

TENDER DOCUMENT

FOR

Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at “The Willows” Unitech Grande, Sector 96, 97 & 98 at Noida, U.P.

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SECTION-1

Notice Inviting Tender

Notice Inviting Tender (NIT)

M/s Unitech Limited (hereinafter referred to as the Employer), invites tenders from experienced and eligible agencies for Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at “The Willows” Unitech Grande, Sector 96, 97 & 98 at Noida, U.P.as per Schedule as under:

Sr. No.	Subject	Description
(i)	Tender Document No.	UL/KY/NOD/Willows/2023/232
(ii)	Bidding Process	Two envelope bidding System (i) To be uploaded/ filled as per the instructions given in e-Tendering Procedure at Annexure - III.
(iii)	Name of the Work	Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at “The Willows” Unitech Grande, Sector 96, 97 & 98 at Noida, U.P.
(iv)	Brief Scope of Work	Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at “The Willows” Unitech Grande, Sector 96, 97 & 98 at Noida, U.P.
(v)	Estimated Cost	Rs. 19.49 Crores
(vi)	Period of Completion	24 Months
(vii)	Earnest Money Deposit	Rs. 2.5 Lacs (In Words Two Point Five Lacs Bank Details of the Employer for Preparation of bank Guarantee only Name of Beneficiary:- Unitech Limited Bank:- ICICI Bank Limited Current A/c No 245105001682 IFSC Code:- ICICI0002451 CIF ID:- 587747798
(viii)	Non-refundable cost of Tender document	Rs. 10,000/- + GST@ 18% through e- payment gateway
(ix)	Non-refundable e-Tender processing fee	Rs. 5,000/- + GST@ 18% through e- payment gateway
(x)	Site Visit with PMC/ Employer	On 13-11-2023 at 11:00 Hrs (IST)
(xi)	Site Visit – Contact	Bidder may contact Mr. Sandeep Raina Contact No. 8800396076 for conducting site visit.

Sr. No.	Subject	Description
(xii)	Last date of receipt of Bidder's Queries in consolidated form	14-11-2023 on Email id :- Ky@unitechgroup.com
(xiii)	Pre-Tender Meeting (Time & Venue)	16-11-2023 at by 15.00 Hrs (IST)
(xiv)	Last date & time of submission of Online Tender	Up to 08-12-2023 by 16.00 Hrs (IST)
(xv)	Date & Time of Opening of Technical Bids	On 11-12-2023 at 11:00 Hrs (IST)
(xvi)	Intimation of technically qualified bids.	To be notified Later
(xvii)	Date & time of opening of Financial Bids of technically qualified bidders.	To be notified Later
(xviii)	Validity of offer	180 days from the date of opening of Technical Bid.

1.2 The tender document can be downloaded from the website www.unitechgroup.com

1.3 Corrigendum,if any, would appear only on the website and not to be published in any Newspaper.

2.0 Eligibility Criteria:

The interested bidders should meet the following qualifying criteria:

2.1 Work Experience:

- (i) Experience of having successfully completed similar works during the last 07 (seven) years ending previous day of last date of submission of tenders.
 - (a) Three similar works each costing not less than 40% of the estimated cost put to tender, OR
 - (b) Two similar works each costing not less than 60% of the estimated cost put to tender, OR
 - (c) One similar work costing not less than 80% of the estimated cost put to tender.

AND

“Similar works” shall mean “The works covering Electrical Sub-station work and Electrification work in external areas for Commercial/ Institutional/ Multi-storied residential buildings”.

Notes: -

- (i) The past experience in similar nature of work should be supported by certificates i.e. copies of Letter of Award & Completion Certificate issued by the respective Employer's organizations. In case, the work experience is of Private sector, the said certificates shall be supported with copies of Corresponding TDS Certificates. Value of work will be computed from the amount reflected in the TDS Certificates in conjunction with the completion certificate.
- (ii) The value of executed works shall be brought to the current level by enhancing the actual value of work done at a simple rate of 7% per annum, calculated from the date of completion to the date of submission of tenders including extension(s) given, if any.
- (iii) The values of completed work shall be exclusive of Service Tax/GST. Bidder shall produce documentary evidence against the Taxes & Duties applicable against the concerned job(s). In case the value of job submitted by the bidder does not have clarity with regard to inclusion/exclusion of Service tax/GST, the amount appearing in the Completion Certificate, the bidder shall provide statutory auditors certificates clearly stating the service tax/GST in the computation to arrive at the completed work value in conjunction with the completion certificate. In case where such certification is not provided or the completion certificate does not have clarity, the value of completed work shall be considered inclusive of applicable GST @18% tax and shall be evaluated accordingly.
- (iv) **Joint venture/ consortium of firms/ companies shall not be allowed, and the bidder should meet the above criteria himself.**
- (v) **Certificates of Subsidiary/ Group Companies:**
 - (a) Any company/ firm while submitting the bid can use the work experience of its subsidiary company to the extent of its ownership in the subsidiary company.
 - (b) In case, the companies/ firms, which intend to get qualified on the basis of experience of the parent company/Group Company, the same shall not be considered. However, for the purpose of clarification, the parent company by itself only can submit the bid.
 - (c) In case, the companies/ firms, which intend to get qualified on the basis of experience of their own works/in-house works, the same shall not be considered.
 - (d) In case of a Company/ firm, formed after merger and/ or acquisition of other companies/ firms, past experience and other antecedents of the merged/ acquired companies/ firms will be

considered for qualification of such Company/ firm provided such Company/ firm continues to own the requisite assets and resources of the merged/ acquired companies/ firms relevant to the claimed experience.

(vi) **Foreign Certificate:**

- (a) In case the work experience is for the work executed outside India, the bidders must submit the completion/ experience certificate issued by the owner duly signed & stamped and a self-attested undertaking towards the correctness of the completion/ experience certificates. The contractor shall also get the completion/ experience certificates attested by the Indian Embassy/ Consulate/ High Commission in the respective country.
- (b) In the event of submission of completion/ experience certificate by the Bidder in a language other than English, the English translation of the same shall be duly authenticated by Chamber of Commerce of the respective country and attested by the Indian Embassy/ Consulate/ High Commission of the respective country.
- (c) For the purpose of evaluation of bidders, the conversion rate of such currency into INR shall be arrived at by the daily representative exchange rate published by the IMF as of 7 (Seven) days prior to last date of Submission of bid including extension(s) given, if any.

2.2 Financial Strength:

- (i) The average annual financial turnover for the three best out of last five financial years, ending 31st of the March of the previous financial year, shall be at least 35% of the estimated cost put to tender. The requisite Turnover shall be duly certified by a Chartered Accountant/ Statutory Auditor with his Seal/ signatures and registration number. In case of Companies/ Firms less than 3 years old, the Average annual financial turnover shall be worked as relevant to the available period only.
- (ii) Net Worth of the company/ firm as on the last day of preceding Financial Year should be positive.

Net worth means paid-up share capital, Share Application Money pending allotment* and reserves # less accumulated losses and deferred expenditure to the extent not written off. Net worth has been calculated using the following formula.

Reserves to be considered for the purpose of Net worth shall be all reserves created out of the profits and securities premium account but shall not include reserves created out of revaluation of assets, write back of depreciation and amalgamation.

** Share Application Money pending allotment will be considered only in respect of share to be allotted.*

Paid up share capital	
Add: Share Application Money pending allotment	
Add: Reserves (As defined Above)	
Less: accumulated losses	
Less: Deferred Revenue Expenditure to the extent not written off	
Net Worth	

Notes:-

- (a) Self-certified copy of Bank Solvency Certificate issued from Nationalized or any Schedule Bank should be at least 40% of Estimated Cost of the Project put to tender. The certificate should have been issued within 6 months from the last date of the submission of the tender including extension(s) given if any.

Bank Solvency Certificate is not required if estimated cost put to tender is less than or equal to INR 25 Crore.

- (b) The bidders are required to upload and submit one page of summarized Balance Sheet (Audited) and also one page of summarized Profit & Loss Account (Audited) for the last three years.

3.0 The intending bidder must read the terms and conditions of this document carefully including the checklist at **Annexure-IV**. He should submit his tender only if he considers himself eligible and he is in possession of all the documents required. Information and Instructions/addendums for bidders posted on Website(s) shall form part of the Tender Document.

4.0 The Tender Document, as uploaded, can be viewed and downloaded free of cost by the intending tenderer. However, the tender can be submitted only after payment of (a) Non-refundable cost of tender document (b) Non-refundable Tender Processing Fee and (c) EMD through e-payment gateway & all other documents shall be as per Notice Inviting e-tender.

5.0 Set of Contract/ Tender Documents:

The following documents will constitute set of tender documents:

- (i) Notice Inviting e-Tender
- (ii) Summary of price
- (iii) Instructions to Tenderers & General Conditions of Contract
- (iv) Technical Specifications
- (v) Bill of Quantities

- (vi) List of approved makes of materials
- (vii) Tender Drawings
- (viii) GENERAL DETAILS Annexure-I
- (ix) Acceptance of Tender Conditions
- (x) Integrity Pact at Annexure-II (To be signed and stamped by the contractors and scanned copy to be uploaded with the bid)
- (xi) Addendum/ Corrigendum, if any, - Duly signed by the authorized person
- (xii) Special Conditions of Contract
- (xiii) Pre Tender clarifications, if any

- 6.0** The bidders are required to quote strictly as per terms and conditions, specifications, standards given in the tender documents and is not allowed to stipulate any deviations/ conditions.

The bidders are advised to submit complete details with their bids as Technical Bid Evaluation will be done on the basis of documents uploaded on the website by the bidders with the bids. The procedure for e-Tendering, including the maximum allowable file size for the upload, is described at **Annexure-III** and must be complied by the tenderer for successful bid submission. The information should be submitted in the prescribed Performa and only in PDF format as per the sequence defined in the checklist at **Annexure IV**. All pages of all submittals are to be duly signed/attested by the authorised signatory of the bidder along with the company seal.

Bids with Incomplete / Ambiguous information will be rejected.

The Bank Guarantee for EMD submitted by the bidders shall be strictly in the format prescribed in the General Conditions of Contract GCC. In case, EMD is not found verbatim in the prescribed format, the bid will be liable for rejection.

- 7.0** The bidders are advised in their own interest to submit their bid documents well in advance from last date/ time of submission of bids so as to avoid problems which the bidders may face in submission at the last moment/during rush hours for the purpose of uploading the bids.
- 8.0** On the opening date, the tenderer can login and see the tender opening process.
- 9.0** Notwithstanding anything stated above, the Employer reserves the right to assess the capabilities and capacity of the tenderer to perform the contract in the overall interest of work. In case, bidder's capabilities and capacities are not found satisfactory, the Employer reserves the right to reject the tender and the bidder will have no objection to it.

10.0 Certificate of Financial Turn Over:

The submission at Clause 2.2 part (ii) (b) above of the audited balance sheet and P&L account, the bidder shall upload the certificate duly attested by the Chartered Accountant/statutory auditor mentioning the Financial Turnover of last 3 years, however, the entire voluminous balance sheets or P&L accounts are not to be uploaded. Only one page of summarized balance sheet (Audited) and one page of summarized Profit & Loss Account (Audited) copy for last 03 years shall be uploaded and the same shall also be submitted in hard copy.

11.0 The bidder must ensure to quote separate rates of percentage for Schedule-A and Schedule-B items. The Rate shall be quoted up to two decimals places. The rate of percentage (above, at par or below) quoted by the bidder for Schedule-A items will be applicable to all items covered under Schedule-A and the rate of percentage (above, at par or below) quoted by the bidder for Schedule-B items will be applicable to all items covered under Schedule-B. The evaluation of Lowest (L1) bid shall be done based on the SUM of the value quoted by the bidder towards combined Schedule-A and Schedule-B items.

- a. In case bidder has quoted percentage increase or decrease and the total amount in the summary of prices, but there is discrepancy in total amount, quoted and the amount arrived at after calculating the percentage increase/ decrease quoted by the bidder over Estimated Cost, then the total amount shall be corrected based on the estimated cost and the quoted percentage.
- b. In case bidder has quoted the percentage and the total amount in summary of prices, but increase or decrease (“+” or “-”) has not been indicated by the bidder against the % figure, then the amount quoted by bidder shall be considered and the percentage increase/ decrease shall be calculated based on the total amount quoted by the bidder and Estimate Cost.
- c. In case bidder has quoted the percentage in the summary of prices, but the total amount has not been quoted and increase or decrease (“+” or “-”) has not been indicated against the % figure, then the ‘+’ shall be considered for the % figure.
- d. In case the bidder left the % and amount Blank, % increase/ decrease shall be considered as NIL.

12.0 The tenderer(s) if required, may submit queries, if any, through E-mail Ky@unitechgroup.com and in writing to the Employer to seek clarifications within 10 days from the date of uploading of Tender on website but latest by 14-11-2023 so as to reach the office. The Employer will respond to only those

queries which are essentially required for submission of bids. The Employer may not respond to the queries which are not considered fit, viz. replies of which can be implied/ found in the NIT/ Tender documents or which are not relevant or in contravention to NIT/ Tender Documents and the queries received after due date. Technical Bids are to be opened on the scheduled dates. **Requests for Extension of Bid submission will not be entertained.**

The Pre-Bid meeting shall be attended by the intending bidders only and not by vendors/ manufacturers. The intending bidders should depute their authorized person with authorization letter in original to attend the pre-bid meeting.

13.0 Integrity Pact

Integrity Pact at **Annexure-II** duly signed and stamped by the tenderer, shall be submitted. Any tenderer submitting the bid without the integrity Pact shall be liable for rejection.

14.0 The Bidder shall submit an affidavit disclosing therein that no criminal case against him/ company, in relation to his normal course of business, is pending at any level including any inquiry by the Central Bureau of Investigation (CBI)/ Enforcement Directorate (ED).

15.0 List of Documents to be scanned, uploaded and also to be submitted in hard copy within the period of tender submission:

- (i) If EMD submit as BG, upload scanned copy of Bank Guarantee
- (ii) GENERAL DETAILS as per Annexure-I.
- (iii) Unconditional Letter of Acceptance of Tender Conditions (in original) on the Letter Head of the Applicant/ Bidder.
- (iv) Integrity pact as per Annexure -II.
- (v) Details of Work Experience Certificates –FORM A.
- (vi) Details of Similar Works – FORM B.
- (vii) Financial Details - FORM C.
- (viii) TDS details for Private Sector Projects – FORM D.
- (ix) Self-certified copy of Bank Solvency Certificate - FORM E.
- (x) Documents regarding Net Worth of the Company/ Firm.
- (xi) General Information – Form F.
- (xii) Work Experience Certificates consisting of details as mentioned in Form G.
- (xiii) Affidavit duly notarized by Notary Public on Non-Judicial Stamp Paper of Rs. 100/- for correctness of Documents /Information – Form H.
- (xiv) Power of Attorney in the name of the person authorized for signing/

submitting the tender.

- (xv) E-payment Transaction details towards cost of e-tender processing fee.
- (xvi) Valid GST registration/ EPF registration/ PAN No.
- (xvii) All pages of the entire Corrigendum (if any) duly signed by the authorized person.
- (xviii) Registration Details of the bidder in the GST Act – Form I.
- (xix) Checklist compliance as per Annexure IV.

Notes:

- (i) All the uploaded documents should be in readable, printable and legible form, failing which the bids are liable for rejection. The document submitted in hard copy should be indexed and duly page numbered in the sequence as per the checklist at Annexure IV.
 - (ii) In case of foreign bidders participating individually, the bidder is exempted from submission of GST/ EPF/ ESIC registration/ PAN etc. including all other statutory registrations/ permissions/ approvals for executing work in India during bid submission. However, foreign bidders have to submit undertaking on a pre-approved format stating that they will be complying with such mandatory requirements within 60 days of issue of Letter of award. Such format, for the purposes of approval, should reach the Employer on or before the date of the Pre-bid meeting.
 - (iii) The Contract agreement shall be signed with successful Bidder only after meeting out all above requirements. No payment during the execution of work shall be released till the compliance to above requirements. In case of non-fulfilment of any such requirement by the successful bidder within the stipulated time period, the EMD shall be forfeited, and the bidder will be put under holiday list of the Employer and its parent company M/s Unitech Ltd.
 - (iv) The foreign bidder can provide the credit limit documents in lieu of Solvency Certificate.
- 16.0** No Clarification will be sought in case of non-submission of Cost of tender document, EMD of requisite amount, Letter of Waiver as per Section 4 (Forms and formats) and Affidavit as per Form H of Section 2 of the bidding document. In such cases the bid shall be rejected out rightly without seeking any further clarification/document.
- 17.0** The Employer reserves the right to reject any or all tenders or cancel/withdraw the invitation for bid without assigning any reasons whatsoever thereof. The Employer does not bind itself to accept lowest tender and reserves the right to negotiate post the financial bid opening if it may so deem fit.

- 18.0** For all scheduled BOQ items as per Schedule A, the nomenclature/rates/unit of applicable DSR items shall be applicable. In case, any ambiguity is observed in scheduled BOQ items, nomenclature, unit and rate of relevant DSR item will hold good.
- 19.0** Canvassing in connection in the overall tender award process is strictly prohibited, and such canvassed tenders submitted by the bidder will be liable to be rejected and his earnest money shall be forfeited.
- 20.0** In case of any query, please contact Mr Sandeep Raina Ph. No 8800396076 during Office hours on all working days.

(.....)

Annexure - I

General Details

Sl. No.	Description	Cl. No. of NIT/ ITT/ GCC	Values/ Description to be Applicable for Relevant Clause(s)						
1	Name of Work		Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at “The Willows” Unitech Grande, Sector 96, 97 & 98 at Noida, U.P.						
2	Employer		M/s Unitech Limited						
3	Type of Tender		Item Rate						
4	Earnest Money Deposit	NIT	Rs 2.50 Lacs (Rupees Two Point Five Lacs only)						
5	Estimated Cost	NIT	Rs 19.49 Crs (Rupees Nineteen Point Forty-Nine Crs only)						
6	Time allowed for Completion of Work	NIT	24 Months						
7	Mobilization Advance	GCC / 4.0	Up to 5% of contract value						
8	Rate of interest on Mobilization Advance	GCC /4.0	Mobilization Advance shall bear an Interest @ 9% per annum						
9	Validity of Tender	ITT /7.0	180 days						
10	Performance Guarantee	GCC / 2.0	3% (Three Per cent Only) of contract value to be submitted within 15 days of issue of Letter of Award						
11	Security Deposit/ Retention Money	GCC / 3.0	5% (Five Per cent Only) of the gross value of each running/ final bill.						
12	Start date of Contract	GCC/1.0	The date of start of contract shall be reckoned from 15 th day from the date of issue of letter of Award.						
13	Deviation limit beyond which clause of GCC shall apply for all works except foundations.	GCC/ 6.0	<table><tr><td>Building Work</td><td>Repair of Buildings</td><td>Road Work</td></tr><tr><td>30%</td><td>50%</td><td>50%</td></tr></table>	Building Work	Repair of Buildings	Road Work	30%	50%	50%
Building Work	Repair of Buildings	Road Work							
30%	50%	50%							

Sl. No.	Description	Cl. No. of NIT/ ITT/ GCC	Values/ Description to be Applicable for Relevant Clause(s)			
14	Deviation limit beyond which clause of GCC shall apply for foundation work.	GCC/ 6.0	Building Work	Repair of Buildings	Road Work	
			100%	NA	NA	
15	Escalation	GCC / 7.0	<p>For operation of Clause 7.0, the basic rate of materials as on last date of receipt of tender will be as under -</p> <p>(a) Cement –</p> <p>(b) Reinforcement steel/ TMT bars –</p> <p>(c) Structural steel -</p>			
16	Defect Liability Period	GCC/ 42.0	05 (Five) years from the date of Issuance of Completion Certificate for the works by the Employer.			

SECTION - 2

Instructions to Tenderers

Instructions to Tenderers (ITT)

1. Online percentage rate open tenders are invited from eligible agencies for Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at "The Willows" Unitech Grande, Sector 96, 97 & 98 at Noida, U.P. by M/s Unitech Limited
2. The work is estimated to cost Rs 19.49 Crores
3. The tender document, as uploaded, can be seen on website www.unitechgroup.com and can be downloaded free of cost.
4. **Earnest Money Deposit**
 - (i) Earnest Money Deposit (EMD) i.e. Rs 2.50 Lacs to be paid online on the e-Tendering portal or as a Bank Guarantee (BG) .
 - (ii) The EMD shall be valid for a minimum period of 180 (One Hundred Eighty) days from the last date of submission of Tender. The Bank Guarantee (BG) against EMD shall be scanned and uploaded to the e-Tendering website at the time of tender submission. The original BG shall be maintained with the bidder and deposited in the office of Employer as and when demanded. The EMD shall be payable to the Employer without any condition(s), recourse or reservations.
 - (iii) Wherever the EMD is not paid in the online mode, scanned copy of BG should be uploaded on the portal, Original copy of BG shall be submitted to the Employer as and when demanded by them, failing which the Employer have the right to reject the Bid.
 - (iv) The Employer will verify all EMD submitted as a BG with the issuing bank. Incase the BG is not confirmed by the bank the bid will be marked as unresponsive and will be rejected.
 - (v) The EMD of unsuccessful bidders will be returned within 15 days after the award of work to the successful bidder or within 180 days from the date of opening of the financial bid, whichever is earlier.
 - (vi) The EMD of the successful bidder will be discharged after the contractor has furnished the performance guarantee.
 - (vii) No interest shall be paid by the Employer on the EMD.
 - (viii) The EMD shall be forfeited in the following events:
 - (a) If the bidder withdraws the bid after bid opening during the period of validity;
 - (b) Any unilateral revision in the offer made by the tenderer during the validity of the offer.
 - (c) Upon non-acceptance of LOI/ LOA by bidder, if and when issued by the Employer.

- (d) In the case of a successful bidder, if the bidder fails to sign the contract Agreement within 15 days from the date of issue of LOA or furnish the required Performance Guarantee or fail to mobilise within 30 days of the LOA/LOI.
 - (e) If any bidder furnishes any incorrect or false statement/ information/ document.
 - (f) If bidder commits any breach of the Integrity Pact.
5. Interested bidder, who intends to participate in the tender, has to make following payments online
- (a) Cost of Tender Document (Non-refundable) – Rs.10,000.00 + GST@ 18%
 - (b) Cost of e-Tender Processing Fee (Non- refundable) – Rs. 5,000.00 + GST @ 18%
 - (c) EMD amount as specified in previous section. To be paid online or as BG. In case of BG the scanned copy of BG shall be uploaded on the portal failing which the bid will be rejected.
6. Online technical tender documents only of those tenderers shall be opened, whose Earnest Money Deposit, Cost of Tender Document and e-Tender Processing Fee and other documents submitted are found in order. The Financial Bids of only those tenderers will be opened whose technical bid documents are complete in all respect and meet the qualification criteria.
7. **Validity of Tender**
- The tender for the works shall remain open for acceptance by the bidder for a period of 180 days from the date of opening of financial bid. If any tenderer withdraws his tender before the said period or issue of letter of acceptance, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the Employer, then the Employer shall, without prejudice to any other right or remedy, be at a liberty to forfeit the Earnest Money Deposit of the bidder. Further, the tenderers shall be put under holiday list of the Employer and its parent company M/s Unitech Ltd.
8. The tender submitted shall become invalid if:
- (a) The tenderer is found ineligible on technical evaluation.
 - (b) The tenderer does not upload all the documents as stipulated in the tender document.
9. **Acceptance of Tender**
- The Employer reserves the right to reject any or all the tenders in part or full without assigning any reason whatsoever.
10. The bid shall be submitted strictly in accordance with the conditions of

Contract and instructions to tenderer. Tenders with any additional condition(s)/ modifications shall be rejected. Tenders, in which any of the prescribed conditions are not fulfilled or found incomplete in any respect, are liable to be rejected.

11. On acceptance of tender, the name of the authorised representative(s) of the contractor, who would be responsible for taking instructions from the Engineer-in-Charge, shall be intimated by the contractor within 15 days of issue date of Letter of Award by the Employer.
12. The tenderer is not permitted to bid for the works if his family member or a close relative is posted in the project office or concerned Zonal Office of the Employer or its parent company Unitech Limited, unless otherwise permitted. The contractor shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are close relatives to any of the officers of the Employer or its parent company Unitech Limited through the entire duration/ time period of the project. Any breach of this condition by the tenderer would render him liable to the withdrawal of the work awarded to him and forfeiture of Earnest Money Deposit and Security Deposit. This may also debar the contractor from tendering for other/ future works of the Employer or its parent company Unitech Ltd. For the purpose of operation of this clause, a close relative shall mean wife, husband, parents, grandparents, children, grandchildren, brothers, sisters, uncles, aunts, cousins and their corresponding in-laws.
13. The time for completion of the work as contained in contract shall be as per “GENERAL DETAILS - **Annexure-I**”.
14. Canvassing, whether directly or indirectly, with Employers/ PMC/ TPIA is strictly prohibited, and the tenders submitted by the bidders, who resort to canvassing, will be liable for rejection.
15. The tender award, execution and completion of work shall be governed by tender documents consisting of (but not limited to) Letter of Award/ Letter of Work Order, Bill of Quantities, General Conditions of Contract, Special Conditions of Contract, Specifications, Drawings. The tenderers shall be deemed to have gone through the various conditions including sub-soil water conditions, topography of the land, drainage and accessibility etc. or any other condition which, in his opinion, will affect his price/ rates before quoting their rates for the work. No claim whatsoever against the foregoing shall be entertained at any stage after the award of works.
16. The drawings issued with the tender documents are indicative. Works shall be carried out as per “Good For Construction/ GFC drawings issued by Engineer-in-Charge to the Contractor” and the “Shop Drawings prepared by the Contractor and approved by Engineer-in-Charge”.

17. Addenda/ Corrigenda

Addenda/Corrigenda to the tender documents may be issued at least three days prior to last date of submission of the tender to clarify or effect modification in specification(s) and/or contract terms included in various sections of the tender document. The tenderer shall suitably take into consideration such Addenda/Corrigenda while submitting his tender. The tenderer shall return such Addenda/ Corrigenda duly signed and stamped as confirmation of its receipt & acceptance and submit along with the tender document as per **Annexure - IV**. All addenda/ Corrigenda shall be signed and stamped on each page by the tenderer and shall become part of the tender and contract documents.

18. Site Visit and Collecting Local Information

Before tendering, the tenderers are advised to visit the site of work, the present status of the project/ work, its surroundings to assess and satisfy themselves about the local conditions such as the status of the project, working and other constraints at site, approach roads to the site, availability of water & electrical power supply, application of taxes/ duties/ levies/ Toll/ Octroi as applicable & any other relevant information required by them to execute the complete scope of work. It becomes even more important in the case of brown-field projects where part works have already been executed that the tenderer obtain all necessary information as to the risks, weather conditions, contingencies & other circumstances, which may influence or affect its tender prices. Tenderer shall be deemed to have considered the above site and local conditions whether he has inspected the site or not and to have satisfied himself in all respect before quoting his rates so as not to raise any claims or extra charges whatsoever in this regard during the entire duration of the project execution, upon completion or during the defect liability period. No claims or extra charges whatsoever shall be entertained/ payable by the Employer on a later date after award of work.

19. Access by Road

- (i) Contractor, if necessary, shall build temporary access roads to the site of construction for the works at his own cost to make the site accessible. The Contractor shall maintain the same in motorable condition at all the times at his own cost. The contractor shall be required to permit the use of any access roads so constructed by him for vehicles of the Employer or any other agencies/ contractors who may be engaged on the project site without any charges whatsoever.
- (ii) Non-availability of access roads or approach to site, for the use of the contractor shall in no case condone any delay in the execution of work nor be the cause for any claim for Penalty.

20. Handing Over & Clearing of Site

- (i) The Contractor should note that the area for construction may be made available in phases as per availability and in conjunction with pace of actual progress of work at site. The work may require to be carried out in constrained conditions. The work is to be carried out in such a way that the traffic, people movement, if any, is kept operative and nothing extra shall be payable to the contractor due to this phasing/ sequencing of the work. The contractor is required to arrange the resources to complete the entire project within total stipulated completion time of the contract. Traffic diversion, if required, is to be done and maintained as per requirement of local traffic police, by the contractor at his own cost and the contractor shall not be entitled for any extra payment, whatsoever, in this regard.
- (ii) Efforts will be made by the Engineer-in-Charge/ Employer to handover the site to the Contractor free of encumbrances. However, in case of any delay in handing over of the site to the Contractor, the Employer shall only consider suitable extension of time for the execution of the work. It should be clearly understood that the Employer shall not consider any revision in contract price or any other Compensation whatsoever viz. towards any idling of Contractor's labour, equipment etc.
- (iii) Old/ Temporary structures on the site of work, if required, shall be demolished by the contractor properly at his own cost unless and otherwise mentioned elsewhere in the Schedule A & B of the financial bid or as mentioned in SCC. The useful material obtained from demolition of structures & services shall be the property of the Employer and these materials shall be stacked as directed and at the place specified by the Engineer-in-Charge.
- (iv) Necessary arrangement including site maintenance is to be made by the contractor for temporary diversion of flow of existing drain, road etc. The existing drain, road would be demolished, wherever required, with the progress of work under the scope of work. The existing Road and Drain, which are not in the alignment of the said project but are affected and/or need to be demolished during execution for smooth progress of the project, shall be re-constructed/re-habilitated to its original status and condition by the contractor at his own cost. The cost to be incurred by contractor in this regard shall be deemed to be included in the quoted rates and contractor shall not be entitled for any extra payment on this account whatsoever.
- (v) The information about the public utilities (whether over ground or underground) like electrical/ telephone/ water supply lines, OFC Cables, open drain etc. is the responsibility of contractor to ascertain through the site investigation whether the utilities will affect the works.

- (vi) The contractor shall be responsible for obtaining necessary approvals from the respective statutory authorities for shifting/ re-alignment of existing public utilities. The Employer shall only assist the contractor in obtaining the approvals from the concerned statutory authorities.
- (vii) Any services affected by the works must be temporarily supported by the bidder/ contractor who shall also take all reasonable measures required to protect the services and property of various government/ private bodies during the progress of works. The cost towards the same is deemed to be a part of the contract bid, and no extra payment shall be made to the contractor for the same.

21. Scope of Work

- (i) The scope of work covered in this tender shall be as per the Bill of Quantities, specifications, drawings, instructions, orders issued to the contractor from time to time during the execution of work. The drawings for this work, which may be referred for tendering, provide general information about the work to be performed under the scope of this contract. These may not be the final drawings and may not indicate the full range of the work under the scope of this contract. The work will be executed according to the drawings to be released as “GOOD FOR CONSTRUCTION” from time to time by the Engineer-in-charge and according to any additions/ modifications/ alterations/ deletions made from time to time, as required by any other drawings that would be issued to the contractor progressively during execution of work. It shall be the responsibility of the contractor to incorporate the changes that may be in this scope of work, envisaged at the time of tendering and as actually required to be executed.
- (ii) The quantities of various items as entered in the “BILL OF QUANTITIES” are approximate and may vary depending upon the actual requirement of the work. The contractor shall be bound to carry out and complete the stipulated work irrespective of the variation in individual items specified in the bill of quantities. The variation of quantities will be governed as per Section 3, clause No. 6.0 of the contract.

22. Approval of Temporary / Enabling Works

The setting and nature of all offices, huts, access road to the work and all other temporary works as may be required for proper execution of the works shall be subject to the approval of the Engineer- in-Charge. All the equipment, labour, material including cement, reinforcement and the structural steel required for the enabling/ temporary works associated with the entire Contract shall have to be arranged by the Contractor only and at his own costs and is deemed to be considered in the bid price. Nothing extra shall be paid to the Contractor on this account.

23. Clarifications after Tender Submission

Tenderer's attention is drawn to the fact that during the period the tenders are under consideration, the tenderers are advised to refrain from contacting the Employer and/or his employees/ representatives on matters related to the tender under consideration and that, if necessary, Employer/ PMC will obtain clarifications in writing or as may be necessary. The tender evaluation and processing shall be done by the PMC concerned and vetted by the EIL. The recommendations of the PMC & EIL will be put up to the Tender Award Committee constituted by the Employer.

24. Order of Precedence of Documents

In case of any difference, contradiction, discrepancy, regarding the conditions of contract, specifications, drawings, Bill of quantities etc. forming part of the contract, the following shall prevail in order of precedence:

- (i) Contract Agreement
- (ii) Letter of Award
- (iii) Bill of Quantities
- (iv) GFC Drawings
- (v) Technical Specifications
- (vi) Special Conditions of Contract
- (vii) Instructions to Tenderers
- (viii) General Conditions of Contract
- (ix) Others

Annexure - II

Integrity Pact

To be executed Between

The Employer and its representatives such as the PMC/TPIA hereinafter referred to as **“The Principal”** (which expression, unless repugnant to the context thereof, shall mean and include its legal representatives, heirs and assigns)

AND

..... hereinafter referred to as **“The Bidder/ Contractor”** (which expression, unless repugnant to the context thereof, shall mean and include its legal representatives, heirs and assigns)

Preamble

1. Unitech Limited, along with its project owning subsidiaries, being the Employer, is in the process of inviting proposals & bids and award of contracts for procurement, works, goods and services, for completion of its various residential and commercial projects in fulfilment of its given mandate.
2. The Employer places a very high value to the overall integrity, probity and honesty, promoting economic use of resources, and ensure fairness/transparency in its relations with its Bidder(s) and/ or Contractor(s). In order to ensure that highest level of integrity, transparency and trustworthiness is maintained throughout the execution and completion of all its projects, the Employer proposes to adopt and follow an ‘Integrity Pact’ with the prospective bidders/ contractors. The Integrity Pact is applicable to all the stakeholders i.e. the Contractors and their personnel, the Project Management Consulting agencies and staff, the Engineers India Limited (EIL) and their staff in its role as the Third Party Monitoring Agency, and above all, the Employer and its staff. It seeks the commitment of all persons engaged on these projects on whosoever’s behalf to perform without compromising on any aspect, or resorting to any unethical or corrupt practices in any aspect/ stage of the contract, or exercise any unwarranted influence or be influenced on any aspect of the contract or transaction. Only those bidders/ contractors, who commit themselves to this Integrity Pact, would be considered eligible to participate in the bidding process.
3. In order to achieve these goals, the Employer, the EIL and the Project Management Consultants (appointed by the Employer) will monitor the tender process and execution of the contract for compliance with the principles mentioned above.

Section -1: Commitments of the Employer

Unitech Group, along with its staff, commit itself to take all measures necessary to prevent any form of corruption and to observe the following principles:-

- (i) No employee of the Employer or the PMC or the Third Party Inspection & Monitoring Agency (appointed by the Employer) personally or through any other persons/ family members, will take a promise or demand or accept for self or third person, any material or other benefit or consideration, which the person is not legally entitled to in connection with the tender, or the execution of a contract.

- (ii) The Employer or its agents (i.e. the PMCs and the TPIA) will treat all Bidder (s) with equity, fairness and transparency during the tender process. It will, in particular, before and during the tender process, provide to all Bidder (s) the same information and will not provide to any Bidder(s) confidential/ additional information through which the Bidder(s) could obtain an unfair advantage in relation to the process or the contract execution.

Section -2: Commitments of Bidders (s)/ Contractor(s)

The Bidder(s)/Contractor(s) shall also commit himself/herself/ themselves to take all measures necessary to prevent all forms of corruption. The Bidder commits himself/herself to observe the following principles during his/her participation in the tender process and thereafter during the contract execution.

- (i) The Bidder(s)/ Contractor(s) shall not, directly or through any other persons or firm, offer, promise or give to any Employee of the Employer or its agents (PMCs and TPIA) involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage during the tender process or during the execution of the contract.
- (ii) The Bidder(s)/ Contractor(s) shall not enter into any undisclosed agreement or understanding, whether formal or informal, whether collusive or otherwise, with other Bidders. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process in any manner.
- (iii) The Bidder(s)/ Contractor(s) shall not commit any offence surrounding the observance of integrity under any law. The Bidder(s)/ Contractors will not indulge in any improper use of any information or document provided by the Employer or its agents in the course of a business relationship, for purposes of competition or personal gain, or pass on to others such information or documents regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- (iv) In case of sub-contracting, Bidder (s)/ Contractor(s) shall also like-wise ensure the adoption and signing of the Integrity Pact by the respective sub-contractors.
- (v) The Bidder(s)/ Contractor(s) shall, when presenting their/ its bid, faithfully disclose any and all payments he/she/it has made or committed or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

Section-3: Equal treatment of the Bidders/Contractors/Subcontractors.

- (i) The bidders(s)/ contractor(s) undertake(s) to obtain a commitment in conformity with this integrity pact from all the sub-contractors.
- (ii) The Employer shall enter into agreements with identical conditions with all bidders and contractors.
- (iii) Employer will disqualify the bidders, who do not sign this Integrity Pact or violate its provisions, from the tender process.

Section-4: Disqualification from tender process and exclusion from future contracts.

If the Bidder(s)/ Contractor(s), before award or during the project execution, has committed a transgression through a violation of Section-2 above or in any other form such as to put his reliability or credibility in question, the Employer is entitled to disqualify the Bidder(s)/ Contractor(s) from the tender process and restrict the Bidder (s)/ Contractor(s) from participating in future tenders of the Employer for a period of two years.

Section-5: Compensation for Damages

If the Employer has disqualified the Bidder(s) from the tender process prior to the award of the contract in terms of Section 4, the Employer shall be entitled to demand and recover the amount equivalent to Earnest Money Deposit towards compensation for damages.

Section – 6: Integrity Pact Duration

- (i) This Integrity pact comes into effect as soon as it is signed by both parties. It shall expire for the Contractor(s) 12 months after the Completion of the work, and 03 months for other unsuccessful Bidder(s) after the contract has been awarded.
- (ii) If any complaint is made/ lodged by either Party to the Employer during the periods mentioned in (i) above, the management would be at liberty to take such action as may be deemed appropriate.

Section – 7: Miscellaneous

- (i) If the Bidder(s)/ Contractor(s) is/are a partnership firm or a consortium or a joint venture, the Integrity Pact shall be signed by all members of the partnership firm or the consortium or the Joint Venture, as the case may be.
- (ii) Any dispute or difference arising between the parties with regard to the terms of this Integrity Pact/Agreement, any action taken by the Employer in accordance with this Integrity Pact/ Agreement or interpretation thereof shall not be subject to arbitration.
- (iii) This agreement shall be governed by the Indian laws for the time being in force. The Courts in Delhi, having the ordinary original civil jurisdiction will have the authority to deal with matters arising from this Pact/ Agreement.

(For and on behalf of the Principal)	(For and on behalf of Bidders/Contractors)
(Official Seal)	(Official Seal)
Witness-1	Witness -2
<Name>	<Name>
<Address>	<Address>

Place: _____

Date: _____

Annexure - III

Procedure for e-Tendering

Bidders intending to participate in the tenders of Unitech Group have to register first on the e-Tendering portal of Unitech Limited. For this purpose, the authorized representative of the bidder must possess a Class 3 DSC (Digital Signature Certificate). Registration and participation of the bid has to be done at etenders.unitechgroup.com.

1. Registration / Empanelment

Registration includes issuance of a unique User ID to each Bidder by the system. The request for the same is made online. The Bidder fills in the basic identification information during the registration process. The approval of registration will be automatic via email verification. Registration and approval are mandatory to be able to operate as a Bidder on the e-tendering processes.

2. File Size

The documents required to be submitted are given in Annexure-III of Section-2. Five (5) Buckets of different documents have been made in such a manner that each document size is within 25 MB, which is the maximum limit for uploading the said document. This arrangement must be strictly adhered to overcome any problems qua e-filing of documents.

3. Bidder Information Update

Bidder information can be updated as and when required by Bidders online by going on to “ Edit Profile”. The changes may be subject to Employer approval depending on configuration.

4. Update of Digital Signature Certificate (DSC)

The Digital Signature Certificate (DSC) is required to be registered by each bidder on the System. Since DSCs are valid for a limited period, the digital certificates need to be updated (re-registered) online from time to time. Bidders can participate in a bid only by using their DSC.

5. Public View of Tenders

5.1 View of tender notices/ Notice Inviting Tenders

The bidders can view the detailed N.I.T and the time schedule (Key Dates) for all the tenders floated through the tendering portal on the homepage at <https://etenders.unitechgroup.com>. The tender documents can be downloaded from the portal.

5.2 View of in-process tenders

The list of live tenders is available to bidders at the home page of the eTendering portal. However, details of the participants who have downloaded

the tender or from whom the bids are received are not made available in order to maintain the confidentiality of identities of bidders and transparency of the procurement process until the process of tender opening has been initiated. The list shows the status of each tender and allows viewing of the tender notices of these tenders.

5.3 View of completed tenders

Bidders will be able to view their completed tenders online on the portal.

5.4 View of opened bids

- (i) The participating bidder will be able to view only his opened technical bid.
- (ii) The participating bidder, whose technical bid is qualified, will be able to view all the financial bids on the date of opening of financial bids.

5.5 Key Dates

The bidders are strictly advised to follow dates and times as indicated in the tender document. The data and time shall be binding to all bidders. All online activities are time tracked and the system enforces time locks to ensure that no activity or transaction can take place outside the start and end dates and the time of stage as defined in the tender document.

6. Bid Preparation

Bid preparation must be done online. In order to operate on the electronic tender management system, a user's machine is required to be set up. A help file on system setup/Pre-requisite can be downloaded from home page of the website - <https://etenders.unitechgroup.com>

6.1 Filling up the bid forms

Bid forms are in tabular format. Each bid will be submitted on two envelope formats. Bidder has to fill all forms related with these envelopes. Bid form data can be saved only after encryption with the public key of the Bidder's digital certificate. Data can be edited only after decrypting it with the private key of the Bidder's digital certificate. Unencrypted data cannot be saved in the System.

6.2 Adding attachments

- (i) The attachments, if required, may need to be submitted. Some of these may be mandatory and some not. This is clearly indicated on the form for attachment upload. Extra attachments i.e. the ones not asked for in the tender document can also be uploaded at the choice of the Bidder. Employer has the option to disallow uncalled for attachments.
- (ii) The Bidder has an additional feature of 'Briefcase' where he can keep his commonly used documents. While attaching the same to the tender,

he can select document either from the briefcase or he can directly upload the same.

- (iii) **Scan copy of Documents to be submitted/uploaded for Prequalification or Technical bid under online PQQ/ Technical Envelope:** The required documents (refer to Tender document) shall be prepared and scanned in different file formats (in PDF /JPEG/MS WORD format such that file size is not exceed more than 25 MB) and uploaded during the on-line submission of PQQ or Technical Envelope.
- (iv) **FINANCIAL or Price Bid PROPOSAL shall be submitted mandatorily online under Commercial Envelope .**
- (v) **Technical and Financial bid to be submitted on portal and not to be submitted manually**

6.3 Validating bid data

Basic validation rules such as item set rules and mandatory field validations are done during validation. Bidder can choose to go back and rework the bid at this stage, if required.

6.4 Bid signing

- (i) Each electronic bid is digitally signed. The server also obtains a digitally signed time stamp for each envelope that can be verified at any later date. Bidders can generate and print proof of Bid submission with time stamping.
- (ii) The System does not allow the process to be carried out before or after the designated time in tender schedule. Bidder can rework on its bid till the last date of bidding. A bidder seeking to withdraw its bid should initiate the “re-submit” button.

6.5 EMD and Tender Document fees

Bids submitted with EMD and tender fees will only for considered for evaluation. The system will not permit submission of Bid without payment of complete fees.

7 Bid Opening

Unitech representative will undertake the bid opening. Bidder will be able to see the status of bid opened. Technical bids will be opened in the first instance. Upon completion of the technical evaluation, the bids will be marked as “qualified” or “not-qualified”. Financial bids of only such bidders, who qualify in the technical bid evaluation, will be opened.

8. Assistance to the Bidders (Help Desk):

E-mail: Support.tenders@unitechgroup.com

Contact No: **8010208825, 9356477055 & 9028672454 (Nextenders (India) Pvt. Ltd.)** Queries related with e-Tendering only

Support Timings: Monday to Friday- 09.00 A.M. to 08.00 P.M.

Saturday- 10.00 A.M. to 04.30 P.M.

Important Note:-

All queries would require to be registered at our official email-support.tenders@unitechgroup.com for on-time support. (Only those queries which are sent through email along with appropriate screenshots or error description will be considered as registered with the Help-desk). Contact our helpdesk on or before prior to 4 hours of the scheduled closing date & time of respective Tender event.

Bidders participating in online tenders shall check the validity of his/her Digital Signature Certificate before participating in the online Tenders at the portal <https://etenders.unitechgroup.com>. For help manual please refer to the 'Home Page' of the eTendering portal <https://etenders.unitechgroup.com>, and click on the available link 'How to...?' to download the file.

Annexure - IV

Check-list - documents to be submitted along with the bid

(All documents mentioned in the Check-list are to be uploaded as a part of the Technical Bid)

Sr. No.	Description	Reference from Tender	Bucket (Size not exceeding 20MB for each bucket)	Submission Compliance (Yes / No)
Pre-Qualification Documents				
1	If EMD submit as BG, upload scanned copy of Bank Guarantee	As per Form No. VI (Section 4)	Bucket-1	
2	General Details	Annexure-I		
3	Unconditional Letter of Acceptance of Tender Conditions (in original) on the Letter Head of the Applicant/ Bidder.	Section-4		
4	Integrity pact	Annexure-II		
5	Details of Work Experience Certificates	Form-A		
6	Details of Similar Works	Form-B		
7	Financial Details	Form-C		
8	TDS details for Private Sector Projects	Form-D		
9	Documents regarding Net Worth of the Company/ Firm.	2.2(II) & 14(XI) of NIT		
10	Self-certified copy of Bank Solvency Certificate	Form-E		
11	Audited summarised Balance Sheet (Last 3 years)	2.2 (ii) Note B of NIT		
12	Audited summarised Profit & Loss Account (Last 3 years)	2.2 (ii) Note B & Para 10 of NIT		
13	General Information	Form-F		
14	Work Experience Certificates	Form-G		
15	Affidavit duly notarized by Notary Public on Non-Judicial Stamp Paper of Rs. 100/- for correctness of Documents /Information	Form-H	Bucket-2	
16	Power of Attorney in the name of the person authorized for signing/ submitting the tender	14(XV) of NIT		
17	E-payment Transaction details towards cost of e-tender processing fee.	6.5 of Annexure-3/ 14(ii) & (xvi) of NIT		

Sr. No.	Description	Reference from Tender	Bucket (Size not exceeding 20MB for each bucket)	Submission Compliance (Yes / No)
18	Registration Details of the bidder in the GST Act	Form-I		
19	Valid GST registration/ EPF registration/ PAN No.	14 (xvii) of NIT & Note -2 of NIT		
20	All pages of the entire Corrigendum/ Addenda (if any) duly signed and stamped by the authorized representative of the tenderer	14(xviii) of NIT	Bucket-3	
Technical Submissions as Part of Bid				
21	Project Execution Plan	18 of GCC	Bucket-4 (It is not mandatory to submit these documents)	
22	Overall Project Schedule (Resource loaded-Level 3) along with Critical Path	18 of GCC		
23	Progress 'S' Curves	17.2(IV) of GCC		
24	Manpower and Machinery Deployment	33 of GCC		
25	Details of Software's to be used for planning, material control etc.	17.2(iv)		
26	Any other relevant documents the tenderer wishes to submit to support the bid.	-		
27	Forms and Formats			
I	Declaration By the Bidder Regarding Bidding Document	As per Form No. I (Section 4)	Bucket-5	
II	Letter of Waiver	As per Form No. II (Section 4)		
III	Undertaking For Non-Engagement of Child Labour	As per Form No. III (Section 4)		
IV	Affidavit disclosing therein that no criminal case against him/ company, in relation to his normal course of business, is pending at any level including any inquiry by the Central Bureau of Investigation (CBI)/ Enforcement Directorate (ED)			

Signatures of the Bidders

(Name of the Signatory _____)

Place:

Date:

Form - A
Tender for _____

Mandatory Information Documents

Details of Work Experience Certificates

Sr. No.		1	2	3	4
1.	Name of Work and its Location				
2.	Name of Employer				
3.	Date & Reference No. of Completion Certificate				
4.	Date of Start				
5.	Date of Planned Completion				
6.	Date of Actual Completion				
7.	Awarded cost of Work (Exc. Tax)				
8.	Cost of Work on Completion (Exc. Tax)				
9.	Value of Tax (as considered in the Completion Certificate)				
10.	Reference and page No. of documentary proof of the detail missing in the Completion Certificate				

1. Certified that the Completion Certificates of above works are enclosed with the Tender Documents;
2. Details mentioned in the above Form are as per Completion Certificates and have not been presumed.

Note: If any detail is not mentioned in the Completion Certificate, documentary proof of details like drawings, LoA, BoQ, Completion Certificate/ Occupation Certificate, copy of final bill, etc. is to be submitted and uploaded on e-Tender Website along with the Completion Certificate.

Signature of the Bidder with Seal.

Form - B
Tender for _____

Mandatory Information Documents

Details of Similar Works

Sr. No.		1	2	3	4
1.	Name of Work for which Experience Certificate has been submitted				
2.	Name of Employer				
3.	Date & Reference No. of Completion Certificate				
4.	Type of Work				
5.	No. of Basements	Not applicable			
6.	No. of Storeys				
7.	Height of Building (From GF level to Terrace Floor level)				
8.	Reference and page No. of documentary proof of the detail missing in the Completion Certificate				
9.	Any Other				

If any detail is not mentioned in the Work Completion Certificate, documentary proof of detail is to be submitted and uploaded on e-Tender Website along with the Completion Certificate.

Signature of the Bidder with Seal.

Form – C
Tender for _____

Mandatory Financial Documents

Sr. No.	Description	1 st Year (Rs. in Lakh)	2 nd Year (Rs. in Lakh)	3 rd Year (Rs. in Lakh)
		(A)	(B)	(C)
(i)	Profit/ Loss			
(ii)	Gross Annual Turnover of previous 3 financial years ending as on the last date of the preceding Financial Year			
(iii)	Average Annual Turnover for previous 3 Financial Years (Rs. in Lakh) = (A+B+C)/3			
(iv)	Net Worth (Paid-up Capital + Reserves) on the last date of the previous Financial Year			
(v)	Bank Solvency amount as mentioned in the bank Solvency Certificate			

Note: This Form-C is to be submitted in Original

1. Summarised page of Audited Profit & Loss Account of previous 03 Financial Years duly certified by the Chartered Accountant/ Statutory Auditor, has been submitted.
2. Summarised page of Audited Balance Sheet of last Financial Year (ending on the last day of the preceding Financial Year) duly certified by the Chartered Accountant/ Statutory Auditor, has been submitted.

Signature of Chartered Accountant/ Statutory Auditor with Membership Number and Seal	Signature of the Bidder along with the Seal

Form – D**TDS details of Private Sector Projects**

Sr. No.	Subject	1	2	3
(i)	Name of Work			
(ii)	Name of Employer			
(iii)	Project Cost (Rs. in Cr.)			
(iv)	No. and date of Completion Certificate			
(v)	Cost of the Work on Completion (Rs. in Cr.)			
(vi)	Payments received as per TDS (Rs. in Cr.)			
(vii)	TDS corresponding to the Payments			
(viii)	Year-wise TDS as per Form 26AS/ Form 16-A relating to the Work			

Notes:

1. Value of work done will be considered commensurate with the value of TDS Certificates.
2. In case of multiple contracts undertaken from a Employer, details of TDS/ Form 26AS for each work mentioned above need to be segregated and given separately.
3. This Form needs to be supported with Form -26AS taken in HTML format on Form – 16A

Signature of Chartered Accountant/ Statutory Auditor with Membership Number and Seal	Signature of the Bidder along with the Seal

Form – E

Dispatch number of bank/ Date

Solvency certificate on Letter-head of the Bank

1. This is to state that to the best of our knowledge and information that M/s _____ having/ registered office address is a customer of the bank and has been maintaining his accounts with our branch since _____. As per records available with the bank, M/s..... can be treated as solvent up to a limit of Rs.....(Rupees in words).
2. It is clarified that the above information is furnished and this certificate is being issued at the specific request of the customer.

Name, designation, Signature with seal

Form – F**General Information**

1.	Name of Applicant/ Company	
2.	Address for correspondence	
3.	Official e-mail for communication	
4.	Contact Person: Telephone Nos. Fax Nos. Mobile	
5.	Type of Organization: (a) An individual (b) A proprietary firm (c) A firm in partnership (Attach copy of Partnership) (d) A Limited Company (e) (Attach copy of Article of Association) (f) Any other (mention the type)	
6.	Place and Year of Incorporation	
7.	Name(s) of Directors/ Partners in the organization	
8.	Name(s) and Designation of the persons, who is authorized to deal with Employer (Attach copy of power of Attorney)	
9.	Bank Details: Name of Bank, Address of Bank Branch, Account No., RTGS, IFS Code	

Signature of the Bidder with Seal

Form – G**Work Experience Certificate**

Name of Employer with Address, Email & Phone Number

Dispatch No. _____

Date: _____

Name of Contractor _____

Sr. No.	Subject	Description			
1.	Name of work / project & Location				
2.	Name and Address of the Employers				
3.	Agreement Amount				
4.	Cost of work on completion				
5.	Date of start				
6.	Stipulated date of completion				
7.	Actual date of completion				
8.	Amount of Penalty levied for delayed completion (if any).				
9.	Type of Work:				
10.	No. of Basements in any Building of this work	Not Applicable			
11.	Maximum Height of any Building of this work (From Ground Floor Level to Terrace Floor Level)				
12.	Maximum No. of storeys of any Building of this work				
13.	Performance report	Outstanding	Very Good	Good	Poor
(a)	Quality of work				
(b)	Resourcefulness				
(c)	Financial soundness				
(d)	Technical proficiency				
(e)	General behaviour				

Name & Designation Signature with

Seal of issuing Authority

Date: _____

Form - H

AFFIDAVIT

(To be submitted by bidder on non-judicial stamp paper of Rs.100/ (Rupees Hundred only) duly attested by Notary Public)

Affidavit of Mr. _____ S/o.....R/o

I, the deponent above named do hereby solemnly affirm and declare as under:

1. That I am the Proprietor/Authorized signatory of M/s having its Head Office/ Regd. Office at
2. That the information/ documents/ Experience certificates submitted by M/s..... along with the tender for (*Name of work*) to (*Hereinafter referred to as the Employer*) are genuine and true and nothing has been concealed.
3. I shall have no objection in case the Employer verifies them from issuing authority (ies). I shall also have no objection in providing the original document(s) in case the Employer demands so for verification.
4. I hereby confirm that in case, any document, information &/or certificate submitted by me found to be incorrect/ false/ fabricated, the Employer at its discretion may disqualify / reject / terminate the bid/contract and forfeit the EMD/ All dues.
5. I shall have no objection in case the Employer verifies any or all Bank Guarantee(s) under any of the clause(s) of Contract including those issued towards EMD and Performance Guarantee from the Zonal/ Branch office of issuing Bank and I/We shall have no right or claim on my submitted EMD before the Employer receives said verification.
6. That the Bank Guarantee issued against the EMD issued by (name and address of the Bank) is genuine and if found at any stage to be incorrect / false / fabricated, M/s The Employer shall reject my bid, cancel pre-qualification, and debar me from participating in any future tender.
7. I hereby confirm that our firm /company is not blacklisted/ barred /banned from tendering by M/s The Employer If this information is found incorrect, the Employer at its discretion may disqualify / reject / terminate the bid/contract.
8. The person who has signed the tender documents is our authorized representative. The Company is responsible for all of his acts and omissions in the tender.

I,, the Proprietor / Authorized signatory of do hereby confirm that the contents of the above Affidavit are true to my knowledge, and nothing has been concealed there from.....and that no part of it is false.

DEPONENT

Verified atthis.....day of

ATTESTED BY (NOTARY PUBLIC)

Form - I

GST Registration Details of Contractor/ Vendor	
Name	
Address (As per registration with GST)	
City	
Postal Code	
Region/ State (Complete State Name)	
Permanent Account Number	
GSTIN ID/ Provisional ID No.: (Copy of Acknowledgement required)	
Type of Business (As per registration with GST)	
Service Accounting Code/HSN Code:	
Contact Person	
Phone Number and Mobile Number	
Email ID	
Compliance Rating (if updated by GSTN)	

Signature of Bidder with Seal

SECTION-3

General Conditions of Contract

1. Definitions

In the contract, the following expressions shall, unless the context otherwise requires, have the meanings hereby respectively assigned to them:

- (a) **Approval** means approval of the Engineer in Charge/Employer, as the case may be, in writing including subsequent written confirmation of previous verbal approval, if any.
- (b) **Authorized Representative of Employer** means the person designated by the Employer/ TPIA and/ or the PMC and shall include their authorized nominee(s) or agent(s).
- (c) **Bill of Quantities** or **Schedule of Quantities** means the priced complete bill of quantities or schedule of quantities forming part of the complete bill of tender/ tender document.
- (d) **Contract** means the documents forming the tender and acceptance thereof and the formal agreement executed between the Unitech Group Company and the Contractor, together with the documents referred to therein including these conditions, specifications, designs, drawings and instructions issued from time to time by the Engineer-in-Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.
- (e) **Contractor** means the individual, firm, or company, whether incorporated or not, undertaking the works and shall include the legally authorized personnel and representative of such individual or the persons composing such firm or company, or the successors of such firm or company and the permitted assignees of such individual, firm or company.
- (f) **Contract Value** means the sum for which the tender is accepted as per the letter of Award.
- (g) **Drawings** mean the drawings referred to in the contract document including modifications, if any, and such other drawings as may from time to time be furnished and/ or approved by Engineer-in-charge/PMC.
- (h) **Date of Commencement of Work:** The date of commencement of contract shall be reckoned from the 15th day after the date of issue of Letter of Award.
- (i) **Employer** means Unitech Limited, the holding Company or any of its subsidiaries/ JV/ affiliate, with its corporate office at 8/13th Floor, Tower-B, Signature Towers, South City-1, Gurugram-122007, Haryana.
- (j) **Engineer-in-Charge** shall mean the Authorized representative of the Employer.

- (k) **Excepted Risks** are risks due to riots (other than those among Contractor's employees), war (whether declared or not), invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurgency, military or usurped power, any acts of Government, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, pandemic and other causes over which the Contractor has no control and accepted as such by the Employer or causes solely due to use or occupation by Government/ Employer of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to Employer's faulty design of works.
- (l) **Language:** All documents and correspondence in respect of this contract shall be in English Language.
- (m) **Letter of Award (LoA)** shall mean Employer's notification letter conveying its acceptance of the tender along with the conditions stated therein.
- (n) **Market Rate** shall be the rate as decided by the Engineer-in-Charge on the basis of the prevailing cost of materials and labour at the site of work where the work is to be executed plus 15% (Fifteen per cent) to cover all overheads and profits of the Contractor.
- (o) **Month** means English Calendar month, 'Day' means a Calendar Day of 24 Hrs each.
- (p) **PMC** means the Project Management Consultancy agency appointed by the Employer for the works, its Authorized Representatives, Agents, Successors, Beneficiaries, and Legal Heirs.
- (q) **Site** means the land and other places on, under, in or through which the works are to be executed or carried out and any other lands or places provided by the Employer or used for the purpose of the contract.
- (r) **Tender or Bid** means the tender submitted by the bidder for acceptance by the Employer.
- (s) **TPIA** means Third Party Inspection & Monitoring Agency i.e. M/s Engineers India Limited,. appointed by the Employer for Inspection, Monitoring, Audit & Quality Control of the works.
- (t) **Writing** means any manuscript type-written or printed statement under or over signature and/or seal of the concerned, as the case may be.
- (u) **Work or Works** shall, unless there be something in the subject or either context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be

executed whether temporary or permanent, and whether original, altered, substituted or additional.

Notes:

- (i) Headings in the clauses/conditions of tender documents are for convenience only and shall not be used for interpretation of the clause/condition.
- (ii) Words imparting the singular meaning only also include the plurals and vice versa where the context requires. Words imparting persons or parties shall include firms and corporations and organizations having legal capacities.

2.0 Performance Guarantee

- (i) Within 15 (Fifteen) days from the date of issue of Letter of Award (LoA), the Contractor shall submit an irrevocable Performance Guarantee (as per Form No. VII, Section 4) of 3% (Three per cent) of the tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement (notwithstanding and/or without prejudice to any other provisions in the contract). The Performance Guarantee shall be initially valid up to the stipulated date of completion of work plus 60 days. In case the time for completion of works gets extended, the Contractor shall get the validity of Performance Guarantee extended up to such extent to cover such extended time for completion of work + 60 days. The performance guarantee shall be returned to the Contractor/ discharged, without any interest thereon, after issue of the Completion Certificate for the work by the Engineer-in-Charge.
- (ii) The Employer reserves the right to ask for Additional Performance Guarantee where the quoted rates are found to be lower by 15% as compared with the rates indicated in the NIT.
- (iii) The Engineer-in-Charge shall make a claim under the performance guarantee except for amounts to which the Engineer-in-Charge is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:
 - (a) Failure by the Contractor to extend the validity of the Performance Guarantee as described herein above, in which case the Engineer-in-Charge may claim the full amount of the Performance Guarantee.
 - (b) Failure by the Contractor to pay any amount due, either as agreed by the Contractor or determined under any of the Clauses/ Conditions of the agreement, within 30 days of the service of notice to this effect by the Engineer-in-Charge.
 - (c) In the event of the contract being determined or rescinded under provisions of any of the Clauses/ Conditions of the agreement, the

performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of Engineer-in-Charge.

3.0 Security Deposit/ Retention Money

3.1 At the time of making payment to Contractor towards each running and final bill for the work done under the contract, the Contractor shall permit the Engineer-in-Charge to deduct a sum at the rate of 5% (five per cent) of the gross amount of bill till the sum deducted will amount to security deposit of 5% (five per cent) of the tendered value of the work. Such deductions will be made and held by the Engineer-in-Charge by way of Security Deposit unless the Contractor has deposited the amount of Security at the rate mentioned above in cash or in the form of a Bank Guarantee. At any event, if the Bank Guarantee is to be revoked by Engineer-in-Charge, and the Bank is unable to make payment against the said bank guarantee, the loss caused thereby shall fall on the Contractor and the Contractor shall forthwith, on demand, furnish additional security to the Engineer-in-Charge to make good the deficit.

3.2 All Compensation or other sums of money payable by the Contractor under the terms of this contract may be deducted from, or paid by adjustment of a sufficient part of his security deposit or from the interest arising there from, or from any sums which may be due to or may become due to the Contractor by Engineer-in-Charge on any account whatsoever. In the event of his Security Deposit being reduced by reason of any such deductions or adjustment as aforesaid, the Contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the State Bank of India or by any Scheduled Bank or Government Securities (if deposited for more than 12 months) endorsed in favour of the Employer, any sum or sums which may have been deducted from, or raised by adjustment of his security deposit or any part thereof.

3.3 Release of Security Deposit

5% Security Money will be released as per following –

- (a) 25% of the Retention Money/ Security Deposit will be released after 01 year from the date of issue of Completion Certificate subject to the condition that any defects observed during this period are duly rectified/ repaired by the Contractor at his cost to the satisfaction of the Engineer-in-Charge;
- (b) Another 50% of the Retention Money/ Security Deposit will be released after completion of two years from the date of issue of Completion Certificate subject to the condition that any defects observed during this period are duly rectified/ repaired by the Contractor at his cost to the satisfaction of the Engineer-in-Charge;
- (c) The balance 25% of the Retention Money/ Security Deposit will be released after the Defect Liability Period of 5 years from the date of

issue of Completion Certificate subject to the condition that any defects observed during this period are duly rectified/ repaired by the Contractor at his cost to the satisfaction of the Engineer-in-Charge;

- (d) If any defect arises within defect liability period, it is the contractor's sole responsibility to rectify the same at his cost once communicated by the Engineer-in-Charge in writing as per Clause 42 & 82 below. In case the contractor fails to rectify the same, then such defect(s) will be got rectified/ repaired by the Employer through any other agency at contractor's risk and cost. The cost will be deducted from the security deposit retained towards such defect liability period.
- (e) The Contractor may, if he so wishes, get his Security Deposit/ Retention Money released from the Employer and replace the same with Bank Guarantees, valid for a period of one year +60 days (25% of the Retention Money), 50% after two years +60 days and the balance 25% after five years +60 days respectively.

4.0 Mobilization Advance

4.1 Mobilization advance up to 5% of the contract value, bearing a simple interest rate of 9% per annum, shall be paid to the Contractor, if requested by him on submission of irrevocable Bank Guarantee (as per Form VIII of Section 4) of an amount equivalent to 110% of the respective instalment of mobilization advance, valid for the entire contract period from a Scheduled Bank in the enclosed Performa.

4.2 The mobilization advance, if requested, shall be paid in three instalments as follows:

- (i) First Instalment of Twenty per cent (20%) of the total mobilization advance shall be paid after:
 - (a) Initial mobilisation at the project site;
 - (b) Submission of bank guarantee in approved Performa (annexed under Forms and Formats).

This instalment shall be paid if the request is made by the Contractor within 30 days from date of issue of LOA/LOI.

- (ii) Second instalment of Forty per cent (40%) of total mobilization advance shall be paid after the Contractor has constructed Site Office, storage shed, fabrication yard, site laboratory, etc. and has physically mobilized plant and machinery, scaffolding & shuttering materials etc. at site and is ready to start the work to the entire satisfaction of Engineer-in-Charge and commenced the work at site.

The above instalment will be released subject to the actions at sub-para (ii) above are performed by the Contractor within 60 days of signing the contract and/or 90 days from the date of issue of LOA/LOI, whichever is earlier.

- (iii) The Balance Forty per cent (40%) of mobilization advance shall be paid to the Contractor on submission of Utilization Certificate (For this contract only) of 60% of the mobilization advance for the already paid to him.

4.3 The mobilization advance, including the accrued interest, shall be recovered from each running account bill of the Contractor in such a manner that the total Mobilization Advance is recovered when 85% of the contract value gets paid to the contractor.

4.4 The Contractor can submit a single bank guarantee for the entire mobilisation amount or submit the bank guarantees in parts against the mobilization advances in the proposed numbers of recovery instalments equivalent to the amount of each instalment as per Clause 4.1 and 4.2 above. The bank guarantee submitted by Contractor against mobilization advance shall initially be valid for the entire contract period and shall be kept renewed from time to time to cover the balance amount arrived by deducting the amount already recovered along with the accrued interest till such time.

5.0 Secured Advance

- (i) Interest-free secured advance will be payable to the Contractor up to a maximum of 60% (sixty per cent) in respect of purchase of material required for incorporation in the permanent works and brought to site on production of the Tax Invoice against which the Secured Advance is being sought subject to approval by the Engineer-in-charge. This secured advance will be tenable only for non-perishable material/s brought to site after due verification by the Engineer-in-Charge for quality, quantity requirements on site and value as described above. The advance will be paid only on submission of Indemnity Bond in the prescribed Performa (As per Form XII, Section 4).
- (ii) The Contractor shall construct suitable Go-down/ warehouse at the site of work for safe storage of the materials against any possible damages due to sun, rain, dampness, fire, theft etc. at his own cost. He shall also employ necessary watch & ward establishment for the purpose at his risk and costs. No claims extra charges on account of safe keeping, pilferage or loss for any reason whatsoever will be tenable or entertained by the Employer.
- (iii) Such secured advance shall not be payable on other items of perishable nature, fragile and combustible. No secured advance shall be paid on high-risk materials such as glass, sand, petrol, diesel etc.

5.1 Recovery of Secured Advance

When materials on account of which an advance has been paid under clause 5.0, are incorporated in the work, the amount of such advance shall be recovered from the next payment to be made to the Contractor under any

of the clauses of this contract.

If there is any inordinate and inexcusable delay on the part of contractor in incorporation of the goods and materials for which the Secured Advance is provided in the permanent work, the Engineer in Charge may levy interest @ 12% on the value of unutilized goods and materials from the date on which such goods and materials were scheduled to be incorporated in the work as per the work completion schedule till the date on which goods and materials are incorporated in the work.

6.0 Deviations/ Variations Extent and Pricing

The Engineer-in-Charge shall have the power to (i) make alteration in, omissions from, additions to, or substitutions for the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work, and (ii) omit a part of the works in case of non-availability of a portion of the site or for any other reasons and the Contractor shall be bound to carry out the works in accordance with any instructions given to him in writing by the Engineer-in-Charge and such alterations, omissions, additions or substitutions shall form part of the contract as if originally provided therein and any altered, additional or substituted work which is instructed, the contractor shall be bound to carry out the works on the same conditions in all respects including the price on which he agreed to do the main work except as hereafter provided in Clause 6.1 and 6.2 below.

The time for completion of the works shall, in the event of any deviations resulting in additional cost over the tendered value sum being ordered, be suitably extended, if requested by the Contractor. Such extension in time on account of additional work shall be proportionate to the value of additional work.

6.1 Deviations, Extra Items & Pricing

- (i) In the case of extra item(s) (items that are completely new and are in addition to the items contained in the contract), the Contractor may within 15 days of receipt of order or occurrence of the item(s) submit the rates as per the relevant DSR/DAR supported by proper analysis which shall include detailed CPWD specifications for the work. The Engineer-in-Charge shall, within prescribed time limit of 90 days of the date from the receipt of the claims supported by analysis, determine the rates based on the contractor submission, and the Contractor shall be paid in accordance with the rates so determined. In case the Contractor fails to claim such scheduled item rate claim within the prescribed time of 15 days, the rate approved later by the Engineer- in-Charge shall be binding on the Contractor.
- (ii) In the case of extra item(s) (items that are completely new, not a part of the DSR and are in addition to the items contained in the contract), the Contractor

may within 15 days of receipt of order or occurrence of the item(s) submit the rates as per the relevant market rate claim rates, supported by proper analysis based on relevant available costs in the DAR which shall include invoices, vouchers etc. and manufacturer's specifications for the work. The Engineer-in-Charge shall, within prescribed time limit of 90 days of the date from the receipt of the claims supported by analysis, determine the rates on the basis of the market rates after giving consideration to the analysis of the rates submitted by the Contractor, and the Contractor shall be paid in accordance with the rates so determined. In case the Contractor fails to claim such market rate claim within the prescribed time of 15 days, the rate approved later by the Engineer- in-Charge shall be binding on the Contractor.

(iii) In the case of substituted items (items that are taken up with partial substitution or in lieu of items of work in the contract), the rate for the agreement item (to be substituted) and substituted item shall also be determined based on the substituted item being a scheduled item of Schedule A or Schedule B in the manner as mentioned in the following para:

- (a) For Schedule B item, If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the Contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted)
- (b) For Schedule B item, If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the Contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).
- (c) For Schedule A item, if the scheduled/DSR/DAR rate for the substituted item so determined is less than the rate of the agreement item (to be substituted), the rate payable to the Contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the DAR/DSR rates (as prevalent on the day of receiving the bid) of substituted item and the agreement item (to be substituted).
- (d) For Schedule A item, if the scheduled/DSR/DAR rate for the substituted item so determined is more than the rate of the agreement item (to be substituted), the rate payable to the Contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the DAR/DSR rates (as prevalent on the day of receiving the bid) of substituted item and the agreement item (to be substituted).

The Engineer-in-Charge shall, within prescribed time limit of 90 days from the date of the receipt of the claims **for the substituted item mentioned at Clause 6.1 (iii) (a), (b), (c) & (d) above**, supported by analysis, determine the rates based on the contractor submission, and the Contractor shall be paid in accordance with the rates so determined. In case the Contractor fails to claim such rates for the substituted item within the prescribed time of 15 days, the rate approved later by the Engineer- in-Charge shall be binding on the Contractor.

- (iv) Market rates, in case not available in the DAR/DSR, are to be determined as per various sub-clauses under clause 6.0 and shall be based on prevailing rates of materials excluding GST unless mentioned otherwise, relevant authority rate for labour, market rates of T&P etc. plus 15% towards Contractor's overheads and profits.

6.2 Deviation, Deviated Quantities & Pricing

- (i) In the case of contract items, substituted items, contract-cum-substituted items, which exceed the limits laid down in General details (Annexure-I) are scheduled rates (Schedule A) or have been derived from Scheduled rates based on DSR/DAR, the Contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis for the work in excess of the above-mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the latest DSR along with its associated latest cost index adjustments (if any) as published by CPWD for the DSR, till the date of receipt of the claim, by the contractor, post adjusting the (below/above/at par percentage quoted by the contractor in his financial bid for Schedule A rates). The Engineer-in-Charge shall within prescribed time limit of 90 days from the date of receipt of the claims supported by analysis, after considering the analysis of the rates submitted by the Contractor, determine the rates on the basis of the DSR/DAR/Cost Index and the Contractor price bid shall be paid in accordance with the rates so determined. In case the Contractor fails to claim such market rate claim within the prescribed time of 15 days, the rate approved later by the Engineer- in-Charge shall be binding on the Contractor.
- (ii) In the case of contract items, substituted items, contract-cum-substituted items, which exceed the limits laid down in General details (Annexure-I) are NOT scheduled rates (Schedule A) or have not been derived from Scheduled rates based on DSR/DAR, the Contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis for the work in excess of the above-mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities. The Engineer-in-Charge shall within prescribed time limit of 90 days from the date of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by

the Contractor, determine the rates on the basis of the market rates (as per invoice, vouchers from the manufacturers or suppliers submitted by the agency and duly verified by Engineer-in-Charge or his representative) and the Contractor shall be paid in accordance with the rates so determined. In case the Contractor fails to claim such market rate claim within the prescribed time of 15 days, the rate approved later by the Engineer- in-Charge shall be binding on the Contractor for the cases where market rate for the deviated quantity comes out to be less than SOR rate.

