, lugs, End termination kits | Lapp Kabel, Gripwel, HMI, Denson, Multipressings, Yamuna Gasses. |
| 15 | MCB, RCBO | Legrand , Siemens, L&T Hager, Schneider Electric, ABB, Indo Asian Gold plus. |
| 16 | MCB Distribution Boards/ Load banks | Legrand , L&T, Siemens, , GE ,ABB Schneider Electric |
| 17 | Light fitting | Philips, Wipro, Crompton, K-lite |
| 18 | Ceiling fans | Usha, Crompton, Khaithan, |
| 19 | Exhaust fan | Almonard, Crompton |
| 20 | PVC conduit | Precision ,Balco, conceal |

**TECHNICAL SPECIFICATIONS**
**AIR CONDITIONING SYSTEM**

## 7.0 SCOPE OF WORK

The complete scope of work shall cover supply, installation, testing and commissioning of Air Conditioning System including sizing of pipes etc.

## 7.1 Basis of Design

The entire system has been designed based on climatological data available as given under the section basis of Design. The technical requirements given under here is only indicative and not descriptive and the contractor shall ensure that the whole system supplied is complete in all respects for the smooth operation of the plant and should be suitable for the rated performance.

## 7.2 Terms and Definitions

The following terms have been used in the tender specifications, drawings, etc.

| | |
|---|---|
| BIS | Bureau of Indian Standards |
| ASHRAE | American society of Heating, Refrigeration and Air-conditioning Engineers, USA. |
| ASME | American Society of Mechanical Engineers. |
| ASA | American Standard Association. |
| B.S | British Standards |
| CMH | Cubic Meter per Hour |
| CFM | Cubic Feet per Minute |
| US GPM | US Gallons per Minute |
| IGPM | Imperial Gallons per Minute. |
| RPM | Revolutions per Minute |
| BTU/Hr. | British Thermal Unit per Hour |
| KCal/Hr. | Kilo Calories per Hour |
| HZ | Hertz |
| H.P | Horse Power |
| $Kg/CM^2$ | Kilo Gram per Square Centimeter |
| SG | Supply Air Grilles |
| SD | Supply Air Diffuser |
| SAF | Supply Air Filters |
| FD | Fire Damper |
| VCD | Volume Control Damper |
| RG | Return Air Grilles |
| RD | Return air diffuser |
| FAD | Fresh Air Damper |
| RH | Relative Humidity |
| DB | Dry Bulb Temperature |
| WB | Wet Bulb Temperature |
| MV | Mechanical Ventilation |

DP Drain Point.
RO Rate Only

The design, manufacture, identification of material and testing of the equipment covered in this specification shall comply with the latest edition of the appropriate standard of the following:

1) Duct Work
   IS:655 (latest edition)
2) Welding
   IS:3589
3) Refrigeration and Air-conditioning
   As per ASHRAE/ISI air-conditioning and refrigeration institute standards.
4) Sluice Valves for Water Lines
   IS:778-1980
5) Copper alloy Gate/ Globe / Check Valve for water lines
   IS:778
6) Colour code for the identification of pipe lines
   IS:2379-1963
7) Specific requirements for the direct switching of the individual motors
   IS:4064 (Part-II)-1978
8) PVC insulated (HD) Electric Cables for working voltage up including 1100 Volts
   IS:1554 (Part I)
9) Starters
   IS:8554 (Part-I) 1979
10) HRC Cartridge fuse links upto 650 Volts
    IS:2208
11) Inspection and testing of installation
    IS:732 (Part-III) 1979
12) Galvanized steel wire for fencing
    IS:277-1977
13) Three phase induction motors
    IS:325
14) Horizontal centrifugal pumps
    IS:1620
15) Wrought aluminum and aluminum alloy sheet and strip for general engineering purposes
    IS:737
16) Bourdan tube pressure & vacuum gauges
    IS:3624
17) Glossary of terms used in refrigeration and air-conditioning
    IS:3615
18) Code for practice for standard for selection of standard worm and helical gears
    IS:7403
19) PVC insulated (heavy duty) electric cables for working voltage upto and including 1100 watts: IS:1554 (Part-I)
20) Expanded Polystyrene (EPS) : IS 4671.
21) Resin bonded glass wool: IS 8183.

## 7.3 Safety Codes

The following IS codes shall be followed:

Safety code for mechanical refrigeration
IS:660
Safety code for air-conditioning
IS:659
Safety code for scaffolds & ladders
IS:3696
Code of practice for fire precautions in welding & cutting operations
IS:3016
Code for safety procedures and practices in electrical works
IS:5216
Code of practice for safety and health requirements in electrical & gas welding and cutting operations
IS:3696
Indian Electricity Act 1910
Electricity Supply Act and Indian Electricity Rules.

## 7.4 AIR COOLED HI-WALL SPLIT AIR CONDITIONING UNIT

**1. Cabinet**

The ductable split air conditioning units shall have metal cabinet of 1.6mm thick (16 gauge) galvanized sheet steel. The body should be machine pressed and adequately stiffened. The body should be chemically treated for corrosion resistance and Polyester powder coated.

**2. Compressor**

All compressors shall be hermetically sealed rotary/ scroll type of suitable capacities. Compressor shall be suitable for R22 refrigerant. The compressor shall be electrically interlocked with indoor and outdoor fan motors, HP/LP cutouts and thermostat in the evaporator. The compressor shall be housed inside the Condenser.

3. **Condenser (Air cooled)**

The coils shall be made of copper hydraulically bonded with aluminium fins. The tubes shall have a minimum of 9.5 mm outer diameter, firmly bonded with aluminium fins spaced at 12-14 fins/inch. The air velocity across the face of the coil shall not exceed 200 m/min. The coils shall be designed for a maximum working pressure of 35 kg./sq.cm. The condenser coil shall be protected on the open end by a wire mesh duly powder coated/plastic coated.

4. **Evaporator coil**

The coils shall be made of copper hydraulically bonded with aluminium fins. The coils shall be hydrophilic in nature. The tubes shall have a minimum of 9.5 mm outer diameter, firmly bonded with aluminium fins spaced at 12-14 fins/inch. The air velocity across the face of the coil shall not exceed 170 m/min. The coils shall

be designed for a maximum working pressure of 35 kg/sq.cm. The circuit should include a thermostatic expansion valve/capillary tube, distributor, liquid strainer, suction line shut off valve and liquid line shut off valve.

5. **Condenser motor**

The condenser motor shall be of IP-55 rating.

6. **Refrigeration piping and accessories**

Soft drawn copper shall be used in piping with brass fittings wherever required. Brazing shall be with silver copper phosphorous alloy. Horizontal lines shall have a grading of atleast 1:250 away from the compressor and towards condenser to prevent gravity draining of oil to compressor. Liquid lines shall be sized to ensure that flashing of liquid refrigerant does not occur. The circuit should include a thermostatic expansion valve, distributors, liquid strainer, de-hydrator and liquid lines shut off valve and suction line shut off valve.

All refrigerant pipes shall be insulated with flexible elastomeric closed cell insulation having a built-in vapour barrier. It shall be of pre-formed tubes of appropriate thickness. Insulation must have a thermal conductivity of less than or equal to 0.034 W/(m.K) at 0°C and less than or equal to 0.036 W/(m.K) at 24°C when measured according to ASTM C 177, ASTM C 518 or EN ISO 8497. Insulation must have a Moisture Resistance Factor of μ greater than or equal to 7,000 according to DIN 52615 or less than or equal to 0.02 per inch according to ASTM E96 Procedure A., flame spread not over 25 and smoke development not over 50. Insulation must have an operational temperature range of -50°C to +105°C (tubes).All refrigerant piping shall have minimum 25mm thick insulation.
All drain piping shall have minimum 12mm thick insulation.

