

BID DOCUMENT

Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis.

2025 –26



May– 2025

Rourkela Smart City Limited
1st Floor, RMC City library Udit Nagar,
Rourkela-769012

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INVITATION FOR BIDS (IFB)
NATIONAL COMPETITIVE BIDDING



Bid Id No. RSCL/ 608 /2025/ Dated 05/05/2025
NATIONAL COMPETITIVE BIDDING

	Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis.
Date of Invitation of Bid	08/05/2025
Pre- bid	16/05/2025 at 12:30 Hrs.
Last date and time for receipt of bids	29/05/2025 at 17:00 Hrs.
Last date of Physical Submission of Bid	30/05/2025 at 15:00 Hrs.
Time and date of opening of bids	30/05/2025 at 16:00 Hrs.
Place of Sale/Receiving of bids	Online mode only
Officer inviting bids	The Chief Executive Officer, Rourkela Smart City Limited, Rourkela, Odisha
Officer of Accepting bids	The General Manager(E&T), Rourkela Smart City Limited, Rourkela, Odisha

CHECK LIST TO BE ENSURED BY THE BIDDER

S.No.	Particular	Reference to DTCN Clause	Whether		Reference to Page no.
			Yes	No	
01	Cost of tender paper Rs.11,800.00 Including GST (Scanned copy of financial instrument shall be furnished)	No.4 & 5(i)			
02	E.M.D	No.5(i) & 20			
03	Copy of valid Registration Certificate	No.5 (i) & 21			
04	Copy of PAN Card	No.5 (i) & 21			
05	Turn over certificate	No. 111 (h)			
06	No Relationship Certificate in Schedule – A	No.35			
07	Information regarding current litigation, debarring /expelling of the tender or abandonment of the work by the tenderer (Schedule-D)	No.49			
08	Affidavit (Schedule-E)	No.49			
09	Works Experience : List of projects under execution/ executed that are similar in nature to the work	Schedule-F & Schedule -C			
10	M.O.U. (Memorandum of Understanding duly notarized) with eligible registered electrical contractor having valid HT. license;	No. 8 & Schedule – J			
11	Affidavit for Eligible Class of Contractor e-mail ID & Contact no	Schedule K to Schedule-O			

CONTRACT DATA

A.GENERAL INFORMATIONS

S. No.	Item	Detail
1	Name of Work	Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis.
2	Employer	Rourkela Smart City Limited
3	Employer's Representative	The Chief Executive Officer
4	Estimated Cost	Rs.16,85,19,741/- (Rs. Sixteen Crore Eighty Five Lakhs Nineteen Thousand and Seven hundred Forty One Only) Excluding GST

B. BID INFORMATION

5	Intended completion period/Time period assigned for Completion		Eighteen (18) Calendar Months
6	Last Date & time of online submission of Bid		Date: 29/05/2025. Time 17:00 hours
7	Cost of Bid Document		
	i	Bank draft amount	Rs.11,800/- Including GST
	ii	in favour of	RSCL (Smart City Mission Grant Fund)
	iii	payable at	Rourkela
8	Earnest Money Deposited		
	i	In Form of Bid DD,TDR,FDR BG etc.	Rs.17,00,000/- (Rs. Seventeen lakhs only)
	ii	In favour of	RSCL(Smart City Mission Grant Fund)
	iii	payable at	Rourkela
	iv	Type of instrument	As specified in the bid document
9	Period of submission of original Bid security and Demand draft towards cost of Bid documents in the office of the Chief Executive Officer, Rourkela Smart City Ltd, Rourkela		Date: 08/05/2025 to 30/05/2025 15:00 Hours
10	Bid validity period		90 days
11	Currency of Contract		Indian Rupee
12	Language of Contract		English
13	Retention Money		5(five)%
14	Price Adjustment in Not Applicable in this tender		

Instruction to Bidders (ITB) e- procurement
(Relevant clauses in the DTCN/Bid document shall be superseded)

1. NOTICE INVITING BID AND OBTAINING BID DOCUMENTS:

- 1.1. The authority belonging to the major discipline is competent to invite tender of composite bids. He will also nominate the G M (E & T), Rourkela Smart City Limited, who will deal with all matters relating to the bids in the invitation of bids.
- 1.2. For composite tender, estimated cost of each component should be clearly indicated in addition to combined estimated cost put to tender. The eligibility of bidders will correspond to the combined estimated cost of different components.
- 1.3. The contractor shall comply with the provisions of the Apprentices Act 1961, and the rules / amendments issued there under from time to time. If he fails to do so, it will be considered a breach of the contract and the GM (E&T) may at his discretion Without prejudice to any other right or remedy available under law, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation of the provisions of the said Act by him.
- 1.4. The contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices quoted in the Bill of Quantities, all of which shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, plant & services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the work and the remedying of any defects therein.
- 1.5. The successful bidder shall complete the works by the intended completion date specified in the Contract data.
- 1.6. Throughout these bidding documents, the terms “bid and tender” EMD and Bid Security and their derivatives (bidder / tenderer, bidding / tendering, etc.) are synonymous.
- 1.7. In case the tender for composite work includes in addition to main work / building work all other ancillary works such as sanitary and water supply installations drainage installation, electrical work, horticulture work, roads, paths, sculpture and mural paintings etc., the bidder apart from being a registered civil Contractor of appropriate class must associate himself with agencies of appropriate class those who is eligible to tender for sanitary and water supply drainage, electrical, horticulture works, artistic & sculpture works in the composite tender. Intending Employers are not required to produce any documents viz. copy of Registration, PAN at the time of purchase of tender documents but will be required for verification purpose at later stage.

1.8. PARTICIPATING IN THE BID IN THE E-PROCUREMENT PORTAL: The

Contractor/ Bidder intending to participate in the bid is required to register in the Portal with some information about the firm/Contractor. This is a onetime activity for registering in Portal. During registration, the contractor has to attach a Digital Signature Certificate (DSC) to his / her unique user ID. The DSC used must be of appropriate class (Class II or Class III) issued from a registered Certifying Authority such as n-Code, Sify, TCS, MTNL e-Mudra etc.

- 1.8.1 To log on to the portal the Contractor/Bidder is required to type his/her username and password. The system will again ask to select the DSC and confirm it with the password of DSC. For each login, a user's DSC will be validated against its date of validity and also against the Certificate Revocation List (CRL) of respective CAs stored in system database. The system checks the unique ID, password and DSC combination and authenticates the login process for use of portal.
- 1.8.2 The tender documents uploaded by the Tender Inviting Officer in Website www.tendersodisha.gov.in, will appear in the section of "Upcoming Tender" before the due date of tender sale. Once the due date has arrived, the tender will move to "Active Tender" Section of the homepage. Only a small notification will be published in the newspaper specifying the work details along with mention of the specific website for details. The publication of the tender will be for specific period of time till the last date of submission of bids as mentioned in the 'Invitation for Bid' after which the same will be removed from the list of Active tenders. Any bidder can view or download the bid documents from the web site.
- 1.8.3 Contractor exempted from payment of EMD/ Bid security will be able to participate the tender directly by uploading documentary evidences towards his eligibility for such exemption.
- 1.8.4 If the software application has the provision of payment of cost of tender document through payment gateways of authorized bankers by directly debiting the account of the bidders, bidders will be required to avail on-line payment.
- 1.9 The bidder intending to participate in the bid on-line shall prepare the bid security and demand draft towards cost of bid as per IFB (except for exempted contractors) and upload the scanned copy of the draft and bid security to the portal against the bid where he is participating and the original shall be deposited to the tender inviting officer within the period specified in the "contract data". If the Bidder fails to deposit the original bid security and demand draft towards cost of bid within the stipulated time his bid shall be rejected and action as per prevailing rule shall be taken.
- 1.10 In the case of any failure, malfunction, or breakdown of the electronic system used during the e-procurement process, the tender inviting officer shall not accept any responsibility for failures or breakdowns other than in those systems strictly within their own control.
- 1.11 Any third party/company/person under a service contract for operation of e-procurement system in the State or his/their subsidiaries or their parent companies shall be ineligible to participate in the procurement

processes that are undertaken through the e-procurement system irrespective of who operates the system.