- (iii) For the purpose of operation/ Accounting of quantities in deviation, the following works shall be treated as works relating to foundation unless & otherwise defined in the contract -
 - (a) For Buildings: All works up to 1.2 meter above ground level or up to floor 1 level, whichever is lower.
 - (b) For abutments, piers and well staining: All works up to 1.2 meter above the bed level.
 - (c) For retaining walls, wing walls, compound walls, chimneys, overhead reservoirs/ tanks and other elevated structures - All works up to 1.2 meter above the ground level.
 - (d) For reservoirs/ tanks (other than overhead reservoirs/tanks) - All works up to 1.2 meter above the ground level.
 - (e) For basement - All works up to 1.2 meter above ground level or up to floor 1 level, whichever is lower.
 - (f) For Roads, all items of excavation and filling including treatment of sub-base.
- (iv) Any operation incidental to or necessary for proper execution of the item included in the Schedule of Quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations and such claims will be rejected as submissions for deviations, deviated quantities and pricing and not be treated tenable under this clause.

7.0 Escalation (Cement, Reinforcement & Structural Steel only)

7.1 Payment due to variation in prices of materials after receipt of tender:

- (i) If after submission of the tender, the price of materials increases/ decreases beyond the base price(s) for the work as mentioned in the contract, then the amount of the contract shall be accordingly varied.

Provided that any such variations shall be effected for the stipulated period of Contract including the justified extended period under the provisions of

Clause 17 of the Contract without any action under Clause 8. .

- (ii) However, for work done during the justified extended period, it will be limited to the indices prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-rata basis only as cost of extra work x stipulated period/tendered cost). If updated stipulated date of completion as calculated on pro- rata basis does not cover a full calendar month, then indices will be considered or restricted to the previous month.
- (iii) The increase/ decrease in prices of cement, steel reinforcement and structural steel shall be determined by the Price indices issued by the Director General, CPWD. Base price for cement, steel reinforcement and structural steel shall be as issued under the authority of Director General CPWD applicable for the NCR i.e. Delhi including Noida, Gurgaon, Faridabad & Ghaziabad and for other places as issued under the authority of Zonal Chief Engineer, CPWD.
- (iv) The amount of the contract shall accordingly be varied for all such materials and will be worked out as per the formula given below for individual material:

Adjustment for component of individual material -

$$V = P \times Q \times (CI - CI_0) / CI_0$$

where,

V = Variation in material cost i.e. increase or decrease in the amount of rupees to be paid or recovered.

P = Base Price of material as mentioned in the contract

Q = Quantity of material brought at site for bona-fide use in the works since previous bill excluding any such quantity consumed in the deviated quantity of items beyond deviation limit and extra /substituted item, paid/to be paid at rates derived on the basis of market rate under clause 6.2.

CI₀ = Price index for cement, steel reinforcement bars, structural steel as issued by DG, CPWD and corresponding to the time of base price of respective material.

CI = Price index for cement, steel reinforcement bars, structural steel as issued under the authority of DG, CPWD for period under consideration.

Notes:

- (i) In respect of the justified extended period under the provisions of clause 17 of the contract, without any action under clause 8, the index prevailing at the time of updated stipulated date of completion considering the effect of extra work (extra time to be calculated on pro-

rata basis only as cost of extra work x stipulated period/ tendered cost) shall be considered.

- (ii) If updated stipulated date of completion, as calculated on pro- rata basis, does not cover full calendar month then the indices will be considered or restricted to the previous month.
- (iii) If during progress of work or at the time of completion of work, it is noticed that any material brought at site is in excess of requirement, then the amount of escalation, if paid earlier on such excess quantity of material, shall be recovered on the basis of cost indices as applied at the time of payment of escalation or as prevailing at the time of effecting recovery, whichever is higher.
- (iv) Cement, wherever mentioned in this clause, also includes Cement component used in RMC brought at site from the outside approved RMC plants, if any.
- (v) The date-wise record of ready-mix concrete shall be kept in a register and the cement consumption for the same shall be calculated accordingly.
- (vi) If built-up steel items are brought at site from workshop, then the variation shall be paid for the structural steel up to the period when the built-up item/ finished product is brought at site or as applicable on the date of purchase of such material based on the invoice, whichever is lower.

8.0 Compensation for Delay

- (i) If the Contractor fails (a) to maintain the required progress in terms of clause 17, or (b) to complete the work and clear the site on or before the stipulated date of completion of contract or justified extended date of completion as well as any extension granted under any other clause, he shall, without prejudice to any other right or remedy available under the law to the Employer on account of such breach, pay as Penalty the amount calculated at the rates stipulated in sub para (ii) below.

- (ii) Compensation for delay of work - With maximum rate @ 0.5% (zero point five per cent) per week of delay to be computed on per day basis.

Provided always that the total amount of Penalty for delay to be levied under this condition shall not exceed 10 % (ten per cent) of accepted tendered value.

- (iii) In case, penalty for delay has not been decided/ not communicated to the contractor by the Engineer-in-Charge during the progress of work, it shall not be treated as a deemed waiver of right to levy penalty by Engineer-in-Charge if the work remains incomplete on the actual date of completion or the final justified extended date of completion.

9.0 Action in case work is not done as per Specifications

- (i) All works under or in the course of execution or executed in pursuance of the contract, shall at all times be open and accessible to inspection and supervision of the Engineer-in-charge, his authorized subordinates, and all the superior officers, officer of the Third Party Inspection and Monitoring Agency (TPIA) of the Employer or any organization engaged by the Employer for Monitoring and Quality Assurance, during the usual working hours and at all other times for which reasonable notice of the visit of such officers will be communicated to the Contractor in writing by the Engineer-in-charge/ Employer/ PMC. Orders given to the Contractor's authorised representative shall be considered to have the same force as if they had been given to the Contractor himself.
- (ii) If it shall appear to the Engineer-in-charge or the PMC and/or his authorized subordinates or to the officer of the TPIA or his subordinate officers that –
 - (a) Any work has been executed with unsound, imperfect, or unskilful workmanship; or
 - (b) With materials or articles provided by him for the execution of work are unsound or of a quality inferior to that contracted; or
 - (c) Otherwise not in accordance with the contract;the Contractor shall, on demand in writing, which shall be made within twelve months of the completion of the work from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for, forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other approved proper and suitable materials or articles at his own risk, charge and cost including the cost of suitable barricading around the work front as directed by the engineer in charge.
- (iii) In such case, the Engineer-in-Charge may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the Engineer-in-Charge may consider reasonable during the preparation of on-account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the Contractor. Decision of the Engineer-in-Charge will be conveyed in writing in respect of the same and will be final and binding on the Contractor.

10.0 Action in case of Bad Work

- (i) If it shall appear to the Employer/ Engineer-in-Charge or his authorized representative or to any other inspecting agency, that any work has been executed with unsound, imperfect, or unskilful workmanship or with materials of any inferior description, or that any materials or articles provided by him for the execution are unsound or of a quality inferior to that contracted for or of the works are otherwise not in accordance with the contract, the Contractor shall on demand in writing, which shall be made within twelve months of the completion of the work, from the Engineer-in-Charge specifying the work, materials or articles complained of notwithstanding that the same may have been passed, Certified and paid for, forthwith rectify or remove and reconstruct the work so specified in whole or in part as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own proper charge and cost.
- (ii) In the event of the Contractor failing to do so within a period to be specified by the Engineer-in-Charge in his demand aforesaid, while the Contractor failure to do so shall continue, the Engineer-in-Charge may rectify or remove and re-execute the work or remove and replace with others, the material or articles complained of, as the case may be, at the risk and cost of the Contractor in all respects.

11.0 Non-Waiver:

Failure of Engineer-in-Charge to insist upon strict performance of any of the terms & conditions hereof, or failure or delay to exercise any rights or remedies provided herein or by law or failure to properly notify the Contractor in the event of breach or the acceptance of or payment for any services hereunder or approval of interim reports, shall not release the Contractor of any of the warranties or obligations of this order and shall not be deemed a waiver of any right of Engineer-in-Charge/ Employer/ PMC/ TPIA to insist upon strict performance hereof or of any of its rights or remedies as to any such services regardless when received or accepted, nor shall any purported oral modification or rescission of this Order by Engineer-in-Charge operate as a waiver of the terms hereof.

12.0 Cancellation/ Determination of Contract in Full or Part

- 12.1** Subject to other provisions contained in this clause, the Engineer-in-Charge may, without prejudice to his any other rights or remedy against the Contractor in respect of any delay, or not following safety norms, inferior workmanship, any claims for damages and/ or any other provisions of this contract or otherwise, and whether the date of completion has or has not elapsed, by notice in writing, absolutely determine the contract in any of the following cases:

- (i) If the Contractor having been given a notice in writing by the Engineer-in-Charge to rectify, reconstruct or replace any defective work or that the work is being performed in an inefficient or otherwise improper or in a manner of unacceptable and poor workmanship, does not comply with the requirement of such notice for a period of 15 days thereafter; or
- (ii) If the Contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence so that in the opinion of the Engineer-in-Charge (which shall be final and binding) he will be unable to secure completion of the work by the scheduled date for completion and continues to do so after a notice in writing of 15 days from the Engineer-in-Charge; or
- (iii) If the Contractor fails to complete the work within the stipulated date or items of work/ achieve the milestones with individual dates of completion, if any stipulated, on or before the stipulated date; and does not complete them within the period specified in a notice given in writing by the Engineer-in-Charge; or
- (iv) If the Contractor persistently neglects to carry out his obligations under the contract and/ or commits default in complying with any of the terms and conditions of the contract and does not remedy it or take effective steps to remedy it within 15 days after a notice in writing is given to him in that behalf by the Engineer-in-Charge; or
- (v) If the Contractor shall offer or give or agree to give to any person in Employer's/ PMC/ TPIA service or to any other person on his behalf, any gift or consideration or make a promise of any kind as an inducement or reward for doing or forbearing to do or for having done or forborne to do any action in relation to the obtaining or execution of this or any other contract for the Employer/ PMC/ TPIA; or
- (vi) If the Contractor being an individual, or if a firm, any partner thereof shall at any time be adjudged insolvent or have a receiving order or order for administration of his estate made against him or shall take any proceedings for liquidation or composition (other than a voluntary liquidation for the purpose of amalgamation or reconstruction) under any Insolvency law for the time being in force or make any conveyance or assignment of his effects or composition or arrangement for the benefit of his creditors or purport to do so, or if any application be made under any Insolvency law for the time being in force for the sequestration of his estate or if a trust deed be executed by him for benefit of his creditors;
- (vii) If the Contractor, being a company, shall pass a resolution or the Court

shall make an order that the company shall be wound up or if a receiver or a manager on behalf of a creditor shall be appointed or if circumstances shall arise which entitle the Court or the creditor to appoint a receiver or a manager or which entitle the Court to make a winding up order;

- (viii) If the Contractor assigns (excluding part(s) of work assigned to other agency(s) by the Contractor as per terms of contract), transfers, sublets (engagement of labour on a piece-work basis or of labour with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Engineer -in-Charge with reference to the General Conditions of Contract.

12.2 When the contractor has made himself liable for action under any of the cases aforesaid, the Engineer-in-Charge, without prejudice to any other right or remedy which shall have accrued or shall accrue hereafter to the Employer/ PMC, by a notice in writing to cancel the contract as a whole or only such items of work in default from the contract, shall have the powers to:

- (i) Determine or rescind the contract as aforesaid in full or in part (of which termination or rescission notice in writing to the Contractor under the hand of the Engineer-in-Charge shall be conclusive evidence) and get the same executed at the risk & cost of the Contractor. Upon such determination or rescission, Security Deposit already recovered, Security deposit payable and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of Engineer-in-Charge and unused materials, construction plants, implements, temporary buildings, etc. shall be taken over by Engineer-in-Charge and shall be absolutely at the disposal of the Engineer-in-Charge.
- (ii) After giving notice to the contractor to measure up the work of the contractor and to take such whole, or the balance or part thereof as shall be un-executed or delayed with reference to the General Conditions of Contract clause no. 24.0 and/ or relevant clause of Special Conditions of Contract, out of his hands and to give it to another contractor to complete.

Notes:

- (i) The Contractor, whose contract is determined as above, shall not be allowed to participate in the tendering process for the balance work including any new items needed to complete the work.
- (ii) In the event of the Engineer-in-Charge taking recourse to the above,

the Contractor shall have no claim to Penalty for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on account of or with a view to the execution of the work or the performance of the contract; and

- (iii) In case action is taken under any of the provisions aforesaid, the Contractor shall not be entitled to recover or be paid any sum for any work thereof or performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

12.3 Any sums in excess of the amounts due to Employer and unsold materials, constructional plant etc. shall be returned to the Contractor, provided always that if the cost or anticipated cost of completion of the works or part of the works by Employer/ PMC/ TPIA is less than the amount which the Contractor would have been paid if he had completed the works or part of the works, such benefit shall not accrue to the Contractor.

12.4 In the event of anyone or more of the above courses being adopted by the Engineer-in-Charge, the Contractor shall have no claim towards Penalty for any loss sustained by him by reasons of his having purchased or procured any materials or entered into any engagements or made any advances on such account or with a view to the execution of the work or the performance of the contract. In case action is taken under any of the aforesaid provisions, the Contractor shall not be entitled to recover or be paid any sum for any work thereof or actually performed under this contract unless and until the Engineer-in-Charge has certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

12.5 In case, the work cannot be started due to reasons not within the control of the Contractor within 1/8th of the stipulated time or two months for completion of work, whichever is lower, either party may close the contract by giving notice to the other party stating the reasons. In such an eventuality, the Performance Guarantee of the Contractor shall be refunded within following time limits:

(i)	If the Tendered value of work is up to Rs. 1.00 Crore	15 days
(ii)	If the Tendered value of work is more than Rs. 1 Crore and up to Rs. 10 Crore	21 days
(iii)	If the Tendered value of work exceeds Rs. 10 Crore	30 days

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

13.0 Contractor liable to pay Compensation even if action not taken under clause 12.0

In a case where any of the powers conferred upon the Engineer-in-Charge shall have become exercisable under the relevant clause of the Contract, and the same are not exercised, the non-exercise thereof shall not constitute an ipso facto waiver of any of the conditions hereof. Such powers shall be exercisable in the event of any future case of default by the Contractor and the liability of the Contractor for Penalty shall remain unaffected. In the event of the Engineer-in-Charge putting in force all or any of the powers vested in him under any clause, he may, if he so decides, after giving a notice in writing to the Contractor, take possession of (or at the sole discretion of the Engineer-in-Charge, which shall be final and binding on the Contractor), use as on hire (the amount of the hire money being also in the final determination of the Engineer-in-Charge) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work/ or any part thereof, paying or allowing for the same in account at the contract rates, or in the case of these not being applicable, at current market rates to be certified by the Engineer-in-Charge, whose certificate thereof shall be final and binding on the contractor and/or direct the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) in the event of the contractor failing to comply with any such requisition, the Engineer-in-Charge may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Engineer-in-Charge as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

14.0 Carrying out part work at the risk & cost of the Contractor

14.1 If the Contractor:

- (i) At any time makes default during currency of work or does not execute any part of the work with due diligence and continues to do so even after receiving a notice in writing of 15 days in this respect from the Engineer-in-charge: or
- (ii) Commits default in complying with any of the terms and conditions of the contract and does not remedy it or takes effective steps to remedy it within 15 days even after a notice in writing is given in that behalf by the Engineer-in-Charge; or
- (iii) Fails to complete the work(s) or items of work with individual dates

of completion, on or before the date(s) so determined, and does not complete them within the period specified in the notice given in writing in that behalf by the Engineer-in-Charge;

The Engineer-in-Charge, without invoking action under clause 12.0 of the contract may, without prejudice to any other right or remedy against the Contractor, which have either accrued or accrue thereafter to Employer/PMC, by a notice in writing to take the part work/ part incomplete work of any item(s) out of his hands and shall have the powers to:

- (a) Take possession of the site and any materials, constructional plant, implements, stores, etc. thereon; and/or
- (b) Carry out the part work/ part incomplete work of any item(s) by any means at the risk and cost of the Contractor.

The Engineer-in-Charge shall determine the amount recoverable from the Contractor, if any, for completion of the part work/ part of any incomplete work and execute the same at the risk and cost of the Contractor. The liability of the Contractor on account of loss or damage suffered by the Employer because of action under this clause shall not exceed 10% of the tendered value of the work.

In determining the amount, credit shall be given to the Contractor for the value of work done in all respects in the same manner and at the same rate as if it had been carried out by the Contractor under the terms of his contract, the value of Contractor's materials taken over and incorporated in the work and use of plant and machinery belonging to the Contractor. The certificate of the Engineer-in-Charge as to the value of work done shall be final and binding on the Contractor provided that action under this clause shall be taken only after giving notice in writing to the Contractor. Provided also that if the expenses incurred by the Employer are less than the amount payable to the Contractor at his agreement rates, the difference shall not be payable to the Contractor.

- 14.2 Any excess expenditure incurred or to be incurred by the Employer in completing the part work/ part incomplete work of any item(s) or the excess loss of damages suffered or may be suffered by the Employer as aforesaid after allowing such credit, shall without prejudice to any other right or remedy available to the Employer in law or as per agreement, be recovered from any money due to the Contractor on any account, and if such money is insufficient, the Contractor shall be called upon in writing and shall be liable to pay the same within 30 days.

If the Contractor fails to pay the required sum within the aforesaid period of 30 days, the Engineer-in-Charge shall have the right to sell any or all of the Contractors' unused materials, constructional plant, implements, temporary building at site etc. and adjust the proceeds of sale thereof towards the dues

recoverable from the Contractor under the contract and if thereafter there remains any balance outstanding, it shall be recovered from the Contractor in accordance with the provisions of the contract.

In the event of above course being taken by the Engineer-in-Charge, the Contractor shall have no claim to compensation for any loss suffered by him by reason of his having purchased or procured any materials or entered into any engagements or made any advance on any account or with a view to the execution of the work or the performance of the contract.

15.0 Suspension of Works

- (i) The Contractor shall, on receipt of the order in writing of the Engineer-in-charge (whose decision shall be final and binding on the Contractor), suspend the progress of the works or any part thereof for such time and in such manner as the Engineer-in-charge may consider necessary for any of the following reasons:
 - (a) On account of any default on part of the Contractor, or
 - (b) For proper execution of the works or part thereof for reason other than the default of the Contractor, or
 - (c) For safety of the works or part thereof.
- (ii) The Contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Engineer-in-charge.
- (iii) If the suspension is ordered for reasons (b) and (c) in sub-Para (i) above.
 - (a) The Contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion period. No adjustment in contract price will be allowed for reasons of such suspension.
 - (b) In the event of the Contractor treating the suspension as an abandonment of the Contract by Employer, he shall have no claim to payment of any Penalty on account of any profit, loss of profit or advantage, which he may have derived from the execution of the work in full.

16.0 Termination of Contract on Death of the Contractor

Without prejudice to any of the rights or remedies under this contract, if the Contractor dies, the Engineer-in-Charge shall have the option of terminating the contract without any Penalty to the Contractor.

17.0 Time & Extension for Delay

- 17.1** The time allowed for execution of the Works as specified or the extended time in accordance with the conditions as per this clause shall be the essence of

the Contract. The execution of the work shall commence from the 15th day of issue of LoA or from the date of handing over of the site, notified by the Engineer-in-Charge, whichever is later. If the Contractor commits default in commencing the execution of the work as aforesaid, the performance guarantee shall be forfeited by the Engineer-in-Charge and shall be absolutely at the disposal of the Engineer-in-Charge without prejudice to any other right or remedy available in law.

17.2 As soon as possible but within 10 days of award of work:

- (i) The Contractor shall submit a Time and Progress Chart for each milestone as per the format required by the engineer-in-charge. The Engineer-in-Charge may, if required, within 30 (Thirty) days thereafter modify, and communicate the approved program to the Contractor, failing which the program submitted by the Contractor shall be deemed to be approved by the Engineer-in-Charge. The work programme shall include all details of drawings and decisions required to complete the contract with specific dates by which these details are required by the Contractor without causing any delay in execution of the work. The Chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various activities of the work and may be amended as necessary by agreement between the Engineer-in-Charge and the Contractor within the overall limitations of time imposed in the Contract documents.
- (ii) In case of non-submission of construction programme by the Contractor, the program approved by the Engineer-in-Charge shall be deemed to be final.
- (iii) The approval by the Engineer-in-Charge of such programme shall not relieve the Contractor of any of the obligations under the contract.
- (iv) The Contractor shall submit the Time and Progress Chart using the mutually agreed software or in other format decided by Engineer-in-Charge for the work done during the previous month to the engineer in charge on or before the 7th day of each month with S curves of the proposed planning vs actual execution progress.

17.3 If the work(s) be delayed by -

- (i) force majeure; or
- (ii) abnormally bad weather; or
- (iii) serious loss or damage by fire; or
- (iv) civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work; or
- (v) delay on the part of other Contractors or tradesmen engaged by Engineer-in-Charge in executing work not forming part of the Contract; or

- (vi) any other cause like above which, in the reasoned opinion of the Engineer-in-Charge is beyond the Contractor's control;

then upon the happening of any such event causing delay, the Contractor shall immediately give notice thereof in writing to the Engineer-in-Charge but shall nevertheless constantly use his best endeavours to prevent or make good the delay and shall do all that may be reasonably required to the satisfaction of the Engineer-in-Charge to proceed with the works.

The Contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in above sub clauses and he shall update the progress schedule reports submitted at above Clause for all such delays once they are approved by the engineer in charge based on the contractor submittals as defined in Clause below.

- 17.4** In case the work is hindered by the Employer for any reason/event, for which the Employer is responsible, the Engineer-in-Charge shall, if justified, give a fair and reasonable extension of time and reschedule the milestones for completion of work. Such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law. Provided further that for concurrent delays under this clause and sub clause 17.3 to the extent the delay is covered under sub clause 17.3, the Contractor shall be entitled to only extension of time and no damages and/or claims on this account.
- 17.5** Request for rescheduling of Milestones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within ten days of the happening of the event causing delay. The Contractor shall indicate in such a request the period by which rescheduling of milestone/s or extension of time is required.
- 17.6** In case the work is delayed by the Contractor for any reasons, in the opinion of the Engineer-in-Charge, beyond the events mentioned in clause 17.3 or clause 17.4 and beyond the justified extended date, without prejudice to the right to take action, the Engineer-in-Charge may grant extension of time required for completion of work without rescheduling of the milestones. The Contractor shall be liable for levy of Penalty for delay for such extension of time.

18.0 Time Schedule & Progress

- 18.0** Time allowed for carrying out all the works as entered in the tender shall be as mentioned in the "GENERAL DETAILS (Annexure-I)" which shall be reckoned from the 15th day from the date on which the letter of Award or the date of handing over of site whichever is later, is issued to the Contractor. Time shall be the essence of the contract and contractor shall ensure the completion of the entire work within the stipulated time of completion.
- 18.1** The contractor shall also furnish within 15th days of date of issue of letter of

Award a CPM network/ PERT chart/ Bar Chart for completion of work within stipulated time. This will be duly got approved from the Engineer-in-Charge. This approved Network/ PERT Chart shall form a part of the agreement. Achievement of milestones as well as total completion has to be within the time period allowed.

- 18.2** Contractor shall mobilize and employ sufficient resources for completion of all the works as indicated in the agreed BAR CHART/PERT Network. No additional payment will be made to the contractor for any multiple shift work or other incentive methods contemplated by him in his work schedule even though the time schedule is approved by the Engineer-in-Charge.
- 18.3** During the currency of the work the contractor is expected to adhere to the time schedule on milestone and total completion and this adherence will be a part of Contractor's performance under the contract. During the execution of the work contractor is expected to participate in the review and updating of the Network/BAR CHART undertaken by the Engineer-in-Charge. These reviews may be undertaken at the discretion of Engineer-in-charge either as a periodical appraisal measure or when the quantum of work order on the contractor is substantially changed through deviation orders or amendments. The review shall be held at site or any of the offices of Employer/PMC at the sole discretion of Engineer-in-Charge. The contractor will adhere to the revised schedule thereafter. The approval to the revised schedule resulting in a completion date beyond the stipulated date of completion shall not automatically amount to a grant of extension of time to the contractor.
- 18.4** Contractor shall submit (as directed by Engineer-in-Charge) progress reports on a computer-based program (program and software to be approved by Engineer-in-Charge) highlighting status of various activities and physical completion of work. The contractor shall send completion report with as built drawings to the office of Engineer-in-Charge, in writing within a period of 30 days of completion of work.
- 18.5** At least 10 Nos dated photographs of the project taken on last day of every month indicating progress of work (in soft copies) shall be attached along with the physical progress reports to be submitted to Engineer-in-charge
- 18.6** The defined timelines for documents to be submitted post-award, though mentioned at various other places, are summarised as under:

Sr. No.	Document Title	From issue of Letter of Award (On or before)
1	Time & Progress Chart for each mile-stone	10 days
2	Date of Commencement of Work	15 th day
3	Details of Contractor's Authorised Representative	15 days

	taking instructions from Engineer-in-charge	
4	<u>Updated</u> Overall Project Schedule	15 days
5	CPM network/ PERT chart/ Bar Chart for completion of work within stipulated time	15 days
6	Submission of Irrevocable Performance Bank Guarantee (5% of tendered amount)	15 days
7	Quality Assurance Programme/ Plan	30 days
8	Detailed contract coordination procedure	30 days
9	Site organizational chart and individual personnel resume, including details of experience of the Project-in-Charge and other staff proposed to be deployed by him	30 days
10	Insurance Policies	30 days

Notes: Document Review and Submission Cycle

- (i) Post submission of the document by the Contractor, the Engineer-in-charge/ PMC-TPIA will review and provide comments/approval within fourteen (14) days of the receipt of respective documents.
- (ii) The contractor shall re-submit the documents (incorporating comments) within Five (5) days of receipt of the comments, for review/approval.
- (iii) The Engineer-in-charge/PMC-TPIA will be reviewing the same and providing comment s/approval within seven (7) days of the receipt of revised/updated document. The defined cycle will be followed till all the project requirements are complied with by the contractor and document is approved.

19.0 Taxes and Duties

19.1 The contract price is inclusive of all taxes, duties, cesses, fees, charges, interest/ late fees, incidental expenses, and statutory levies payable under any law (as applicable on the date of submission of bid) by the Contractor in connection with execution of the contract) but excluding the GST as applicable. The contract price shall be adjusted for any increase/ decrease in the rate of GST on works contract as notified by Government of India, from time to time.

19.2 Notwithstanding anything contained in clause 19.1, the Contractor shall ensure payment of applicable taxes on the supplies made under the contract. The Contractor shall take registration under the applicable enactment levying tax on supply of goods or services under the contract and issue invoices having all the particulars prescribed under the applicable provisions of law, including description of goods/services, rate and amount of tax paid or payable on the supplies made under the contract, so that the Employer can avail credit of such tax, wherever applicable. The Contractor shall comply with

all applicable provisions of Goods and Service Tax (GST) levied by Union Government and State Governments/ Union Territories (CGST, UTGST, SGST and IGST). The Contractor shall get himself registered and discharge his obligations for payment of taxes, filing of returns on time etc. under the appropriate provisions of law in respect of all the taxes, duties, levies, cess, etc. The Employer would have the right to seek necessary evidence that the Contractor is registered under the law and duly discharging its obligations under the tax laws, enabling the Employer to avail input tax credit, wherever admissible.

Whenever any GST, interest, penalty, late fees etc. is payable by the Employer on reversal of Input Tax Credit (ITC) or through cash payment under GST Act or rules due to default on Contractor's part, such as, non-filing/ late filing of GST returns, non-payment/ late payment of GST liabilities, delay in issue of invoices or non-appearance of GST invoice on the GST portal within the prescribed period, then in such an eventuality, the amount of GST, interest, penalty, late fees, if any, liable to be paid by the Employer under the said contract shall be borne by the Contractor and shall be recoverable from him.

- 19.3** In case the Contractor does not deposit the tax payable on execution of the contract, or has not provided the tax invoice to the Employer showing the amount of tax, or has not uploaded the document in computerized tax network as per prevailing law, leading to non-availability of inputs credit of the tax to Employer, the amount equivalent to such tax shall be retained or withheld from the subsequent RA Bill or payment to be made to the contractor on any account by the Employer till such time that the contractor ensures availability of input credit of the tax to the Employer.
- 19.4** The Contractor will be under obligation for charging correct rate of tax as prescribed under the respective tax laws from time to time during the entire duration of the contract. Further, the contractor shall avail and pass on benefits of all exemptions/concessions available under the tax laws to the Employer.
- 19.5** The Contractor will ensure its registration with the respective tax authorities and submit self-attested copy of such registration certificates to the Employer within 30 days of the award of LOA. The Contractor will be responsible for procurement of material on its own registration (GSTIN) and also to issue/ arrange its own Road Permit/ E-way Bill, if applicable, and comply with the statutory laws of the concerned state.
- 19.6** Any error of interpretation of applicability of taxes/ duties by the Contractor shall be to the Contractor's account. The classification of Goods & Services as per GST Act and charging of correct rate of tax as prescribed under the respective tax laws should be correctly done by the Contractor to ensure that input credit benefit is not lost to the Employer on account of any error on the

part of the Contractor or its sub-contractor/vendor. The contractor must ensure that Employer is not subjected to any additional liability towards payment of applicable taxes & duties as a result of wrong classification, valuation, assessment/ interpretation of applicable taxes & duties by the Contractor and the contractor will reimburse all losses on this account to the Employer (if any).

- 19.7** GST shall be applicable on all advance payments as per GST Act, Rules and relevant notifications thereunder.
- 19.8** Stamp duty and registration charges, if any, under Income Tax/ GST Act, payable towards the execution of any and all contract documents/agreements, shall be borne by the Contractor.
- 19.9** Tax deduction at source (TDS), if any, under Income Tax/ GST Act, shall be made by the Employer as per law applicable from time to time, from the amount payable to the Contractor.
- 19.10** Statutory variations on IGST/ CGST/ SGST/ UTGST (included in quoted prices) in case of imported materials from outside India in Contractor's name (i.e. for Indian Bidders) shall be to the Contractor's account.

19.11 New Taxes & Duties

All new taxes, duties, cess, levies notified or imposed after the due date of submission of last/ final price bid before the contractual date of completion of work (including extended contractual completion period for the reasons attributable to the Employer or due to Force Majeure condition), shall be to the Employer's account. These shall be reimbursed against documentary evidence. In case of reduction/elimination of taxes, the necessary credit shall be given to the Employer. However, in case of delays attributable to the Contractor, any new or additional taxes and duties imposed after the Scheduled Completion Date, as above, shall be to the Contractor's account.

19.12 Any Other Taxes Duties and Levies

- (i) Except as hereinabove specified, the Contractor shall be liable for and shall pay all fees, cesses, taxes, duties and levies assessable against the Contractor in respect of or pursuant to the Contract. If any legal/ departmental proceedings are initiated against the Contractor for short levy or non-levy of taxes, he shall be fully responsible to defend the same at his own.
- (ii) In addition, the Contractor shall be responsible for payment of all duties, levies, and taxes assessable against the Contractor or Contractor's employees or Sub-Contractor's whether corporate or personal as applicable in respect of property.
- (iii) The Contractor shall accept sole liability for the payment of any and all taxes, duties, cesses and levies, as are payable to any government, local or

statutory authority in any country other than India as are now in force or as are hereinafter imposed, increased or modified and as are payable by the Contractor, his agents, Sub-Contractors and Suppliers and its/their respective employees for or in relation to the performance of this Contract. The Contractor shall be deemed to have been fully informed with respect to all such liabilities and shall be deemed to have considered and included the same in his bid. The quoted Price shall not be varied in any manner on this account.

20.0 Tax Deduction at Source

20.1 Income Tax Deduction (TDS)

Income tax deductions shall be made from all payments made to the Contractor including advances, in respect of the work/ project undertaken by the Contractor, in accordance with the provisions of the Income Tax Act and Rules made thereunder prevailing and in force from time to time.

20.2 TDS under GST

TDS under GST, if applicable, shall be deducted from Contractor's bill at applicable rate and a certificate as per rules for tax so deducted shall be provided to the Contractor.

The Contractor shall be solely responsible and liable to deduct TDS, if applicable, from the sub-Contractors/ sub-vendors and remit the same to the Government within the due date, as per applicable laws.

20.3 Income Tax & Corporate Tax

- (i) The Contractor shall be solely responsible and liable to pay all Direct Taxes including income tax, profession tax and wealth tax on any payments arising out of the Contract, whether payable in India or in any other jurisdiction.
- (ii) The Contractor shall be responsible for ensuring compliance with all provisions of the Direct Tax laws of India including, but not limited to, the filing of appropriate Returns and shall promptly provide all information required by the Employer for discharging any of its responsibilities under such laws in relation to or arising out of the Contract.
- (iii) The Contractor shall indemnify the Employer against any and all liabilities or claims arising out of this contract for such taxes including interest and penalty which any tax authority may assess or levy on the Employer or its representatives.
- (iv) Tax shall be deducted at source by the Employer from all sums due to an Indian tax resident Contractor in accordance with the provisions of Indian Income Tax Act/ Rules as in force at the relevant point of time.

- (v) Corporate Tax Liability pertaining to contractor's work, if any, shall be to the Contractor's account.

20.4 Employer shall issue a Tax Deduction Certificate to the Contractor evidencing the Tax deducted or withheld and deposited by the Employer on payments made to the Contractor to enable the Contractor to claim the credit of the Tax deducted by the Employer.

20.5 Construction Workers' Cess / Labour Cess

- (i) The Contractor shall comply with the Building and Other Construction Workers' Welfare Cess Act, 1996, the Building and Other Construction Workers' (Regulation of Employment and Condition of Service) Central Rules, 1998 and the Building and Other Construction Workers' Welfare Cess Rules, 1998.
- (ii) Prices quoted by the bidder shall be deemed to be inclusive of construction workers cess/ labour cess.
- (iii) Cess as per the prevailing rate, shall be deducted at source from the bills of the Contractor and remitted to the "Secretary, Building and Other Construction Workers Welfare Board" of the concerned State by the Employer as per regulations. The Contractor shall be responsible to submit final assessment return of the cess amount to the assessing officer after adjusting the cess deducted at source.

21.0 Royalty and other costs on Materials

The cost of procurement of materials required for construction, including the Royalty, Cess, Toll, Octroi, if applicable for procurement/ supply of materials such as bajri, stone, kankar, sand, ordinary earth and other materials etc. shall be deemed to be included in the quoted rates and nothing additional would be payable on this account.

22.0 Insurance of Works etc.

22.1 Contractor is required to take 'Contractor's All Risk Policy' or 'Erection All Risk Policy', as the case may be, before start of work from an approved insurance company in the joint name with first name of Employer and bear all costs towards the same for the full period of execution of works for the full amount of contract against all loss of damage from whatever cause arising other than excepted risks for which he is responsible under the terms of the contract and in such manner that the Employer and his authorized representatives and the Contractor are covered during the period of construction of works for loss or damage in respect of:

- (i) The work and the temporary works to the full value of such works.
- (ii) The materials, constructional plant, centring, shuttering and scaffolding materials and other things brought to the site for their full value.

The Contractor is required to submit the original policy document and the receipt for payment of the current premium to the Employer.

22.2 Insurance under Workmen Compensation Act

- (i) Contractor is required to take insurance cover under the Workman Compensation Act, 1923 amended from time to time from an approved insurance company and pay premium charges thereof.
- (ii) The Contractor is required to submit the original policy document and the receipt for payment of the current premium to Employer.

22.3 Third Party Insurance

- (i) Contractor is required to take third party insurance cover for an amount of 5% (five per cent) of contract value from an approved insurance company for insurance against any damage, injury or loss which may occur to any person or property including that of Employer, arising out of the execution of works or temporary works.
- (ii) The Contractor is required to submit the original policy document and the receipt for payment of the current premium to Employer.
- (iii) Engineer-in-charge to ensure that Insurance policies are submitted by the Contractor within 30 days from the date of issue of LOA. In case of failure of the Contractor to obtain Contractors All Risk Policy, insurance under Workman Compensation Act and third-party insurance as described above, Employer reserves the right of forfeiture of the Performance Bank Guarantee.
- (iv) If the Contractor could not effect a comprehensive insurance cover against risks which he may be required to effect under the terms of the contract, then he shall give his attention and even in case to get the best insurance cover available of effecting a wider insurance cover than the one which the subsidiary of the General Insurance Company could offer, such an insurance is ought to be done after the Employer's approval, by or through the subsidiary of the General Insurance Company.

- 22.4** The Contractor shall at all times indemnify the Employer against all claims, damages or compensation under the provision of Payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, the Workmen's Compensation Act 1947, Industrial Disputes Act 1947 and Maternity Benefit Act 1961 or any modifications thereof or any other law in force or as a consequence of any accident or injury to any workman or other persons in or about the works, whether in the employment of the Contractor or not, against all costs, charges and expenses of any suit, action or proceedings arising out of such incident or injury and against all sum or sums which may, with the consent of the Contractor, be paid to compromise or

compound any such claim. Without limiting his obligations and liabilities as above provided, the Contractor shall insure against all claims, damages or compensation payable under the Workmen's Compensation Act 1923 or any modification thereof or any other law relating thereto.

23.0 Payments

23.1 All running payments shall be regarded as payments by way of advance against the final payment only and not as payments for work actually done and completed and/or accepted by Engineer-in-Charge and shall not preclude the recovery for bad, unsound and imperfect or unskilled work to be removed and reconstructed or re-erected. The final bill shall be submitted by the Contractor within three months of the completion of work otherwise Engineer-in-Charge's certificate of the total measurement shall be binding on the Contractor.

- (i) Intermittent progress Photographs, as and when required, shall also be provided by the Contractor at his own cost as per the direction of Engineer-in-Charge. No payment of running account bill shall be released unless it is accompanied by photographs, Monthly Progress Report and tax invoices as stated above.
- (ii) It may be noted that GST shall be recoverable as extra on all applicable recoveries e.g. Workmen recovery, compensation etc. made from the bills of Contractor.
- (iii) The Running Bills will be submitted by the Contractor (in 4 copies), complete in all respects, on a monthly basis. The Engineer-in-Charge shall process and verify the same within 15 days of submission of the bill, complete in all respects, who shall then forward the same with his certification to the Employer. The Employer will make every effort to process the payment thereof within 15 days of receipt of the certified bill from the Engineer-in-Charge.
- (iv) All payments shall be released by way of e-transfer through RTGS in India directly to their Bank account by the Employer.
- (v) No Running Account Bill shall be paid for the work till the labour licenses, registration with EPFO, ESIC and BOCW Welfare Board, whatever applicable, is submitted by the Contractor to the Engineer-in-Charge/Employer.

23.2 Payment of Final Bill

- (i) The final bill shall be submitted by the Contractor in the same manner as specified in the interim bills/ running bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Engineer-in-Charge, whichever is earlier.

- (ii) No further claims shall be made by the Contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute for quantities and rates, as approved by Engineer-in-Charge, will, as far as possible be made within 3 months of submission of final bill. As regards the disputed items, the payment to the extent of amount considered reasonable/ acceptable to the Engineer-in-Charge shall be made along with the payment of undisputed items. However, the payment in respect of the remaining claim shall be resolved and paid as per the provisions in Clause.83

23.3 Opening of Designated Bank Account for the Project

- (i) The Contractor shall maintain a separate bank account with a Scheduled Bank for the purpose of receiving all payments under the Contract and for utilization of payments received from the Employer for disbursement to sub-Contractors, sub-vendors, PRW's, suppliers etc. for this contract. The Contractor shall maintain separate Books of Account for all payments under this contract and the Engineer-in-Charge shall have access to it at all times.

24.0 Measurements of Works

- (i) Engineer-in-charge shall, except as otherwise provided, ascertain and determine by measurement, the value of work done in accordance with the contract. Except where any general or detailed description of the work expressly shows to the contrary, measurement shall be taken in accordance with the procedure set forth in the CPWD Specifications. In the case of items, which are not covered by specifications, mode of measurement as specified in the Technical Specifications of the contract, and if for any item no such technical specification is available, then a relevant standard method of measurement issued by the Bureau of Indian Standard shall be followed.
- (ii) Provided further that, in case of Cancellation/ Determination of Contract in Full or in Part in accordance with clause 12.0 (and its sub-clauses), following methodology shall be adopted in respect of measurements in addition to what has been mentioned in foregoing:
 - (a) All measurements and levels shall be taken jointly by the Engineer-in- Charge or his authorized representative and by the Contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Engineer-in-Charge and the Contractor or their representatives as token of their acceptance. If the Contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by Engineer-in-Charge & the Contractor.
 - (b) If for any reason, the Contractor or his authorized representative is not

available and the work of recording measurements is suspended by the Engineer-in-Charge or his representative, the Engineer-in-Charge shall not entertain any claim from Contractor for any loss or damages on this account. If the Contractor or his authorized representative does not remain present at the time of such measurements after the Contractor or his authorized representative has been given a notice in writing three (3) days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Engineer-in-Charge or his representative shall be deemed to be accepted by the Contractor.

- (c) The Contractor shall, without any extra charge, provide all assistance with every appliance, equipment, scaffolding, labour and any other things necessary for recording the measurements.

25.0 Computerised Measurement Books

- (i) Engineer-in-Charge shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract. All measurements of all items having financial value shall be entered by the Contractor and compiled in the shape of the Computerized Measurement Book as per the format provided by Engineer-in-Charge so that a complete record is obtained of all the items of works performed under the contract. All such measurements and levels recorded by the Contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the Contractor from the Engineer-in-Charge or his authorized representative as per interval or program fixed in consultation with Engineer-in-Charge or his authorized representative.
- (ii) After the necessary corrections made by the Engineer-in-Charge, the measurement sheets shall be returned to the Contractor for incorporating the corrections, and for resubmission to the Engineer-in-charge for the dated signatures by the Engineer-in-Charge and the Contractor or their representatives in token of their acceptance.
- (iii) Whenever a Running Account bill is due for payment, the Contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/ test- checked from the Engineer-in-Charge and/or his authorized representative. The Contractor will, thereafter, incorporate such changes as may be done during these checks/ test checks in his draft computerized measurements, and submit it to Engineer-In-Charge in both Soft and Hard copies.
- (iv) All the required documents viz. measurement sheets, summary of quality test reports, ESIC/EPF challans, Tax invoice, theoretical v/s actual

consumption of material (as required by Engineer-in-Charge) etc. shall also be submitted along with the RA bill in both soft and hard copies.

- (v) The Contractor shall give not less than seven days' notice to the Engineer-in-Charge or his authorized representative before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work. The Contractor shall not cover up and place beyond reach of measurement any work without consent of the Engineer-in-Charge or his authorized representative in writing in order to ensure the proper checking and measurement thereof. The Engineer-in-Charge or his authorized representative shall within the aforesaid period of seven days inspect the work, and if any work is found to be covered up or placed beyond the reach of checking and/or test checking measurements without such notice having been given or the Engineer-in-Charge's consent being obtained in writing, the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.
- (vi) It is also a term of this contract that checking and/or test checking the measurements of any item(s) of work in the Measurement Book and/or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the Contractor from liabilities from any over measurement or defects noticed till the final completion of the work and certification thereof.

26.0 Withholding & Lien In Respect of Sums Due From Contractor

- (i) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the Contractor, Employer shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the Security Deposit by the Contractor and for the purpose aforesaid, Employer shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the Contractor, Employer shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter become payable to the Contractor under the same contract or any other contract pending finalization of adjudication of any such claim.
- (ii) It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Engineer-in-Charge or Employer will be kept withheld or retained till the claim arising out of or under the contract is determined by the competent authority and that the Contractor will have no claim for interest or damages whatsoever on any

account in respect of such withholding or retention under the lien referred to above and duly notified as such to the Contractor. For the purpose of this clause, where the Contractor is a partnership firm or a limited company, the Engineer-in-Charge or the Employer shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/ limited company, be whether in his individual capacity or otherwise, as the case may be. Employer shall have the right to cause an audit and technical examination of the works and the final bills of the Contractor including all supporting vouchers, abstract etc. to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the Contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the Contractor shall be liable to refund the amount of over-payment and it shall be lawful for Employer to recover the same from him in any other manner legally permissible. If it is found that the Contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by Employer to the Contractor, without any interest thereon whatsoever.

Lien In Respect of Claims in Other Contracts

Any sum of money due and payable to the Contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Engineer-in-Charge or by Employer against any claim of Engineer-in-Charge or Employer in respect of payment of a sum of money arising out of or under any other contract made by the Contractor with the Engineer-in-Charge or the Employer. It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Engineer-in-Charge or the Employer will be kept withheld or retained till his claim arising out of the same contract or any other contract is either mutually settled or determined by the Competent Authority, as the case may be, and that the Contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the Contractor.

27.0 Work to be executed in accordance with Specifications, Drawings and Orders etc.

- (i) All items of work in the bill of quantities/ schedule of quantities shall be carried out as per the CPWD specifications, drawings and instructions of the Engineer-in-Charge and the rates shall include procurement and supply of required materials including proper storage, consumables, skilled & unskilled labour, supervision and tools, plant & machinery complete as called for in the detailed specifications and conditions of the contract. Latest updated CPWD

specifications shall be followed for execution of work.

- (ii) The Contractor shall execute the whole of the work in the most substantial and workman like manner for materials and otherwise in all other aspects in strict accordance with the specifications. The Contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work assigned by the Engineer-in-Charge.
- (iii) The Contractor shall comply with the provisions of the contract and execute the works with due care and diligence and maintain the works and provide all labour and materials, tools and plants, including for measurements and supervision, of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability, and safety of all the works and methods of construction.

28.0 Materials to be provided by the Contractor

- (i) The Contractor shall, at his own expense, provide all materials required for the works. The Contractor at his own expense and without delay provide to the Engineer-in-Charge samples of materials to be used on the work and shall get the same approved in advance. In some cases, the contractor would be instructed by the engineer in charge to create mood boards with a set of samples being available at the same place and time to justify the design aspects for getting Employer's approvals. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The Contractor shall, if requested by the Engineer-in-Charge, furnish proof to the satisfaction of the Engineer-in-Charge regarding the material being conforming to the specifications. The Contractor shall submit the samples of materials to be tested or analysed and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications.
- (ii) The Engineer-in-Charge or his authorized representative/ Employer/ PMC/ TPIA shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles, equipment's or machinery are being obtained for the works and the Contractor shall offer every assistance in obtaining the right to visit and ensure physical visit to such works as directed by engineer-in-charge. The cost for travelling and accommodation to these works of the engineer in charge or his authorized representatives will be borne by the Employer/ PMC/ TPIA

apart from those specifically written in the Special conditions of contract. However, the costs towards the contractor or his representatives towards the costs of such visits will be borne by the contractor. The Engineer-in-Charge shall have full powers to instruct the contractor for acceptance, rejection, improvement or substitution prior to delivery on site of any such material that he might have undertaken to inspect the materials at the works.

- (iii) The Engineer-in-Charge shall have full powers to instruct the contractor for removal of all materials from the site/premises, which in his opinion are not in accordance with the specifications. In case of default, the Engineer-in-Charge shall be at liberty to employ at the expense of the Contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Engineer-in-Charge shall also have full power to require other proper materials to be substituted thereof and in case of default, the Engineer-in-Charge may cause the same to be supplied by others at the risk and cost of the contractor. All such costs for removal and substitution shall be borne by the Contractor.
- (iv) The Contractor shall ensure that the materials are brought to the site in original sealed containers (except where the packing, bearing manufacturer's markings and brands, and quantity required is a fraction of the smallest packing). Materials not complying with this requirement shall be rejected. The empty containers of such materials shall not be destroyed/disposed-off without the permission of Engineer-in-Charge or his authorized representative.
- (v) The Contractor shall produce receipt vouchers showing quantity of materials to satisfy the Engineer-in-Charge that the materials comply with the contract stipulations. These vouchers shall be endorsed, dated and signed by the Contractor. A certified copy of each such voucher signed both by the Engineer-in-Charge and the Contractor shall be kept on record.

29.0 Materials, Samples and Testing

- (i) The materials/products used on the works shall be one of the approved makes/ brands out of the list of approved manufacturers/ brands/ makes given in the tender document. The Contractor shall submit samples/specimens out of approved makes to the Engineer-in-Charge for prior approval.
- (ii) In case single brand/ make are mentioned, other equivalent makes/ brands may be considered by the Engineer-in-Charge on the request of the Contractor. In case of variance in CPWD/IS/BIS specifications

from approved products/makes specification, the specification of approved product/ make shall prevail for which nothing shall be paid extra to the Contractor. In case no make or brand of any materials, articles, fittings and accessories etc. is specified, the same shall comply with the relevant Indian Standard Specifications and shall bear the ISI/BIS mark and meet the contractual specifications. The Engineer-in-charge shall have the discretion to check quality of materials and equipment to be incorporated in the work, at source of supply or site of work and even after incorporation in the work. The Contractor shall provide the necessary facilities and assistance for this purpose.

- (iii) The above provisions shall not absolve the Contractor from the quality of final product and in getting the material and workmanship quality checked and approved from the Engineer-in-Charge/Employer.
- (iv) The Contractor shall well in advance, produce samples of all materials, articles, fittings, accessories etc. that he proposes to use and get them approved in writing by the Engineer-in-Charge. The materials, articles etc. as approved shall be labelled as such and shall be signed by Engineer-in-Charge and the Contractor's representative.
- (v) The approved samples shall be kept in the custody of the Engineer-in-Charge till completion of the work. Thereafter the samples, except those destroyed during testing, shall be returned to the Contractor. No payment will be made to the Contractor for the samples or samples destroyed in testing.
- (vi) The Contractor shall set up and maintain at his cost, a field-testing laboratory for all day-to-day tests at his own cost to the satisfaction of the Engineer-in-Charge. This field-testing laboratory shall be provided with equipment and facilities to carry out all mandatory field tests as per CPWD specifications. The Field-testing laboratory shall be constructed and installed with appropriate facilities. Temperature and humidity controls shall be available, wherever necessary, during the testing of sample(s). All equipment shall be provided by the Contractor so as to be compatible with the specified testing requirements.
- (vii) The Contractor shall maintain all the equipment in good working condition for the duration of the contract. The Contractor shall provide/ deploy approved qualified personnel to run the laboratory for the duration of the Contract. The number of staff and equipment available must be sufficient to keep pace with the sampling and testing programme as required by the Engineer-in-charge. The Contractor shall fully service the site laboratory and shall supply everything necessary for its proper functioning, including all transport needed to move equipment and samples to and from sampling points on the site,

etc. All measuring devices/equipment shall be calibrated, and Contractor shall keep the records of valid calibration certificates of devices/ equipment at the field laboratory for inspection by Engineer-in-Charge at all times. All field tests shall be carried out in the presence of Engineer-in-Charge or his representative.

- (viii) All costs towards samples, materials, collection, transport, manpower, testing etc. shall be borne by the Contractor and are deemed to be included in the rates quoted by him in the bill of quantities.
- (ix) In the case of certain materials pertaining to mechanical, electrical, and plumbing (MEP) works, the Contractor shall be responsible for getting the items tested from Employer/ PMC approved laboratories at his own cost as per the tests written in the Special conditions of contract (SCC) or as deemed fit by engineer in charge, when it is not found feasible to establish a testing facility at site in respect of such items.

30.0 Makes of Materials

The materials required to be supplied by the Contractor under this contract shall be procured from the list of approved manufacturers/ brands/ makes enclosed in the contract document. Where the makes of materials are not indicated in the Bidding document, Contractor shall furnish the details of makes/ brands and shall obtain prior approval of Engineer-in-Charge before placing order.

31.0 Materials Procured with the Assistance of Engineer-in-Charge

If any material for the execution of this contract is procured with the assistance of Engineer-in-Charge by issue from its stores, the Contractor shall use the said materials solely for the purpose of contract and shall not dispose them without the permission of Engineer-in-Charge. Rates of material available at site are mentioned in Annexure VI of SCC. However, if no rate is mentioned for any material, the rate shall be worked out as per DSR rate with "plus" or "minus" percentage quoted by the bidder for such item in that tender. If the rate is not available in DSR, then the same shall be as per the market rate of new material (Non-Schedule Items) at the time of execution of the work. The Contractor shall deploy security personnel for safe-keeping and safeguarding of all such materials procured at site and handed over to the contractor by the Engineer-in-Charge. The contractor will satisfy himself with the quantity, specifications and quality of the material being procured with the assistance of the Engineer in charge so as to ensure that the works are done in accordance with the contractual stipulations. The contractor is not allowed to raise any claim/deviation/relaxation on the use of any/all such material post the handover of the material by the Engineer-in-Charge. The contractor though can submit his objections in writing for the

consideration of the engineer in charge prior to accepting the handover of any/all such material.

32.0 Contractor to Supply Tools & Plants

The Contractor shall provide at his own cost all materials, machinery, tools & plants as required for execution of the work. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of completion of the work. The Contractor shall also supply without any charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting in the measurement or examination at any time and from time to time of the work or materials. In the event of his failure to do so, the same may be provided by the Engineer-in-Charge at the expense of the Contractor and the expenses thereon shall be recovered from any money due to the Contractor under this contract or otherwise and/ or from his security deposit.

33.0 Mobilization of Men, Materials and Machinery

- (i) All expenses towards mobilization at site and de-mobilization including bringing in equipment, work force, materials, dismantling the equipment, clearing the site etc. shall be deemed to be included in prices quoted and no separate payment on account of such expenses shall be entertained.
- (ii) It shall be solely the Contractor's responsibility to provide, operate and maintain all necessary construction equipment, scaffoldings and safety, gadget, lifting tackles, tools and appliances to perform the work in a workman-like and efficient manner and complete all jobs as per the specifications and within the scheduled time of completion of work. Contractor shall also be responsible for obtaining temporary electric and water connections for all purposes. The Contractor shall also make standby arrangements for un-interrupted supply of water & electricity.
- (iii) The procurement and supply in sequence and at the appropriate time of all materials and consumables shall be solely the Contractor's responsibility and his rates for execution of work shall be inclusive of supply of all these items.
- (iv) It is mandatory for the Contractor to provide safety equipment and gadgets to all his workers, supervisory and technical staff engaged in the execution of the work while working. The minimum requirement (but not limited to) shall be gumboots, safety helmets, Rubber

hand- gloves, face- masks, safety- nets, safety-belts, goggles, hand sanitizers etc. as per work requirements. The Contractor shall keep a few spare sets of such gadgets for use by the Employer or the Engineer-in-Charge and /or his representative or any other inspecting teams. No staff/ worker shall be allowed to enter the site without these equipment/ gadgets.

- (v) The cost of the above equipment/ gadgets is deemed to be included in the rates quoted by the Contractor and the Contractor shall not be entitled for any extra payment in this regard. The Contractor shall abide by the regulations pertaining to Health, Safety and Environment as per the HSE policy attached elsewhere as a part of this contract.
- (vi) All designs, drawings, bill of quantities etc., except Bar Bending Schedule, Shop & Fabrication drawings, for all works shall be supplied to the Contractor for his scope of work by the Engineer-in-charge in a phased manner, as the works progresses. However, it shall be the duty and responsibility of the Contractor to bring to the notice of the Engineer-in-charge as to any variation, discrepancy or any other changes required and to obtain revised drawings and designs and/ or approval of the Engineer-in-Charge in writing for the same.
- (vii) One copy of contract documents, including drawings furnished to the Contractor, shall be kept at the site and the same shall at all reasonable times be available for inspection of Engineer-in-charge and his authorised representatives.
- (viii) All materials, construction plants and equipment etc. (including scrap of brought in material) once brought by the Contractor within the project area will not be allowed to be removed from the premises without the written permission of the Engineer-in-charge. Similarly, all enabling works built by the Contractor for the main construction undertaken by him, shall not be dismantled, and removed without written permission of the Engineer-in-charge.
- (ix) The Contractor shall need to furnish list of equipment/ machinery/ plants available with the Contractor along with the details/ capacities and manufacturing year of each equipment/ machinery/ plant.
- (x) Contractor shall prepare the Bar Bending Schedule, shop and fabrication drawings at no extra cost to Employer, if required for any of the items of work as directed by the engineer in charge. Five copies of these drawings and documents will be submitted to the Engineer-in-charge/Employer for approval, at least 30 days prior to execution of the works related to these documents and drawings.
- (xi) All Contractor's plant, machinery and equipment shall be kept in perfect working condition during currency of the contract.

34.0 Health, Safety and Environment (HSE) Management

- (i) The Contractor, during entire duration of the Contract, shall adhere to HSE requirement as enclosed in the Bidding Document as Annexure-VIII to SCC.
- (ii) The contractor shall also barricade the site with minimum 3 mtr high sheets or as per the requirement of Green Tribunal/ State Pollution Control Board/ Environment Department or any directions by the local administration during the entire duration of the contract wherever required. Nothing extra shall be paid on this account.
- (iii) Safety Regulations
The Contractor shall abide by all safety regulations and ensure that safety equipment for specific jobs, as stipulated in the factory act/ safety handbook, is issued to workers during execution of work, failing which all the works at site shall be suspended.
- (iv) Security
The Contractor shall make proper security arrangements at his own cost for the materials at site & the works till handing over of the works to the Employer/ Engineer-in-Charge.

35.0 Quality Assurance Programme

- (i) To ensure that the services under the scope of this contract are in accordance with the specifications, the Contractor shall adopt Quality Assurance Programme to control such activities at the necessary points. The Contractor shall prepare and submit to Engineer in charge, such Quality Assurance Programme within 30 days from date of issue Letter of Award for approval. Engineer-in-charge shall also carry out quality audit and quality surveillance of systems and procedures of Contractor's quality control activities. A Quality Assurance Programme of Contractor shall generally cover the following:
 - (a) His organization structure for the management and implementation of the proposed Quality Assurance Program;
 - (b) Documentation control system;
 - (c) The procedure for materials and source inspection;
 - (d) System for site controls including process controls;
 - (e) Control of non-conforming items and systems for corrective actions;
 - (f) Inspection and test procedure for site activities;
 - (g) System for indication and appraisal of inspection status;
 - (h) System for maintenance of records;

- (i) System for handling, storage, and delivery; and
 - (j) A quality plan detailing out quality practices and procedures, relevant acceptance levels for all types of work under the scope of this contract.
- (ii) The Contractor shall maintain all the quality reports. Checklists & Registers as per CPWD norms in this regard shall be submitted to the Engineer-in-Charge for approval and the same shall be adopted. If any item is not covered by the Check-list/ Register, the Format for the same may be developed and submitted to the Engineer-in-Charge for approval and the same shall be adopted. These filled-in reports shall be duly signed by representatives of the Contractor and the Engineer-in-charge. All the costs associated with Printing of Formats and testing of materials required as per technical specifications or as per instructions of Engineer-in-Charge shall be included in the Contractor's quoted rates in the Schedule/ Bill of quantities. Nothing extra shall be paid to the Contractor on this account.

36.0 Contract Coordination Procedures, Coordination Meetings and Progress Reporting

The Contractor shall prepare and finalize a detailed contract coordination procedure within 30 days from the date of issue of Letter of Award in consultation with the Engineer-in-charge for the purpose of execution of the Contract. The Contractor shall have to attend all the meetings at any place in India at his own cost with the representatives of the Employer, the PMC, the TPIA and their representatives during the currency of the Contract, as and when required and fully co-operate with such personnel and agencies involved during these discussions. The Contractor would be advised to deal with the Employer/ PMC only through the Engineer-in-Charge and any dealing/correspondence, if required, at any time with the Employers/ PMC/ TPIA shall be done through Engineer-in-Charge only.

37.0 Protection of Existing Facilities

- (i) Contractor shall obtain full details of all existing and planned underground services from concerned agencies and shall always follow these closely during the performance of work. Contractor shall be responsible for location and protection of all underground lines, structures, power cables, OFC cables etc. at his own cost.
- (ii) Despite all precautions, should any damage to any structure/ utility etc. occur, the Contractor shall immediately inform the Engineer-in-Charge and the Contractor shall forthwith carry out repair at his expense under the direction and to the satisfaction of Engineer-in-Charge. If the same is not attended by the Contractor within the said time period, it will be got done at the risk and cost of the contractor through other agencies.

- (iii) Contractor shall take all precautions to ensure that no damage is caused to the existing pipelines, cables etc. during services.

38.0 Completion Plans and Completion Certificate

- (i) Within ten days of completion of the work, the Contractor shall give notice of such completion to the Engineer-in-Charge. On the receipt of such notice, the Engineer-in-Charge shall within thirty days inspect the work and if there is no defect in the work, he shall furnish the Contractor with a final certificate of completion.
- (ii) In case of any shortcomings/ defects, a provisional certificate of physical completion indicating the defects (a) to be rectified by the Contractor, and/or (b) for which payment will be made at reduced rates, shall be issued.
- (iii) However, no final certificate of completion shall be issued, nor shall the work be considered to be complete until the Contractor shall have removed from the premises on which the work is executed, all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work, people on the site in connection with the execution of the works and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of the execution. Similarly, no completion Certificate shall be issued until the work shall have been measured by the Engineer-in-Charge.
- (iv) If the Contractor shall fail to comply with the requirements of this clause as regards removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Engineer-in-Charge may remove such scaffolding, surplus materials and rubbish etc. at the expense of the Contractor and dispose of the same as he deems fit and clean off such dirt as aforesaid, and the Contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof less actual cost incurred on removal of materials/ debris / malba etc.
- (v) The Contractor shall be responsible for handing over of the completed works including signing of inventories by the Engineer-in-charge on a pre-approved format.
- (vi) The Contractor shall, during the course of execution, prepare and keep updated a complete set of 'As Built' drawings to show each and every change from the contract drawings, changes recorded shall be counter-signed by the Engineer-in-Charge and the Contractor.

No payment of final bill shall be released to the Contractor until final work completion certificate is obtained from Employer.

39.0 Completion Documents

The following documents shall be submitted in soft copy and hard-binders by the Contractor in 05 (Five) sets as a part of completion documents:

- (i) Test Certificates, Warranty/ Guarantee certificates and copies of Purchase Orders (Required for Warranty/ Guarantee).
- (ii) All other documents as specified in the respective specifications.
- (iii) Complete set of “As-built” drawings showing therein corrections and modifications (if any) made during the course of execution of the Works, signed by the Engineer-in-Charge;
- (iv) Declaration by the Contractor that it has duly cleared any and all of the dues payable by it to its labourer, employees, piece-rate workers (PRWs), and other personnel, sub-Contractors, suppliers, vendors, GST, income Tax, entry tax, excise, customs duty, provident fund, employees state insurance (ESI) and royalties, or other amounts payable under any Applicable Law (if any) and Certificate towards ‘No claim’ other than the claim in the Final bill.

40.0 Prohibition of Unauthorised Construction & Occupation

- (i) No unauthorized buildings, construction of structures should be put up by the Contractor anywhere on the project site, neither any building built by him shall be occupied in un-authorized manner by him or his staff.
- (ii) It shall be the responsibility of the Contractor to see that the building under construction is not occupied by anybody in un-authorized manner during construction and is handed over to the Engineer-in-Charge with vacant possession of complete building. If such building, though completed, is occupied unauthorisedly/ illegally, then the Engineer-in-Charge shall have the option to refuse to accept the said building/ buildings in that position. Any delay in acceptance on this account will be treated as delay in completion and, levy of Penalty may be imposed in line with Clause 8.0 of GCC for such delay.

41.0 Foreclosure of Contract

- (i) If at any time after acceptance of the tender or during the progress of work, the purpose or object for which the work is being done changes due to any unforeseen and compelling reasons and as a result of which the work has to be abandoned or reduced in scope, the Engineer-in-Charge shall give notice in writing to that effect to the Contractor stating the decision as well as the cause for such decision and the Contractor shall act accordingly in the matter. The Contractor

shall have no claim of any compensation or otherwise, whatsoever, on account of any profit, loss of profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

- (ii) The Contractor shall be paid for the works executed at site at contract rates at the time of foreclosure.
- (iii) The Contractor shall, if required by the Engineer-in-Charge, furnish to him, books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.
- (iv) In the event of action being taken under Clause 14.0 to reduce the scope of work, the Contractor may furnish fresh Performance Guarantee on the same conditions, in the same manner and at the same rate for the balance tendered amount and initially valid up to the extended date of completion or stipulated date of completion if no extension has been granted plus minimum 60 days beyond that. Wherever such a fresh Performance Guarantee is furnished by the Contractor, the Engineer-in-Charge/Employer may return the previous Performance Guarantee.

42. Defects Liability Period

- (i) The Contractor shall be responsible for rectification of defects in the works for a period 5 (Five) years from the date of issue of Completion Certificate by the Engineer-in-Charge. Any defects, except normal wear & tear, discovered and brought to the notice of the Contractor forthwith shall be attended to and rectified by him at his own cost and expense. In case the Contractor fails to carry out these rectifications, the same may, without prejudice to any other right or remedy available, be got rectified by Engineer-in-Charge at the risk and cost of the Contractor.

Provided that the Contractor shall not be liable for any such structural/ architectural defect as may be induced by the allottee(s), by means of carrying out structural or architectural changes from the original specification designs.

- (ii) A part of the security deposit will be retained towards defect liability as per Clause 3.0 of the GCC above. The final amount towards defect liability would be released after 5 years from the actual date of completion or the final justified extended date of completion.

43. Sub-Letting / Sub-Contracting

No subletting of whole work or part shall be allowed. However, the Contractor may engage the sub-Contractor for specialized works as mentioned below:

- (i) The Contractor, after obtaining approval from the Engineer-in-Charge, shall engage specialized agencies in respect of the following works at site, in case the Contractor does not have such in-house expertise:
 - (a) Anti-termite treatment.
 - (b) Water proofing works.
 - (c) Fire Fighting works
 - (d) Electrical / LV Works
 - (e) HVAC Works
 - (f) BMS works
 - (g) Horticulture works
 - (h) Tree Transplantation Works, if any
 - (i) Painting work.
 - (j) Any other work as directed by Engineer-in-Charge
- (ii) If the Contractor is required to engage a Sub-Contractor for any part of work, then such Sub-Contractors shall have prior proven experience of similar work and shall require specific approval by the Engineer-in-charge.
- (iii) The Contractor will submit to the Engineer-in-Charge for approval, the details of Sub-Contractors as per the format enclosed as Form XIV at Section 4 for approval. Contractor shall ensure that very competent and resourceful agencies with proven track record and performance should be proposed for the work to be sub-contracted.
- (iv) However, whatever arrangements are made by the Contractor for sub-letting any part of the work/ getting any part of the work executed through a sub-contractor, getting the works executed from such sub-contractors or payments to such sub-contractors shall always remain the responsibility of the Contractor and the Employer shall not in any manner deal with such sub-contractors.
- (v) Notwithstanding any consent to sub-contract given by the Engineer-in-Charge, if in his opinion it is considered necessary, the Engineer-in-Charge shall have full authority to order the removal of any sub-Contractor from the site.

44. Execution of Electrical Works

The Contractor shall engage an approved electrical agency for execution of electrical works, holding valid electrical Contractor licence. In case the Contractor himself executes electrical works, then he shall arrange valid electrical Contractor licence before start of electrical works at site.

45. Force Majeure

- (i) Any delay in or failure to perform on the part of either party, shall not constitute default so as to give rise to any claim for damages, to the extent such delay or failure to perform is caused by an act of God, due to Pandemic, or by fire, explosion, flood or other natural catastrophe, governmental legislation, orders or regulation etc. The time for performance of the respective obligations by the parties shall be deemed to be extended for a period equal to the duration of the force majeure event. Both parties shall make their best efforts to minimize the delay caused by the force majeure event. If the failure/ delay of the Employer in handing over the entire site and/ or in releasing the funds continues even on the expiry of the stipulated date of completion, Engineer-in-charge, may, at the request of the Contractor, foreclose the contract without any liability to either party. In the event of such foreclosure, the Contractor shall not be entitled to any compensation whatsoever. If prior to such foreclosure, the Contractor has brought any material at site and which remain unused, the Engineer-in-Charge shall always have the option of taking over of all such materials at their purchase price or at the local current /DSR rates, whichever is lower.
- (ii) The Contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in this clause.

46. No Compensation

The Contractor shall have no claim, whatsoever, for compensation or idling charges against the Employer or his authorized representative on any ground or for any reason, whatsoever.

47. Directions for Works

- (i) All works under the contract shall be executed under the direction and subject to approval in all respects of the Engineer-in-Charge.
- (ii) The Engineer-in-Charge and his authorized representative shall communicate or confirm their instructions to the Contractor in respect of execution of work during their site inspection in a 'Works Site Order Book' maintained at the site office of Engineer-in-Charge. The Contractor or his authorized representative shall confirm receipt of such instructions by signing against the relevant orders in of the Site Order Book. A soft copy of this "works site order book" shall be mailed

to the contractor and Employer/PMC/TPIA monthly.

48. Work in Monsoon Season and Rains

The execution of the work may entail working in the monsoon season also. The Contractor must maintain labour force as may be required for the work and plan and execute the construction and erection according to the prescribed schedule. No special/ extra rate will be considered for such work during the monsoon season. The stipulated period for completion of project includes the monsoon period, holidays & festivals and the contractor shall make provisions of the same in the contract scheduling submitted to the engineer in charge/Employer. Further;

- (i) During monsoon season and other periods, it shall be the responsibility of the Contractor to keep the construction work site free from any water accumulation at his own cost by making suitable arrangements/ deploying de-watering pumps.
- (ii) Contractor must take due cognizance of the presence of monsoon/ rainy season/ days in his scheduled completion period and accordingly, take all necessary measures to protect, reorganize and maintain progress on the work without any interruptions.
- (iii) No extension of time due to interruption/suspension of work, waterlogging, reduced/ slowing down of progress, non-availability of manpower etc., whatsoever may be the reason, shall be tenable on account of monsoons/ rains and further no claim for stand-by of manpower and equipment, other resources etc. shall be paid for subject to provisions under Clause 17 of the General conditions of contract.
- (iv) Contractor shall procure and stock sufficient quantities of materials viz. coarse and fine aggregates, bricks etc. adequate for the planned volume of the work during the monsoons, well in advance of the onset of same so that progress of work is not affected on this account.
- (v) All electrical installations, equipment shall be placed on plinths above ground under proper rain sheds to avoid any inundation, short circuit and hazards of electrocution.
- (vi) Price shall be inclusive of all costs and expenses including supply of materials required for monsoon protection like tarpaulins, shed, structural, GI sheet etc. for the above provisions and no separate payment shall be made on this account.

49. Work on Sundays, Holidays and During Night

For carrying out work on Sundays and Holidays or during night, the Contractor shall make necessary arrangements to carry out the works at no extra cost to the Employer, under intimation to the Engineer-in-Charge.

50. Water and Electricity

The Contractor shall make his own arrangements for Water, fit for construction, use & Electrical Power for construction including all necessary materials and equipment's for its distribution and utilisation for construction activities and other purposes at his own cost. The Contractor shall also make standby arrangements for water & electricity to ensure un-interrupted supply of water and electricity for smooth progress of works as per relevant clauses in the special conditions of contract (SCC).

51. Land for Labour Huts/ Site Office and Storage Accommodation

- (i) The Contractor may construct temporary office, storage, accommodation, and labour huts within the site premises wherever possible, with prior approval of the Engineer-in-Charge. In case, where surplus land is not available within the site and/or not permitted by the Employer, the Contractor shall arrange the land for temporary office, storage, accommodation and labour huts at his own cost and shall be responsible for taking the clearance of local authorities, if required, for setting up/construction of labour camp and the same is deemed to be included in the rates quoted by the Contractor for the works. The Contractor shall check the availability of land before tendering and no claim whatsoever shall be entertained in this regard.
- (ii) The Contractor shall ensure that the labour huts are kept clean and in hygienic conditions. The land for the above purposes shall be so placed that it does not hinder the progress of work or access to the worksite. Vacant possession of the land used for the purpose shall be given back by the Contractor to Employer/ authority after completion of the work.
- (iii) The security deposit of the Contractor shall be released only after the Contractor demolishes all temporary structures and clears the site to the satisfaction of Engineer-in-Charge. In the event the Contractor has to shift his labour camps at any time during execution of the work on the instructions of local authorities or as per the requirement of the work progress or as may be required by the Engineer-in-Charge, he shall comply with such instructions at his risk and cost and no claim whatsoever shall be entertained on this account.

52. Watch & Ward and Lighting of Work Place

- (i) The Contractor shall at his own cost take all precautions to ensure safety of life and property by providing necessary barriers, obstructions, lights, watchmen etc. during the progress of work as directed by Engineer-in-Charge.
- (ii) The Contractor shall provide uninterrupted lighting of the work-place

and surrounding areas during the night hours with a minimum lux level of 10-15 lux. No additional payment shall be made on this account and the cost in this regard is deemed to be included in the quoted rates.

53. Installation of Sign Boards

The Contractor shall fix/ install Construction/safety sign boards of suitable sizes and in adequate numbers as per the instructions of Engineer-in-Charge before/during the execution of work. No additional payment shall be made to the Contractor on this account.

54. Cement and Cement Godown

- (i) Cement shall be procured by Contractor in line with the technical specifications and requirement of the contract.
- (ii) The cement shall be procured directly from the reputed manufacturers/ stockists as per list of approved makes. Relevant vouchers and test certificates will be produced as and when required by the Engineer-in-charge. It shall be stored by the Contractor in suitable covered and lockable stores, well protected from climate and atmospheric effects. The cement go-down shall be constructed by the Contractor as per the CPWD specifications at his own cost. Cement bags shall be used on "first-in -first -out" basis. Cement stored beyond 90 days will not be used in structural works. However, this cement can be used in other works after getting the cement tested and found suitable as per relevant IS codes at Contractor's cost and accepted by Engineer-in-charge, before use in works.

55. Steel & Steel Stockyard

Steel conforming to contract specifications/ BIS specifications (latest edition) shall be procured by the Contractor directly from reputed manufacturers/ producers as per list of approved makes. Relevant vouchers & test certificates will be produced by the Contractor. Reinforcement steel, structural steel shall be stored and stacked in such manner so as to facilitate easy identification, removal etc. The Contractor shall take proper care to prevent direct contact between the steel and the ground/water for which he shall provide necessary arrangement at his own cost including ensuring proper drainage of area to prevent water logging as per directions of the Engineer-in-Charge. Steel shall also be protected by applying a coat of neat cement slurry or any other protective treatment over the TMT bars in order to save it from any rusting, for which no extra payment shall be made. Test certificates for each consignment of steel shall be furnished and tests will be got carried out from the authorized NABL accredited laboratory, as per the directions of the Engineer-in-Charge, before incorporating the materials in the work.