Leaks shall be tested with soap solution at a minimum pressure of 21 kg/sq.cm. After all leaks have been repaired, system shall be tested with the test pressure maintained for a period of not less than 24 hours. No measurable drop in pressure should be detected after the pressure readings are adjusted for temperature changes. After satisfactory completion of the pressure test, the system shall be evacuated to reduce the pressure to 0.1 Kg/Sq.cm. for a period of 6 hours and vacuum broken. A vacuum pump connected to the refrigeration system shall be used to create the vacuum and the installed compressor shall not be used to create the purpose. The system shall again be evacuated and a vacuum of 0.01 Kg/Sq.cm maintain for 24 hours before charging with correct quantity of refrigerant and oil. The system shall be operated for 12 hours and then again tested for leaks.

7. **Drain Piping**

Drain pipe shall be of suitable dia PVC pipes. All Split units shall be provided with independent drain lines. The drain shall be taken to the drain main line. All drain pipe shall be insulated with 9mm thick insulation of closed cell elastometric nitrile rubber with density not less than 80kg/m3.

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8. **Fan**

Fan section including wheel and housing shall be of heavy gauge steel/aluminium. Fans shall be centrifugal, forward curved multi-blade type. Fan housing shall have inlets and guide vanes for smooth air flow. Fans shall be complete with drive motor. The fans should be statically and dynamically balanced. The fan motor should be resilient mounted. The fan should deliver a static pressure of 20 mm.

9. **Filters**

All evaporator units shall be provided with air filters capable for filtration upto 20 microns. The filters shall be of washable synthetic fibre type.

10. **Control Panel**

All units shall have independent electrical control panels housing contactors, overload relays, voltage cutouts, time delays, interlocks, strip connectors, indication lamps, and control fuse. All these have to be housed inside the Outdoor unit of each circuit.

11. **Thermostat**

The indoor blower motor shall have 3 speeds and indoor units noise shall not exceed 41/38/35 dBA .The unit shall be provided with cordless remote micro processor control

12. **Installation**

Adequate vibration isolation using rubber/neoprene pads/vibration springs in order to reduce transmission of vibrations to the floor shall be provided for all condensing units.

13. **Testing**

Split units after installation shall be tested for its conformity to specifications. Units shall also be tested for the rated capacity and power consumption.

14. **Electric motor**

The electric motor driving the compressor shall be as per manufacturer's standard for this compressor and motor shall be suitable for operation on A.C. supply. The motor shall be continuous duty rated for the application. The motor shall be selected such a way that the motor rating is for actual requirement. The motor shall be provided with suitable bearing to take care of loads/thrust. Necessary lubricators shall be provided to enable the bearings to be correctly greased as required. The tenderer shall also calculate KW/TR.

## 7.5 PAINTING WORK

**7.5.1** All equipment shall be painted as specified under respective headings. The contractor has to get approval of the quality and colour of paints for all types of painting work.

### 7.5.2 Colour scheme for the plant and equipment

| | | |
|---|---|---|
| i) | Compressor | .. Battle ship grey |
| ii) | Condenser | .. Battle ship grey |
| iii) | Refrigerant discharge line | .. Red |
| iv) | Refrigerant liquid line | .. Yellow |
| v) | Steel supports | .. Black |
| xi) | Electrical panels/sub-panel/remote control console | .. Light grey or any approved colour |
| xii) | Cable trays | .. Black |
| xiii) | Supports for ducts | .. Black. |

## 7.6 MODE OF MEASUREMENT

**THE FOLLOWING MEASUREMENT CODE SHALL APPLY TO THIS CONTRACT:-**

### 7.6.1 MECHANICAL ITEMS

#### 7.6.1.1 Structural Supports

Structural supports including supports fabricated for the indoor and outdoor units shall not be separately quoted . Unit rates shall be inclusive of hoisting, cutting, jointing, welding, cutting of holes and chases in walls, slabs or floors, painting supports and other items as described in specifications, drawings and schedule of quantities or as required at site by project co-ordinator.

#### 7.6.1.2 Copper Connections for Split Units

Copper connection assembly for making connections to the split units shall be measured, as part of the split unit price and shall include brass flare nuts, brass straight connector, brass tees, brass reducing fittings, fixing of automatic 3 way valve, making connections and leak testing, complete assembly as per specifications and drawings. Nothing extra shall be payable on account of any variation in the length of copper pipe.

### 7.6.2 ELECTRICAL ITEMS

#### Mode of Measurement of Electrical Items

The Works shall be measured, as prescribed in the specification of work, notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the Contract. Wherever not specifically mentioned in the Contract, the mode of measurement as prescribed in the relevant IS codes shall be applicable and binding to the Contract. Only the latest editions of all the codes of practices including all latest official amendments and revisions shall be applicable.

## 7.7 TESTING OF AIR-CONDITIONING SYSTEM

7.7.1 Routine and type tests for the various items of equipment of the system shall be performed at the Contractor's own cost and test certificates are to be submitted.

7.7.2 The performance tests to determine whether or not the full intent of the specification is met shall be conducted by the contractor. After notification to Purchaser that the installation has been completed and the system has run continuously for a period of atleast one week, the contractor shall conduct under the direction and the presence of Purchaser such tests as specified to establish the capacity of various equipment supplied and installed by the contractor.

7.7.3 The contractor shall operate, test and adjust the air-conditioning system units, fan, motors, all air handling appliances including adjustment of regulators etc. All testing equipments, labour, operating personnel, oil, refrigerant or any other item required for these tests shall be provided by the contractor to enable the plant to be put in a continuous running test.

7.7.4 **TEST PROCEDURE**:

7.7.4.1 Design Conditions:

The inside and outside conditions shall be recorded on hourly basis. The outside and inside dry bulb and wet bulb temperatures shall be recorded by means of a sling psychrometer with mercury thermometers. The relative humidity shall be computed from the psychometric chart. The inside dry bulb temperature and relative humidity shall fall within the specified limits.

The contractor should conduct performance such tests as indicated in the rated Technical Part and produce sufficient documentary proof that the plant is operating at the rated capacity.

7.7.5 The following readings shall be recorded hourly during the tests and capacity of the plant shall be computed.

**1. Compressor**

| | | |
|---|---|---|
| a. | Suction pressure | - $Kg/cm^2$ (psi) |
| b. | Suction temperature | - $^oC$ ($^oF$) |
| c. | Discharge pressure | - $Kg/cm^2$ (psi) |
| d. | Condensing Tempr. | - $^oC$ ($^oF$) |
| e. | Oil pressure | - $Kg/cm^2$ (psi) |
| f. | Compressor Speed | - RPM |

**2. Compressor motor**

| | | |
|---|---|---|
| a. | Rated capacity | - HP |
| b. | Rated volts | - Volts |
| c. | Rated current | - Amps |
| d. | Starting current | - Amps |

**3. Inside unit**

| | | |
|---|---|---|
| a. | Air velocity | - M/Hr. (FPM) |
| b. | Face area | - $M^2$ (SFT) |
| c. | Air quantity | - $M^3$/Hr. (CFM) |
| d. | Entering air temp. DB | - $^oC$ ($^oF$) |
| e. | Entering air temp. WB | - $^oC$ ($^oF$) |
| f. | Leaving air temp. DB | - $^oC$ ($^oF$) |
| g. | Leaving air temp. WB | - $^oC$ ($^oF$) |

**4. Filters**

| | | |
|---|---|---|
| a. | Total area | - $M^2$ (Sft) |
| b. | Effective area | - $M^2$ (Sft) |
| c. | Velocity of air | - M/Hr (FPM) |
| d. | Quantity of air | - $M^3$ (CFM) |

## 7.8 TECHNICAL DATA

**(To be submitted along with the tender)**

**1** The following data shall be furnished along with the offer: (REFER LIST OF APPROVED MAKES)
(Attach catalogues, brochures, etc.)