2. ELIGIBLE BIDDERS:

2.1 This Bid is open to all Civil Contractors of 'Special' Class & 'A' Class contractors as per OPWD Code, registered with the State Governments and Contractors of Equivalent Grade/ Class Registered with Central Government/ MES/ Railways for execution of civil works. The Bidders are required to enclose the proof of registration from the registering authority along with the Bid subject only the registration in the portal using his/her DSC for on-line bids.

Contractors not registered with Govt. of Odisha can participate in the e-procurement after necessary enrolment in the portal but have to subsequently register themselves with the appropriate registering authority of the state Govt. before award of the work as per prevalent registration norms of the state.

2.2 All bidders shall provide a statement that the bidder is neither associated, nor has been associated, directly or indirectly, with the Consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Engineer-in-Charge to provide consulting services for the preparation or supervision of the works, and any of its affiliates shall not be eligible to bid.

2.3 If the bidder has a relative employed as an Officer in the rank of an Assistant Engineer/Under Secretary and above in the Government of Odisha in the concerned Department, he shall inform the same in Schedule-G of the bid document mentioning the exact details in a covering letter along with the tender, failing which his bid will not be considered. Also, if the fact of relationship subsequently comes to light, his contract will be rescinded. The bid security or the performance security will be forfeited, and he shall be liable to make good any loss or damage resulting from such cancellation. In case the bidder has no relationship with any of the officers mentioned above he shall have to furnish with his bid an undertaking to that effect.

2.4 He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any gazetted officer in the concerned Department. Any breach of this condition by the contractor would render him liable for penal action for suppression of facts.

2.5 No Engineer of gazetted rank or other gazetted officer employed in Engineering or Administrative duties in an Engineering Department of the Government of Odisha is allowed to work for contractor for a period of two years after his retirement from Government service, without prior permission of the Government of Odisha in writing. Such a contract is liable to be cancelled if either the contractor or any of his employees is found any time to be such a person who had not obtained the permission of the Government of Odisha as aforesaid before submission of the tender for engagement in the contractor's service.

3. QUALIFICATION CRITERIA:

3.1 For submission of Bids through the E-Procurement Portal, the bidder shall up-load the scanned copy/copies of documents listed under clause 3.2 in prescribed format wherever warranted in support of eligibility criteria and qualification information. The L-1 bidder shall have to produce the original documents in support of the scanned copies and statements uploaded in the portal within 5 days of opening of price bid. Bids from Joint ventures are not acceptable.

3.2 The bid shall include following information and documents.

- a) Copy of valid contractor's registration certificate, PAN card, GST Registration should accompany the technical bid.
- b) Copies of original documents defining the constitution or legal status, place of registration, and principal place of business; written power of attorney of the signatory.
- c) The contractor shall furnish ownership documents for those machineries which he is planning to deploy for the tendered work.
- d) Details of work under progress as per tender documents.
- e) Details of works executed during the last five years and works in hand (list of on-going works) as per bid documents.

3.3 The Bidders are subject to be disqualified if they have:

- a) Made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements; and/or
- b) Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or
- c) Indulged in unlawful & corrupt means in obtaining bids
- d) Been black listed/their registrations by the competent authority.

4. ONE BID PER BIDDER:

4.1 Each bidder shall submit only one bid for one package. A bid is said to be responsive if accompanied by cost of bid document and appropriate bid security. The system shall consider only the last bid submitted through the E-Procurement portal.

5. COST OF BIDDING:

5.1 The bidder shall bear all costs associated with the preparation and submission of his bid, and the Engineer-in-Charge will in no case be responsible and liable

for those costs.

- 5.2 All the rates and prices in the bid shall cover all taxes, viz. or any other local taxes, ferry, tollage charges and royalties and any other charges except GST
- 5.3 The rate of royalties and taxes prevailing on the date of measurement shall be considered while making deductions in the bills.
- 5.4 The successful bidder shall make his own arrangement for all materials unless otherwise specified in the conditions of contract.

6. SITE VISIT :

- 6.1 Bidders are advised to inspect and examine the site and its surroundings and satisfy themselves before submitting their tenders as to the nature of the ground and sub-soil (so far as practicable), the form and nature of the site, the means of access to the site, the accommodation they may require and in general shall themselves obtain all necessary information as to risks contingencies and other circumstances which may influence or affect their bid. A Bidder shall be deemed to have full knowledge of the site whether he inspects it or not and no extra charges consequent on any misunderstanding or otherwise shall be allowed. The Bidder shall be responsible for arranging and maintaining workers and all other services required for executing the work unless otherwise specifically provided for in the contract documents. Submission of a bid by a bidder implies that he has read this notice and all other contract documents and has made himself aware of the scope and specifications of the work to be done and of conditions and rates at which tools and plant, etc. Will be issued to him by the Government and local conditions and other factors having a bearing on the execution of work.
- 6.2 The bidder, in preparing the bid, shall go through the site Investigation Reports provided in the Contract Data before filling up the Bid document.
- 6.3 The Officer inviting the bid / Engineer-in-Charge will clarify queries on the Contract Data on requisition by the intending Bidder. The bidder may ask question in the e-procurement portal using his DSC; provided the questions are raised before the date mentioned in the home page under critical dates.

BIDDING DOCUMENTS

7. GENERAL INSTRUCTIONS:

7.1 The description of the work is as mentioned under Invitation for Bid

7.2 The bids uploaded by the Tender Inviting Officer may consist of general arrangements drawings or typical sections of the project. Bidder may download these drawings and take out the print for detail study. Any other drawings and documents pertaining to the works available with the officer inviting the Bid as well as in the office of the RSCL as mentioned in the contract data will be open for inspection during working hours on all working days by the bidders. The bidder is required to download all the documents including the drawings for preparation of his bid. It is not necessary on the part of the Bidder to upload the drawings or other Bid documents (after signing) while uploading his bid. He is required to upload documents related to his qualification information and Bill of Quantities duly filled in. It is assumed that while participating in the bid, the bidder has referred to all the drawings and documents uploaded by the Officer Inviting the Bids. Seeking any revision of rates or backing out of the bid claiming for not having referred to any or all documents provided in the Bid document by the Officer Inviting the Bids will be construed as plea to disrupt the bidding process and in such cases he will be suspended/prohibited/debarred/blacklisted from participating in bidding in any contract of the State as per OPWD/ELBO or Cancellation of Empanelment (registration of from ELBO/ OPWD) action will be taken by RSCL.

7.3 The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, scope of work, technical specifications, bill of quantities, forms, Annexes and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk.

8. CLARIFICATION OF BIDDING DOCUMENTS:

8.1 Bid documents consisting of drawings, plans, specifications, the schedule of quantities of the various items of work to be done and the set of terms & conditions of contract to be complied with by the contractor who intends to bid and other necessary Documents can be seen in the office of the officer inviting the Bid during office hours every day except on Sundays & Public Holidays till last date of sale of tender paper.