56. Schedule of Quantities/ Bill of Quantities

The quantities shown against the various items of work are approximate quantities, which may vary as per the actual requirement of work. Any variation in quantities, if occurs during the execution of the works, will be dealt as per the provisions of the contract.

57. Water - proof Treatment

57.1 The water-proof treatment shall be of type and specifications as given in the schedule of quantities.

57.2 The water-proofing of basement, roofs, water retaining areas shall be and remain fully effective for a period of not less than 10 (Ten) years to be reckoned from the date of issue of Completion Certificate, prescribed in the contract. If any defect or any evidence of re-infestation, dampness, leakage in any part of buildings or structure is found in the said treatment at any time during the said guarantee period and the Contractor is notified of the same, the Contractor shall be liable to rectify the defect or give re-treatment. The Contractor shall commence the work or such rectification or re-treatment within seven days from the date of issue of such letter to him. If the Contractor fails to commence such work within the stipulated period, the Employer may get the same done by deploying another agency at the Contractor's risk & cost.

57.3 Water- proofing shall be got done through approved/ specialized agencies only with prior approval of Engineer-in-Charge.

57.4 During the execution of work, if any damage occurs to the treatment already done, either due to rain or any other circumstances, the same shall be rectified and made good to the entire satisfaction of Engineer-in-Charge by the Contractor at his cost and risk.

57.5 The Contractor shall make his own arrangement for all equipment required for the execution of the job. The Contractor shall execute a Guarantee Bond in the prescribed form as appended for guaranteeing the water-proofing treatment.

58. Indian Standards

Wherever any reference is made to any BIS in any particular specifications, drawings or bill of quantities, it means the Indian Standards editions with up-to-date amendments issued till the last date of receipt of tender documents.

59. Centring & Shuttering

Plywood/steel/Aluminium plates or any material fit for the use as mentioned elsewhere in the tender document or as approved by Engineer-in-Charge shall be used for formwork. The shuttering plates shall be cleaned and oiled before every repetition and shall be used only after obtaining approval of the

Engineer-in-charge. The number of repetitions allowed for plywood/ steel shuttering/ aluminium shall be at the discretion of Engineer-in-Charge depending upon the condition of shuttering surface after each use and the decision of Engineer-in- Charge in this regard shall be final and binding on the Contractor. No claim, whatsoever, on this account shall be admissible.

60. Records of Consumption of Cement, Steel & Other Materials

- (i) For the purpose of keeping a record of cement and steel received at site and consumed in works, the Contractor shall maintain a register in the format approved by the Engineer-in-Charge, showing columns like quantity received and used in work and balance in hand etc. This register shall be signed daily by the Contractor's representative and the representative of the Engineer-in-Charge.
- (ii) The register of cement, steel & other materials (if required) shall be kept at site in the safe custody of Engineer-in-charge during progress of the work. This provision will not, however, absolve the Contractor from the quality of the final product.

61. Borrow Areas

The Contractor shall make his own arrangements for borrow pits and borrow disposal areas including their approaches and space for movement of man, machinery, other equipment as required for carrying out the works. The Contractor shall be responsible for taking all safety measures, getting approval, making payment of royalties, charges etc. and nothing extra shall be paid to the Contractor on this account and unit rates quoted by the Contractor for various items of bill of quantities shall deemed to include the same.

62. Care of Works

From the commencement to the completion of works and handing over, the Contractor shall take full responsibility for care of all the works and in case of any damage/ loss to the works or to any part thereof or to any temporary works due to lack of precautions or due to negligence on the part of Contractor, the same shall be made good by the Contractor at no extra cost to Employer.

63. Coordination with Other Agencies

- (i) Work shall be carried out in such a manner that the work of other agencies operating at the site is not hampered due to any action of the Contractor. Proper coordination with other agencies will be Contractor's responsibility. In case of any dispute, the decision of Engineer-in-charge shall be final and binding on the Contractor.
- (ii) If and when required for the coordination of works with other agencies involved at site, the Contractor shall within the scope of work, re-route

and/or prepare approaches and working areas as may be necessary.

64. Setting Out of the Works

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. If any error appears or arises in the position, levels, dimensions or alignment of any part of the works at any time during the progress of works, the Contractor shall rectify such error to the satisfaction of Engineer-in-charge at his own expenses. The checking of any setting out or of any line or level by the Engineer-in-charge shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

65. Site Clearance

- (i) The Contractor shall ensure that the working site is kept clean and free of obstructions for easy access to job site and also from safety point of view. Before handing over the completed work to the Engineer-in-charge, the Contractor shall remove all temporary structures like the site offices, cement go-down, stores, labour hutments, scaffolding, rubbish, debris, left-over materials, tools and plants, equipment etc. and clean the site to the entire satisfaction of the Engineer-in-charge. If this is not done, the same may be got done by the Engineer-in-charge at the risk and cost of Contractor.
- (ii) The Contractor shall clean all floors, remove cement/ lime/ paint drops and deposits, clean joinery, glass panes etc., touching all painter's works and carry out all other necessary items of works to make the premises clean and tidy before handing over the completed works, and the rates quoted by the Contractor shall be deemed to have included for the same.
- (iii) If the work involves dismantling of any existing structure in whole or part, any RCC foundation and/ or paved area, care shall be taken to limit the dismantling up to the exact point and/ or lines as directed by the Engineer-in-Charge and any damage caused to the existing structure beyond the said line or point shall be repaired and restored to the original condition at the cost and risk of Contractor to the satisfaction of the Engineer-in-Charge, whose decision shall be final and binding upon the Contractor.
- (iv) The Contractor shall not dispose of the ordinary earth excavated from within the boundary limits to any place outside such limits as the same may be required as per the discretion of the engineer in charge.
- (v) Disposal of Debris/ Surplus Earth (including contaminated earth) shall be done by the Contractor at the designated disposal area(s) within the boundary limits as directed by engineer in charge. In case the Employer is not in a position to provide disposal area within the

boundary limits due to space constraints, the Contractor has to dispose the same outside the boundary limits as per the provisions of the contract. While disposing the Debris/ Surplus Earth (including contaminated Earth) outside the boundary limit, the Contractor has to ensure that the same are disposed off safely and fulfilling the local statutory regulations including but not limited to the guidelines/ stipulations of State Pollution Control Board.

66. General Guidelines during and before Erection

- (i) The Contractor shall be responsible for organizing the lifting of the equipment in the proper sequence for orderly progress of the work and to ensure that access routes for erecting the other equipment are kept open. The installation of machines at different floor levels/ terrace and at basement shall be carried out by the Contractor with due care so as to guard against any damage to the existing finishes of the building and shall augment if required, necessary machineries/ lifting crane for installation purpose within the quoted prices.
- (ii) Orientation of all foundations, elevations, lengths and disposition of anchor bolts and diameter of holes in the supports and saddles shall be checked by the Contractor well in advance of the installation. Rectifications, including chipping of foundations, shall be carried out only where necessary in consultation with the Engineer-in-Charge. If a structural member needs to be dismantled to facilitate the equipment erection, this shall be done by the Contractor after ensuring proper stability of the main structure in consultation with the Engineer-in-Charge. All such dismantled members shall be put back in position to the satisfaction of Engineer-in-Charge after the completion of the equipment erection.
- (iii) During the performance of the work the Contractor shall at his own cost keep structures, materials and equipment adequately braced by guys, struts or other approved means which shall be supplied and installed by the Contractor as required till the installation work is satisfactorily completed. Such guys, shoring, bracing, strutting, planking supports etc. shall not interfere with the work of other agencies and shall not damage or cause distortion to other works executed by the Contractor or other agencies.
- (iv) The Contractor shall duly comply with manufacturer(s) recommendations and detailed specifications for the installation of the various equipment and machines. Various tolerances required as marked on the drawings and/or in accordance with the specifications and/or instructions of the Engineer-in-charge shall be maintained. Verticality shall be verified with the Total-station and shall be maintained.

67. Security and Security Arrangements

- (i) The Contractor shall provide adequate number of watch and ward personnel on round the clock basis with limited/restricted access to the site through gates manned by the Security personnel. The responsibility for safe custody of materials, works in progress, office of Employer/ Engineer-in-charge, building and all services etc. lies with the Contractor till handing over of the works to the Employer.
- (ii) The Contractor shall ensure adequate illumination of the worksite(s) on a continuous basis to ensure safe working and to avoid pilferage/theft of materials lying at the work site. The rates quoted shall be deemed to be inclusive of this scope and the Contractor is not entitled for any additional payment in this regard. This is to be implemented from start of work till handing over of the works to the Employer.
- (iii) The project site during execution shall be properly barricaded with Pre-coated sheets/ GI/ MS sheets of at least 3.0 meters and, as directed by the engineer in charge, with proper supports/ foundations in order to isolate the site from surroundings to avoid any disturbance and to avoid the entry of unauthorized personnel. Expenditure towards this activity is considered to be included in the quoted rates.
- (iv) The Contractor shall make adequate security arrangement for protection of the work site and to prevent unauthorized entry to protect their materials and equipment in its own interest at no extra cost to the Employer.
- (v) If at any place/site, entry is restricted by the Employer, the Contractor shall then arrange to obtain through the Engineer-in-Charge, well in advance, all necessary entry permits/ gate passes for his staff and labourer and entry and exit of his men and materials shall be subject to vigorous checking by the security staff. The Contractor shall not be eligible for any claim or extension of time whatsoever on this account.
- (vi) The Contractor shall, at their own cost, construct their centralized store for safe keeping of the materials/equipment and for proper accounting of the material/ equipment being used in this project.

68. Works to remain Open to Inspection

- (i) All works executed or under the course of execution in pursuance of this contract shall at all times be open to inspection of the Engineer-in-charge.
- (ii) The work during its progress or after its completion may be inspected

by the third party appointed by the Employer. The compliance of observations/ improvements suggested by the inspecting officers shall be obligatory on the part of the Contractor at his cost.

69. Set-Off of Contractor's Liabilities

The Engineer-in-charge shall have the right to deduct or set off the expenses incurred or likely to be incurred by it in rectifying the defects and/or any claim under this agreement against the Contractor from any or against any amount payable to the Contractor under this agreement including security deposit, defect liability and proceeds of performance guarantee.

70. Possession Prior to Completion

The Engineer-in-charge shall have the right to take temporary possession of any completed or use partially completed work or part of the work. Such possession or use shall not be deemed to be any acceptance of any work not completed in accordance with the contract agreement. If such prior possession or use by Engineer-in-charge delays the progress of work, an equitable adjustment in the time of completion will be made and the contract agreement shall be deemed to be modified accordingly. The decision of Engineer-in-charge in such case shall be final binding and conclusive on the Contractor.

71. Employment of Personnel

- (i) The Contractor shall employ his representatives and workmen after verifying their antecedents and loyalty. He shall ensure that no personnel of doubtful antecedents is associated with the works in any manner.
- (ii) In case the Engineer-in-charge observes misconduct, negligence or incompetence etc. on the part of any representative, agent and workmen or employees etc. of the Contractor, the Engineer-in-charge shall be competent to instruct the Contractor to remove such engineer/ staff/ worker from the site without giving any reason to the Contractor and ask to provide suitable replacements. The decision of the Engineer-in-charge shall be final and binding on the Contractor. The Contractor shall not be allowed any compensation on this account.

72. Technical Staff for Work

- (i) The Contractor shall employ adequate number of technical staff at his cost during the execution of this work depending upon the requirement of work. For this purpose, the numbers to be deployed, their qualification and experience, as decided by Engineer-in-charge, shall be final and binding on Contractor. The Contractor shall not be entitled for any extra payment in this regard.
- (ii) The technical staff should be available at site to take instructions from

the Engineer-in-Charge.

- (iii) The Contractor shall submit a site organizational chart and Resume, including details of experience of the Project-in-Charge and other staff proposed to be deployed by him. The technical team shall be deputed by the Contractor on the Project after getting approval from the Engineer-in-Charge.
- (iv) In case the Contractor fails to employ the staff as aforesaid, he shall be liable to pay a reasonable amount as defined in Special conditions of contract for each month of default in the case of each person. The decision of the Engineer-in-charge as to number of Technical Staff to be adequate for the project and the period for which the desired strength of technical staff was not employed by the Contractor and as to the reasonableness of the amount to be deducted on this account shall be final and binding on the Contractor.

73. Valuable Articles Found at Site

All gold, silver and other minerals of any description and all precious stones, coins, treasure, relics, antiques and all other similar things which shall be found in, under or upon the site shall be the property of the Employer.

74. Labour Laws - to be Complied with by the Contractor

- (i) The Contractor shall obtain a valid license under the Contract Labour (Regulation & Abolition) Act, 1970 and the Contract Labour Act (Regulation & Abolition) Central Rules 1971, as amended from time to time, and continue to have a valid license until the completion of the work including the defect liability period.
- (ii) The Contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the Building and other Construction Workers Welfare Cess Act, 1996 and its amendments, if any.
- (iii) The Contractor shall also comply with the provisions of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.
- (iv) The Contractor shall not engage any labour below the age of 18 years under any circumstances. The provisions under Child Labour (Prohibition and Regulation) Amendment Act, 2016 shall be strictly adhered to. In case of any non-compliance with the requirements of Labour laws, the Contractor shall be liable for all consequences or any penalty imposed in this regard.

74.1 Payment of Wages:

- (i) The Contractor shall pay to the labour employed by him either directly

or through sub-Contractors, wages not less than fair wages as defined in the Contractor's Labour Regulations or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970 and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable.

- (ii) The Contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wages to labour indirectly engaged on the work, including any labour engaged by his sub-Contractors in connection with the said work, as if the labour had been employed by him.
- (iii) The Contractor shall transfer/ credit the wages/ salary of all labourer/ workers preferably in their bank accounts. He shall be responsible for opening of bank accounts of all labourers/workers employed by the Contractor at the work site in this regard.
- (iv) In respect of all labour, directly or indirectly employed in the works for performance of the Contractor's part of this contract, the Contractor shall comply with Labour Regulations in regard to payment of wages, wage period, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and the Contract Labour (Regulation and Abolition) Central Rules, 1971, wherever applicable..
- (v) Under the provision of labour rules, the Contractor is bound to allow one-day rest for 6 days' continuous work and pay wages at the same rate as for duty to the labour directly or indirectly employed in the works. In the event of default, the Engineer-in-Charge shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labourer/ worker and pay the same to the persons entitled thereto from any money due to the Contractor.
- (vi) The Contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, and the Contractor's Labour (Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rules made there under from time to time.
- (vii) The Contractor shall indemnify and keep the Employer indemnified against payments to be made under and for the observance of the laws aforesaid and the Labour Regulations without prejudice to his right to claim indemnity from his sub-Contractors.

- (viii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

74.2 Labour Safety Provisions

- (i) The Contractor shall be fully responsible to observe the labour safety provisions. The Contractor shall at his own cost take all precautions to ensure safety of life and property by providing necessary barriers, lights, watchmen etc. during the progress of work.
- (ii) In case of all labour, directly or indirectly employed in work for the performance on the Contractor's part of this contract, the Contractor shall comply with all rules framed by Government from time to time for the protection of health and sanitary arrangements for workers.

74.3 Observance of Labour Laws

- (i) The Contractor shall be fully responsible for observance of all labour laws, including the local laws and other laws, applicable in this matter and shall indemnify and keep the Employer indemnified against any adverse effect or non-observance of any such laws. The Contractor shall be liable to make payment to all its employees, workers and sub-Contractors and make compliance with labour laws. If the Employer or his authorized representative is held liable as "Principal Employer" to pay contributions etc. under legislation of Government or Court decision in respect of the employees of the Contractor, then the Contractor would be liable to reimburse the amount of such payments, contribution etc. to the Employer and/ or the same shall be deducted from the payments, security deposit etc. of the Contractor.
- (ii) The Contractor shall submit proof of having a valid EPF registration certificate. He shall within 7 days of the close of every month, submit a statement to the Employer showing the recoveries of contributions in respect of each employee employed by or through him and shall furnish to Employer such information as the Employer is required to furnish under the provisions of para 36B of the EPF Scheme 1952 to the EPF authorities and other information required by the EPFO authorities from time to time. He shall also submit a copy of challan every month in token of proof of having deposited the subscription and contribution of workers engaged on the project, if demanded by the Engineer-in-Charge.
- (iii) The Contractor shall also ensure the compliance of EPF Act, 1952 by the sub-Contractors, if any, engaged by the Contractor for the above said work.
- (iv) The Contractor shall indemnify and keep the Employer harmless from and against all actions, suits, proceedings, losses, costs, damages, charges, claims and demands of every nature and description brought

or recovered against the Employer by reasons of any act or omission of the Contractor, his agents or employees in connection with complying the provisions of the Employees Provident Fund & Miscellaneous Provisions Act, 1952 as amended from time to time. All sums payable by way of compensation/ damages/ interest on the outstanding amounts payable by the Contractor shall be considered as reasonable and be payable by the Contractor to the Employer immediately and if the Contractor does not pay the amount immediately the same will be deducted from the security deposit or earnest money or any other amount available with the Employer or any money payable to the Contractor by the Employer.

74.4 Minimum Wages Act

The Contractor shall comply with all provisions of the Minimum Wages Act, 1948, Contract Labour Act (Regulation & Abolition) 1970, and rules framed thereunder and other labour laws/ local laws affecting the contract labour that may be brought into force from time to time.

74.5 Labour Records

- (i) The Contractor shall submit a true statement of the following data by the 4th & 19th of every month to the Engineer-in-Charge, showing in respect of the second half of the preceding month and the first half of the current month respectively:

(a)	The number of the labourer employed by him (category-wise)	
(b)	Their working hours	
(c)	The wages paid to them	
(d)	The accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused.	
(e)	The number of female workers who have been allowed Maternity Benefits and the amount paid to them.	
(f)	Any other information required by Engineer-in-Charge	

- (ii) In the event of the Contractor(s) committing a default or breach of any of the provisions of the Labour Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing any statement under the provisions of the above Regulations and Rules which is materially incorrect, the compensation imposed, if any, by the concerned Department will be recoverable from his dues.
- (iii) Should it appear to the Engineer-in-Charge that the Contractor is not properly observing and complying with the provisions of the Contractor's Labour Regulations and Model Rules and the provisions

of the Contract Labour (Regulation and Abolition) Act 1970, and the Contract Labour (R&A) Central Rules 1971, for the protection of health and sanitary arrangements for workers employed by the Contractor(s) (hereinafter referred as “the said Rules”) the Engineer-in-Charge shall be competent to give a notice in writing to the Contractor requiring that the said Rules be complied with the amenities prescribed therein and shall be provided to the workers within a reasonable time to be specified in the notice.

- (iv) If the Contractor(s) fails to comply with the notice and observe the said rules within the period specified to provide the amenities to the workers as aforesaid, the Engineer-in-Charge shall have the power to provide the amenities hereinbefore mentioned at the cost of the Contractor(s). The Contractor(s) shall erect, make and maintain at his/their own expense and in accordance with the approved standards all necessary huts and sanitary arrangements required for his/their work-people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Engineer-in-Charge shall have the power to give notice in writing to the Contractor(s) requiring that the said huts and sanitary arrangements be remodelled and/or reconstructed according to approved standards. If the Contractor(s) fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Engineer-in-Charge shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the Contractor(s).
- (v) The Contractor shall provide his labourers with a sufficient number of huts (hereinafter referred to as the camp) at his own cost of the following specifications on a suitable plot of land:
 - (a) The minimum height of each hut at the eave's level shall be 2.10 m. (7 ft.) and the floor area to be provided will be at the rate of 2.70 sqm (30 Sqft.) for each member of the worker's family staying with the labourer.
 - (b) The Contractor shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6'x5') adjacent to the hut for each family.
 - (c) The Contractor shall also construct temporary latrines and urinals, and bathing & washing places for the use of labour/ workers, which shall be at the rate one such facility for each 25 users (men and women to be counted separately), and separate latrines and urinals to be provided for women. These facilities shall be suitably screened.

- (vi) All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Engineer-in-Charge. In case of sun-dried bricks, the walls should be plastered with mud gobi on both sides. The floor may be kutcha but plastered with mud gobi and shall be at least 15 cm (6") above the surrounding ground. The roofs shall be laid with thatch, or any other materials as may be approved by the Engineer-in-Charge and the Contractor shall ensure that throughout the period of their occupation, the roofs remain water-tight.
- (vii) The Contractor(s) shall provide each hut with proper ventilation.
- (viii) All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.
- (ix) There shall be kept an open space of at least 7.2 m. between the rows of huts, which may be reduced to 6 m. according to the availability of site with the approval of the Engineer-in-Charge. Back-to-back construction will be allowed.
- (x) Water Supply - The Contractor(s) shall provide adequate supply of water for the use of labourer. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The Contractor(s) shall also at his/ their own cost make arrangements for laying pipelines for water supply to his/ their labour camp from the existing mains wherever available, and shall pay all fees and charges thereof.
- (xi) Disposal of Excreta- The Contractor shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the Contractor shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of labourers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the Contractor and paid directly by him to the Municipality/authority. The Contractor shall provide one sweeper for every eight seats in case of dry system.
- (xii) Drainage - The Contractor shall provide efficient arrangements to drain away sullage water so as to keep the camp neat and tidy.
- (xiii) The Contractor shall make necessary arrangements for keeping the

camp area sufficiently lighted to avoid accidents to the workers.

- (xiv) Sanitation - The Contractor shall make arrangements for conservancy and sanitation in the labour camps according to the Public Health and Medical Authorities.

75. Recovery of Compensation Paid to Workmen

In every case in which by virtue of the provisions of the Workmen's Compensation Act, 1923, Employer is obliged to pay Compensation to a workman employed by the Contractor, in execution of the works, Engineer-in-Charge/Employer will recover from the Contractor, the amount of the Compensation so paid from any sum due to the Contractor whether under this contract or otherwise.

76. Ensuring Payment and Amenities to Workers if Contractor Fails

In every case in which by virtue of the provisions of the Contract Labour (Regulation and Abolition) Act, 1970, and of the Contract Labour (Regulation & Abolition) Central Rules 1971, Employer is obliged to pay any amount of wages to workman employed by the Contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act or under the Labour Regulations, or under the Rules framed by Government from time to time for the protection of health and sanitary arrangements for workers employed by Contractors, Employer will recover from the Contractor, the amount of wages so paid or the amount of expenditure so incurred from any sum due by Employer to the Contractor whether under this contract or otherwise.

77. Change in Firm's Constitution to be Intimated

Where the Contractor is a partnership firm, the prior approval in writing of the Engineer-in-Charge shall be obtained before any change is made in the constitution of the firm. Where the Contractor is an individual or a Hindu Undivided Family business concern such approval as aforesaid shall likewise be obtained before the Contractor enters into any partnership under agreement where the partnership firm would have the right to carry out the works hereby undertaken by the Contractor.

78. Indemnity Against Patent Rights

The Contractor shall fully indemnify the Employer and his authorized representatives from and against all claims and proceedings for or on account of any infringement of any patent rights, design, trademark or name or other protected rights in respect of any construction plant, machine, work or material used for in connection with the works or temporary works.

79. Law Covering the Contract

This contract shall be governed by the Indian laws for the time being in force.

80. Laws, Bye-Laws Relating to the Work

The Contractor shall strictly adhere by the provisions of law for the time being in force relating to works or any regulations and bylaws made by any local authority or any water & lighting agencies or any undertakings within the limits of the jurisdiction of which the work is proposed to be executed. The Contractor shall be bound to give to the authorities concerned such notices and take all approvals as may be provided in the law, regulations or bylaws as aforesaid, and to pay all fees and taxes payable to such authorities in respect thereof.

81. Jurisdiction

The agreement shall be executed at Gurugram on non-judicial stamp paper purchased in Gurugram and the courts at Gurugram alone will have jurisdiction to deal with matters arising there from, to the exclusion of all other courts.

82. Contractor Liable for Damages, Defects During Defect Liability Period

If the Contractor or his working people or servants shall break, deface, injure, or destroy any part of the building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work, he shall, upon receipt of a notice in writing from Engineer-in-Charge on that behalf, make the same good at his own expense or in default, the Engineer-in-Charge shall cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the Contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof.

83. Resolution and Settlement of Disputes & Arbitration

Except where otherwise provided in the contract, all questions and disputes relating to the meaning of the specifications, design, drawings and instructions here-in before mentioned and as to the quality of workmanship or materials used on the work or as to any other question, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works or the execution or failure to execute the same, whether arising during the progress of the work or after the cancellation, termination, completion or abandonment thereof shall be dealt with as mentioned hereinafter:

- (i) If the Contractor considers any work demanded of him to be outside the requirements of the contract, or disputes any drawings, record or decision

given in writing by the Engineer-in-Charge or if the Engineer-in-Charge considers any act or decision of the Contractor on any matter in connection with or arising out of the contract or carrying out of the work, to be unacceptable and is disputed, such party shall promptly within 15 days of the arising of the disputes, request as under.

- (a) Dispute to be put up before the Employer for resolution.
 - (b) If the resolution fails, the matter be put up before the Conciliation Committee to be appointed by the Employer.
 - (c) If the conciliation also fails, the Contractor may request for the appointment of arbitrator under intimation to the other party.
 - (d) On receipt of such request, the Employer may appoint a sole arbitrator for adjudication of the dispute(s).
- (ii) It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed, if any, in respect of each such dispute along with the notice for appointment of arbitrator.
 - (iii) The parties shall share the Arbitration fees equally. In case there is no finalization of place of arbitration, the Arbitral Tribunal shall determine the place of arbitration. The venue of the arbitration shall be such place as may be fixed by the Arbitral Tribunal in consultation with both the parties. Failing any such agreement, the Arbitral Tribunal shall decide the venue.

84. Action where no Specifications are prescribed

In the case of any class of work for which there is no such specifications, such work shall be carried out in accordance with the latest CPWD, Bureau of Indian Standards Specifications. In case there are no such specifications mentioned in the CPWD/ Bureau of Indian Standards, the work shall be carried out as per DHBVN/HVPN/ manufacturers' specifications, if not available then as per State/ District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Engineer-in-Charge.

SECTION - 4

Forms and Formats

Format-I

Declaration by the bidder regarding bidding document

1. I/ We _____ (Name of the Bidder) hereby represent that we have gone through and understood the Bidding Documents (including but not limited to) the Commercial & Technical Requirements/ Specifications and that our Bid has been prepared accordingly in compliance with the requirements stipulated in the said documents.
2. I/ We are submitting the **Table of Contents of Bidding Documents and amendments, if any**, as part of our Bid duly signed and stamped on each page in token of our acceptance. We are not submitting the total Bidding Document as part of our Bid but undertake that said Bidding Document shall be deemed to form part of our Bid and in the event of award of work to us, all parts shall be considered for constitution of the Contract Agreement. Further, I/ We shall sign and stamp each page of these documents as a token of Acceptance and as a part of the Contract in the event of award of Contract to us.

Signed for and on behalf of <bidder's name>
<Name of the Signatory>
Authorised Representative of the Bidder

Place: _____

Date: _____

Format-II

Letter of Waiver (on Letter-head of the Bidder)

1. I/ We _____ <Bidder's Name> _____ hereby agree to fully comply with, abide by and accept without variation, deviation or reservation, all technical, commercial and other conditions whatsoever of the Bidding Document including Addenda (if any).
2. I/ We further hereby waive, withdraw and abandon any and all deviations, variations, objections or reservations whatsoever thereto here to-before set out, given or indicated in our offer, clarifications, correspondence, communications, or otherwise, with a view that the price bid submitted shall be treated to conform in all respects with the terms and conditions of the said Bidding Documents including all Addenda.
3. I/ We further hereby confirm that the prices quoted in the price bid are as per the provisions of the Bidding Document and there is no deviation in the price bid.

Signed for and on behalf of <bidder's name>
<Name of the Signatory>
Authorised Representative of the Bidder

Place: _____

Date: _____

Format-III

Undertaking for Non-engagement of Child Labour

I/ We hereby declare that:

- (i) We are committed to elimination of child labour in all its forms.
- (ii) Neither we nor any of our nominated sub-contractor(s) are engaging Child Labour in any of our work(s) in terms of the provisions of The Child Labour (Prohibition and Regulation) Act, 1986 and other applicable laws.
- (iii) We, as well as our nominated sub-contractor(s), undertake to fully comply with provisions of The Child Labour (Prohibition and Regulation) Act, 1986 and other applicable labour laws in case the work is awarded to us.
- (iv) It is understood that if I/We, either before award or during execution of Contract, commit a transgression through a violation of (ii) and (iii) above or in any other form, such as to put my/our reliability or credibility in question, the Employer is entitled to disqualify us from the Tender process or terminate the Contract, if already executed or exclude me/us from future contract award processes. The imposition and duration of the exclusion will be determined by the severity of transgression as determined by the Employer. Such exclusion may be for a period of 1 year to 3 years as per the procedure prescribed in the guidelines for holiday listing of the Employer.
- (v) I/ We accept and undertake to respect and uphold the Employer's absolute right to resort to and impose such exclusion.

Signed for and on behalf of <bidder's name>
<Name of the Signatory>
Authorised Representative of the Bidder

Place: _____

Date: _____

Format - IV

Form for submission of Pre-bid queries by the bidders

[illegible]

**(Name & Signature of the Bidder
or his authorised representative)**

Place:

Dated:

Format-V**Application for Extension of Time**

(To be submitted by the Contractor)

1.	Name of the Contractor											
2.	Name of the work as given in the Agreement											
3.	Agreement No.											
4.	Estimated amount put to tender											
5.	Date of commencement of work as per agreement											
6.	Period allowed for completion of work as per agreement											
7.	Date of completion stipulated as per agreement											
8.	Period for which extension of time has been given previously: Extension Granted earlier: <table border="1"> <tr> <td>a)</td> <td>First extension vide Engineer-in-charge letter No... ..date</td> <td>Months</td> <td>Days</td> </tr> <tr> <td>b)</td> <td>2nd extension vide Engineer-in-charge letter No..... date</td> <td>Months</td> <td>Days</td> </tr> </table>			a)	First extension vide Engineer-in-charge letter No... ..date	Months	Days	b)	2nd extension vide Engineer-in-charge letter No..... date	Months	Days	
a)	First extension vide Engineer-in-charge letter No... ..date	Months	Days									
b)	2nd extension vide Engineer-in-charge letter No..... date	Months	Days									
9.	Reasons for which extension have been previously given (copies of the previous application should be attached)											
10.	Period for which extension is applied for:											
11.	Hindrances on account of which extension is applied for with dates on which hindrances occurred, and the period for which these are likely to last - a) Serial No. b) Nature of hindrance c) Date of Occurrence d) Period for which it is likely to last e) Period for which extension required for this particular hindrance. f) Over lapping period, if any, with reference to item g) Net extension applied for h) Remarks, if any											
12.	Total period for which extension is now applied for			Month/ days								

	on account of hindrances mentioned above	
13.	Extension of time required for extra work.	
14.	Details of extra work and on the amount involved: a) Total value of extra work b) Proportionate period of extension of time based on estimated amount put to tender on account of extra work.	
15.	Total extension of time required for 11 & 12	

Submitted in the office of the Engineer-in-Charge.

Signed for and on behalf of
<bidder's name>

<Name of the Signatory>

Authorised Representative of the Bidder

Place: _____

Date: _____

Format - VI

Performa of Bank Guarantee in lieu of EMD

(Judicial Stamp paper of appropriate value as per stamp Act of respective state)

Employer/PMC,

1. In consideration of the Employer/PMC, having its Registered Office at _____ (hereinafter called "Employer/ PMC" which expression shall, unless repugnant to the subject or context, include its successors and assigns) having issued Notice Inviting Tender No. _____ and M/s. _____ having its Registered Office at _____ (hereinafter called the "Tenderer") is to participate in the said tender for _____.
2. Whereas the Employer/PMC, as a special case, has agreed to accept an irrevocable and unconditional Tender Bond Guarantee for an amount of Rs. _____, valid up to _____ from the tenderer in lieu of Cash Deposit of Rs. _____ required to be made by the tenderer, as a condition precedent for participation in the said tender.
3. We the (hereinafter called the "BANK") having its Registered Office at _____ and branch office at _____, do hereby unconditionally and irrevocably undertake to pay to the Employer/PMC immediately on demand in writing, without any demur/ protest, any amount but not exceeding Rs. _____ and any such demand made by the Employer/PMC shall be conclusive and binding on us irrespective of any dispute or differences that may be raised by the tenderer. Any change in the constitution of the tenderer or the Bank shall not discharge our liability under this Guarantee.
4. We, the _____ Bank, lastly undertake not to revoke this guarantee during its currency without the prior consent of the Employer/PMC in writing and this guarantee shall remain valid up to _____ upon expiry of which, we shall be relieved of our liability under this guarantee thereafter.

For and on behalf of the Bank

Place:

Dated:

Witness.

- 1.
- 2.

Format-VII

Performa of Bank Guarantee (Performance)

(Judicial Stamp paper of appropriate value as per stamp Act of respective state)

Employer/PMC,

1. Whereas the Employer/ PMC, having its Registered Office at _____ (hereinafter called "Employer/PMC", which expression shall include its successors and assigns) having awarded a work order/contract / supply order No. dated _____ (hereinafter called the contract) to M/s _____ (hereinafter called the contractor/ supplier) at a total price of Rs. _____ subject to the terms and conditions contained in the contract.
2. Whereas, the terms and conditions of the contract require the contractor to furnish a bank guarantee for Rs. _____ (Rupees _____) being _____ % of the total value of the contract for proper execution and due fulfilment of the terms and conditions contained in the contract.
3. We, the Bank, (hereinafter called the "Bank") do hereby unconditionally and irrevocably undertake to pay to the Employer/PMC immediately on demand in writing and without protest/or demur all moneys payable by the contractor/ supplier to the Employer/PMC in connection with the execution/ supply of and performance of the works/ equipment, inclusive of any loss, damages, charges, expenses and costs caused to or suffered by or which would be caused to or suffered by Employer/PMC by reason of any breach by the contractor/ supplier of any of the terms and conditions contained in the contract as specified in the notice of demand made by Employer/PMC to the bank. Any such demand made by Employer/PMC on the bank shall be conclusive evidence of the amount due and payable.
4. This guarantee shall be a continuing guarantee and irrevocable for all claims of the Employer/PMC as specified above and shall be valid during the period specified for the performance of the contract.
5. We, the said bank, further agree with the Employer/PMC that the Employer/PMC shall have the fullest liberty, without our consent and without affecting in any manner our obligations and liabilities hereunder, to vary any of the terms and conditions of the said contract or to extend time for performance of the contract by the contractor from time to time or to postpone for any time or from time to time any of the powers exercisable by Employer/PMC against the contractor/supplier under the contract and forbear or enforce any of the terms and conditions relating to the said contract and we shall not be relieved from our liability by reason of any such variations or extension being granted to the contractor or for any forbearance, act or omission on the part of Employer/PMC or any indulgence by Employer/PMC to the contractor or by any such matter or thing, whatsoever, which under the law relating to the sureties would, but for this provision, have effect of so relieving us.

6. This guarantee/undertaking shall be in addition to any other guarantee or security whatsoever Employer/PMC may now or at any time have in relation to the performance of the works/ equipment and the Employer shall have full re-course to or enforce this security in performance to any other security or guarantee which the Employer/PMC may have or obtained and there shall be no forbearance on the part of the Contractor in enforcing or requiring enforcement of any other security which shall have the effect of releasing the Bank from its full liability. It shall not be necessary for Employer/PMC to proceed against the said contractor/supplier before proceeding against the Bank.
7. This guarantee/ undertaking shall not be determined or affected by the liquidation or winding up, dissolution or change of constitution or insolvency of the supplier/ contractor, but shall in all respects and for all purposes be binding and operative until payment of all moneys payable to Employer/PMC are paid by the Bank in terms thereof.
8. The Bank hereby waives all rights at any time inconsistent with the terms of this Guarantee and the obligations of the bank in terms hereof shall not be otherwise effected or suspended by reasons of any dispute or disputes having been raised by the supplier/ contractor (whether or not pending before any Arbitrator, Tribunal or Court) or any denial of liability by the supplier/ contractor stopping or preventing or purporting to stop or prevent any payment by the Bank to Employer/PMC in terms hereof.
9. We, the said Bank, lastly undertake not to revoke this guarantee during its currency except with the previous consent of Employer/PMC in writing, upon expiry of which we shall be relieved from all liabilities under this guarantee thereafter.
10. Signed this _____ day of _____ at _____.

For and on behalf of the Bank

(Signature, name and Designation of the Signatory
along with the Bank Seal)

WITNESS.

1.

2.

Format - VIII

Performa of Bank Guarantee

(For mobilization advance)

(Judicial Stamp paper of appropriate value as per stamp Act of the respective state)

Employer/PMC,

1. In consideration of the Employer/PMC, having its Registered Office at _____ (hereinafter called "Employer/PMC", which expression shall unless repugnant to the subject or context include its successor and assigns) having agreed under the terms and conditions of Contract No. _____ dated _____ made between _____ and the Employer/PMC in connection with _____ (hereinafter called "the said contract") to make at the request of the Contractor a Mobilization Advance of Rs. _____ for utilizing it for the purpose of the Contract on his furnishing a guarantee acceptable to Employer/PMC, we the _____ Bank Ltd. (hereinafter referred to the "the said Bank") and having our registered office at _____ do hereby guarantee the due recovery by Employer/PMC of the said advance as provided according to the terms and conditions of the Contract.
2. We, the said Bank, do hereby undertake to pay the amount due and payable under this Guarantee without any demur, merely on a demand from the Employer/PMC stating that the amount claimed is due to the Employer/PMC under the said Agreement. Any such demand made on the _____ shall be conclusive as regards the amount due and payable by the _____ under this guarantee and _____ agree that the liability of the _____ to pay the amount so demanded to the Employer/PMC, shall be absolute and unconditional notwithstanding any dispute or disputes raised by the Contractor and notwithstanding any legal proceeding(s) pending in any Court or Tribunal relating thereto. However, our liability under this Guarantee shall be restricted to an amount not exceeding Rs. _____, which shall be valid up to _____.
3. We, _____ Bank further agree that Employer/PMC shall be the sole judge of and as to whether the amount claimed has fallen due to the Employer/PMC under the said agreement or whether the said Contractor has not utilized the said advance or any part thereof for the purpose of the Contract and the extent of loss or damage caused to or suffered by Employer/PMC on account of the said advance together with interest not being recovered in full and the decision of Employer/PMC that the amount has fallen due from contractor or the said Contractor has not utilized the said advance or any part thereto for the purpose of the contract and as to the amount or amounts of loss or damage caused to or suffered by Employer/PMC shall be final and binding on us.

4. We, the said Bank, further agree that the Guarantee herein contained shall remain in full force and effect till the said advance has been fully recovered and its claims satisfied or discharged and till the Employer/PMC certify that the said advance has been fully recovered from the said contractor and, accordingly, discharges this Guarantee subject, however, that Employer/PMC shall have no claims under this Guarantee after the said advance has been fully recovered, unless a notice of the claims under this Guarantee has been served on the bank before the expiry of the said Bank Guarantee in which case the same shall be enforceable against the Bank.
5. The Employer/PMC shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee or indemnity from time to time to vary any of the terms and conditions of the said Contract or the advance or to extend time of performance by the said Contractor or to postpone for any time and from time to time of the powers exercisable by it against the said Contractor and either to enforce or forbear from enforcing any of terms and conditions governing the said Contract or the advance or securities available to the Employer/PMC and the said Bank shall not be released from its liability under these presents by any exercise by Employer/PMC of the liberty with reference to the matters aforesaid or by reasons of time being given to the said Contractor or any other forbearance, act or omission on the part of Employer/PMC or any indulgence by Employer/PMC to the said Contractor or of any other matter or thing whatsoever which under sureties the law relating to would but for this provision have the effect of so releasing the bank from its such liability.
6. It shall not be necessary for Employer/PMC to proceed against the Contractor before proceeding against the Bank and the Guarantee herein contained shall be enforceable against the Bank notwithstanding any security which Employer/PMC may have obtained or obtain from the Contractor or shall at the time when proceedings are taken against the Bank hereunder be outstanding or unrealized.
7. We, the said Bank, lastly undertake not to revoke this Guarantee during its currency except with the previous consent of Employer/PMC in writing and agree that any change in the constitution of the said Contractor or the said Bank shall not discharge our liability hereunder.
8. Signed this ____ day of _____ at _____.

For and on behalf of the Bank

(Signature, name and Designation of the Signatory
along with the Bank Seal)

WITNESS.

1. _____ 2. _____

Format – IX

Performa for Bank Guarantee

(In lieu of Security Deposit)

(Judicial Stamp paper of appropriate value as per Stamp Act of respective state)

Employer/PMC,

- A. In consideration of the Employer/PMC, having its Registered Office at _____ (hereinafter called) "Employer/PMC"), which expression shall include its successors and assigns, having awarded to M/s _____ (hereinafter called "the Supplier/ Contractor"), which expression shall wherever the subject or context so permits includes its successors and assigns, a Contract in terms inter-alia of Employer/PMC's letter No. _____ dated _____ and the Contract/ Purchase Conditions of the Employer/ PMC with the condition of the Contractor/ Supplier furnishing a Bank Guarantee to secure the performance of Contractor's/ Supplier's obligations and /or discharge of the contractor's/ supplier's liability under and/or in connection with the said supply/ contract up to a sum of Rs. _____ (Rupees _____ only).
- B. We, _____, ((hereinafter called "the Bank"), which expression shall include its successors and assigns, hereby undertake and guarantee payment to Employer/ PMC forthwith on the same day on demand in writing and without any protest or demur of any and all moneys payable by the supplier/contractor to the Employer/PMC under, in respect or in connection with the said contract inclusive of all the losses, damages, costs, charges and expenses and other moneys payable in respect of the above as specified in any notice of demand made by Employer/PMC to the Bank with reference to this guarantee up to and aggregate limit of Rs. _____ (Rupees _____ only) and the Bank hereby agree with Employer/PMC that:
1. This Guarantee shall be a continuing guarantee and shall remain valid and irrevocable for all claims of the Employer/PMC and liabilities of Supplier/ Contractor arising up to and until midnight of _____ ;
 2. This Guarantee shall be in addition to any other Guarantee or Security whatsoever that Employer/PMC now or at any time have in relation to the Supplier's/ Contractor's obligations/ liabilities under and/or in connection with the said supply/contract, and the Employer/PMC shall have full authority to take recourse or to enforce this Security in preference to any other Guarantee or Security which the Employer/PMC may have or obtain and no forbearance on the part of Employer/PMC in enforcing or requiring enforcement of any other Security shall have the effect of releasing the Bank from its liability

hereunder;

3. The Employer/PMC shall be at liberty without reference to the Bank and without affecting the full liability of the Bank hereunder to take any other security in respect of the Supplier's/Contractor's obligations and/or liabilities under or in connection with the said supply/contract or to grant time and / or indulgence to the supplier/ contractor or to increase or otherwise vary the prices or the total contract value or to release or to forbear from enforcement of all or any of the conditions under the said supply/ contract and/or the remedies of the Employer/PMC under any other security/securities now or hereafter held by Employer/PMC and no such dealings, increase(s) or other indulgence(s) or arrangement(s) with the supplier/ contractor or releasing or forbearance whatsoever shall have the effect of releasing the Bank from its full liability to Employer/PMC hereunder or prejudicing rights of Employer/ PMC against the Bank;
4. This Guarantee shall not be determined or affected by the liquidation or winding up, dissolution or change of constitution or insolvency of the supplier/ contractor but shall in all respects and for all purposes be binding and operative until payment of all moneys payable to the Employer/PMC in terms thereof;
5. The Bank hereby waives all rights at any time inconsistent with the terms of this Guarantee and the obligations of the Bank in terms hereof shall not be otherwise affected or suspended by reason of any dispute or disputes having been raised by the supplier/ contractor (whether or not pending before any Arbitrator, Tribunal or Court) or any denial or liability by the supplier/ contractor stopping/ preventing or purporting to stop or prevent any payment by the Bank to Employer/PMC in terms thereof;
6. The amount stated in any notice of demand addressed by Employer/PMC to the Guarantor as liable to be paid to the Employer/PMC by the supplier/contractor or as suffered or incurred by Employer/PMC on account of any losses or damages, costs, charges and/or expenses shall as between the Bank and Employer/PMC be conclusive of the amount so liable to be paid to the Employer/PMC or suffered or incurred by Employer/PMC as the case may be and payable by the Guarantor to the Employer/PMC in terms hereof subject to a maximum of Rs _____ (Rupees _____ only);
7. Unless demand or claim under this Guarantee is made on the Guarantor in writing within three months from the date of expiry of the Guarantee i.e. up to the Guarantor shall be discharged from all liabilities under this Guarantee there under;

8. Notwithstanding anything contained hereinbefore, our liability under this guarantee is restricted to Rs. _____ (Rupees _____ only). This guarantee will expire on _____. Any claim under this Guarantee must be received by us within three months from the date of expiry.
9. Signed this _____ day of _____ at _____.

For and on behalf of the Bank

(Signature, name and Designation of the Signatory
along with the Bank Seal)

WITNESS.

- 1.
- 2.

Format - X

Form for Guarantee Bond for anti-termite Treatment

THIS AGREEMENT is made this _____ day of _____ at _____ between:

M/s _____ (hereinafter called the guarantor) of the one part;

and

M/s Employer/ PMC, hereinafter called the Employer/PMC of the other part, which expression shall include its successors or assigns, more particularly the Resident Welfare Association (RWA) of the said complex.

This agreement witnesses as under:

1. Whereas this agreement is supplementary to the contract hereinafter called the Main Contract dated _____ between the guarantor of the one part and the Employer/PMC of the other part whereby the contractor, inter-alia, is understood to render the buildings and structures in the said contract recited, completed, termite proof.
2. And whereas the guarantor agreed to furnish a guarantee to the effect that the said structure will remain termite proof for TEN YEARS to be so reckoned from the date of issue of Completion Certificate of the Contract by the Employer/ PMC;
3. During this period of guarantee, the guarantor shall make good all defects and for that matter shall replace at his risk and cost such wooden member(s) as may be damaged by termite and in case of any other defect being found, he shall render the building termite- proof at his cost to the satisfaction of the Engineer-in-charge and shall commence the works of such rectification within seven days from date of issuing notice from the Engineer-in-Charge, and later the manager concerned from the concerned RWA, calling upon him to rectify the defects falling which the work shall be got done by Employer/PMC/ Employer by some other contractor at the guarantor's cost and risk and in the latter case the decision of the Engineer-in-charge as to the cost recoverable from the guarantor shall be final and binding.
4. That if the Guarantor fails to execute the Anti-Termite treatment or commits breaches hereunder, then the Guarantor will indemnify Employer/PMC against all losses damages, costs, expenses or otherwise which may be incurred by him by reasons of any default on the part of the guarantor in performance and observance of this supplemental Agreement. As to the amount of loss and or damage and/or cost incurred by Employer/PMC, decision of the Engineer-in-charge will be final and binding on the parties.

5. In witness where of these presents have been executed by the Guarantor _____ and by _____ for and on behalf of Employer/PMC on the day of month and year first above written.

For and on Behalf of the Guarantor	For and on behalf of the Employer/ PMC
<Signature>	<Signature>
<Name and Address of the Authorised Signatory>	<Name and Address of the Authorised Signatory>
Witnesses	
1.	1.

Format - XI

Draft for Guarantee to be executed by the Contractor for removal of defects after completion in respect of Water-proofing works

This agreement made on this _____ day of _____, Two thousand Twenty Two between _____ (hereinafter called Guarantor of the one Part) and the Employer/ PMC (hereinafter called the Execution Agency of the other Part).

- A. WHEREAS this agreement is supplementary to a contract (hereinafter called the Contract) dated _____ made between the GUARANTOR of the ONE Part and the Employer/ PMC of the Other Part, whereby the Contractor, inter-alia, undertook to render the buildings and structures in the said contract recited completely water and leak proof.
- B. AND WHEREAS the Guarantor agreed to give a guarantee to the effect that the said structures will remain water and leak proof for a period of Ten years from the date of issue of Completion Certificate by the Employer.

NOW, THE GUARANTOR hereby guarantees that the water-proofing treatment given by him will render the structures completely leak-proof and the minimum life of such water-proofing treatment shall be Ten years to be reckoned from the date of issue of Completion Certificate of the building/ project by the Employer/PMC as prescribed in the contract.

Provided that the Guarantor will not be responsible for leakage caused by earthquake or structural defects or misuse of roof or alteration and for such purpose.

- (a) Misuse of roof shall mean any operation, which will damage water-proofing treatment, like chopping of fire wood and things of the same nature which might cause damage to the roof.
- (b) Alternation shall mean construction of an additional storey or a part of the roof or construction adjoining to existing roof whereby proofing treatment is removed in parts.
- (c) The decision of the Engineer-in-Charge with regard to cause of leakage shall be final.

That this Agreement, inter alia, provides for the following:

1. During this period of guarantee, the Guarantor shall make good all defects, in case of any defect being found, and render the building completely water-proof to the satisfaction of the Engineer-in-Charge at his cost. The Guarantor shall commence the work for such rectification within seven days from the date of issue of notice by the Engineer-in-Charge calling upon him to rectify the defects, failing which the work shall be got done by the Employer/ PMC from some other Contractor at the guarantor's cost and risk. The decision of

Engineer- in-Charge as to the cost, payable by the Guarantor, shall be final and binding.

2. That if the Guarantor fails to execute the waterproofing or commits any breach thereunder, then the Guarantor will indemnify the principal and his successors against all laws, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Employer/PMC, the decision of the Engineer-in-Charge will be final and binding on the parties.
3. IN WITNESS WHEREOF these presents have been executed by the Obligator _____ and by _____ and for and on behalf of the Employer/PMC on the day, month and year first above written.

For and on Behalf of the Guarantor	For and on behalf of the Employer/PMC
<Signature>	<Signature>
<Name and Address of the Authorised Signatory>	<Name and Address of the Authorised Signatory>
Witnesses	Witnesses
1.	1.
2.	2.

Format-XII

Performa for Indenture for Secured Advance or Credit

THIS INDENTURE made this _____ day of _____

Between

The Contractor, which expression shall where the Context as admits or implies be deemed to include his executor/ administrators and assigns of the one part;

And

The Employer/PMC, having its Registered Office at _____ (represented through the Engineer-in-Charge), which expression shall where the context so admits or implies be deemed to include its successors and assign of the other part;

Whereas by an agreement dated (hereinafter called the said agreement), the Contractor has agreed to construct _____ ;

And whereas the Contractor has applied to the Engineer-in-Charge that he may be or be given credit for materials brought by him to the site of the work subject to the said agreement for use in construction of the work.

NOW. THIS INDENTURE Witnessed that in pursuance of the said agreement and in consideration of the sum of Rs. _____ (Rupees _____ only) paid to the contractor by the Engineer-in-Charge, the receipt whereof the Contractor hereby acknowledges and of such advance or credit (if any) as may be made to him as aforesaid, the Contractor hereby covenants and agrees with the Engineer-in-Charge and declares as follows:

1. That all sums given as advance or credit by the Engineer-in-Charge to the Contractor as aforesaid shall be employed by the Constructor in or toward the execution of the said works and for no other purpose whatsoever.
2. That the material for which the advance or credit is given are offered to and accepted by the Engineer-in-Charge as security and are absolutely the Contractor's own property and free from encumbrances of any kind. The Contractor will not make any application for or receive further advance or credit on the security or material which are not absolutely his own property and free from encumbrances of any kind and the Contractor shall indemnify the Engineer-in-Charge against any claims to any material in respect of which advance or credit has been made to him as aforesaid.
3. That the said material and all other material on the security of which any further advance or advances or credit may be given as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Engineer-in-Charge and in terms of said agreement.

4. That the Contractor shall make all necessary and adequate arrangements for the proper safe custody and protection at his own cost against all risks qua the said material and, that until used in the construction as aforesaid, the material shall remain at the site of the said works in the Contractor's custody and on his responsibility and shall at all times be open to inspection by the Engineer-in-Charge. In the event of the materials or any part thereof being stolen, destroyed or damaged or getting deteriorated, the Contractor will replace the same with other materials of like quality or repair and make good the same as required by the Engineer-in-Charge.
5. That said material shall not on any account be removed from the site of work except with the written permission of the Engineer-in-Charge.
6. That the advance shall be repayable in full when or before the Contractor receives payment from the Engineer-in-Charge of the price payable to him for the said work under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done then on the occasion of each payment, the Engineer-in-Charge will be at liberty to make a recovery from the Contractor's bill from such payments by deducting therefrom the value of the said materials than actually used in the construction and in respect of which recovery has not been made previously. The value of this purpose being determined in respect of each description of materials at the rates at which the amounts of the advance as made under these presents was calculated.
7. That if the Contractor shall at any time make any default in the performance of observance in respect of any of the terms and provisions of the said agreement or of that provisions the total amount of the advance or advances that may still be owing to the Engineer-in-Charge, shall immediately on the happening of such default be repayable by the Contractor to the Engineer-in-Charge together with interest thereon at 12% p.a. from the date of respective dated to such advance or advances to the date of payment and with all costs. Damages and expenses incurred by the Engineer-in-Charge in or for recovery hereof or the Contractor hereby covenants and agrees with The Engineer to repay and pay the same respective to him accordingly.
8. That the Contractor hereby charges all the said materials with the repayment to The Engineer of all sums advances or credit as aforesaid and all costs. Charges, damages and expenses payable under these presents PROVIDED ALWAYS it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and wherever the covenant for payment and repayment herein before contained shall be become enforceable and the money owing shall not be paid in accordance therewith. The Engineer may at any time thereafter adopt all or any of the following courses he may deem best:

- (i) Seize the utilize the said material or any part thereof in the completion of the said works in accordance with the provision in that behalf contained in the said agreement debating the Contractor with the actual cost of effecting such completion and the amount due in respect of advance or credit under these presents and crediting the Contractor with value of work done as if he has carried it out in accordance with the said agreement and the rates thereby provided if the balance is against the Contractor is to pay the same to the engineer on demand.
 - (ii) Remove and sell by public action the seized materials or any part thereof and out of the money arising from the sale repay the engineer under these presents and pay over the surplus (if any) to the Contractor.
 - (iii) Deduct all or any part of the moneys owing from any sums due to the contractor under said agreement.
9. Expect in the event of such default on the part of contractor as aforesaid, interest or the said advance shall not be payable.
10. That in the event of conflict between the provisions of these presents and the said agreements, the provision of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents, the settlement of which has not been hereinbefore expressly provided for the same shall so far as is lawful be subject to jurisdiction of Delhi courts only.

IN WITNESS whereof the said the engineer and the contractor hereunto set their respective hands and seals the day year first above written.

Signed Sealed and delivered by Contractor

Note:-As described in the GCC clause 5 regarding secured advance, the interest on secured advance will be charged as mentioned in form no 12, Section-4, Sr No 7. for the delay in incorporation of material by the contractor (For which secured advance is paid to the contractor) in work.

Format - XIII

Undertaking by the Contractor regarding Compliance with the provisions of Contract Labour (Regulation & Abolition) Act & Rules, EPF and ESI Obligations

(To be submitted along with each RA/Final Bill)

I, S/o Sh. _____, authorised representative of M/s _____ <the Contractor> _____ do hereby declare and undertake as under:

- (i) That in the capacity of independent Contractor for M/s _____ <Employer/PMC> _____ at _____, I and the sub-contractor engaged by me for the above said work, if any, have complied with the provisions of Contract Labour (Regulation & Abolition) Act, 1970 by holding a valid license under the Act and Rules thereto. I have paid the wages **for the month of** _____.
- (ii) These wages are not less than the minimum rates applicable to all the employees and no other dues are payable to any employee.
- (iii) That I and the sub-contractor engaged by me for the above said work, if any, have covered all the eligible employees under the Employees Provident Funds and Miscellaneous Provisions Act, 1952 and the Employees State Insurance Act, 1948 and deposited the Contributions for the months up to _____ and, as such, no amount towards EPF/ESI contributions, whatsoever is payable, is pending.
- (iv) I further declare and undertake that in case any liability pertaining to my employees or towards employees of the sub-contractor engaged by me for the above said work, if any, arises in future, I shall be fully responsible for all consequences. In case any liability is discharged by Employer/PMC due to my/ my sub-contractor's lapse, I undertake to reimburse the same or the Employer/PMC is authorised to deduct the same from my dues at this Project or at any other Project.

Authorised Signatory

(Name & Seal of Company)

Date:- _____

Witness

1. –

2. –

Format - XIV
Approval of Sub-Contractor

1.	Name of Main Contractor	
2.	Name of Work, Location	
3.	Name of Proposed Sub- Contractor	
4.	Scope of Work Proposed to be Sub-contracted (Brief)	
5.	Estimated Value of the Proposed Work to be Sub-Contracted (INR)	
6.	Qualifying Criteria for Sub-Contractor	
6.1	Similar Work Experience	
(i)	1 (One) Contract of 50% or 2 (Two) Contracts of 30% Each of Estimated Value of Proposed Work to be Sub-Contracted	
(ii)	Annual Turnover (Not Less Than 100% of Estimated Value of the Proposed Work to be Sub-Contracted)	
(iii)	Positive Net Worth as per latest Annual Balance Sheet/ Profit & Loss Account	
7	Experience and Financial Details of Proposed Sub-Contractor	
(i)	Contract Value of Similar Work Executed (as Evidenced by Work Order & Completion Certificate) during the Last 7 Years	
(ii)	Maximum Annual Turnover During Last 3 (Three) Years (as Evidenced by Balance Sheet)	
(iii)	Net Worth as per latest Annual Balance Sheet/ Profit & Loss Account	
8	Criteria for Qualification of Sub-Contractor	
(i)	Sl. No. 7(i) > 6(i)	YES / NO
(ii)	Sl. No. 7(ii) > 6(ii)	YES / NO
(iii)	Sl. No. 7(iii)>0	YES / NO

9.	Based On Above Mentioned Information, We M/S _____ (Name Of Main Contractor) Propose M/S _____ (Name Of Proposed Sub-Contractor) As Our Sub-Contractor For The Above Mentioned Works. We Understand That Notwithstanding Above Approval, We Shall Remain Fully Responsible For The Performance Of The Said Sub- Contractor And Any Failure Of The Sub-Contractor Shall Not Absolve/Relieve Us Of Our Responsibility To Complete The Works As Per The Terms And Condition Of The Contract.
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Note: Contractor to fill all the details in the above performa. Further Contractor shall also fill-in the details at SI.No.5 above based on the estimated value of the proposed work to be subcontracted.

(STAMP & SIGNATURE OF CONTRACTOR)

SECTION - 5

Special Conditions of Contract

1. General

The documents forming the Contract are to be taken as mutually explanatory of one another. If there is an ambiguity or discrepancy in the documents, the Employer shall issue necessary clarifications or instructions to the Contractor, and the order of precedence of the documents shall be as follows:

- I. Contract Agreement
- II. Letter of Award
- III. Bill of Quantities
- IV. GFC Drawings
- V. Technical Specifications
- VI. Special Conditions of Contract
- VII. Instructions to Tenderers
- VIII. General Conditions of Contract
- IX. Other

2. Scope of Work

The scope of work covered in this contract will be as described in **Annexure - I to SCC**.

3. Scope of Supply

The scope of supply covered in this contract will be as described in **Annexure –II to SCC**.

4. Time Schedule

- 4.1. The work shall be executed strictly as per the Time Schedule mentioned in **Annexure - III to SCC**. The period of completion given includes the time required for mobilization & demobilization as well as testing, commissioning, rectifications, if any, re-testing, and completion in all respects as per the directions of the Engineer-in-Charge.

5. Statutory Approvals

- 5.1. Obtaining statutory approvals (for both temporary and permanent works) during construction and upon completion, as required, and as defined in Contractor's Scope of Work in **Annexure-I to SCC**, shall be the responsibility of the Contractor. Contractor shall arrange the inspection of the works by the authorities and necessary co-ordination and liaison work in this respect.

The statutory approvals/ permissions (but not limited to the following) are required to be arranged by the contractor for the execution of works. In case the permissions/ approvals are arranged by the contractor in the name of employer, the fees paid for obtaining such statutory approvals shall be

reimbursed as per actuals by the employer on production of documentary evidence .

- (a) Permission for excavation
- (b) Labour registration
- (c) Temporary water, sewer and electricity connections.
- (d) NOC from electrical inspectorate.
- (e) NOC from Labour department.
- (f) Any other approvals from the statutory authorities that the Contractor may need to obtain in connection with his scope of work.

5.2 However, in addition to the above, the contractor shall render all possible support for submission and approval of various other statutory approvals required to be taken by the PMC/ Employer, including the following:

- (a) Application for obtaining the Occupation Certificate and to support checking by the authorities that the Building has been constructed in conformity with the sanctioned building plans;
- (b) Obtaining the Fire NOC;
- (c) Obtaining Permanent Water, Sewer and Electricity connections from the authorities;
- (d) Any other approval arising from the execution of works that may be required.

6. Site Organization and Construction Equipment

6.1. Site Organisation:

- (i) The contractor stands liable and responsible to provide adequately qualified, skilled, semi-skilled, and unskilled personnel on the work. The contractor shall deploy the minimum key Construction Personnel as specified in **Annexure-IV to SCC** and augment the same from time to time as decided by the Engineer-in-Charge depending upon the site requirements & the exigencies of work so as to complete all works within the contracted time schedule and the same shall be done without any additional cost to the Employer. In case the contractor fails to deploy the minimum required key personal, the recovery shall be effected as per details in **Annexure –IV**.

6.2. Construction Equipment

To complete the work as per specifications and within the time schedule, the Contractor shall progressively deploy **Equipment & Machinery** as specified in **Annexure-V to SCC** as and when required and augment the same as decided and directed by the Engineer-in-Charge depending on the exigencies of the work so as to complete all works within the contracted time schedule and without any additional cost to the Employer. The Employer shall not supply any equipment, except those mentioned in Clause 8 below.

7. Materials to be supplied by the Employer

In continuation to Clause 31 of the GCC, the issue of materials lying at Site and listed in **Annexure-VI to SCC** shall be supplied by the Employer to the contractor against Payment as per rates depicted in **Annexure-VI** which includes GST. The contractor shall be responsible for the transportation, up-keep and watch and ward of the material after issue.

8. Tools and Equipment Lying at Site.

- (i) The Employer shall not supply any Tools and Equipment lying at site as 'free issue' material.
- (ii) However, for the purpose of faster mobilization and timely project execution, if opted by the contractor, the tools and equipment already lying at site under Employer's Possession, will be offered to the Contractor for work execution at the rates as mentioned in **Annexure-VII of SCC**. The amount based on the mentioned Rates will be recovered by the Employer from the RA/ final bills of the contractor on a pro rata basis.
- (iii) It may be noted that the repair, operation and maintenance of the equipment so made available would be the responsibility of the contractor.
- (iv) The quality of work shall be as per bid document irrespective of the Employer's offered equipment supply. The responsibility of the quality of work that has been executed using the corresponding equipment solely lies with the Contractor, without any time and cost implications to the Employer.
- (v) On completion of the work, the contractor shall handover the possession of tools and equipment to the Engineer-in-Charge in working condition. In case of any damage to the tools and equipment, contractor shall repair the same before handing over to the Employer/ his representative.

9. Health Safety and Environment (HSE) Management

In continuation with Clause 34 of the GCC, the HSE management at site shall be carried out in strict compliance to **Annexure - VIII to SCC**.

10. Office Accommodation to be arranged by the Contractor for the Engineer-in-Charge/ PMC/ TPIA/ Employer

- (i) The Contractor to establish/ provide an Office at site, furnished with basic furniture, for the PMC/ TPIA/ Employer's personnel to the satisfaction of Engineer-in-charge. Minimum capacity of the number of persons and area shall be as per site requirements.
- (ii) The contractor shall maintain the aforesaid facilities for various site activities operational during the currency of the contract and till the contractual completion date including extensions (if any). Operation and maintenance cost on the above facilities shall be completely borne by the contractor.

11. Maintenance of the Works

- (i) The maintenance cost of the works executed shall be borne by the Employer after the offer of possession to the homebuyers or 6 months from the date of issue of the Completion Certificate, whichever is later.
- (ii) Contractor shall prepare and submit all Operation & Maintenance manuals as per “Good Engineering Practices” after completion of work, which shall be got approved from the Engineer- in-charge.

12. Additional Special conditions of contract (Annexure-IX)

Additional special project specific conditions are given in the **Annexure-IX**.

Annexure - I

(Special Conditions of Contract)

Scope of Work

1. Work covered in this contract shall include design, manufacture, supply, transportation, delivery, installation, testing and commissioning of Electrical and Substation works and shall include but not limited to the following.
 - Supply and erection of Substation equipment's such as Main LT Panel, Capacitor panel, common service panel, DG LT panel with PLC system Distribution board etc.
 - 7x1000KVA 11/0.433 KV outdoor type ONAN distribution Transformer.
 - 1x250KVA 11/0.433 KV outdoor type ONAN distribution Transformer for common services.
 - 11 KV HT ICOG VCB Switchboard with 11 metering unit.
 - 3 No. 5/7 Panel 11 KV HT VCB Switchboard.
 - 11KV Metring cubicle.
 - Outdoor 11KV RMU.
 - Supply, Laying, termination of LT/HT cable (including & upto 400Sq.mm).
 - 415 V ACDB, 24 Volts DCDB with battery bank & Battery charger.
 - Construction of Electric sub-station room, DG foundation, civil foundation for feeder panels, RMU, transformers, fencing work etc. all other Civil works required for carrying out electrical works under this contract including making good and painting of such civil works.
 - Earthing and lightning protection work.
 - Submission of technical particulars along with the tender and shop drawings after award of contract.
 - Obtaining Electrical Inspector's approval before commissioning of the electrical systems.
 - Liaisoning and obtaining necessary approvals and power connection from relevant authorities.
 - All other works/items which is necessary to complete the entire system function as required.
2. All material, equipment, consumables etc. required for successful completion of the works are to be supplied by the contractor.
3. All materials, equipment, labour & consumables required for successful completion of work as per the description of items in the Schedule of Rates shall be supplied by the Contractor and the cost of such supply shall be deemed to be included in the quoted rates without any additional liability on the Employer except for the material (if any) specifically covered under Employer's Scope of Supply.

Annexure - II

(Special Condition of Contract)

Scope of Supply

1. GENERAL

Work under this contract is intended to cover the Electrification and Street lighting works at Plotted Development, Sector 96, 97 & 98 Noida, UP and shall be executed as stipulated in this tender document and as required at site whether specifically shown or not. The contractor shall carry out and complete the work under this contract in every respect in conformity with the contract documents and as per directions of and to the satisfaction of the Architects/ Owners.

2. INTENT OF SPECIFICATION

Technical specifications forming a part of this contract are intended to cover work referred above. It is not the intent to specify completely herein all aspects of design, constructional features of equipment and details of the work to be carried out, but nevertheless the intent of the specification is to ensure that the equipment and work shall conform in all respects to the relevant Discom's technical specification, Bureau of Indian Standard Specifications, Codes of Practice, Indian Electricity Act, Indian Electricity Rules and other Statutory Regulations as may be applicable and to high standards of engineering, design and workmanship. The equipment and work shall perform in continuous operation in a manner acceptable to the owners who will interpret the meaning of the specifications and drawings and shall have the right to reject or accept any equipment or work which in their assessment is not complete to meet the requirements of this specification and/or applicable Codes and Standards.

3. The Equipment tools and tackles to facilitate construction and after final commissioning, Performance Guarantee, Test run shall be in Contractor's scope. The Contractor may arrange the same through purchase/ hire/ lease basis and such equipment, tools, tackles shall remain the property of the Contractor and it shall be removed from site after its requirement is over. No additional payment shall be made for mobilization and/or demobilization of such equipment, tools & tackles etc.

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Annexure- III (Special Condition Of Contract)

Time Schedule

Sr. No.	Description	Time of Completion
1	Development of work for Electrical infrastructure i.e. HT & LT Electrification, Electric Substation and Street Lighting works, at “The Willows” Unitech Grande, Sector 96, 97 & 98 at Noida, U.P.	24 Months

Notes:

1. Time of Completion shall be as defined in the NIT.
2. The Time indicated is for completing all the works in all respects as per specifications, codes, drawings and instructions of Engineer-in-Charge.

Annexure- IV (Special Conditions of Contract)

Qualifications & Experience of Key Construction Personnel

1. Minimum Qualification, Experience & Numbers of Key Personnel to be deployed along with rate of recovery in case minimum staff not deployed:

Sr. No.	Category	Qualification & Experience	Nos.	Rate at which recovery shall be made per month form the contractor in the event of not fulfilling provision of clause 36
1.	Project Manager	B.E. (Civil. Engg). with minimum 8 years' experience in Construction of Electrical Installation	1	Rs 80,000/- Rs Eighty thousand only
1.	Discipline Electrical Engineer s	Degree in Electrical Engineering Discipline with minimum 5 years' experience in Construction of Electrical Installation OR Diploma in Engineering with minimum 15 Years' relevant experience.	1	Rs 60000/- Rs Sixty thousand Only
2.	Discipline Civil Engineer s	Degree in Civil Engineering Discipline with minimum 5 years' experience OR Diploma in Engineering with minimum 15 Years' relevant experience.	1	Rs 60000/- Rs Sixty thousand Only
3.	Safety Manager	A recognized degree/ diploma or equivalent in any branch of engineering or technology. Also, had	1	

		practical experience of working in a construction project site in supervisory capacity for a period of not less than 10-15 years. Possesses a degree or diploma in construction / industrial safety recognized by the Central / State Government.		Rs. 50000/- Rs Fifty thousand Only
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2. Notes-

- (i) The detail of manpower required to be deployed by the contractor during Construction for Completion of the work within schedule time is Indicative only. This should be corresponding to the scale and size of the Contract. The Contractor is required to augment the above list with additional numbers/categories of personnel as required and/or as directed by Engineer-in-Charge to carry out the works in working hours including night shifts and complete the work within the completion schedule.
- (ii) The Key Personnel identified above shall be well qualified & having adequate relevant experience as specified in document above. The other manpower shall also be qualified and experienced with their assigned work. The contractor shall submit the Detailed Manpower Deployment schedule along with the Bid.
- (iii) CVs of key persons proposed to be deployed shall be submitted to Engineer-in-Charge prior to their mobilization at site.

Annexure - V

(Special Conditions of Contract)

Indicative List of Equipment & Machinery to be deployed by the Contractor

Sr. No.	Equipment	Minimum Capacity	Indicative Nos.
	Concrete pump		
1	Concrete Vibrator (Electrical / Pneumatic)	-	As required
2	DG Set	40 kVa	As required
3	Water Pumps	nos.	As required
4	Bar Cutting Machine	nos.	As required
5	Bar Bending Machine	nos.	As required
6	Hydra Machine	Nos	1
7	Welding Machine	Nos	2
8	Stone Cutting Machine	Nos.	2
9	Stone polishing Machine	Nos.	2
10	HILTI Breaker	Nos.	2
11	Steel Scaffolding pipes , clamps and related accessories	-	As Required

The Equipment/ Machinery required to be mobilized by the contractor during Construction to Complete the work within schedule time is Indicative only. Contractor is required to augment the above list with additional numbers/categories as required and/or as directed by Engineer-In-Charge to carry out the works within the completion schedule.

Annexure - VI
(Special Conditions of Contract)

Material lying at site to be supplied by the Employer

NIL

Annexure - VII
(Special Conditions of Contract)

List of Plant & Equipment in possession of Employer, lying at Site along with rates to be recovered from the Contractor.

Sr. No.	Description of Machinery /equipment	Unit	Rate per day to be charged including GST
1			
2	-----Nil-----		
3			
4			

Note:- It is not compulsory to use plant & material laying at site. Only, if the contractor is willing to use the same at mutually agreed rates, he is free to use the same.

Annexure - VIII
(Special Conditions of Contract)

Health, Safety & Environment Management Plan

HEALTH, SAFETY & ENVIRONMENT MANAGEMENT PLAN

1. Scope

This specification establishes the Health, Safety and Environment (HSE) management requirement to be complied by Contractors/Vendors including their sub-contractors/sub vendors during construction.

This specification is not intended to replace the necessary professional judgment needed to design & implement an effective HSE system for construction activities and the contractor is expected to fulfil HSE requirements in this specification as a minimum. It is expected that contractor shall implement best HSE practices beyond whatever are mentioned in this specification.

Requirements stipulated in this specification shall supplement the requirements of HSE Management given in relevant Act(s)/ Legislations, General Conditions of Contract (GCC), Special Conditions of Contract (SCC) and Technical Specifications. Where different documents stipulate different requirements, the most stringent shall apply.

2 References

The document should be read in conjunction with following:

- General Conditions of Contract (GCC)
- Special Conditions of Contract (SCC)
- Building and other construction workers Act,
- Indian Factories Act
- Technical specifications
- Relevant State & National Statutory requirements.
- Operating Manuals Recommendation of Manufacturer of various construction Machineries

3. Requirements of Health, Safety & Environmental (HSE) Management System to be complied by contractors

3.1 Management Responsibility

3.1.1 HSE Policy & Objectives

The Contractor should have a documented and duly approved HSE policy & objectives to demonstrate commitment of their organization to ensure health, safety and environmental aspects in their line of operations.

3.1.2 Management System

The HSE management system of the Contractor shall cover the HSE requirements & commitments to fulfil them, including but not limited to what have been specified under clauses 1.0 and 2.0 above. The Contractor shall obtain the approval of its site specific HSE Plan from Engineer in charge prior to commencement of any site works. Corporate as well as Site management of the Contractor shall ensure compliance of their HSE Plan at work sites in its

entirety in true spirit.

3.1.3 Indemnification

Contractor shall indemnify & hold harmless, Employer & their representatives, free from any and all liabilities arising out of non-fulfilment of HSE requirements or its consequences.