**2. Ductable split unit**

Manufacturer

Model

Actual capacity TR

Overall dimensions

Over all weight

Operating weight

Refrigerant

**Compressor**
Manufacturer

Model

Type

Capacity at the specified water temp. and flow rates - in TR

Type of capacity control provided

Type of lubrication

KW / TR

**Motor**
Model
Manufacturer
Number of motors
Capacity HP
Whether provided with part winding
Type
Class of insulation
Speed RPM

Characteristics
Type of starter
Rating
Whether the following protections are provided.

| | | |
|---|---|---|
| i) | Overload | Yes/No |
| ii) | Under voltage | Yes/No |
| ii) | Single phase protection<br>(for three phase motor starters) | Yes/No |

**Inside units**

Manufacturer
Model
Type of fan
Fan speed (R.P.M.)
No. of fans.
Fan wheel diameter (mm)
Drive arrangement
Material and thickness of fan wheel and blades.
Materials and thickness of housing.
Fan outlet area
Outlet velocity.
Total air quantity
Static pressure at outlet. (mm. of water)
Whether statically and dynamically balanced.
B.H.P. Consumed
Total weight of all items

**Cooling Coil**

Material of Tubes
Material of fins
Tube diameter
Tube thickness

Fin thickness
Method of bonding of fins
No. of fins/cm.
Total tube surface outside
Test pressure
Coil face area

**Filter**

Manufacturer
Type of filters

Filter medium
Material of frame work and its thickness
Face area
Face velocity across filters
Pressure drop across filters (mm of water)

**Motor**

Manufacturer
Model
Number of motors
Capacity HP
Type
Class of insulation
Speed RPM
Characteristics
Type of starter
Rating
Whether the following protections are provided.

| | | |
|---|---|---|
| i) | Overload | Yes/No |
| ii) | Under voltage | Yes/No |
| iii) | Single phase protection (for three phase motor starters) | Yes/No |

Note : Any other data relevant to each equipment shall also be furnished.

## APPROVED MAKES OF ITEMS

| | | | |
|---|---|---|---|
| 1. | AC –Hi-wall split units | - | Carrier/Hitachi/ETA/Daikin/Mitsubishi/ Bluestar/Voltas/Samsung/LG |
| 2. | Three phase motors | - | Siemens/Kirloskar/Crompton/Bharath Bijlee /ABB /Alsthom |
| 3. | GI Sheets | - | SAIL/TATA/JINDAL |
| 4. | Resin bonded Glass wool | - | UPTWIGA /Owens Coning/KIMMCO |
| 5. | Grilles/Diffusers | - | Airmaster/Carryaire/Air Flow/Sachins Ravistar |
| 6. | Pressure gauges | - | Feibig/H-Guru/Jaspin |
| 7. | Industrial type thermometers | - | Feibig/H-Guru/Jaspin |
| 8. | Nitrile rubber insulation | - | Armaflex/K-flex/Totaline |
| 9. | Filter | - | Promac/Dyna or equivalent |
| 10. | Paints | - | ICI/Asian/Berger |

## TECHNICAL SPECIFICATIONS
## FIRE HYDRANT&AUTOMATIC DETECTION SYSTEM

### 8.1 SCOPE OF WORK

The scope of the work covers, supply of materials, installation, testing and commissioning of Fire Hydrant & Automatic Fire Detection and Alarm system inside the **Corporation Stadium at Thrissur.**

Copies of drawings of buildings and schedule of quantities are enclosed in the tender document. All the equipment and installation shall conform to specifications contained in Indian Standards.
The installation of Fire Hydrant &Detection systems shall conform to norms as per NBC. The scope of work also includes obtaining initial and final approvals (NOC) for the system from local authorities like State Fire Dept. and liaison works with the departments.

In General the scope of Work includes the following.

1. Pumps and accessories.
2. Internal Fire Hydrant System
3. Hand Held Appliances.
4. Automatic Fire Detection and alarm system.

Without restricting the generality of the foregoing, the work shall include the following.

1. Hydrant system covering the entire building and consisting of the following:

a) Electric Motor Driven Main Pump-2280 Lpm at 55m head.

b) Diesel Engine Driven Stand by Pump-2280 Lpm at 55m head.

c) Electric Motor Driven Jockey Pump-180Lpm at 55m head.

d) Electric Motor Driven Terrace Pump -450 Lpm at 35 m head.

e) Suitable electrical panel and instrumentation for automatic operation of pumps and incorporating Generator supply for running electric main pump as Detailed in technical specification.

f) Cabling from electrical panel to electric main pump, Jockey pump, Battery charger of diesel engine. Cabling to terrace pump from starter panel. The scope also includes supply of starters and isolators for terrace pump.

g) Internal hydrant system inside the building consisting of MS pipes of suitable diameter as detailed in BOQ and drawings, Landing valves in each Floor accompanied by I no. of swinging Hose reel, 2 nos. of RRL hose & Branch pipe in hose box.

h) Underground piping from Riser in the building to Fire Brigade Inlet Breeching point in the vicinity of the building.

i) Hand appliances as specified in bill of quantities.

j) Automatic fire detection and alarm system consisting of smoke and heat detectors, Manual call points, Hooters, Central Fire Alarm panel and control cabling.

k) Preparation of drawings and liaison works for Obtaining statutory approval from local fire authority for the fire hydrant and detection system in the building.

## SECTION – I - FIRE HYDRANT SYSTEM

### 9.1 STANDARDS

The manufacture, identification of material and testing of equipment covered in this specification shall comply with the latest editions as on date of opening of tenders of the appropriate standards of the following. Unless otherwise specified, Indian Standards are preferred. All the appliances and accessories shall carry IS or International certification and shall be of approved make.

| | |
|---|---|
| IS: 1239 | Mild steel, black ERW pipes, with fittings. |
| IS: 3589 | Mild steel, black ERW pipes 200 mm dia, and above, with fittings. |
| IS 4984 | HDPE pipes |
| IS 4985 | PVC pipes |
| IS: 10221 | Code of practice for coating and wrapping of underground mild steel pipelines |
| IS: 823 | Welding procedure |
| IS: 2062 | Steel for General Structural Purposes |
| IS: 780 | Cast iron sluice valve |
| IS: 903 | Nozzle, Branch pipe, Female and Male couplings (Gun metal) |
| IS: 5290 | Fire hydrant valve, gunmetal with cap & GI chain. |
| IS: 908 | Fire hydrants |
| IS: 8423 | Water shield controlled percolation hose. |
| IS: 325 | Induction motors |
| IS: 900 | Installation of motors |
| IS: 13947 | SDFUs |
| IS: 1554 | PVCAPVC Al. power/control cables |
| IS: 1652 | Batteries |
| IS: 694 | PVC insulated cables (light duty) for working voltage upto 1100 volts. |
| IS: 1554 | PVC insulated cables (heavy duty) for voltage upto 1100 volts. |
| IS: 1554 | — do — for voltage 3.3 kV to 11 kV |
| IS: 5959 | Specification for polyethylene insulated PVC sheathed heavy-duty electric cables, voltage not exceeding 1100 V |
| IS: 5959 | — do — voltage 3.3 kV to 11 kV |
| IS: 5578 | Guide for marking of insulated conductors |
| IS: 1255 | Code of practice for installation and maintenance of power cables. |
| IS: 3043 | Code of practice for earthing. |
| IS: 5216 | Guide for safety procedures and practices in electrical work. |

In case where the offer deviates from the specified standards, the tenderer shall indicate clearly in the offer the alternative standards proposed to be adopted and details thereof.