8.2 No paper copy of the bid shall be sold.

8.3 The Contract Data to bid shall be filled and completed in the office of Officer inviting bid before issue of bid documents. If the documents are issued to the intending bidder without having been so filled in & completed, he shall request the officer inviting the bid to have this done before he completes and delivers his bid.

8.4 The bidder can seek clarification on the bids which he received earlier than 14 days prior to the deadline for submission of bids. The Employer's response will be uploaded in e-tendering portal before deadline for submission of bid.

8.5 PRE-BID MEETING: As scheduled in the NIT

(One request for each interested Participant will be entertained only)

9. AMENDMENT OF BIDDING DOCUMENTS:

9.1 Before the deadline for submission of bids, the officer inviting the Bid may modify the bidding documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the bidding documents and shall be notified in the website www.tendersodisha.gov.in / notice board and through web site of Rourkela Municipal Corporation www.rmc.nic.in.

9.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Officer inviting the Bid if also happens to be the Engineer-in-Charge with the permission of the higher authority may,

at his discretion, extend as necessary the dead line for submission of bids.

C. PREPARATION OF BIDS

10. LANGUAGE OF THE BID:

10.1 All documents relating to the Bid shall be in the English language. Bids submitted in any other language shall be summarily rejected.

11. DOCUMENTS COMPRISING THE BID:

11.1 Following documents will be deemed to be part of the bid even if not submitted with the bid.

- i. Invitation for Bids (IFB)
- ii. Instructions to bidders (ITB)
- iii. Conditions of Contract
- iv. Contract Data
- v. Specifications

11.2 All the volumes/documents shall be provided in the portal by the Officer inviting the bid. The bidder shall carefully go through the document and prepare the required documents and up load the scanned documents in Portable Document Format to the portal in the designated locations of Technical Bid. He will fill up the percentage rate in the BOQ down loaded for the work in designated Cell and up-load the same in designated locations of Financial Bid. Submission of document shall be effected by using DSC of appropriate class.

A. Cost of “Bid document” & “Bid Security” shall comprise

- i. Cost of Bid Document
- ii. Bid Security .

B. “Technical Bid” shall comprise.

- i. Declaration under the Official Secret Act, 1923
- ii. Qualification Information and supporting documents,
- iii. Certificates, undertakings, affidavits,

C. “Financial Bid “shall comprise”.

- i. Priced Bill of Quantities

12. PROPOSAL BY THE BIDDER:

12.1 In the E-Procurement Portal, an intelligent Bill of Quantity in Microsoft Excel format shall be made available to the bidder.

12.2 Deleted

12.3 In case of percentage rate tender, the bidder will only fill in the designated cell and activate “less” or “excess” to indicate how much his price offer is excess or less (Up to two decimal Place) than the estimated amount.

12.4 The bidder shall bid for the whole works as described in the Bill of Quantities.

12.5 Bidders shall submit offers that fully comply with the requirements of the bidding documents, Minutes of meeting of the Pre-Bid meeting, Including the Conditions of Contract basic technical design as indicated in the drawing and specification.

Conditional offer or alternative offers will not be considered in the process of bid evaluation.

- 12.6 All duties, taxes, excluding GST and other levies including Building and other Construction Workers Welfare Cess @ 1% payable by the contractor under the contract, or for any other cause shall be included in the rates, prices by the bidder. GST, purchase tax, turnover tax or any other tax on material in respect of this contract shall be payable by the Contractor and Government will not entertain any claim whatsoever in respect of the same.
- 12.7 The contractor shall be deemed to have satisfied himself as to the correctness and sufficiency of the Tender and of the rates and prices stated in the Bill of Quantities, all of which shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract (including those in respect of the supply of goods, materials, plant & services or of contingencies for which there is a Provisional Sum) and all matters and things necessary for the proper execution and completion of the work and the remedying of any defects therein.
- 12.8 The contractor shall conform in all respects, by giving all notices and paying all fees, with the provisions of:
- i. Any national or State Statute, Ordinance, or other Law, or any regulation, or bye-law of any local or other duly constituted authority in relation to the execution and completion of the works and remedying of any defects therein, and
 - ii. The rules and regulations of all public bodies and companies whose property rights are affected or may be affected in any way by the works.

12.9 FOR COMPOSITE BIDS: DELETED.

13. CURRENCIES OF BID AND PAYMENT:

13.1 The estimated unit rates and the prices are in Indian Rupees.

14. VALIDITY:

- 14.1 Bids shall remain valid for a period not less than 90 days or the period mentioned in the Contract Data, after the deadline date for submission of bid as specified in the notice inviting the Bids. A Bid valid for a shorter period shall be rejected by the Engineer-in-charge as non-responsive.
- 14.2 In exceptional circumstances, prior to expiry of the original time limit, the Officer inviting the Bid may request the bidders to extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by cable or by e-mail.

15. BID SECURITY:

15.1 The Bidder shall furnish, as part of his Bid, a Bid security for the amount mentioned under Contract Data. The bidder shall scan all the written pages of the bid security and upload the same to the system in designated place. The successful Lowest bidder will produce the original of all scanned documents for verification within 5 days of opening of all tender (Price Bid). In the eventuality of failure on the part of the successful bidder to produce the original documents, he will be may debarred in future from participation in tender as per Govt of Odisha, it may be lost her Empanelment (registration of OPWD) and / or suspend/prohibit/ and will be blacklisted by the competent authority as per OPWD Code/ELBO. In such a situation, successful L-2 bidder will be required to produce his original documents for consideration of his/her tender at the negotiated equal to L-1 bidder.

15.1.1 Fixed deposit receipt of any scheduled bank approved by the Reserve bank (OFDC approved) of India/Indian Post Office Time deposit/National Saving Certificate/Kissan Vikas Patra duly pledged in favour of The Chief Executive Officer, Rourkela Smart City Limited, Rourkela with six month validity as per notice inviting bid by the Department.

15.2. The Bid shall be declared non-responsive and shall be rejected if submitted without an acceptable Bid Security and not secured as indicated in Sub-Clauses 15.1.

15.3. Combined bid security for more than one work is not acceptable.

15.4. In the case of Government Undertakings, Co-operatives Societies, Diploma or Degree holders in Engineering who are registered with the Government of Odisha, the rules framed by government from time to time about Cost of Bid documents, Bid security, performance security will apply.

15.5. Bid Security of unsuccessful bidders will be returned within 28 days of the end of the validity period specified in sub clause 14.1

15.6. Bid Security of successful bidder will be discharged when the bidder has signed the Agreement and furnished the required Performance Security and Additional Performance security if any

15.7. The Bidder may be lost her Empanelment (registration of ELBO/OPWD) and / or suspend/prohibit/debar/blacklist from participating in bidding in any contract of the State as per OPWD Code.

15.7.1. If the bidder withdraws the bid after opening of the bid but within the period of validity.

15.7.2. If the Bidder seeks any revision of rates or backs out of the bid claiming for not having referred to any or all documents provided in the Bid by the Officer Inviting the Bids.

15.7.3 In the case of a successful bidder, if the bidder fails within the specified time limit to

15.7.3.1 Sign the Agreement; or

15.7.3.2 Furnish the required Performance Security including additional performance security if any

16. FORMAT AND SIGNING OF BID:

16.1. The bidder can download the tender of his choice and save it in his system and undertake the necessary preparatory work off-line and upload the completed tender at his convenience within the final date and time of submission. The bidder shall only submit single copy of the required documents and Price Bid in the portal. In the Financial bid, the bidder cannot leave any figure blank. He has to only write the figures; the words will be self-generated. The Bidders are advised to up-load the completed Bid document well ahead of the last date & time of receipt to avoid any last moment problem of power failures etc.