3.1.4 Deployment & Qualifications of Safety Personnel

The Contractor shall designate / deploy various categories of HSE personnel at site as indicated below in sufficient number. The Safety supervisors, Safety stewards/Observer etc. would facilitate the HSE tasks at grass root level for construction sites and shall assist Safety Officer/Engineers. Contractor shall appoint safety personnel as given below;

3.1.4.1 Safety Observer/Steward: Contractor shall depute one Safety Observer/Steward.

3.1.4.2 Safety Supervisor: In addition to above, contractor shall depute one Safety Supervisor for every 250 workers and additionally thereon.

3.1.4.3 Safety Engineer: In addition to above (i & ii), one safety engineer/ officer for every 1000 workers and additionally thereon.

a) Safety Steward/Observer

As a minimum, he shall possess class XII pass certificate and should have minimum two year of practical experience in construction work environment and should have adequate knowledge of the local language spoken by majority of the workers at the construction site.

b) Safety Supervisor

As a minimum, he shall possess a recognized graduation Degree or a Diploma in Engg. with minimum Two years of practical experience in construction work environment and should possess requisite skills to deal with construction safety related day-to-day issues.

c) Safety Officer / Safety Engineer

Safety Officer/Engineer should possess following qualification & experience:

- (i) Recognized degree in any branch of Engg. or Tech. or Architecture with practical experience of working in a building or other construction work in supervisory capacity for a period of not less than two years, **or** possessing recognized diploma in any branch of Engg. or Tech with practical experience of working in a building or other construction work in supervisory capacity for a period of not less than five years.

- (ii) Recognized degree or one year diploma in Industrial safety (from any reputed Indian Institutes).
- (iii) Preferably have adequate knowledge of the language spoken by majority of the workers at the construction site.

Alternately

- (i) Person possessing Graduation Degree in Science with Physics & Chemistry and degree or one year diploma in Industrial Safety (from any reputed Indian institutes) with practical experience of working in a building, plant or other construction works (as Safety Officer) for a period of not less than five years, may be considered as Safety Officer.

The Contractor shall verify & authenticate credentials of such safety personnel and furnish Bio-Data/Resume/Curriculum Vitae of the safety personnel as above for approval of Engineer in charge.

Imposition/ Realization of penalty shall not absolve the Contractor from his/her responsibility of deploying competent safety officer at site.

Adequate planning and deployment of safety personnel shall be ensured by the Contractor, so that field activities do not get affected because of non-deployment of competent & qualified safety personnel in appropriate numbers.

3.1.5 Implementation, Inspection/Monitoring

- a) The Contractor shall be fully responsible for planning, reporting, implementing and monitoring all HSE requirements and compliance of all laws & statutory requirements.
- b) The Contractor shall also ensure that the HSE requirements are clearly understood & implemented conscientiously by their site personnel at all levels at site.
- c) The Contractor shall ensure physical presence of their field engineers / supervisors, during the continuation of their contract works / site activities including all material transportation activities. Physical absence of experienced field engineers / supervisors of Contractor at critical work spot during the course of work may invite halting / stoppage of work.
- d) The Contractor shall regularly review inspection report internally and implement all practical steps / actions for improving the status continuously.
- e) Contractor skilled workmen like riggers, scaffold erectors, welders, crane operators etc. should have sufficient past experience and skill on the relevant job.
- f) The Contractor shall ensure important safety checks right from beginning of works at every work site locations. and to this effect format No. HSE-

10 "Daily Safety Check List" shall be prepared by field engineer & duly checked by safety personnel for conformance.

- g) The Contractor shall carry out inspection to identify various unsafe conditions of work sites/machinery/equipments as well as unsafe acts on the part of workmen/supervisor/engineer while carrying out different project related works.
- h) Adequate records for all inspections shall be maintained by the Contractor and the same shall be furnished to Engineer in charge, whenever sought.
- i) As a general practice lifting tools/tackles, machinery, accessories etc. shall be inspected, tested and examined by competent person (approved by concerned State authorities) before being used at site and also at periodical interval (e.g. during replacement, extension, modification, elongation/reduction of machine/parts, etc.) as per relevant statutes. Hydra, cranes, lifting machinery, mobile equipments/ machinery/ vehicles, etc. shall be inspected regularly by only competent / experienced personnel at site and requisite records for such inspections shall be maintained by contractor. Contractor shall also maintain records of maintenance of all other site machinery (e.g. generators, rectifiers, compressors, cutters, etc.) & portable tools/equipments being used at project related works (e.g. drills, abrasive wheels, punches, chisels, spanners, etc.).
- j) Site facilities /temporary. installations, e.g. batching plant, cement go down, DG-room, temporary electrical panels/distribution boards, fabrication yards, etc. and site welfare facilities, like labour colonies, canteen/pantry, rest-shelters, motor cycle/bicycle-shed, First-aid centers, urinals/toilets, etc. should be periodically inspected by Contractor.

3.1.6 Awareness and Motivation

- a) The Contractor shall promote and develop awareness on Health, Safety and Environmental protection among all personnel working for the Contractor.
- b) The contractor shall display safety statistics board at all prominent location .Also shall provide dedicated notice board for displaying of safety alerts or any other safety related notices for awareness site workforces.
- c) Regular awareness programs and fabrication shop/work site meetings at least on monthly basis shall be arranged on HSE activities to cover hazards/risks involved in various operations during construction.

- d) Contractor to motivate & encourage the workmen & supervisory staff by issuing/ awarding them with tokens/ gifts/ mementos/ monetary incentives/ certificates etc. The motivational program shall be organized on regular basis.

3.1.7 Fire Prevention & First-Aid

- a) The Contractor shall arrange suitable First-aid measures such as First Aid Box

(Refer Appendix-B for details), stand-by Emergency Vehicle .Additionally separate_ambulance. At least one fire extinguisher shall be placed at each location of DG Set, Hot works, electrical booth etc.
- b) The Contractor shall arrange installation of fire protection measures such as adequate number of steel buckets with sand & water and adequate number of appropriate portable fire extinguishers (Refer Appendix-C for details) to the satisfaction of Engineer in Charge..
- c) The Contractor shall arrange EMERGENCY MOCK DRILL like fire, bomb threat, gas leakage, earth quake, etc. at each site at least once in three months, involving site workmen and site supervisory personnel & engineers.
- d) The contractor shall require to tie-up with the hospitals located in the neighbourhood for attending medical emergency.

3.1.8 Documentation

The Contractor shall evolve a comprehensive, planned and documented system covering the following as a minimum for implementation and monitoring of the HSE requirements and the same shall be submitted for approval by Engineer in Charge & EIL.

- HSE Organogram
- Site specific HSE Plan
- Safety Procedures, forms and Checklist. Indicative list of HSE procedures is attached as Appendix :H
- Inspections and Test Plan

3.1.9 Audit

The Contractor shall submit an Audit Plan to Engineer in charge indicating the type of audits covering following as minimum:

- a) Internal HSE audits regularly on six monthly basis by engaging internal qualified auditors However, minimum two internal HSE audit will have to be conducted irrespective of time period of the contract.

All HSE shortfalls/ non-conformances on HSE matters brought out during review/audit, shall be resolved forthwith (generally within a week) by Contractor& compliance report shall be submitted to Engineer in charge.

In addition to above audits by contractor, the contractor's work shall be subjected to HSE audit by Engineer in charge at any point of time during the pendency of contract. The Contractor shall take all actions required to comply with the findings of the Audit Report and issue regular Compliance Reports for the same to Engineer in charge till all the findings of the Audit Report are fully complied. Failure to carry-out HSE Audits & its compliance by Contractor, shall invite penalization.

3.1.10 Meetings

- i. The Contractor shall ensure participation of his top most executive at site (viz. Resident Construction Manager / Resident Engineer/ Project Manager / Site-in-Charge) in Safety Committee/HSE Committee meetings arranged by Engineer in charge usually on monthly basis or as and when called for. In case Contractor's top most executive at site is not in a position to attend such meeting, he shall inform Engineer in charge in writing before the commencement of such meeting indicating reasons of his absence and nominate his representative – failure to do so may invite very stringent penalization against the specific Contractor, as deemed fit as per Contract. The obligation of compliance of any observations during the meeting shall be always time bound. The Contractor shall always assist Engineer in charge to achieve the targets set by them on HSE management during the project implementation.
- ii. In addition, the Contractor shall also arrange internal HSE meetings chaired by his top most executive at site on fortnightly basis and maintain records. Such internal HSE meetings shall essentially be attended by field engineers / supervisors including safety personnel of the Contractor and its associates. Records of such internal HSE meetings shall be maintained by the Contractor for review by Engineer in charge or for any HSE Audits.
- iii. Agenda of internal HSE meeting should broadly cover: -
 - a) Confirmation of record notes /minutes of previous meeting
 - b) Discussion on outstanding subjects of previous points / subjects, if any
 - c) Incidents / Accidents (of all types) at project site, if any
 - d) Current topics related to site activities / subjects of discussion
 - e) House keeping
 - f) Information / views / deliberations of members / site sub-contractors
 - g) Report from Owner / Client
 - h) Status of Safety awareness, Induction programs & Training programs. The time frame for such HSE meeting shall be religiously maintained by one and all.

3.1.11 Intoxicating drinks & drugs and smoking

- a) The Contractor shall ensure that his staff members & workers (permanent as well casual) shall not be in a state of intoxication during working hours and shall abide by any law relating to consumption & possession of intoxicating drinks or drugs in force.
- b) The Contractor shall not allow any workman to commence any work at any locations of project activity who is/are influenced / effected with the intake of alcohol, drugs or any other intoxicating items being consumed prior to start of work or working day.
- c) Awareness about local laws on this issue shall form part of the Induction Training and compulsory work-site discipline.
- d) The Contractor shall ensure that all personnel working for him comply with “No-Smoking” requirements of the Owner as notified from time to time. Cigarettes, lighters, auto ignition tools or appliances as well as intoxicating drugs, dry tobacco powder, etc. shall not be allowed inside the project / plant complex.
- e) Smoking shall be permitted only inside smoking booths, if any, exclusively designated & authorized by the Engineer in charge.

3.1.12 Penalty

The Contractor shall adhere consistently to all provisions of HSE requirements. In case of non- compliances and also for repeated failure in implementation of any of the HSE provisions, Engineer in charge may impose stoppage of work without any cost & time implication to the Owner and/or impose a suitable penalty.

The amount of penalty to be levied against defaulted Contractor shall be up to a cumulative limit of 2.0% (Two percent) of the contract value.

This penalty shall be in addition to all other penalties specified elsewhere in the contract. The decision of imposing stop-work-instruction and imposition of penalty shall rest with Engineer in charge. The same shall be binding on the Contractor. Imposition of penalty does not make the Contractor eligible to continue the work in unsafe manner.

The amount of penalty applicable for the Contractor on different types of HSE violations is specified below:

Sl. No.	Violation of HSE Norms	Penalty Amount
1.	For not using personal protective equipment like Helmet, Safety Shoes, and other safety gadgets as applicable as per nature of work.	Rs.500/- per day/Item / Person
2.	Execution of work without deployment of requisite field engineer / supervisor at work spot	Rs.5,000/- per violation per day
3.	Unsafe electrical practices (not installing ELCB, using poor joints of cables, using naked wire without top plug into socket, laying wire/cables on the roads, electrical jobs by incompetent person, etc.)	Rs.5,000/- per item per day
4.	Working at height without full body harness, using non-standard/ rejected scaffolding and not arranging fall protection arrangement as required, like handrails, life-lines, Safety Nets etc.	Rs.10,000/- per case per day
5.	No fencing/barricading of excavated areas / trenches.	Rs.5,000/- per occasion
6.	Absence of Contractor's RCM/SIC or his nominated representative (prior approval must be taken for each meeting for nomination) from site HSE meetings whenever called by Engineer in Charge & failure to nominate his immediate deputy for such HSE meetings.	Rs.10,000/- per meeting
7.	Poor House Keeping	Rs.5,000 /- per occasion per subject
8.	Failure to report & follow-up accident (including Near Miss) reporting system within specific timeframe.	Rs.20,000/- per occasion
9.	Failure to deploy adequately qualified and competent Safety Officer	Rs.10,000/- Per day
10.	Any violation not covered above	To be decided by Engineer in charge

Note: Penalty amount deducted from the contractor shall be utilized by Engineer in charge for the promotion of the safety during the currency of the project.

The Contractor shall make his field engineers/supervisors fully aware of the fact that they keep track with the site workmen for their behavior and compliance of various HSE requirements. Safety lapses / defects of project construction site shall be attributable to the concerned job supervisor / engineer of the Contractor, (who remains directly responsible for safely executing field works). For repeated HSE violations, concerned job supervisor / engineer shall be reprimanded or appropriate action, as deemed fit, shall be initiated (with information to Engineer in charge) by the concerned Contractor.

Contractor shall initiate verbal warning shall be given to the worker/employee during his first HSE violation. A written warning shall be issued on second violation and specific training shall be arranged / provided by the Contractor to enhance HSE awareness/skill including feedback on the mistakes/ flaws. Any further violation of HSE stipulations by the erring individuals shall call for his forthright debar from the specific construction site. A record of warnings for each worker/employee shall be maintained by the Contractor, like by punching their cards / Gate passes or by displaying their names at the Project entry gate. Warnings, penalizations, appreciations etc. shall be discussed in HSE Committee meetings by site Head of the Contractor.

3.1.13 Accident/ Incident investigation

All accidents/incidents shall be informed to Engineer in charge at least telephonically by Contractor immediately and in writing within 24 hours on Format No. HSE-2 as applicable, by Contractor. Thereafter, a Supplementary Accident/Incident investigation Report on Format No.

HSE-3 shall be submitted to Engineer in Charge within 72 hours. Near Miss incident(s), Dangerous accidents/incident shall also be reported on Format No. HSE-4 within 24 hours. The accident/ incident shall be investigated by a team of Contractor's senior Site personnel (involving Site-in- Charge or at least by his deputy) for establishing root-cause and recommending corrective & preventive actions. Findings shall be documented and suitable actions taken to avoid recurrences shall be communicated to Engineer in charge. Engineer in charge shall have the liberty to independently investigate such occurrences and the Contractor shall extend all necessary help and cooperation in this regard. Engineer in charge shall have the right to share the content of this report with the outside world.

3.2 House Keeping

The Contractor shall ensure that a high degree of housekeeping is maintained and shall ensure inter-alia; the followings:

- a) All surplus earth and debris are removed/disposed-off from the working areas to designated location(s).
- b) Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas are removed to identify

location(s).

- c) All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).
- d) Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete, chips and bricks etc. shall not be allowed on the roads to obstruct free movement of men & machineries.
- e) Fabricated steel structural, pipes & piping materials shall be stacked properly.
- f) Water logging on roads shall not be allowed.
- g) No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.
- h) Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.
- i) Protective measures to be ensured with projected rebar by suitable means.
- j) Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the plant area/ or these materials shall be transported with top surface wet.
- k) The contractor shall ensure that the atmosphere in plant area and on roads is free from particulate matter like dust, sand, etc. by keeping the top surface wet for ease in breathing.
- l) At least two exits for any unit area shall be assured at all times – same arrangement is preferable for digging pits/ trench excavation/ elevated work platforms/ confined spaces etc.
- m) Welding cables and the power cable must be segregated and properly stored and used. The same shall be laid away from the area of movement and shall be free from obstruction.
- n) Schedule for upkeep /cleaning of site to be firmed up and implemented on regular basis.

The Contractor shall carry-out regular checks (minimum one per fortnight) as per format No. HSE-11 for maintaining high standard of housekeeping and maintain records for the same. The Contractor shall provide supervisor for housekeeping exclusively for management of day-to-day housekeeping activities.

3.3 HSE Measures

3.3.1 Construction Hazards

The Contractor shall ensure identification of all Occupational Health, Safety & Environmental hazards in the type of work he is going to undertake and enlist mitigation measures specially towards following activities;

- a) Working at height (+2.0 Mts height)
- b) Work in confined space,
- c) Deep excavations & trench cutting (depth > 2.0 mts.)
- d) Operation & Maintenance of Batching Plant.
- e) Shuttering / concreting (in single or multiple pour) for columns, parapets & roofs.
- f) Erection & maintenance of Tower Crane.
- g) Erection of structural steel members / roof-trusses / pipes at height more than 2.0 Mts. with or without crane.
- h) All lifts using 100T Crane plus mechanical pulling.
- i) Any lift exceeding 80% capacity of the lifting equipments (hydra, crane etc.).
- j) Laying of pipes (isolated or fabricated) in deep narrow trenches – manually or mechanically.
- k) Maintenance of crane / extension or reduction of crane-boom on roads or in yards.
- l) Erection of any item at >2.0 Mts. height using 100T crane or of higher capacity
- m) Work in Live Electrical installations / circuits
- n) Demolishing/ dismantling activities
- o) Welding/ gas cutting jobs at height (+2.0 Mts.)
- p) Lifting/placing roof-girders at height (+2.0 Mts.)
- q) Working in “Charged/Live” elect. Panels
- r) Erection/dismantling of scaffolding

The necessary HSE measures devised shall be put in place, prior to start of an activity & also shall be maintained during the course of works, by the Contractor.

3.3.2 Accessibility

- a) The Contractor shall provide safe means of access(in sufficient numbers) & efficient exit to any working place including provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen and Engineer in Charge or his representative.
- b) The Contractor shall implement use of all measures including use of “life line”, “fall- arresters”, “retractable fall arresters”, “safety nets” etc. during the course of using all safe accesses & exits, so that in no case any individual remains at risk of slip & fall during their travel.

- c) A ladder or step- ladder must have a level and firm footing, in case of use of fixed ladders, sufficient foot hold and hand hold to be provided.
- d) The access to operating plant / project complex shall be strictly regulated. Any person or vehicle entering such complex shall undergo identification check, as per the procedures in force / requirement of Engineer in charge.
- e) Accessibility to 'confined space' shall be governed by specific system / regulation, as established at project site.

3.3.3 Personal Protective Equipment (PPEs)

- a) The Contractor workmen shall be permitted entry inside the project premises only with proper PPEs.
- b) The Contractor shall ensure that all their staff, workers and visitors including their sub- contractor(s) have been issued (records to be kept) & wear appropriate PPEs like nape strap type safety helmets preferably with head & sweat band with $\frac{3}{4}$ " cotton chin strap, High ankle safety shoes with steel toe cap and antiskid sole, full body harness, protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications. The Contractor shall implement a regular regime of inspecting physical conditions of the PPEs being issued / used by the workmen of their own & also its sub-agencies and the damaged / unserviceable PPEs shall be replaced forthwith.
- c) Engineer in charge may issue a comprehensive color scheme for helmets to be used by various agencies. The Contractor shall follow the scheme issued by the Engineer in charge and shall choose colour other than blue (for Owner and their representatives). All HSE personnel shall preferably wear dark green band on their helmet or green color safety helmet so that workmen can approach them for guidance during emergencies. HSE personnel shall preferably wear such dresses with fluorescent stripes, which are noticeable during night, when light falls on them.
- d) Florescent jackets with respective company logo to be worn by the contractor workmen with different color coding for categories like supervisor and workmen.
- e) An indicative list of HSE standards/codes is given under **Appendix-A**.
- f) Contractor shall ensure procurement & usage of following safety equipments/ accessories (conforming to applicable IS mark) by their staff, workmen & visitors including their subcontractors all through the span of project construction.

- i. PPEs (Helmet with company name/logo, Safety Goggles, Coverall, Ear-muff, Face Shield, Hand Gloves, High Ankle Safety Shoes, Gum Boot etc.)
- ii. Barricading tape / warning signs
- iii. Rechargeable Safety torch (flame-proof)
- iv. Safety nets (with tie-chords)
- v. Fall arresters
- vi. Portable ladders (varying lengths)
- vii. Life-lines (steel wire-rope, dia. not less than 8.0 mm)
- viii. Full body double lanyard Safety harness with Rebar/ladder hook or scaffolding hook.
- ix. Retractable fall arresters (various length)
- x. Portable fire extinguishers of adequate capacity
- xi. Portable Multi Gas detector

3.3.4 Working at height

- a) The Contractor shall issue permit for working (PFW) at height after verifying and certifying the checkpoints as specified in the attached permit (Format No. HSE-6). He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence of personal protective equipments. Contractor's Safety Officer shall verify compliance status of the items of permit document after implementation of action is completed by Contractor's execution / field engineers at work site.
- b) Such PFW shall be initially issued for one single shift or expected duration of normal work and extended further for balance duration, if required.
- c) Contractors are expected to maintain a register for issuance of permit and extensions thereof including preserving the used permits for verification during audits etc.
- d) The Contractor shall ensure that Full body harnesses with double lanyards conforming IS Specifications is used by all personnel while working at height. The life lines should have enough tensile strength to take the load of the worker in case of a fall. The harness should be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself.
- e) The Contractor shall ensure that a proper Safety Net System is used wherever the hazard of fall from height is present. The safety net, preferably a knotted one with mesh ropes conforming to relevant IS specifications shall have a border rope & tie cord of minimum 12mm dia. The Safety Net shall be located not more than 6.0 meters below the working surface extending on either side upto sufficient margin to arrest

fall of persons working at different heights.

- f) In case of accidental fall of person on such Safety Net, the bottom most portion of Safety Net should not touch any structure, object or ground.
- g) Beam Clamps may be used for construction of localized temporary working platforms sheds for welding booths etc. at height in all types of steel structure due to faster installation and requirement of less scaffolding materials.
- h) Hanging Platform, manufactured by Standard HSE equipment vendors must be encouraged for painting of Buildings etc.
- i) All the tools used at height (like spanner, screw driver etc.) shall be provided with securing arrangement like back-pack/waist pouch to prevent accidental slippage from worker hand.
- j) The Contractor shall install temporary lightening arrester in tall structures during construction to save human life and to avoid damage to equipments & machineries. During the possibility of a thunderstorm, all the work at height where a person can be exposed to lightning shall be stopped.

3.3.5 Scaffoldings& Barricading

- a) Suitable steel scaffoldings only shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that can be safely done using ladders or man-basket. When a ladder is used, an extra workman shall always be engaged for holding the ladder. The ladder shall be inspected before use for cracked or split stiles, missing, broken, loose or damaged rungs & splinters. The ladder shall be of adequate length to enable it to extend to at least 1.0m above the landing place or working point. Metallic ladders shall be only used as access.
- b) The Contractor shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. Only metallic scaffold boards shall be allowed to use. Steel tubes shall be free from cracks, splits, Surface flaws & other defects. All couplers & fittings shall be properly oiled and maintained.
- c) All scaffolds shall be inspected by a safety officer. He shall paste a GREEN tag on each scaffold found safe and a RED tag on each scaffold found unsafe. Scaffolds with GREEN tag only shall be permitted to be used and Scaffolds with RED ones shall immediately be made inaccessible.
- d) The Contractor shall ensure positive barricading (indicative as well as protective) of the excavated, radiography, heavy lift, high pressure hydrostatic & pneumatic testing and other such areas. Sufficient warning

signs shall be displayed along the barricading areas.

- e) Scaffolding shall be constructed using foot seals or base plates only. Base plates shall be used below each standard on surface. Sole plate of timber shall be used beneath the base plate to achieve greater load distribution.

3.3.6 Electrical installations

- a) All electrical installations/ connections shall be carried out as per the provisions of latest Indian codes/standard.
- b) All temporary electrical installations / facilities shall be regularly checked by the licensed/competent electricians of the Contractor.

The Contractor shall meet the following requirements:

- a. Ensure that electrical systems and equipment including tools & tackles used during construction phase are properly selected, installed, used and maintained as per provisions of the latest revision of the Indian Electrical/ applicable international regulations.
- b. Shall deploy qualified & licensed electricians.
- c. All switchboards / welding machines shall be kept in well-ventilated & covered shed/ with rain shed protection. The shed shall be elevated from the existing ground level to avoid water logging inside the shed. Installation of electrical switch board must be done taking care of the prevention of shock and safety of machine.
- d. No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment / switchboard. Adequate clearances and operational space shall be provided around the equipment.
- e. Fire extinguishers and insulating mats shall be provided in all power distribution centers.
- f. Temporary electrical equipment shall not be employed in hazardous area without obtaining safety permit.
- g. Proper housekeeping shall be done around the electrical installations.
- h. All temporary installations shall be tested before energizing, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.
- i. All welders shall use hand gloves irrespective of holder voltage.
- j. Multilingual (Hindi, English and local language) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name & telephone No. of contact person in emergency shall be provided in substations and near all distribution

boards / local panels.

- k. ELCB tester /test meter shall be used for testing the ELCBs operation. ELCBs testing shall be carried out by using ELCB tester on monthly basis but in specific cases like heavy rain as decided by owner/EIC. Record of the testing shall be maintained.
- l. Regular inspection of all installations at least once in a month.

The following features shall also be ensured for all electrical installations during construction phase by the contractor:

- a). Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 M. The main switch shall be connected to the point of supply by means of armoured cable.
- b). The outgoing feeders shall be double or triple pole switches with fuses / MCBs. Loads in a three phase circuit shall be balanced as far as possible and load on neutral should not exceed 20% of load in the phase.
- c). The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be HRC type. Use of rewirable fuses shall be strictly prohibited. ELCB/RCCB (Residual Current Circuit Breaker) must be fitted with all Electrical installation. The earth leakage device shall have an operating current not exceeding 30 mA.
- d). All connections to the hand tools / welding receptacles shall be taken through proper switches, sockets and plugs.
- e). All single phase sockets shall be minimum 3 pin type only. All unused sockets shall be provided with socket caps.
- f). Only 3 core (P+N+E) overall sheathed flexible cables with minimum conductor size of 1.5 mm² copper shall be used for all single phase hand tools.
- g). Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used.
- h). All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multi-strand wires / cables.
- i). Cables shall be free from any insulation damage.
- j). Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route.

When laid above ground, cables shall be properly cleated or supported on rigid poles of at least 2.1 M high. Minimum head clearance of 6 meters shall be provided at road crossings.

- k). Underground road crossings for cables shall be avoided to the extent feasible. In any case no underground power cable shall be allowed to cross the roads without pipe sleeve.
- l). All cable joints shall be done with proper jointing kit. No taped/temporary joints shall be used.
- m). An independent earthing facility should preferably be established within the temporary installation premises. All appliances and equipment shall be adequately earthed. In case of armored cables, the armour shall be bonded to the earthing system. IS: 3043 Code for earthing practices shall be followed at project site.
- n). All cables (green colour) and wire rope used for earth connections shall be terminated through tinned copper lugs.
- o). In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour.
- p). Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in any case.
- q). ON/OFF position of all switches shall be clearly designated / painted for easy isolation in emergency.

3.3.7 Ergonomics and tools & tackles

- a) The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health.
- b) All lifting tools, tackles, equipment, trailers, trucks/dumpers, accessories including cranes shall be tested periodically by competent authority for their condition and load carrying capacity. Valid test & fitness certificates from the applicable authority shall be submitted to Engineer in charge for their review/acceptance before the lifting tools, tackles, equipment, trailers, trucks/dumpers, accessories and cranes are used. Third party inspection certificate is mandatory for all lifting tools & tackles before put into use.
- c) Load testing of Cranes by competent person must be made mandatory after each modification/alteration of crane configuration/change in boom length. All heavy equipments including cranes must be maintained in good condition & record of such maintenance shall be maintained.
- d) The contractor shall not be allowed to use defective equipment or tools

not adhering to safety norms.

- i. Tower Crane, Crane, Hydra mobile Crane (F-15 or equivalent), Hydraulic Rig & Boom
Lift shall be inspected on fortnightly basis as per Format No. HSE-20, HSE-21, HSE- 22, HSE-23 & HSE-24.
- ii. The Contractor shall deploy experienced operator & may arrange training program for operators of hydra mobile crane, crane, excavator, mobile machinery, Tower Crane, etc. at site by utilizing services from renowned manufacturers.
- iii. Hydra mobile crane (F-15 or equivalent) having steering control mechanism shall be permitted at construction site only for the purpose of loading/unloading. However, continuous rigger availability during marching of hydraulic crane at site shall be ensured by contractor.

3.3.8 Occupational Health

- a) The contractor shall identify all operations that can adversely affect the health of its workers and issue & implement mitigation measures.
- b) The Contractor shall arrange Medical Camps at regular intervals at work sites and labor colonies to assess health condition of workers.
- c) The Contractor shall ensure vaccination of all the workers including their families if residing at site, during the course of entire project span.

3.3.9 Hazardous substances

- a) Hazardous, inflammable and/or toxic materials such as solvent coating, thinners, anti- termite solutions, water proofing materials shall be stored in appropriate containers preferably with lids having spillage catchment trays and shall be stored in a good ventilated area. These containers shall be labeled with the name of the materials highlighting the hazards associated with its use and necessary precautions to be taken.
- b) The work place shall be checked prior to start of activities to identify the location, type and condition of any asbestos materials which could be disturbed during the work. In case asbestos material is detected, usage of appropriate PPEs by all personnel shall be ensured.

3.3.10 Slips, trips & falls

- a) The contractor shall establish a regular cleaning and basic housekeeping programme that covers all aspects of the workplace to help minimize the risk of slips, trips & falls. The contractor shall take positive measures like keeping the work area tidy, storing waste in suitable containers & harmful items separately, keeping passages, stairways, entrances & exits especially emergency ones clear, cleaning

up spillages immediately and replacing damaged carpet/ floor tiles, mats & rugs at once to avoid slips, trips & falls.

3.3.11 Demolition/ Dismantling

- a) The contractor shall adhere to safe demolishing/ dismantling practices at all stages of work to guard against unsafe working practices.
- b) Before carrying out any demolition/dismantling work, the contractor shall take prior approval of Engineer in charge and generate the Format No.HSE-9.

3.3.12 Road Safety

- a) The Contractor shall ensure adequately planned road transport safety management system.
- b) The vehicles shall be fitted with reverse warning alarms & flashing lights / fog-lights and usage of seat belts shall be ensured.
- c) The Contractor shall also ensure a separate pedestrian route for safety of the workers and comply with all traffic rules & regulations, including maintaining speed limit of 20 KMPH or indicated by owner for all types of vehicles / mobile machinery. The maximum allowable speed shall be adhered to.
- d) In case of an alert or emergency, the Contractor must arrange clearance of all the routes, roads, access.
- e) Dumpers, Tippers, etc. shall not be allowed to carry workers within the site and also to & from the labour colony to & from project sites.
- f) The Contractor shall not deploy any such mobile machinery / Equipments, which do not have competent operator and / or experienced banks-man/signal-man. Such machinery/equipments shall have effective limit-switches, reverse-alarm, front & rear-end lights etc. and shall be maintained in good working order.
- g) The Contractor shall not carry-out maintenance of vehicles / mobile machinery occupying space on project / plant roads and shall always arrange close supervision for such works.
- h) Contractor's shall arrange /install visible road signs, diversion boards, caution boards, etc. on project roads for safe movement of men and machinery.

3.3.13 Welfare measures

Contractor shall, at the minimum, ensure the following facilities at work sites:

- a) A crèche at site where 10 or more female workers are having children below the age of 6 years.
- b) Adequately ventilated / illuminated rooms at labour camps & its hygienic

up-keeping.

- c) Reasonable canteen facilities at site and in labour camps at appropriate location depending upon site conditions. Contractor shall make use of “industrial” variety of LPG cylinder & satisfactory illumination at the canteens. Necessary arrangement for efficient disposal of wastes from canteens & urinals /toilets shall also be made and regular review shall be made to maintain the ambience satisfactorily hygienic & shall also comply with all applicable statutory requirements.
- d) Adequately lighted & ventilated Rest rooms at site (separate for male workers and female workers).
- e) Provision for suitable mobile toilets to be made available by Contractor for remote/scattered job locations.
- f) Urinals, Toilets, drinking water, washing facilities, adequate lighting at site and labour camps.
- g) The contractor at periodic interval shall arrange to prevent mosquito breeding by fumigation/spraying of insecticides at workplace/ fabrication yard.

3.3.14 Environment Protection

Contractor shall ensure proper storage and utilization methodology of materials that are detrimental to the environment. Where required, Contractor shall ensure that only the environment friendly materials are selected and emphasize on recycling of waste materials, such as metals, plastics, glass, paper, oil & solvents. The waste that cannot be minimized, reused or recovered shall be stored and disposed of safely. In no way, toxic spills shall be allowed to percolate into the ground. The contractor shall not use the empty areas for dumping the wastes.

The contractor shall strive to conserve energy and water wherever feasible.

The contractor shall ensure dust free environment at workplace by sprinkling water on the ground at frequent intervals. The air quality parameters for poisonous gases, toxic releases, harmful radiations, etc. shall be checked by the contractor on daily basis and whenever need arises. The contractor shall not be allowed to discharge chemicals, oil, silt, sewage, sullage and other waste materials directly into the controlled waters like surface drains, streams, rivers, ponds. A discharge plan shall be submitted to Engineer in charge for approval.

3.3.15 Rules & Regulations

All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulations relating to the hazardous materials, substances and wastes. Contractor shall not dump, release or otherwise

discharge or disposes off any such materials without the express authorization of Engineer in charge. An indicative list of Statutory Acts & Rules relating to HSE is given under Appendix-D.

3.3.16 Weather Protection

Contractor shall take appropriate measures to protect workers from severe storms, rain, solar radiations, poisonous gases, dust, etc. by ensuring proper usage of PPEs like Sun glasses, Sun screen lotions, respirators, dust masks, etc. and rearranging/ planning the construction activities to suit the weather conditions. Effective arrangement (without creating inconvenience to project facilities & permanent installations) for protecting workmen from hailstorm, drizzle in the form of temporary shelter shall be made at site.

3.3.17 Communication

All persons deployed at the work site shall have access to effective means of communication so that any untoward incident can be reported immediately and assistance sought by them.

All health & safety information shall be communicated in a simple & clear language easily understood by the local workforce.

For information to all, typical subjects that should be communicated are: -
Inside the company (Top to down)

- a. Quality Policy
- b. HSE Policy contents
- c. Environment Policy
- d. HSE Objectives
- e. Safety Cardinal Rules
- f. HSE Target – reached or missed
- g. Praises & Warnings to personnel for HSE Management
- h. Safety Walk Through Reports and safety defects / shortfalls (by management)
- i. HSE Audit results
- j. Revised Statutory Health & Safety provisions, if any
- k. H & S publicity
- l. Suggestions

Inside the Company (Bottom to up)

- a. Complaints
- b. Compliances on safety defects / shortfalls

- c. Suggestions
- d. Proposals for changes & improvements
- e. HSE Reports (including near-miss reports)

3.3.18 Confined Space Entry

The contractor shall generate a work permit (Format No. HSE -7) before entering a confined space. People, who are permitted to enter into confined space, must be medically examined. All necessary precautions mentioned therein shall be adhered to. An attendant shall be positioned outside a confined space for extending help during an emergency. Effective communication shall be maintained between personnel in confined space and outside by combination of visual/voice or portable radio. Compressed gas cylinders shall not be taken into confined space.

Entry Register for confined space to be maintained with the name and time of entry/exit.

3.3.19 Excavation

The Contractor shall obtain permission from competent authorities prior to excavation wherever required.

The Contractor shall locate the position of buried utilities (water line, cable route, etc.) by referring to project in consultation with Engineer in charge. The Contractor shall start digging manually to locate the exact position of buried utilities & thereafter use mechanical means.

The Contractor shall keep soil heaps at least 1.5 M away from edge or a distance equal to depth of pit (whichever is more)

All excavated pits greater than 10 Sq.M plan area and depth more than 1.5M shall have at least two access routes for ingress and egress. Also, additional access routes shall be provided such that distance between any two access routes shall not be more than 20M.

The Contractor shall maintain sufficient “angle of repose” during excavation – shall also provide slope or suitable bench as decided by Engineer in Charge.

The Contractor shall arrange “battering” or “benching” wherever required for preventing collapse of edge of excavations.

The Contractor shall identify & arrange de-watering pump or well-point system to prevent earth collapse due to heavy rain / influx of underground water.

The Contractor shall arrange protective fencing/ hard barricading with warning signal around excavated pits, trenches, etc. along with minimum 2 (two) entries, exits / escape ladders.

The Contractor must avoid “underpinning” / under-cutting to prevent collapse of chunk of earth during excavation

The Contractor shall use “stoppers” to prevent over-run of vehicle wheels at the edge of excavated pits / trenches.

The Contractor shall arrange strengthening of “shoring” & “strutting” proactively to avoid collapse of earth / edges due to vehicular movement in close proximity of excavated areas / pits/ trenches, etc.

3.4 Tool Box Talks (TBT)

Contractor shall conduct daily TBT with workers prior to start of work and shall maintain proper record of the meeting. A record shall be maintained in a format suggested by Engineer in charge.

The Contractor shall conduct TBT before start of every morning or evening shift or night shift activities, for alerting the workers on specific hazards and their appropriate dos & don'ts. The Contractor shall provide sufficient rests to the site workmen and their foremen to avert fatigue & thereby endangering their lives during the course of site works.

3.5 Training & Induction Programme

- a) Initial induction of workers into Construction oriented activities and appraising them about the methodology of works and how to carry-out safely and the same should not be inter mixed with Tool Box Talks or HSE Training. In this regard careful action should be made & maintained for imparting HSE induction to every individual, irrespective of his task/designation/level of employment, whereas, HSE Training should be imparted to specific person/group of people who are to carry-out that specific task more than once – for example, Riggers must be trained for working at heights, welders must be trained for work in confined space, fitters/carpenters, mesons must be trained for work at heights, etc.
- b) Contractor shall conduct Safety induction programme on HSE for all his workers and maintain records. The Gate Pass shall be issued only to those workers who successfully qualify the Safety induction programme.
- c) The Contractor shall brief the visitors about the HSE precautions which are required to be taken before their proceeding to site and make necessary arrangements to issue appropriate PPEs like Aprons, hard hats, ear-plugs, goggles & safety shoes etc., to his visitors. The Contractor shall always maintain relevant acknowledgement from visitor on providing him brief information on HSE actions.
- d) Contractor shall ensure that all his personnel possess appropriate training to carry out the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about
 - Potential hazards to which they may be exposed at their workplace

- Measures available for prevention and elimination of these hazards The topics during training shall cover, at the minimum:
 - Why safety should be considered during work - explanation
 - Education about hazards and precautions required
 - Employees' duties & responsibilities
 - Emergency and evacuation plan
 - HSE requirements during project activities
 - Fire fighting and First-Aid
 - Use of PPEs
 - Occupational health issues – dos & don'ts
 - Local laws on intoxicating drinks, drugs, smoking in force
 - Common environmental subjects – lighting, ventilation, vibration, smoke/fumes etc.
- e) Records of the training shall be kept and submitted to Engineer in charge.

DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR

On Award of Contract

The Contractor shall submit a comprehensive Health, Safety and Environmental Plan or programme for approval by Engineer in charge prior to start of work. The Contractor shall participate in the pre-start meeting with Engineer in charge to finalize HSE Plans which shall including the following:

- HSE policy & Objectives
- Job procedure to be followed by the Contractor for construction activities including handling of equipments, scaffolding, electric installations, etc. describing the risks involved, actions to be taken and methodology for monitoring each activity. Indicative list of procedures is enclosed as Annexure-H
- Engineer in Charge' review/audit requirement.
- Organization structure along with responsibility and authority, on HSE activities.
- Administrative & disciplinary steps involving implementation of HSE requirements
- Emergency evacuation plan/ procedures for site and labour camps
- Procedures for reporting & investigation of accidents and near misses.
- HSE Inspection
- HSE Training programme at project site
- HSE Awareness programme at project site
- Reference to Rules, Regulations and statutory requirements.
- HSE documentation viz reporting, analysis & record keeping.

A. IS CODES ON HSE

APPENDIX-A

(Sheet 1 of 2)

SP: 53	Safety code for the use, Care and protection of hand operated tools.
IS: 838	Code of practice for safety & health requirements in electric and gas welding and cutting operations
IS: 1179	Eye & Face precautions during welding, equipment etc
IS: 1860	Safety requirements for use, care and protection of abrasive grinding wheels.
IS: 1989	(Pt -II) Leather safety boots and shoes
IS: 2925	Industrial Safety Helmets
IS: 3016	Code of practice for fire safety precautions in welding & cutting operation.
IS: 3043	Code of practice for earthing
IS: 3764	Code of safety for excavation work
IS: 3786	Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents
IS: 3696	Safety Code of scaffolds and ladders
IS: 4083	Recommendations on stacking and storage of construction materials and components at site
IS: 4770	Rubber gloves for electrical purposes
IS: 5121	Safety code for piling and other deep foundations
IS: 5216	Recommendations on Safety procedures and practices in electrical works
IS: 5557	Industrial and Safety rubber lined boots
IS: 5983	Eye protectors
IS: 6519	Selection, care and repair of Safety footwear
IS: 6994	(Pt-I) Industrial Safety Gloves (Leather & Cotton Gloves)
IS: 7293	Safety Code for working with construction Machinery
IS: 8519	Guide for selection of industrial safety equipment for body protection
IS: 9167	Ear protectors
IS: 11006	Flash back arrestor (Flame arrestor)
IS: 11016	General and safety requirements for machine tools and their

	operation
IS: 11057	Specification for Industrial safety nets
IS: 11226	Leather safety footwear having direct moulded rubber sole
IS: 11972	Code of practice for safety precaution to be taken when entering a sewerage system
IS: 13367	Code of practice-safe use of cranes
IS: 13416	Recommendations for preventive measures against hazards at working place

B. INTERNATIONAL STANDARDS ON HSE
APPENDIX-A
(Sheet 2 of 2)

Safety Glasses	ANSI Z 87.1, ANSI ZZ 87.1, AS 1337, BS 2092, BS 1542, BS 679, DIN 4646/ 58311
Safety Shoes	ANSI Z 41.1, AS 2210, EN 345
Hand Gloves	BS 1651
Ear Muffs	BS 6344, ANSI S 31.9
Hard Hat	ANSI Z 89.1/89.2, AS 1808, BS 5240, DIN 4840
Goggles	ANSI Z 87.1
Face Shield	ANSI Z 89.1
Breathing Apparatus	BS 4667, NIOSH
Welding & Cutting	ANSI Z49.1
Safe handling of compressed	P-1 (Compressed Gas Association Gases in cylinders 1235 Jefferson Davis Highway, Arlington VA 22202 - USA)
Full body harness	EN-361
Lanyard	EN-354
Karabiner	EN-362 and EN-12275

APPENDIX-B

DETAILS OF FIRST AID BOX		
SL. NO.	DESCRIPTION	QUANTITY
1.	Small size Roller Bandages, 1 Inch Wide (Finger Dressing small)	6 Pcs.
2.	Medium size Roller Bandages, 2 Inches Wide (Hand & Foot Dressing)	6 Pcs.
3.	Large size Roller Bandages, 4 Inches Wide (Body Dressing Large)	6 Pcs.
4.	Large size Burn Dressing (Burn Dressing Large)	4 Pkts.
5.	Cotton Wool (20 gms packing)	4 Pkts.
6.	Antiseptic Solution Dettol (100 ml.) or Savlon	1 Bottle
7.	Mercurochrome Solution (100 ml.) 2% in water	1 Bottle
8.	Ammonia Solution (20 ml.)	1 Bottle
9.	A Pair of Scissors	1 Piece
10.	Adhesive Plaster (1.25 cm X 5 m)	1 Spool
11.	Eye pads in Separate Sealed Pkt.	4 pcs.
12.	Tourniquet	1 No.
13.	Safety Pins	1 Dozen
14.	Tinc. Iodine/ Betadine (100 ml.)	1 Bottle
15.	Polythene Wash cup for washing eyes	1 No.
16.	Potassium Permanganate (20 gms.)	1 Pkt.
17.	Tinc. Benzoine (100 ml.)	1 Bottle
18.	Triangular Bandages	2 Nos.
19.	Band Aid Dressing	5 Pcs.
20.	Iodex/ Moov (25 gms.)	1 Bottle
21.	Tongue Depressor	1 No.
22.	Boric Acid Powder (20 gms.)	2 Pkt.
23.	Sodium Bicarbonate (20 gms.)	1 Pkt.
24.	Dressing Powder (Nebasulf) (10 gms.)	1 Bottle
25.	Medicinal Glass	1 No.
26.	Duster	1 No.

DETAILS OF FIRST AID BOX		
SL. NO.	DESCRIPTION	QUANTITY
27.	Booklet (English& Local Language)	1 No. each
28.	Soap	1 No.
29.	Toothache Solution	1 No.
30.	Vicks (22 gms.)	1 Bottle
31.	Forceps	1 No.
32.	Snake –Bite Lancet	1No.
33.	Note Book	1 No.
34.	Splints	4 Nos.
35.	Lock	1 Piece
36.	Life Saving/Emergency/Over-the counter Drugs	As decided at site

Box size: Suitable size first aid box to be used for first aid items

Note : The medicines prescribed above are only indicative. Equivalent medicines can also be used. A prescription, in this regard, shall be required from a qualified Physician.

APPENDIX-C

TYPE OF FIRES VIS-À-VIS FIRE EXTINGUISHERS

Fire Extinguisher Fire ↓	→ Water	Foam	CO ₂	Dry Powder	Multi purpose (ABC)
Originated from paper, clothes, wood	?	?	can control minor surface fires	can control minor surface fires	?
Inflammable liquids like alcohol, diesel, petrol, edible oils, bitumen	x	?	?	?	?
Originated from gases like LPG, CNG, H ₂	x	X	?	?	?
Electrical fires	x	X	?	?	?

LEGEND : ? : CAN BE USED

x : NOT TO BE USED

Note: Fire extinguishing equipment must be checked at least once a year and after every use by an authorized person. The equipment must have an inspection label on which the next inspection date is given. Type of extinguisher shall clearly be marked on it.

APPENDIX-D

List of Statutory Acts & Rules Relating to HSE

- The Indian Explosives Act and Rules
- The Motor Vehicle Act and Central Motor Vehicle Rules
- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules
- The Indian Electricity Act and Rules
- The Indian Boiler Act and Regulations
- The Water (Prevention & Control & Pollution) Act
- The Water (Prevention & Control of Pollution) Cess Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Atomic Energy Act
- The Radiation Protection Rules
- The Indian Fisheries Act
- The Indian Forest Act
- The Wild Life (Protection) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Manufacturing, Storage & import of Hazardous Chemicals Rules
- The Public Liability Act
- The Building and Other Construction Workers (Regulation of Employment and Condition of Service) Act
- Other statutory acts Like EPF, ESIS, and Minimum Wages Act.

APPENDIX-E

LIST OF PROCEDURES (MINIMUM) TO BE FORMING PART OF HSE PLAN:-

- A. HSE Management Procedures:
 - HSE Objectives & Performance
 - HSE Training and Competence (including Induction)
 - HSE Motivation & Award Scheme
 - HSE Audits
 - HSE Emergency Management
 - HSE Incidents Reporting and Management
 - First Aid & Management
 - Roles, Responsibility, accountabilities and Authorities
- B. Job procedures/Safe Operating procedures
 - Setting Up Site & Signages
 - Working at Height
 - Confined Space Entry
 - Permit to Work Housekeeping
 - Transportation of materials including Manual Handling
 - Earthmoving Operations & excavation
 - Scaffolding
 - Fire Prevention/Protection
 - Hazardous Substance handling & Storage
 - Personal Protective Equipment

FORMAT NO.:HSE-2 REV 0**ACCIDENT / INCIDENT REPORT**

(To be submitted by Contractor after every Incident / Accident within 24 hours to Engineer in Charge)

Report No.: _____ **Date:** _____

Project site: _____ **Name of work:** _____

Contractor's name: _____ Contractor's Job Engineer (name) _____

Non-disabling injury (Non-LTA)	Hospitalized but resumed duty before end of 48 hrs
Disabling injury (other LTA)	Hospitalized & failed to resume duty within next 48 hrs
Fatal (LTA):	Death / Expiry
First Aid case (non LTA)	Resume duty after first aid

Name of the injured: _____

Father's name of victim: _____

Sub Contractor's Name: _____

Gate Pass No.: Age: _____ Yrs.

Victim's medical fitness exam. (Pre-empl.) date: - _____

Date & time of Accident / Incident: _____

Names of Witnesses: (1) _____ (2) _____ (3) _____

Profession of victim:

Bar bender		Carpenter		Meson	
Fitter		Helper		Gas cutter	
Grinder		Welder		Electrician	
Driver		Rigger		M/c. operator	
Engineer		Manager		Other/specify	

Qualification

No formal education		Non-Matriculate		Matriculate	
Graduate		Post- grad		Other/specify	

Job Experience

NIL		Less than 2 yrs		2-5 yrs	
5-10 yrs		11-15 yrs		15 years and above	

Location where the incident happened:

Activity / Works that were continuing during incident / accident: -

Excavation		Demolition		Concrete carrying	
Concrete pouring		Transportation of materials (manually)		Transportation of materials (mechanically)	
Work on or adjacent to water		Work at height (+2.0 mts)		Scaffold preparation	
Scaffold dismantling		Piling works		Welding	
Grinding		Gas-cutting		Pipe fit-ups & fabrication	
Structural fabrications		Machine works		Hydro-testing works	
Electrical works		Erection activities		Other/specify	

What exactly the victim was doing just before the incident / accident?

.....

Nature of injury:

Bruise or Contusion		Abrasion (superficial wound)		Sprains or strains	
Cut or Laceration		Puncture or Open wound		Burn	
Inhalation of toxic or Poisonous fumes or gases		Absorption		Amputation	
Fracture		Other/specify			

Parts of body involved in incident / accident

Head		Face		Eyes	
Throat		Arm (above wrist)		Hand (including wrist)	
Fingers		Trunk (Abdomen / Back / Chest / Shoulder)		Throat	
Leg (above ankle)		Foot (incl. ankle)		Toes	
Multiple				Other/specify	

Accident type:

Struck against		Struck by		Fall from Elevation	
Fall on same level		caught in		caught under	
caught in between		Rubbed or abraded		Contact with (Electricity)	
Contact with (Temp./ extremes)		Contact with chemicals or oils		Vehicle accident	
Other/specify					

Medical Aid provided:- (indicate specific aids / treatment etc.)-

.....
.....

Actions taken to prevent recurrence of similar incident / accident:

.....
.....
.....
.....
.....
.....

Intimation to local authorities (Dist. Collector / Local Police Station / ESI authority): Yes / No / NA. If yes, to whom

.....

Safety Officer

Site Head / Resident Construction
Manager

(Signature and Name)

(Signature and Name)

Stamp of Contractor

FORMAT NO. : HSE-3 REV 0

SUPPLEMENTARY INCIDENT / ACCIDENT INVESTIGATION REPORT

TICK THE APPROPRIATE ONE AS APPLICABLE (furnish within 72 hours)

Supplementary to Incident / Accident Report No: _____ (Copy enclosed)

Report No.: _____ **Date:** _____

Project site: _____ **Name of work:** _____

Contractor's name: _____ Contractor's Job Engineer (name) _____

Non-disabling injury (Non- LTA)	Hospitalized but resumed duty before end of 48 hrs.
Disabling injury (other LTA)	Hospitalized & failed to resume duty within next 48 hrs.
Fatal (LTA):	Death / Expiry
First Aid case (non LTA)	Resume duty after first aid

Name of the injured: _____

Father's name of victim: _____

Sub Contractor's Name: _____

Gate Pass No.: Age: _____ Yrs.

Victim's medical fitness exam. (Pre-empl.) date: - _____

Date & time of Accident / Incident: _____

Names of Witnesses: (1) _____ (2) _____ (3) _____

Profession of victim:

Bar bender		Carpenter		Meson	
Fitter		Helper		Gas cutter	
Grinder		Welder		Electrician	
Driver		Rigger		M/c. operator	
Engineer		Manager		Other/specify	

Qualification

No formal education		Non-Matriculate		Matriculate	
Graduate		Post- grad		Other/specify	

Job Experience

NIL		Less than 2 yrs.		2-5 yrs.	
5-10 yrs.		11-15 yrs.		15 years and above	

Location where the incident happened:

Activity / Works that were continuing during incident / accident: -

Excavation		Demolition		Concrete carrying	
Concrete pouring		Transportation of materials (manually)		Transportation of materials (mechanically)	
Work on or adjacent to water		Work at height (+2.0 mts)		Scaffold preparation	
Scaffold dismantling		Piling works		Welding	
Grinding		Gas-cutting		Pipe fit-ups & fabrication	
Structural fabrications		Machine works		Hydro-testing works	
Electrical works		Erection activities		Other/specify	

What exactly the victim was doing just before the incident / accident?

.....

Particular of tools & tackles being used and condition of the same after incident/accident:

.....

Description of Incident/Accident (How the incident was caused):

.....

Nature of injury:

Bruise or Contusion		Abrasion (superficial wound)		Sprains or strains	
Cut or Laceration		Puncture or Open wound		Burn	
Inhalation of toxic or Poisonous fumes or gases		Absorption		Amputation	
Fracture		Other/specify			

Parts of body involved in incident / accident

Head		Face		Eyes	
Throat		Arm (above wrist)		Hand (including wrist)	
Fingers		Trunk (Abdomen / Back / Chest / Shoulder)		Throat	
Leg (above ankle)		Foot (incl. ankle)		Toes	
Multiple				Other/specify	

Accident type

Struck against		Struck by		Fall from Elevation	
Fall on same level		caught in		caught under	
caught in between		Rubbed or abraded		Contact with (Electricity)	
Contact with (Temp./ extremes)		Contact with chemicals or oils		Vehicle accident	
Other/specify					

Name & Designation of person who provided First-Aid to the victim:

Name & Telephone number of Hospital where the victim was treated

Mode of transport used for transporting victim – Ambulance / Private car / Tempo/ Truck / Others How much time taken to shift the injured person to Hospital

In case of FATAL incident, indicate clearly the BOCW Registration No. ____ of the victim/ Company.....Comments of Medical Practitioner, who treated/attended the victim/injured (attached / described here).

What actions are taken for investigation of the incident, please indicate clearly – (Video film / Photography / Measurements taken etc)

Immediate cause (Please tick the right applicable) –

Hazardous methods or procedures inadequately guarded		Poor housekeeping		Inadequate or improper PPE	
Environmental hazards (excess noise/ space constraint/ inadequate Ventilation)		improper illumination/ Moving on oval surface		Working on dangerous equipment	

Failure to secure		Horse-play		Failure to use PPE	
Inattention to surroundings		Improper use of hands & body-parts		By-passing safety devices	
Unsafe mixing or placement of tools & tackles		Bypassing standard procedures		Failure in communication	
Operating without authority		Improper use of equipment or tools & tackles		drug or alcoholic influence	
excessive haste		Others(specify)			

Basic cause

Over confidence		Impulsiveness		over-exertion	
Faulty judgement or poor understanding		Failing to keep attention constantly		Nervousness & Fear	
Fatigue		Defective vision		Ill health or sickness	
Slow reaction		Others (specify)			

Root cause

Inadequate Engg		Improper Design		Inadequate Planning & organization	
Inadequate knowledge		Inadequate skill		Inadequate training	
Inadequate supervision		Improper work procedure		Inadequate compliance with standard	
Substandard performance		Inadequate maintenance		Improper inspection	
Others (specify)					

Loss of man days and impact on site works, (if any) –

Remarks from Contractor's Safety Officer/ Engineer –

Was the victim performing relevant tasks for which he was engaged /employed? Yes / No
 Was the Supervisor present on work-site during the incident? Yes /No

Have the causes of incident rightly identified?
 Yes / No

Cause of Accident was_____

.....

.....

Site Head / Resident Construction
Manager

(Signature and Name)
Stamp of Contractor

FORMAT NO. : HSE-4 REV0

**NEAR MISS INCIDENT/ DANGEROUS OCCURRENCE SUGGESTED
PROFORMA**

(to be submitted within 24 hours)

- Near Miss : **Human injury escaped & no damage to property, equipment or interruption to work.**
- **Dangerous Occurrence:** Damage to property, equipment or interruption of work, but not resulting in personal injury/ illness, e.g. Fire incident, collapse of structure, crane failure, etc.

Report No.: _____

Name of Site: _____

Date: _____

Name of work: _____

Contractor: _____

Incident reported by :

Date & Time of Incident :

Location :

Brief description of incident

Probable cause of incident

Suggested corrective action

Steps taken to avoid recurrence

☐

Yes

☐

No

Safety Officer
Manager

Site Head / Resident Construction

(Signature and Name)

(Signature and Name)

Stamp of Contractor

FORMAT NO. : HSE-5 REV:-0
MONTHLY HEALTH, SAFETY & ENVIRONMENTAL (HSE) REPORT

(To be submitted by each Contractor)

Actual work start Date: _____ Project: _____ Name of the Contractor: _____

Name of Work : _____ For the Month of: _____ Report No: _____

Status as on : _____ Job No : _____

(Contractor in consultation with Engineer in Charge shall generate here ports through web based package only.

Sr No	ITEM	UPTO PREVIOUS MONTH	THIS MONTH	CUMULATIVE
1	Average number of Staff & Workmen (average daily headcount, not man days)			
2	Total Man-hours worked			
3	Number of Induction programmes conducted			
4	Number of HSE meetings organized at site			
5	Number of HSE awareness programmes conducted at site			
6	Number of Tool Box Talks conducted			
7	Number of Lost Time Accidents (LTA)	Fatal		
		Other LTA		
8	Number of Loss Time Injuries (LTI)	Fatalities		
		Other LTI		
9	Number of Non-Loss Time Accidents			
10	Number of First Aid Cases			
11	Number of Near Miss Incidents			
12	No. of unsafe acts/ practices detected			
13	No. of disciplinary actions taken against staff/ workmen			
14	Man-days lost due to accidents			
15	LTA Free man-hours i.e. LTA free man-hours counted from the Last LTA (enter date:)			
16	Frequency Rate (No. of LTA per 2 lacs man-hours worked)			
17	Severity Rate (No. of man days lost per 2 lacs man-hours worked)			

Sr No	ITEM	UPTO PREVIOUS MONTH	THIS MONTH	CUMULATIVE
18	Loss Time Injury Frequency (No. of LTI per 2 lacs man-hours worked)			
19	No. of activities for which HIRAC completed			
20	No. of incentives/ awards given			
21	No. of occasions on which penalty imposed by Engineer in Charge			
22	No. of Audits conducted			
23	No. of pending NCs in above Audits			
24	Compensation cases raised with Insurance			
25	Compensation cases resolved and paid to workmen			
26	No of Vehicular Accident cases			
27	No of fire/Explosion cases			
28	Whether workmen compensation policy taken		Yes	No
29	Whether workmen compensation policy is valid		Yes	No
30	Whether workmen registered under ESI Act, as applicable		Yes	No
31	Whether HIRAC Register prepared and updated		Yes	No
32	Whether Environment Aspect Impact Register prepared and updated		Yes	No
33	Whether Legal Register prepared and updated		Yes	No
	Remarks, if any			

Date: _____

Prepared by Safety Officer

Approved by Site Head /
Resident Construction Manager

(Signature and Name)

(Signature and Name)

FORMAT NO.: HSE-6 REV 0**PERMIT FOR WORKING AT HEIGHTS (ABOVE 2.0 METER)**

Permit No. Name of Main ContractorName of
 work executing agency / sub agency / vendor:
DateExact Location of work

Nature of workDuration of work (from)
 (to)

Number of workers covered within this permit

(List enclosed with name & gate pass numbers.)

Sl. No.	Items / Subjects	Status of compliance (Yes / No)	
1	Work areas / Equipments inspected		
2	Work area cordoned off		
3	Adequate lighting is provided		
4	Precautions against public traffic taken		
5	Concerned persons in & around have been alerted & cautioned		
6	Hazards / risks involved in routine / non-routine task assessed and control measures have been implemented at specific task		
7	ELCB provided for electrical connection & found working		
8	Ladder safely attached / fixed		
9	Scaffoldings are checked and TAGs are found used correctly		
10	Working platforms are provided and are found sound /safe for use		
11	Safe access & egress arrangements (e.g. ladders, fall arresters, life-lines etc.) are satisfactorily incorporated		
12	a. Openings on platform / floors are effectively cordoned / covered		
	b. Safety Nets are provided wherever required		

Sl. No.	Items / Subjects	Status of compliance (Yes / No)	
13	Use of following safety gadgets by people working at area under this permit, is checked and found satisfactory - Safety helmet Safety harness (full body) with double lanyard Safety Shoes Safety gloves Safety goggles		
14	Housekeeping of work area found satisfactorily tidy / clean & clear		
15	Adequate measures have been taken for works being continued at the ground level, when simultaneous works are permitted overhead at that very location.		
16	Materials are not thrown from heights on to ground		
17	Medical examination of workers are made & found satisfactory		
18	Responsible job engineer / supervisor found physically present at work spot for overall administration of work as well as safety of people.		

Above items have been checked & compliance has been found in place. Hence work is permitted to start / continue at the above-mentioned location. Work shall not start till identified lapses are rectified.

Additional Precautions, if any

.....

Work Permit issued by
Contractor Engineer/RCM

Verification By
Contractor Safety Officer

AT THE END OF THE DAY/WORK:

All works at height are completed & workmen have returned safely from work location at (time)..... (date)

(Sig. Contractor Engineer)

CONFINED SPACE ENTRY PERMIT

Project site _____ Name of the work _____
 Name of Contractor _____ Exact location of work _____
 Sr. No. _____ Date _____ Nature of work _____

Safety Requirements POSITIVE ISOLATION OF THE VESSEL IS MANDATORY								
(A) Has the equipment been ?								
Y	NR		Y	NR		Y	NR	
<input type="checkbox"/>	<input type="checkbox"/>	Isolated from power/steam/air	<input type="checkbox"/>	<input type="checkbox"/>	water flushed &/or steamed	<input type="checkbox"/>	<input type="checkbox"/>	radiation sources removed
<input type="checkbox"/>	<input type="checkbox"/>	isolated from liquid or gases	<input type="checkbox"/>	<input type="checkbox"/>	Man ways open & ventilated	<input type="checkbox"/>	<input type="checkbox"/>	proper lighting provided
<input type="checkbox"/>	<input type="checkbox"/>	depressurized &/or drained	<input type="checkbox"/>	<input type="checkbox"/>	cont. inert gas flow arranged			
<input type="checkbox"/>	<input type="checkbox"/>	blanked/ blinded/ disconnected	<input type="checkbox"/>	<input type="checkbox"/>	adequately cooled			
(B) Expected Residual Hazards								
<input type="checkbox"/>	<input type="checkbox"/>	lack of O ₂ corrosive chemicals heat/ steam / frost	<input type="checkbox"/>	<input type="checkbox"/>	combustible gas/ liquid pyrophoric iron / scales high humidity	<input type="checkbox"/>	<input type="checkbox"/>	H ₂ S / toxic gases electricity / static ionizing radiation
(C) Protection Measures								
<input type="checkbox"/>	<input type="checkbox"/>	gloves	<input type="checkbox"/>	<input type="checkbox"/>	ear plug / muff	<input type="checkbox"/>	<input type="checkbox"/>	goggles / face shield
<input type="checkbox"/>	<input type="checkbox"/>	protective clothing	<input type="checkbox"/>	<input type="checkbox"/>	dust / gas / air line	<input type="checkbox"/>	<input type="checkbox"/>	personal gas alarm
<input type="checkbox"/>	<input type="checkbox"/>	grounded air duct/blower /AC	<input type="checkbox"/>	<input type="checkbox"/>	mask attendant with SCBA/air mask	<input type="checkbox"/>	<input type="checkbox"/>	rescue equipment/team communication
<input type="checkbox"/>	<input type="checkbox"/>	Fire fighting arrangements	<input type="checkbox"/>	<input type="checkbox"/>	safety harness & lifeline			
Authorization / Renewal (It is safe to enter the confined space)								
	No. of persons allowed	Name of persons allowed	Signature		Time		Signature	
			Contractor's Supervisor	Contractor's Safety Officer	From	To	Workman	

Permit Closure :

(A) Entry ☐ was closed ☐ stopped ☐ will continue on ...

(B) ☐ Site left in a safe condition ☐ Housekeeping done

(C) ☐ Multilock ☐ removed ☐ key transferred

☐ Ensured all men have come out ☐ Man-ways barricaded

Remarks, if any:

FORMAT NO.: HSE-9 REV 0**DEMOLISHING/DISMANTLING WORK PERMIT**

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Name of sub-contractor : No. of workers to be engaged:

(List enclosed with name & gate pass numbers.)

Line No./ Equipment No./ Structure to be dismantled :

Location details of dismantling/ demolition with sketch : (clearly indicate the area)

S. No.

The following items have been checked & compliance shall be ensured during currency of the permit:

Item description	Done	Not Applicable
Services like power, gas supply, water, etc. disconnected.	<input type="checkbox"/>	<input type="checkbox"/>
Dismantling/ Demolishing method reviewed & approved Usage of appropriate PPEs ensured.	<input type="checkbox"/>	<input type="checkbox"/>
Precautions taken for neighboring structures First-Aid arrangements made	<input type="checkbox"/>	<input type="checkbox"/>
Fire fighting arrangements ensured	<input type="checkbox"/>	<input type="checkbox"/>
Precautions taken for blasting		

(Contractor's Supervisor)

(Contractor's Safety Officer)

Permission is granted.

(Permit issuing authority-Client)

Name : Date :

Completion report:

Dismantling/ Demolishing is completed on _____ Date at _____ Hrs.

Materials/ debris transported to identified location ☐ Tagging completed (as applicable) ☐

Services like power, gas supply, water, etc. ☐

restored (Permit issuing authority-Client)

CONTRACTOR's NAME

FORMAT NO. : HSE-10 REV 0

HOUSEKEEPING ASSESSMENT& COMPLIANCE

(Sheet 1 of 2)

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Name of contractor : Fortnightly

Sl.No	Subjects of Review	Satisfactory/ Yes	Non-satisfactory/ No	Remarks	Action
1.	Cleanliness at the Main entry / access of site				
2.	Ground condition / floor areas free from water- logging / oil spillage				
3.	Ground & elevated floors free from rubbish / wastes / accumulated debris / scraps.				
4.	Manholes / openings are covered / fenced				
5.	Trenches are barricaded / walkways are in place				
6.	Drains are cleaned / not choked / not occupied by dumped materials				
7.	Sufficient CAUTION boards / instructions displayed				
8.	Construction machinery are maintained & parked in orderly manner.				
9.	Movement of site people are not obstructed because of dumping / storing of construction materials				
10.	Access / egress to Electrical Distribution Boards / Panels clear from wires / cables / earth-strips etc.				

Sl.No	Subjects of Review	Satisfactory/ Yes	Non-satisfactory/ No	Remarks	Action
11.	Electrical panel rooms / sheds / MCC / Control rooms / Substations etc. are clean & tidy and not used for storing dress / clothes, tiffin-box or bicycles.				
12.	Passage behind Elec. panels are free for access				
13.	Fire extinguishers / fire-buckets are accessible without any difficulty.				
14.	Stair-steps, platforms & landings are clear & tidy				
15.	Sheds / rooms & work areas have got sufficient illumination as well as ventilation				
16.	Cables / Wires / welding leads are routed / hanged appropriately & are not creating unsafe condition.				
17.	Stacking / storing of insulation materials or their packing.				
18.	Removal or cleanliness of left-over sand, concrete, brick-bats, insulation-materials, excess earth, wastes etc.				
19.	Storing / stacking of sand, metal chips, re-bars, steel pipes, valves, fittings etc.				
20.	One escape route at ground & minimum two escape routes at elevation available,				
21.	Captions / Posters / Slogans on various safety instructions are displayed legibly in local language				
22.	Cable trenches are water-free or regular arrangement for taking out accumulated water exists.				

Sl.No	Subjects of Review	Satisfactory/ Yes	Non-satisfactory/ No	Remarks	Action
23.	Windows of rooms / offices are regularly cleaned				
24.	Facilities for cycle sheds, drinking water, washing, rest-rooms etc. are maintained in tidy manner.				
25.	Toilet, Urinals, Canteen / kitchen / pantry etc. are maintained & free from obnoxious smell.				
26.	Construction tools / tackles are stored systematically - the items are tagged / tested / certified by competent third party.				
27.	Sufficient numbers of Dust-bins / Waste-bins found at site and are regularly emptied.				

Additional remarks, if any -

.....

.....

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer

FORMAT NO. : HSE-13 REV 0

INSPECTION FOR SCAFFOLDING

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :

(Sheet 1 of 2)

Sr No	Description	Yes	No	N.A.	Actions taken
1	Whether work permit is obtained to take up work at height above 1.5 Mts?				
2	Whether atmospheric condition is “stormy” or “raining” and works at heights have been permitted?				
3	Whether steel pipes scaffoldings are used for units /off-site areas?				
4	Whether scaffolding has been erected on rigid/firm/leveled surfaces / ground? Whether “foot-seals” or “base-plates” are used beneath the up-rights (vertical steel pipes)				
5	Whether scaffold construction is as per IS specification with toe-board and hand-rails (top-rail as well as mid-rail)?				
6	Whether distance between two successive up-rights are less than 2.5 Mts (height of scaffold & load carrying capacity governs the distance between two uprights)				
7	Whether all uprights are extended at least 900 mm above the top most working platform (to enable fitting of handrails)?				
8	Whether vertical distance of two successive ledgers is satisfactory? (<i>varying between 1.3 Mts. To 2.1 Mts</i>)				
9	Whether the peripheral areas of working at height are cordoned-off? (for avoiding accident to people arising out of dropped / deflected materials)				
10	Whether platform is provided? Is it safely approachable?				
11	Whether end of scaffold platform / board are extended beyond transoms? (125mm to 150 mm)				

Sr No	Description	Yes	No	N.A.	Actions taken
12	Whether CE / IS approved quality and worthy conditioned full-body safety harness (with double lanyard & karabiners) are used while working at heights?				
13	Whether life-line of safety harness is anchored to an independent secured support capable of withstanding load of a falling person?				
14	Whether the area around the scaffold is cordoned off to prohibit the entry of unauthorized person / vehicle?				
15	Whether clamps used are of good condition, of adequate strength and free from defects?				
16	Whether ladder is placed at secured and leveled surface?				
17	Whether water-pass and oil-spills are avoided around the scaffold structure?				
18	Whether ladder is extended 1.5mts. above the landing point at height?				
19	Whether more than one access/egress provided to the scaffold?				
20	Whether ladder used are of adequate length and overlapping of short ladders avoided?				
21	Whether metallic ladders are placed much away from near-by electrical transmission line?				
22	Whether rungs of ladder are inspected and found in good order?				
23	Whether fall-arresters provided on both the access/egress routes?				
24	Whether diagonal (cross) bracings are provided at regular interval on the scaffold?				
25	Whether working platform on the scaffold has been made free from "jolt" or "gap"?				
26	Whether tools or materials are removed after completion of the day's job at heights?				
27	Whether a valid Permit for Work (PFW) is obtained before taking up work over asbestos or fragile roof?				
28	Whether sufficient precaution is taken while working on fragile roof?				
29	Whether provision is made to arrange duck ladder, crawling board for working on fragile roof?				
30	Whether scaffold has been inspected by qualified civil engineers prior to their use?				

Sr No	Description	Yes	No	N.A.	Actions taken
31	Whether the scaffolding has been designed for the load to be borne by the same?				
32	Whether the erection and dismantling of the scaffolding is being done by trained persons and under adequate supervision?				
33	Whether safety net with proper working arrangement and life-line has been provided?				
34	Whether TAGS (Green for acceptable and Red for incomplete/unsafe scaffolds) are used on scaffolds?				

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer

FORMAT NO. : HSE-14 REV 0

(sheet 1 of 2)

PERMIT FOR ERECTION / MODIFICATION & DISMANTLING OF SCAFFOLDING

Project : Sr. No. :
Name of the work : Date :
Name of contractor : Job No. :
Nature of activities : Duration: From.....To.....

SL. No.	SUBJECTS / ITEMS	DONE	NOT DONE	REMARKS
1	Specific task of Erection / Modification / Dismantling of scaffolds, identified & TAGGED accordingly (before as well as after carrying-out jobs).			
2	People engaged in doing the job are identified & are certified by Job Engineer of Main Contractor as experienced / trained.			
3	Concerned persons are alerted by the Job Engineer of Main Contractor in connection with possible hazards & what the workmen MUST do / MUST not do.			
4	Verification by Job Engineer of Main Contractor made for confirming that all persons permitted to carry-out the jobs are making use of Helmet, Safety Shoes, Goggles, Gloves & Double lanyard safety harness and other relevant PPEs.			
5	Area of work is effectively cordoned-off / barricaded / illuminated.			
6	For taking-up / lowering down Scaffolding members / clamps / couplings etc. appropriate ropes / pulleys/ chains etc. have been arranged for use (not to throw any item) & the same have been verified as "fit for purpose".			
7	Items / members of scaffold, being lowered are removed from the area & stacked correctly.			
8	Ropes, chains, pulley blocks etc. being used for lifting or lowering scaffold items, are inspected by the Job Engineer & their certifications as well as physical conditions have been found O.K, before signing this PERMIT.			

SL. No.	SUBJECTS / ITEMS	DONE	NOT DONE	REMARKS
9	Safety Net / Life-line / Fall Arresters etc. are arranged in position and Job Engineer has found working conditions favourable for activities to start.			
10	Scaffold erection or dismantling tasks are being supervised by Experienced Engineer / Competent person.			
11	Only competent & experienced people have been selected / engaged in Scaffolding erection, modification or dismantling tasks.			
12	Adequate & effective actions for traffic and movement of people around the cordoned-off area taken to avoid inadvertent incident			
13	Working platforms are protected with handrails & toe-boards.			
14	Access & Exit (for reach & escape) are safe for use by people.			
15	Tools, tackles to be used for above jobs are verified by job Engineers of Main contractor as genuinely good and tied-up at height (to prevent their fall).			
16	Site important Telephone Nos. are made known to everyone			
17	SOP (Safe Operating Procedure) for the specific task is made & followed too.			
18	Emergency vehicle has been arranged at work locations.			