Unless otherwise mentioned, all applicable codes and standards shall be of the latest editions as published by the Indian Standards and all other such as may be published by them during the tenure of the contract, and shall govern in respect of workmanship, properties of materials, installation and methods of testing. In case where suitable Indian Standards or TAC norms are not available, generally accepted codes and practices as approved by the Purchaser shall be adopted. Any

changes or modifications directed by the Purchaser shall also be incorporated by the contractor during execution of the work.

## 9.2 PUMPS AND ACCESSORIES

Pumps shall be direct-coupled and not belt-driven. Parts of pumps like impeller, shaft sleeve, wearing sleeves, etc. shall be of non-corrosive metal such as brass or bronze. Pumps shall be capable of furnishing not less than 150% of the rated capacity at a head not less than 65 % of the rated head. The shut-off rate shall not exceed 120% of the rated head in the case of horizontal pumps. Each pump shall be provided with a nameplate showing the delivery head, capacity and the rpm. Pumps shall be securely mounted on a robust bedplate of horizontal type with ant vibration pads, and shall be free from vibration at all varying loads. Suitable RCC foundation shall be provided for all pumps, the drawings of which are to be submitted to the client/Consultant for approval before construction at site.

The main electric pump shall be powered by diesel generator whereas the Jockey pump and battery charger of standby Diesel engine driven pump shall be fed from KSEB supply. The diesel Engine standby pump, electric motor driven main pump, Diesel Generator and Jockey Pump shall be interconnected through pressure switches such that in the event of low system pressure the sequence of operation of pumps as specified in section 3 of "Inspection and Testing Of Hydrant System" is achieved. The terrace pump shall be manually operated in case of an emergency.

The construction of suitable electric panel and allied accessories like pressure switches, cables etc for Automatic operation of pumps in the mentioned sequence is included in the scope of the contractor. However the feeding of KSEB supply and DG supply to the panel is not included in the contractor's scope. The supply of starters and, cabling from panel to pumps is included in the scope of the contractor.

The Jockey pump shall have automatic starting and stopping arrangements to maintain the system pressure. In the event of low system pressure upto $5kg/cm^2$, the jockey pump shall operate to maintain the pressure. Sequence of operation of pumps is mentioned in the section 'Inspection and Testing'. .

## 9.3 DIESEL ENGINE FOR PUMPS

The diesel engine shall start automatically but it should have manual hand starting facility also along with all standard equipment and accessories like water circulating pump, lub. Oil filter, oil cooler, fly wheel housing, governor, tachometer, radiator, thermostat, etc. Engine shall also have standard safety devices like temperature gauges, automatic shut down for over speed, lub. Oil pressure gauge, stopping arrangement, etc. The engine shall be capable of operating continuously on full load for a period of 8 hours. The engine shall be provided with an adjustable governor to control the engine speed within 10% of its rated speed under any condition of load up to full load rating. The governor shall be set to maintain rated pump speed at maximum pump load. It shall also be provided with an in-built tachometer to indicate RPM of the engine. It shall be securely mounted on a robust bedplate of horizontal type, and shall be free from vibration at all varying loads.

The cooling system for the engine shall be air-cooled radiator with a multiple fan belt driven from the engine. The number of belts shall be such that even when half of the belts are broken the engine shall be capable of driving the fan. The air intake shall be fitted with a filter of adequate size to prevent foreign matter entering the engine. The exhaust shall be fitted with a suitable silencer and the total backpressure shall not exceed as per the engine manufacturer's recommendations. When the exhaust system rises above the engine, means shall be provided to prevent any condensate flowing into the engine. The engine fuel oil shall be of quality and grade specified by the engine manufacturer. Provisions shall be made for two separate methods of engine starting, namely:

a. Manual starting and
b. Automatic starting by means of a battery powered electric starter motor having automatic repeat start facilities. The battery capacity shall be adequate for 10 consecutive starts without recharging with a cold engine under full compression.

## 9.4 BATTERIES AND BATTERY CHARGER

9.4.1 General

The battery charging equipment (transformer rectifier unit) shall be provided to charge the batteries required for Diesel Engine starting and it shall be inter connected to the MCC/Panel board.

9.4.2 Construction

The battery charging equipment shall be part of the diesel engine control panel.

9.4.3 Operation

The battery shall normally be in parallel with a constant voltage float (trickle) charger of adequate capacity to meet the continuous loads and to keep battery in fully charged capacity under all the conditions of system variations.

A boost charge shall be provided for initial charging and re-charging the batteries when they are in 'run-down' condition. A selector switch for selecting 'float charge' and 'boost-charge' shall also be provided on panel.

9.4.4 Accessories

The following instruments shall be mounted on the charging panel:
Voltmeter with protective HRC fuses and Ammeter

9.4.5 Lead Acid Battery

The battery cells and charging equipment will be housed in separate units. The battery shall be in accordance with IS 1652 'Specifications for Stationary cells and batteries lead acid type'.

9.4.6 Construction

i. Batteries shall be of lead acid stationary type, indoor, comprising enough number of cells for the required output of 12 V. The battery shall be complete with inter-cell connectors, acid level indicating floats, filter vent plugs, etc.

9.4.7 Capacity

The battery ampere-hour rating shall suit the required duty but not less than 180 AH. The discharge rate shall take into account the maximum load imposed during starting of engine, together with steady load.

9.4.8 Accessories and tools for battery

The following accessories and tools required for battery and shall be supplied by the Contractor:

i) Hydrometer, syringe type, suitable for testing specific gravity of the electrolyte.
ii) Thermometer, with specific gravity correction scale.
iii) Acid level indicator.
iv) Center zero 3-0-3 voltmeters.
v) Any other accessories considered necessary/desirable.

## 9.5 HYDRANT SYSTEM AND PIPING

9.5.1 MS Pipes

The MS pipes used shall be of standard IS 1239, heavy-duty type (Class C), electric resistance welded and shall be free from scale, cracks, surface flaws and other defects. For pipes 200 mm dia. and above IS 3589 Class '2' shall be applicable.

9.5.2 Exposed/Above ground (AG) pipes

Exposed/Above ground (AG) pipelines and fittings shall be coated with two coats of oil primer and two coats of enamel paint as per IS approved colour code. The surfaces shall be properly cleaned before applying the primer. AG pipes shall be supported at regular intervals on masonry, RCC, truss, beams, roofs, trenches etc. Air release valves shall be provided in the hydrant lines at an interval of 50 m. The spacing of supports shall be as shown below: -

Pipe dia. in mm
80, 100 and 125 : 3.5 m
150, 200 and 250 : 5.0 m
Above 250 mm : 7.0 m

9.5.3 Under ground (UG) pipes

Underground pipes shall be laid such that the top of the pipe is not less than 1 m below the ground level. Pipes shall be supported by PCC blocks (1:2:4) of size 250 mm x 250 mm x 200 mm at intervals of 3.5 m in trenches. The bends and joints

shall also be supports at both sides. Mains shall not be laid under buildings. The underground pipes shall be applied with standard anti-corrosive treatment as described below. Air release valves shall be provided in the hydrant lines at an interval of 50 m.