16.2 The Bidder shall go through the Bid carefully and list the documents those are asked for submission. He shall prepare all documents including cost of Bid Document, Bid Security, Declaration form, price bid etc and store in the system.

16.3. The bidder shall log on to the portal with his DSC and move to the desired tender for up-loading the documents in appropriate place one by one simultaneously checking the documents. Once the Bidder makes sure that all the documents have been up-loaded in appropriate place, he clicks the submit button to submit the bid to the portal.

16.3.1 Tender cannot be pre-opened and cannot be submitted after due date and time. Therefore, only after satisfying that all the documents been uploaded, the Bidder should activate submit button.

16.3.2 . In the e-procurement process, each process is time stamped. The system can identify each individual who has entered into the portal any bid and the time of entering into the portal.

16.3.3 The Bidder should ensure clarity of the document up-loaded by him to the portal, especially the scanned documents by taking out sample printing. Non-submission of legible documents may render the bid non-responsive. However, the Officer inviting the Bids if so desires, can ask for legible copies for clarification within a stipulated period of 7 days, provided such document in no way alters the Bidder's price bid. If the Bidder fails to submit Such documents with in the stipulated date, his bid shall be evaluated on it's own merit.

D. SUBMISSION OF BIDS

17. SECURITY OF BID SUBMISSION:

17.1 All bid data uploaded by the Bidder to the portal will be encrypted by the DSC of the opener(s). The system shall require all the mandatory forms and fields filled up by the contractor during the process of submission of the bid/tender.

17.2 The Bid shall be received in encrypted format by the system which can only be time.

18. DEADLINE FOR SUBMISSION OF THE BIDS:

18.1. The online bidding will remain active till the last date and time of the bid submission. Once the date and time (Server date and time) is over, the bidder will not be able to submit the bid. The date & time of bid submission shall remain unaltered even if the specified date for the submission of bids declared a holiday for the Officer inviting the Bid.

18.2. The officer inviting the bid may extend the deadline for submission of bids by issuing an amendment in accordance with Sub-Clause 9.3, in which case all rights and obligations of the officer inviting the bid & Engineer-in-Charge and the bidders previously subject to the original deadline will then be subject to the new deadline.

19. LATE BIDS:

19.1. The system shall reject submission of any bid through portal after closure of the receipt time. For all purpose the server time displayed in the e-procurement portal shall be the time to be followed by the bidder and concerned officers.

20. MODIFICATION AND WITHDRAWAL OF BIDS:

20.1 In the E-Procurement Portal, it is allowed to modify the bid any number of times before the final date and time of submission. The bidder shall have to log on to the system and resubmit the documents as asked for by the system including the price bid. In doing so, the bids already submitted by the bidder will be removed automatically from the system and the latest bid only will be admitted. But the bidder should avoid modification of bid at the last moment to avoid system failure or malfunction of internet or traffic jam or power failure. If the bidder fails to submit his modified bids within the designated time of receipt, the bid already in the system shall be taken for evaluation.

20.2 In the E-Procurement Portal, with-drawl of bid is allowed. But in such case he has to write a letter with appropriate reasons for his withdrawal addressed to the Officer inviting the bid and up load the scanned document to portal in the respective bid before the closure of receipt of the bid. The system shall not allow any withdrawal after expiry of the closure time of the bid.

E. OPENING AND EVALUATION

21. OPENING OF THE BID:

21.1 Bid opening dates are specified during tender creation or can be extended vide corrigendum. These dates are available in IFB, tender document as well as the home page of portal. Bid opening can be done by the authorized users which are defined during the tender publication / approval stage. The bids are encrypted using their public keys and can be decrypted only on or after the Bid Opening due date. The bid openers private key will be required to open the bids and all the openers have to log on to the portal during that time.

21.1.1. The bidders who participated in the on-line bidding can witness opening of the bid from any system logging on to the portal with the DSC away from opening place. Contractors are not required to be present during the bid opening at the opening location if they so desire.

21.1.2. Each activity is date and time stamped with user details. For time stamping, server time is taken as the reference.

21.2. In the event of the specified date of bid opening being declared a holiday for the Officer inviting the Bid/Engineer-in-Charge, the bids will be opened at the appointed time on the next working day.

21.3. In case bids are invited for more than one package, the order for opening of the "Bid" shall be that in which they appear in the "Invitation for Bid".

21.4 During bid opening, the covers containing original demand draft towards Cost of bid in the form specified in the Invitation for Bid, received after last of receipt of bid and before opening of the bids shall be opened and declared. The original copy of the Bid Security and period of validity in conformity with clause 15 shall be checked and announced. The list of bidders who have submitted the original copy of the cost of Bid and Bid Security shall be prepared and announced.

21.4.1 Combined bid security for more than one work is not acceptable. If the bid security/EMD has not been furnished in the form specified in Clause 15, the bid will be declared non-responsive and rejected.

21.5 The Bid openers; who have been pre-defined shall log on to the portal with their respective DSC. Unless all the Officers who have been declared as Opening officers, log on the portal with their DSC the Tender cannot be opened.

- 21.5.1 The Opening Officers will systematically check the scanned demand draft towards cost of the bid document and the scanned document of Bid security with that of the original submitted. If found in order, they will continue opening of all other documents in the system provided under Technical Bid.
- 21.5.2. The bids accompanied with appropriate bid cost and valid bid security /EMD will be taken up for evaluation with respect to the qualification Information and other information furnished in Part - I pursuant to Clause 3.
- 21.5.3. Immediately on receipt of these clarifications, the Evaluating Officers; predefined in the system for the bid, will finalize the list of responsive bidders. They will log on to the site with their DSC and record their comments on the Technical evaluation page in the system. The Officer Inviting the Bid if also the accepting authority, shall log on to the system with his digital signature and check technical evaluation. He can either accept or pass on to the evaluating officers for re-evaluation. Upon acceptance of technical evaluation by the Accepting authority in the system, the system shall automatically generate letter to all the responsive bidders and the system shall forward the letter to all the responsive bidder that their technical bid has been evaluated responsive with respect to the data/information furnished by him and the letter shall also intimate him the date & time of opening of financial bid. The system shall also inform the non-responsive bidders in their email ID that their bid has been found non-responsive.
- 21.6 The Technical evaluation of all the bids will be taken up as per the information furnished by the Bidders. If any of the information/ statements/documents/ /certificates furnished by the bidder is found to be false/fabricated/bogus, his registration in the portal shall be blocked and the bidder is liable to be blacklisted.
- 21.7 After technical evaluation of the bidders and selection of the qualified bidders, the financial bids of the technically qualified bidders shall be opened on the due date of opening. Members of the bid opening committee log on to the system in sequence and open the financial bids for the technically qualified bidders. The opening of financial bid by the opening officer using their DSC shall decrypt the financial bids.
- 21.7.1 Opening of price bid and evaluation of lowest bidder is subject to satisfaction of other qualification information asked for in the bid pursuant to

Clause-3.

- 21.7.2 The Officer inviting Bid shall ensure that all the Bidders are individually intimated about the date, time & venue of opening of the financial bid along with the responsiveness of the Technical Bid.
- 21.7.3 The Financial Bid will be opened on the notified date & time in the presence of bidders or their authorized representative who wish to be present.
- 21.7.4 At the time of opening of "Financial Bid", the names of the bidders whose bids were found responsive in accordance with Sub-Clause 24.1 will be announced. The bids of only those bidders will be opened. The remaining bids will be rejected.
- 21.7.5 The responsive bidders names, percentage rates, any discounts and withdrawals, and such other details as the officer inviting the tender may consider appropriate, will be announced by him or his authorized representatives at the opening.
- 21.7.6 Special conditions and/or rebate/discount offer if any uploaded to the system shall be declared and recorded first.
- 21.7.7 The Financial bid of the bidders shall be opened one by one by the designated officers. The system shall auto-generate the Comparative statement.
- 21.7.8 The Bidder can witness the principal activities and view the documents/summary reports for that particular work by logging on to the portal with his DSC from anywhere.