- This permit for work shall be available at specific work location all the time.
- After completion of work, permit shall be returned to safety cell of main contractor, without fail.
- This Permit shall be issued maximum upto (Monday to Sunday).
- Additional Precautions, if any
.....
- **ACCORD OF PERMISSION** (to be ticked) - **YES** () / **NO** ()

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer]

Everyday Site working conditions & performance of workmen shall be assessed / checked by Contractor Site Engr. and Safety Officer shall verify the same.

	Name / Sign.	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Site Engr.								
Safety Off.								

FORMAT NO. : HSE-17 REV 1

PERMIT FOR EXCAVATION (depth 2m and above)

Project : Sr. No. :

Name of the work : Date :

Name of contractor : Job No. :

Job Description : Location:

Size of excavation :

(Sheet 1 of 2)

SL. NO.	Description of Item	COMPLIANCE STATUS			Remarks
		Yes	No	Not applicable	
1)	Suitable and sufficient risk assessments and method statements has been carried to ensure that the work shall be undertaken in accordance with specification and standard.				
2)	Are plans/details of underground services available and the same has been reviewed?				
3)	Has survey done to locate the services/obstacles etc.				
4)	Has the live services (electrical, water line, air line, telephone line, etc.) has been disabled for carrying out the job.				
5)	Is adequate barriers/fences to protect the excavation are in place?				
6)	Is Adequate warning signs are in place?				
7)	Is Assessment of ground conditions done and remedial action (if any) taken?				
8)	Safe access / egress (e.g. ramp / steps / ladders etc.) provided for site workmen & supervisors.				
9)	Is the excavation work being undertaken in proximity of structure, etc.? If Yes, its effect is considered?				
10)	Availability of competent person for supervising the excavation work?				
11)	Adequate safe arrangement to prevent collapse of edges (e.g. shoring / strutting / benching / sloping etc.) made at site.				

SL. NO.	Description of Item	COMPLIANCE STATUS			Remarks
		Yes	No	Not applicable	
12)	Hard barricades (at least 1.0M away from edge & for excavation near site access roads) with warning signs/caution boards are provided				
13)	Accumulation / passage-ways of water at periphery of excavation / trench stopped/ restricted.				
14)	Is the equipment being used for excavation has been checked for adequacy and is in good working condition having all the safety features?				
15)	Age & fitness of workmen ensured by medical test before engagement in job ?				
16)	Arrangement of Monitoring of possible oxygen deficiency or obnoxious gases done & action taken?				

PERMIT GRANTED - Yes / No

(List enclosed with name & gate pass numbers.)

Name & Signature of Site Engr.
of Contractor (Initiator)

Name & Signature of Area – In charge/RCM
Contractor (Issuing authority) Verification by
Contractor Safety Officer

NOTES: -

1. Slopes or benches for excavation beyond 2.0M depth shall be designed & approved by Contractor's site head.
2. Excavated earth to be kept at least 1.5M away from edges
3. Safety helmets, Safety shoes or gum-boots, gloves, goggles, Face shield, Safety Harness shall be essential PPEs.
4. Permit shall be made in **duplicate** and original shall be available at site of work.
5. Permit shall be issued for maximum **one week** only (Monday to Sunday)
6. After completion of works, permit shall be closed & preserved for record purpose

GRANT OF PERMIT AND EXTENSIONS

Sl. No.	Validity period From _____ To _____	Working Time From _____ To _____	Initiator (site Engr. of Main Contractor)	Issuing authority (Area In charge/ RCM of Main Contractor)	Review by Engineer in Charge/EIL (Remarks with date)
1.					
2.					
3.					
4.					
5.					
6.					
7.					

Additional safety instructions if any: -

- 1.
- 2.
- 3.

Inspection of Tower Crane

Name of Contractor:

Project:

Name of Work:

Job No:

Vehicle Identification/Registration No:

Date:

Sr. No.	Description	Observation	Remarks & Suggestions
1	Serial number plate & SWL marking		
2	Valid TPI Certificate		
3	Valid Insurance		
4	Safe access and egress are provided to the crane operator.		
5	Front glass of Operator cabin		
6	Operator crane cabin is provided with a locking mechanism so as to prevent unauthorised entry.		
7	A safety bar is fitted across the operator's cabin window where there is likelihood of the operator falling through it.		
8	Manufacturer Operating Manual and Maintenance Manual are made available.		
9	An updated Operation and Maintenance log book is available in the operator cabin.		
10	All mounting bolts are in good condition.		
11	Load chart provided		
12	SLI available		
13	Crane hooks have got smooth surface and no dent		
14	Hook-latch / Dog-clamp in hook is effective		
15	Over hoist limit switch		
16	Double body earthing of Tower Crane		
17	Jib angle indicator is provided (For Luffing Jib Tower Crane).		
18	Emergency stop button, which will terminate the operation of the crane engine, is installed in the operator cabin and correctly identified.		
19	Effective braking mechanisms for Hoisting, Derricking, Slewing, Trolley Travelling maintained:		
20	Trolley Travelling limiter to prevent over-travelling of trolley is functional.		
21	Limit switches to prevent over-derricking and over-		

Sr. No.	Description	Observation	Remarks & Suggestions
	lowering of jib (For Luffing Jib Tower Crane) is functional.		
22	Slewing limiter to restrict slewing of crane is functional.		
23	Over load Limiter to prevent overloading of crane is functional.		
24	Load Moment Limiter to prevent over-turning moment is functional.		
25	Anti-collision devices are tested to stop the tower crane's operation such that the crane-to-crane interference must be maintained at not less than 3 m.		
26	Condition of boom		
27	Counter weight placement and pins		
28	Winches, pulleys and wire ropes are in good working condition.		
29	Colour coding		
30	Leakage in hydraulic cylinder		
31	Fire Extinguisher		
32	Tower crane is adequately grounded or protected against lightning.		
33	Wind anemometer is installed and is in good working condition.		
34	Aviation lamp is functional (Reqd. for 30mt and above)		
35	Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator		
36	Safety Induction for Operator		
37	Others		

Signature & Name of Operator:

Signature and name of Job Engineer

Signature & Name of Contractor's Safety Officer

Crane Inspection Checklist

Name of Contractor:

Project:

Name of Work:

Job No:

Vehicle Identification/Registration No:

Date:

Sr. No.	Description	Observation	Remarks & Suggestions
1	Crane hooks have got smooth surface and no dent		
2	Hook-latch / Dog-clamp in hook is effective		
3	Over hoist limit switch		
4	Over Load Indicator		
5	Over Boom limit switch		
6	Boom angle indicator		
7	Colour coding		
8	Condition of boom		
9	Condition of wire rope		
10	Rope drum / sheaves are in good working condition		
11	Swing break & lock		
12	Swing Alarm		
13	Over hoist break & lock		
14	Boom break & lock (For Telescopic Boom)		
15	Leakage in hydraulic cylinder		
16	Condition of Outrigger (For Tyre Mounted Crane)		
17	Outrigger fully extended Marking (For Tyre Mounted Crane)		
18	Condition of Tyre (For Tyre Mounted Crane)		
19	Wheel chokes are present and are used whenever required (For Tyre mounted)		
20	Battery & lamps		
21	Moving & rotating parts guarded		
22	Load chart provided		
23	Reverse horn (For Tyre Mounted Crane)		
24	Body Condition of crane		

Sr. No.	Description	Observation	Remarks & Suggestions
25	Front glass of Operator cabin		
26	Both side Mirror		
27	Number Plate (For Tyre Mounted Crane)		
28	Fire Extinguisher		
29	Horn		
30	Windshield and wipers		
31	Working of light & Indicator		
32	SLI		
33	Spark Arrestor(For Running Refinery/ Petrochemical/Chemical Plant)		
34	Foot-steps and hand-holds are in good working condition for exit /enter in to cabin		
35	TPI Certificate		
36	RC Document (For Tyre Mounted Crane)		
37	Fitness Certificate of Vehicle by authority		
38	Insurance		
39	PUC		
40	HMV License for Operator		
41	Pre Medical Check-up& Periodic Medical check- up (every 6 months) including vision test for Operator		
42	Safety Induction for Operator		
43	Others		

Signature & Name of Operator:

Signature & Name of Contractor's Concern Engineer

Signature & Name of Contractor's Safety Officer

FORMAT NO. : HSE-22 REV 0

Hydra Crane Inspection Checklist

Name of Contractor:

Project:

Name of Work:

Job No:

Vehicle Identification/Registration No:

Date:

Sr. No.	Description	Observation	Remarks & Suggestions
1	Identification number of Hydra crane boldly scribed in front and rear end of machine		
2	Hydra Operator has got adequate document in support of his competency (i.e. HMT driving license, knowledge & training)		
3	Marking of SWL on hook position is clearly visible		
4	Test & examination of Hydra crane by statutory / competent authority is carried out & document is valid		
5	Colour Coding		
6	RC Document		
7	Fitness Certificate of Vehicle by authority		
8	Valid Insurance		
9	Valid PUC		
10	Pre Medical Check-up & Periodic Medical check-up (every 6 months) including vision test for Operator		
11	Safety Induction for Operator		
12	Crane hooks have got smooth surface and no dent		
13	Hook-latch / Dog-clamp in hook is effective		
14	Over hoist limit switch		
15	Over Load Indicator		
16	SLI		
17	Condition of boom		
18	Condition of wire rope		
19	Rope drum / sheaves are in good working condition		
20	Leakage in hydraulic cylinder		

Sr. No.	Description	Observation	Remarks & Suggestions
21	Tyre condition		
22	Battery		
23	Moving & rotating parts guarded		
24	Break		
25	Parking Break		
26	Front horn		
27	Reverse horn		
28	Hydra cabin body and frame of machine is in good order		
29	Both side Mirror		
30	Fire Extinguisher		
31	Front glass pane of the Hydra operator's cabin is clean & clear (i.e. not cracked / damaged / broken)		
32	Windshield and wipers condition		
33	Working of front & back lights, turn Indicators, parking lights & fog lamps		
34	Spark Arrestor (For Running Refinery/ Petrochemical/ Chemical Plant)		
35	Wheel chokes are present and are used whenever required		
36	Foot-steps and hand-holds are in good working condition for exit /enter in to cabin		
37	Others		

Signature & Name of Operator:

Signature & Name of Contractor's Concern Engineer

Signature & Name of Contractor's Safety Officer

FORMAT NO. : HSE-23 REV 0

**Hydraulic Rig Inspection
Checklist**

Name of Contractor:

Project:

Name of Work:

Job No:

Vehicle Identification/Registration No:

Date:

Sr. No.	Description	Observation	Remarks & Suggestions
1	Control panel is clean & all buttons/switches are clearly visible (no paint over spray, etc.)		
2	All switch & mechanical guards are in good condition and properly installed		
3	All Safety Indicator lights work		
4	Drive controls function properly & accurately labelled (up, down, right, left, forward, back)		
5	Motion alarms are functional		
6	Safety decals are in place and readable		
7	Any defects such as cracked welds, fuel leaks, hydraulic leaks, damaged control cables or wire harness, etc.		
8	Braking devices are operating properly		
9	Winches, pulleys and wire ropes are in good working condition.		
10	Function of interlocks and limit switch		
11	The manufacturer's operations manual (in all languages of the operators)		
12	Oil level, Hydraulic Oil Level, Fuel Level, Coolant Level		
13	Battery Charge		
14	Outriggers in place or functioning. Associated alarms working		
15	Moving & rotating parts guarded		
16	Load chart provided		
17	Fire Extinguisher		
18	Spark Arrestor, if operated by using fuel (For Running Refinery/ Petrochemical/		

Sr. No.	Description	Observation	Remarks & Suggestions
	Chemical Plant)		
19	Serial number plate		
20	SLI		
21	TPI Certificate		
22	Colour Coding		
23	Insurance		
24	Pre Medical Check-up & Periodic Medical check-up (every 6 months) including vision test for Operator		
25	Safety Induction for Operator		
26	Others		

Signature & Name of Operator:

Signature & Name of Contractor's Concern Engineer

Signature & Name of Contractor's Safety Officer

Boom Lift Inspection Checklist**Name of Contractor:****Project:****Name of Work:****Job No:****Vehicle Identification/Registration No:****Date:**

Sr. No.	Description	Observation	Remarks & Suggestions
1	Operating and emergency controls are in proper working condition, EMO button or Emergency Stop Device		
2	Functional upper drive control interlock (i.e. foot pedal, spring lock, or two hand controls)		
3	Emergency Lowering function operates properly		
4	Lower operating controls successfully override the upper controls		
5	Both upper and lower controls are adequately protected from inadvertent operation.		
6	Control panel is clean & all buttons/switches are clearly visible (no paint over spray, etc.)		
7	All switch & mechanical guards are in good condition and properly installed		
8	All Safety Indicator lights work		
9	Drive controls function properly & accurately labelled (up, down, right, left, forward, back)		
10	Motion alarms are functional		
11	Safety decals are in place and readable		
12	Guardrails and anchor points are in place, and in good condition		
13	Work platform & extension slides are clean, dry, & clear of debris		
14	Work platform extension slides in and out freely with safety locking pins in place to lock setting on models with extension platforms.		
15	Any defects such as cracked welds, fuel		

Sr. No.	Description	Observation	Remarks & Suggestions
	leaks, hydraulic leaks, damaged control cables or wire harness, etc.		
16	Braking devices are operating properly		
17	The manufacturer's operations manual is stored on AWP (in all languages of the operators)		
18	Oil level, Hydraulic Oil Level, Fuel Level, Coolant Level		
19	Battery Charge		
20	Outriggers in place or functioning. Associated alarms working		
21	Tyres and wheels are in good condition, with adequate air pressure if pneumatic		
22	Wheel chokes are present and are used whenever required		
23	Moving & rotating parts guarded		
24	Load chart provided		
25	Fire Extinguisher		
26	Spark Arrestor, if operated by using fuel (For Running Refinery/ Petrochemical/ Chemical Plant)		
27	Serial number plate with Load capacity		
28	TPI Certificate		
29	Colour Coding		
30	Insurance		
31	Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator		
32	Safety Induction for Operator		
33	Others		

Signature & Name of Operator:

Signature & Name of Contractor's Concern Engineer

Signature & Name of Contractor's Safety Officer

Annexure- IX
(Special Conditions of Contract)

Additional Special Conditions of Contract

- (i) The guidelines of NGT, Environment department and local administration issued from time to time will be strictly followed by contractor.
- (ii) The payment terms of MEP related works will be as under:-

A. For items involving Erection only:-

- (a) 90% on Erection of material at site & acceptance by Engineer -in -Charge.
- (b) 10% on testing, commissioning of the material and acceptance thereof by the Engineer- in - Charge.

B. For items involving Supply & Erection:

- (a) 60% on supply of material at site & acceptance by Engineer in Charge.
- (b) 30% on Erection of material at site and acceptance by Engineer in Charge.
- (c) 10% on testing, commissioning of the material and acceptance thereof by the Engineer in Charge.

Note: Clause 3.0 of GCC will be applicable on above payment terms.

- (iii) Sufficient funds are available with Unitech for execution of works. If for any unforeseen reasons, there is shortage of fund for payment to contractors, in lieu of the work done, Unitech may exercise the option of offering the unsold inventory of the project at the current rate, discounted by 10% on that particular day, subject to the acceptance of the contractor.

SECTION 6

TECHNICAL SPECIFICATIONS:

(CIVIL, STRUCTURAL & ARCHITECTURAL WORKS)

1. GENERAL

The work in general shall be executed as per the description of the item, specifications attached and CPWD Specifications (Latest version). Wherever any reference to any Indian Standard Specifications is made in the document relating to this contract, the same shall be inclusive of all amendments issued there to or revision thereof, if any, up to the date of receipt of tender. The rates quoted by the contractor shall be inclusive of all items, included in these specifications and special conditions and nothing extra shall be payable whatsoever unless otherwise specified.

However, wherever required by Engineer in charge, the contractor shall submit a detailed methodology for execution of the specific work and shall get the same approved before the start of that specific work.

For the specialized works contractor shall engage specialized agencies with prior approval of Engineer-In-Charge.

Wherever it is mentioned "at all levels" in Schedule of Rates/ Technical Specifications for any item, the same shall be considered for "at all heights" irrespective of height of the structural element viz. Columns, Walls, Retaining walls etc. Contractor to quote his rates accordingly and nothing extra shall be paid on this account.

2. MORTARS

The work shall be carried out as per CPWD specifications, Vol. -1, Sub-head No 3. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer-in-charge.

The cement used shall be Portland cement (Min. Grade 43) conforming to IS 1489 (Part 1) and Sand conforming to Zone-II/III as per IS 383.

3. CONCRETE WORK & REINFORCED CEMENT CONCRETE WORK

3.1 General

All concrete included in the work shall comply with the General requirements of this section of the specification except where those requirements are modified by the provisions of later Clauses relating to specialized uses for concrete in which case the requirements of those Clauses shall take precedence. Apart from this specification, construction of Plain and Reinforced Cement Concrete works shall be in accordance with Vol. 1, Sub-head No - 4 & Sub-head No - 5 of CPWD Specifications, the Indian Standard Code of Practice for Plain and Reinforced Cement Concrete - IS: 456 and other relevant codes mentioned therein.

3.2 Materials

- 3.2.1 Portland Cement (OPC) confirming to IS 1489 Part 1, shall be used for all concrete works.
- 3.2.2 The responsibility of storing and stacking of all construction materials lies with the contractor.
- 3.2.3 Quarry/ Source of materials shall be inspected / approved by Engineer in charge. Change of source, if proposed by the contractor, shall immediately be informed to and got approved by Engineer in charge.

3.3 Water

Water for construction purpose shall confirm to IS: 456. Contractor shall get the water tested from any approved laboratory before commencement of works at his own cost. Water shall be tested at every three months to ascertain the quality. In case, there is change in the source of water, the same shall be tested again to meet the requirements at any stage of construction as directed by the Engineer-in-charge.

3.4 Laying of Concrete

- 3.4.1 To ensure proper cover, preferably factory made cover blocks/PVC cover blocks will be used to avoid displacement of bars in any direction.
- 3.4.2 The construction joints if unavoidable shall be provided in predetermined locations only as directed by Engineer-in-charge. Nothing extra shall be paid for providing Shuttering as required or for applying a coat of neat cement slurry on the joints before re-commencing concreting work.
- 3.4.3 The contractor shall necessarily use the surface vibrator for compaction of concrete in floor slab etc. For placement of concrete at various levels tower crane of appropriate size, capacity and boom length or concrete pump shall necessarily be deployed by the contractor. However, mechanical hoist can be used by the contractor for lifting other construction materials.

3.5 RMC (Ready Mix Concrete) Plant

- 3.5.1 Alternatively the contractor may be allowed by Engineer in Charge to arrange Ready Mix Concrete (RMC) from producing plants. The RMC plant proposed to be engaged by the contractor shall fulfill the following requirements:
 - a) It shall be fully automatic and computerized with facility for providing printed advice showing ingredients of concrete carried by each mixer.
 - b) It should have supplied RMC for projects of similar magnitude.
- 3.5.2 For procurement of ready mix concrete from RMC plants, the contractor shall, within 15 days of award of the work, submit list of at least three RMC plant companies of repute along with details of such plants including details of transit mixer and pumps etc. to be deployed indicating name of owner/ company, its location, capacity, technical establishment, past experience and text of MOU/ Agreement proposed for Technical Specifications be entered between

purchaser (the contractor) and supplier (RMC Plant) to the Engineer-in-Charge. The Engineer-in-Charge shall give approval in writing (subject to drawl of MOU). The contractor shall draw the MOU with approved RMC plant owner/a company and submit to Engineer-in-Charge within a week of such approval. The contractor will not be allowed to purchase ready mixed-concrete without completion of above stated formalities for use in this project. Availability of concrete round the clock throughout the project duration shall also be included in MOU.

- 3.5.3 Notwithstanding the approval granted by Engineer-in-Charge in aforesaid manner, the contractor shall be fully responsible for quality of concrete including input control, transportation and placement etc.
- 3.5.4 The Engineer-in-Charge will reserve the right to inspect at any such stage and reject the concrete if he is not satisfied about quality of product. The contractor should therefore draw MOU/ agreement with RMC owner/ company very carefully keeping all terms and conditions/ specifications forming a part of this tender document.
- 3.5.5 It shall be the responsibility of the contractor to ensure that all-necessary equipment manpower & facilities are made available to Engineer-in-Charge and/ or his authorized representative at RMC plant.
- 3.5.6 Ingredients, admixtures & water declared unfit for use in production of mix shall not be used. A batch mix found unfit for use shall not be loaded into the transit mixer for transportation.
- 3.5.7 The RMC produced concrete shall be accepted by Engineer-in-Charge at site after receipt of the same after fulfilling all the requirements of mix mentioned in the tender documents.

3.6 Quality Control of Ready-Mix Concrete

It shall be the responsibility of the contractor to ensure that the RMC producer provides all necessary testing equipment's and take all necessary measures to ensure Quality control of ready – mixed concrete. In general the required measures shall be:

Control of Purchased Material Quality:

RMC producer shall ensure that all the materials purchased and used in the production of concrete conform to the stipulation of the relevant agreed standards with the materials supplier and the requirements of the products mix design and quality control procedures.

The materials shall be accomplished by visual checks, sampling and testing, certification and information/ data from material supplier. Necessary equipment for the testing of all material shall be provided and maintained in calibrated condition at the plant by the RMC producer.

Adequate and effective storage arrangement shall be provided by RMC producer at RMC plant for prevention of contamination, reliable transfer and feed systems, drainage of aggregates, prevention of freezing or excessive solar

heating of aggregate etc. Each truckload/ transit mixer dispatched to site shall carry computer printout of the ingredients of the concrete it is carrying. The printout shall be handed over to Engineer-in-Charge or his representative at site before RMC is used in work.

Transfer and Weighing Equipment:

RMC producer shall ensure that a documented calibration is in place. Proper calibration records shall be made available indicating date of next calibration due, corrective action taken etc. RMC producer shall ensure additional calibration checks whenever required by Engineer-in-Charge in writing to contractor. RMC producer shall also maintain a daily production record including details of cubes. Record shall also be maintained of the materials used for that day's production including water and admixtures. The accuracy of measuring equipment shall be as per manufacturer's recommendation/ relevant IS specifications.

Production of Concrete:

The following precautions shall be taken during the production of RMC at the plant;

Weighing (correct reading of batch data and accurate weighing) - For each load written, printed or graphical records shall be made of the weights of the materials batched, the estimated slump, the total amount of water added to the load, the delivery ticket number for that load and the time of loading the concrete into the truck.

Visual observation of concrete during production and delivery during sampling and testing of fresh concrete assessment of uniformity, cohesion, workability, adjustment to water content: The workability of concrete shall be controlled on a continuous basis during production. The batch mix found unfit shall not be loaded into the truck for transportation. Necessary corrective action shall be taken in the production of mix as required for further batches.

Use of adequate equipment at the plant to measure surface moisture content of aggregates, particularly fine aggregate or the workability of the concrete, cube tests etc. shall also be ensured.

Making corresponding adjustment at the plant automatically or manually to batched quantities to allow for observed, measured or reported changes in materials or concrete qualities.

Sampling of concrete, testing, monitoring of results. Diagnosis and correction of faults identified from observations/complaints. The RMC plant produced concrete shall be accepted by Engineer-in-Charge at site after receipt of the same after fulfilling all the requirements of mix mentioned in the tender documents.

Ready mix concrete shall be arranged in quantity as required at site of work.

The ready mix concrete shall be supplied as per the pre-agreed schedule approved by Engineer-in-Charge.

If so required by the Engineer-in-Charge, the RMC producer shall provide separate storage space/ go down for storage of materials approved by Engineer-in-Charge for the design mix concrete.

Use of Fly ash/ mineral based admixtures in RMC shall not be permitted without prior approval of Engineer in Charge.

No addition of water or other ingredients shall be permitted in the RMC at site or during transit.

Concrete shall be placed by pump of suitable capacity or tower crane or boom placer and the contractor shall arrange sufficient length of pipe at site to place the concrete in the minimum required time. Nothing extra shall be paid for placing of concrete through concrete pump/ tower crane/boom placer.

Printed delivery tickets shall be produced with each truck load of RMC.

The representative of RMC supplier shall attend the site meeting as and when decided by the Engineer-in-Charge.

The contractor shall assess the quantity of RMC requirement at site well in advance and order accordingly to the RMC supplier. In case excess RMC is received at site, the Engineer-In-Charge shall not be under any obligation to get the extra quantity utilized and no payment for such RMC shall be made.

The contractor shall have to employ labour in shifts to ensure continuous casting of raft and other RCC members as directed by Engineer-In-Charge. No extra payment on this account shall be made.

3.7 Form Work and scaffolding / Staging

- 3.7.1 For the execution of centering and shuttering, the contractor shall use chemical mould release agent of approved make shuttering oil as recommended by the manufacturer and nothing extra shall be paid on this account.
- 3.7.2 The shuttering system shall have sufficient strength to withstand the pressure resulting from placement and vibration of concrete and shall have sufficient rigidity to maintain specified tolerances.
- 3.7.3 Scheme of arrangement /Shop drawings/shuttering design for the shuttering system shall be submitted for approval of the Engineer-In-Charge sufficiently prior to commencement of work.
- 3.7.4 The design and engineering of the shuttering system shall be the responsibility of the contractor and Contractor shall use the latest technology available for staging and shuttering.
- 3.7.5 The selection of material shall be consistent with safety and quality required in the finished work. **Contractor to ensure availability of shuttering material required for 2 complete floors to ensure timely completion of major concrete works.**

- 3.7.6 The shuttering system shall be sufficiently tight to prevent loss of cement slurry from the concrete and shall be securely braced against lateral deflection.

3.8 Removal of Formwork (Striking Time)

- 3.8.1 Unless specified in the drawing, or directed by the Engineer-in-charge, the minimum intervals of time, which should be allowed between the placing of the concrete and the striking of the formwork shall be as per relevant CPWD Specifications and other IS Standards.

3.9 Curing

- 3.9.1 Curing of concrete shall be done using water/curing compound of approved make.
- 3.9.2 Exposed concrete slabs: Water/Curing compound should be spray applied on to the newly placed concrete slab as soon as possible after it is free from visible surface water.

3.10 Reinforcement steel works

- 3.10.1 Rate quoted for uncoated reinforcement steel shall include cost of supplying, de coiling, straightening, cleaning, cutting, bending, placing, binding, welding if required and providing necessary cover blocks of concrete.
- 3.10.2 No payment for cement wash shall be made separately and is deemed to be included in the quote rate for RCC works.

3.11 BRICK WORK

The work shall be carried out as per CPWD specifications, Vol. -1, Sub-head No - 6. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

4. MARBLE WORK

The work shall be carried out as per CPWD specifications, Vol. -1, Sub-head No - 8 and other relevant IS codes. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

5. WOOD WORK AND PVC WORK

The work shall be carried out as per CPWD specifications, Vol. -1, Sub-head No - 9 and other relevant IS codes. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

6. STEEL WORK

The work shall be carried out as per CPWD specifications, Vol. -1, Sub-head-10. However, where CPWD specifications and relevant IS standards are not available; the work shall be carried out with prior approval of Engineer in charge. The rate quoted by the contractor shall be inclusive of the following clauses as well.

7.1 Fabrication Drawings

- 7.1.1 The contractor shall prepare fabrication and erection drawings for major works

on the basis of design drawings supplied to him and submit the same in triplicate to the Engineer-in-charge for review. Engineer-in-charge shall review and comment, if any, on the same. Such review, if any, by the Engineer-in-charge, does not relieve the contractor of any of his required guarantees & responsibilities. The contractor shall however be responsible to fabricate the structural members strictly conforming to specifications and reviewed drawings.

- 7.1.2 Review by Engineer-in-charge shall not absolve the contractor of his responsibility for the correctness of dimensions, adequacy of details and connections. One copy will be returned with or without comments to the contractor for necessary action.
- 7.1.3 The contractor shall supply two prints each of the final reviewed drawings to the Engineer-in-charge within a week since final review, at no extra cost for reference and records.
- 7.1.4 Fabrication and erection drawings shall be thoroughly checked and stamped "Approved for Construction" and signed by the responsible engineer of the Contractor and shall be released for construction by the contractor directly to his work site.
- 7.1.5 If any modification is made in the design drawing during the course of execution of the job, revised design drawings will be issued to the contractor. Further changes arising out of these shall be incorporated by the contractor in the fabrication drawings already prepared at no extra cost and the revised fabrication drawings shall be duly got reviewed as per the above Clauses.

7.2 Painting on structural steel Work

The work shall be carried out as per CPWD specifications, Vol. -2, chapter-13. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

The work shall be carried out as per CPWD specifications, Vol. -1, Sub-head No - 11 and other relevant IS codes. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

8. CARPET FLOORING, WOODEN LAMINATE FLOORING, RAISED/ FALSE FLOORING

The respective items of flooring as given in SOR shall be inclusive of protecting and keeping the flooring clean till handing over. No extra amount shall be payable to the contractor on this account.

Installation of these flooring shall be carried out as described in the respective item of Schedule of Rates (SOR) and as per manufacturer's specifications.

The warrantee of these flooring shall be as per manufacturer's specifications floorings like carpet flooring, wooden laminate flooring, raised/ false flooring.

9. ALUMINIUM WORK

The work shall be carried out as per CPWD specifications, Vol. - 2, sub-head-

21. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

10. WATER PROOFING

The work shall be carried out as per CPWD specifications, Vol. -2, chapter-22. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

10.1 Water Proofing (EPDM Membrane)

10.1.1 Material

The water proofing works shall be carried out with 1.52 mm or 1.14mm thick EPDM (Ethylene-Propylene-Diene Terpolymer Membrane) in both horizontal as well as vertical applications and similar other locations as specified in the Schedule of Rates. The Technical parameters of EPDM Membrane are given below:

SI No.	Property of membrane	Minimum Requirement	
		1.52mm	1.14mm
1.	Thickness	1.52mm	1.14mm
2.	Weight	2.10 kg/sqm	1.51 kg/sqm
3.	Tensile strength	≥7N/SQMM	≥7N/SQMM
4.	Minimum service temperature	≤ -45° C	≤-45° C
5.	Maximum service temperature	130° C	130° C
6.	Elongation	≥300%	≥300%
7.	Tear resistance	≥40N	≥40N
8.	UV resistance	PASS	PASS
9.	Water absorption	0.15%	0.15%

10.1.2 Installation/Application

Contractor shall submit the application procedure to Engineer-In-Charge prior to commencement of work at site. Work shall be started only after approval of Application/Installation Procedure by Engineer-In-Charge.

10.1.3 Guarantee

Guarantee for the entire installation carried out for Water proofing shall be provided. Performance guarantee shall cover for replacement of any or all components by the Contractor at its own cost in case of any deficiency or failure in performance of the water proofing during the Guarantee period of 1 year.

11. DISMANTLING AND DEMOLISHING

The work shall be carried out as per CPWD specifications, Vol. -2, chapter-15. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer in charge.

12. FINISHING WORKS

The work shall be carried out as per CPWD specifications, Vol. -2, chapter-13. However, where CPWD specifications are not available, the work shall be carried out with prior approval of Engineer.

13. Any other item not mentioned above shall be executed as per the relevant CPWD specifications.

(ELECTRICAL WORKS)

1. GENERAL

The electrical Installation work shall be carried out in accordance with Indian Standard Code of Practice. It shall also be in conformity with the current Indian Electricity rules and regulations and requirements of the Local Electricity Supply Authority and Fire Insurance regulations so far as these become applicable to the installation. Electrical work in general shall be carried out as per following CPWD Specifications.

- i) General Specifications for Electrical Works.(Part I)Internal Work - 2013.
- ii) General Specifications for Electrical Works Part IV Sub Station 2013.
- iii) General Specifications for Electrical Works Part VIII Gas Based Fire Extinguishing System - 2013.

Wherever these specifications calls for a higher standard of material and or workmanship than those required by any of the above mentions regulations and specification then the specification here under shall take.

11000/433 Volts, ONAN type TRANSFORMER

1. GENERAL

Technical specifications in this section cover supply of outdoor type, step down, 11000/433 volts, double wound core type, delta/star vector group Dyn11, oil immersed (ONAN) transformers. The transformers shall be suitable for operation on 11 kV, 3 phase 50 cycle earthed system, connected delta on H.V. side and star on the L.V. side with neutral brought out for solid grounding. The transformer shall be suitable for continuous operation at the rated capacity under site conditions.

2. STANDARDS AND CODES

The Standards and Codes applicable to the works are listed in Annexure I of the tender document and may be referred to.

3. TRANSFORMER SPECIFICATIONS

3.1 General Construction

All materials, components, instruments etc. used in manufacture of transformer shall be new, of best quality available and conforming to the relevant Indian standards. Exposed surface shall not have pockets where water can collect and internal design shall ensure that air is not trapped in any location. If air pockets is unavoidable, suitable air release vent shall be provided in interconnection piping. Means of lubricating bearings and moving mechanism shall be provide. Materials in contact with oils shall not cause acid formation. Assembly should be capable of withstanding transportation and installation stresses. Nuts, bolts and pins inside the transformer and tap changer shall be lockable.

3.2 Voltage Ratio

Unless otherwise specified, the transformer shall be suitable for a voltage ratio of 11 KV/433V.

Vector Group

In case of step down transformers, the winding connections shall conform to vector Group Dyn11 unless otherwise specified.

3.3 Temperature rise

The reference ambient temperatures assumed for the purpose of this specification are as follows: -

- a) Maximum ambient air temperature 50⁰ C.
- b) Maximum daily average ambient air temperature 40⁰ C.
- c) Maximum yearly weighted average ambient temperature 32⁰ C.
- d) Minimum yearly weighted average ambient temperature (-)5⁰ C.

The temperature rise at the above conditions and at the altitude not exceeding 1000 meters shall be as follows: -

By resistance method 55⁰ C(maximum temperature being 95⁰ C).

By thermometer 50⁰ C.

If the site conditions indicated for a particular job is more severe than the refereed ambient temperature mentioned above, the temperature rise shall be suitably scaled down such that the hot spot temperature shall not exceed the values for the reference conditions.

3.4 Core

The core shall be constructed from high grade cold rolled non ageing grain oriented silicon steel laminations of grade 51. Core and insulation shall be capable of withstanding thermal and mechanical stresses. Suitable core grounding system shall be

provided. Frame, core clamps and core bolts shall be electrically insulated from the core. Insulation shall be capable of withstanding maximum temperature existing in the core. Core clamps shall be electrically connected to the tank.

3.5 Windings

The HV and LV windings shall be fabricated from electrolytic grade copper conductors. Windings shall not contain any sharp bends which might induce high dielectric stress or damage the insulation. Windings shall be thoroughly seasoned so that no further shrinkage occurs in use. Winding conductors shall be suitably transposed to minimize eddy currents and ensure equal current and temperature distribution. Winding coils shall be supported on insulating spacers so arranged as to ensure positive and effective oil circulation. The support arrangements shall be suitable to withstand electrical and mechanical stresses. Thermistor sensors suitable for 24 volt DC shall be embedded in the low voltage winding for warning and tripping. Winding temperature indicator of 150 mm dia shall be provided. Uniform insulation to earth shall be provided for windings capable of withstanding upto 72.5 kV rms system voltage. Winding insulation material shall be class 'A'

3.6 Tank

Tanks shall be fabricated from low carbon steel and shall be of welded construction and shall be suitable for being lifted by crane or lifting jacks. The tanks shall be suitable to withstand vacuum of 500 ml mercury. Suitable guides shall be provided in the tanks for positioning the core and coil assembly. Adequate space shall be provided at the bottom for collection of sediments. The tank top shall be provided with a detachable cover with bolted flanged gaskets joint. Lifting lugs shall be provided to remove the cover. 150 mm dia dial type thermometer for top oil temperature indication alongwith alarm and trip contacts shall be provided. Magnetic oil level gauge with low level alarm shall be provided. The cover shall be sloped to drain out rain water. Gaskets for tanks, manual cover, bushing etc shall be so designed that they are not exposed to atmosphere. An inspection hole with matching cover shall be provided. The tank base shall be provided with bi-directional rollers.

Tank mounted radiators shall be welded to the tank unless otherwise stipulated. Detachable type with bolted flanged connections shall not be provided unless shutoff butterfly valves with blanking plates are provided on transformer tank. Top and bottom shutoff valves and blanking plates for each radiator, lifting lugs, oil filling hole with cap, air release plug and oil drain plug shall be provided. All flanged joints and valves shall be rendered totally leak proof

3.7 Insulation Oil

Transformer shall be supplied with first filling of oil conforming to IS 335 + 10% extra in non-returnable drums. Oil shall be without inhibitors of approved brand.

General Requirements

The transformer shall be indoor or outdoor type as specified. Unless otherwise specified the transformer in addition shall have thermal and dynamic ability to withstand external short-circuit as per clause 9 of IS 2026 (Part I) 1977 and as per IS latest Level 2 of IS-1180/Part-1/2014.

3.8 Buchholz relay

A double float type Buchholz relay as per IS : 3637 shall be provided on each transformer. All gas evolved in the transformer shall collect in this relay. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation. A copper tube shall be connected from the gas collector to a valve located

about 1.25 m above ground level to facilitate sampling with the transformer in service. The device shall be provided with two electrically independent ungrounded contacts one for alarm on gas accumulation and the other for tripping on sudden rise of pressure. This relay shall be designed to withstand a seismic acceleration of 0.4 g. Test certificate shall be furnished to prove conformity with this requirement.

3.9 Transformer Characteristics

The no load voltage ratio of the transformer shall be 11000/433 volts and the percentage impedance shall not exceed 5% as per IS.

3.10 Transformer Terminations

The transformer shall have self supporting cable boxes with suitable glands and cable sockets for receiving 11,000 volt grade XLPE cables on the H.V. side. On the MV side the transformer shall have a suitable self supporting terminal arrangement with extended busbars to receive 1100 volt grade PVC insulated and sheathed aluminium conductor armoured cables or bus duct as stipulated in Schedule of Quantities. When connection is by cables, a disconnecting chamber for isolating and moving away the transformer without draining oil from the transformer tank or unsealing the cables shall be provided.

3.11 Marshalling Box

A marshalling box fabricated from minimum 2 mm thick MS sheets and provided with gasketed hinged doors (IP-55) and pad locking arrangement shall be provided for terminating wiring for control, protection, alarm and power circuits. Suitable heaters with manual switching shall be provided to prevent moisture condensation. A lamp with switch shall be provided for lighting the inside of the box. All wiring shall be terminated in suitable terminal box of required rating. Control wiring for trip and alarm circuit shall be terminated on separate terminal block. Minimum 40% spare terminals shall be provided for control wiring. An earth bus shall be provided. Wiring to the marshalling box shall be with armoured cables for which suitable terminal blocks and glands shall be provided. Control wiring shall be with minimum 2.5 sq mm copper conductor oil and fire resistant cables.

3.12 Transformer Fittings

The transformer shall be fitted with all fittings, accessories, protection and instruments as per the relevant Indian Standard Specifications including but not restricted to the following.

- Diagram and Rating plate
- Lifting Lugs.
- Two earthing terminals on either side of the tank.
- Four bidirectional rollers on the under carriage for movement.
- Winding Temperature Indicator with alarm contacts for alarm and trip circuits.
- Externally operated tapping switch with locking arrangement
- Terminal marking plate.
- Jacking Lugs.
- H.V. cable box for 3 core XLPE cable as required.
- L.V. cable box suitable for reception of 1100 volt grade, 3.5 core, XLPE, Aluminium, armoured cables or chamber for receiving bus duct as required.
- Oil conservator with drain plug.
- Oil filling hole and cap.
- Filter valve with plug.
- Drain valve with plug or cover plate.

- Oil level indicator with minimum marking.
- Dehydrating breather.
- Air release valve.
- Explosion vent.
- Thermometer pocket with plug.
- 150 mm dial type contact thermometer with maximum temperature indicator and alarm, trip and resetting device.
- Buchholz relay of double float type with alarm and trip contacts with M.S. box for terminating control cables of 4 x 2.5 sq. mm. size.
- Oil conservator with oil level indicator, minimum level marking and drain plug
- Thermometer pocket with plug
- 100 mm dial type /stem type thermometer with metal guard Dial type thermometer shall have max. temperature indicator and resetting device.
- Additional Neutral separately brought out on a bushing for earthing for all transformers.
- Radiator assembly for all transformers.
- Silica gel breather for all transformers.
- First filling of oil to IS 335/1993 including make-up fill during installation for all transformers.
- Inspection covers on tank cover for access to terminal connections for all transformers.
- Bushing terminations or cable box terminations as specified.
- Necessary hardware, clamps, lugs etc. for termination on HV/MV etc. for all transformers.
- Cooling : Unless otherwise specified, the transformer shall be oil immersed natural air-cooled type (ONAN).

3.14 Accessories

The transformer shall be a single tank type with termination on bushings or cable end box as specified on HV side. The MV side shall be suitable to receive bus bar trunking or MV cable inter-connection suitable for full load current of the transformer.

3.15 Explosion Vent

Explosion vent or pressure relief device shall be provided of sufficient size for rapid release of any pressure that may be generated within the tank and which might result in damage to the equipment. The device shall operate at a static pressure less than the hydraulic test pressure for transformer tank. Means shall be provided to prevent the ingress of moisture and of such a design to prevent gas accumulation.

3.16 Accommodation for Auxiliary Apparatus

Where specified, such as, for restricted earth fault protection, facilities shall be provided for the mounting of a neutral current transformer.

3.17 Rating And Diagram Plates

The following plates shall be fixed to Transformer in a visible position.

- a) A rating plate of weather proof material bearing the data specified in the appropriate clauses of IS: 2026/1977 and as per IS latest Level 2 of IS-1180/Part-1/2014 .
- b) A diagram plate showing the internal connection and also the voltage vector relationship of the several windings in accordance with IS: 2026-1977 and as per

IS latest Level 2 of IS-1180/Part-1/2014 and a plan view of the transformer giving the correct physical relationship of the terminals.

3.18 Cable Box

Cable box shall not be mounted on the tank covers. It shall be feasible to remove the tank covers for inspection during maintenance etc. without recourse to breaking the joints or disturbing the cables already terminated. Necessary removable links in oil approachable through inspection cover in tank cover etc. after lowering oil shall be provided for test purpose.

3.19 Parallel Operation

For parallel operation of transformers, the transformers shall have the same percentage impedance, same voltage ratio, same vector group, phase sequence etc.

3.20 Joints And Gaskets

All gaskets used for making oil tight joints shall be of proven material such as granulated cork bonded with synthetic rubber gaskets or synthetic rubber or such other good material.

4. TRANSFORMER TESTING AT WORKS

All the routine tests as below and any or all type tests, if specifically asked for, shall be carried out on each transformer prior to despatch of the equipment to site. Owners reserve the right to depute their representative to inspect and witness the testes at manufacturers work prior to despatch. Contractor shall give minimum 2 weeks advance notice and shall make all arrangements for facilitating this inspection if opted by the Owners.

Routine tests

- Ratio of each tapping, polarity angular displacement and phase displacement.
- No load current and no load losses
- Load losses
- Impedance voltage (to be measured at all tapplings)
- Resistance of windings at principal and extreme tapplings
- Insulation resistance
- Induced over voltage withstand (induced potential)
- Separate source voltage withstand (applied potential)

Type Tests

Copies of the following type tests shall be enclosed with the tender.

- Impulse test
- Temperature rise test
- Zero phase sequence impedance measurement
- Insulation for each windings and between windings at varying power factor.
- High voltage withstand test on auxiliary wiring at 2 kV for 15 minutes.
- Oil pressure test at 0.35 g/cm² above maximum operating oil pressure, preferably under hot oil condition shall be carried out. The pressure shall be maintained for 12 hours.

5. COMMISSIONING TESTS

The following tests shall be carried out prior to commissioning

- Insulation resistance of the winding between phases and phase and earth on the H.T. side.
- Winding resistance of all the windings on all tap positions.

- Voltage ratio test shall be carried out by applying low voltage on H.T. side and measuring the voltage between phases and phase and neutral on the L.T. side for every tap setting.
- On commissioning of the transformer the following readings shall be taken
 - MV side voltages at all tap settings
 - Temperature rise under no load conditions

The bidder shall include in cost for providing a commissioning engineer at site to supervise commissioning of the transformers. The cost shall be quoted on a man day basis

FEEDER PILLAR

1. GENERAL

This section covers specification for feeder pillars to distribute power to the Plots and landscape lighting luminaries. The feeder pillars are provided with Isolators/ MCCBs incomers as specified in BOQ Street light feeder pillar shall have contactors and timers on each phase. The timers on each phase shall be individually adjustable for automatically switching on and switching off various circuit at predetermined times for optimizing illumination provided with illumination required at various times of the day at various seasons for minimizing uncalled for switching on of lights resulting in energy wastage.

2. STANDARDS AND CODES

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Low Voltage switchgear & control gear

IS 13947	:	1993
Part I	:	General rules
Part II	:	Circuit Breakers
Part III	:	Switches, disconnectors, switch disconnectors and fuse combination units
Part IV	:	Contactors
Part V	:	Control circuit devices and switching elements

Marking of Switchgear busbars	IS 11353 : 1985
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Degree of Protection of Enclosures for low voltage switchgear.	IS 2147 : 1962
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Code of Practice for selection, installation and Maintenance of switchgear & control gear	IS 10118 : 1982
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Low voltage switchgear & control gear assemblies	IS 8623 : 1993
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3. OUTDOOR TYPE DISTRIBUTION FEEDER PILLARS

The feeder pillar shall be of the floor mounting type, totally enclosed, and weather proof, conforming to IP 54 ingress protection incorporating MCCBs, contactors, timers and MCBs as per schedule of quantities. The feeder pillar shall be suitable for 440 volts 3 phase 4 wires, 50 cycles AC supply.

The cubicle shall be fabricated out of heavy gauge sheet steel of thickness not less than 2 mm thick with suitable side frame and stiffeners. Hinged doors of not less than 1.6 mm thick shall be provided at the front and rear of the cubicle to provide access for installation, operation, tests and inspection. The rear door is provided to facilitate cable termination and the front door for inspection of fuses, to switch 'ON' and 'OFF' the switch as and when required. All doors shall be fitted with dust excluding neoprene gaskets. The doors shall also be fitted with suitable locking arrangement with lock to prevent unauthorized opening. The cubicle shall be designed for mounting over cement concrete plinths by the roadside, and shall be of substantial construction capable of withstanding the vibrations normally experienced due to vehicular traffic. The top of the feeder pillar shall be of slanting construction in all directions to prevent any collection of water due to rain. A gland plate shall be provided at the bottom of the feeder pillar (removable) for mounting the cable glands. The feeder pillar shall be fitted on an angle iron pedestal at the bottom covered with sheet metal from all the four sides which facilitates cable bending etc. Two lifting hooks shall be provided at the top. A door switch shall be provided in the feeder pillar so as to switch 'ON' and 'OFF' the lamp fixed in the brass batten holder below the top sheet of the pillar.

The sheet steel materials used in the construction of the cubicle shall have undergone a rigorous rust proofing process comprising alkaline degreasing, descaling in dilute sulfuric acid solution and recognised phosphating process. After metal treatment, the interior of the cubicle shall be painted with two coats of air-drying red lead primer followed by two coats of air drying anti-condensation paint. The exterior of the cubicle shall be painted with two coats of staving red oxide primer followed by PU coats of epoxy finishing paint of approved shade warranty for five years for non corrosion of panel.

All the nuts, bolts shall be cadmium plated and provided with spring washers minimum spacing from cable connection to the bottom of gland plate shall be 300mm.

The bus bars shall be of electrical grade aluminium. They shall be air insulated with adequate clearances between conductors and between conductors and earth. These shall be colour coded to enable immediate identification of the phases and neutral. The current density for bus bars shall not be more than 1.0 amps per square mm considering all derating factors (party has to submit details calculation). All bus bar joints and tapings shall be of the clamped type as far as possible thereby avoiding drilling of holes on bus bars. The bus bars shall be carried on supports made out of a suitable non-inflammable and non-hygroscopic material. Suitable insulating phase barriers shall be provided to prevent accidental short-circuits during operation.

The neutral bus bar shall be rated at 100 % of the phase bus bars. The design shall allow for neutral cable sockets to be fitted directly to the bus bars. A Aluminium earth bar of size minimum 40 x 5mm together with two cable eyes shall be provided for connections to earth. All the cables shall be terminated at ELEMEX terminal block and there from wiring shall be done with PVC insulated copper conductor wires neatly bunched. The wiring shall be neatly bunched and shall be secured to wiring cradles.

A circuit cardholder shall be made inside the front door and the card duly engraved / painted on aluminium / hylam sheet, Identification ferrules shall be used for incoming and out going cables.

4. TESTING AT WORKS

Copies of type test carried out at ACB/ MCCB manufacturers works and routine tests carried out at feeder pillar fabricators shop shall be furnished along with the delivery of

the feeder pillars. Engineering in charge reserves the right to get the feeder pillar inspected by their representative at fabricators works prior to dispatch to site to witness the routine tests.

5. INSTALLATION

The foundations prepared as per the manufacturers drawings shall be leveled, checked for accuracy and the feeder pillar installed. All bus bar connections shall be checked with a feeler gauge after installation. The cable end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths.

After installation the feeder pillar shall be tested as required prior to commissioning.

6. TESTING AT SITE

Pre-commissioning tests as required and as per manufacturers recommendations shall be carried out on each feeder pillar at site before energizing the switchboards including but not restricted to the following.

- Physical checking of the feeder pillar including checking alignment of panels, interconnection of Bus bars, tightness of bolts/connections and evidence of damage/cracks in any components.
- Physical checking and inspections of Inter panel wiring
- Checking free movement of MCCBs
- Checking of operation of breakers
- Insulation tests of bus bar supports and control wiring etc. with 1.1 kV megger.

CONTROL, OPERATION AND SYNCHRONIZATION THROUGH PLC PANEL

1 Programmable Logic Controller (PLC)

The automation station consists of the following types of module: processor/coprocessor, power supply, discrete and analog I/O, communication and application-specific modules which can be distributed on racks.

With the exception of the processor and power supply modules, all I/O and application-specific modules can be assigned to a slot in any order in the configuration.

The PLC rack system should be modular to address small and bigger I/O systems

The PLC CPUs should be able to address Process control loops in a deterministic manner, that is, the CPU should be able to scan closed loops in a fixed amount of time.

The PLC should be able to extend itself on a local bus over a long distance so that the advantages of local bus speeds are achieved for process control loops and at the same time, achieve the I/O distribution required in order to achieve minimum cabling configurations.

The Local Bus configuration can be Trunk and Drop or even Star based to allow greater flexibility.

The PLC in addition to an extendable Local Bus should also feature a Remote I/O bus, which is deterministic and can extend over longer distances(7- 8 kms) than that of a local bus.

The memory area of PLCs should consist of internal RAM designed to hold the application (data, program and constants), which can be extended by a PCMCIA memory card (intended to hold the program and constants and, depending on the model, to back up files and symbols for the various application objects).

1.1 Modules

All of the modules, except processor (CPU) and power supply (PSU) modules, can be inserted and removed while powered up i.e. Hot swappable I/O's . This will, under no circumstances, cause unpredictable behaviour in the PLC.

I/O modules with terminal blocks should have a device for the automatic transfer of coding on first use. This avoids handling errors during replacement of the module. The coding ensures electrical compatibility for each type of module.

The consistency of the software configuration is automatically checked after the program has been loaded in the PLC.

The software 1st level diagnostics system also indicates graphically the faulty configuration components for both "in-rack" and remote modules.

The processor and all modules to have a front panel display unit indicating the module status (in-rack or remote). The internal and external faults (operative part) of the module are signalled. The display block should also indicate the status of the channels managed by the module

1.2 Communication functions

There should be pre defined function blocks to ensure that PLC can communicate with other devices: read/write language objects, send/receive data, send requests, read/write character strings, etc.

The CPU should be able to perform these communication functions in a multi tasking mode. The functions are independent of the protocol used. The parameters are written in a parameter- setting window in the software

The software for programming these functions should include as a minimum

- A parameter screen for constructing the configuration data to be transmitted to the module

- A debugging and test screen for communication which can be accessed online

1.3 **Programming Development software**

The development software should be compatible with Windows 95, Windows 98, Windows NT 4.0 and Windows 2000 Professional operating systems. and conform to standard IEC 1131-3.

Access to all debugging and programming tools is via the software application browser. The browser gives an overall view of the program and offers fast access (via context-specific menus) to all application components.

- Configuration editor
- Program editor
- DFB user function block editor
- Variables editor
- Animation tables editor
- Documentation editor
- Runtime screens editor

The software configuration editor should allow as a minimum:

Hardware configuration

The configuration editor is used, in an intuitive and graphic way, to declare and configure the various components of the PLC application:

- Processor and coprocessor
- Tasks
- Application-specific I/O modules
- Memory

The management of access rights is to be used to limit and control the use of the various software functions. The software should allow various profiles with different access rights The software should have a multi-instance function to be used to work on several applications simultaneously. This function is used:

- To open several different applications locally on the PC to check or copy information
- To debug online two (or more) applications of two PLC5 on the same network

This is particularly useful when debugging inter-PLC communication functions.

1.4 **Standards and certifications**

PLC conforms to the following standards:

- IEC1131-2
- EN 61131-2
- CSA 22-2 (Canadian Standards Association)
- UL 508 (Underwriters Laboratories)
- C-Tick ACA (Australian Communication Authority/Australia)

It should conform to the certifications relating to marine classification:

- BV (Bureau Veritas/France)
- DNV (Det Norske Veritas/Norway)
- GL (Germanischer Lloyd/Germany)
- LR (Lloyd's Register/United Kingdom)
- RINA (Registro Italiano Navale/Italy)

1.5 **Processors**

Each PLC processor has a programming terminal (non-isolated RS 485 link), with two 8-pin mini-DIN connectors for physically connecting two devices to the processor front panel.

- TER connector: used to connect a PC-compatible type terminal or to connect the PLC to the commn. Bus
- AUX connector: used to connect a self-powered peripheral (terminal, operator terminal or printer (no voltage supplied on the connector)).

The CPU needs to be 32 bit, multi tasking, with 1 scan time of 0.2 ms or better for l k of program logic

1.6 Memory

The memory area of PLCs consists of internal RAM designed to hold the application (data, program and constants) which can be extended by a PCMCIA memory card intended to hold the program and constants and, depending on the model, to back up files and symbols for the various application objects. The application memory is divided into memory areas, physically distributed in the internal RAM and the PCMCIA memory card (if the processor has a memory card):

- The application data area is always in internal RAM.
- The application program area is in the internal RAM or the PCMCIA memory card.
- The constants area is in the internal RAM or the PCMCIA memory card.

Application in internal RAM

The application is entirely loaded in the internal RAM which is backed up by the processor (the capacity depends on the processor model).

The memory area (64 Kbytes) is distributed between the application data, the program, the constants and the system data.

Application in PCMCIA card

The internal RAM is now reserved for application data. The PCMCIA memory card contains the program and the constants.

The storage area for files of 256 Kbytes or 1.2 Mbytes (depending on the model of PCMCIA card) can be used for distributed applications or for storing information of production data type, manufacturing recipes, etc.

The storage area for symbols of 0 or 256 Kbytes or 512 Mbytes (depending on the model of PCMCIA card) can be used to access the application symbols database on the PLC.

Three types of memory extension card are available:

- Protected RAM type memory card
This card is used in particular in the application program creation and debugging phases and enables all transfer and modification services for the application in online mode. A removable battery integrated in the memory card backs up the memory.
- Flash EPROM type memory card
This card is used when the application program debugging is completed and enables only one full transfer of the application to avoid problems resulting from battery-dependent back-up.
- Backup type memory card

This card is pie-loaded with the application program and can be used to reload the program in the internal RAM and internal Flash EPROM of the processor without using a programming terminal. The function is limited to applications where the program does not exceed 64 Kbytes when fully loaded in the internal RAM of the processor.

By default, the application program comments (irrespective of the language used) are stored in the PLC memory.

Certain models of Flash EPROM card also have an area to back up the symbols and comments of the various application objects. The user therefore does not have to pre-

load the symbols file for the application on which he wishes to work when connecting the programming terminal for debugging or modifying the application.

The symbols are automatically backed up when a memory extension with a symbols area is selected in configuration.

1.7 Power supplies

The power supply modules equip each rack on the PLC and are designed to supply power to the installed modules. Various types of module depending on the electrical power system required are:

- 24 VDC non-isolated
- 24...48 VDC isolated
- 100...240VAC

The AC power supply modules have an integrated power supply delivering a voltage of 24 VDC to supply the input sensors. The sensor power supply connection can be accessed via the module screw terminal block.

The alarm relay located in each power supply module has a volt-free contact which can be accessed via the module screw terminal block. When any fault occurs (partial stop of the application, occurrence of a blocking fault, incorrect voltage, etc.) the relay is activated and its associated contact opens (state is 0).

1.8 "In rack" discrete I/O

The input modules in the PLC consist of:

DC

- 24V, 8 and 16 isolated inputs, type 2, screw terminal
- 24V, 32 and 64 isolated inputs, type 1, HEIO connectors
- 48V, 16 isolated inputs, type 2, screw terminal
- 48V, 32 isolated inputs, type 2, HEIO connectors

AC

- 24V, 16 isolated inputs, type 2, screw terminal
- 48V, 16 isolated inputs, type 2, screw terminal
- 100... 120V, 16 isolated inputs, type 2, screw terminal
- 200...240V, 16 isolated inputs, type 2, screw terminal

The inputs are compatible with 2-wire/3-wire/PNP, NPN type proximity switches in accordance with standard IEC 947-5-2.

The output modules in the PLC consist of:

Transistor

- 24V/O.5A, 8 protected outputs, screw terminal
- 24V/2A, 8 protected outputs, screw terminal
- 24V/O.5A, 16 protected outputs, screw terminal
- 48V/1A, 8 protected outputs, screw terminal
- 48V/O.25A, 16 protected outputs, screw terminal
- 24V/O.IA/channel, 32 and 64 protected outputs, HEIO connector

Relay

- 24VDC/3A, 24...240VAC/3A, 8 and 16 outputs, screw terminal
- 24...48VDC/5A, 24...240VAC/5A, 8 protected outputs, screw terminal
- 24... 120VDC/5A, 8 protected outputs, screw terminal

Triac

- 24...120VAC/IA/channel, 16 sorties, screw terminal
- 48...240VAC/IA/channel, 16 protected outputs, screw terminal
- 48...240VAC/2A/channel, 8 protected outputs, screw terminal

The outputs conform to standard IEC 1131-2.

Each group of 8 channels can be assigned to a specific application task in configuration: MAST, FAST, EVil task.

1.9 “in-rack analog I/O

The configuration software should offer the following configuration and debugging functions:

- Selecting the modules used
- Configuration of the channels according to the type of module: scanning (normal or fast), cold junction compensation (internal or external), range, filtering, display format, task, terminal block detection, wiring check
- Debugging, access to adjustments of certain parameters, diagnostics, module/channel, forcing, calibration

The analog modules consists of:

Input modules

High-level inputs with common point:

- 4 fast channels (1 ms), +/-10 V, 0...5/10V, 1.5V, 0/4..20 mA, resolution 16 bits
- 8 and 16 channels, +/-IOV, 0..5II0V, 1...5V, 0/4...20mA, resolution 12 bits

Isolated high-level inputs:

- 8 channels, +/-IOV, 0...5/10V, 1...5V, 0/4..20mA, resolution 16 bits

Thermocouple inputs:

- 16 channels, +I-63mV (B,E,J,K,L,N,R,S,T,U), resolution 16 bits

Multi-range isolated low-level inputs:

- 4 channels, +/-10V, 0...5/10V, 1...5V, 0/4...20mA, -13.+63mV, 0.400I3850 Ohms, temperature probe, thermocouple, resolution 16 bits

Isolated outputs:

- 4 channels, +/-10V, 0...20mA, 4...20mA, resolution 11 bits + sign

Outputs with common point:

- 8 channels, +/-IOV, 0..20mA, 4..20mA, resolution 13 bits + sign

1.10 Process control

The PLC processor can be used to install 10, 15 or 20 process control channels. Special screens, accessible using software, are used to configure and debug the control loops without programming.

The software offers default parameters with initial values.

All of the I/O and parameters for the various control channels configured can be accessed by the user at the program level.

The control channels each adopt one of the 5 loop profiles below:

- Process-type loop: loop with only one controller
- Controller with 3 simple loops: controller used to increase the capacity of the number of loops (for 20 channels: 60 loops)
- Auto selective loop, also called secondary loop: consists of 2 loops in parallel with an output selection algorithm
- Cascade loop: consists of 2 dependent loops (the master loop output is the slave loop set point)
- Setpoint programmer: consists of a maximum of 6 composite profiles totalling 48 segments

The channels are independent and the various loops are characterized by:

- The different algorithms
- 5 processing branches (measurement, setpoint, Feed Forward, controller and output processing)
- Calculation functions (gain, filtering, square root, etc) defined using parameters entered using software

Process control-related calculations are performed in floating point arithmetic expressed in physical units.

1.11 Ethernet communication

PLC is connected to the Ethernet network via modules (10 / 100 Mbps) with automatic speed recognition. Communication uses the TCP/IP Ethernet profile.

The modules have on the front panel:

- A display block indicating the state of the module
- A standard RJ45 connector for a 1 ObaseT/1 OObaseTX interface

The modules can be installed in any PLC slot except for slots dedicated to the power supply and the processor. The module can be used to exchange 800 messages/second. These modules should have a ready-to-use Web server installed. The Web server functions should not require any programming at either PLC level or at the level of the PC supporting the browser.

These functions should not affect the PLC scan time. The main functions are as follows:

- PLC system diagnostics (configuration, module, I/O)
- Access to PLC variables and data (password protection, read/write, access by address and symbols)
- Display, acknowledgment and deletion of alarms (password protection)
- Graphic editor for animated objects linked to PLC variables (copy/paste, set colour parameters, PLC variable, wording)
- Transparent scanning of I/O using read/write requests with Modbus on TCP/IP.
- Word area in the application reserved for read/write of I/O
- Refresh periods independent of the PLC scan
- Management of TCP/IP connections for each remote device
- Feedback of status words for monitoring the correct operation of the service from the PLC application
- Application of pre-configured fallback values if a communication problem occurs
- Scan time for 64 devices: 20 ms

The software option offers:

- a library of C functions for debugging data send/receive requests (240 bytes) directly on the "socket" interface of the TCP layer using software
- elementary communication function blocks integrated in the application
- higher level function blocks, provided as examples, performing more advanced functions such as a complete initialization sequence or the closing of a connection

2. TYPE TEST CERTIFICATE

Switchboard configurations offered shall be CPRI /Independent test house tested. Copies of the CPRI test certificates for same rating & identical switchgear shall be submitted by successful Tenderers at the time obtaining of Vender approval. This shall not be more than 5 years old.

3. TESTING AT WORKS

Copies of type test carried out at ACB/MCCB manufacturers works and routine tests carried out at the switchboard fabricators shop shall be furnished along with the delivery

of the switchboards. Engineer-in-Charge reserves the right to get the switchboard inspected by their representative at fabricators works prior to dispatch to site to witness the routine tests

4. INSTALLATION

The foundations prepared as per the manufacturers drawings shall be leveled, checked for accuracy and the Switchboard installed. All bus bar connections shall be checked with a feeler gauge after installation. The cable end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths.

Antistatic rubber matting of approved make conforming to IS 5424 – 1983, of minimum 915 mm width 6.5 mm thickness shall be provided in front of and along the full length of the Switchboard. The rubber mat shall withstand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

After installation the Switchboard shall be tested as required prior to commissioning.

9. TESTING AT SITE

Pre-commissioning tests as required and as per manufacturers recommendations shall be carried out on each switchboards at site before energizing the switchboards including but not restricted to the following.

- Physical checking of the switchboards including checking alignment of panels, interconnection of Bus bars, tightness of bolts/connections and evidence of damage/cracks in any components.
- Physical checking and inspections of Inter panel wiring
- Checking free movement of ACBs/MCCBs/SFUs
- Checking of operation of breakers
- Insulation tests of bus bar supports and control wiring etc. with 1.1 kV megger.
- Primary & secondary injection tests of relays and CTs.
- Checking of Interlocking function.
- Closing and left out holes to ensure the entire panel is seal proof
- Earth testing

RELAYS, CTs, PTs, METERS, INDICATING LAMPS ETC..

1.0 GENERAL

This section covers specifications for Protection and Control Relays for breakers, Instrument Transformers, Measuring Instruments, Push Buttons, Indicating Lamps etc. required in LT and HT switchboards.

2.0 STANDARDS AND CODES

Updated and current Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 2003, Indian Electricity Rules 1956, National Building Code 1994, National Electric Code 1985, Code of Practice for Fire Safety of Building (general) :General Principal and Fire Grading – IS 1641 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

Application guide for Current Transformers	IS 4201 :
Application guide for Voltage Transformers	IS 4140 :
Application guide for Relays	IS 3842 :
Electromagnetic Relays	IS 5051 :

3.0 PROTECTION AND CONTROL RELAYS

The Circuit Breaker shall have protection and control relays as specified in the schedule of quantities. Relays shall be approved types complying to relevant ISS and having approved characteristic. Relays shall be flush mounted in dust proof cases. Relays shall be arranged so that adjustments, testing and replacement can be affected with minimum of time and labour.

In case of C.T. operated thermal overload and magnetic instantaneous short circuit release, the overload releases shall be such that each phase can be individually set depending on the phase unbalanced currents. The releases shall have inverse time current characteristics and the magnetic release shall be time delayed with a minimum setting of 25 ms varying upto 300 ms for discrimination without effecting the breaking current capacity of the ACB.

4.0 CURRENT TRANSFORMERS

Separate sets of CTs shall be provided for metering and protection. C/Ts shall confirm to IS 2705 (part -I, II and III) in all respects. All C/Ts used for medium voltage application shall be rated for 1 kV. C/Ts shall have rated primary current, rated burden and class of accuracy as specified in Schedule of Quantities/drawings. Rated secondary current shall be 5A unless otherwise stated. Minimum acceptable class for measurement shall be class 0.5 to 1 and for protection class 5P10. C/Ts shall be capable of withstanding magnetic and thermal stresses due to short circuit faults as applicable. Terminals of C/Ts shall be paired permanently for easy identification of poles. C/Ts shall be provided with earthing terminals for earthing chassis, frame work and fixed part of metal casing (if any). Each C/T shall be provided with rating plate indicating :

- Name and make
- Serial number
- Transformation ratio
- Rated burden
- Rated voltage
- Accuracy class

CTs shall be mounded such that they are easily accessible for inspection, maintenance

and replacement. Wiring for CT shall be with copper conductor LSZH PVC insulated wires with proper termination works and wiring shall be bunched with cable straps and fixed to the panel structure in a neat manner. Facilities for shorting terminal shall be provided.

5 POTENTIAL TRANSFORMER

PT's shall conform to IS 3156 (Part I, II and III) in all respects. Primary and secondary circuit wiring star star connected and voltage ratio shall be 11 kV $\sqrt{3}/110/\sqrt{3}$ or 415/ $\sqrt{3}/110/\sqrt{3}$ as specified in Schedule of Quantities. Class of accuracy shall be 1.0. Over voltage factor shall be 1.2

6 MEASURING INSTRUMENTS

Direct reading electrical instruments shall conform to IS 1248 or in all respects. Accuracy of direct reading shall be 1.0. Meters shall be suitable for continuous operation between 0° C and 50°C. Meters shall be flush mounting and shall be enclosed in dust tight housing. The housing shall be of steel or phenolic mould. Design and manufacture of meters shall ensure prevention of fogging of instrument glass. Display shall be 0.5 inches, 7 segment bright LED's. Suitable selector switches shall be provided for ammeters and volt meters used in three phase system unless otherwise stipulated, 96 mm x 96 mm instrument shall be used. The meter shall be built-in selector switch. The rating type and quantity of meters, instruments and protective device shall be as per Schedule of Quantities /drawings. Ammeter on motor circuit shall be provided with suppressed scales to take care of shorting surges.

6.1 Ammeters

Ammeters shall be of digital type. Ammeter shall be latest Micro controller based technology, built-in selector switch for phase selection, ultra bright LED display, CT ratio programmable through front key pad and auto ranging.

6.2 Voltmeters

Volts meters shall be digital type range of 3 phase 415 volt voltmeters shall be 0-500. Volt meters shall be provided with protection MCB.

6.3 Watt meter

Wattmeter shall be of 3 phase digital type and shall be provided with a maximum demand indicator if required.

6.4 Power factor meters

3 phase power factor meters shall be of digital type with current and potential coils suitable for operation with current and potential transformers provided in the panel. Scale shall be calibrated for 50% lag - 100% - 50% readings. Phase angle accuracy shall be $\pm 4^\circ$.

Energy and reactive power meters

Trivector meters shall be two element, integrating type, KWH, KVA, KVARH meters. Meters shall conform to IEC 170 in all respects. Energy meters, KVA, and KVARH meters shall be provided with integrating registers. The registers shall be able to record energy consumption of 500 hours corresponding to maximum current at rated voltage and unity power factor. Meters shall be suitable for operation with current and potential transformers available in the panel.

7.0 INDICATING LAMPS

Cluster LED type indicating lamps shall be provided for indication of phases and Breaker position as required in the schedule of quantities. Lamps shall be easily removed and replaced from the front of the panel by manual means not requiring the use of extractors.

8.0 PUSH BUTTONS

Push buttons shall be of non hygroscopic material, non-swelling and fitted to avoid any possibility of sticking. Contacts shall be of adequate strength and have a positive whipping action when in operation

ELECTRIC POWER DISTRIBUTION AND WIRING

1. Introduction

The electric power will be received and distributed in a building, through following means:-

1.1. Cabling and switchgear to receive power.

The building is divided into convenient number of parts, each part served by a rising main system to distribute power vertically/horizontally.

1.2. Power flows from rising main through tap-off box to floor main board to final DBs and then to wiring.

1.3. Dedicated circuit for different loads such as lighting, HVAC, power plug loads shall be provided, wherever possible.

1.4. Rising main, which takes care of general lighting and power outlet load of the building, should have independent cables for lighting as well as power, wherever possible. Other loads like lifts, water pump sets, other motor loads are fed by independent cables of suitable capacity fed from properly designed essential/ non- essential LT power panels with suitably designed switchgear having necessary control and safety features.

1.5. Therefore, the distribution/wiring system essentially consists of provision of cables, switchgear, rising main, bus-ducting, earthing, laying of pipes/ conduits etc. (in surface or recess) based on proper detailed designing to decide on various sizes/ capacities of these components and various controls and safeties involved, to provide an efficient, reliable, safe and adequate electrical distribution and wiring system.

1.6. A typical schematic diagram of power distribution of a building is enclosed. (See Chapter 19 Fig. 2).

1.7. Fire Prevention – Lifesaving and Restricting Damages to the Property

Fire Survival (FS) cables shall be used where integrity of electric supply is important especially to save human life and where electric supply is required for evacuation operation during the fire instances. These cables are designed to withstand temperatures from 650°C to 950°C and for period upto 180 min along with additional protection against mechanical shock and water splash. The fire survival cable shall be used at following location as given below and additional requirement, if any as mentioned in NBC 2016 as amended up to date, CEA Regulation 2010 as amended up to date and NEC 2023 :-

Application of FS cable			
NOTE – For more details, refer Annex A of IS 17505(Part 1) : 2020			
Sl No. (1)	System Description (2)	Cable Fire Rating Required (°C) (3)	Time for which System should Withstand (Minutes) (4)
(i)	Fire pumps	FS (950/FWS)	180
(ii)	Pressurization	FS (950/FWS)	180

(iii)	Smoke venting including its ancillary systems, such as dampers and actuators	950	60
(iv)	Fire-fighting shaft (staircase, lift, lift lobby)	FS (950/FWS)	180
(v)	Fireman's lifts (including all lifts)	FS (950/FWS)	180
(vi)	Exit signage lighting	950	120
(vii)	Emergency lighting	950	120
(viii)	Fire alarm system		
(a)	Conventional (zone-based system)	650	60
(b)	Intelligent addressable system	650	60
(ix)	Public address (PA) system (related to emergency voice evacuation and annunciation)	650	60
(x)	Magnetic door hold-open devices	650	60
(xi)	Lighting in fire command center and security room	FS (950/FWS)	180

2. System of Distribution and Wiring

- The wiring shall be done from a distribution system through main and/or branch distribution boards. The system design and location of boards will be properly worked out.
- Each main distribution board and branch distribution board shall be controlled by an incoming circuit breaker. Each outgoing circuit shall be controlled by a circuit breaker.
- For non-residential and residential buildings as far as possible DBs shall be separate for light and power.
- Only MCCB/MCB type main and branch distribution boards shall be used. HRC/ Rewireable type fuses shall not be used.
- Three phase DBs shall not be used for final circuit distribution as far as possible.
- 'Power' wiring shall be kept separate and distinct from light wiring, from the level of circuits, i.e., beyond the branch distribution boards. Conduits for light/power wiring shall be separate.
- Essential/non-essential/UPS distribution each will have a completely independent and separate distribution system starting from the main, switchboard upto final wiring for each system. As for example, conduit carrying non-essential wiring shall not have essential or UPS wiring. Wiring

for essential and UPS supply will have their own conduit system. No mixing of wiring is allowed.

- Generally, no switchboard will have more than one source of incoming supply. More than one incoming supply will be allowed only at main board with proper safety and interlocking so that only one source can be switched on at a time.
- Each MDB/DB/Switch Board will have reasonable spare outgoing ways for future expansion.
- Balancing of 3-phase circuit shall be done.
- Power and light MCB distribution boards in office/ non-residential building should be of same size irrespective of number of circuits as far as possible in order to get aesthetic look.

2.1. Wiring

All flexible copper wires used shall have Class 2 copper conductor satisfying the resistance requirements of NEC 2023 Part 1 Section 17, Annex B.

2.2. Submain & Circuit Wiring

- (a) Submain Wiring:
Submain wiring shall mean the wiring from one main/distribution switchboard to another.
- (b) Circuit Wiring:
Circuit wiring shall mean the wiring from the distribution board to the 1st tapping point inside the switch box, from where point wiring starts.