9.5.4 Anti-corrosive treatment for UG pipes

For applying anti corrosive treatment, pipes are initially wire brushed to remove all foreign matters. It shall be with two coats of asphaltic primer and the primer shall be allowed to dry until the solvent evaporates and the surface becomes tacky. Then the pipes are wound with polymeric mix of approved make to a thickness of 4 mm. The mix shall be wound around the pipes and the overlap is maintained at 15 mm. The material shall conform to IS 10221

9.5.5 Flanges

The flanges shall be of heavy-duty type manufactured from material as per standards mentioned having flat face as per requirement and its dimensions shall also satisfy appropriate standards. All bolt holes in flanges shall be drilled. The drilling of each flange shall be in accordance with relevant Indian Standards. The gaskets used in all flange joints shall be of standard size and are to be approved, verified and checked before use. Fixing of gasket is to be as per standard procedures so as to ensure efficient and quality type joints. The flange faces shall be true and perpendicular to the axis of the pipes, and if due to other various reasons, such as, but not necessarily limited to the process and / or layout requirements, it is not feasible, the Contractor shall ensure that the joints shall be drawn up in order to provide even and adequate uniform pressure on gaskets. All flanges shall be installed such that the bolt holes straddle the normal centerlines.

9.5.6 Welding procedure

The welding procedure shall only be carried out by fully trained and experienced welders and shall conform to IS-823. Purchaser reserves the right to set the correct welding procedure, if not satisfied. The welding electrode shall be of reputed make, and shall have suitable coating complying with relevant Indian Standards.

9.5.7 Air cushion tank

The air cushion tank shall be of 300 mm dia. and 1500 mm height fabricated out of 8 mm MS sheet steel and shall be complete with 20 mm dia. air release valve and associated piping work, etc. It shall be constructed with air outlet at the top. Drain valves of gunmetal shall be provided at the lowest points of the piping work to enable draining of water from the system. The drain valves assembly shall include nipple and PVC rubber hose.

9.5.8 Diesel tank

Diesel tank shall be fabricated out of MS steel sheet of thickness 4 mm with inlet, outlet, open / close valves, by-pass lines, clear level indicators, drain pipes, MS ¼" fuel lines to the diesel engine, etc. The same shall be installed at a suitable height in the pump house with necessary supports. The drawings of the tank shall be got prepared and approved before fabrication and installation.

9.5.9 Butterfly Valve (BV)

It shall be of Cast Iron Body, Nitrile seat, SG iron Disc for water purpose and Wafer type. Pressure class shall be of PN 1.0 and tested to15 kg/Sq.cm pressure. The valve shall be hand lever operated.

9.5.10 Non-Return Valve (NRV)

It shall be of IS 5312 standards. Construction shall be of swing type with bolted cover for water purpose and wafer end construction. Pressure class shall be of PN 1.0 for water purpose and Wafer type.

9.5.11 Ball Valve

The valves shall be of full bore type and of quality approved by the Consultant/Owner. The body and ball shall be of copper alloy and stem seat shall be of Teflon.Pressure class shall be of PN 1.0. End connection shall be of screwed type.

9.5.12 Pressure gauges

It shall be of dial type with Bourden tube element of SS 316. The dial size shall be 150 mm dia. and scale division shall be in metric unit marked in black on white dial. It shall be comprised with snubber, isolation coke, nipples, tail, connecting pipes, etc.

9.5.13 Pressure switches

It shall be of industrial type, single pole, double throw electric pressure switching designed for starting or stopping equipment within the pressure of the system drops or exceeds the pre-set limits. All switches shall have ¼" BSP (F) inlet connection and screwed cable entry for fixing cable gland.

9.5.14 Hydrant valves

The external/internal fire hydrant valves shall be of oblique type single headed of 63 mm dia. conforming to IS-5290 suitable for connecting to 80 mm pipe. The hydrant shall be complete with hydrant valve, orifice plate, other fittings, etc. The hydrant couplings shall be flanged gunmetal with instantaneous female spring lock of 63 mm dia. and valves shall be of screw down type. Orifice plates of suitable design shall be provided for hydrants where pressure exceeds 7 Kg per Sq. cm.

The number of fire hydrants in a main of 80 mm dia. shall not feed more than one hydrant, that having a dia. of 100 mm shall not feed more than two hydrants, that having a dia. of 125 mm shall not feed more than three hydrants. The pressure at the most highest end hydrant in the hydrant mains shall be restricted to 3.5 Kg per Sq. cm. All hydrant outlets shall be situated 1 m above ground level.

9.5.15 Hose reel

The hose reel shall consist of 30 m long 20 mm dia. Thermo plastic(Textile Reinforced)hose mounted on heavy duty circular MS drum complete with gun-metal shut-off valve, nozzle, etc. The hose reel bracket shall be of MS fabricated or cast iron swing type suitable for 90 deg. smooth and free rotation in vertical plane conforming to IS-884.

9.5.16 Hose boxes

The fire hose boxes shall be of size 750x250x600 mm, 16 SWG sheet steel with front side glass of 4 mm thick, lockable hinged door and painted with one coat of primer and two coats of synthetic enamel paint of approved colour.

9.5.17 Couplings

All couplings shall be of the instantaneous spring-lock type and the nozzles shall be of not more than 16 mm in dia. All couplings in the branch pipes and nozzles shall be of gunmetal and shall comply with IS-903. The hose shall be attached to the coupling. Spare hose and nozzles to the extent of 10 % of the total requirements shall be supplied by the contractor as per BOQ.

9.5.18 Foot valve

It shall conform to IS: 4038 standard and shall be ball type, C.I. metallic and with G.M. trim & grey C.I. /galvanised steel perforated screen with flanged connection, nut bolts, gasket, washers etc. to be connected only for negative suction. It shall be tested certified for hydrostatic test pressure, for Body: 8.5 kg/$cm^2$ and Seat: 2 kg/ $cm^{2.}$

9.5.19 Fire brigade outlets

The fire brigade collective breaching shall be with 150 mm flange outlet connection with gunmetal twin-Siamese collecting head having 4 instantaneous outlets with built-in check valves. The fire brigade breaching shall be connected to the sump and the main header.

9.5.20 Delivery Hose

Delivery Hose for fire fighting. 100% synthetic hose 63 mm dia 15 m long confirming to IS 636 1988. Type A circular woven jacketed rubber lined Hose, with instantaneous male and female gun metal coupling and copper wire binding. Both hose and coupling shall confirm to relevant Indian Standards and shall have ISI marking.. Also have burst pressure 35 Kg/$cm^2$ and working pressure of 14 kg/$cm^2$.

## INSPECTION AND TESTING
## (Hydrant System)
## (Amended specifications)

**9.6 Inspection**

9.6.1 General

All site fabricated work/ material shall be subject to inspection in cleaned condition, prior to erection. At no event, site fabricated work /material shall be installed in position without inspection and approval by Purchaser. The Contractor shall ensure that each stage of fabrication is carried out in compliance with the procedures specified in the IS / NBC standards as applicable and/or specified in this document.