22. PROCESS TO BE CONFIDENTIAL:

- 22.1 Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful bidder has been announced. Any effort by a bidder to influence the officer inviting the bid, processing of bids or award decisions may result in the rejection of his bid.

23. CLARIFICATION OF BIDS:

- 23.1 To assist in the examination, evaluation, and comparison of bids, the officer inviting the bid may, at his discretion, ask any bidder for clarification of his rates including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable or by e-mail, but no change in the bid price or substance of the bid shall be sought, offered.

23.2 Subject to sub-clause 23.1 , no bidder shall contact the officer inviting the bid on any matter relating to his bid from the time of the opening to the time the contract is awarded. If the bidder wishes to bring additional information to the notice of the officer inviting the bid, it should do so in writing.

24. EXAMINATION OF BIDS AND DETERMINATION OF RESPONSIVENESS:

24.1 During the detailed evaluation of “Technical Bids”, the officer inviting the bid will determine whether each bid:-

24.1.1 Whether the Bid security is confirmed by issuing institution/Bank.

24.1.2 Has submitted legible documents for evaluation

24.1.3 Meets the eligibility criteria defined in Clause 3 and;

24.1.4 Is substantially responsive to the requirements of the bidding documents.

24.2 During the detailed evaluation of the “Financial Bid”, the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications and drawings.

24.3 A substantially responsive “Financial Bids” is one, which conforms to all the terms, conditions, and specifications of the bidding documents, without material deviation or reservation. A material deviation or reservation is one

24.3.1 Which affects in any substantial way the scope, quality, or performance of the works.

24.3.2 Which limits in any substantial way, inconsistent with the bidding documents, the right of the officer inviting the bid or the bidder's obligations under the contract or

24.3.3 Whose rectification would affect unfairly the competitive position of other bidders presenting substantially responsive bids.

24.4 If a “Financial Bid” is not substantially responsive, it will be rejected by the officer inviting the bid, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

24.5 On opening of the price bid the system shall arrange the financial bids in order of their value (L1 first, followed by L2, L3) for subsequent evaluation. The evaluation status (Sheet) will be visible to all the participating bidders after opening on their respective logins. Each activity is recorded in the system with date and time stamping.

25. EVALUATION OF BIDS:

25.1 If the officer inviting the Bid in his opinion judges that the price quoted by the lowest qualified bidder is high or a special condition imposed by the bidder is to be

withdrawn, the bidder shall be invited for negotiation by the officer inviting the Bid or by an officer authorised by him in writing.

F. AWARD OF CONTRACT

26. AWARD CRITERIA:

- 26.1 The officer inviting the bid will award the contract to the bidder whose bid has been determined to be substantially responsive to the bidding documents and who has offered the lowest evaluated price.
- 26.2 On acceptance of the tender, the Contractor shall name in writing his accredited representative(s) who would be responsible for taking instructions from the Engineer-in-Charge.
- 26.3 Competent Authority reserves to himself the right of accepting the whole or any part of the bid and the bidder shall be bound to perform the same at the rate quoted.
- 26.4 The successful bidder registered under other State Government / MES / Railways / CPWD in equivalent rank has to register under state PWD before signing of the agreement if required.

27. OPTIONS IF THE BIDDER BACKS OUT FROM BIDDING PROCESS:

- 27.1 In case the 1st lowest Bidder or even the next lowest Bidder withdraw in series one by one, thereby facilitating a particular Bidder for award, then they shall be penalized with Appropriate action i.e. Cancelled the (registration of OPWD) and / or suspend/prohibit/debar/blacklist from participating in bidding in any contract of the State as per Guiding of OPWD/Govt. of Odisha Guiding.
- 27.2 The bidding process shall be deemed to be complete after the issue of letter of acceptance. If the bidder fails to sign the agreement within the stipulated period mentioned under clause 29.2, his bid security shall stand forfeited.

28. RIGHT TO ACCEPT OR REJECT ANY OR ALL BIDS:

- 28.1 The competent authority on behalf of Rourkela Smart city Limited, does not bind him to accept the lowest or any other tender and reserves to him the authority to reject any or all the tenders received without assigning any reason.
- 28.2 All bids in which any of the prescribed condition is not fulfilled or any condition including that of conditional rebate is put forth by the bidder shall be summarily rejected.

29. NOTIFICATION OF AWARD AND SIGNING OF AGREEMENT:

- 29.1. In the E-Procurement Portal, the system shall generate the template of award letter and the Officer Inviting the Bid shall mention the amount of Performance Security and additional security required to be furnished in the letter and intimate the bidders in his e-mail ID. The issue of the letter of acceptance shall be treated as closure of the Bid process and commencement of the contract.
- 29.2 The bidder shall within 15 days of issue of letter of acceptance, furnish the Performance security & additional Performance security (if any) in the form & the work programme & shall sign the agreement in prescribed format, failing which the Engineer-in-Charge shall without prejudice to any other right or remedy available in law, be at liberty to either he will suspend/prohibit/debar/blacklist from

participating in bidding in any contract of the State or Cancellation as per OPWD code/ of Empanelment (registration of from OPWD) action will be taken or both. The agreement will incorporate all agreements between the officer inviting the bid and the successful bidder. If L1 bidder does not turn up for agreement after finalization of the tender, then he will suspend/prohibit/debar/blacklist from participating in bidding in any contract of the State as per OPWD Code and /or Cancellation of Empanelment (registration of from OPWD) action will be taken . In that case, the L2 bidder, if fulfils, required criteria would be called for drawing agreement for execution of work subject to the condition that L2 bidder negotiates at par with the rate quoted by the L1 bidder otherwise the tender will be cancelled.

In case a contractor is blacklisted, it will be widely published and intimated to all departments of Government and also to Govt. of India agencies working in the state.

(Amendment to Para-3.5.14 Note-I of OPWD Code Vol.-I by inclusion).

29.2.1 Following documents shall form part of the agreement.

29.2.1.1 The notice inviting bid, all the documents including additional conditions, specifications and drawings, if any, forming the bid as issued at the time of invitation of bid and acceptance thereof together with any correspondence & documents leading thereto & required amount of performance security including additional performance security as per sub clause 29.2 hereof.

29.2.1.2 Standard Bid Document P.W.D. Form P-1

29.3 The letter to proceed with the work shall be issued by Engineer-in-charge only after signing of the agreement. The notification of award will constitute the formation of the contract subject only to the furnishing of performance security and additional performance security in accordance with the provisions of the agreement.

29.4 On acceptance of the composite bids by the competent authority the letter of award will be issued by the Engineer-in-Charge of the major component of the work.

29.5 Upon signing of the agreement by the successful bidder, the Engineer-in-Charge will promptly notify the other bidders that their bids have been unsuccessful.

30. CORRUPT OR FRAUDULENT PRACTICES:

30.1. The Engineer-in-Charge will reject a proposal for award if he determines that the bidder recommended for award has been engaged in corrupt or fraudulent practices in competing for the contract in question. He will report to the Officer Inviting Bid / next higher authority.

30.2 Canvassing whether directly or indirectly, in connection with tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable for rejection.