2.3. Measurement of Submain and Circuit Wiring

- (a) Circuit and submain wiring shall be measured on linear basis along the run of the wiring. The measurement shall include all lengths from end to end of conduit or channel as the case may be, exclusive of interconnections inside the switchboard etc. The increase on account of diversion or slackness shall not be included in the measurement.
- (b) The length of circuit wiring with two wires shall be measured from the distribution board to the nearest switch box from which the point wiring starts. Looping of switch boxes also will be counted towards circuit wiring, measured along the length of conduit/channel.
- (c) When wires of different circuits are grouped in a single conduit/ channel, the same shall be measured on linear basis depending on the actual number and sizes of wires run.
- (d) Protective (loop earthing) conductors, which are run along the circuit wiring and the submain wiring, shall be measured on linear basis.

Note: Conduit carrying submain will not carry circuit/point wiring. Similarly, conduit carrying circuit wiring will not carry submain/point wiring. Conduit carrying point wiring will not carry submain/circuit wiring.

2.4. Measurement of Other Wiring Work

Except as specified above for point wiring, circuit wiring and submain wiring, other types of wiring shall be measured separately on linear basis along the

run of wiring depending on the actual number and sizes of wires run.

2.5. Point Wiring

All flexible copper wires used shall have Class 2 copper conductor satisfying the resistance requirements of NEC 2023 Part 1 Section 17, Annex B

2.6. Definition

A point (other than socket outlet point) shall include all work necessary in complete wiring to the following outlets from the controlling switch or MCB.

- (a) Ceiling rose or connector (in the case of points for ceiling/exhaust fan points, prewired light fittings, and call bells).
- (b) Ceiling rose (in case of pendants except stiff pendants).
- (c) Back plate (in the case of stiff pendants).
- (d) Lamp holder (in the case of goose neck type wall brackets, batten holders and fittings which are not prewired).

2.7. Scope

Following shall be deemed to be included in point wiring:

- (a) Conduit/channel as the case may be, accessories for the same and wiring cables between the switchbox and the point outlet, loop protective earthing of each fan/ light fixture.
- (b) All fixing accessories such as clips, screws, Phil plug, rawl plug etc. as required.
- (c) Metal or PVC switch boxes for control switches, regulators, sockets etc, recessed or surface type, and phenolic laminated sheet covers over the same.
- (d) Outlet boxes, junction boxes, pull-through boxes etc. but excluding metal boxes if any, provided with switchboards for loose wires/conduit terminations.
- (e) Control switch or MCB, as specified.
- (f) 3 pin or 6 pin sockets, ceiling rose or connector as required. (2 pin and 5 pin socket outlets shall not be permitted.)
- (g) Connections to ceiling rose, connector, socket outlet, lamp holder, switch etc.
- (h) Bushed conduit or porcelain tubing where wiring cables pass through wall etc.

Note: In areas where false ceiling are provided, termination of wires should be at the fittings. flexible metallic conduits helically wound in galvanized steel from ceiling junction box to the fittings shall be provided duly coupled at both ends with GI couplers. This shall be included within the scope of point wiring.

- (i) Interconnecting wiring between switches within the switch box on the same circuit.
- (j) PVC conduit glands/ double check nuts at conduit terminations.
- (k) Wire termination lugs at all terminations.
- (l) Terminal blocks at switch boards and junction boxes.

2.8. Measurement

- (a) Point Wiring (other than socket outlet points)

Unless and otherwise specified, there shall be no linear measurement for point wiring for light points, fan points, exhaust fan points and call bell points. These shall be measured on unit basis by counting, and classified as laid down in 3.4.4.

2.9. Classification

Points measured under 3.4.3 on unit basis shall be classified as under according to the type of building:

- (a) **Residential Buildings**

- (i) Group 'A' for point wiring for type I, type II and type III residential quarters and hostels.
- (ii) Group 'B' for point wiring for type IV and above type of residential quarters and barracks.

- (b) **Non-residential Buildings**

Group 'C' for all types of non-residential buildings such as offices, hospitals, laboratories, educational institutions, libraries etc.

- (c) **For any Other Type of Building**

The group under which the points are to be classified shall be decided by the concerned Chief Engineer (Elect.).

2.10. Point Wiring for Socket Outlet Points

- (a) The light plug (6 A) point and power (16 A) point wiring shall be measured on linear basis, from the respective tapping point of live cable, namely, switch box, another socket outlet point, or the sub-distribution board as the case may be, up to the socket outlet.
- (b) The metal/PVC box with cover, switch/MCB, socket outlet and other accessories shall be measured and paid as a separate item.

Note: There shall normally be no "on the board" light plug point.

- (c) The power point outlet may be 16 A/6 A six pin socket outlet, where so specified in the tender documents.

2.11. Group Control Point Wiring

- (a) In the case of points with more than one point controlled by the same switch, such points shall be measured, in parts i.e. (a) from the switch to the first point outlet as one normal point and classified according to 3.4.4, and (b) for the subsequent points as Group Controlled Points. The distance from that outlet to the next one and so on, shall be treated as separate point(s) and classified according to 3.4.4. There shall be no linear measurement for these Group Controlled Points and these shall be measured on unit basis by counting and classified as laid down in 3.4.4.

2.12. Twin Control Light Point Wiring

- (a) A light point controlled by two numbers of two-way switches shall be measured as two points from the fitting to the switches on either side and classified according to 3.4.4.

- (b) No recovery shall be made for non-provision of more than one ceiling rose or connector in such cases.

2.13. Multiple Controlled Call Bell Point Wiring

- (a) In the case of call bell points with a single call bell outlet, controlled from more than one place, the points shall be measured in parts i.e.
 - (i) from the call bell outlet to one of the nearest ceiling roses meant for connection to bell push, treated as one point and classified according to 3.4.4, and
 - (ii) from that ceiling rose to the next one and so on, shall be treated as separate point(s) and classified according to 3.4.4.
- (b) No recovery shall be made for non-provision of more than one ceiling rose or connector for connection to call bell in such cases.

2.14. Wiring System

- Wiring shall be done only by the looping system. Phase/live conductors shall be looped at the switch box. For point wiring, neutral wire/earth wire looping for the 1st point shall be done in the switch box; and neutral/earth looping of subsequent points will be made from point outlets.
- In wiring, no joints in wiring will be permitted anywhere, except in switch box or point outlets, where jointing of wires will be allowed with use of suitable connector.
- The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switchgear.
- Light, fans and call bells shall be wired in the 'lighting' circuits. 15A/16A socket outlets and other power outlets shall be wired in the 'power' circuits. 5A/6A socket outlets shall also be wired in the 'power' circuit both in residential as well as non-residential buildings.
- Colour Coding of Wiring:
Following colour coding shall be followed in wiring:

Phase	: Red/Yellow/Blue. (Three phase wiring)
Live	: Red (Single phase wiring)
Neutral	: Black
Earth	: Yellow/Green.
- Termination of Circuit into Switchboard
Circuit will consist of phase/neutral/earth wire. Circuit will terminate in a switch board (first tapping point, where from point wiring starts) in following manner:
Phase wire terminated in phase connector. Neutral wire terminated in neutral connector. Earth wire terminated in earth connector.
The switchboard will have phase, neutral and earth terminal connector blocks to receive phase/neutral/earth wire. See Fig 3.

2.15. Run of Wiring

- The type of wiring shall be as specified in the tender documents namely, surface conduit/recessed conduit, steel/PVC, channel.

- Surface wiring shall run as far as possible along the walls and ceiling, so as to be easily accessible for inspection.
- Above false ceiling, in no case, open wiring shall be allowed. Wiring will be done in recessed conduit or surface steel conduit.
- In recessed conduit system, routes of conduit will be planned, so that various inspection boxes provided don't present a shabby look. Such boxes can be provided 5 mm above plaster level, and they can be covered with plaster of Paris with marking of junction boxes.
- Where number of electrical services like electrical wiring, telephone wiring, computer cabling, pass through corridors, it may be proper to plan such service with properly designed aluminium/PVC channels duly covered by a false ceiling, so that subsequently such service can be maintained and additional cables can be provided.
- Generally, conduits for wiring will not be taken in floor slabs. When it is unavoidable special precaution to be taken to provide floor channels with provision for safety and maintenance. Alternatively floor trunking (raceways) / false flooring can be provided.

2.16. Passing through Walls or Floors

- When wiring cables are to pass through a wall, these shall be taken through a protection (steel/ PVC) pipe or porcelain tube of suitable size such that they pass through in a straight line without twist or cross in them on either porcelain, PVC or other approved material.
- All floor openings for carrying any wiring shall be suitably sealed after installation.

2.17. Joints in Wiring

- No bare conductor in phase and/or neutral or twisted joints in phase, neutral, and/ or protective conductors in wiring shall be permitted.
- There shall be no joints in the through-runs of cables. If the length of final circuit or submain is more
- than the length of a standard coil, thus necessitating a through joint, such joints shall be made by means of approved mechanical connectors in suitable junction boxes.
- Termination of multistranded conductors shall be done using suitable crimping type thimbles.

2.18. Ratings of Outlets

(to be adopted for design).

- LED fittings shall be used in the buildings and the rated capacity shall be as per actuals subject to "each circuit shall not have more than 800 W connected load or more than 20 points whichever is less".
- Conventional Ceiling fans shall be rated at 60W and BLDC fans shall be rated as per the actuals. Exhaust fans, fluorescent tubes, compact fluorescent tubes, HPMV lamps, HPSV lamps, CFL fittings etc. shall be rated according to their capacity. Control gear losses shall also be

considered as applicable.

- 6A and 16A socket outlet points shall be rated at 100W and 1000W respectively, unless the actual values of loads are specified.

2.19. Capacity of Circuits

- Lighting circuit shall feed light/fan/call bell points. Each circuit shall not have more than 800 W connected load or more than 20 points whichever is less as because of introduction of LED lights, load on lighting circuit gets reduced drastically.
- Power circuit in non-residential building will have only one outlet per circuit. However in non- residential building for computer points 3 nos. 6A outlet sockets can be feed through power circuit.
- Each power circuit in residential building can feed following outlets:
 - (a) Not more than 2 Nos. 16A outlets.
 - (b) Not more than 3 Nos. 6A outlets.
 - (c) Not more than 1 No.16A and 2 Nos. 6A outlets.
 - (d) Independent circuit each to feed Geyser, AC Outlet and Kitchen oven, washing machine outlets
- Load more than 1 KW shall be controlled by suitably rated MCB and cable size shall be decided as per calculations.
- Power Wiring with Bus Trunking
It is permitted to meet large-scale power requirement in a hall, or floor, with use of single phase or 3 phase bus bars running inside a metal enclosure. This will be provided with careful design and use offactory fabricated bus-trunking of reputed make, conforming to relevant BIS standards and with standard accessories like End feed unit, tap off with necessary safety features like over current, short-circuit and earth fault protection. Such trunking will be of specified breaking KA rating.

2.20. Socket Outlets

- Socket outlets modular type shall be 6A 3 pin, 16 Amp 3 pin or 16/6 Amp 6 pin. 5 pin socket outlets will not be permitted.
- The third pin shall be connected to earth through protective earthing conductor. 2 pin or 5 pin sockets shall not be permitted to be used.
- Conductors connecting electrical appliances with socket outlets shall be of flexible type with an protective earthing conductor for connection to the earth terminal of plug and the metallic body of the electrical appliance.
- Sockets for the power outlets of rating above 1KW shall be of suitable rating modular switch/ socket configuration with controlling MCB.
- Where specified, shutter type (interlocking type) of sockets shall be used.
- Every socket outlet shall be controlled by a switch or MCB, as specified. The control switch/MCB shall be connected on the 'live' side of the line.
- 6A and 16A socket outlets shall be installed at the following positions, unless otherwise specified.
 - (a) Non-residential buildings –

- (i) 6A socket outlet: 110 cm above floor level.
- (ii) 16A socket outlet: 23 cm/ 110 cm above floor level.
- (b) Kitchen/ Pantry:
6A/ 16A socket outlet – 23 cm above working platform and away from the likely positions of stove and sink.
- (c) Bathroom:
6A socket outlet: Socket outlet for portable appliances like hair dryer, shaver etc. to be provided adjacent to wash basin/ mirror at 110 cm height above floor level.
For Geyser:
16A MCB in modular switch box arrangement be provided in bathroom at 110 cm height, adjacent to switchboard (for light and exhaust fan) with socket outlet at minimum 2mt. height from floor level and at least 60 cm. away from shower head adjacent to geyser (within 30 cm).

OR

16A MCB in modular box arrangement be provided in bathroom at 110 cm height at suitable location near door, with socket outlet at minimum 2mt. height from floor level and at least 60 cm. away from shower head adjacent to geyser (within 30 cm).

- (d) Rooms in residences
 - (i) 6A socket outlet: 70 cm above floor level on bed side(s)
 - (ii) 6A socket outlet: for other locations, 23 cm/110 cm above floor level, or any other level in special cases as desired by the Engineer-in-charge.
 - (iii) 16A socket outlet – 23 cm/110 cm above floor level, or any other level in special cases as desired by the Engineer-in-charge.
- Unless and otherwise specified, the control switches for the 6A and 16A socket outlets shall be kept along with the socket outlets.

2.21. Cables

- Copper conductor cable only will be used for submain/ circuit/ point wiring.
- Minimum size of wiring:

Light Wiring	:	1.5 sq.mm.
Power Wiring	:	4.0 sq.mm.
Power circuit rated	:	More than 1 KW, Size as per calculation.
Insulation	:	Copper conductor cable shall be PVC insulated conforming to BIS Specification
Multi stranded	:	Cables are permitted to be used. However, proper termination on the ends with lugs/ thimbles should

be used.

2.22. Flexible Cable

- Conductor of flexible cables shall be of copper. The cross-sectional area of conductor for flexible cable shall be as per design.
- Only 3 core flexible cables shall be used for connecting single-phase appliances.
- Unless the flexible cables are mechanically protected by armour, or tough rubber, or PVC sheath, these shall not be used in workshops and other places where they are liable to mechanical damage.
- Flexible cable connection to bell push from ceiling rose shall be taken through steel conduit/metallic casing and capping.

3. Wiring Accessories

3.1. Control Switches for Point

- (a) Control switches (single pole switch) carrying not more than 16A shall be modular type. The switch shall be 'On' when the knob is down.
- (b) (i) In type II & III quarters, Barracks & school buildings (except principal's & staff rooms) etc. Modular type switches and sockets should be used.
- (ii) Modular type switches and sockets to be provided for remaining types of buildings i.e. in all types of remaining non-residential buildings & residential buildings of type IV & above & Transit hostel or as may be decided by the Architect/ user department.
- (c) It is recommended to provide MCB in Modular type boxes with controlling MCB for window type, split type AC units, geysers etc. The location of the controlling MCB and related socket should can be at separate location depending upon type of gadget. For example, in case of geyser/ split AC the socket can be near the geyser/ indoor split unit and switch/ controlling MCB can be at different location at approachable height.

3.2. Specification of Modular Switches and socket

The modular switch shall be as per following/ have features mentioned below: -

- Suitable for 240V, AC, with normal gap constructions, Flush type, Screw type terminal, IP20
- Current carrying plastic parts of Nylon (PA6) with glass fibres up to 16A
- Non-Flammable insulating parts & very high Insulating resistance after Humidity test.
- Marked with IS 3854:1997
- Snap fit with Modular Plates very easy to install
- Arrow marking for correct orientation with plate.
- Double rocker mechanism to prevent visible spark.
- Bimetal Silver contact tips for less spark & longer life.
- Fire retardant and UV stabilized.
- The modular sockets shall be as per following/ have features mentioned below:-

- 240V, AC, Flush type, Screw type terminal, Shuttered.
- Polycarbonate material thickness ~1.5 mm to 2.5 mm
- Non-Flammable insulating parts & very high Insulating resistance after Humidity test.
- 6A, 6/16A Socket market with ISI, as per IS1293:2019
- Snap fit with Modular Plates easy to install
- Brass current carrying parts.
- Fire retardant and UV stabilized.

3.3. Switch Box

- (a) Switch box shall be hot dip galvanized, factory fabricated, suitable in size for surface/ recess mounting and suitable in size for accommodating the required number of switches and accessories (where required to be used for applications other than modular switches/ sockets).
- (b) Switch box also can be of non-metallic material. The technical sanctioning authority will approve specified makes of reputed quality and specifications.

3.4. Switch Box Covers (for application other than modular type)

Phenolic laminated sheets of approved shade shall be used for switch box covers. These shall be of 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conforming to grade P- I of IS 2036: 1995.

Note: Specification for switch boxes is covered in the chapters on the various types of wiring.

3.5. Ceiling Rose

- (a) A ceiling rose shall not be used on a circuit, the voltage of which normally exceeds 250V.
- (b) Only one flexible cord shall be connected to a ceiling rose. Specially designed ceiling roses shall be used for multiple pendants.
- (c) A ceiling rose shall not embody fuse terminal as an integral part of it.

3.6. Lamp Holders

- (a) Lamp holders may be batten, angle, pendant or bracket holder type as required. The holder shall be made of brass/ ABS Plastic material/ Bakelite (ISI marked) and shall be rigid enough to maintain shape on application of a nominal external pressure. There should be sufficient threading for fixing the base to the lamp holder part so that they do not open out during attention to the lamp or shade.
- (b) Lamp holders for use on brackets and the like shall have not less than 1.3 cm nipple, and all those for use with flexible pendant shall be provided with cord grips.
- (c) All lamp holders shall be provided with shade carriers.
- (d) Where centre contact Edison Screw lamp holders are used, the outer or screw contact shall be connected to the 'middle wire', or the neutral conductor of the circuit.

3.7. Fittings

- (a) Types: The type of fittings shall be as specified in tender documents. The fitting proposed shall be compliant to the related Bureau of Indian Standards (BIS) as applicable, including LED fittings.
- (b) Indoor Type Fittings
 - (i) Where conductors are required to be drawn through tube or channel leading to the fitting, the tube or channel must be free from sharp angles or projecting edge, and of such size as will enable them to be wired with the conductors used for the final circuit without removing the braiding or sheathing. As far as possible all such tubes or channels should be of sufficient size to permit looping back.
 - (ii) Wires used within prewired fittings shall be flexible with PVC insulation and 14/0.193 mm (minimum) copper conductors. The leads shall be terminated on built-in-terminal block, ceiling rose or connector, as required.
 - (iii) Fittings using discharge lamps shall be complete with power factor correction capacitors, either integrally or externally. An earth terminal with suitable marking shall be provided for each fitting for discharge lamps.
 - (iv) Fittings shall be installed such that the lamp is at a height of 2.4m above floor level, unless otherwise directed by the Engineer-in-charge.
 - (v) Fittings made of CRCA shall be phosphatized and powder/epoxy painted. For coastal areas and humid area like toilets, kitchen, for prolonging the life of such fittings, corrosion free materials like engineering plastic, aluminium, stainless steel etc. should be used.
- (c) Outdoor Fittings

Outdoor fittings shall have suitable IP protection. It is preferable that street light fittings are of cast aluminium body of minimum IP 65, for reducing recurring maintenance cost and improved performance. Where ever required IP 66 fittings also can be provided for reducing maintenance frequency and cost.

Other fittings, which are not available with tested IP 65/54 protection, can be properly fabricated with weatherproof features, proper gasketing etc. As far as possible corrosion free material like cast aluminium, stainless steel, engineering plastics may be used for fabrication of such fittings, to prolong life of such fittings. There should not be any exposed wiring in such outdoor fittings.

4. Attachment of Fittings and Accessories

4.1 Conduit Wiring System

- (a) All accessories like switches, socket outlets, call bell pushes and regulators shall be fixed in flush pattern inside the switch/regulator boxes. Accessories like ceiling roses, brackets, batten holders etc. shall be fixed on outlet boxes. The fan regulators may also be fixed on outlet boxes, if

so directed by the Engineer-in-charge.

- (b) Aluminium alloy or cadmium plated iron screws shall be used to fix the accessories to their bases.
- (c) The switch box/regulator box shall normally be mounted with their bottom at 1.1 m from floor level, unless otherwise directed by the Engineer-in-charge.

4.2 Fixing to Walls and Ceiling

- (a) Wooden plugs for fixing to wall/ceiling will not be allowed. Fixing will be done with the help of PVC sleeves/Rowel plugs/ dash fasteners as required.
- (b) Drilling of holes shall be done by drilling machines only. No manual drilling of hole will be allowed.

5. Fans, Regulators and Clamps

5.1 Ceiling Fans

- (a) Ceiling fans including their suspension shall conform to relevant Indian Standards.
- (b) The capacity of a ceiling fan to meet the requirement of a room with the longer dimension D meters should be about $55 D \text{ m}^3/\text{min}$.
- (c) The height of fan blades above the floor should be $(3H + W)/4$, where H is the height of the room, and W is the height of the work plane.
- (d) The minimum distance between fan blades and the ceiling should be about 0.3 meters.
- (e) When actual ventilated zone does not cover the entire room area, then optimum size of ceiling fan should be chosen based on the actual usable area of the room, rather than the total floor area of the room.
- (f) The number of fans and the optimum sizes for rooms of different dimensions are given as under

OPTIMUM SIZE/NUMBER OF FANS FOR ROOMS OF DIFFERENT SIZES

Room Width	Room Length										
m	4m	5m	6m	7m	8m	9m	10m	11m	12m	14m	16m
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
3	1200/1	1400/1	1500/1	1050/2	1200/2	1400/2	1400/2	1400/2	1200/3	1400/3	1400/3
4	1200/1	1400/1	1200/2	1200/2	1200/2	1400/2	1400/2	1500/2	1200/3	1400/3	1500/3
5	1400/1	1400/1	1400/2	1400/2	1400/2	1400/2	1400/2	1500/2	1400/3	1400/3	1500/3
6	1200/2	1400/2	900/4	1050/4	1200/4	1400/4	1400/4	1500/4	1200/6	1400/6	1500/6
7	1200/2	1400/2	1050/4	1050/4	1200/4	1400/4	1400/4	1500/4	1200/6	1400/6	1500/6

8	1200/2	1400/2	1200/ 4	1200/ 4	1200/ 4	1400/ 4	1400/4	1500/4	1200/ 6	1400/ 6	1500/ 6
9	1400/2	1400/2	1400/ 4	1400/ 4	1400/ 4	1400/ 4	1400/4	1500/4	1400/ 6	1400/ 6	1500/ 6
10	1400/2	1400/2	1400/ 4	1400/ 4	1400/ 4	1400/ 4	1400/4	1500/4	1400/ 6	1400/ 6	1500/ 6
11	1500/2	1500/2	1500/ 4	1500/ 4	1500/ 4	1500/ 4	1500/4	1500/4	1500/ 6	1500/ 6	1500/ 6
12	1200/3	1400/3	1200/ 6	1200/ 6	1200/ 6	1400/ 6	1400/6	1500/6	1200/ 7	1400/ 9	1400/ 9
13	1400/3	1400/3	1200/ 6	1200/ 6	1200/ 6	1400/ 6	1400/6	1500/6	1400/ 9	1400/ 9	1500/ 9
14	1400/3	1400/3	1400/ 6	1400/ 6	1400/ 6	1400/ 6	1400/6	1500/6	1400/ 9	1400/ 9	1500/ 9

Note: This table is indicative only. Case specific design should be done by field officers based on site conditions & constraints.

- (g) Performance values of fans as per Table below and other test parameters such as speed, input watt, power factor etc. shall be corresponding to the highest speed achievable from remote control or regulator. Any other devices or speed regulation features, if provided, shall be suitably set to achieve the highest speed. **(refer IS 374:2019, Amendment-1-2022).** Energy Efficient fans with BEE 3–5-star rating or complying with IS 374: 1979, shall be used. The minimum service value of fans shall be 3.5 m³/min/W and air delivery 200 m³/min.

The values of service factor and air delivery for ceiling fans with 1200 mm sweep are given in the table under as

SI No	Fan Size mm	Minimum Air Delivery m ³ /min	Minimum Service Value m ³ /min/W
1.	600	100	1.5
2.	> 600 and ≤ 750	115	1.7
3.	> 750 and ≤ 900	130	3.1
4.	> 900 and ≤ 1 050	150	3.1
5.	> 1 050 and ≤ 1 200	210	4.0
6.	> 1 200 and ≤ 1 320	220	4.0
7.	> 1 320 and ≤ 1 400	245	4.1
8.	> 1 400 and ≤ 1 500	270	4.3

NOTES:

- (i) Air delivery values are on the basis of air velocity measurement up to 15 m/min.
- (ii) However In Hostel, Barracks a, Number of fans shall also be decided taken into account the location of furniture layout etc.
- (h) Two module Step type electronic regulators should be used instead of resistance type regulators for controlling speed of fans
- (i) All ceiling fans shall be wired to ceiling roses or to special connector

- boxes, and suspended from hooks or shackles, with insulators between hooks and suspension rods. There shall be no joint in the suspension rod.
- (j) For wooden or steel joists and beams, the suspension shall consist of GI flat of size not less than 40 mm x 6 mm, secured on the sides of the joists or beams by means of two coach screws of size not less than 5 cm for each flat. Where there is space above the beam, a through-bolt of size not less than 1.5 cm dia, shall be placed above the beam from which the flats are suspended. In the latter case, the flats shall be secured from movements by means of another bolt and nut at the bottom of the beam. A hook consisting of MS rod of size not less than 1.5 cm dia shall be inserted between the MS flat through oval holes on their sides. Alternatively, the flats may be bent inwards to hold tightly between them by means of a bolt and nut, a hook of 'S' form.
 - (k) In the case of 'I' beams, flats shall be shaped suitably to catch the flanges and shall be held together by means of a long bolt and nut.
 - (l) For concrete roofs, a 12 mm dia. MS rod in the shape of 'U' with their vertical legs bent horizontally at the top at least 19 cm on either side, and bound to the top reinforcement of the roof shall be used, as shown in Fig. 4.
 - (m) In buildings with concrete roofs having a low ceiling height, where the fan clamp mentioned under sub-clause (v) above cannot be used, or wherever specified, recessed type fan clamp inside metallic box, as shown in Fig. 5 shall be used.
 - (n) Canopies on top of suspension rod shall effectively hide the suspension.
 - (o) The leading in wire shall be of nominal cross-sectional area not less than 1.5 sq. mm. and shall be protected from abrasion.
 - (p) Unless otherwise specified, all ceiling fans shall be hung 2.75 m above the floor.
 - (q) In the case of measurement of extra down rod for ceiling fan including wiring, the same shall be measured in units of 10 cm. Any length less than 5 cm shall be ignored.
 - (r) The wiring of extra down rod shall be paid as supplying and drawing cable in existing conduit.

5.2 Exhaust Fans

- (a) Exhaust fans shall conform to relevant Indian Standards.
- (b) Exhaust fans shall be erected at the places indicated by the Engineer-in-charge. For fixing an exhaust fan, a circular opening shall be provided in the wall to suit the size of the frame, which shall be fixed by means of rag bolts embedded in the wall. The hole shall be neatly plastered to the original finish of the wall. The exhaust fan shall be connected to the exhaust fan point, which shall be wired as near to the opening as possible, by means of a flexible cord, care being taken to see that the blades rotate in the proper direction.

- (c) Exhaust fans for installation in corrosive atmosphere, shall be painted with special PVC paint or chlorinated rubber paint.
- (d) Installation of exhaust fans in kitchens, dark rooms and such other special locations need careful consideration; any special provisions needed shall be specified.

5.3 Regulators

The metallic body of regulators of ceiling fans/exhaust fans shall be connected to earth by protective conductor.

6. Marking of Switch Boards

6.1 Schematic Diagram

First a comprehensive schematic diagram for each building is to be prepared, starting from Main LT Panel, rising main, submain boards, DBs, etc. and the manner in which they are connected. This will include essential, non-essential and UPS systems. Sizes of interconnecting main/submain cables shall be indicated.

6.2 Marking of each Main Board

Each main board/submain board shall be marked indicating rating of each incoming/ outgoing switch and the details of load/area it feeds. Detail/size of incoming and outgoing cable also shall be marked indicating from where the incoming cable has originated.

6.3 Marking of Distribution Board

Each Distribution Board shall be marked indicating detail of incoming switch (Size of cable and from where it is fed) and marking of each outgoing MCB indicating the area it feeds. Suitable marking sticker will be suitably fixed to indicate such details.

6.4 Marking of Power/Light DBs

Power/light DBs shall be marked 'P' and 'L' respectively.

6.5 Marking for Non-essential/Essential/UPS/Switch Boards

Each switchboard shall be marked essential/non-essential/UPS to indicate the nature of such switchboards.

6.6 Marking of Main Earthing Terminal

Main Earthing terminals in main/submain switchboard shall be permanently marked, as "SafetyEarth – Don't Remove".

7. LT Distribution Switchgear

Only following type switchboards will be used:

- Main/Submain switchboard of cubicle type.
- DBs shall have incoming and outgoing terminal blocks with factory pre-wiring up to outgoing terminal blocks having phase/neutral/Earth terminal block for each circuit. This is to minimise chance of loose wiring which is a potential fire hazard. Conventional DBs of reputed makes with factory fabricated loose wire box with terminal blocks can also be used with the approval of technical sanctioning authority/NIT authority in addition to pre wired DBs. (See fig 8)
- Specially designed switchboards.

- Also specially designed switchboards can be used with detailed specification and fabrication drawings approved by the technical sanctioning authority.

8. Location of Switchboards

- Switchboards are to be located in common areas like corridors, lobby etc. and not to be located in locked room.
- Switchboard shall be located only in dry situation and in well-ventilated space. They shall not be placed in the vicinity of storage battery or exposed to chemical fume.
- Switchboards shall not be erected above gas stove, or sinks or within 2.5 meter of any washing unit in washing rooms or laundries or in the bath rooms, toilets, or kitchen.
- As far as possible main boards shall not be located in basement. Such main boards can be located in ground floor.
- It is preferable to locate floor main boards in rising main shafts of adequate size, with steel doors (having ventilation) or in suitable room.
- Similarly, DBs can be in suitable niches in corridor walls having doors.
- Locating main boards under staircase or standing open in corridor is not a desirable practice, besides being highly unesthetic.
- The main switchboard, which receives power to the building, should be invariably located in a switch room, having round the clock access, for emergency attendance to the switchboard.

9. Guidelines for Planning Residential Areas

- **U.G. System of Power Distribution, Street Lighting, Telephone Cabling and TV Cabling**

For long-term economical maintenance, better reliability of service, safety, protection against heavy rains, storm, wind etc. and aesthetics, underground cable system will be generally followed. Also considering the high cost of land, underground system results in better economic utilization of land area, otherwise substantial land route has to be earmarked for overhead lines.

- Efficient working of street lights and staircase lighting is required for security of the colony and safety and convenience of the residents. Therefore, adequate street lighting, staircase lighting is to be provided. Generally back lanes of residential blocks remain dark. Such areas are also to be covered by basic street lighting for security.

- **Kitchen**

- (a) Exhaust fans opening with one point outlet to be provided irrespective of yardstick of provision of exhaust fans.
- (b) In addition to one 16 A 6-pin power outlet for kitchen, one 3 pin 6 Amp. outlet to be provided for water filter.

- **Washing Machine**

Location to be finalized in consultation with the Architect. A power outlet plus water supply/drainage to be coordinated with Architect/Civil

Engineer.

- **Meter Board**

(For a Block of Quarters)

Generally, for a block of quarters of 2/3/4 storied, electric supply for each block is received in a meter board, where a cubicle meter panel is provided with system of power distribution to each quarter. (Chapter – 19 See Fig. 6)

At present such meter boards are invariably located under staircase.

This is not a desirable practice from technical/aesthetic viewpoint.

It is technically desirable to coordinate with Architect to provide separate meter room for each block

of quarters or a number of blocks.

- **Stair Case Lighting**

Stair case lighting is to be treated as an extension of street lighting, for security and convenience of the residents. LED light fitting for staircase lighting may be provided to reduce load. Incandescent stair case lighting and bulk head fittings should not be provided, in view of excessive energy consumption and low burning hours.

- **Emergency Electric Supply**

For ensuring essential water supply and security lighting, a D.G. set to be provided for each colony to take care of water supply pump set, sewerage pump set, street lighting and essential load requirement of buildings like CGHS Dispensary, Community Centre etc.

- **Fittings**

Subject to limit of yardstick of fittings for various types of quarters following guidelines to be provided:

- (a) Every room to be provided with one LED batten fitting for energy saving.
- (b) Kitchen to be provided with a LED batten fitting.
- (c) Incandescent bulkhead fittings not to be used.
- (d) Quality fittings of reputed make to be used.
- (e) Colour temperature of LED Lights to be used should be specified in the NIT.

- **Main Board of Each Quarter**

It shall be MCB type with provision of ELCB with the incoming MCB. It shall be located in a niche with ventilated door cover, in the room connecting to the entry of the quarter. MCB DB shall be double door type.

- **Corrosion Free Fittings**

Coastal areas and humid areas like kitchen, toilet are subject to corrosion, which substantially reduces the useful life of such fittings, besides giving an ugly look on account of rusting.

Therefore, for coastal areas, and other humid areas corrosion free type

of fittings (like aluminium, stainless steel, engineering plastic) should be used, for ensuring long life of such fittings and to achieve life cycle economy, after taking into account recurring expenditure on account of painting offittings.

- **Telephone Wiring**

Telephone wiring is to be provided for each quarter. Such telephone wiring to be brought to a tag- block at a suitable point in ground floor. Provisions shall be kept for suitable entry-pipe for laying incoming telephone cable. The number of telephone points shall be as per scale of amenities for electrical installation in general pool residential accommodation.

- **TV Cabling**

Internal TV cabling shall be provided,. Similarly, from suitable point at ground floor, TV cabling shall be provided. With use of suitable splitters, such TV cabling to be connected to each quarter. The number of TV points shall be as per scale of amenities for electrical installation in general pool residential accommodation.

- **Lighting for Parks**

Colonies are provided with parks. Such parks should be provided with adequate lights to include arealights, pathway lights etc. so that the parks can be effectively used by the residents and they remain secure during night time.

- **External Pipe Network for Laying Telephone and TV Cabling for the Colony**

Starting from a suitable room, pipe network may be provided to lay telephones/TV cables for the colony. Suitable road cross pipe and manholes to be provided for drawing such cables and their maintenance.

- **Preliminary Estimate to Take Care of Telephone/TV Cabling in a Colony**

At present, such services are provided in a very crude manner making use of existing poles and hanging cables. Apart from making colonies shabby, such services are subject to damages and unsatisfactory service. Therefore, preliminary estimate should provide for such TV/Telephone cabling for the colony.

- **Other Allied Services**

Modern residential colonies require support services like CCTV (for Gate and house security), intercom system, basic security system etc. for the safety and convenience of the residents. Therefore, preliminary estimate should provide for basic provisions for such safety/security systems. Most of these services pay for themselves within 3 / 4 years of installation, besides providing security, which sometimes amount to life saving instances.

10. Guidelines for Planning Office Buildings

- The main objective is to provide safe, efficient, reliable electricity with measures to avoid possible fire hazards, which calls for sound detailed designing and use of quality equipment and materials executed with sound workmanship and supervision.
- All control LT Panels, controlling power supply to the entire building will be located in a centralized room, from where centralized control and monitoring of the entire power supply system can be made.
- Earth fault protection shall be provided for each individual building at the LT receiving point i.e. Main LT Panel. RCD/ RCCB shall be used as per the provisions of CEA (Measures related to Safety and Electric supply) Regulations.
- Office buildings are prone to fire hazard during night hours. Therefore, after office hours, all the LT Panels should be switched off. Based on need of the building, only the specified LT panel to be kept 'ON' which feed the loads during night hours. Such panel, called common service panel, may feed following loads, which are normally used after office hours: -
 - (a) Some specified lifts.
 - (b) Staircase/ Corridor/ Compound light.
 - (c) Fire protection loads.
 - (d) Pump Sets.
 - (e) Other loads which are kept 'ON' after office hours.
- **Reliability of Power Supply**
Minimum two transformers to be provided to provide certain redundancy.
- It is preferable to plan for a separate service building, to combine all electrical and mechanical services of the building, so that the services can be maintained comprehensively at a lower cost and also reducing the overall area requirement. Such service building can combine electric sub-station, DG Sets, UPS, Air- conditioning Plant, water supply pump sets, etc.
- While planning, maintainability of various services to be ensured, like providing facilities like access, approachability of various equipment, maintenance space etc.
- **Mandatory test for wire :**
This Mandatory Test is applicable for original works only (original Works means all new constructions, site preparation, additions and alterations, special repairs to newly purchased or previously abandoned buildings or structures, including re-modelling or replacement).
The Acceptance Test as mentioned in IS 694-2010 (Reaffirmed 2020) shall constitute the mandatory test for wires non-metallic rigid conduit :
Acceptance tests:
 - (a) Annealing test (for copper)
 - (b) Tensile test (for aluminium)

- (c) Wrapping test (for aluminium)
- (d) Conductor resistance test
- (e) Test for thickness of insulation
- (f) Tensile strength and elongation at break of insulation
- (g) Insulation resistance test
- (h) High voltage test or spark test
- (i) Flammability test
- (j) Oxygen index test
- (k) Test for temperature index
- (l) Test for halogen acid gas evaluation
- (m) Test for smoke density rating
- (n) Persulphate test (for tinned copper conductor cable only)

11. METALLIC CONDUIT WIRING SYSTEM

11.1. Scope

This chapter covers the detailed requirements for wiring work in metallic conduits. This chapter covers both surface and recessed types of works.

11.2. Application

Recessed conduit is suitable generally for all applications. Surface conduit work may be adopted in places like workshops, plant rooms, pump rooms, wiring above false ceiling/below false flooring, and at locations where recessed work may not be possible to be done. The type of work, viz. surface or recessed, shall be as specified in the respective works. Flexible conduits may only be permitted for interconnections between switchgear, DBs and conduit terminations in wall.

11.3. Material

11.3.1 Conduits

- (a) All rigid conduit pipes shall be of steel and be ISI marked (IS 9537: part 2 :1981 (reaffirmed 2017)). The wall thickness shall be not less than 1.6 mm (16 SWG) for conduits upto 32 mm dia and not less than 2 mm (14 SWG) for conduits above 32 mm dia. The wall thickness of the steel conduit shall be as per relevant IS.
- (b) These shall be solid drawn or reamed by welding and finished with galvanized or stove enamelled surface.
- (c) The maximum number of PVC insulated cables conforming to IS 694: 2018 that can be drawn in one conduit is given size wise in Table 4.1 below, and the number of cables per conduit shall not be exceeded. Conduit sizes shall be selected accordingly in each run.
- (d) No steel conduit less than 20 mm in diameter shall be used.

11.3.2 Conduit Accessories

- (a) The conduit wiring system shall be complete in all respects, including their accessories.
- (b) All conduit accessories shall be of threaded type, and under no circumstances pin grip type or clamp grip type accessories shall be used.
- (c) Bends, couplers etc. shall be solid type in recessed type of works and

- may be solid or inspection type as required, in surface type of works.
- (d) (i) Saddles for surface conduit work on wall shall not be less than 0.55 mm (24 gauges) for conduits up to 25 mm dia and not less than 0.9 mm (20 gauges) for larger diameter. The corresponding width shall be 19 mm & 25 mm.
 - (ii) The minimum width and the thickness of girder clips used for fixing conduits to steel joists, and clamps shall be as per Table 4.2 below.
 - (e) All accessories of steel conduit like junction box, bend etc. shall be ISI marked only (BIS 14768 Part 2 : 2003 Conduit fittings and BIS 3837:1976, Reaffirmed 2006, Accessories for Rigid Steel Conduit).
 - (f) For the connections between the ceiling to the fitting (in the areas having false ceiling), flexible GI conduit with helical construction along GI couplers on both the ends shall be used.

11.3.3 Outlets

- (a) 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 3 mm and in case of welded mild steel sheet boxes, the wall thickness shall not be less than 1.2 mm (18 gauge) for boxes up to 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 as per chapter 15 of these Specifications. The modular switch boxes shall be of required number of modules, made of GI sheet steel and compliant to relevant BIS.
- (b) Where a large number of control switches and/or fan regulators are required to be installed at one place, these shall be installed in more than one outlet box adjacent to each other for ease of maintenance.
- (c) An earth terminal with stud and 2 metal washers and terminal block shall be provided in each MS box for termination of protective conductors and for connection to socket outlet/metallic body of fan regulator etc.
- (d) A metal strip shall be welded/screwed, to the metal box as support if tumbler type of control switches, sockets and/or fan regulators in flush pattern.
- (e) 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.
- (f) 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.
- (g) Except where otherwise stated, 3 mm thick phenolic laminated sheets as per clause 3.14(c) shall be fixed on the front with brass screws, or aluminium alloy/ cadmium plated iron screws as approved by the Engineer-in-charge.

11.4. Installation

11.4.1 Common Aspects for Recessed and Surface Conduit Works

(a) Conduit Joints

- (i) The conduit work of each circuit or section shall be completed before the cables are drawn in.
- (ii) Conduit pipes shall be joined by means of screwed couplers and screwed accessories only. Threads on conduit pipes in all cases shall be between 13 mm to 19 mm long, sufficient to accommodate pipes to full threaded portion of couplers or accessories.
- (iii) Cut ends of conduit pipes shall have no sharp edges, nor any burrs left to avoid damage to the insulation of the conductors while pulling them through such pipes.
- (iv) The Engineer-in-charge, with a view to ensuring that the above provision has been carried out, may require that the separate lengths of conduit etc., after they have been prepared, shall be submitted for inspection before being fixed.
- (v) No bare threaded portion of conduit pipe shall be allowed, unless such bare threaded portion is treated with anticorrosive preservative or covered with approved plastic compound.

(b) Bends in Conduit

- (i) 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.
- (ii) No length of conduit shall have more than the equivalent of four quarter bends from outlet to outlet.
- (iii) Conduit fittings shall be avoided as far as possible on conduit system exposed to weather. Where necessary, solid type fittings shall be used.

(c) Outlets

- (i) All outlets such as switches, wall sockets etc. may be either flush mounting type, or of surface mounting type, as specified in the Additional Specifications.
- (ii) All switches (except piano type switches), socket outlets and fan regulators shall be fixed on metal strips which shall be screwed / welded to the box. Piano type switches and accessories shall be fixed on the phenolic laminated sheet covers in flush pattern.

(d) Painting after Erection

After installation, all accessible surfaces of conduit pipes, fittings, switch and regulator boxes etc. shall be painted in compliance with the clauses under Chapter 15 "Painting".

11.4.2 Additional Requirements for Surface Conduit Work

- (a) Painting before Erection
The outer surface of conduit including all bends, unions, tees, junction boxes etc. forming part of the conduit system, shall be adequately protected against rust when such system is exposed to weather, by being painted with 2 coats of red oxide paint applied before they are fixed.
- (b) Fixing Conduit on Surface
 - (i) Conduit pipes shall be fixed by saddles, secured to suitable approved plugs with screws in an approved manner at an interval of not more than one meter, but on either side of the couplers or bends or similar fittings, saddles shall be fixed at a distance of 30 cm from the center of such fittings.
 - (ii) Where conduit pipes are to be laid along the trusses, steel joists etc. the same shall be secured by means of saddles or girder clips or clamps as required by the Engineer-in-charge.
 - (iii) In long distance straight run of conduit, inspection type couplers at reasonable intervals shall be provided, or running threads with couplers and jam nuts shall be provided.
- (c) Fixing Outlet Boxes
Only portion of the switch box shall be sunk in the wall, the other portion being projected out for suitable entry of conduit pipes into the box.

11.4.3 Additional Requirements for Recessed Conduit Work

- (a) Making Chase
 - (i) The chase in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the manner desired.
 - (ii) 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.
 - (iii) 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.
- (b) Fixing Conduits in Chase
 - (i) The conduit pipe shall be fixed by means of staples, J-hooks, or by means of saddles, not more than 60 cm apart or by any other approved means of fixing.
 - (ii) All threaded joints of conduit pipes shall be treated with some approved preservative compound to secure protection against rust.
- (c) Fixing Conduits in RCC Work
 - (i) The conduit pipes shall be laid in position and fixed to the steel reinforcement bars 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.

- (ii) 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.
 - (iii) 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.
- (d) Fixing Inspection Boxes
- (i) Suitable inspection boxes to the minimum requirement shall be provided to permit inspection and to facilitate replacement of wires, if necessary.
 - (ii) 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: 1988.
 - (iii) Suitable ventilating holes shall be provided in the inspection box covers.

11.4.4 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.

Fish Wire

To facilitate subsequent drawing of wires in the 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.

Bunching of Cables

- (i) Cables carrying Direct Current may, if desired, be bunched whatever their polarity, but cables carrying alternating current, if installed in metal conduit shall always be bunched so that the outgoing and return cables are drawn into the same conduit.
- (ii) Where the distribution is for single phase loads only, conductors for these phases shall be drawn in one conduit.
- (iii) In case of three phase loads, separate conduits shall be run from the distribution boards to the load points, or outlets as the case may be.

11.4.5 Earthing Requirements

- (a) The entire system of metallic conduit work, including the outlet boxes and other metallic accessories, shall be mechanically and electrically continuous by proper screwed joints, or by double check nuts at terminations. The conduit shall be continuous when passing through walls or floors.

- (b) A protective earthing conductor(s) shall be laid inside the conduit between the metallic switch boxes and distribution switch boards and terminated with proper earth lugs/ terminals. Only PVC insulated copper conductor cable of specified size green in colour shall be allowed.
- (c) The protective conductors shall be terminated properly using earth studs, earth terminal block etc. as the case may be.
- (d) Gas or water pipe shall not be used as protective conductor (earth medium).

Maximum Number of PVC Insulated 650/1100 V grade Aluminium / Copper Conductor Cable conforming to IS 694:2018

[Clause 4.2.1 (ii)]

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	2	3	4	5	6	7	8	9	10	11	12	13
1.50	5	4	10	8	18	12	–	–	–	–	–	–
2.50	5	3	8	6	12	10	–	–	–	–	–	–
4	3	2	6	5	10	8	–	–	–	–	–	–
6	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 capacity of conduits for a simultaneous drawing in 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' apply to runs of conduit, which deflect from the straight by an angle of more than 15 degrees.
- (3) Conduit sizes are the nominal external diameters.

Girder Clips or Clamps

[Clause 4.2.2 (iv) b]

Size of Conduit	Width	Thickness
(i) 20 mm	19 mm	0.9 mm (20 SWG)
(ii) 25 mm	19 mm	0.9 mm (20 SWG)
(iii) 32 mm & above	25 mm	1.2 mm (18 SWG)

11.5. Mandatory test :

The Mandatory Test are applicable for original works (original Works means all new constructions, site preparation, additions and alterations, special repairs to newly purchased or previously abandoned buildings or structures, including re-modelling or replacement).

The following below mentioned tests are the mandatory tests for rigid steel conduit:-

- (1) Bending Test
- (2) Compression Test
- (3) Resistance to Heat test
- (4) Resistance to Burning Test
- (5) Electrical Characteristics Test

The Testing including sampling shall be done as per BIS 9537: part 2:1981 (Reaffirmed 2017).

11,000 VOLT GRADE CABLES

1. GENERAL

Technical specifications in this section cover supply and laying of 11kV HT cables.

2. APPLICABLE STANDARDS AND CODES

The Standards and Codes applicable to the works are listed in Annexure I of the tender document and may be referred to.

3. 11 KV GRADE POWER CABLES

Conforming to IS 7098 Part II

3.1 Aluminium Conductor cables

		Standard Cables as per IS 7098 Part II	Cables with ZHLS sheathing	Cables with FR sheathing
	SPECIFICATIONS APPLICABLE TO ALL TYPES OF CABLES			
3.1.1	Voltage Grade	11,000 Volts		
3.1.2	Conductor	Electrolytic aluminium of H2 or H4 grade as per IS 8130		
3.1.3	Conductor screening	Layer of semi-conducting material		
3.1.4	Conductor Insulation	XLPE insulation of high purity shall be extruded		
3.1.5	Insulation screening (non mettalic) and mettalic	Layer of semi-conducting material and copper tape to prevent partial discharge at insulation surface		
3.1.6	Inner Sheath	PVC type ST2 as per IS 5831:1984		
3.1.7	Armouring	Galvanized strip steel armouring		
3.1.8	Outer Sheath	PVC type ST2 as per IS 5831:1984	Zero Halogen Low Smoke (ZHLS) extruded PVC sheathing	Fire Resistant Low smoke extruded PVC sheathing
3.1.8	Manufacturers Marking	The outer sheath shall bear the manufacturer's name and trade mark at every meter length		

3.2 Copper Conductor cables

The specifications shall be the same as in para 3.1 above other than that Conductor material as per para 3.1.2 shall be "Electrolytic grade copper (99.97% purity) as per IS 8130"

3.3 1100 VOLT GRADE POWER CABLES

1. Aluminium Conductor cables

		Standard Cables as per IS 7098 Part II	Cables with ZHLS sheathing	Cables with FR sheathing
	SPECIFICATIONS APPLICABLE TO ALL TYPES OF CABLES			
1.1	Voltage Grade	1100 volts		
1.2	Conductor	Electrolytic grade aluminium H2 or H4 grade as per IS 8130 Stranded circular for sizes upto 10 sq mm Stranded compacted sector shaped 16 Sq. mm. and above		
1.3	Conductor Insulation	XLPE insulation		
1.4	Inner Sheath	Extruded PVC type ST2 as per IS 5831:1984		
1.5	Armouring	Galvanized steel wire for cable size upto 4 x 10 sq mm and 2 x 16 sq mm Galvanised strip steel for cable sizes 3 x 16 sq mm and above.		
1.6	Outer Sheath	PVC type ST2 as per IS 5831:1984	Zero Halogen Low Smoke (ZHLS) extruded PVC sheathing	Fire Resistant Low smoke extruded PVC sheathing
1.7	Manufacturers Marking	The outer sheath shall bear the manufacturer's name and trade mark at every meter length		
1.8	Colour Coding	1 Core : Red/Black/Yellow/Blue 2 Core : Red and Black 3 Core : Red, Yellow and Blue 3 ½ /4 Core : Red, Yellow, Blue and Black		

2. 1100 Volt Grade Control Cables

		Cables as per IS:1554/ P-I/88	Cables with ZHLS Sheathing	Cables with FR sheathing
2.1	Voltage Grade	1100 Volts		
2.2	Conductor	Electrolytic grade stranded copper conductor as per IS:8130		
2.3	Conductor insulation	PVC Type-A as per IS:5831		
2.4	Inner Sheath	PVC Type ST-I as per IS:5831		
2.5	Armouring	Galvanised steel wire/strip as per IS:3975		
2.6	Outer Sheath	PVC Type ST-I as per IS:5831	Zero Halogen Low Smoke (ZHLS)	Fire resistant Low Smoke extruded PVC sheathing

			compound sheathing	
2.7	Manufacturers Marking	The outer sheath shall bear the manufacturer's name, trade mark, voltage grade, size & sequential length marking at every meter		
2.8	Colour Coding	1 core – Red/Black/ Yellow/ Blue		
		2 core – Red & Black		
		3 core – Red, Yellow & Blue		
		4 core – Red, Yellow, Blue & Black		
		5 core – Red, Yellow, Blue, Black & Grey		
		6 core & Above – By numbering on cores.		

3.0 Copper Conductor cables

The specifications shall be the same as in para 4.1 above other than that Conductor material as per para 4.1.2 shall be "Electrolytic grade copper (99.97% purity) as per IS 8130"

4.0 DEFINITION OF CABLES

All cables shall be identified as per the following codes

		First Letter	Second Letter	Third Letter	Fourth Letter
4.1	Conductor				
-	Aluminium	A			
-	Copper	No Letter			
4.2	Conductor Insulation				
-	XLPE		2X		
-	PVC		Y		
4.3	Armouring				
-	Steel wire			W	
-	Steel strip			F	
-	Aluminium wire			Wa	
-	Aluminium strip			Fa	
4.4	Outer Sheath				
-	PVC				Y

5.0 CABLE RATINGS

The cables have been selected based on the current ratings on the following conditions.

- a) Maximum conductor temperature 90° C for XLPE
- b) Ambient air temperature 40° C
- c) Ground temperature 30° C
- d) Depth of laying LT Cable 900 mm
- e) Depth of laying HT Cable 1200 mm

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shall recheck the sizes before cables are fixed and connected to service.

6.0 GI CABLE TRAYS

6.1	Construction	Fabricated from perforated sheet steel doubled bend channel complete with tees, elbows, risers, and all necessary hardware. Trays shall not have sharp edges, burrs or projections injurious to cable insulation. Width of the horizontal arms of the support structure shall be same as the tray width plus length required for threading /bolting /welding to the vertical supports. The length of vertical supporting members for horizontal tray runs shall be to suit the number of tray tiers required. All bends T, off sets shall be factory fabricated.
6.2	Installation of cable trays	Cable trays shall be mounted on support structure. Spacing of the support structure shall be such that the cable trays shall remain perfectly horizontal without buckling when fully loaded with cable runs.
6.3	Final painting	Cable trays and accessories shall be painted with two coats of red oxide zinc chromate primer after proper surface preparation and two finishing coats of synthetic enamel paint of approved make
6.4	Earthing	Cable trays shall be earthed by 2 runs of 25 mm x 6 mm GI strips through out their lengths.
6.5	Mounting clearances	Minimum clearance between the top most tray tier and the ceiling shall be 300 mm.

7.0 DELIVERY, STORAGE AND HANDLING

7.1	Cables storage	Both ends of cables shall be properly sealed to prevent moisture ingress.
7.2	Storage	On a well drained, hard surface, preferably of concrete in well ventilated area protected from sun and rain During storage drums shall be rolled once in 3 month through ninety degrees. Drums shall always be rested on the flanges and not on flat sides Drums shall not be dropped even from a small height
7.3	Transportation	Drums shall either be mounted on drum wheels or on trailers and pulled by ropes Drums shall be unloaded preferably by crane

8.0 LAYING OF CABLES

8.1 General

8.1.1	Cable laying	In masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts
8.1.2	Maximum Bending radius	1100 volt cables.....12 times the overall diameter of the cable 11000 volt cables.....15 times the overall diameter of the cable 11000 Volt Cables.....25 times the overall diameter of the cable
8.1.3	Laying of cables with Different Voltages	Cables of different voltages shall be laid in different trenches. Wherever not possible LT cables shall be laid above HT cables.
8.1.4	Cable crossings	The cables of higher voltage shall be laid at a lower level than the cables of lower voltage.
8.1.5	Power and Communication cables	Power and communication cables shall cross at right angles. Horizontal and vertical clearances shall not be less than 600 mm.
8.1.6	Cable markers	Cable marker tags of approved type inscribed with cable details shall be permanently attached to cables at entry points to the building and in locations like manholes, pull pits etc.

8.2 Cables laid in Masonry Trenches

8.2.1	MS Supports and Spacing	Laid on painted MS supports fabricated from minimum 38mm x 38mm x 6mm painted / galvanized angle iron supports grouted in trench walls at intervals not exceeding 600 mm.
8.2.2	Multi tiers	If required, cables shall be arranged in tier formation
8.2.3	Clamps and Saddles	Suitable clamps, hooks and saddles shall be used for securing the cables in position
8.2.4	Cable dressing	Ensure the clear spacing between the cables shall not be less than the diameter of the cable.
8.2.5	Trench filling	After dressing of cables, trenches shall be filled with fine sand as directed.
8.2.6	Trench covers	Chequered plate/RCC covers.

8.3 Cables laid on cable trays

8.3.1	Cable dressing	Ensure the clear spacing between the cables shall not be less than the diameter of the cable.			
8.3.2	Cable Clamping	Type of cables	Size	Clamping by	Spacing
		LT	Upto 25 sq mm	MS Saddles 1 mm thick	45 cm
		LT & HT	35 sq mm to 120 sq mm	MS Clamps 3 mm thick 25 mm wide	60 cm
		LT & HT	150 sq mm and above	MS Clamps 3 mm thick 40 mm wide	60 cm
	Spacing specified applies to straight runs. In the case of bends, additional clamping shall be provided at 30 cm from the center of the bend on both sides.				

8.4 Laying In Pipes/Closed Ducts

8.4.1	Type of Pipes	Spun reinforced concrete or PVC pipes shall be used for such purposes
8.4.2	Installation conditions	Single cable ...Pipe diameter shall not be less than 100 mm Multiple cables ...Minimum diameter of pipe 150 mm Top surface of pipes shall be at a minimum depth of 600 mm from the ground level
8.4.3	Pipe cleaning	Pipes shall be continuous, clear of debris or concrete and sharp edges at ends smoothed before cable is drawn.

8.5 Laying Of Cables In Floors

8.5.1	Restricted	Only with prior approval of Engineer –in-charge.
8.5.2	Installation Conditions	No cables to be laid directly in floors Cable laying only in GI pipes of adequate size

8.6 Buried Directly In Ground

8.6.1	General conditions	All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them.
8.6.2		Any telephone or other cables coming in the way are to be properly shielded as directed by Engineer-in-Charge
8.6.3		Route of the cables shall be decided with the Engineer-in-Charge. While shortest practicable route shall be preferred, cable runs shall preferably follow roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy.
8.6.4		The LV/MV cables shall be laid further from the kerb line than HV cables
8.6.5	Trench width	Single cable.....minimum width 350 mm. Multiple cables in horizontal formation maintain inter-axial spacing between the cables minimum 200 mm Minimum clearance of 150 mm between axis of the end cables and the sides of the trench.
8.6.6	Trench depth	1100 volt cables Single tier formation depth minimum750 mm Multiple vertical tier additional.....300 mm per tier 11000 volt cables Single tier formation depth minimum1250 mm Multiple vertical tier additional.....300 mm per tier
8.6.7	Excavation of Trenches	Excavate in reasonably straight lines. For change in direction, suitable curvature of 12D/15D as above All gradients and changes in depths shall be gradual.

		<p>Excavated soil shall be stacked firmly to ensure no collapse. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Engineer-in-Charge.</p> <p>Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Engineer-in-Charge.</p> <p>The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required.</p> <p>If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Excavation through lawns shall be done in consultation with the Engineer-in-Charge.</p> <p>Bottom of the trench shall be level and free from stone, brick, etc.</p>
8.6.8	Laying of cables	<p>The cable drum shall be properly mounted on jacks or on a cable wheel and it shall be ensured that the spindle, jack etc are strong enough to carry the weight of the drum and the spindle is horizontal in the bearings</p> <p>The cable shall be pulled over rollers in the trench steadily and uniformly without jerks or strains.</p> <p>The entire cable length shall, as far as possible, be laid in one stretch.</p> <p>If this is not possible the remainder of the cable shall be removed by flaking i.e. making one long loop in the reverse direction.</p> <p>After the cable is laid over the rollers it shall be lifted slightly over the rollers beginning from one end and drawn straight. The cable shall then be taken off the rollers and laid in the trench in a reasonably straight line.</p> <p>For short runs and cable sizes upto 50 sq mm 1.1 kV grade the alternative method of direct handling can be adopted with the prior approval of the Engineer-in-Charge.</p>
8.6.9	Testing and measuring cable	<p>When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance and cable measured. Suitable moisture sealing compound/tape shall be used for sealing of the ends.</p>
8.6.10	Cable protection	<p>Trench Base Cushion 80 mm layer of clean dry sand</p> <p>Single tier 170 mm covering of clean dry sand above base cushion</p>

		<p>vertical multi-tier sand cushion of 300 mm after first layer of cables</p> <p>Each additional tiers shall have a sand cushion of 300 mm. Top most cable shall have a final sand covering not less than 170 mm</p> <p>Final protective cover with second class bricks of not less than 200 mm x 100 mm x 100 mm (normal size) laid breadth wise for the full length of the cable covering all the cables and projecting minimum 50 mm over the sides of the end cables.</p> <p>In addition bricks on edge shall be placed along the entire run on either side of the cable run.</p>
8.6.11	Finishing trenches	<p>Back filling with excavated earth free from stones or other sharp edged debris and ramming and watering in successive layers not exceeding 300 mm. Unless otherwise specified a crown of earth not less than 50 mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence.</p> <p>Where road berms or lawns have been cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Engineer-in-Charge and all surplus earth and rocks removed to places as specified.</p>
8.6.12	Cable route markers	<p>Cable route markers made out of 100 mm x 5 mm GI plates bolted to 35 mm x 35 mm x 6 mm x 60 cm long angle with details of cables shall be installed at intervals not exceeding 100 m in straight runs and at cable bends. Underground joints shall also be identified with markers.</p>

8.7 Cable Entry Into Buildings

- Cable entry into buildings through RCC pipes recessed in the floor.
- RCC Hume pipes shall slope down wards from the building.
- The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water.
- Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

8.8 Wall / Floor Crossing

- Adequately sized sleeves shall be provided for all wall and floor crossings. The annular space around the cables at either ends shall be sealed with fire resistance packing material.

9.0 TERMINATION/JOINTING OF CABLES

9.1	1100 volt Grade cables	
9.1.1	Type of jointing	NO Soldered jointing/termination shall be totally avoided. Only Solderless crimped terminations to be provided
9.1.2	Compression Glands	double compression glands
9.1.3	Crimping Tools	Any terminations may without use of proper crimping tool is shall be liable to be rejected.
9.1.4	Conductor cleaning	Conductor oxidation shall be cleaned with emery paper and a thin coat of tin applied before crimping into any equipment.
9.2	11000 volt grade cables	
9.2.1	Terminations	Heat shrinkable terminations shall be provided for High Voltage cables

9.3 MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap in joints. The rate shall include all the above mentioned material, labour etc for laying as required.

10.0 CABLE LOOPS

At the time of the installation approximately 3 meters of surplus cable shall be left

- at each end of the cable
- on each side of underground straight through/tee/termination joints.
- at entries to buildings
- and such other places as may be decided by the Engineer-in-Charge .

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at 200 m intervals or as specified by the Engineer-in-Charge.

11.0 BONDING OF CABLES.

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

12.0 TESTING

12.1 Tests at Manufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards IS 10810 to prove the design and general qualities to the cables as below

- Routine test on 100% of cables.
 - Conductor resistance test,
 - High voltage test,
- Acceptance tests on drums chosen at random as per IS 7098 for acceptance of the lot.
 - Annealing test for copper,
 - Aluminium - tensile test,
 - Aluminium wrapping test
 - Conductor resistance test

- Thickness of insulation and sheath
- Hot set test for insulation
- Tensile strength and elongation at break test for insulation and sheath
- High voltage test
- Insulation resistance test (volume resistivity)
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

12.2 Site Testing

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2,500/5,000 V megger for cables of higher voltages. The cables cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shall be subject to above mentioned test during laying, before covering the cables by protective covers and back filling and also before the jointing operations.
- After laying and jointing, the cable shall be subjected to a 15 minutes AC/DC pressure test. In the absence of facilities for pressure testing, it is sufficient to test for one minute with 1000 V megger for cables of 1.1 kV grade and with 2500/5000 V megger for cables of higher voltages.

12.3 Witnessing of Testing

Tests shall be performed in presence of representative of Engineer-in-Charge. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

EXTERNAL LIGHTING WORKS

1 Materials

1.1 Steel Tubular Poles

- i) These shall conform to IS : 2713 (Parts 1 to 3) – 1980. These shall be of seamless/swaged and welded type in three stepped sections as specified.
- ii) The pole shall be complete with cap and base plate.
- iii) Unless otherwise specified, on sixth of the length on the pole plus 30 cm from its base shall be coated with black bituminous paint, both internally and externally. The remaining portion of the pole shall be painted with one coat of red oxide primer on its external surface.
- iv) Street lighting poles shall be of appropriate length, after taking into account the bracket design to meet the lighting design. The stresses likely to be experienced due to wind, and weight of the bracket and luminaires shall be the guiding factor for the selecting the pole section as per relevant BIS.

1.2 Brackets

Brackets for luminaires with discharge lamps shall be of GI or MS, with or without an extension pipe piece welded to the same, as may be required to fix the luminaires thereto.

Pole bracket shall be at angle of 12° from the horizontal. GI set nut-bolts shall be used for fixing arrangement.

1.3 Looping box

- i) A looping box shall be provided with every pole having underground cable connection.
- ii) The looping box shall be fabricated out of 2 mm (14 SWG) thick MS sheet, with hinged front cover having allen key locking arrangement. The hinge should preferably be at the top to enable self-closing of the cover. Neoprene rubber gasket shall be provided under cover
- iii) The looping box shall be of minimum size 200 mm x 200 mm x 150 mm where 2 core cables are involved, minimum 250 mm x 300 mm x 150 mm where 4 core cables are involved, or any other specified size to suit the individual site requirements.
- iv) The box shall be complete with brass compression gland (s) of appropriate size (s) if specified, earth stud, two MS clamps of 25 mm x 3 mm section for fixing to the pole, the required number of terminal blocks with brass connector strips and fuse carrier with base/MCB, as specified.
- v) The box shall be treated with anti-corrosive paint before erection.

1.4 Installation

- i) Poles shall be fixed in cement concrete 1:3:6 (1 cement: 3 coarse sand : 6 graded stone aggregate of 40 mm nominal size) foundation with not less than 20 cm thick layer of the cement concrete all-round the support, the foundation being continued above ground level as specified and tapered suitably into a collar.
- ii) Where the work involves provision of looping boxes for cables in street lighting works, these should be installed at 60 cm from ground level or above high flood level whichever is more. The cables shall be routed from ground through GI pipes of suitable size to the looping box. These pipes shall be suitably bent outwards and embedded when the foundation work is done, thus avoiding any cutting later.

- iii) Looping boxes for compound lighting poles may be installed within the concrete pedestal for the poles (before casting of the pedestal) at such a height cables entry pipe (s) shall be fixed to the box, properly bent outwards, when fixing the box to the pole. Necessary cable entry pipe (s) shall be fixed to the box, properly bent outwards, when fixing the box to the pole. Necessary chamfering should be done on the pedestal to enable lifting the front cover of looping box and having proper access inside for maintenance.
- iv) Brackets for luminaries shall be fixed to the poles firmly so as not to be disturbed by wind or by manual pressures during maintenance. Clamps, locking studs or any other reliable means shall be adopted for this purpose. The luminaries shall be fixed to the brackets firmly such that they are not disturbed by wind, vibration due to traffic etc. Arrangement, if any recommended by the manufacturer, should be followed.
- v) Wiring of poles from looping box to the fittings should be done with specified size of copper conductor PVC insulated cables.
- vi) Where compression type glands are used with the boxes, the cables shall be terminated on to them. Where the cable entry pipes are terminated directly on to the boxes, without the provision of cable gland (s), suitable metallic clamp shall be provided with each cable end for earthing the cable armour through the earth terminal in the boxes.
- vii) The poles shall be painted in approved colour with 2 coats of approved paints suitable for outdoor applications. The interior of the looping boxes shall be painted with synthetic enamel paint. All poles shall be numbered with figure height of 30 mm

1.5 Earthing

- i) Though earth continuity shall be ensured through cable armour, earthing of pole with 2 nos of 8 SWG tinned copper wires each 8 m long coiled in one meter dia at a depth of 1400 mm below ground level shall be provided
- ii) The luminaire body shall be connected to the earth stud in the looping box by bare aluminium conductor.

2. MEDIUM VOLTAGE CABLES

2.1. GENERAL

Technical specifications in this section covers supplying and laying of :

- Medium voltage cables.

2.2. STANDARDS AND CODES

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents.

PVC insulated heavy duty cables

IS 1554 - 1988

Cross link polyethylene insulated PVC (sheathed XLPE cables)	IS 7098 – 1985
Code of practice for installation and maintenance of power cables	IS 1255 – 1983
Conductors for insulated electrical cables	IS 8130 - 1984
Drums for electrical cable	IS 10418 - 1982
Methods of test for cables	IS 10810 - 1988
Recommended current rating	IS 3961 - 1987
Recommended short circuit rating of high voltage PVC cables	IS 5891 - 1970

2.3. CABLES

2.3.1. Medium Voltage Cables

Medium voltage cables shall be aluminium conductor PVC insulated, PVC sheathed armoured conforming to IS 1554. Cables shall be rated for a 1100 Volts. The conductor of cables from 16 Sq. mm. to 50 Sq. mm. shall be stranded. Sector shaped stranded conductors shall be used for cables of 50 sq. mm and above. Conductors shall be made of electrical purity aluminium 3/4 H or H temper. Conductors shall be insulated with high quality PVC base compound. A common covering (bedding) shall be applied over the laid up cores by extruded sheath of unvulcanised compound. Armouring shall be applied over outer sheath of PVC sheathing. The outer sheath shall bear the manufacturer's name and trade mark at every meter length. Cores shall be provided with following colour scheme of PVC insulation.

1 Core	:	Red/Black/Yellow/Blue
2 Core	:	Red and Black
3 Core	:	Red, Yellow and Blue
3 1/2 /4 Core	:	Red, Yellow, Blue and Black

Current ratings shall be based on the following conditions.

- a) Maximum conductor temperature 70 0 C
- b) Ambient air temperature 450 C
- c) Ground temperature 300 C
- d) Depth of laying 1000 mm

Short circuit rating of cables shall be as specified in IS 1554 Part-I.

Cables have been selected considering conditions of maximum connected loads, ambient temperature, grouping of cables and allowable voltage drop. However, the contractor shall recheck the sizes before cables are fixed and connected to service.

2.4. DELIVERY, STORAGE AND HANDLING

Cable drum shall be stored on a well drained, hard surface, preferably of concrete, so that the drums do not sink in ground causing rot and damage to the cable drum. The cable drum shall conform to IS 10418. During storage, periodical rolling of drums, in the direction of arrow marked on the drum, shall be done once in 3 month through 90o C Both ends of cables shall be properly sealed to prevent moisture ingress Drums shall be stored in well ventilated area protected from sun and rain. Drums shall always be rested on the flanges and not on flat sides. Damaged battens of drums etc. shall be replaced. Movement of drums shall always be in direction of the arrow marked on the drum. For transportation over long distance, the drums shall either be mounted on drum wheels and pulled by ropes or they shall be mounted on trailers etc. drums shall be unloaded preferably by crane otherwise they shall be rolled down carefully on

suitable ramps. While transferring cable from 1 drum to another, the barrel of the new drum shall have diameter not less than the original drum. Cables with kinks or similar visible defects like defective armouring etc shall be rejected. Cables shall be supplied at site in cut pieces as per actual requirements.

2.5. LAYING OF CABLES

Cables shall be so laid that the maximum bending radius is 12 times the overall diameter of the cable for medium voltage cables and 15 times the overall diameter for 11 kV cables. Cables shall be laid in masonry trenches, directly on walls/cable trays, directly buried in ground or in pipes/ducts as elaborated below. Cables of different voltages and also power and control cables shall be laid in different trenches with adequate separation. Wherever available space is restricted such that this requirement cannot be met, medium voltage cables shall be laid above HT cables.

2.5.1 Buried Directly In Ground

2.5.1.1 General

Cables shall be so laid that they will not interfere with under ground structures. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected 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 as directed by Architects/Owners. Surface of the ground shall be made good so as to conform in all respects to the surrounding ground to the satisfaction of Architects/ Owners.

2.5.1.2 Routing of cables

Before cable laying work is undertaken, the route of the cables shall be decided with the Architects/Owners. While shortest practicable route shall be preferred, cable runs shall follow fixed development such as roads, footpaths etc with proper off-sets so that future maintenance and identification are rendered easy. Whenever cables are laid along well demarcated or established roads, the LV/MV cables shall be laid further from the kerb line than HV cables. Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted, LV/MV cables shall be laid above HV cables. Where cables cross one another, the cables of higher voltage shall be laid at a lower level than the cables of lower voltage. Power and communication cables shall as far as possible cross at right angles. Where power cables are laid in proximity to communications cables the horizontal and vertical clearances shall not normally be less than 60 cm.

2.5.1.3 Width Of Trench

The width of trench shall be determined on the following basis. The minimum width of trench for laying single cables shall be 350 mm. Where more than one cable is to be laid in the same trench in horizontal formation, the width of trench shall be increased such that the inter-axial spacing between the cables except where otherwise specified shall be at least 200 mm. There shall be a clearance of at least 150 mm between axis of the end cables and the sides of the trench.

2.5.1.4 Depth Of Trench

The depth of trench shall be determined on the following basis:

- Where cables are laid in single tier formation, the total depth of the trench shall not be less than 750 mm for cables upto 1.1 kV and 1250 mm for cables above 1.1 kV.

- When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of trench shall be increased by 300 mm for each additional tier to be formed.

2.5.1.5 Excavation Of Trenches

The trenches shall be excavated in reasonably straight lines. Wherever there is a change in direction, suitable curvature of 12 times the overall diameter of the largest cable shall be provided. Where gradients and changes in depths are unavoidable these shall be gradual. Excavation should be done by any suitable manual or mechanical means. Excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench. Adequate precautions shall be taken not to damage any existing cables, pipes or other such installations during excavation. Wherever bricks, tiles or protected covers or bare cables are encountered, further excavation shall not be carried out without the approval of the Architects/ Owners. Existing property exposed during trenching shall be temporarily supported or propped adequately as directed by the Architects/ Owners. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables therein and the trench refilled as required. If there is any danger of a trench collapsing or endangering adjacent structures the sides shall be well shored up with timbering and/or sheathing as the excavation proceeds. Where necessary these may even be left in place when back filling the trench. Excavation through lawns shall be done in consultation with the Architects/ Owners. Bottom of the trench shall be level and free from stone, brick, etc. The trench shall then be provided with a layer of clean dry sand cushion of not less than 80 mm in depth.