The contractor shall conduct sample tests of all the materials supplied at reputed laboratories/agencies as directed by Purchaser at his own cost and test reports are to be submitted. Inspecting offiNGSs of Purchaser and Local Authorities shall have the right to access the premises of the work at any time with or without giving prior notice. All the formalities or procedures for conducting the inspections by the authorities as required by them shall be arranged by the contractor free of cost.

All testing shall be carried out in the presence of Purchaser / statutory authorities and test registers shall be maintained by the contractor. The contractor shall provide all material, tools, equipment, instruments, services and personnel required to perform the tests and remove debris/water resulting from cleaning and after testing free of cost

The original test certificates of all tests conducted are to be forwarded to Purchaser. After conducting the tests, any defects found on materials, equipment, piping, etc. shall be got rectified/ repaired by the Contractor without any extra cost.

9.6.2 Testing

Before energizing electrically operated equipment, care shall be taken to meet the local electrical rules and regulations, earthing of the body, verifying availability of safe insulation resistance value, etc. Also confirm the motor enclosure to the level of protection required for the particular application.

a. Pumps

The pumps shall be tested according to the standard recommendations of the manufacturer. The following parameters are to be recorded and plotted and submitted to the Purchaser.

a. Discharge Q

b. Pressure P or Head H

c. Motor voltage and current.
d. Efficiency

The power consumption is to be computed and crosschecked with manufacturer's data. Any abnormalities, if noted, shall be brought to the notice of the manufacturer and necessary corrective action be taken before commissioning and handing over, without any extra cost. Manufacturers test certificates shall also be submitted to Purchaser for verification.

b. Piping

All piping shall be tested by filling water, removing air locks, foreign materials, etc. and applying pressure at 1.5 times of the maximum working pressure and see that the pressure drop is within 0.5 Kg per Sq. cm over a period of 2 hours. The testing shall be carried in sections by blocking both ends or closing the valves provided. After completion of the installation and connecting to the mains of pumping system the installation shall once again tested and rectify breakage if any or replace the defective material, free of cost.

At least 10% of the total weld joints on pipes shall be tested by radiography as per TAC requirement. Holiday tests may preferably be carried out by flexible and detachable ring probe, which shall enable the entire 360 deg. of the surface of the pipe to be scanned.

c. Electrical system

The following tests are recommended:-
i) Earth resistance
ii) Cable Insulation

Trial run and testing of diesel engine.

Resistance of metal conduits/sheaths (Earth continuity test)

Insulation of the cables shall be not less than one mega ohm when tested with a 500 volts meggar for any particular section of the wiring.

In case of cables encased in metal conduit or metallic sheathing, the total resistance of the conduit or sheathing from the earthing point to any other position in the completed installation shall not exceed 2 Mega Ohms.

d. Hydrant system
The entire hydrant system shall be tested in the presence of Purchaser to ascertain the functioning of each system, equipment, etc. as desired by Purchaser. The contractor shall hand over the system only if it is proved that the system performs as per the specifications.

9.6.3 Operation of pumps

All the pumps shall be operated by both auto /manual modes, and shall have automatic starting and stopping arrangements to maintain the system pressure.
Jockey pump shall not be in operation while the main pump is in operation. Under normal conditions, the water pressure in the hydrant lines is 7 kg/sq.cm, and the auto/manual switch shall be in the auto mode. When the pressure drop is upto 5 kg/sq.cm. the jockey pump shall start automatically through pressure switch arrangements and when pressure develops to 7 kg/sq.cm the pump shall stop automatically.

The main electric driven pump and diesel Engine Generator shall be interconnected through pressure switches and necessary control wiring such that in the event of a system pressure below 5 kg/sq.cm,the DG set is triggered and the power supply for the functioning of Main electric pump is released.The Diesel Engine driven main pump is so interlinked with the above system such that the latter shall operate automatically only in case of failure of starting of the former within a specified switchover time or fall in pressure. The pump shall not be stopped automatically afterwards, and it shall be stopped only manually. The pumps shall be suitably interlocked to prevent simultaneous operation .

The Terrace pump shall not operate automatically it shall only be manually operated in case of emergency.

The contractor shall carry out necessary arrangements for supply and installation of items required like timer switches, sensors, cables, etc. and control wiring between pressure switches and panels to operate the pumps as described above. The cost for the same shall be included in the total contract value.

## 9.7 AUTOMATIC FIRE DETECTION AND ALARM SYSTEM

### 9.7.1 STANDARDS

The manufacture, identification of material and testing of equipment covered in this specification shall comply with the latest editions as on date of opening of tenders of the appropriate standards of the following. Unless otherwise specified, Indian Standards are preferred. All the appliances and accessories shall carry IS or International certification and shall be of approved make.

NFPA 72E Standards on automatic fire detection.

IS:2189 Code of practice for selection, installation and maintenance of automatic fire detection and alarm system.

**IS: 823 Welding procedure**

IS: 1652 Batteries

IS: 694 PVC insulated cables (light duty) for working voltage upto 1100 volts.

IS: 1554 PVC insulated cables (heavy duty) for voltage upto 1100 volts.

IS: 5959 Specification for polythelene insulated PVC sheathed heavy duty electric cables, voltage not exceeding 1100 V

**IS: 5578 Guide for marking of insulated conductors**

IS: 3043 Code of practice for earthing.

IS: 5216 Guide for safety procedures and practices in electrical work.

In case where the offer deviates from the specified standards, the tenderer shall indicate clearly in the offer the alternative standards proposed and details thereof.

Unless otherwise mentioned, all applicable codes and standards shall be of the latest editions as published by the Indian Standards and all other such as may be published by them during the tenure of the contract, and shall govern in respect of workmanship, properties of materials, installation and methods of testing. In case where suitable Indian Standards are not available, generally accepted codes and practices as approved by CLIENT/CONSULTANT shall be adopted. Any changes or modifications directed by CLIENT/CONSULTANT shall also be incorporated by the contractor during execution of the work.

Automatic fire detection and alarm system consists of fire control panel, detectors, manual call points, hooters, isolators, response indicators, etc. The equipment and cables of the system shall be independent of any other system in the premises and shall not be shared with any other system. The fire detection and alarm system shall be installed as per NFPA 72E / IS-2189 code.

### 9.7.2 Detectors

The fire detectors shall be of analogue addressable type to detect one or more characteristic of fire like smoke, heat or flame. It shall be sleek, suitable communication technique with noise immunity, built-in functional test switch, microprocessor based technology, mechanically integrated photoelectric and ionisation shared volume smoke chamber, etc. All types of detectors shall be of both

electronically and manually programmable type using dipswitches or handheld programmer or from fire control panel. Reversed polarity or faulty zone wiring shall not damage the detector. The detector shall have no moving parts of components subject to wear. It shall be possible to test the detector in the field. The response of a detector shall always be clearly visible from outside by a flashing light on the base. The detector shall connect to the control unit via a fully supervised two-wire circuit. A built barrier shall prevent entry of insects into the sensor. The detector shall be designed for fast and simple cleaning.

All electronic circuits must be solid-state devices and virtually hermetically sealed to prevent their operation from being impaired by dust dirt or humidity. All circuitry must be protected against usual electrical transients and electromagnetic interference. All radioactive parts of the source, if any, shall be fully gold plated. The detector shall be inserted into or removed from the base by a simple push-twist mechanism to facilitate easy exchange for cleaning and maintenance.