DETAILED TENDER CALL NOTICE

Sealed percentage rate bids are invited in double cover system from the Civil Contractors of 'Special' Class & 'A' class contractors registered with the State Government and contractors of equivalent Grade / class registered with Central Government / MES / Railways having registration for Civil, Electrical and P.H works for execution of Civil / E.I. / P.H. works on production of definite proof from the appropriate authority in prescribed form to be eventually drawn in P.W.D. FORM P-1 for the work/Project : "Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis." an estimated cost of Rs.16,85,19,741/- (Rs. Sixteen Crore Eighty Five Lakhs Nineteen Thousand and Seven hundred Forty One Only) Excluding GST Contractors not registered with Govt. of Odisha can participate in the e- procurement after necessary enrolment in the portal but have to subsequently register themselves with the appropriate registering authority of the state Govt. before award of the work as per prevalent registration norms of the state.

- a) This tender is of composite nature and consisting of Civil, Electrical, fire fighting and PH works.
 - b) This detailed Tender Call Notice along with the Pre-Bid Meeting minutes, clauses mentioned herein shall form a part of the contract and agreement.
2. The Bid documents are available on official website of Government: <https://www.tendersodisha.gov.in> & www.rmc.nic.in from 08.05.2025 17:00 Hrs to 29.05.2025 17:00Hrs. The last date and time of submission of Bid is as per contract data.
 3. The Technical Bid documents (Cover-I) will be opened by the assigned officer in the office of Chief Executive Officer, RSCL at 16:00 Hours on 30.05.2025. in the presence of the bidders or their authorized representatives who wish to attend. After evaluation of the documents contained in Cover-I, the Cover-II containing price bid/s of the technically responsive bidder/s will be opened. The date, time and place of opening the price bid will be intimated to the eligible qualified bidders through system generated E-mails.
 4. The cost of Bid documents in shape of demand draft issued from any Nationalized / Scheduled bank may be prepared in the name of RSCL(Smart City Mission Grant Fund), and payable at Rourkela for Rs.11,800/- towards tender paper cost. The online bid must be accompanied with scanned copies of demand draft towards cost of tender paper.
 5. The bid is to be submitted in two covers.
 - i. Cover-I is to contain scanned copy of EMD and Cost of bid document, Registration Certificate, PAN, Profit Loss statement, GST Registration Certificate, List of similar nature of works, work in hand, affidavit, turn over certificate and all other documents required as per the relevant clauses of this DTCN. Before award of final contract, such bidders will have to produce the GST clearance certificate. ii) The similar nature of work are of following types: Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis.
 - ii. Cover-II is to contain the PRICE BID duly filled in and signed by the bidder.
 6. Furnishing scanned legible copy of Original Registration certificate, PAN card & GST Registration Certificate along with the Technical Bid is mandatory otherwise his/ her bid shall be declared as non responsive and thus liable for rejection.
 7. Deleted
 8. Deleted

- i. The contract will be drawn in P.W.D. P-1 contract form and will constitute all civil, electrical and PH works.

The contract shall be drawn & signed by Chief Executive Officer on behalf of Rourkela Smart City Limited.

- ii. The entire works of the Agreement shall be supervised measured and check measured by the Engineer in Charge.
9. If an individual makes the application, the individual should sign (with DSC) above his full type written name and current address.
 10. If the application is made by proprietary firm, it shall be signed (with DSC) by the proprietor & furnish full type written name and the full name of his firm with its current address in a forwarding letter.
 11. If the application is made by a firm in partnership, it shall be signed (with DSC) by a partner holding power of attorney for the firm in which case a certified copy of the power of attorney shall accompany the application. A certified copy of the partnership deed and current address of all partners of the firm shall also accompany the application.
 12. If the application is made by a limited company or a corporation, it shall be signed (with DSC) by a duly authorized person holding power of attorney for signing the application in which case a certified copy of the power of attorney shall accompany the application. Such limited company or corporation will be required to furnish satisfactory evidence of its existence along with the technical bid.
 13. The tender should be strictly in accordance with the provisions as mentioned in the tender schedule. Any change in the wordings will not be accepted.
 14. The work is to be completed (Construction work) in all respects within Eighteen(18) calendar months from the date of issue of work order. Before acceptance of tender, the successful bidder will be required to submit a work programme and milestone basing on the financial achievement so as to complete the work within the stipulated time and in case of failure on the part of the agency to achieve the milestone liquidated will be imposed (Amendment to Para-3.5.18 Note-VIII of OPWD Code Vol.-I).
 15. All tenders received will remain valid for a period of 90 days from the last date prescribed for receipt of tenders and validity of tenders can also be extended if agreed by the tenderers and the Department
 16. The tenderer shall carefully study the tentative drawings and specifications applicable to the contract and all the documents, which will form a part of the agreement to be entered in to, by the accepted tenderer and detailed specifications for Odisha, and other relevant specifications and drawings, which are available. Complaint at a future date that the tenderers have not seen plans and specifications cannot be entertained.
 17. The drawings furnished with the tender are tentative and subject to revision or modification as tendered during the execution as per actual necessity and detail test conducted. But the tendered rates quoted by the tenderer will hold good in case of such modification of drawings during the time of execution and shall in no way invalidate the contract and no extra monetary compensation will be entertained. The work shall however be executed as per final approved drawing to be issued by the Engineer-in- Charge as and when required.
 18. By admission of a tender for the work, a tenderer will be deemed to have satisfied himself by actual inspection of the site and locality of the work, about the quality

and availability of the required quantity of material, and that rates quoted by him in the tender will be adequate to complete the work according to the specifications attached there to and that he had taken in to account all conditions and difficulties that may be encountered during its progress and to have quoted rates including labour and materials with taxes, octroi, other duties, lead, lifts, loading and unloading, freight for all materials and all other charges necessary for the completion of the work, to the entire satisfaction of the Engineer-in Charge of the work and his authorized subordinates. After acceptance of the contract rate Government will not pay any extra charges for any reason in case the contractor claims later on to have Misjudged as regard availability of materials, labour and other factors. For the purpose of estimate, the approved quarry lead is to be provided judiciously. Engineers in charge would be responsible for ensuring the quality of the materials supplied. The contractors would, however, be responsible for procurement of material from authorized sources and voluntarily disclose the source of procurement for the purpose of billing. Besides, the bidder would be required to submit the details of quarry for procurement while submitting the bids.

(Amendment to Para-3.4.16 (a) (vii) of OPWD Code Vol.-I by substitution). Design,

19. The bid must be accompanied by Bid security accepting, that if the bidder withdraw or modify its bid during the period of validity i.e. not less than 90(Ninety) days from the bid due date or if the bidder is awarded the contract and fail to sign the contract or to submit a performance security and Addition Performance Security. Tender Not accompanied with Scanned copy of Bid security shall be declared as non-responsive and thus liable for rejection. The bid security should remain valid minimum of 45(Forty-five)days beyond the bid validity period
20. The tender should be accompanied with the Scanned copies of the valid Registration certificate of Class of Contractor , GST Registration Certificate and PAN card which are mandatory, otherwise his/her bid shall be declared as non-responsive and thus liable for rejection.
21. The tender containing extraneous conditions not covered by the tender notice are liable for rejection and quotations should be strictly in accordance with the items mentioned in the Tender Call Notices. Any change in the wording will not be accepted.
22. The department reserves the right of authority to reject any or all tenders received without assigning any reason whatsoever.
23. The earnest money of the L-1 bidder will be retained and will be dealt with as per terms and condition of O.W.P.D Code. The retention of E.M.D with the Department will carry no interest.
24. The Engineer-in-charge will notify the bidder / tenderer whose bid has been accepted of the award prior to expiration of the validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the conditions of Contract called the "Letter of Acceptance") will state the sum that the Engineer-in-charge will pay the contractor in consideration of the execution and completion of the Works by the contractor as prescribed by the contract (Hereinafter and in the contract called the "Contract Price").