2.5.1.6 Laying Of Cable In Trench

The cable drum shall be properly mounted on jacks or on a cable wheel at a suitable location. It should be ensured that the spindle, jack etc are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating. The cable shall be pulled over rollers in the trench steadily and uniformly without jerks or strains. The entire cable length shall, as far as possible, be laid in one stretch. However when this is not possible the remainder of the cable shall be removed by flaking i.e. making one long loop in the reverse direction. After the cable is uncoiled and laid over the rollers, the cable shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 metres apart and drawn straight. The cable should then be taken off the rollers by additional helpers lifting the cables and then laid in the trench in a reasonably straight line. For short runs and cable sizes upto 50 sq mm 1.1 kV grade the alternative method of direct handling can be adopted with the prior approval of the Architects/ Owners. If two or more cables are laid in the same trench care should be taken to preserve relative position. All the cables following the same routes shall be laid in the same trench. Cables shall not cross each other as far as possible. When the cable has been properly straightened the cores shall be tested for continuity and insulation resistance. The cable shall be measured thereafter. Suitable moisture sealing compound/tape shall be used for sealing of the ends. Cable laid in trenches in a single tier formation shall have a covering of clean dry sand of not less than 170 mm above the base cushion of sand before the protective cover is laid. In the case of vertical multi-tier formation after the first cable has been laid a sand cushion of 300 mm shall be provided over the initial bed before the second tier is laid. If additional tiers are formed each of the subsequent tiers also shall have a sand cushion of 300 mm. The top most cable shall have a final

sand covering not less than 170 mm before the protective cover is laid. A final protection to cables shall be laid to provide warning to future excavators of the presence of the cable and also to protect the cables against accidental mechanical damage. Such protection shall be with second class bricks of not less than 200 mm x 100 mm x 100 mm (normal size) laid breadth wise for the full length of the cable to the satisfaction of the Owners /Architects. Where more than one cable is to be laid in the same trench this protective covering shall cover all the cables and project at least 50 mm over the sides of the end cables. In addition bricks on edge shall be placed along the entire run on either side of the cable run. The trenches shall then be back filled with excavated earth free from stones or other sharp edged debris and shall be rammed and watered in successive layers not exceeding 300 mm. Unless otherwise specified a crown of earth not less than 50 mm in the centre and tapering towards the side of the trench shall be left to allow for subsidence. The crown of earth should however not exceed 100 mm so as not to be a hazard to vehicular traffic. Where road berms or lawns have been cut or kerb stones displaced the same shall be repaired and made good to the satisfaction of the Clients and all surplus earth and rocks removed to places as specified.

2.5.1.7 Laying In Pipes/Closed Ducts

In locations such as road crossings, entry to buildings/poles in paved areas etc., cables shall be laid in pipes or closed ducts. Spun reinforced concrete pipes shall be used for such purposes and the pipe shall not be less than 100 mm in diameter for a single cable and not less than 150 mm for more than one cable. These pipes shall be laid directly in ground without any special bed. Sand cushioning and/or brick tiles need not be used in such installations. Unless otherwise specified the top surface of pipes shall be at a minimum depth of 1000 mm from the ground level when laid under roads, pavements etc. The pipes for road crossings shall preferably be on the skew to reduce the angle of bend as the cable enters and leaves the crossing. Pipes shall be continuous and clear of debris or concrete before cable is drawn. Sharp edges at ends shall be smoothened to prevent injury to cable insulation or sheathing. No deduction shall be made for sand and bricks not used for cables passing through RCC Hume pipes or for parts of vertical cables at the lighting poles. Wherever so required, cables shall be laid at the bed of the lake through existing PVC pipe as itemized in bill of quantities.

2.5.1.8 Laying Of Cables In Floors

Laying of cables directly in floors shall be avoided and GI pipes of adequate size shall be used wherever necessary. However if the cables have to be laid direct in the floor specific written approval of architect/ Owners shall be obtained and the Contractor shall cut chases, lay the cables and make good the chases to original finish.

2.5.1.9 Cable Entry Into Buildings

Cable entry into buildings shall be made through RCC pipes recessed in the floor. RCC Hume pipes shall be provided well in advance for service cable entries. The pipe shall be filled with sand and sealed at both ends with bitumen mastic to avoid entry of water. Suitable size manholes shall be provided wherever required to facilitate drawing of cables as per requirements.

2.6 TERMINATION/JOINTING OF CABLES

Soldered jointing/termination shall be totally avoided. Solderless terminations by using Dowel crimping tools and suitable legs shall be adopted for all cable terminations. Any terminations may without use of proper crimping tool is shall be liable to be rejected.

In the case of aluminium conductors, it is to be ensured that the conductor oxidation is cleaned by means of emery paper and then a thin coat of tin is applied before pinching into any equipment. Heat shrinkable Raychem type or approved equivalent terminations shall be provided for High Voltage cables and Siemens make or approved equivalent make brass double compression glands shall be provided for Medium Voltage cable terminations. Straight through jointing of Medium Voltage or High Voltage cable shall normally be totally avoided. If absolutely unavoidable, such jointing shall be carried out as per procedure to be got specifically approved from Architect/Owners.

2.7. MEASUREMENT OF CABLE RUNS

The cable runs shall be measured upto the outer end of the boxes without any allowances for over lap in joints. The actual run of the cables shall be measured and the rate shall include all the above mentioned material, labour etc for laying as required.

2.8. CABLE LOOPS

At the time of the installation approximately 3 meters of surplus cable shall be left

- at each end of the cable
- on each side of underground straight through/tee/termination joints.
- at entries to buildings
- and such other places as may be decided by the architects/owners.

This cable shall be left in the form of a loop.

Wherever long runs of cable length are installed cable loops shall be left at suitable intervals as specified by the architect/owners.

2.9. BONDING OF CABLES.

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

2.10. TESTING

2.10.1 Tests At Manufacturer's Work

The cables shall be subjected to shop test in accordance with relevant standards to prove the design and general qualities to the cables as below (as per IS 10810) :

- Routine test on each drum of cables.
- Acceptance tests on drums chosen at random for acceptance of the lot.
- Type test on each type of cables, inclusive of measurement of armour DC resistance of power cables.

2.10.2 Site Testing

- All cables before laying shall be tested with a 500 V megger for 1.1 kV grade or with a 2,500/5,000 V megger for cables of higher voltages. The cables cores shall be tested for continuity, absence of cross phasing, insulation resistance to earth/sheath/armour and insulation resistance between conductors.
- All cables shall be subject to above mentioned test during laying, before covering the cables by protective covers and back filling and also before the jointing operations.
- After laying and jointing, the cable shall be subjected to a 1.5 minutes AC/DC pressure test.

- In the absence of facilities for pressure testing in accordance with clause__ above it is sufficient to test for one minute with 1000 V megger for cables of 1.1 kV grade and with 2,500/5,00 V megger for cables of higher voltages.

2.10.3 Test Witness

Tests shall be performed in presence of representative of Owners/Architect. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.

3.0 OUTDOOR TYPE DISTRIBUTION FEEDER PILLARS

The feeder pillar shall be of the floor mounting type, totally enclosed, and weather proof, conforming to ISI IP 54 incorporating phenolic moulded fuse fittings with high rupturing capacity cartridge fuse links having a certified rupturing capacity of not less than 35 MVA at 433 volts. The feeder pillar shall be suitable for 440 volts 3 phase 4 wires, 50 cycles AC supply.

The cubicle should be fabricated out of heavy gauge sheet steel of thickness not less than 2 mm thick with suitable side frame and stiffeners. Hinged doors of not less than 1.6 mm thick should be provided at the front and rear of the cubicle to provide access for installation, operation, tests and inspection. The rear door is provided to facilitate cable termination and the front door for inspection of fuses, to switch 'ON' and 'OFF' the switch as and when required. All doors should be fitted with dust excluding neoprene gaskets. The doors should also be fitted with suitable locking arrangement with lock to prevent unauthorized opening. The cubicle should be designed for mounting over cement concrete plinths by the roadside, and should be of substantial construction capable of withstanding the vibrations normally experienced due to vehicular traffic. The top of the feeder pillar is of slanting construction in all directions to prevent any collection of water due to rain. A gland plate is provided at the bottom of the feeder pillar (removable) for mounting the cable glands. The feeder pillar shall be fitted on an angle iron pedestal at the bottom covered with sheet metal from all the four sides which facilitates cable bending etc specially with aluminium cables. Two lifting hooks shall be provided at the top. A door switch shall be provided in the feeder pillar so as to switch 'ON' and 'OFF' the lamp fixed in the brass batten holder below the top sheet of the pillar.

The sheet steel materials used in the construction of the cubicle should have undergone a rigorous rust proofing process comprising alkaline degreasing, descaling in dilute sulfuric acid solution and recognised phosphating process. After metal treatment, the interior of the cubicle should be painted with two coats of air-drying red lead primer followed by two coats of air drying anti-condensation paint. The exterior of the cubicle should be painted with two coats of staving red oxide primer followed by one coats of epoxy finishing paint. One final spray of epoxy paint shall be applied at the time of handing over the installation.

All the nuts, bolts shall be cadmium plated with spring washers. A minimum spacing from cable connection to the bottom of gland plate shall be 300mm.

The bus bars should be of electrical grade copper. They should be air insulated with adequate clearances between conductors and between conductors and earth. These should be colour coded to enable immediate identification of the phases and neutral. The current density for bus bars shall not be more than 1.2 amps per square mm. All bus bar joints and tapings should be of the clamped type as far as possible thereby avoiding drilling of holes on bus bars. The bus bars should be carried on supports

made out of a suitable non-inflammable and non-hygroscopic material such as Hylam, Permali or Formics. Suitable insulating phase barriers should be provided to prevent accidental short-circuits during operation.

The fuse base contacts should be of copper comprising one top contact for bolting to the bus bar, one bottom contact for terminating the incoming or outgoing cable and a cable lug. The bottom contacts should be so designed that the cable tail from the cable gland to the cable lug is vertical and does not foul with any live parts in its run. The spacing between the respective fuse bases should not be less than 40mm.

The fuse carriers should be fitted as standard to all fuses to minimize accidental contact with live metal during inspection or maintenance. The carriers should be phenolic moulded, designed to accommodate HRC fuse-links and should incorporate a wedge action device for tightening the fuse-link to the base contact. This wedge action should be operated externally by insulated thumb screws giving uniformly high pressure contact and ensuring cool running under full load conditions, with positive location of the fuse-link tags on the base contact. The fuse-link shall not work loose due to vibration occurring from vehicular traffic.

A viewing aperture should be provided on the carrier to facilitate location of a 'blown' fuse. The fuse carriers should also be easily withdrawable in service. The design of the carrier should be such that carrier components do not carry any current and the contact is decidedly between fuse-link tag and base contact.

When incoming links are called for it should be possible to fit the carriers with solid links in lieu of fuses.

The neutral bus bar shall be rated at 100 % of the phase bus bars. The design should allow for neutral cable sockets to be fitted directly to the bus bars. A GI earth bar of size 40x5mm together with two cable eyes shall be provided for connections to earth pits. All the cables shall be terminated at ELEMEX terminal block and therefrom wiring shall be done with PVC insulated aluminium conductor cable to fuse units. The wiring shall be neatly bunched and shall be secured to wiring cradles.

A circuit cardholder to be made inside the front door and the card duly engraved / painted on aluminium / hylam sheet, Identification ferrules shall be used for incoming and outgoing cables.

DISTRIBUTION BOARDS (DB)

1.0 GENERAL

This section covers specification of Distribution Boards (DBs) suitable for operation on 415 V 3 Phase 4 wire 50 Hz supply feeding final lighting and power sub circuits.

2.0 APPLICABLE STANDARDS AND CODES

The Standards and Codes applicable to the works are listed in Annexure I of the tender document and may be referred to.

3.0 MINIATURE CIRCUIT BREAKERS

3.1	Operating System	240/415 volts 50 Hz
3.2	Fault withstand current Ics	10 kA
3.3	Protection	
3.4	Overload	Thermal
3.5	Short Circuit	Instantaneous magnetic
3.6	Characteristics	Inverse Time Current characteristic Curve B having instantaneous tripping at 3-5 In Curve C having instantaneous tripping at 5-10 In for lighting Curve D having instantaneous tripping at 10-20 In for high starting current equipment
3.7	Type Test Certificates	To be furnished with tenderer

4.0 RESIDUAL CURRENT CIRCUIT BREAKERS (RCCB)

4.1	Construction	2 pole construction for single phase and 4 pole construction for 3 phase.
4.2	Sensing element	Current
4.3	Sensitivity	trip within 20 mili sec at a current sensitivity of 30 mA
4.4	Life	minimum life expectancy of 20,000 operations

5.0 PRE WIRED DISTRIBUTION BOARDS

5.1	Ingress Protection	Totally enclosed, dust and vermin proof conforming to IP 42
5.2	Construction	Box and cover fabricated from 1.6 mm sheet steel Double door type with integral loose wire box. Access to the wiring shall be possible without removing the outer hinged door.
5.3	Mounting	Wall mounting, recessed/surfaced type
5.4	Bus Bars	Copper bus bar
5.5	Earthing Terminal	Two Earthing terminals inside box in case of three phase DB and one for single phase DB. Door earthed with insulated copper braided flexible wires
5.6	Internal Wiring	All internal wiring with FR 1100 volt grade copper conductor wires. Wiring from MCB's to phase terminal block Interconnection between terminal block/incoming switch / bus bar/neutral terminal block / earth terminal connector with specified size of FR pre-insulated copper conductor cable duly fitted with copper lugs / thimbles

		Colored terminal blocks and FR wires for easy identification of RYB phases, neutral and earth
5.7	Terminal Blocks	<p>Phase / neutral / earth terminal blocks for termination of incoming and outgoing wires.</p> <p>Terminal blocks should be suitable for termination of conductor / cable of required size but minimum rated cross section of the terminal blocks should be 6 sq mm</p> <p>Terminal block shall be made of flame retardant polymide material</p>
5.8	Finish	Pretreated, phosphotized with powder coated finish
5.9	Labels	Suitable engraved white on black name plates and identification labels of metal for all Circuits shall be provided.
5.10	Temporary Cover	The DB shall have peelable poly layer on the cover for protection from cement, plaster, paints etc. during the construction period.

EARTHING

1. GENERAL

All the non-current carrying metal parts of electrical installation shall be earthed properly. All metal conduits, trunking, cable sheaths, switchgear, distribution MCB boards, light fittings and all other parts made of metal shall be bonded together and connected by means of specified earthing conductors to an efficient earthing system. All earthing shall be in conformity with Indian Electricity Rules.

The Earthing System shall in totally comprise the following:-

- a) Earth Electrodes
- b) Earthing Leads
- c) Earth Conductors

All three phase equipment shall have two separate and distinct body earths and single phase equipment shall have a single body earth.

2. STANDARDS

All equipments, components, materials and entire work shall be carried out in conformity with applicable and relevant Bureau of Indian Standards and Codes of Practice, as amended upto date and as below. In addition, relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and /or IEC Standards shall be applicable.

Equipments certified by Bureau of Indian Standards shall be used in this contract in line with government regulations. Test certificates in support of this certification shall be submitted, as required.

It is to be noted that updated and current standards shall be applicable irrespective of dates mentioned along with ISS's in the tender documents

3. EARTHING MATERIAL

Materials of which the protective system is composed shall be resistant to corrosion or be adequately protected against corrosion. The material shall be as specified in the schedule of quantities and shall comply to the following requirements:

- Copper - When solid or stranded copper wire is used it shall be of the grade ordinarily required for commercial electrical work generally designated as being of 98% conductivity when annealed, conforming to Indian standard specifications.
- Galvanised Steel - Galvanised steel used shall be thoroughly protected against corrosion by hot dipped Zinc coating. The material coating shall withstand the test specified in IS 2309:1969.
- The strips to be used shall be in maximum lengths available as manufactured normally avoiding unnecessary joints.

4. EARTH ELECTRODES

• Plate Earth Electrode

The plate electrodes shall be of copper/ GI as called for in the schedule of quantities. The minimum dimensions of the electrodes shall be 600 mm x 600 mm. Thickness of copper electrodes shall not be less than 3 mm and of GI electrodes not less than 6 mm.

The electrode shall be buried in ground with its face vertical and top not less than 3 meters below ground level.

• GI Pipe Earth Electrode

A 4.5 m long GI pipe earth electrode as per Schedule of Quantities shall be

provided.

- **Earth Electrode Pit / pipe**

Method Of Installing Watering Arrangement

In the case of plate earth electrode, a watering pipe of 20 mm dia of medium class G.I. Pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided at the top of this pipe for watering the earth. In case of pipe electrodes a 40mmx20mm reducer shall be used for fixing the funnel with mesh. The watering funnel attachment shall be housed in masonry enclosure of not less than 300 x 300 x 300 mm. A cast iron/M.S. frame with cover having locking arrangement shall be suitably embedded in the masonry enclosure. A suitable test link shall be provided in the earth chamber.

Location of Earth Electrode

The following guidelines shall be followed for locating the earth electrodes

An earth electrode shall not be situated less than 3 metres from any building.

The excavations for electrode shall not affect the column footings or foundations of the buildings.

In such cases electrode may be further away from the building.

The location of the earth electrode shall be such where the soil has reasonable chance of remaining moist, as far as possible.

Entrances, pavements and road ways shall not be used for locating the earth electrode.

Number of Earth Electrodes

In all cases the relevant provision of rule 33, 61 & 67 of the Indian Electricity Rules 1956 as amended shall be complied with.

Metallic covers or supports of all medium or H.T. apparatus or conductors shall, in all cases be connected to not less than two separate and distinct earth electrodes.

5. EARTHING LEADS

The strip earthing leads shall be connected to the Earth Electrode at one end and to the metallic body of the main equipment at the other end. The earthing lead shall connect to the earthing network in the installation.

- **Earthing Lead Sizes**

Strip earthing leads shall be of copper/GI and as per specifications.

- **Earthing Lead Installation**

The length of buried strip earthing lead shall be not less than 15 metres and shall be buried in trench not less than 0.5 m deep.

If conditions necessitates use of more than one earthing lead they shall be laid as widely distributed as possible preferably in a single straight trench or in a number of trenches radiating from one point.

- **Method Of Connecting Earthing Lead To Earth Electrode**

In the case of plate earth electrode the earthing lead shall be securely bolted to the plate with two bolts, nuts, checknuts and washers as required by IS 3043 : 1987.

In case of pipe earth electrode wire type earthing conductor shall be securely bolted to the pipe with bolts, nuts, checknuts and washers as required by IS 3043 : 1987.

All materials used for connecting the earth lead with electrode shall be GI in case of GI Pipe and GI plate earth electrodes or tinned brass in case of Copper plate

electrode.

- **Protection Of Earthing Lead**

The earthing lead from electrode onwards shall be suitably protected from mechanical injury and corrosion by a 15 mm dia GI pipe in case of wire and 100/40 mm dia medium class GI Pipe. The portion of the G.I. pipe within ground shall be buried at least 30 cm deep (to be increased to 60 cm in case of road crossing or pavements). The portion within the building shall be recessed in walls and floors to adequate depth.

6. **EARTHING CONDUCTORS**

Earthing conductors shall form the earthing network throughout the installation for earthing of all non-carrying metal parts.

Connection Of Earthing Conductors

- Main earthing conductors shall be taken from the earth connections at the main switch boards to all other switchboards in the network.
- Sub-mains earthing conductors shall run from the main switch board to the sub distribution boards and to the final distribution boards.
- Loop earthing conductors shall run from the distribution boards and shall be connected to any point on the main/sub-main earthing conductor, or its distribution board or to an earth leakage circuit breaker.
- Metal conduits, cable sheathing and armouring shall be earthed at the ends adjacent to switch boards at which they originate, or otherwise at the commencement of the run by an earthing conductor in effective electrical contact with cable sheathing, Switches, accessories, lighting fitting etc shall be effectively connected to the Loop Earthing Conductors. These though rigidly secured in effective electrical contact with a run of metallic conduit shall not be considered earthed, even though the run of metallic conduit is earthed.

- **Earthing Conductor Installation**

The earthing conductors inside the building wherever exposed shall be properly protected from mechanical injury by running the same in GI pipe of adequate size. Joints shall be revetted and brazed in approved manner.

Sweated lugs of adequate capacity and size shall be used for termination. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substances and properly tinned.

- **Sizing Of Earthing Conductors**

All fixtures, outlet boxes and junction boxes shall be earthed with Bare copper wires as specified.

All 3 phase switches and distribution boards upto 60 amps rating shall be earthed with 2 Nos. distinct and independent 4 mm dia copper/6 mm dia GI wires. All 3 phase switches and distribution boards upto 100 amps rating shall be earthed with 2 Nos. distinct and independent 6 mm dia copper/8 mm dia GI wires. All switches, bus bar, ducts and distribution boards of rating 200 amps and above shall be earthed with a minimum of 2 Nos. separate and independent 25 mm x 3 mm copper/25mm x 6 mm GI tape.

7. **PROHIBITED CONNECTIONS**

conductor, sprinkler pipes, or pipes conveying gas, water, or inflammable liquid, structural steel work, metallic enclosures, metallic conduits and lighting protection system conductors shall not be used as a means of earthing an installation or even as a link in an earthing system.

8. RESISTANCE TO EARTH

No earth electrode shall have a greater ohmic resistance than 3 ohms as measured by an approved earth testing apparatus. In rocky soil the resistance may be upto 5 ohms. The electrical resistance measured between earth connection at the main switchboard and any other point on the completed installation shall be low enough to permit the passage of current necessary to operate circuit breakers, and shall not exceed 1 ohm.

11 KV HT VACUUM CIRCUIT BREAKER AND PANELS

1.0 GENERAL

This section covers the technical specifications of High Voltage 11 kv switchgear.

2.0 STANDARDS AND CODES

The Standards and Codes applicable to the works are listed in Annexure I of the tender document and may be referred to.

3.0 AMBIENT CONDITIONS

The equipment shall be suitable for operation at the rated current at ambient condition of 45 Deg C and 80% RH unless otherwise stated in special condition of contract.

4.0 SWITCHGEAR

4.1 High Voltage Circuit Breakers

4.1.1	Type	Vacuum
4.1.2	Operating voltage	11,000 volt 3 phase 50 Hz
4.1.3	Insulation Voltage	12,000 volts
4.1.4	Current rating	As per Schedule of Quantities
4.1.5	Fault Level withstand	350 MVA/ 18 kA at 11 kv or as per Schedule of Quantities whichever is greater
4.1.6	Short time rated thermal current	18 kA for 1 second at 11 kv or as per Schedule of Quantities whichever is greater
4.1.7	Short time peak withstand current	18 kA at 11 kv or as per Schedule of Quantities whichever is greater
4.1.8	One minute power frequency withstand voltage (kv)	28 kv
4.1.9	Impulse voltage withstand with 1.2/50 micro second wave shape (kv peak)	75 kv peak
4.1.10	Operating Duty	O-0.3 sec-CO-15 secs-CO
4.1.11	Breaker rating	The Circuit Breaker shall be continuously rated as specified with a minimum current rating of 630 amps.
4.1.12	No of Poles	3
4.1.13	Interrupting medium	Single break contacts housed in a sealed vacuum interrupter. The vacuum interrupter shall be

		hermetically sealed and shall be designed for minimum contact erosion, fast recovery of di-electric strength, maintenance free and suitable for auto reclosing.
4.1.14	Cassette mounting	<ul style="list-style-type: none"> • Draw out. • Each Circuit Breaker shall have its own Cassette.
		•
4.1.15	Operating mechanism	<ul style="list-style-type: none"> a) Trip free such that the circuit breaker is at all times free to open immediately the trip coil is energised b) Independent Manual spring closing (IMS) or motor wound spring closing mechanism (MWS) as per Schedule of Quantities c) One open-close-open operation of the breaker shall be possible after loss of supply to the motor.
4.1.16	Mechanism Positions	<p>Circuit breaker operating mechanism shall provide 3 distinct and separate positions of the circuit breakers on the cradle</p> <ul style="list-style-type: none"> ➤ Service ➤ Test ➤ Fully Isolated ➤ Earth
4.1.17	Anti Pumping feature	Required
4.1.18	All current carrying parts	Silver plated
4.1.19	Circuit Breaker Housing	Flush front rigid fabricated construction truck. The breaker carriage shall be fabricated from steel, providing a sturdy vehicle for the circuit breaker and its operating and tripping mechanism. The carriage shall be mounted on wheels, moving on guides, designed to align correctly and allow easy smooth movement of the circuit breaker and for removing the carriage for inspection and maintenance purposes.
4.1.20	Isolating Contacts	Self aligning cluster type
4.1.21	Auxiliary Contacts	<ul style="list-style-type: none"> a) Self aligning sliding auxiliary contacts. b) Free / minimum 4 NO/NC auxiliary contacts rated at 16 amps 415 volts 50 Hz c) These shall be approachable from the front for connecting all external wiring d) They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle. e) The fixed portion of the sliding contacts shall have easy access for maintenance purposes.

		After meeting all necessary control and indication requirements 2 nos NO and 2 nos NC auxiliary contacts of the breaker shall be made available for the Owner, wired upto terminal block.
4.1.22	Safety Shutters	Earthed metal or insulated automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle
4.1.23	Surge Protection	Vacuum circuit breakers shall be provided with suitable surge protection devices to restrict rate of rise of restriking voltage.
4.1.24	Interchangeability	Circuit breakers of identical rating shall be completely interchangeable
4.1.25	Circuit Breaker Accessories	<ul style="list-style-type: none"> a) Racking in / Racking out mechanism. b) Isolating plugs and sockets. c) Safety shutters.
4.1.26	Indications-mechanical and LED	<p>The following minimum indication mechanical/ lamps shall be provided in the front of the cubicle. Lamps shall be clustered LED type and trip circuit supervision scheme shall be of continuous supervision type.</p> <p>Mechanical Indications</p> <ul style="list-style-type: none"> a) Mechanical ON/OFF indicator. b) Mechanical counter to assess the total number of operations of the breaker c) Shrouded manual emergency trip push button, d) Breaker in test position e) Breaker in service position. <p>LED Indicating Lamps</p> <ul style="list-style-type: none"> a) Breaker Open/ Closed/Tripped. b) Spring charged trip circuit healthy c) Control supply healthy. . d) Spring charged/discharged indicator.
4.1.27	Safety Device	Safety shutters shall be earthed
4.1.28	Interlocking	<p>The Circuit Breaker/ panels shall be provided with the following interlocks in conformity with IES 62271-200</p> <ul style="list-style-type: none"> a) The withdrawal or engagement of a Circuit Breaker shall be prevented unless it is in the Open position b) The operation of a Circuit Breaker shall be prevented unless it is in the Service, disconnected, removed, test or earth position. c) The interlocking shall prevent the closing of the Circuit Breaker in the Service position unless any auxiliary circuits associated with the automatic opening of these devices are connected. Conversely it shall prevent the

		<p>disconnection of the auxiliary circuits with the Breaker closed in the Service position.</p> <p>d) Breaker cannot be racked from one position to the other in close position.</p> <p>e) Earthing switch cannot be switched ON when truck is inside panel.</p> <p>f) Truck can not be inserted with earthing switch is ON position.</p> <p>g) Breaker cannot be operated in any intermediate position.</p> <p>h) Breaker cannot be opened or closed with compartment front door open.</p> <p>i) With selector switch in "local" position breaker can only be operated in "test" position. For operation in "service" position, control must be from "remote".</p> <p>j) All switching operations including Breaker rack in/out to be performed with front door closed.</p> <p>The drive mechanism shall preferably be provided with facility for pad locking at any position namely, "Service", "Test" and "Fully Isolated".</p>
4.1.29	Earthing	The earthing of the breaker body and moving portion shall be so arranged that the earthing of the non-current carrying structure to the frame earth bar is completed well before the main circuit breaker plugs enter the fixed sockets.
4.1.30	Type test certificates	Submit Certificates from a recognised test house for the Circuit Breakers offered.

4.2 Current transformer:

4.2.1	BSI Standards	Compliance to IS 2705: 1992 as per latest issue
4.2.2	Construction	Cast Epoxy Resin
4.2.3	C.T. configuration	Dual core – one core for measurements and the second for protection
4.2.4	Current rating – primary	As per Schedule of Quantities
4.2.5	Current rating – secondary	1 or 5 amp as per Schedule of Quantities
4.2.6	C.T. Burden	As per Schedule of Quantities but not less than 15 VA
4.2.7	Class of Accuracy	As per Schedule of Quantities
4.2.8	CT Shorting blocks	To be provided
4.2.9	Short circuit	C.T.'s shall withstand thermal and dynamic stresses

	withstand	during short circuits
4.2.10	C.T. Secondary terminals	Secondary terminals of CTs shall be brought out suitably to a terminal block which will be easily accessible for testing and terminal connections

4.3 Voltage transformer:

4.3.1	BSI Standards	Compliance to IS 3156 as per latest issue
4.3.2	Construction	Cast Epoxy Resin
4.3.3	Voltage rating – primary	As per Schedule of Quantities
4.3.4	Voltage rating – secondary	As per Schedule of Quantities
4.3.5	P.T. Burden	As per Schedule of Quantities but not less than 100 VA
4.3.6	Class of Accuracy	As per Schedule of Quantities
4.3.7	P.T. mounting	Chassis mounted withdrawable
4.3.8	11 kv Protection	HRC Fuses
4.3.9	Low Voltage protection	MCB/ MCCB/ MPCB of adequate and suitable fault withstand level.

5.0 11000 VOLT SWITCHGEAR PANELS

The 11 kv switchgear panels shall be provided with Circuit Breakers, protective relays, meters, indicating instruments with associated current and potential transformers as per bill of quantities and schematic drawing.

5.1	Supply System	Three phase 3 wire, 11000 volt, 50 Hz system
5.2	Current Rating	As per Schedule of Quantities not less than 630 amps
5.3	Short circuit level and withstand	As per Schedule of Quantities but not less than 350 MVA and for a withstand of 1 second
5.4	Ingress protection	IP 42 unless otherwise stated Metal based neoprene gaskets between all adjacent units and beneath all doors and covers shall be provided to render the joints dust and vermin proof
5.5	Internal Arc Test	The switchgear panels shall have arc resistance performance to comply with the following IEC 62271-200 internal arc test assessment criteria at the stipulated short circuit breaking current for an internal arc duration of 1 second. The switchgear construction shall be arc resistant on the front, back and all sides of the enclosure. The distance between the indicators during testing shall not exceed 300 mm.

		a) Criteria 1....Doors and covers must not open b) Criteria 2....Parts of the switchgear must not fly c) Criteria 3....Holes must not develop in the external parts of the enclosure d) Criteria 4....Vertical indicators must not ignite e) Criteria 5....Horizontal indicators must not ignite f) Criteria 6....Earth connections must remain effective
5.6	Panel Compartmentation	
5.6.1	Loss of Service Continuity	The switchgear Compartmentation and construction shall ensure compliance to Category LSC2B as per IEC 62271-200 in that other functional units and all cable compartments can be energized when opening accessible compartment.
5.6.2	Compartment	Separate individual segregated totally enclosed earthed compartments shall be provided for each <ul style="list-style-type: none"> a) Circuit Breaker b) Voltage Transformer and PT fuses c) Relays and Instruments chamber d) Cabling chamber with cable boxes e) Bus Bar chamber All partition sheets shall be minimum 2 mm Sheet
5.6.3	Circuit Breaker Metering	Separate segregated compartment shall be provided for accommodating relays, instruments, indicating lamps, 415 volt control contactors and control MCB/ MCCB/ MPCB as required etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
5.6.4	Control wiring compartment	A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections finger touch proof terminal.
5.7	Panel Configuration	
5.7.1	Panel configuration	Vacuum Circuit Breakers one per panel
5.7.2	Extensible	Shall be extensible on both sides
5.8	Panel Construction	
5.8.1	Panel construction	<ul style="list-style-type: none"> • Metal clad totally enclosed, • Dead front • Floor mounted • Free standing type • Modular extensible design • Suitable for indoor mounting.
5.8.2	Switchboard cubicles, doors and covers	Fabrication with... CRCA Sheet Steel Cubicles..... thickness not less than 2.5 mm folded and braced to ensure rigid support for all components.

		Doors/ covers..... thickness not less than 1.6 mm. Joints seam welded Welding slag ground off Welding pits wiped smooth with plumber metal.
5.8.3	Switchboard frames	Fabrication with.....electro galvanized MS sheets 'U' Channel frames 2.5 mm thick All joints.....neatly formed andfinished flush with adjacent surfaces No joints shall be located in corners. Bare edges shall be lipped. Structural members and bracings where ever required shall be welded or bolted to the frame. The frame shall be of modular design and extensible.
5.8.4	Cable compartment	Shall be provided at the rear of the panel. Adequate space shall be provided for ease of installation and maintenance with safety for working without coming into contact with any live parts. The cable chambers shall be complete with <ul style="list-style-type: none"> • Adequate support for cables. • supporting clamps and brackets etc for termination of 11000 volt grade XLPE aluminium conductor cables.
5.9	Ventilation Fans	Panel mounting type ventilation fans shall be provided in each panel with switchgear rated for 2500 amp and above. The fan shall be interlocked with switchgear operation.
5.10	Space Heaters	Anti- condensation heaters shall be fitted in each cubicle together with an ON/OFF isolating switch suitable for electrical operation at 240 volts A.C 50 Hz single phase of sufficient capacity to raise the internal ambient temperature by 5° C operation interlocked with switchgear.
5.11	Doors and Accessories	
5.11.1	Doors	Lockable hinged doors shall be provided for <ul style="list-style-type: none"> • Circuit Breaker Compartment • Relays and Instrument chamber • Voltage Transformer All other doors may be of the bolted type
5.11.2	Door handles	Good quality door handles fitted with toggles to operate rods to latch with suitable slots in both top and bottom of switchboards shall be provided. Latching rods and associated brackets shall be cadmium plated.
5.11.3	Operating handles	All operating device shall be located in front of switchgear only.
5.11.4	Lifting Arrangement	Each Circuit Breaker panel shall be provided with lifting hooks.

5.11.5	Fixing Screws	Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in switchboards.
5.12	Dimensional Limitations	<ul style="list-style-type: none"> • Base channel 100 mm x 6 mm thick shall be provided at the bottom. • Overall height shall be limited to 2700 mm unless otherwise stipulated. • Height of the operating handle, push buttons etc shall be restricted between 300 mm and 1700 mm from finished floor level.
5.13	Switchboard Bus Bars, Interconnections etc rating	
5.13.1	Rating of Bus Bars, interconnections and to feeders	<p>These shall be designed as per requirements in Schedule of Quantities but for a minimum current rating of 630 amps to</p> <ul style="list-style-type: none"> • Carry full load current for phase bus bars • withstand the stresses of the designated fault level
5.14	Switchboard Bus Bars	
5.14.1	Bus Bar material	<p>As per Schedule of Quantities and with</p> <ul style="list-style-type: none"> • High conductivity, high strength aluminium alloy, complying with requirements of grade E 91E of IS 5082 – 1981 <p>Alternatively</p> <ul style="list-style-type: none"> • Electrical grade 99.99% pure copper
5.14.2	Bus Bar Insulation	Heat shrunk PVC sleeving of 15 kV grade and bus bar joints provided with clip-on shrouds.
5.14.3	Bus Bar supports	<p>12 kv Class Non-breakable, non-hygroscopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand</p> <ul style="list-style-type: none"> • operating temperature of 110° C at regular intervals, • the forces arising from a fault level as stipulated in schedule of quantities. • 28 kv rms 1 minute power frequency
5.14.4	Colour Coding	All bus bars shall be colour coded.
5.15	Switchboard Interconnections	
5.15.1	Instrument and control wiring	<p>All wiring for relays and meters shall be with 1100 volt grade ZHFR PVC insulated copper conductor wires. The minimum size of copper conductor control wires for PT circuits shall be 1.5 sq mm and for CT circuits shall be 2.5 sq. mm.</p> <p>All wire terminations shall be crimped with insulating sleeves and terminated in terminal blocks. Not more than 2 wires shall be connected to a terminal.</p>

		<p>Terminals shall be segregated circuit wise and voltage wise.</p> <p>Spare terminals equal to at least 20% shall be provided.</p> <p>The wiring shall be labelled with approved ferrules for identification and coded.</p>
5.15.2	Cable Connections	
5.16	Cabling	<p>Switchboards shall be suitable for cable entry from bottom or as specified.</p> <p>3mm thick removable gland plate of non magnetic material shall be provided for cable termination.</p> <p>Power and control cabling shall be completely segregated.</p> <p>Suitable space for termination/maintenance shall be provided in the cable compartment and between gland plate and power cable box for mounting core balance CTs if required.</p>
5.17	Safety Devices	<ul style="list-style-type: none"> Independent pressure relieve vents for all HT compartments
5.18	Earthing	<p>Continuous earth bus of Aluminium/ GI sized for prospective fault current shall be provided with arrangement for connecting to station earth at two points.</p> <p>All instrument transformers shall be connected to earth bus through removable links.</p> <p>Hinged doors / frames shall be connected to earth through adequately sized flexible braids.</p>
5.19	Sheet Steel Treatment And Painting	<p>Sheet steel used in the fabrication of switchboards shall undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process after which a coat of primer paint compactively with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 50 micron thickness, of sheet approved by Engineer-in-Charge shall then be provided.</p>
5.20	Labels	<p>Suitable engraved white on black metal identification labels shall be provided for each switchgear cubicle in front and back identifying the circuit, switchgear type, rating and duty.</p>
5.21	Local Authority Requirements	<p>All requirements by the local Authority including those listed below shall be complied with</p> <ul style="list-style-type: none"> Provision for Gas nozzles within each cubicle Danger Notice Plate Rubber floor mat of 6 m thickness and 1 m width provided for the full length of the switchboard.

		<ul style="list-style-type: none"> • A dry chemical type fire extinguisher of required capacity with approved label
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6.0 TESTING

6.1	At Manufacturers Works	Each type of 11Kv Switchgear shall be completely assembled, wired, adjusted and tested at the factory as per the relevant standards i.e. IS:9920, IS:3427, IS:13118, IEC:265, IEC:298 during manufacturing and on completion
6.2	Routine Tests	<p>The tests shall include but not necessarily limited to the following</p> <ul style="list-style-type: none"> a) Operation under simulated service condition to ensure accuracy of wiring, correctness of control scheme and proper functioning of the equipment. b) All wiring and current carrying part shall be subjected to an appropriate High Voltage test. c) All wiring continuity shall be tested
6.3	Routine Test Certificates	Copies of routine tests carried out at manufacturer's works shall be furnished along with the delivery of the switchboards.
6.4	Type Test Certificates	Copies of type tests certificates shall be furnished along with the tender for approval of the product.
6.5	Works Inspection prior to Delivery	Owners reserves the right to get the panels inspected and witness the routine tests by their representative at manufacturer's works prior to dispatch to site. The contractor shall provide the necessary facilities and also give due notice.
6.6	Tests at site	<p>Pre-commissioning tests as per manufacturers recommendations shall be carried out on the switchboard at site after installation including but not restricted to the following.</p> <ul style="list-style-type: none"> • Physical checking of the switchboard including checking for damage or cracks in components, bolt tightness, gasketing etc. • Mechanical endurance test by frequent breaker operation • Checking of vacuum bottles to ensure leak tightness • Insulation testing of Bus bar supports by 5 kV megger.

		<ul style="list-style-type: none"> • Insulation testing of Control wiring by 1 kV megger. • Testing of relays and CTs with secondary injection kit. • Checking of breaker operation • Checking of earth continuity • High Voltage test.
7.0	SPECIAL MAINTENANCE TOOLS & TACKLES	<p>The tenderer shall provide a list of recommended spare parts with their individual prices for equipment to be supplied against this specification. This list shall identify all essential spares items for any recommended maintenance for a period of five years after commissioning.</p> <p>The Owners may order all or any of the spare parts listed at the time of contract award and the spare parts so ordered shall be supplied as part of the definite works. The Owners may order additional spares at any time during the contract period at the rates stated in the Contract Document.</p> <p>A spare parts catalogue with price list shall be provided and this shall form part of the drawings and literature to be supplied.</p> <p>The tenderer shall give an assurance that spare parts and consumable items will continue to be available through the life of the equipment, which shall be 25 years minimum.</p> <p>Any spare apparatus, parts or tools shall be subject to the same specification, tests and conditions as similar material supplied under the Contract. They shall be strictly interchangeable and suitable for use in place of the corresponding parts supplied with the plant and must be suitably marked and numbered for identification.</p> <p>Spare parts shall be delivered suitably packed and treated for long periods in storage. Each pack shall be clearly and indelibly marked with its contents, including a designation number corresponding to the spare parts list in the operation and maintenance instructions, Spanners and other maintenance equipment provided under this contract shall not be used</p>

		<p>for the purpose of erection.</p> <p>Any special devices, slings or shackles necessary for the maintenance shall be handed over to the Purchaser in working order on completion of the installation and commissioning of the equipment.</p>
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BATTERY CHARGER SUITABLE FOR HT/LT PANELS

1. SCOPE

- a) The specifications give details of the battery charger suitable for HT/ LT panels. The batteries are housed in the bottom compartment of the battery charger. Sealed maintenance free batteries upto 24 V – 200 AH or lead acid batteries upto 24 V – 150 AH can be housed in the battery compartment. The battery charger is a composite battery charger cum DC distribution board
- b) The specifications give details of the battery charger suitable for HT/ LT panels. The sealed maintenance free batteries or lead batteries are placed outside the charger on a wooden / MS stand. This specification is applicable for batteries 24 V – 200 AH to 110 V – 200 AH. The battery charger and DC distribution board is a composite unit

2. GENERAL

The battery charger shall be float cum boost type, thyristor controlled. The charger shall have selector switch for auto float – boost/manual, float /manual boost mode of operation. during auto float – boost mode, automatic changeover shall take place from float mode to boost mode and vice versa. This means that when the batteries are fully charged the charging shall automatically change from boost charge to trickle charge.

3. CONSTRUCTION FEATURES

- a) The float cum boost charger and DC distribution board shall be housed in sheet steel cubicle with panels of 1.6 mm thickness, louvers for ventilation, glands plate will be provided for cable entry from front bottom. The cubicle shall be painted in siemens grey shade. The battery charger shall be divided into two compartments. The upper compartment shall house the battery charger and DCDB with all the necessary controls. The lower compartment shall be suitable for housing the batteries.
 - b) The float cum boost charger and DC distribution board shall be housed in sheet steel cubicle of angle iron frame work with panels of 1.6 mm thickness, louvers for ventilation, glands plate will be provided for cable entry from front bottom. The cubicle shall be painted in siemens grey shade. Four wheels/2 nos channels shall be provided at the base.
- 3.1 The DC output voltage of float /boost charger shall be stabilized to within $\pm 2\%$ for AC. Input variation of 230 V $\pm 10\%$, frequency variation of 50 Hz $\pm 5\%$ and DC load variation of 0-100%. The voltage regulation shall be achieved by a constant voltage regulator having fast response SCR & Controlled. The ripple content in output shall be within 3% of DC output nominal voltage.
 - 3.2 There shall be provision to select auto float/manual float /manual boost modes. During auto float mode the battery charging shall automatically changeover from boost mode to flat mode and vice versa. During manual float/boost modes it shall be possible to set the output volts by separate potentiometers.
 - 3.3 The battery charger shall have automatic output current limiting feature

4 COMPONENTS

The battery charger shall essentially comprise of the following

- 4.1 1 no. double pole ON/OFF MCB at AC input
- 4.2 1 no. pilot lamp to indicate charger ON.
- 4.3 1 no. main transformer : Double wound, naturally air cooled, having copper windings.
- 4.4 1 set single phase full wave bridge rectifier consisting of 2 nos. Diodes and 2 nos SCRs liberally rated, mounted on heat sinks and complete with resistor / condenser network

for surge suppression.

- 4.5 1 no. rotary switch to select auto float / manual float / manual boost. During auto float mode automatic changeover shall take place from float mode to boost mode and vice versa.
- 4.6 1 set solid state constant potential controller to stabilize the DC output voltage of the float cum boost charger at $\pm 2\%$ of the set value for AC input voltage variation of 230 V $\pm 10\%$, frequency variation of $\pm 5\%$ from 50 Hz and simultaneous load variation of 0-100% and also complete with current limiting circuit to drop the float charger output voltage upon overloads to enable the battery to take over.
- 4.7 1 no. electronic controller to automatically changeover battery charging from boost to float and vice versa
- 4.8 1 no. DC ammeter and toggle switch to read charger output current and battery charge/discharge current.
- 4.9 1 no. moving coil DC voltmeter to read the DC output voltage.
- 4.10 2 set potentiometer to adjust the output voltage during manual/auto float and boost modes.
- 4.11 1 no. double pole ON/OFF MCB at charger output.
- 4.12 DC distribution board.
 - Incomer : 1 no. 32 A/63 A DP MCB
 - Outgoing : 24 no. 16 A DP MCB (however the actual qty of MCB can vary as per the prevailing site/design (parameters) requirement.
- 4.13 Alarm annunciation
 - Visual and audible alarm with manual accept/ reset facility shall be provided for the following
 - AC mains fail
 - Charger fail
 - Load / output over volt

5. RATINGS

AC Input	: 230 V $\pm 10\%$ AC 50 Hz single phase
DC output	: to float / boost charge 24 V / 180 AH batteries and also supply a continuous load
Current rating	: 15 A
Float mode	: 27 V nominal (adj. between 24 – 28 V)
Boost mode	: 28 V nominal (adj. between 24 – 30 V)
Voltage regulation	: $\pm 2\%$ of the set value
Ripple	: Less than 3%

6. MAKE OF VARIOUS COMPONENTS

a)	Rotary switch	KAYCEE
b)	MCB	SCHNEIDE (PROTEC)
c)	Fuses / fuse fittings	GE
d)	Silicon diodes / SCRs	RUTTONSHA/HIRECT
e)	Meters	YOKINS
f)	Transformers	VOLTRON
g)	Toggle switches	GE/KAYCEE

LT SWITCHBOARDS

1.0 GENERAL

This section covers specification of LT Switchboards

2.0 STANDARDS AND CODES

The Standards and Codes applicable to the works are listed in Annexure I of the tender document and may be referred to.

3.0 SWITCHGEAR

3.1 LT Air Circuit Breakers

3.1.1	Type	Air Break
3.1.2	Operating voltage	415 volt 3 phase 50 Hz
3.1.3	Insulation Voltage	660 volts
3.1.4	Current rating	As per Schedule of Quantities. The current carrying capacity of ACBs shall be specified at 40 Deg C (Ref clause 7.2.2.2 of IEC 60947 – Part 2). The maximum permissible temperature rise at ACB terminals shall be 80 Deg C (ref Clause – 7.2.2.1 of IEC 60947-Part 2) i.e maximum allowable absolute temperature at ACB terminals shall be 120 Deg C The maximum absolute temperature specified shall not be exceeded for ACB's Mounted within a Switchboard Panel
3.1.5	Fault Level withstand Ics	As per Schedule of Quantities
3.1.6	Icu	100% Ics
3.1.7	Icw	100% Ics
3.1.8	Isolation function	As per IEC 60947-2 Section 7.12
3.1.9	Insulation	class II insulation between the front panel and internal power circuits
3.1.10	Cubicle mounting	Draw out unless otherwise stated.
3.1.11	Operating mechanism	Trip free such that the circuit breaker is at all times free to open immediately the trip coil is energised Independent Manual spring closing (IMS) or motor wound spring closing mechanism (MWS) as per Schedule of Quantities
3.1.12	No of Poles	3 or 4 as required
3.1.13	All current carrying parts	silver plated
3.1.14	Arcing contacts	Shall be provided to protect the main contacts and shall be separate from the main contacts and easily replaceable.
3.1.15	Arc chutes	Shall be provided for each pole, and shall be suitable for being lifted out for the inspection of the main and the arcing contacts.

3.1.16	Isolating Contacts	Self aligning cluster type
3.1.17	Safety Shutters	Earthed metal or insulated automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle
3.1.18	Auxiliary Contacts	<p>Self aligning sliding auxiliary contacts.</p> <p>Free / minimum 6 NO/NC auxiliary contacts rated at 16 amps 415 volts 50 Hz</p> <p>These shall be approachable from the front for connecting all external wiring</p> <p>They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle.</p> <p>The fixed portion of the sliding contacts shall have easy access for maintenance purposes.</p>
3.1.19	Indications and Operations integral with ACB on front	<ul style="list-style-type: none"> • mechanical ON/OFF indication • Operating handle • mechanical trip push button • mechanical indicator for 'Ready to close' situation for the breaker by checking all interlockings. • Indication of mechanical wear of contacts and hence contact life
3.1.20	Anti pumping mechanism	Mechanical and electrical devices integral to Breaker
3.1.21	Circuit Breaker operational positions	<p>Four distinct and separate positions and shall be indicated on the face of the panel.</p> <p>"Service" -- Both main and secondary isolating contacts closed</p> <p>"Test" -- Main isolating contacts open and secondary isolating contacts closed</p> <p>"Isolated" -- Both main and secondary isolating contacts open</p> <p>"Maintenance" -- Circuit Breaker fully outside the panel ready for maintenance</p>
3.1.22	Accessories	Control wiring and all accessories shunt trip coil, under voltage release etc shall be fit- table and accessible from front.
3.1.23	Circuit Breaker Interlocking	<p>Sequence type strain free interlocks shall be provided to ensure the following:</p> <ul style="list-style-type: none"> • Breaker cannot be withdrawn from the cubicle when in the "ON" position. Suitable mechanism shall be provided to lock the Breaker in the tripped position before the Breaker is isolated.

		<ul style="list-style-type: none"> • Breaker cannot be switched "ON" until it is either in the fully inserted position or, for testing purposes, it is in the fully isolated position. • Circuit Breaker cannot be plugged in unless it is in the OFF position. • A safety latch shall be provided to ensure that the movement of the Breaker is checked when being withdrawn to prevent its accidental fall due its weight. • Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position.
3.1.24	Protection	Microprocessor based releases and/or electro magnetic/ numeric relays shall be provided for the Circuit Breakers as stipulated in the Schedule of Quantities
3.1.25	Earthing	The frame of the Circuit Breaker shall be positively earthed when the Circuit Breaker is racked into the cubicle.
3.1.26	Types of terminals	Flexibility in changing at site to suit the bus bar orientation
3.1.27	Electrical endurance with maintenance	Breakers upto 4000 ampsgreater than 5000 cycles Breakers 4000 amps and above.... 1500 cycles
3.1.28	Type test certificates	Submit Certificates from a recognised test house for the Circuit Breakers offered.

3.2 LT Moulded Case Circuit Breakers

3.2.1	Type	Air Break
3.2.2	Operating voltage	415 volt 3 phase 50 Hz
3.2.3	Insulation Voltage	660 volts
3.2.4	Current rating	As per Schedule of Quantities
3.2.5	Fault Level withstand Ics	As per Schedule of Quantities
3.2.6	Icu	100% Ics
3.2.7	Icw	100% Ics
3.2.8	Isolation function	As per IEC 60947-2 Section 7.12
3.2.9	Insulation	class II insulation between the front panel and internal power circuits
3.2.10	Cubicle mounting	Fixed unless otherwise specified
3.2.11	Operating mechanism	Trip free Independent Manual spring closing (IMS) or motor wound spring closing mechanism (MWS) as per Schedule of Quantities

3.2.12	No of Poles	3 or 4 as required
3.2.13	All current carrying parts	Silver plated
3.2.14	Arcing contacts	Shall be provided to protect the main contacts and shall be separate from the main contacts and easily replaceable.
3.2.15	Arc chutes	Shall be provided for each pole, and shall be suitable for being lifted out for the inspection of the main and the arcing contacts.
3.2.16	Common Operating handle	Required for Three phase MCCBs for simultaneous operation and tripping of all the three phases.
3.2.17	Indications and Operations integral with ACB on front	<ul style="list-style-type: none"> • mechanical ON/OFF/ Tripped indication • Operating handle • mechanical trip push button
3.2.18	Accessories	Following accessories shall be provided as required <ul style="list-style-type: none"> • Under voltage trip • Shunt trip • Alarm switch • Auxiliary switch
3.2.19	Circuit Breaker Interlocking	Interlocks shall be provided to ensure the following: <ul style="list-style-type: none"> • Handle interlock to prevent unnecessary manipulations of the breaker. • Door interlock to prevent door being opened when the breaker is in ON position • Deinterlocking device to open the door even if the breaker is in ON position. • Sheet steel hinged lockable doors for each separate compartment shall be provided and duly interlocked with the breaker in "ON" and "OFF" position.
3.2.20	Protection	Microprocessor based releases and/or thermal magnetic releases shall be provided for the Circuit Breakers as stipulated in the Schedule of Quantities
3.2.21	Electrical endurance	Upto 250 amps..... minimum 10,000 operations For 400 amps & above.....minimum 4,000 operations
3.2.22	Type test certificates	Submit Certificates from a recognised test house for the Circuit Breakers offered.

4.0 SWITCHBOARDS

4.1	Supply System	Three phase 4 wire, 415 volt, 50 Hz, Indian TN-S system
4.2	Short circuit level withstand	As per Schedule of Quantities
4.3	Ingress protection	IP 42 unless otherwise stated Metal based neoprene gaskets between all adjacent units and beneath all doors and covers shall be provided to render the joints dust and vermin proof
4.4	Pressure relief devices	Shall be provided to minimize danger to operator during internal fault conditions.
4.5	Panel Compartmentation	
4.5.1	Compartment	Form 3B as per IECunless otherwise stated in Schedule of Quantities
4.5.2	Circuit Breaker Metering	Separate segregated compartment shall be provided for accommodating instruments, indicating lamps, control contactors and control MCB etc. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, busbars and connections.
4.5.3	Control wiring compartment	A horizontal wire way with screwed cover shall be provided at the top to take interconnecting control wiring between vertical sections.
4.6	Panel Configuration	
4.6.1	Panel configuration	MCCB's arranged..... multi-tier formation Air Circuit Breakers..... Single or Double tier formation
4.6.2	Spare Space provision	The Switchboards shall have a provision of 25% spare space to accommodate possible future additional switch gear.
4.6.3	Extensible	Shall be extensible on both sides
4.7	Panel Construction	
4.7.1	Panel construction	<ul style="list-style-type: none"> • Metal clad totally enclosed, • Dead front • floor mounted • free standing type • modular extensible design • suitable for indoor mounting.
4.7.2	Switchboard cubicles, doors and covers	Fabrication with.... CRCA Sheet Steel Cubicles..... thickness not less than 2.0 mmfolded and bracedto ensure rigid support for all components. Doors/ covers..... thickness not less than 1.6 mm. Jointsseam welded

		<p>Welding slagground off</p> <p>Welding pitswiped smooth with plumber metal.</p>
4.7.3	Switchboard frames	<p>Fabrication withelectro galvanized MS sheets</p> <p>'U' Channel switchboard frames..... 2.5 mm thick</p> <p>All joints..... neatly formed andfinished flush with adjacent surfaces</p> <p>No joints shall be located in corners.</p> <p>Bare edges shall be lipped.</p> <p>Structural members and bracings where ever required shall be welded or bolted to the frame. The frame shall be of modular design and extensible.</p>
4.7.4	Cable compartment	<p>Rear Access switchboards.....all cabling from rear</p> <p>Front access switchboards.....Separate vertical cable Accessible from front only</p> <p>Adequate space shall be provided for ease of installation and maintenance with safety for working without coming into contact with any live parts.</p> <p>The cable chambers shall be complete with</p> <ul style="list-style-type: none"> • Adequate support for cables. • tinned brass cable sockets, • tinned brass compression glands, • 3 mm thick gland plates, • supporting clamps and brackets etc <p>for termination of 1100 volt grade aluminium conductor XLPE/ PVC/ PVCA cables.</p>
4.7.5	Door handles	<p>Good quality door handles fitted with toggles to operate rods to latch with suitable slots in both top and bottom of switchboards shall be provided. Latching rods and associated brackets shall be cadmium plated.</p>
4.7.6	Operating handles	<p>All operating device shall be located in front of switchgear only.</p>
4.7.7	Fixing Screws	<p>Fixing screws shall enter holes tapped into an adequate thickness of metal or provided with hank nuts. Self threading screws shall not be used in switchboards.</p>
4.7.8	Dimensional Limitations	<ul style="list-style-type: none"> • Base channel 75 mm x 5 mm thick shall be provided at the bottom.

		<ul style="list-style-type: none">• Minimum 200 mm blank space between the floor of switchboard and bottom most unit shall be provided.• Overall height shall be limited to 2300 mm unless otherwise stipulated.• Height of the operating handle, push buttons etc shall be restricted between 300 mm and 1700 mm from finished floor level.				
4.8	Rating of Bus Bars, interconnections and to feeders	<p>These shall be designed as per requirements in Schedule of Quantities to</p> <ul style="list-style-type: none">• Carry full load current for phase and neutral bus bars• withstand the stresses of fault level <p>The following indicative sizes of Aluminium and Copper links be used for ACB Ratings upto 3150 A. Please note that these are for reference only and actual sizes shall be determined to withstand full load current, stipulated temperature rise and fault levels.</p>				
Switchboard Bus Bars, Interconnections etc rating						
		Range of current	Copper bars as per IEC 60947-2		Aluminum bars as per IS 13947- 2	
			No of Runs	Dimensions (mm)	No of Runs	Dimensions (mm)
		400 – 500	2	30 x 5	2	32 x 8
		500 – 630	2	40 x 5	2	40 x 8
		630 – 800	2	50 x 5	2	50 x 8
		800 – 1000	2	60 x 5	2	50 x 10
		1000 – 1250	2	80 x 5	2	63 x 12
		1250 – 1600	2	100 x 5	4	50 x 8
		1600 - 2000	3	100 x 5	3	100 x 10
		2000 – 2500	4	100 x 5	4	100 x 10
		2500 – 3150	3	100 x 10	4	150 x 10

4.9	Switchboard Bus Bars		
4.9.1	Bus Bar material	High conductivity, high strength aluminium alloy, complying with requirements of grade E 91E of IS 5082 – 1981 Alternatively Electrical grade 99.99% pure copper/aluminium bar as per Schedule of Quantities	
4.9.2	Bus Bar Insulation	Heat shrunk PVC sleeving of 1.1 kV grade and bus bar joints provided with clip-on shrouds.	
4.9.3	Bus Bar supports	Non-breakable, non-hygroscopic epoxy resin or glass fiber reinforced polymer insulated supports able to withstand operating temperature of 110 ^o C at regular intervals, to withstand the forces arising from a fault level as stipulated in schedule of quantities.	
4.9.4	Colour Coding	All bus bars shall be colour coded.	
4.9.5	Auxiliary Bus	Electrolytic copper Auxiliary buses for control power supply, space heater power supply or any other specified service shall be provided. These shall be insulated, adequately supported and sized to suit specific requirement.	
4.10	Switchboard Interconnections		
4.10.1	Interconnection material	Unit ratings upto 100 amps,	FR PVC insulated copper conductor wires with crimped terminations.
		Rating of 100 amps and above	Solid copper/ aluminium connections PVC sleeved
4.10.2	Interconnection joining	All connections, tappings etc <ul style="list-style-type: none">• Shall be made to ensure minimum contact resistance.• shall be firmly bolted and clamped with even tension. Before assembly <ul style="list-style-type: none">• joint surfaces shall be filed or finished to remove burrs, dents and oxides and silvered to maintain good continuity at all joints. All screws, bolts, washers shall be cadmium plated. Approved spring washers shall be used with cadmium plated high tensile steel bolts with BSF threads.	
4.10.2	Instrument and control wiring	All wiring for relays and meters shall be with ZHFR PVC insulated copper conductor wires. The wiring shall be coded and labelled with approved ferrules for identification. The minimum size of copper conductor control wires shall be 2.5 sq. mm.	
4.11	Earthing	Continuous earth bus sized for prospective fault	

		current shall be provided with arrangement for connecting to station earth at two points. Hinged doors / frames shall be connected to earth through adequately sized flexible braids.
4.12	Ventilation Fans	Panel mounting type ventilation fans shall be provided in each panel with switchgear rated for 2500 amp and above. The fan shall be interlocked with switchgear operation.
4.13	Space Heaters	Anti- condensation heaters shall be fitted in each cubicle together with an ON/OFF isolating switch suitable for electrical operation at 230 volts A.C 50 Hz single phase of sufficient capacity to raise the internal ambient temperature by 5 ^o C operation interlocked with switchgear.
4.14	Sheet Steel Treatment And Painting	Sheet steel used in the fabrication of switchboards shall undergo a rigorous cleaning and surface treatment seven tank process comprising of alkaline degreasing, descaling in dilute sulphuric acid and a recognised phosphating process after which a coat of primer paint compactively with the final paint shall be applied over the treated surface. Final paint coat of oven baked powder coating, of minimum 50 micron thickness, of sheet approved by Engineer-in-Charge shall then be provided.
4.15	Labels	Suitable engraved white on black metal identification labels shall be provided for each switchgear cubicle in front and back identifying the circuit, switchgear type, rating and duty.
4.16	Local Authority Requirements	All requirements by the local Authority including those listed below shall be complied with <ul style="list-style-type: none"> • Provision for Gas nozzles within each cubicle • Danger Notice Plate • Rubber floor mat of 6 m thickness and 1 m width provided for the full length of the switchboard. • A dry chemical type fire extinguisher of required capacity with approved label

5. CONTROL, OPERATION AND SYNCHRONIZATION THROUGH PLC PANEL

5.1 Programmable Logic Controller (PLC)

The automation station consists of the following types of module: processor/coprocessor, power supply, discrete and analog I/O, communication and application-specific modules which can be distributed on racks. With the exception of the processor and power supply modules, all I/O and application-specific modules can be assigned to a slot in any order in the configuration. The PLC rack system should be modular to address small and bigger I/O systems

The PLC CPUs should be able to address Process control loops in a deterministic manner, that is, the CPU should be able to scan closed loops in a fixed amount of time. The PLC should be able to extend itself on a local bus over a long distance so that the advantages of local bus speeds are achieved for process control loops and at the same time, achieve the I/O distribution required in order to achieve minimum cabling configurations.

The Local Bus configuration can be Trunk and Drop or even Star based to allow greater flexibility.

The PLC in addition to an extendable Local Bus should also feature a Remote I/O bus, which is deterministic and can extend over longer distances (7- 8 kms) than that of a local bus.

The memory area of PLCs should consist of internal RAM designed to hold the application (data, program and constants), which can be extended by a PCMCIA memory card (intended to hold the program and constants and, depending on the model, to back up files and symbols for the various application objects).

5.1.1 Modules

All of the modules, except processor (CPU) and power supply (PSU) modules, can be inserted and removed while powered up i.e. Hot swappable I/O's. This will, under no circumstances, cause unpredictable behaviour in the PLC. I/O modules with terminal blocks should have a device for the automatic transfer of coding on first use. This avoids handling errors during replacement of the module. The coding ensures electrical compatibility for each type of module. The consistency of the software configuration is automatically checked after the program has been loaded in the PLC.

The software 1st level diagnostics system also indicates graphically the faulty configuration components for both "in-rack" and remote modules.

The processor and all modules to have a front panel display unit indicating the module status (in-rack or remote). The internal and external faults (operative part) of the module are signalled. The display block should also indicate the status of the channels managed by the module.

5.1.2 Communication functions

There should be pre-defined function blocks to ensure that PLC can communicate with other devices: read/write language objects, send/receive data, send requests, read/write character strings, etc.

The CPU should be able to perform these communication functions in a multi-tasking mode. The functions are independent of the protocol used. The parameters are written in a parameter-setting window in the software. The software for programming these functions should include as a minimum

- A parameter screen for constructing the configuration data to be transmitted to the module
- A debugging and test screen for communication which can be accessed online.

5.1.3 Programming Development software

The development software should be compatible with Windows 95, Windows 98, Windows NT 4.0 and Windows 2000 Professional operating systems. and conform to standard IEC 1131-3.

Access to all debugging and programming tools is via the software application browser. The browser gives an overall view of the program and offers fast access (via context-specific menus) to all application components.

- Configuration editor
- Program editor
- DFB user function block editor
- Variables editor
- Animation tables editor
- Documentation editor
- Runtime screens editor

The software configuration editor should allow as a minimum: Hardware configuration The configuration editor is used, in an intuitive and graphic way, to declare and configure the various components of the PLC application:

- Processor and coprocessor
- Tasks
- Application-specific I/O modules
- Memory

The management of access rights is to be used to limit and control the use of the various software functions. The software should allow various profiles with different access rights The software should have a multi-instance function to be used to work on several applications simultaneously. This function is used:

- To open several different applications locally on the PC to check or copy information
 - To debug online two (or more) applications of two PLC5 on the same network
- This is particularly useful when debugging inter-PLC communication functions.

5.1.4 **Standards and certifications**

PLC conforms to the following standards:

- IEC1131-2
- EN 61131-2
- CSA 22-2 (Canadian Standards Association)
- UL 508 (Underwriters Laboratories)
- C-Tick ACA (Australian Communication Authority/Australia)

It should conform to the certifications relating to marine classification:

- BV (Bureau Veritas/France)
- DNV (Det Norske Veritas/Norway)
- GL (Germanischer Lloyd/Germany)
- LR (Lloyd's Register/United Kingdom)
- RINA (Registro Italiano Navale/Italy)

5.1.5 **Processors**

Each PLC processor has a programming terminal (non-isolated RS 485 link), with two 8-pin mini-DIN connectors for physically connecting two devices to the processor front panel.

- TER connector: used to connect a PC-compatible type terminal or to connect the PLC to the commn. Bus
- AUX connector: used to connect a self-powered peripheral (terminal, operator terminal or printer (no voltage supplied on the connector)).
The CPU needs to be 32 bit, multi tasking, with 1 scan time of 0.2 ms or better for 1 k of program logic

5.1.6 **Memory**

The memory area of PLCs consists of internal RAM designed to hold the application

(data, program and constants) which can be extended by a PCMCIA memory card intended to hold the program and constants and, depending on the model, to back up files and symbols for the various application objects. The application memory is divided into memory areas, physically distributed in the internal RAM and the PCMCIA memory card (if the processor has a memory card):

- The application data area is always in internal RAM.
- The application program area is in the internal RAM or the PCMCIA memory card.
- The constants area is in the internal RAM or the PCMCIA memory card.

Application in internal RAM

The application is entirely loaded in the internal RAM which is backed up by the processor (the capacity depends on the processor model). The memory area (64 Kbytes) is distributed between the application data, the program, the constants and the system data.

Application in PCMCIA card

The internal RAM is now reserved for application data. The PCMCIA memory card contains the program and the constants. The storage area for files of 256 Kbytes or 1.2 Mbytes (depending on the model of PCMCIA card) can be used for distributed applications or for storing information of production data type, manufacturing recipes, etc. The storage area for symbols of 0 or 256 Kbytes or 512 Mbytes (depending on the model of PCMCIA card) can be used to access the application symbols database on the PLC.

Three types of memory extension card are available:

- Protected RAM type memory card
This card is used in particular in the application program creation and debugging phases and enables all transfer and modification services for the application in online mode. A removable battery integrated in the memory card backs up the memory.
- Flash EPROM type memory card
This card is used when the application program debugging is completed and enables only one full transfer of the application to avoid problems resulting from battery-dependent back-up.
- Backup type memory card
This card is pre-loaded with the application program and can be used to reload the program in the internal RAM and internal Flash EPROM of the processor without using a programming terminal. The function is limited to applications where the program does not exceed 64 Kbytes when fully loaded in the internal RAM of the processor.
By default, the application program comments (irrespective of the language used) are stored in the PLC memory.

Certain models of Flash EPROM card also have an area to back up the symbols and comments of the various application objects. The user therefore does not have to pre-load the symbols file for the application on which he wishes to work when connecting the programming terminal for debugging or modifying the application.

The symbols are automatically backed up when a memory extension with a symbols area is selected in configuration.

5.1.7 Power supplies

The power supply modules equip each rack on the PLC and are designed to supply power to the installed modules. Various types of module depending on the electrical power system required are:

- 24 VDC non-isolated
- 24...48 VDC isolated
- 100...240VAC

The AC power supply modules have an integrated power supply delivering a voltage of 24 VDC to supply the input sensors. The sensor power supply connection can be accessed via the module screw terminal block.

The alarm relay located in each power supply module has a volt-free contact which can be accessed via the module screw terminal block. When any fault occurs (partial stop of the application, occurrence of a blocking fault, incorrect voltage, etc.) the relay is activated and its associated contact opens (state is 0).

5.1.8 "In rack" discrete I/O

The input modules in the PLC consist of:

DC

- 24V, 8 and 16 isolated inputs, type 2, screw terminal
- 24V, 32 and 64 isolated inputs, type 1, HEIO connectors
- 48V, 16 isolated inputs, type 2, screw terminal
- 48V, 32 isolated inputs, type 2, HEIO connectors

AC

- 24V, 16 isolated inputs, type 2, screw terminal
- 48V, 16 isolated inputs, type 2, screw terminal
- 100... 120V, 16 isolated inputs, type 2, screw terminal
- 200...240V, 16 isolated inputs, type 2, screw terminal

The inputs are compatible with 2-wire/3-wire/PNP, NPN type proximity switches in accordance with standard IEC 947-5-2.

The output modules in the PLC consist of:

Transistor

- 24V/O.5A, 8 protected outputs, screw terminal
- 24V/2A, 8 protected outputs, screw terminal
- 24V/O.5A, 16 protected outputs, screw terminal
- 48V/1A, 8 protected outputs, screw terminal
- 48V/O.25A, 16 protected outputs, screw terminal
- 24V/O.IA/channel, 32 and 64 protected outputs, HEIO connector

Relay

- 24VDC/3A, 24...240VAC/3A, 8 and 16 outputs, screw terminal
- 24...48VDC/5A, 24...240VAC/5A, 8 protected outputs, screw terminal
- 24...120VDC/5A, 8 protected outputs, screw terminal

Triac

- 24...120VAC/IA/channel, 16 sorties, screw terminal
- 48...240VAC/IA/channel, 16 protected outputs, screw terminal
- 48...240VAC/2A/channel, 8 protected outputs, screw terminal

The outputs conform to standard IEC 1131-2.

Each group of 8 channels can be assigned to a specific application task in configuration: MAST, FAST, EVil task.

5.1.9 “in-rack analog I/O

The configuration software should offer the following configuration and debugging functions:

- Selecting the modules used
- Configuration of the channels according to the type of module: scanning (normal or fast), cold junction compensation (internal or external), range, filtering, display format, task, terminal block detection, wiring check
- Debugging, access to adjustments of certain parameters, diagnostics, module/channel, forcing, calibration

The analog modules consists of:

Input modules

High-level inputs with common point:

- 4 fast channels (1 ms), +/-10 V, 0...5/10V, 1.5V, 0/4..20 mA, resolution 16 bits
- 8 and 16 channels, +/-10V, 0..5/10V, 1...5V, 0/4...20mA, resolution 12 bits

Isolated high-level inputs:

- 8 channels, +/-10V, 0...5/10V, 1...5V, 0/4..20mA, resolution 16 bits

Thermocouple inputs:

- 16 channels, +/-63mV (B,E,J,K,L,N,R,S,T,U), resolution 16 bits

Multi-range isolated low-level inputs:

- 4 channels, +/-10V, 0...5/10V, 1...5V, 0/4...20mA, -13..+63mV, 0.400/3850 Ohms, temperature probe, thermocouple, resolution 16 bits

Output modules

Isolated outputs:

- 4 channels, +/-10V, 0...20mA, 4...20mA, resolution 11 bits + sign

Outputs with common point:

- 8 channels, +/-10V, 0..20mA, 4..20mA, resolution 13 bits + sign

5.1.10 Process control

The PLC processor can be used to install 10, 15 or 20 process control channels. Special screens, accessible using software, are used to configure and debug the control loops without programming.

The software offers default parameters with initial values.

All of the I/O and parameters for the various control channels configured can be accessed by the user at the program level.

The control channels each adopt one of the 5 loop profiles below:

- Process-type loop: loop with only one controller
- Controller with 3 simple loops: controller used to increase the capacity of the number of loops (for 20 channels: 60 loops)
- Autoselective loop, also called secondary loop: consists of 2 loops in parallel with an output selection algorithm
- Cascade loop: consists of 2 dependent loops (the master loop output is the slave loop set point)
- Setpoint programmer: consists of a maximum of 6 composite profiles totalling 48 segments

The channels are independent and the various loops are characterized by:

- The different algorithms
- 5 processing branches (measurement, setpoint, Feed Forward, controller and

output processing)

- Calculation functions (gain, filtering, square root, etc) defined using parameters entered using software

Process control-related calculations are performed in floating point arithmetic expressed in physical units.

5.1.11 Ethernet communication

PLC is connected to the Ethernet network via modules (10 / 100 Mbps) with automatic speed recognition.

Communication uses the TCP/IP Ethernet profile.

The modules have on the front panel:

- A display block indicating the state of the module
- A standard RJ45 connector for a 1 ObaseT/1 OObaseTX interface

The modules can be installed in any PLC slot except for slots dedicated to the power supply and the processor.

The module can be used to exchange 800 messages/second.

These modules should have a ready-to-use Web server installed. The Web server functions should not require any programming at either PLC level or at the level of the PC supporting the browser.

These functions should not affect the PLC scan time.

The main functions are as follows:

- PLC system diagnostics (configuration, module, I/O)
- Access to PLC variables and data (password protection, read/write, access by address and symbols)
- Display, acknowledgment and deletion of alarms (password protection)
- Graphic editor for animated objects linked to PLC variables (copy/paste, set colour parameters, PLC variable, wording)
- Transparent scanning of I/O using read/write requests with Modbus on TCP/IP.
- Word area in the application reserved for read/write of I/O
- Refresh periods independent of the PLC scan
- Management of TCP/IP connections for each remote device
- Feedback of status words for monitoring the correct operation of the service from the PLC application
- Application of pre-configured fallback values if a communication problem occurs
- Scan time for 64 devices: 20 ms

The software option offers:

- a library of C functions for debugging data send/receive requests (240 bytes) directly on the "socket" interface of the TCP layer using software
- elementary communication function blocks integrated in the application
- higher level function blocks, provided as examples, performing more advanced functions such as a complete initialization sequence or the closing of a connection

6. TYPE TEST CERTIFICATE

Switchboard configurations offered shall be CPRI /Independent test house tested. Copies of the CPRI test certificates for same rating & identical switchgear shall be submitted by successful Tenderers at the time obtaining of Vender approval. This shall not be more than 5 years old.