The smoke & heat detectors shall fit into a common type standard base. The standard base shall be supplied with a seal plate, preventing dirt, dust, condensation or water reaching the wire terminals or the detector points. Detectors shall be provided with a MS box for entry and termination of armoured cable and to protect detectors terminals.

At the time of installation and prior to commissioning, every detector shall be allotted an identification number. All detectors shall have LED blink when it is addressed. Detectors shall not be either partially or totally recessed in ceiling or wall. Detectors shall be suitably protected where they are liable to be subjected to mechanical damage. Detectors should not be painted or coated or covered in any manner after installation, as this will adversely affect the sensitive of operation.

Smoke detectors

It shall be of optical-cum-thermal type. Smoke detectors shall quickly respond to smoke containing small particles normally produced and heat likely to be generated and automatically adjusts sensitivity without needing operator intervention.

**Heat detectors**

It shall be of fixed cum rate of rise temperature type. Heat detectors shall be Suitable for use in situation where sufficient heat is likely to be generated and Damage caused by heat generated is more.

## 9.8 Loop Hooters

The loop hooters shall be so arranged that when any alarm operates all the hooters through out the premises shall be activated. The hooters at the fire alarm shall be electronic type having frequency of suitable frequency range. The hooters shall be capable to produce a sound output of 90 db at 1 m. Hooters shall be of loop powered and no separate power is provided.

'Fault' alarm and 'Fire' alarm in a panel sounder shall be distinctly different. Fire alarm sounders shall not be used for any purpose other than for fire operations. When installed flush with a false ceiling these shall match the ceiling surface. Necessary provisions such as wooden boxing or frame work, if required, to accommodate the sounders shall be made in the ceiling in advance.

These shall be installed at a height not lower than 2.4 m, except when recessed in a false ceiling of lower height. In such cases the sounders shall be recessed at false ceiling level.

The panel sounders in the respective panels shall be actuated automatically as soon as fire alarm signal is initiated from any trigger device connected to them. These shall also be sounded when there is a fault alarm signal within their areas of control. The sound shall be continuous and of the same characteristics from all fire alarm sounders in a building.

9.9 Loop Isolators

Loop isolators shall be designed to protect one area or a number of devices, which are consecutively wired in a loop. Its function is to isolate a section of the loop if a problem develops within that section, allowing the remainder of devices connected on the loop to function correctly. Loop isolators shall be provided after every 20-30 devices in each loop.

9.10 Manual Call Points (MCPs)

It shall be of Re-settable type via special key, with fire resistant back box for surface mounting.The MCPs shall be recess mounted suitable to support the intelligent addressable panel. It shall form an integral part of the fire detector system. The housing shall be dust/vermin proof properly sealed. MCPs shall be easily resetable with key. The MCP should have clear instructions imprinted on it about the operational steps in case of fire.

**9.11 Installation requirements: -**

Manual call points shall be located at exit space and shall be installed at a height of 1.4 m above the floor at an easily accessible position. They shall be installed at easily accessible, well-illuminated positions, preferably in a contrasting background so that they are easily noticeable from either direction. They may be semi-recessed so as to project by 10mm. They shall be installed free from obstructions.

9.12 **Fire Control Panel**

The fire alarm control panel shall be of microprocessor controlled and of modular hardware design of intelligent addressable type. It shall be housed in a steel enclosure. It shall also be finished with hard wear textured epoxy paint/ powder coated. Cable entries shall be provided on the top and bottom of the panel.

The system capacity shall be based on the number of devices and control modules. Each device in the system shall be identified by its unique address position on the

two-wire loop. The panel retains command over the alarm process, LED indicators, automatic test feature and loop hooters. The panel shall be of software programmable.

**9.13 The panel shall be capable of:-**

(a) Programmable at site.
(b) Automatic system test activates
(c) Detector sensitivity adjustments
(d) Alarm verification
(e) Alpha/numerical display
(f) Relay control module
(g) Maintenance alert facilities

The manufacturer of fire control panel, detectors and other detection devices shall have own or authorized service centre in India with spares for carrying out maintenance service during the guarantee and maintenance periods. The tenderer shall submit a brief write-up of the service centre facilities available in India along with the tender.

**9.14 Power Supply of panel**

The power supply shall drive the system from either the main electrical supply single-phase supply or the standby power supply. The standby power supply shall be derived from exclusive SMF back-up batteries of reputed make. Standby power supply shall be capable of maintaining the system in normal operation having a period of not less than 24 hrs.after the failure of normal main supply.

**9.15 Control Cable**

The control cable for wiring fire alarm system shall be of 650 Volt grade. Cables shall be laid as per relevant installation standards. The sizes of these cables are specified in schedule of requirements. It shall be of FRLS armoured copper cable.

9.16 **Cable Glands**

Cable glands shall be of heavy-duty single compression type of brass, chrome plated. These shall have a screwed nipple with conduit electrical thread and check nut. These shall be suitable for armoured/unarmoured cables, which is being used.

9.17 **Cable Connectors**

Cable connectors, lugs/sockets, shall be of copper/aluminium alloy, suitably tinned, solder less, crimping type. These shall be suitable for the cable being connected and type of function (such as power, control or connection to instruments, etc.)

## 9.18 INSPECTION AND TESTING
## (Fire detection and alarm system)

### 9.18.1 INSPECTION

All materials shall be offered for inspection in cleaned condition, prior to erection. At no event, site fabricated work /material shall be installed in position without inspection and approval by NGS. The Contractor shall ensure that each stage of fabrication is carried out in compliance with the procedures specified in the IS standards as applicable and/or specified in this document.

The contractor shall conduct sample tests of all the materials supplied at reputed laboratories/agencies as directed by NGS at his own cost and test reports are to be submitted. Inspecting officials like NGS, Local Authorities shall have the right to access the premises of the work at any time with or without giving prior notice. All the formalities or procedures for conducting the inspections by the authorities as required by them shall be arranged by the contractor free of cost.

All testing shall be carried out in the presence of NGS / statutory authorities and test registers shall be maintained by the contractor. The contractor shall provide all material, tools, equipment, instruments, services and personnel required to perform the tests and remove debris resulting from cleaning and after testing free of cost.

The original test certificates of all tests conducted are to be forwarded to NGS. After conducting the tests, any defects found on materials, equipment, piping, etc. shall be got rectified/repaired / replaced by the Contractor without any extra cost.

### 9.18.2 TESTING

**Fire Detection and Alarm System**

The entire fire detection and alarm system shall be tested for continuity and performance as per IS-2189 code. After installation, the visual inspection of all the detectors shall be made to make sure that they are properly installed. Each detector shall be inspected to ensure that it is properly mounted and connected. Heat detectors shall be tested to initiate an alarm by a heat source such as hair drier or a shielded heat lamp. After each heat test, the detectors shall be reset. Smoke detectors shall be tested to initiate an alarm at its installed location with smoke or other aerosol. All detectors found to have the sensibility outside the approved range shall not be used.

Detectors, control and indicating panels, sounders shall be tested at the manufacturer's factory and test certificate be furnished with the supply. Type test certificate to prove conformity to the relevant contract specifications shall be furnished with the supply, from recognised testing institutions or Govt. test bodies in India or abroad.

Following tests shall be conducted in the presence of NGS and the test certificate shall be furnished with the record of tests.

9.8.2.1 Continuity test

Test for insulation resistance of the wiring work and the control and indicating panels.