The Notification of award will constitute the formation of the contract, subject only to the furnishing of a performance security (Initial Security Deposit) in form of Deposit receipt of Schedule Bank / Kissan Vikash Patra / Post Office Savings Bank Account/National Savings Certificate/ Post Office Time Deposit Account/Bank Guarantee of Nationalised Bank /Schedule Bank of India counter guaranteed by local Branch at Rourkela with validity of One year / duly pledged in favour of the Chief

Executive Officer Rourkela Smart City Limited. Rourkela & payable at Rourkela and in no other form, which including the amount already deposited as bid security (earnest money) shall be 2% of the value of the tendered amount and sign the agreement in the P.W.D. form No. P-1 (Schedule XLV No. 61) for the fulfilment of the contract in the office of the Chief Executive Officer and payable at Rourkela or as directed. The security deposit together with the earnest money and the amount withheld according to the provision of P-1 agreement shall be retained as security for the due fulfilment of this contract and additional performance security in accordance with the provisions of the agreement.

The agreement will incorporate all agreements between the officer inviting the bid/ Engineer-in Charge and the successful bidder within 15 days following the notification of award along with the Letter of Acceptance. The successful bidder will sign the agreement and deliver it to the Engineer-in Charge. Following documents shall form part of the agreement.

- a) The notice-inviting bid, all the documents including additional conditions, specifications and drawings, if any, forming the bid as issued at the time of invitation of bid and acceptance thereof together with any correspondence leading thereto & required amount of performance security including additional performance security.
 - b) Standard P.W.D. Form P-1 with latest amendments. Failure to enter in to the required agreement and to make the security deposit as above shall entail either he will suspend/prohibit/debar/blacklist from participating in bidding in any contract of the State as per OPWD CODE and or Cancellation of Empanelment (registration of from ELBO/OPWD) or both No contract (tender) shall be finally accepted until the required amount of initial security money is deposited The security will be refunded after 24 (Twenty four) months of completion of the work and payment of the final bill and will not carry any interest. As concurred by Law Department & Finance Department In their U.O.R. No 848, dt.21.05.97 .O.R.No.202 W.F.D. dt.06.03.98 respectively the E.M.D. will be forfeited case, where tenderers back out from the offer before acceptance of tender by the competent authority.
25. The contractor should be liable to fully indemnify the Department for payment of compensation under workmen compensation act. VIII of 1923 on account of the workmen employed by the contractor and full amount of compensation paid will be recovered from the contractor.
 26. Tenderers are required to liable by fair wages clause as introduced by Govt. of Odisha Works Department letter No.VII (R&B) 5225, dt.26.2.55 and No.II, M-56/61-28842 (5), dt.27.9.61.
 27. The contractor shall bear cost of various incidentals, sundries and contingencies necessitated by work in full within the following or similar category.
 - a) Rent, royalties, cess and other charges of materials, Octroi and all other taxes except prevailing GST from time to time. Ferry tolls, conveyance charges and other cost on account of land buildings including temporary building required by the tenderer for collection of materials, storage, housing of staff or other purpose of the work are to be borne by the contractor at his own cost. No rent will be payable to Govt. for temporary occupation of land owned by govt. at the site of the work for bonafide use of the land for work and all such construction of temporary nature by the contractor shall be done

- after obtaining written permission from the Engineer-in-Charge of Civil portion of the work and all such construction shall have to be demolished and debris removed and ground made good and cleared after completion of the work at no extra cost.
- b) Royalty will be recovered from each bill as notified by Govt. from time to time unless K Forms are enclosed. Refund of royalty at later date after passing of the bills cannot be entertained as the recovery of royalty is being credited to revenue.
 - c) Labour camps or huts necessary to a suitable scale including conservancy sanitary arrangements therein to the satisfaction of the local labour laws and health authorities shall have to be provided by the Contractor.
 - d) Arrangement of suitable water supply including pipe water supply where available for the staff and labour as well as for the execution of the work is sole responsibility of the Contractor and no extra cost for carriage of water will be entertained.
 - e) All fees and dues levied by Municipal, Canal or Water Supply Authorities are to be borne by the Contractor.
 - f) Suitable safety equipments and dresses, gloves, life belts etc. for the labour engaged in risky operations are to be supplied by the contractor at his own cost.
 - g) Suitable fencing barriers, signals including paraffin and electric signals where necessary at work and approaches in order in project the public and employees from accident has to be provided by the Contractor at his own cost.
 - h) Compensation including cost of any legal suit for injury to persons or property arising out of execution of the work and also any sum, which may become payable due to operation of the workmen compensation act, shall have to be borne by the contractor.
 - i) The contractor has to arrange adequate lighting arrangements for the work wherever necessary at his own cost.
29. No payment will be made for layout, benchmark, level pillars, profiles and benching and levelling the ground required, which has to be carried out by the contractor at his own cost. The rates to be quoted should be for finished items of work inclusive of carriage of all materials and all incidental items of work.
30. After the work is finished all surplus materials should be removed from the site of work, preliminary work such as vats, mixing platforms, etc. should be dismantled and all materials removed from the site and premises left neat and his should be inclusive in the rates. No extra payment will be made to the Contractor in this account.
31. It should be understood clearly that no claim what-so-ever will be entertained to extra items of works quantity of any item besides estimate amount unless written order is obtained from the competent authority and rate settled before the extra items of work or extra quantity of any items of work is taken up.
32. The tenderers shall have to abide by the C.P.W.D. safety code rules introduced by the Govt. of India, Ministry of Works and Housing & Supply in their standing order No.44150, dt.25.11.57.
33. No part of the contract shall be sublet without written permission to the concerned Engineer In Charge or transfer to be made by the power of attorney authorizing others to receive payment on contractor's behalf.
34. Bid documents consisting of plans, specifications, the schedule of quantities and the set of terms and conditions of contract and other necessary documents can be seen in all the offices issuing the documents and office of the under signed during

office hours every day except on Sundays and Public Holidays till last date of sale and receipt of tender papers. Interested bidders may obtain further information at the same address. But it must be clearly understood that tenders must be received in order and to instructions in complete shape. Incomplete tender is liable for rejection.

35. No Relation Certificates.

The contractor shall furnish a certificate along with the tender to the effect that he is not related to any officer in the rank of an Assistant Engineer & above Rourkela Smart City Limited. or Assistant/Under Secretary & above in the Department. If the fact subsequently proved to be false, the contract is liable to be rescinded. The earnest money & the total security will be forfeited & he shall be liable of make good to damages the loss or damages resulting for such cancellations. The proforma for no relationship certificate is contained in a separate sheet vide Schedule-A

36. Payment for variation in price : **Not Applicable**

36(a) Deleted

36.(a) (ii) Deleted

36.(b) Deleted

36(c) Deleted.

36(d) Deleted.

36(e) APPLICATION OF ESCALATION CLAUSE: Deleted

Price/rates or Firm during pendency of the contract/execution of Contract

37. If any advance / Secured advance is granted by the Department the same will bear Interest at the rate of 18% P.A.

38. All items of work as per schedule of quantities of this tender should confirm to Odisha Detailed Standard Specification. I.R.C. & I.S.I. Codes & Bridge code section I, II, III, IV & VII & latest design criteria for pre-stressed concrete bridge specially for Roads & Bridges issued by MoRT&H, Government of India, Compacting shall have to be carried out with help of mechanical vibrators from the range of I.S.:2505, I.S.:2006, I.S.:2514. I.S.:4656.