7. TESTING AT WORKS

Copies of type test carried out at ACB/MCCB manufacturers works and routine tests

carried out at the switchboard fabricators shop shall be furnished along with the delivery of the switchboards. Engineer-in-Charge reserves the right to get the switchboard inspected by their representative at fabricators works prior to dispatch to site to witness the routine tests

8. INSTALLATION

The foundations prepared as per the manufacturers drawings shall be leveled, checked for accuracy and the Switchboard installed. All bus bar connections shall be checked with a feeler gauge after installation. The cable end boxes shall be sealed to prevent entry of moisture. The main earth bar shall be connected to the sub-station earths.

Antistatic rubber matting of approved make conforming to IS 5424 – 1983, of minimum 915 mm width 6.5 mm thickness shall be provided in front of and along the full length of the Switchboard. The rubber mat shall withstand 15 KV for 1 minute and leakage current shall not exceed 160 mA/sq. metre.

After installation the Switchboard shall be tested as required prior to commissioning.

9. TESTING AT SITE

Pre-commissioning tests as required and as per manufacturers recommendations shall be carried out on each switchboards at site before energizing the switchboards including but not restricted to the following.

- Physical checking of the switchboards including checking alignment of panels, interconnection of Bus bars, tightness of bolts/connections and evidence of damage/cracks in any components.
- Physical checking and inspections of Inter panel wiring
- Checking free movement of ACBs/MCCBs/SFUs
- Checking of operation of breakers
- Insulation tests of bus bar supports and control wiring etc. with 1.1 kV megger.
- Primary & secondary injection tests of relays and CTs.
- Checking of Interlocking function.
- Closing and left out holes to ensure the entire panel is seal proof
- Earth testing

LIGHTNING PROTECTION

1.0 Scope:

New standard IS/IEC 62305 supersedes old IS 2309:1989 standard for lightning protection. This Section covers necessary requirement of protection of structure from external lightning using new Indian standard IS / IEC 62305, following the various methods and internal lightning protection using surge protection, as defined in the said standard. Please refer IS/IEC 62305 for detail.

2.0 Standard - Brief:

New standard define & mentions the requirement for Lightning protection via its four chapters i.e.

- IS/IEC 62305-1:2010, Protection against lightning – Part 1: General Principles
- IS/IEC 62305-2:2010, Protection against lightning – Part 2: Risk management
- IS/IEC 62305-3:2010, Protection against lightning – Part 3: Physical damage to structures and life hazard
- IS/IEC 62305-4:2010, Protection against lightning – Part 4: Electrical and electronic systems in structures.

Before designing, it is essential to determine the risk involved as per IS/IEC 62305-2, in the structure and depending on the risk involved, level of protection is determined which is basis of designing as per IS/IEC 62305-3.

The design shall be made according to IS/IEC 62305-3 using any or combination of three method, as per defined lightning protection level:-

- ⇒ Rolling sphere method
- ⇒ Mesh method
- ⇒ Protective angle method

The designing is based on level of protection of individual building / structure determined by Risk assessment. It differentiates between four classes of lightning protection system. A Class I lightning protection system provides the maximum protection and a Class IV, by comparison, the least.

Separation distance shall be considered while designing the ELP as per IEC 62305-3 which is essential to avoid creepage flashover. It can be achieved either by maintaining physical separation distance or by use of special cable - High voltage insulated (HVI) cable, as a down conductor to compensate the need of the separation distance, as per IS/IEC 62305 & NBC 2016.

Generally, in new construction buildings, it is recommended to use reinforced down conductor and earthing. As per clause **E.4.3.1 of IS/IEC 62305-3:2010**, It is to be ensured for continuity and maximum overall resistance of 0,2 ohm shall be achieved and can be checked by measuring the resistance between the air-termination system and a ground plate (grounding bus-bar / grounding termination) at ground level.

Lightning Protection components shall be tested for natural weathering and exposure to corrosion in i.e Salt Mist Treatment test according to EN 60068-2-52 and Humid Sulphurous atmosphere treatment test according to BS EN ISO 6988.

Special measure has to be taken for building above 60m, while designing Lightning protection, to protect the building above against side flashes.

Metal compatibility shall be ensured to avoid corrosion and contact resistance at connection point.

2.1 External Lightning Protection (ELP):

The design shall be made according to IS/IEC 62305-3 using any or combination of three method - Rolling sphere, Angle of protection and Mesh method as per defined lightning protection level and same shall be approved by consultant for zone of protection.

Lightning Protection components shall be tested for natural weathering and exposure to corrosion in i.e Salt Mist Treatment test according to EN 60068-2-52 and Humid Sulphurous atmosphere treatment test according to BS EN ISO 6988. Metal compatibility shall be ensured to avoid corrosion and contact resistance at connection point.

Risk Analysis: The design shall be accompanied with proper Risk Analysis as per IS/IEC 62305-2 to determine level of protection required for particular structure which will be basis of design.

External Lightning Protection comprises of below listed items: All components shall meet the requirement of IEC 62305 standard.

Air terminal

It shall be made of Aluminum or it's alloy, complying to EN 62561-2. It shall be mounted in such a way that as far as possible drilling shall be avoided on roof top. The terminal shall withstand wind velocity of 145KM/hour. The length of the Air-terminal rod varies from 1mtr to 4mtr or even higher on special occasion, depending on design to finalize Bill of Material.

Fixing Accessories

Suitable fixing accessories used with Air-terminal to withstand Lightning current and suitable clamp complying to EN 62561-1 for connecting Air terminal with roof conductor.

Down conductor

Preferably round conductor (long length, minimum joints) shall be made of Aluminum or it's alloy or GI or Copper or Stainless Steel, min dia 8 mm, complying to EN 62561-2. Wherever, it is not possible to maintain the separation distance, special isolated cable (like HVI) can be used to avoid separation distance.

Separation distance:

It is necessary to maintain separation distance of down conductors as per IS/IEC 62305-3, to prevent

dangerous flashover between the parts of the external lightning protection system and conductive parts inside the structure (electrical / electronic equipment, pipes, ventilation ducts, etc.) resulting from a direct lightning strike. In case separation is not possible, Special conductors / cable (HVI Cable), according to EN 62305-3 & NBC 2016, may be used for discharging the lightning current to earth while maintaining a sufficient separation distance. High-voltage-resistant insulated down conductor for keeping the separation distance from conductive parts

Natural components made of conductive materials, which will always remain in/on the structure and will not be modified (e.g. interconnected steel-reinforcement, metal framework of the structure, etc.) may be used as parts of an LPS. The reinforcing rods of walls or concrete columns and steel structural frames may be used as natural down-conductors.

As per clause **E.4.3.1 of IS/IEC 62305-3:2010**, It is to be ensured for continuity and maximum overall resistance of 0,2 ohm shall be achieved and can be checked by measuring the resistance between the air-termination system and a ground plate (grounding bus-bar / grounding termination) at ground level.

Roof Conductor

Preferably round conductor (long length, minimum joints) shall be made of Aluminum or it's alloy or GI or Copper or Stainless Steel, min dia 8 mm, complying to EN 62561-2

Fixing Accessories

suitable fixing accessories to be considered to support Roof conductor @ 1 meter as per IS/IEC 62305-3.

Clamp for support to conductor

The conductor shall be made of Stainless Steel/GI and shall be supported with the structure at every 1 mtr, as far as drilling shall be avoided on roof top. The clamps shall be tested for natural weathering and exposure to corrosion in i.e Salt Mist Treatment test according to EN 60068-2-52 and Humid Sulphurous Atmosphere treatment test according to BS EN ISO 6988. In special application, if drilling is not possible, special adhesive clamp is recommended to hold roof conductor on roof / shed.

Test clamps

It shall be made of Stainless Steel/GI and shall be used for every down conductor at 1meter (approx) above to ground level (connection / disconnection purpose).

Earthing system

Each down conductor shall be terminated to either earth electrode or ring earth, Earth electrode shall be 17.2mm dia, 10 feet long, UL listed, min 254-micron copper coating over mild steel, -Each earth electrode shall be supported with RoHS certified, low resistivity ($\leq 0.2\text{ohm mtr}$) Ground Enhancement Material (min22.6Kg), performs in all soil condition, increases the contact area with earth electrode. The final resistance using one rod or ring, shall be $\leq 10 \Omega$.

GI Strip for Earthing

The strip used for connecting down conductor from test link to earth Electrode.
Metal: Galvanized Iron, Size: 30X3.5, Coating of Galvanization: Min 70 micron

Equi-potential bond

All metal (natural conductor) components shall be bonded together with roof/down conductor for equi-potential bonding.

Quantity

Quantity to be determined for each and individual building / structure as per IS/IEC 62305-2 & 3.

Lightning Flash Recorder:

The Lightning system shall be installed complete with the Lightning flash recorder/counter with digital recording.

The Lightning flash recorder, complying to EN 62561-6, shall consist of a mechanical 3 digit display which will register all Lightning discharges with a

sensitivity of up to 100KA 10/350 μ s Lightning impulse current.

The Lightning flash recorder shall be housed in IP 65 rated enclosure and will operate without reliance on batteries or an external power source.

It shall be installed on the most direct down conductor, at height of about 2 meter above ground level or as per user guideline.

Internal Lightning Protection

The Internal Surge Protection Device shall be selected as per zone of protection described in IEC 62305, 61643-11/12/21, 60364-4/5. Depending on Zone concept of provided in IEC 62305 – 1 & 4.

LPZ -O_B & LPZ 1 : At Mains entry point (Main LT Panel): Type 1 + 2, i.e. SPD Combine Arrester with Integrated Backup Fuse.

LPZ1 & LPZ 2 : Sub distribution panel at each floor will be used with Type 2 SPD i.e SPD with integrated fuse - for each Sub Distribution Panel

CCTV control room Panel + Server room Panel + IT building panel will be used with Type 2 SPD for each Panel

All data network will be protected using suitable Surge Protection Device.

3.1 Power Line Protection

Main Distribution Board shall have Type 1 SPD to discharge Lightning current surges for 415 V AC, 3 phase 4 wire (TT) configuration. UPS / Sub Distribution Board shall have Type 2 SPD to discharge switching surges for 415 V AC, 3 phase 4 wire (TT) configuration. Server and sensitive equipments shall have Type 3 SPD at their power input to discharge switching surges.

Type 1, Type 2 and Type 3 devices shall be from same manufacturer to achieve the co-ordination

Type 1 SPD (with inbuild Fuse) - at Main LT Panel

- a) The device shall be non-exhausting metal encapsulated, spark gap based technology.
- b) The device shall be tested as per latest and valid IEC 61643-11:2011 or EN 61643-11:2012 standards .
- c) The device shall be rated for 255 V (U_c) between L-N and N-E.
- d) The SPD should be tested for Temporary overvoltage and it shall with stand 440 V / 120 minutes.
- e) The device shall be capable to discharge Lightning current (10/350 μ s) of 25kA (L-N) and 100kA(N-E).
- f) The device shall have voltage protection level of device shall be ≤ 1.5 KV including inbuilt fuse for L-N.
- g) The device shall have Follow current extinguishing capability [L-N]/[N-PE] : 100 kArms / 100 Arms
- h) The device shall have follow current limitation/Selectivity resulting in no tripping of a 20 A gL/gG fuse up to 50 kArms between L-N.
- i) The device shall have built in fuse and operation of SPD shall be independent of Line current for L-N SPD. The short circuit with stand capability of the device shall be 100 KArms for L-N SPD.

- j) The device shall have mechanical indication for both the states (green for 'healthy' and red for failure) on L-N and N-PE connected SPD.
- k) The device shall be certified by KEMA or VDE as per IEC 61643-11:2011 or EN 61643-11:2012.

Type 2 SPD (with inbuilt Fuse) - at Each Sub Distribution Panel – for Load current more than 125A

- a) The device shall be single shield high duty discharge capacity Zinc Oxide Varistor between L-N and single shield high discharge capacity spark gap between N-Earth.
- b) The device shall be suitable for 3 phase 4 wire (TT) **OR** 1 Phase 2 wire system with nominal voltage parameters of 230 Vac $\pm 10\%$ between L-N and 415 Vac $\pm 10\%$ between L-L
- c) The device shall be capable to discharge 12 KA (10/350 μ s, lightning current) between N-PE and 40 KA (8/20 μ s switching surges)
- d) Voltage Protection level of device shall be ≤ 1.5 KV including built in fuse (for L-N SPD).
- e) The device shall have built in fuse and operation of SPD shall be independent of Line current for L-N SPD.
- f) The device shall have mechanical indication for both the states (green for 'ok' and red for failure) on all modules (L-N and N-PE)
- g) The device shall have pluggable option to change cartridge without disconnection.
- h) The device shall be tested for Vibration and Shock as per EN 60068-2
- i) The device shall be certified by KEMA as per IEC 61643-11:2011 or EN 61643-11:2012.

Note: it is important select proper Type 1 and Type 2 SPDs to ensure achieve co-ordination.

Type 2 SPD: For CCTV Control Room Panel, Server room panel & IT room panel (for load current less than 125A)

- a) The device shall be single shield high duty discharge capacity Zinc Oxide Varistor between L-N and single shield high discharge capacity spark gap between N-E.
- b) The device shall be suitable for 3 phase 4 wire (TT) **OR** 1 Phase 2 wire system with nominal voltage parameters of 230 Vac $\pm 10\%$ between L-N and 415 Vac $\pm 10\%$ between L-L
- c) The device shall be capable to discharge 12 KA (10/350 μ s, lightning current) between N-PE and 40 KA (8/20 μ s switching surges)
- d) Voltage Protection level of device shall be ≤ 1.5 KV
- e) The device shall have mechanical indication for both the states (green for 's' and red for failure) on all modules (L-N and N-PE)
- f) The device shall have pluggable option to change cartridge without disconnection.
- g) The device shall be tested for Vibration and Shock as per EN 60068-2.

- h) The device shall be certified by KEMA as per IEC 61643-11:2011 or EN 61643-11:2012.

2. Data Line Protection:

Telephone line at MDF

Shall consist of Lightning current protector directly coordinated with fine suppressor
Lightning current arrester shall be expandable to a combined lightning current and surge arrester by means of coarse and fine suppressor protective plug.

The integrated disconnection block contacts allow for testing, measuring and patching with plugged-in protection. The three-pole gas discharge tubes have a fail-safe function with visual fault indication.

Fault indication: Visual color change

Nominal voltage: 180 V DC

Max Continuous Operating Voltage: 180 V DC

Max Continuous Operating Voltage: 127 V AC

D1 total 10/350 μ s (I_{imp}) 5KA

D1 per line 10/350 μ s (I_{imp}) 2.5 KA

C2 total Nominal Discharge (I_n) (8/20 μ s) 10 KA

Voltage protection level: ≤ 500 V

Shall comply IEC 61643-21 and approved by third party like EAC

RF Protection:

Protection for UHF/VHF co-axial cable with "N" termination:

Lightning current arrester

SPD class TYPE 1, for coaxial 50 Ohm antenna systems, shall be tested acc. to EN 61643-21, suitable for remote supply, exchangeable gas discharge tube.

- Max. continuous operating voltage (d.c.): 180 V
- D1 Lightning impulse current (10/350 μ s): 5 kA
- C2 Nominal discharge current (8/20 μ s): 20 kA
- Frequency range: 0-2.5 GHz

CCTV:

The IP based camera shall be installed with suitable surge protection device for communication interface over POE at both the ends.

General Specification of SPD

- a) The device shall be capable to discharge lightning impulse current (at 10/350 μ s) of 0.5KA & 10 KA total nominal discharge current (at 8/20 μ s).
- b) The device shall be suitable for maximum continuous DC voltage of 48V.
- c) Voltage Protection level (line to line / line to ground) of device shall be ≤ 700 V.
- d) The device shall be enclosed within Zinc die cast material.
- e) The device shall be DIN rail mounted adopter type with sockets.
- f) The device shall comply to IEC 61643-21/ EN 61643-21 and shall be UL approved.
- g) Cut-off frequency shall be minimum 100 MHz.

Earthing system:

In general, a low earthing resistance is recommended. The recommended value of the overall earth resistance of 10 Ω is fairly conservative in the case of structures in which direct equi-potential bonding is applied. The resistance value shall be as low as

possible in every case but especially in the case of structures endangered by explosive material. **(Refer to IS/IEC 62305-3 Clause E.5.4.1)**

Above ground metal piping in the process/valve area (subject to non Cathodically protected) shall be earthed **(Refer IEC 62305-3, Annex 'D' Para D.5)**

From the viewpoint of lightning protection, a single integrated structure earth-termination system is preferable and is suitable for all purposes (i.e. lightning protection, power systems and telecommunication systems). By interconnecting the earthing system of a number of structures, a meshed earthing system is obtained. This will give low impedance between buildings and has significant LEMP protection advantages.

Thus, different earthing systems like lightning protection earthing, electrical earthing, safety earthing, electronics earthing etc shall be interconnected. And places where direct interconnection is non-permissible then use of **isolating spark gaps (ISG)** is recommended to create equi-potential bonding throughout the earthing system at the event of lightning.

ISG shall be complying to IEC 62561-3, used at the places where direct interconnection is non-permissible to create equi-potential bonding throughout the earthing system at the event of lightning with lightning impulse current (10/350 μ sec / limp) up to 100 KA and rated impulse sparkover voltage of ≤ 1.25 KV with IP 67 degree of protection

LIGHTING

1.0 General

(a) Contract Documents

- (i) All work of this Section shall comply with the requirements of the Conditions of the Contract (General, Supplementary, and Special), with the Drawings, and with all other Contract Documents.

(b) Work Included

- (i) Furnish and install a lighting fitting of the types indicated at each location as per RCP drawings to be approved by Employer's Representative. Combination of various lighting fixtures and downlighter fixtures shall be used to meet the lux level required and to give better aesthetics.
The lighting layout invariable shall be very nice.
- (ii) All materials, accessories, and any other equipment necessary for the complete and proper installation of all lighting fittings included in this Contract shall be furnished by the Contractor.
- (iii) Conformance: Fittings shall be supplied in strict accordance with the Contract Drawings and Specifications.
- (iv) Specifications and scale drawings are intended to convey the salient features, function and character of the fittings only, and do not undertake to illustrate or set forth every item or detail necessary for the work.
- (v) Minor details, not usually indicated on the drawings nor specified, but that are necessary for the proper execution and completion of the fittings, shall be included, the same as if they were herein specified or indicated on the drawings.
- (vi) Omissions: The Employer shall not be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the production of the fittings. The responsibility of accurately fabricating the fittings to the fulfilment of this specification rests with Contractor.

(c) Submittals

- (i) Shop Drawings shall clearly indicate the fitting details used as reference in the development of the shop drawings and the names of the project, Employer, Architect and Designer.
- (ii) The Contractor shall coordinate all his lighting fitting drawings with the drawings and details to the Architectural, Structural, Electrical, Mechanical, and other related trades to assure a correct and efficient installation.
- (iii) No variation from the general arrangement and details indicated on the drawings shall be made on the shop drawings unless required to suit the actual conditions on the premises, and then only with the written acceptance of the Engineer in Charge. All variations must be clearly marked as such on drawings submitted for approval.
- (iv) Catalogue cuts lacking sufficient detail to indicate compliance with contract documents will not be acceptable.
- (v) Timely submission: Shop drawings for all lighting fittings shall be received no later than sixty days after award of Contract.
- (vi) Review of shop drawings or samples does not waive contract requirements.
- (vii) Photometric Data: Where indicated on the fitting schedule and contract

drawings, supply

complete photometric data for the fitting, including optical performance rendered by independent testing laboratory developed according to methods of VDE or IEC as follows:

For down and semi-down lights used for general illumination: (1) coefficients of utilization; (2)

Visual Comfort Probability data (fluorescent only for 100 foot-candles), rooms with reflectance's of 80 percent (ceiling), 50 percent (walls), and 20 percent (floor), including a (7 m. by 7 m.) room with 3.5 m. ceiling and luminaires lengthwise; (3) Candlepower data, presented graphically and numerically, in 5 degree increments (5 degree, 10 degree, 15 degree, etc). Data developed for up and down quadrants normal, parallel, and at 22-1/2 degree, 45 degree, 167-1/2 degree to lamps if light output is asymmetric; (4) Zonal lumens stated numerically in 10 degree increments (5 degree, 15degree, etc) as above.

- (viii) The Contractor shall be responsible for obtaining from his supplying lighting manufacturers,
- for each type of lighting fitting, a recommended maintenance manual including:
- Tools required
 - Types of cleaners to be used
 - Replacement parts identification lists
 - Final, as-built shop drawings
- (ix) Shop drawings for wall switches, push button stations, timers, contactors, lighting control panels and dimmers shall include manufacturers literature, ratings, data, dimensions and schematic diagrams.

(d) Samples

- (i) After shop drawing review, and prior to release for manufacturing, the Contractor shall furnish one sample of each fitting on the fitting schedule and contract drawings for which sample requirement is noted.
- (ii) Shipping: The samples shall be complete with specified lamps and compatible control gear, ready for hanging, energizing, and examining, and shall be shipped, prepaid by the Contractor to the Employer and Designer.
- (iii) Two weeks from date of received shall be allowed for thorough examination of the samples by the Employer and Designer.
- (iv) Not returnable: Samples are not returnable, nor included in quantities listed for a project.
- (v) Samples must be actual working unit of materials to be supplied.

(e) Reference Standards

- (i) Materials and installation shall be in accordance with the latest revision of the International Electrical Code and any other applicable International and local codes and regulations.
- (ii) All equipment and accessories shall be supplied and installed to comply with the relevant EIC Standards or demonstrated equal approved Standards. All the light fixtures shall be with LED lamps with Green Building norm compliances.

NBC – 2016 (or the latest version at the time of execution)	For All the lights of offices, external including Emergency Lighting etc.
ECBC 2017(ECBC+ building)	For LPD to be maintained area wise

2 Products

(a) Fitting Construction (General)

- (i) All materials, accessories, and other related fitting parts shall be new and free from defects which in any manner may impair their character, appearance, strength, durability and function, and effectively protected from any damage or injury from the time of fabrication to the time of delivery and until final acceptance of the work.
- (ii) Sheet Metal Work: All sheet metal work shall be free from tool marks and dents, and shall have accurate angles bent as sharp as compatible with the gauges of the required metal. All intersections and joints shall be formed true of adequate strength and structural rigidity to prevent any distortion after assembly.
- (iii) Housings shall be so constructed that all electrical components are easily accessible and replaceable without removing fittings from mountings or disassembly of adjacent construction.
- (iv) Castings: All castings shall be exact replicas of the approved patterns and shall be free of sand pits, blemished, scales and rust, and shall be smoothly finished. Tolerance shall be provided for any shrinkage of the metal castings in order that the finished castings will accurately fit in their designated locations.
- (v) All lamp holders in lighting fittings shall be suitable for the indicated lamps and shall be set so that lamps are positioned in optically correct relation to all lighting fitting components. If adjustable lamp holder positions are provided, lamp holder should be reset in factory for lamp specified. If different lamp holder positions are specified for same fitting, lamp holders shall be preset for each type, and cartons marked accordingly.
- (vi) All fittings shall be completely wired at the factory.
- (vii) Mounting Frames and Rings: If ceiling/wall system requires, each recessed and semi-recessed fitting shall be furnished with a mounting frame or ring compatible with the ceiling/wall in which they are to be installed. The frames and rings shall be one piece or constructed with electrically welded butt joints, and of sufficient size and strength to sustain the weight of the fitting.
- (viii) Light Leaks between ceiling/wall trims of recessed lighting equipment and the ceilings/walls will not be tolerated. If fitting is used in partially transparent ceiling/wall, light leaks above the ceiling/wall line will not be acceptable.
- (ix) Stirrups, brackets and supplementary supporting members needed to mount lighting fittings to carrier channels or other suitable ceiling members shall be furnished and installed by the Contractor.
- (x) Outdoor Fittings: Fittings for use outdoors or in areas designated as damp locations shall be suitably gasketed to prevent the entrance of moisture. Provide approved wire mesh screens for ventilation openings.
- (xi) Hardware: For steel and aluminum fittings, all screws, bolts, nuts and other fastening and latching hardware shall be cadmium or equivalent plated. For stainless steel fittings, all hardware shall be stainless steel. For bronze

fittings, all hardware shall be stainless steel or bronze.

- (xii) Temperature: All fittings and control gear must operate within the temperature limits of their design and as specified by IEC or applicable local requirements, in the applications and mounting conditions herein specified.
- (xiii) Adjustable Angle Fittings: Each lighting fitting which has a beam angle adjustment shall have reliable angle locking devices.
- (xiv) Oval Beam Fittings: Each lighting fitting which has a lamp with an oval shape beam pattern shall contain lamp orientation locking devices to ensure that beam orientation is not disturbed during fitting lamp replacement or cleaning.
- (xv) Spread Lens Fittings: Each light fitting which has a spread lens shall contain lens orientation locking devices to ensure that lens orientation is not disturbed during future lamp replacement or cleaning.

(b) Reflectors & Trims

- (i) Installation: Reflectors, reflector cones and visible trim of all lighting fittings shall not be installed until completion of plastering, ceiling tile work, painting and general clean-up. They shall be carefully handled to avoid scratching or finger printing and shall be, at the time of acceptance by the Employer, Architect and Designer, completely clean.
- (ii) All silver anodized parabolic cones shall be guaranteed against discoloration for a minimum of ten years, and, in the event of premature discoloration, shall be replaced by the manufacturer, including both materials and the cost of labor.
- (iii) Aluminum reflectors shall be finished specular, semi-specular, or diffuse as required.

Minimum requirements of reflector finished for interior and exterior service shall be as follows:

Description of Service	Minimum Weight of Coating per 25mm square	Minimum Reflectance Percent (specular diffuse)	
		Specular	Diffuse
Exterior industrial and commercial reflector not Protected	10	78	78
Exterior marine service reflector not protected	13	78	65

(c) Lenses

- (i) Plastic for lenses and diffusers shall be formed of colorless 100% Plexiglas or polycarbonate as manufactured by 'I.C.I.' or by 'Elkamet'. The quality of the raw material must equal or exceed IEC Specifications by at least 100% which, as a minimum standard, shall not exceed a yellowness factor of 3 after 2,000 hours of exposure in the Fade-meter or as tested by an independent test laboratory.
- (ii) Plexiglas plastic lenses and diffusers shall be properly cast, molded or extruded as specified, and shall remain free of any dimensional instability,

discoloration, embrittlement, or loss of light transmittance for at least 15 years.

- (iii) Where optical lenses are used, they shall be free from spherical and chromatic aberrations and other imperfections, which may hinder the functional performance of the lenses.
- (iv) Mechanical: All lenses, louvers, or other light diffusing elements shall be removable, but positively held so that hinging or other normal motion will not cause them to drop out.
- (v) All lenses shall be turned over to the Employer clean and free of dust.

(d) Finishes

- (i) Painted Surfaces: Synthetic enamel, with acrylic, alkyd, epoxy, polyester, or polyurethane base, light stabilized, baked on at 350 degree Fahrenheit minimum, catalytically or photo-chemically polymerized after application.
- (ii) White finishes: minimum of 85 percent reflectance.
- (iii) Ceiling/wall opening frames shall either be manufactured of non-ferrous metal, or be suitably rustproof after fabrication.
- (iv) Selection: Unless otherwise noted, finishes shall be as selected by the Employer.
- (v) Undercoat: Except for stainless steel give ferrous metal surfaces a five stage phosphate treatment or other acceptable base bonding treatment before final painting and after fabrication.
- (vi) Unpainted non-reflecting surfaces shall be satin finished and coated with a stoved clear lacquer to preserve the surface. Where aluminum surfaces are treated with an anodic process, the clear lacquer coating may be omitted.

(e) LAMPS

- (i) All lamps shall be LED in accordance with Green Building norms.

(f) CLEANUP

- (i) At the time of final acceptance by the Employer, all lighting fittings shall have been thoroughly cleaned with materials and methods recommended by the manufacturers, all broken parts shall have been replaced, and all lamps shall be operative.

2.1. Specifications for General light fixtures

- (i) All light fixtures shall be LED having LM79 and LM80 certification from NABL accredited laboratory and relevant approved IES files for Dialux. Before dispatch of approved light fixtures, third party test shall be carried out by NABL accredited lab and the test reports shall be submitted
- (ii) The Service Life of the fixture including driver/control gear should be minimum 50,000 burning hours.
- (iii) The CRI of the fixture should be minimum 80 unless otherwise mentioned for both indoor applications and outdoor applications.
- (iv) The THD should be less than 10%.
- (v) The housing of the indoor fixtures should be extruded aluminium/CRCA.
- (vi) For outdoor fixtures the housing shall be of high pressure die cast aluminium.
- (vii) The IP category should be IP20 or higher for indoor applications and IP65 or higher for outdoor applications.

- (viii) The IP category of light fixtures used in entire basements should be IP65 or higher.
- (ix) Edge lit LED lighting fixtures are not acceptable.
- (x) The Surge Protection to be provided conforming to relevant IS standards/IEC 61643-II Class-2 & EN 61643-II Type-2.
- (xi) The manufacturer's name/logo should be engraved/embossed on the housing/body or Name/Logo on aluminum plate labels or Name/logo printed on housing/body.
- (xii) The warranty period on complete LED luminaire including driver/control gear, LED, all accessories should be 5 years from the actual date of completion of work. The guaranty for LED fittings is to be got submitted from the manufacturer also in addition to the guarantee from the contractor. The manufacturer should give undertaking that in case of discontinuation of model and non-availability of spares, they will replace the fittings with equivalent/ high end model in case of manufacturing defect during the warranty period of 5 years.
- (xiii) The Power factor should be 0.95 or higher.
- (xiv) All light fixtures (internal/external) and drivers shall be BIS certified. The manufacturer shall submit BIS certificates with respective R codes for each fitting and driver for approval before execution.
- xv) Before execution, the contractor should get light level calculations from the supplier after selection of fixtures.
- (xvi) The fixtures shall be selected as required as per Reflected Ceiling Plan.

2.2 Specifications for Specialized light fixtures: To be provided in Admin. Building (Executive Director Rooms; Joint Directors Rooms, Deputy Directors Rooms, Conference Rooms and any other senior officers rooms), all rooms of Tutorial Block, Auditorium 1 & 2, Conference Halls 1 & 2. The common areas, corridors, toilets in these buildings may not be provided with this type of specialized light fixtures

- (i) The CRI of the fixtures used in should be minimum 90.
- (ii) LED binning < 3-Step MacAdam
- (iii) UGR<19
- (iv) All fixtures shall be with prismatic diffuser.
- (v) All light fixtures shall be LED having LM79 and LM80 certification from NABL accredited laboratory and relevant approved IES files for Dialux. Before dispatch of approved light fixtures, third party test shall be carried out by NABL accredited lab and the test reports shall be submitted
- (vi) The Service Life of the fixture including driver/control gear should be minimum 50,000 burning hours.
- (vii) The THD should be less than 10%.
- (viii) The housing of the indoor fixtures should be extruded aluminum/CRCA.
- (ix) The IP category should be IP20 or higher for indoor applications and IP65 or higher for outdoor applications.
- (x) Edge lit LED lighting fixtures are not acceptable.
- (xi) The Surge Protection to be provided conforming to relevant IS standards/IEC 61643-II Class-

2 & EN 61643-II Type-2.

- (xii) The manufacturer's name/logo should be engraved/embossed on the housing/body or
Name/Logo on aluminium plate labels or Name/logo printed on housing/body.
- (xiii) The warranty period on complete luminaire including driver/control gear, LED, all accessories should be 5 years from the actual date of completion of work. The guaranty for LED fittings is to be got submitted from the manufacturer also in addition to the guarantee from the contractor. The manufacturer should give undertaking that in case of discontinuation of model and non-availability of spares, they will replace the fittings with equivalent/ high end model in case of manufacturing defect during the warranty period of 5 years.
- (xiv) The Power factor should be 0.95 or higher.
- (xv) All light fixtures (internal/external) and drivers shall be BIS certified. The manufacturer shall submit BIS certificates with respective R codes for each fitting and driver for approval before execution.
- (xvi) Before execution, the contractor should get light level calculations from the supplier after selection of fixtures.
- (xvii) The fixtures shall be selected as required as per Reflected Ceiling Plan.
- (xviii) The LED lighting fixtures shall be DALI dimmable fixtures.

2.3 Lux Level Requirements

- (i) The number of fittings shall be provided to maintain required lux level as well as to maintain the aesthetic look.
- (ii) Number of fittings shall be provided on the basis of average illumination range for different areas mentioned below subject to maximum LPD specified in CPWD internal specification 2013 & ECBC 2017 (ECBC+ Building).
- (iii) **Internal Lighting Levels:**
Lighting shall be based on following average lighting level considerations, which are as per NBC- 2016:

Area / Space	Average Illumination Range in Lux	Type of Lamps	Type of Fixtures
Staircases, Corridors, Refuge Area	100 -150	LED	Location wise fitting and their the specifications as attached for indoor areas
Lift Lobbies, Entrance Lobbies, Waiting Areas	200-250	LED	
Service Areas / Utility Areas Such as Electrical Room, Pump Room, Plant Room/Stores	200-250	LED	

- (iv) **External Lighting:**

Area / Space	Average Illumination Range in Lux	Type of Lamps / Fixtures
Road & outdoor Parking Areas	15 – 20 Lux	LED Lamps Street light fixtures of IP-66 Mounted on 6 to 7m Octogonal type High poles or as required
Boundary wall/Fence for security lighting of patrolling path	15 – 20 Lux	LED Lamps Street light fixtures Mounted on 6 to 7m Octogonal type igh poles or as required.
Path & Landscape areas	Aesthetical Consideration	LED
Façade	As per Aesthetic Intent	LED

- (a) Road Lighting and Boundary wall lighting for partrolling path to be provided with LED lighting placed on Octagonal Poles at suitable height & spacing along the Road and Boundary Wall.
- (b) The brackets may be one/two/three as per the design for the above locations.
- (c) Gates of the campus are to be provided with appropriate Illumination as per Architectural Considerations.
- (d) The bracket of streetlight shall be of the same make of street light pole.
- (e) The Electrical panel board for outdoor lights shall be with programmable Logic Timer controller.
- (f) Wherever, it is possible and as per directions of employer's representative, smart street poles shall be employed for CCTV and street light.
- (v) **Façade, Compound and Landscape Lighting:**
 - (a) The Horticultural Work, Landscaping, Compound Lighting, Water Bodies, Façade Lighting to be provided with appropriate illumination as per aesthetic considerations.
 - (b) Façade and Landscape lighting shall be state-of-the art through a professional lighting designer and shall be provided for the following buildings. The intent shall be to showcase the architectural elements of the following buildings during night time from the arterial roads leading into the building. The various types of LED lighting fixtures, poles etc., to be used for external lighting (Landscaping, façade, Compound Lighting, Water Bodies, Façade Lighting) along with their specifications have been included in this part and the same fittings are to be used.
 - (c) The areas that shall be façade lit:
Façade of the building that are facing road and side facades of the

building based actual layout adopted and as per directions of Employer's Representative.

- (d) The contractor shall prepare and submit façade lighting views along with fixture details before execution of work for approval from Engineer in charge.

(vi) **Fans:**

5 star rated BLDC type 1200 mm Ceiling fans with electronic regulator should be provided in each cabin /room/ work areas as per prescribed norms. If remote is provided for fans, electronic fan regulator is not required to be provided. ISI marked pedestal fans /wall fans shall be used only in areas where using ceiling fans is not possible. These fans will be highest star rated as per availability in the market.

2.4 Internal & External Lighting Fixture Details

- (i) Color temperature of the light fixtures shall be decided area wise at the time of execution. All fittings proposed should be available in 3000/4000K/5600K/6000K/6500K for indoor fixtures depending on the functional usage of the space concerned. The preferred CCT shall be 4000K for indoor spaces.
- (ii) For outdoor fixtures the CCT shall be 6000K/6500K.
- (iii) Color Temperature of fixtures used for façade lighting and landscape lighting shall be approved by the Employer.
- (iv) Different types of fittings are required in different areas. Specifications of different type of fittings have been mentioned below and at the end of this section to provide reference to the bidding parties on the design intent and the energy efficiency. These fixtures are for reference only. Any other fixture with specification mentioned below or better out of the mentioned makes maybe used Subject to approval from Employer's Representative.

Type of Fixture	Mounting Type	Lumen Package (in lumens)	Minimum System Efficacy
2ft x 2ft LED Panel	Recessed	2500/3000/3600 lm	120 lm/W
2ft x 2ft LED Panel	Surface Mounted	3300 lm	120 lm/W
Downlight	Recessed	600-4000 lm	120 lm/W
Downlight	Surface Mounted	700-2000 lm	120 lm/W
4ft/8ftlight linear channel		1300/1800/2300 lm/4ft	120 lm/W
4ft/8ftlight linear channel	Recessed/ Surface Mounted	2600/2900lm/4ft	120 lm/W
4ft/8ft linear channel light (Direct light only)	Suspended	1300/1800/2300 lm/4ft	120 lm/W
4ft/8ft linear channel light (Direct light only)	Suspended	2600/2900lm/4ft	120 lm/W
4ft/8ft linear channel light (Direct/Indirect)	Suspended	2300/2700/3300 lm	120 lm/W
Mirror Light	Wall mounted	800/1600 lm	100 lm/W
IP 20 Batten 20W	Surface/ wall mounted/ suspended	2000 lm	100 lm/W

Type of Fixture	Mounting Type	Lumen Package (in lumens)	Minimum System Efficacy
IP 20 Batten 40W	Surface/ Wall mounted/ suspended	4000 lm	100 lm/W
IP 65 Batten 20W	Surface/ wall mounted/ suspended	2000 lm	100 lm/W
IP 65 Batten 40W	Surface/ wall mounted/ suspended	2000 lm	100 lm/W
Bulkhead	Wall mounted	700 lm	100 lm/W
Pole Light*	Pole mounted	4000/6500/7200/9200 lm	120 lm/W
Uplighter	Inground recessed	900 lm	60 lm/W
Spike Light	Surface mounted	250 lm	70 lm/W
IP 20 Strip Light	Cove	430 lm/W	100 lm/W
IP 65 Strip Light	Cove	250 lm/ft	100 lm/w
Step Light	Wall recessed	200 lm	50 lm/w
Bollard	Surface mounted	300/400 lm	35 lm/W
Flood Light	General area illumination	3500-25000 lm	120 lm/W
Wall grazing	Facade	125-635lm/ft(RGB) / 210-870lm/ft(white)	>50 lm/W
Wall washing	Facade	1500- 2100lm(RGB)/2400- 3200lm(white)	>45 lm/W
Flooding	Facade	4000-10000lm	>45 lm/W
Spots	Facade	1000-1500lm	>45 lm/W

OCTAGONAL POLE

Technical Specification of 9 Mtr Hot Dip Galvanized Street Light Octagonal Pole		
S.I NO	DESCRIPTIONS	
1	General Specifications	Supply of 9Mtr Hot Dip Galvanized Street Light Octagonal Pole with Foundation Type Base Plate & Foundation Bolts (Dimensions for pole as Top Diameter 70 mm, Bottom Diameter 155 mm, Section Length- 9000 mm, Thickness-3 mm, Foundation Type Base Plate (250X250X16 mm), Foundation Bolts (M24 X 700/750 MM- 4Nos).with single type arm bracket 1500 mm long made of 60 mm dia pipe ,suitable for LED street light fitting
2	Pole Shaft	The pole shaft shall be made from sheet steel confirming to BSEN 10025.The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding. All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness (as per IS 2062) with provision for fixing 4 foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e.from inside and outside. Bending of the sheet into polygonal shape shall be done through a CNC controlled, Laser aligned single blade bending process. Foundation accessories will be as per IS 1367.
	Dimension	Pole Top Diameter 70 mm, Bottom Diameter 155 mm, Section Length- 9000 mm, Thickness-3 mm Base Plate (250X250X16 mm), Foundation Bolts (M24 X 700/750 MM-4Nos)
3	Door Opening	The octagonal Poles shall have door of approximate 500 mm length at the elevation of 500 mm from the Baseplate. The door shall be vandal resistance and shall be weather proof to ensure safety of inside connections. Bakelite sheet with one 6A SP MCB and 16 sqmm stud type connector (4 nos) inside the pole at door opening for cable connection. The door shall be flush with the exterior surface and shall have suitable locking arrangement. There shall also be suitable arrangement for the purpose of earthing. The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.
4	Material	Octagonal Poles -Steel Grade BSEN 10025 - S355J0 or Equivalent Base Plate Fe 410 conforming to IS 226 / IS 2062

5	Pole Sections	The Octagonal Poles shall be in single section. There shall not be any circumferential weld joint.
6	Galvanization	The poles shall be hot dip galvanized as per relevant Indian standards with average coating thickness of minimum 65 micron. The poles shall be single dip, hot galvanized as per IS: 2629/IS 2633/IS 4759 standards with minimum coating thickness of 65 microns.
7	Fixing Type	The Octagonal Poles shall be suitable for bolting on a foundation with a set of four foundation bolts for greater rigidity.
8	Bracket for fixing luminaire	The brackets shall be made of specified size G.I heavy duty pipe with minimum 1500 mm long and minimum 48 mm dia with necessary holding brackets, hold fasts etc suitable for LED light mounting. Drawing for light mounting bracket shall also be submitted for approval.
9	Documentation	Pole drawing along with details of baseplate , foundation bolts and foundation details (RCC) shall be submitted along with offer

RING MAIN UNIT (RMU)

1.0 GENERAL

This section covers the technical specifications of High Voltage 11 kv switchgear.

2.0 STANDARDS AND CODES

The Standards and Codes applicable to the works are listed in Annexure I of the tender document and may be referred to.

3.0 AMBIENT CONDITIONS

The equipment shall be suitable for operation at the rated current at ambient condition of 45 Deg C and 80% RH unless otherwise stated in special condition of contract.

4.0 SWITCHGEAR

4.1 High Voltage Circuit Breakers

4.1.1	Type	Vacuum
4.1.2	Operating voltage	11,000 volt 3 phase 50 Hz
4.1.3	Insulation Voltage	12,000 volts
4.1.4	Current rating	As per Schedule of Quantities
4.1.5	Fault Level withstand	350 MVA/ 18 kA at 11 kv or as per Schedule of Quantities whichever is greater
4.1.6	Short time rated thermal current	18 kA for 1 second at 11 kv or as per Schedule of Quantities whichever is greater
4.1.7	Short time peak withstand current	18 kA at 11 kv or as per Schedule of Quantities whichever is greater
4.1.8	One minute power frequency withstand voltage (kv)	28 kv
4.1.9	Impulse voltage withstand with 1.2/50 micro second wave shape (kv peak)	75 kv peak
4.1.10	Operating Duty	O-0.3 sec-CO-15 secs-CO
4.1.11	Breaker rating	The Circuit Breaker shall be continuously rated as specified with a minimum current rating of 630 amps.
4.1.12	No of Poles	3
4.1.13	Interrupting medium	Single break contacts housed in a sealed vacuum interrupter. The vacuum interrupter shall be hermetically sealed and shall be designed for minimum contact erosion, fast recovery of di-electric strength, maintenance free and suitable for auto reclosing.
4.1.14	Cassette mounting	<ul style="list-style-type: none"> • Draw out. • Each Circuit Breaker shall have its own Cassette.
4.1.15	Operating mechanism	<ul style="list-style-type: none"> a) Trip free such that the circuit breaker is at all times free to open immediately the trip coil is energised b) Independent Manual spring closing (IMS) or motor wound spring closing mechanism (MWS) as per Schedule of Quantities c) One open-close-open operation of the breaker shall be possible after loss of supply to the motor.

4.1.16	Mechanism Positions	Circuit breaker operating mechanism shall provide 3 distinct and separate positions of the circuit breakers on the cradle <ul style="list-style-type: none"> ➤ Service ➤ Test ➤ Fully Isolated ➤ Earth
4.1.17	Anti Pumping feature	Required
4.1.18	All current carrying parts	Silver plated
4.1.19	Circuit Breaker Housing	Flush front rigid fabricated construction truck. The breaker carriage shall be fabricated from steel, providing a sturdy vehicle for the circuit breaker and its operating and tripping mechanism. The carriage shall be mounted on wheels, moving on guides, designed to align correctly and allow easy smooth movement of the circuit breaker and for removing the carriage for inspection and maintenance purposes.
4.1.20	Isolating Contacts	Self aligning cluster type
4.1.21	Auxiliary Contacts	<ul style="list-style-type: none"> a) Self aligning sliding auxiliary contacts. b) Free / minimum 4 NO/NC auxiliary contacts rated at 16 amps 415 volts 50 Hz c) These shall be approachable from the front for connecting all external wiring d) They shall close before the main contacts when the Circuit Breaker is plugged in and vice versa when the Circuit Breaker is Drawn Out of the cubicle. e) The fixed portion of the sliding contacts shall have easy access for maintenance purposes. <p>After meeting all necessary control and indication requirements 2 nos NO and 2 nos NC auxiliary contacts of the breaker shall be made available for the Owner, wired upto terminal block.</p>
4.1.22	Safety Shutters	Earthed metal or insulated automatically operated shutters to screen live cluster contacts when the Breaker is withdrawn from the cubicle
4.1.23	Surge Protection	Vacuum circuit breakers shall be provided with suitable surge protection devices to restrict rate of rise of restriking voltage.
4.1.24	Interchangeability	Circuit breakers of identical rating shall be completely interchangeable
4.1.25	Circuit Breaker Accessories	<ul style="list-style-type: none"> a) Racking in / Racking out mechanism. b) Isolating plugs and sockets. c) Safety shutters.
4.1.26	Indications- mechanical and LED	The following minimum indication mechanical/ lamps shall be provided in the front of the cubicle. Lamps shall be

		<p>clustered LED type and trip circuit supervision scheme shall be of continuous supervision type.</p> <p>Mechanical Indications</p> <ol style="list-style-type: none"> Mechanical ON/OFF indicator. Mechanical counter to assess the total number of operations of the breaker Shrouded manual emergency trip push button, Breaker in test position Breaker in service position. <p>LED Indicating Lamps</p> <ol style="list-style-type: none"> Breaker Open/ Closed/Tripped. Spring charged trip circuit healthy Control supply healthy. . Spring charged/discharged indicator.
4.1.27	Safety Device	Safety shutters shall be earthed
4.1.28	Load Break Switch	<p>The switching-unit is designed as a three-position-switch. This three-position-switch combines the functions of switch-disconnector and earthing-switch. The switch-disconnector as well as the earthing-switch is equipped with a separate drive-unit.</p> <p>1 Cable switch 12 kV, 630 A, 21 KA.</p> <p>1 snap action mechanism for manual operation with integrated earthing switch.</p> <p>1 cable bushing 630A, standard C bushings.</p> <p>1 cable cover standard</p> <p>1 capacitive voltage indication fixed type –LCD display</p> <p>1 ON,OFF, EARTH indication on the front mimic of the panel.</p> <p>1 cable box for termination of cable up to 300 sq.mm</p> <p>1 cable entry bottom, front</p>
4.1.29	Interlocking	<p>The Circuit Breaker/ panels shall be provided with the following interlocks in conformity with IES 62271-200</p> <ol style="list-style-type: none"> The withdrawal or engagement of a Circuit Breaker shall be prevented unless it is in the Open position The operation of a Circuit Breaker shall be prevented unless it is in the Service, disconnected, removed, test or earth position. The interlocking shall prevent the closing of the Circuit Breaker in the Service position unless any auxiliary circuits associated with the automatic opening of these devices are connected. Conversely it shall prevent the disconnection of the auxiliary circuits with the Breaker closed in the Service position. Breaker cannot be racked from one position to the other in close position.

		<p>e) Earthing switch cannot be switched ON when truck is inside panel.</p> <p>f) Truck can not be inserted with earthing switch is ON position.</p> <p>g) Breaker cannot be operated in any intermediate position.</p> <p>h) Breaker cannot be opened or closed with compartment front door open.</p> <p>i) With selector switch in "local" position breaker can only be operated in "test" position. For operation in "service" position, control must be from "remote"</p> <p>j) All switching operations including Breaker rack in/out to be performed with front door closed.</p> <p>The drive mechanism shall preferably be provided with facility for pad locking at any position namely, "Service", "Test" and "Fully Isolated"</p>
4.1.30	Earthing	The earthing of the breaker body and moving portion shall be so arranged that the earthing of the non-current carrying structure to the frame earth bar is completed well before the main circuit breaker plugs enter the fixed sockets.
4.1.31	Type test certificates	Submit Certificates from a recognised test house for the Circuit Breakers offered.

4.2 Current transformer:

4.2.1	BSI Standards	Compliance to IS 2705: 1992 as per latest issue
4.2.2	Construction	Cast Epoxy Resin
4.2.3	C.T. configuration	Dual core – one core for measurements and the second for protection
4.2.4	Current rating – primary	As per Schedule of Quantities
4.2.5	Current rating – secondary	1 or 5 amp as per Schedule of Quantities
4.2.6	C.T. Burden	As per Schedule of Quantities but not less than 15 VA
4.2.7	Class of Accuracy	As per Schedule of Quantities
4.2.8	CT Shorting blocks	To be provided
4.2.9	Short circuit withstand	C.T.'s shall withstand thermal and dynamic stresses during short circuits
4.2.10	C.T. Secondary terminals	Secondary terminals of CTs shall be brought out suitably to a terminal block which will be easily accessible for testing and terminal connections

4.3 Voltage transformer:

4.3.1	BSI Standards	Compliance to IS 3156 as per latest issue
4.3.2	Construction	Cast Epoxy Resin
4.3.3	Voltage rating – primary	As per Schedule of Quantities
4.3.4	Voltage rating – secondary	As per Schedule of Quantities
4.3.5	P.T. Burden	As per Schedule of Quantities but not less than 100 VA
4.3.6	Class of Accuracy	As per Schedule of Quantities
4.3.7	P.T. mounting	Chassis mounted withdrawable
4.3.8	11 kv Protection	HRC Fuses
4.3.9	Low Voltage protection	MCB/ MCCB/ MPCB of adequate and suitable fault withstand level.

Section-7

**Bill of Quantities
Attached at Annexure-A**

Section-8

DRAWINGS
Attached in Volume-2

Willows, Electrification Drawings		
SR NO.	DRAWING NO.	DRAWING TITLE
1	UT/WILL/Architectural Plan For ESS-1	Architectural Plan For ESS-1
2	UT/WILL/Architectural Plan For ESS-2	Architectural Plan For ESS-2
3	UT/WILL/Architectural Plan For ESS-3	Architectural Plan For ESS-3
4	UT/WILL/Feeder Panel Foundation Details other side	Feeder Panel Foundation Details Outer Side
5	UT/WILL/PLAN & FOOTING/ESS-1	Footing Plan ,Sections Details For ESS-1
6	UT/WILL/PLAN & FOOTING/ESS-2	Footing Plan ,Sections Details For ESS-3
7	UT/WILL/PLAN & FOOTING/ESS-2	Footing Plan ,Sections Details For ESS-3
8	UT/WILL/G-SET /PLAN & FOOTING/ESS-1	Transformer Pedestals, Gen- set Footing Plan ,Sections Details For ESS-1
9	UT/WILL/G-SET /PLAN & FOOTING/ESS-2	Transformer Pedestals, Gen- set Footing Plan ,Sections Details For ESS-2
10	UT/WILL/G-SET /PLAN & FOOTING/ESS-3	Transformer Pedestals, Gen- set Footing Plan ,Sections Details For ESS-3
11	Typical Fencing Details For ESS-1,2 &3	Typical Fencing Details For ESS-1,2 &3
12	ED-DG-101	DG SCHEMATIC (ESS-1)
13	ED-DG-102	DG SCHEMATIC (ESS-2)
14	ED-DG-103	DG SCHEMATIC (ESS-3)
15	ED-01	ELECTRICAL LAYOUT
16	ED-02	ELECTRICAL SUBSTATION LAYOUT
17	ED-03	ELECTRICAL LAYOUT
18	ED-101	ELECTRICAL SCHEMATIC (ESS-1)
19	ED-102	ELECTRICAL SCHEMATIC (ESS-2)
20	ED-103	ELECTRICAL SCHEMATIC (ESS-3)
21	LP-01	LIGHTNING PROTECTION LAYOUT
22	ED-02	STREET LIGHTING LAYOUT

Section-9

Approved Makes List & Material Specifications

UNITECH PROJECTS : CIVIL WORK BRANDS		
Sr. No.	Material Name	Middle Income Group (MIG)
1	2	5
1	Cement	
i		Ultra Tech
ii		Lafarge
iii		ACC
iv		Ambuja
v		COROMANDAL, CHETTINAD, VASAVDUTTA
vi		NUVOCO, CHETTINAD, DALMIA CEMENTS
vii		PRISM, BIRLA PLUS
2	Reinforcement Steel {TMT Fe 500, Fe 550} and Structural Steel [Tubular sections, Hollow Steel sections & Rolled Steel sections]	
i		JSW
ii		RINL (Vizag Steel)
iii		JSW
iv		SAIL
3	Door Fixtures & Fastenings	
i	Main internal door	
a)	Stainless steel	
i		Haffle
ii		Hattich
iii		Dorset
iv		GEZE
v		GODREJ
vi		OZONE
vii		HARDWYN
viii		
ix		
x		
xi		
4	Aluminium Sections	
i		Jindal
ii		Hindalco
iii		Superfine
iv		Bhoruka
v		Shri Narmada
vi		Agravanshi
vii		Global Aluminium
viii		Indo Alusya

UNITECH PROJECTS : CIVIL WORK BRANDS		
5	Vitrified tiles (600mm x 600mm) incl. Anti-skid , Matt etc. {ONLY MOTHER PLANT TILES TO BE PROCURED}	
i	BASIC RATE FOR TILE & GRANITE	Kajaria
ii		Johnson
iii		Nitco
iv		RAK
v		Asian
vi		
vii		
6	Synthetic Enamel Paint, Plastic Emulsion Paint, Oil Bound Distemper, Acrylic Distemper and Primer	
i		Asian
ii		Nerolac
iii		Berger
iv		Dulux
7	Glass	
i		Saint Gobain
ii		Modi Asahi
iii		Pil Kington
iv		Emiretus
v		Modiguard
8	Expansion Joint treatment	
i		Chowgule Construction Chemicals Pvt. Ltd.
ii		Bizzar Expansion
iii		LBH Expansion Joints India Pvt Limited
iv		NTE India Pvt. Ltd.
v		SANFIELD (INDIA) LIMITED
vi		a) SNPG-600
vii		b) SRFL -600
viii		KANTAFLEX
9	Floor tiles 300 mm x300 mm for Bathrooms	
i		Kajaria
ii		Johnson
iii		Nitco
iv		RAK
v		Asian
vi		Orient Bell
VII		Somany

UNITECH PROJECTS: EXTERNAL and COMMON AREA BRANDS

Sr. No.	Material Name	Approved Makes
1	Self-Adhesive Waterproofing Membrane	Grace India
		Texa India Ltd.
		Supplier to be approved by Engineer in Charge/ Employer after receipt of Samples & Technical Specifications

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
1	2	3
1	LED Tube/Lamp/Bulb	
i		Philips
ii		Havells
iii		Crompton
iv		Toshiba
v		Osram
		GE
		Wipro
2	LED Internal Light Fixture	
i		Philips
ii		Havells
iii		Crompton
iv		Toshiba
v		Osram
vi		Wipro
vii		Bajaj
viii		Decon
		GE
3	LED Street Light Fittings	
i		Philips
ii		Havells
iii		Wipro
iv		Crompton
v		Bajaj
4	LED Flood Light	
i		Philips
ii		Havells
iii		Wipro
iv		Crompton
5	LED Pathway Light	
i		Philips
ii		Havells
iii		Wipro
iv		Crompton
v		HPL
6	LED Gate Light	
i		Philips
ii		Havells

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iii		Wipro
iv		Crompton
v		HPL
7	LED Underwater Light	
i		Philips
ii		Havells
iii		Wipro
iv		Crompton
v		HPL
8	Ceiling Fans	
i		Crompton
ii		Orient
iii		Havells
iv		Khaitan
v		Usha
vi		Bajaj
9	Exhaust Fans	
i		Crompton
ii		Orient
iii		Havells
iv		Khaitan
v		Usha
vi		Bajaj
10	Modular Switch, Socket & Sheet	
i		Schneider Opal
ii		Wipro Stylus +
iii		Legrand Myrius
iv		MK Wrap round plus
v		Anchor Vision
11	Modular TV, Telephone & Data Socket	
i		Schneider Opal
ii		Wipro Stylus +
iii		Legrand Myrius
iv		MK Wrap round plus
v		Anchor Vision
12	Industrial Sockets	
i		Schneider
ii		Hensel
iii		Legrand
iv		Neptune

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
v		HPL
vi		Havells
13	DB, MCB, RCCB, RCBO,ELCB	
i		Schneider
ii		Siemens
iii		ABB
iv		L&T
v		Wipro
vi		Hager
vii		Legrand
viii		Havells
14	MPCB	
i		ABB
ii		L&T
iii		Schneider
iv		Siemens
15	HRC Switch Fuse Units	
i		Schneider
ii		Siemens
iii		ABB
iv		L&T
v		Wipro
vi		Hager
vii		Legrand
viii		Havells
16	Lamp Holder	
i		Havells
ii		Bajaj
iii		wipro
iv		Anchor
v		HPL
17	Video door phone	
i		Zicom
ii		Legrand
iii		Panasonic
iv		Hikvision
v		Honeywell
18	Copper Wires : 1100V/660V Grade FRLS	
i		Finolex
ii		Polycab
iii		KEI

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iv		Havells
v		RR cable
vi		Skytone
19	RG6, RG11 Coaxial T V & Telephone Cable	
i		Finolex
ii		Polycab
iii		Delton
iv		KEI
v		Rallison
vi		Lapp
vii		Beldon
viii		D Link
20	CAT 6 Cable	
i		Finolex
ii		Dlink
iii		Polycab
iv		Legrend
v		Belden
vi		AMP
vii		Systimax
viii		Avaya
21	CAT 6 I/O Socket	
i		Dlink
ii		Lucent
iii		Molex
iv		Legrend
v		Belden
vi		AMP
vii		Systimax
xi		Avaya
22	PVC Conduits & Accessories	
i		Polycab
ii		AKG
iii		BEC
iv		Precision
v		Finolex
vi		Sudhakar
23	MS Black enameled /galvanised ERW conduit	
i		BEC

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
ii		Steel Craft
ii		AKG
24	MS PIPES and GI PIPES	
i		JINDAL
ii		TATA
iii		SURYA
iv		SAIL
25	XLPE Cables & Accessories	
i		Polycab
ii		Havells
iii		Finolex
iv		KEI
v		Cables corporation of India
vi		RPG Cables Ltd.
vii		Universal cables ltd.
viii		Gemscab Industries Ltd
ix		Gloster cables
		Ravin cables pvt ltd
26	Control cable/ Fire survival, Communication Cables	
i		Polycab
ii		Havells
iii		Finolex
iv		KEI
v		Laap
vi		Delton
vii		Fusion Polymer
		Rallison
27	Cables Glands & Lugs	
i		Dowell
ii		Comet
iii		Centurion
iv		Bentec
v		Jainson
		Baliga lighting eqpts ltd
		FCG Power IND Pvt Ltd
28	Bimetalic Cable Lug	
i		Comet
ii		Cosmos
iii		Dowells

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iv		Jainsons
29	PVC Glands	
i		Comet
ii		Dowells
iii		Gripwel
v		Jainsons
		HMI
30	Aluminum Raceways	
i		Jindal
ii		Bemtec
iii		Indiana
iv		HILTI
v		Gripple
vi		Legrand
vii		Slotco
viii		MEM
31	MS/GI Cable Tray & Raceways	
i		Indiana
ii		Ricco
iii		Pilco
iv		Hi Reach
		Slotco
		SPC Electrotech
32	Load break switch	
i		Legrand
ii		L&T
iii		HPL
iv		Panasonic
v		Siemens
vi		Havells
vii		ABB
33	Changeover Switch	
i		Siemens
ii		Schneider
iii		Socomec
iv		L&T
v		ABB
vi		Havells
vii		HPL
34	ATS	
i		Siemens
ii		Schneider

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iii		Socomec
iv		L&T
		ABB
35	ACCL	
i		Pork device
ii		Havells
iii		Salzer
iv		L & T
v		Electron
36	Electrical Measuring Meters	
i		L&T
ii		HPL
iii		Siemens
iv		Socomec
v		Neptune
vi		Conzerv
vii		Schneider
viii		Secure
37	Capacitors	
i		L&T
ii		Epcos
iii		Neptune
iv		Schneider
v		Siemens
38	Lightning Arrestor	
i		Altec
ii		Duval Messien
iii		ABB
iv		Erico
v		Crompton
vi		Jmv Lps Pvt.Ltd
vii		Indelac
viii		Obo Betterman
39	Main LT PANEL and AFC Panel	
i		Tricolite
ii		Adlec System
iii		Advance Panel & Switchgear Pvt. Ltd. New Delhi
iv		Jakson
v		Ambit Switch gears- Noida
vi		Sudhir Power
vii		Indian Electrical

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
		L&T
		SPC Electrotech
40	L.T. Feeder Pillar	
i		Tricolite
ii		Adlec System
iii		Advance Panel & Switchgear Pvt. Ltd. New Delhi
iv		Jakson
v		Ambit Switch gears- Noida
vi		Sudhir Power
vii		Indian Electrical
		L&T
		SPC Electrotech
41	AIR Insulated / Sandwich Bus Duct & Rising Main	
i		C&S
ii		L & T
iii		Schneider
iv		Zucchini Legrand
v		Adlec System
vi		Tricolite
vii		Jakson
viii		Advance Panel & Switchgear Pvt. Ltd. New Delhi
ix		Zeta
		SPC Electrotech
42	Metering Cubicle	
i		Tricolite
ii		Adlec System
iii		Advance Panel & Switchgear Pvt. Ltd. New Delhi
iv		Jakson
v		Ambit Switch gears- Noida
vi		Sudhir Power
vii		Indian Electrical
43	HT Panel Indoor/Out door VCB/RMU	
i		Siemens
ii		Schneider
iii		L & T
iv		Crompton
v		ABB
		SPC Electrotech

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
44	11KV isolator & D.O. fuse.	
i		Topaz
ii		Siemens
iii		ABB
iv		L&T
v		Schneider
vi		GE
45	D G Set- Engine	
i		Kirloskar
ii		Cummins
iii		Cromptons
iv		Perkins
v		Caterpillar
46	D G Set- Alternator	
i		Stamford
ii		Kirloskar
iii		Leroy Somer
iv		Caterpillar
v		Trident
vi		Toyo Donkey power
47	Elevator/ Escalator	
i		Otis
ii		Kone
iii		Johnson
48	Water Pumps	
i		KIRLOSKAR
ii		CROMPTON
iii		GRUNDFOS
iv		WILO
v		EBARA
		Lubi
49	Solar Water Heating Systems	
i		COMFONOMICS
ii		TATA SOLAR
iii		SURYA
iv		BHEL
v		Solarhart
vi		Photon
vii		BIPSUN
viii		RACOLD
ix		Solimpeks
x		KK Tech Eco Product Pvt. Ltd.

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
xi		Ecoguard
xii		Composite Nirman Materail Pvt. Ltd.
50	Air Source Heat Pump	
i		Aquarian Systems
ii		Phillips
iii		Murphy
iv		SYSKA
v		ENSYS
vi		A.O. Smith
vii		STIEBEL ELTON
51	Insulating Mats- LT & HT Rating	
i		Jyoti
ii		Padmini
iii		Premier Polyfilm
iv		Tata Rubber Corporation
v		Suntex
52	Fire Sealent and Fire Retardent Paint	
i		3M India
ii		Hilti
iii		OBO Betterman
iv		Starvac Flammadar
v		M Seal
53	Surge protection device	
i		JMV
ii		DHEN
iii		OBO
iv		MERSEN
54	Solar PV Cleaning System	
i		OORJA
ii		SOLBRIGHT
iii		ECOPPIA
55	Solar Inverter/Power conditioning unit	
i		Solis
ii		Delta
iii		Tata Power
iv		Havells
v		Luminous
vi		BHEL
vii		Moaserbear
56	SPV Modules-Mono Perc	
i		Reneways

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
ii		Adani
iii		Tata Power
iv		Jakson
v		BHEL
vi		Moaserbear
57	SPV Modules Bifacial	
i		Reneways
ii		Adani
iii		Tata Power
iv		Jakson
v		BHEL
vi		Moaserbear
58	FUEL CELL SYSTEM	
i		BLOOM ENERGY
ii		FC TECNRGY
59	EXIT SIGNAGES	
i		Legrand
ii		ABB
iii		Philips
iv		MK
v		D-Lite
vi		Cease Fire
vii		Cooper
ix		Bajaj
60	HDPE - Pipe	
i		Duraline
ii		Rex Poly Extrusion
iii		Tirupati Plasomatics
61	Lighting Poles	
i		Bajaj
ii		Bombay Tubes & poles
iii		Surya
iv		Philips
v		Wipro
vi		Keselec
vii		BPP pole
62	Anchor Fastner	
i		Fischer
ii		Hilti
iii		Power fastener
63	Occupancy Sensors	
i		Honywell

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
ii		Schneider
iii		Johnson
iv		Siemens
v		Wipro
vi		Philips
64	Lighting Control Equipment/ Dimmers	
i		Lutron
ii		Crystron
iii		Schneider
iv		Wipro
v		Legrand
vi		Panasonic
65	Aviation Obstruction Light LED Type	
i		Bajaj
ii		Philips
iii		Wipro
iv		Havells
v		Instapower Ltd
66	Terminal Blocks	
i		Connectwell
ii		Elmax
iii		Wago
67	POP UP Boxes	
i		Legrand
ii		MK
iii		ABB
69	Push Button & Indicating Lamp	
i		L&T
ii		Schneider
iii		Kaycee
iv		ABB
v		Siemens
70	66kV and 33 KV OUTDOOR SWITCHYARD PACKAGE	
i		ABB
ii		CG Power and Industrial Solutions LTD
iii		L&T
iv		SIEMENS
v		SREX POWER INDIA PVT. LTD.
vi		STERLING & WILSON INDIA
71	66kV and 33 KV GIS (Indoor)	

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
i		ABB INDIA
ii		SCHNEIDER ELECTRIC INDIA
iii		SIEMENS
72	CATHODIC PROTECTION SYSTEM	
i		BSS TECH CP INDIA PVT. LTD.
ii		CATHODIC CONTROL COMPANY
iii		CONSULTECH CATHODIC PROTECTION ENGRS & INDIA
iv		CORROSION CONTROL SERVICES PVT. LTD.
73	ELECTRICAL CONTROL SYSTEMS (MICRO-GRID / SCADA)	
i		HONEYWELL
ii		DEIF INDIA PVT LTD
iii		ROCKWELL AUTOMATION
iv		SCHNEIDER ELECTRIC INDIA PVT LTD
v		SIEMENS
74	NEUTRAL GROUNDING RESISTORS-H.V.	
i		IRESKO ELECTRICALS PVT. LTD. INDIA
ii		NATIONAL SWITCHGEARS
iii		RESITECH ELECTRICALS PVT LTD
iv		RSI SWITCHGEAR PVT LTD
v		S.R. NARKHEDE ENGINEERING PVT LTD
75	Protection Relays	
i		ABB
ii		Alstom
iii		Easun Reyrolle
iv		L&T
v		Schneider
vi		Areva
76	AUX. / Bimetalic Relays	
i		ABB
ii		Schneider
iii		Easun Reyrolle
iv		L&T

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
v		Siemens
77	Flame Proof Panel Light LED & Accessories	
i		Baliga Lighting Eqpts Ltd.
ii		FCG Power Industries
iii		Flame proof Eqpts Pvt.Ltd
78	Instrument Transformers CT & PT - MV	
i		Gilbert & maxwell
ii		Kappa
iii		L&T
iv		AE
v		Matrix precise
79	Instrument Transformers -HV CT & PT	
i		Kappa
ii		Pragati
iii		Schneider
iv		Siemens
v		ABB
80	Fuses	
i		Cooper
ii		L&T
iii		Siemens
iv		ABB
v		Schneider
		GE
81	Cable Termination & jointing kit(Heat Shrinkable)	
i		3M India
ii		Raychem
iii		Yamuna gases & Chemicals
iv		M Seal
82	Contactors	
i		ABB
ii		C & S
iii		L & T
iv		Schneider
v		Siemens
		GE
83	Selector Switches	
i		Kaycee

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
ii		L & T
iii		Siemens
iv		Salzer
v		Neptune
84	Air Circuit Breaker- ACB	
i		Siemens - 3WL
ii		Schneider- Masterpact
iii		L & T- U power
iv		ABB -E max
		GE
		C&S Electric limited
85	MCCB	
i		L&T D sine
ii		Schneider compact
iii		Siemens VL
iv		ABB Tmax
86	High Mast Lighting System	
i		Bajaj
ii		CG Power
iii		Philips
87	U.P.S. System	
i		APC
ii		Emerson
iii		Delta
iv		Numeric
v		Eaton
vi		Toshiba
88	Batteries	
i		Exide
ii		Amaron
iii		Amar Raja
iv		Panasonic
v		Amco
vi		HBL
		Hitachi
89	Battery Charger	
i		Max
ii		Mohamai
iii		Amar Raja
iv		HBL
v		Chloride Power System

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
90	Switch Board Fixed for Pakage equipments	
i		Adlec
iii		Advance Panel
iv		Tricolite
v		Jackson
vi		Neptune
		SPC Electrotech
91	Gang Operated air breaker Switch unit 11KV	
i		Pactil
ii		Isotech
iii		Mitsubishi
92	11 KV pallet type lighting accessories	
i		BHEL
ii		WSI
iii		PACTIL
93	11 KV Insulator	
i		BHEL
ii		WSI
iii		PACTIL
94	11 KV Elastomeric Rubber Floor Mat	
i		Suntax
ii		Tycoon
iii		Polymax
95	Time Switches	
i		L&T
ii		Schneider
iii		Siemens
iv		Legrand
96	Chemical Earthing	
i		Altec
ii		Erico
97	Butterfly Valves	
i		Audco
ii		Advance
iii		Sant
98	Balanceing Valve	

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
i		Advance
99	Ball Valve/Gate Valve	
i		Audco
ii		Advance
100	Check valve(NRV)	
i		Audco
ii		Advance
101	Flexible Coupling with SS guard	
i		Resistoflex
ii		Kanwal
102	Strainer for water line	
i		Sant
ii		Venus
iii		Emerald
103	Pressure Guage	
i		Fiebig
ii		H.Guru
104	Temperature Gauge	
i		Fiebig
ii		H.Guru
105	Insulation	
i		UP Twiga
ii		Lloyd
iii		Rock Wool
106	Rotary Gear Pump	
i		Rotodel
ii		Delta
107	Bulk oil Tank	
i		Indo Asiatic
ii		Rapid Cool
iii		Raunaq Enterprises
108	Flame proof motor	
i		Crompton
ii		KEC
109	Red Oxide Primer Paint	
i		Shalimar
ii		Asian
110	Rust Preventing Polymeric tape	
i		Pypekote
111	Flow meter (Diesel)	
i		Kent
ii		AquaMetro

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
112	Bucket/ Y -Strainer	
i		Emerald
ii		Stainwell
iii		Aquo Metro
113	Adaptor	
i		kayess
114	Stainless Steel Bellow	
i		Kanwal
ii		Alfa flexi
115	Flame Proof Level switch	
i		
ii		Minilec
iii		Veksler
116	Fire Extinguisher	
i		Minimax
ii		Newage
iii		Superex
117	MS Conduit Accessories	
i		Sharma
ii		Rama
iii		Noble
118	Hume Pipe	
i		Pragati
ii		Daya Spun
iii		Jain Spun
119	RCC Frame & Cover	
i		KK Manhole
120	Pumps	
i		Grundfos
ii		KSB
iii		Wilo
iv		Mather Platt
v		Xylem
vi		Kirloskar
vii		Armstrong
viii		Crompton
ix		
		Lubi
121	Electrical Motors	
i		Siemens
ii		ABB

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iii		KSB
iv		Crompton
v		Mather & Platt
vi		Grundfos
vii		Kirloskar
viii		Lubi
ix		Marathon
122	CI Y Strainer	
i		Sant
ii		Kartar
iii		Zoloto
iv		Emerald
v		AIP
vi		DRP
vii		DS Engg.
123	Smoke Detector	
i		Siemens
ii		Securiton
iii		Honeywell
iv		BOSCH
v		TYCO
vi		Johnson Control
vii		Copper
viii		
ix		
		Daksh
124	Heat Detector	
i		Siemens
ii		Securiton
iii		Honeywell
iv		BOSCH
v		TYCO
vi		Johnson Control
vii		
viii		
ix		
		Daksh
125	MCP	
i		BOSCH
ii		Honeywell
iii		Siemens

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iv		TYCO
v		Johnson Control
vi		Notifier
vii		Daksh
viii		Copper
126	Sound / Strobe	
i		BOSCH
ii		Honeywell
iii		Siemens
iv		TYCO
v		Johnson Control
vi		Copper
vii		Daksh
127	Response Indicator	
i		BOSCH
ii		APOLLO
iii		Honeywell
iv		Siemens
v		TYCO
vi		Johnson Control
vii		Daksh
128	Controller with Amplifier for Fire Alarm	
i		BOSCH
ii		TYCO
iii		Honeywell
iv		Henriche
v		Siemens
vi		Johnson Control
129	Goose nech Microphone	
i		BOSCH
ii		Honeywell
iii		Henriche
130	Speaker	
i		BOSCH
ii		Honeywell
iii		Henriche
iv		Siemens
v		TYCO
vi		Johnson Control
131	Wooden Rack	
i		BOSCH
ii		Honeywell

MAKE LIST- ELECTRICAL WORKS		
Sr. No..	Material Name	Middle Income Group (MIG)
iii		Henriche
132	Fire Extinguishers	
i		Ceasefire
ii		Firex
iii		Safex
iv		New Age
v		Minimax
vi		Kalpex
vii		Kanex
133	Distribution Transformer	Shall be as per Local Discom Authority Approval List as and where required
i		Siemens
ii		ABB
iii		Kirloskar
iv		Crompton
v		VoltAmp
vi		Schneider Electric
vii		Universal
vii		Vijay Electricals

Note:- In addition to the above the approved brands already used in the existing works will also be considered by Engineer in Charge for approval.