9.8.2.2 Test for system operation.

Tests for detectors shall be conducted using a test fire at normal floor level. The system operation for fault conditions shall be conducted by introducing faults such as open circuit, short circuit, removal of detector, open/short circuit in a sounder circuit etc. Tests relevant to loop isolators shall also be conducted to confirm that it functions as required.

### 9.18.3 Approval from statutory authorities

It is responsibility of the contractor to get initial final approvals / NOC for , fire hydrant and detection system, . from the concerned departments /local bodies. The contractor shall also do all the liaison works with the departments for getting the approvals/ NOC. All the incidental expenses in connection with the above shall be borne by the contractor with no extra cost to the NGS. For all approvals / NOC, statutory fees shall be paid by the contractor initially; however, it shall be reimbursed on submission of documentary evidences.

All testing/calibration, etc. are to be carried out as per the requirements of statutory authorities at no extra cost to NGS. The tests/calibration certificates shall be submitted, if required.

**TECHNICAL DATA**
**(Hydrant System)**
(TO BE SUBMITTED ALONG WITH THE TENDER)

**9.19. Diesel engine driven pump**

1.a Pump details

a) Make
b) Type
c) Model
d) Overall dimensions
e) Weight (Kgs)
f) Material
g) Pump casing
h) Impeller
i) Shaft sleeve
j) Base plate
k) Type and material of steel
l) Operating speed (R.P.M.)
m) Head (Mtr)
n) Efficiency
o) Performance curves (whether enclosed with the tender). Yes/No

1.b Engine details

a) Make
b) Model
c) HP
d) RPM
e) SFC
f) Oil consumption
g) Weight
h) Overall dimension
i) Exhaust pipe dia

**2. Battery & Battery Charger**

a) Make of battery charger
b) Make of batteries
c) Model No. of batteries
d) Voltage
e) AH
f) No. of batteries
g) Model No. of battery charger

**3. Electric motor driven pump**

1.a Pump details

a) Make
b) Type
c) Model

d) Overall dimensions
e) Weight (Kgs)
f) Material
g) Pump casing
h) Impeller
i) Shaft sleeve
j) Base plate
k) Type and material of steel
l) Operating speed (R.P.M.)
m) Head (Mtr)
n) Efficiency
o) Performance curves (whether enclosed with the tender).
p) Yes/No

1.b Motor details

a) Make

b) Model

c) HP

d) RPM

e) Weight

f) Overall dimension

g) Class of insulation

**4. Jockey pump**

1.a Pump details

a) Make
b) Type
c) Model
d) Overall dimensions
e) Weight (Kgs)
f) Material
g) Pump casing
h) Impeller
i) Shaft sleeve
j) Base plate
k) Type and material of steel
l) Operating speed (R.P.M.)
m) Head (Mtr)
n) Efficiency
o) Performance curves (whether enclosed with the tender).
p) Yes/No

1.b Motor details

a) Make

b) Model
c) HP
d) RPM
g) Weight
h) Overall dimension
i) Class of insulation

**5. <u>Terrace Pump</u>**

1.a <u>Pump details</u>

q) Make
r) Type
s) Model
t) Overall dimensions
u) Weight (Kgs)
v) Material
w) Pump casing
x) Impeller
y) Shaft sleeve
z) Base plate
aa) Type and material of steel
bb) Operating speed (R.P.M.)
cc) Head (Mtr)
dd) Efficiency
ee) Performance curves (whether enclosed with the tender).
ff) Yes/No

1.b <u>Motor details</u>

a) Make
b) Model
c) HP
d) RPM
g) Weight
h) Overall dimension
i) Class of insulation

**9.20 Makes and model numbers of following items**

**MS Pipe :**
**GI & MS fittings :**
**Butterfly Valve :**
**Ball Valve :**
**Foot Valve :**
**Non Return Valve :**
**Instrumentation :**
**Pressure guage :**
**Pressure switch :**
**Hardware :**
**Paint :**
**Polymeric mix :**

**Hydrant valve :**
**CP hose :**
**Branch pipe :**
**Hose Reel :**
**RRL hose :**
**Hose Box :**

9.21 Electrical Items

TECHNICAL DATA
(Fire detection and alarm system)
(To be submitted along with the tender)

Smoke Detectors
Make
Model No.
Size:
Operating temp range:
Voltage range:
LED display status:
Air velocity:
Protocol used
IP rating
Heat Detectors
Make
Model No.
Size:
Range:
Size of reflector
Operating temp range:
Voltage range:
LED display status:
Air velocity:
Protocol used
IP rating
Loop isolators
Make
Model No.
Spacing of isolators
Operating voltage
Temp. range
Size:
IP rating
Loop hooters
Make
Model No.
No. of tones
Sound output

IP rating
Size
MCPs
Make
Model No.
Size:
IP rating

Fire control panel
Make
Model No.
Maximum No. of programmable loops
Maximum No. of devices per panel
Maximum devices per loop
Maximum control cable length
Maximum resistance per loop
Length per loop
No. of slots for additional cards
Networking facilities
No. of repeater output
No. of hooters per loop
No. of isolators per loop
Operating voltage
Operating current
No. of display characters
Size
Weight
Battery (FCP)
Type of battery
Voltage V
Battery AH
Make of battery
Backup time of battery

Makes of following items

PVC insulated FRLS

Armoured Cu. Cable

PVC insulated armoured Cu. Cable

PVC insulated FRLS cu. wire :

PVC conduits :

MS conduits

## APPROVED MAKES OF ITEMS
## (Hydrant System)

| | |
|---|---|
| Motor | : Kirloskar/Siemens/ABB/Cromption Greaves |
| Pump | : Kirloskar/Mather & Platt/KSB/Beacon |
| Diesel engine | : Kirloskar/Leyland/ Greaves |
| MS Pipe | : Tata/Jindal/SAIL : |
| GI & MS fittings | : Tube weld/Tube products/Punjab steel/TNT |
| Valves | : Kirloskar / Advance/Audco/Intervalve / Leader |
| Pressure gauge | : Fiebig/H.Guru |
| Pressure switch | : Indfoss/Switzer/Schneider/Danfoss |
| Hydrant valve, Fire brigade point | : Minimax / Safex / Newage/Steelage/ Shah bhogilal |
| Branch pipe | : Newage/ Arihant/Shah Bhogilal/Steelage |
| CP hose | : Newage/Shah Bhogilal/ Safex/Steelage |
| Hose Reel | : Newage/Shah Bhogilal/Steelage/Safex |
| Hose cabinet | : Newage/ Zenith/Shah Bhogilal |
| Hardware | : TATA/Sundaram fasteners/GKW |
| Paint | : Asian/ICI/Nerolac/Berger |
| Polymeric mix | : IWL |
| Battery | : Exide/Amco/Prestolite/ Standard Furkawa |
| Battery charger | : Waves Electronics / Powerturn |
| Portable Fire Extinguishers | : Safex,Minimax,CeaseFire |

APROVED MAKES OF ITEMS
(Fire detection and alarm system)

| | | |
|---|---|---|
| Fire control panel / Detector with base /MCP / Loop isolator / Hooters/RI | : | Siemens/ Honeywell / Cerbrus / EST/ Edward/ simplex/ Essar (all UL or FM approved) |
| MS/PVC conduits | : | ISI marked. |
| FRLS Armoured Cable | : | Polycab,Finolex/Havells/RRKabel. |
| Battery | : | Exide/Prestolite/Standard Furkawa. |

**1.**

## 6.0 SCHEDULE OF QUANTITIES