39. Centring & Shuttering shall be with suitable steel shutters in side of which shall be lined with suitable sheeting and made leak proof and watertight. All joints in formwork shall be properly sealed preferably with P.V.C. joints sealing tapes & compounds.

40. Form work including complete false work shall be designed by the Contractor without any extra cost to employer and the Department will have the right to inspect scaffolding, centering and shuttering made for the work and can reject partly or fully such structures, if found defective in their opinion. Any eventually such as loss of lives or property due to failure of centering and shuttering shall be the responsibility of the Contractor regarding compensation of all claims thereof.

41. Cement shall be used by bags and weight of one bag of Cement should be 50 (fifty) Kg. net & the Engineer-in-Charge or his representative shall have the right to test the weight & quality from time to time.

42. The tenderers shall make all arrangements for proper storage of materials but no cost for raising shed for store and pay of security guard etc. will be borne by the Department.

- The department is not responsible for any theft or loss of materials at site. It is contractor's risk. Under any such plea, if the tenderer stops the work he shall have to pay the full penalty as per clauses of the contract.
43. Approach road to site of work for transport of materials to site of work is sole responsibility of the Contractor. Statutory traffic restriction in the town area for Transport of construction material to site of work is to be taken in to consideration before tendering and no consideration for extra time or compensation thereof shall considered.
44. The contractor should at his own cost arrange necessary tools and plants required for efficient execution of work and the rates quoted should be inclusive of transportation, hire and running charges of such plant and cost of consumables.
45. The contractor shall properly co-ordinate with the execution of P.H., Fire and Electrical works, and take care of the safety of workers.
46. The machineries if available, with the department may be supplied on hire as per charges noted in the enclosed statement and may be changed from time to time subject to the condition that the contractor will execute in advance an agreement with the Engineer-in-Charge.
47. No claim whatsoever will be entertained for supply of machineries. No extension of time will be granted to the contractor under this ground under any circumstances.
48. The tenderer should furnish along with their tender a list of works executed during the last five years duly certified by the concerned Engineer-in-charge indicating the satisfactory completion for Civil, P.H & Electrical works as per the Performa enclosed in a separate sheet of Schedule-C.
49. The tenderer or any of its constituent partners of whose contract for any work has been rescinded or who has abandoned any work in the last five years prior to the date of Bid shall be debarred from qualification. The tenderer is to furnish an affidavit at the time of submission of tender paper about the authentication of tender documents. An affidavit to this effect is to be furnished in Schedule-E and information in Schedule-D.
50. It should be clearly understood that:
- a) The joints of the bars are to be provided with lapping, welds or bolts nuts as well be directed by the Engineer-in-charge.
 - b) Concrete test specimens 150mm × 150mm × 150mm in size (whether plain or reinforced concrete) for the testing shall be taken for each structural member by a representative of the contractor in the presence of responsible officer of the rank not lower than that of an Assistant Engineer or sub-Divisional Officer. The contractor shall bear the cost so involved in testing. The test specimen in cube should be carried out in the Departmental Control and Research Laboratory Cuttack or Rourkela. Test should be carried out in accordance with the stipulation in Bridges code section-III.
 - c) Test specimens shall be formed carefully in accordance with the standard method of taking test specimen and no plea shall be entertained later on the grounds that the casting of the test specimen was faulty and that the result of the specimen did not give a correct indication of the actual quality of concrete.
 - d) Plain concrete and reinforced concrete specimens will be tested in Quality Control and Research Laboratory as per direction of Engineer-in-charge. Cost of testing of all specimens and samples will be borne by the Contractor.
51. The rates quoted should be inclusive of carriage of water required in connection with execution of the work. No claim for carriage of water whatsoever will be entertained.

52. The contractor shall employ one or more Engineering Graduate or Diploma holders as apprentice at his cost if the work as shown in the tender exceeds Rs.2,50,000.00. The apprentices may be selected by the Chief Executive Officer, Rourkela Smart City Limited. The period of employment will commence within one month after the date of work order and would last till the date, when 90% of the work is completed. The fair wage to be paid to the apprentices should not be less than the emolument of personnel of equivalent qualification employed under Government.
53. List of tool & plants in running condition in possession of contractor is to be furnished in a separate sheet.
54. It is the responsibility of the contractor to procure and store explosive required for blasting operation if necessary. Department may render necessary possible help for procuring license.
55. For submission of a tender for the work, the tenderer will be deemed to have satisfied himself by actual inspection of the site and locality of the work about the quality and availability of the required quantity of materials, Medical aid, labour and Flood stuff etc and that the rates quoted by him in the tender will be adequate to complete the work according to the specifications attached thereto and that he had taken in to account all conditions and difficulties that may be encountered during its progress and to have quoted labour rates and materials with taxes, Octroi and other duties lead, lifts, loading and unloading freight for materials and all other charges necessary for the completion of the work to the entire satisfaction of the Engineer-in-charge of the work and his authorized subordinates. After acceptance of the contract rates RSCL will not pay any extra charges for any reason in case the contractor finds later on to have misjudged the conditions as regards the availability of materials, labour and other factors. The contractor will be responsible for any misuse, loss or damages due to any reasons whatsoever of any departmental material during the execution of work. In case of loss, damage or misuse, recovery at the rate at 5 times the cost of the materials will be deducted from the bills or his other dues.
56. The prevailing percentage of I.T. Department of the gross amount of the bill towards income tax will be deducted from the contractor's bill.
57. Deleted.
58. It must be clearly understood that under no circumstances any interest is chargeable for the dues or additional dues if any payable for the work executed and final bill pending disposal due to any reason whatsoever.
59. No extra payment will be made for removing spreading and consolidating salvaged metals and materials.
60. Under section 12 of contractors labour (Regulation and Abolition) Act. 1970 the contractor who undertakes execution of work through labour should produce valid license from licensing authorities of labour Department.
61. Performance Security:
 - 61.1 If the rate quoted by the bidder is less than 15% of the tendered amount, then such a bid shall be rejected and the tender shall be finalized basing on merits of rest bids. But if more than bid is quoted at 14.99% (Decimals up to two numbers will be taken for all practical purpose) less than the estimated cost, the tender accepting authority will finalize the tender thorough a transparent lottery system where all bidders / their authorized representatives, the concerned CEO and CFO will remain present.

(Amendment to Appendix-IX, Clause-36 of OPWD Code Vol.-II by inclusion).

61.2 Additional performance security shall be obtained from the bidder when the bid amount is less than the estimated cost put to tender. In such an event, the bidders who have quoted less bid price/rates than the estimated cost put to tender shall have to furnish the exact amount as per mentioned in below table i.e.

S.No	Range of Difference between the estimated cost put to tender and Bid amount	Additional Performance Security to deposited by the Successful Bidder
i	Below 5%	No Additional Performance Security
ii	From 5% and above and below 10%	50% of (Difference between Estimated cost put to tender and Bid Amount)
iii	From 10% and above	150% of (Difference between estimated cost put to tender and Bid Amount)

as Additional Performance Security in shape of Demand draft/ Bank Guarantee from Nationalised Bank, Schedule Bank for validity of one year/ Term Deposit Receipt of Schedule Bank/ Nationalized Bank pledged in favour of the Chief Executive Officer, Rourkela Smart City Limited and payable at Rourkela before signing the Agreement. The additional performance security in any other form will not be accepted. If the Contractor fails to complete the work, the amount so furnished as additional performance security will be forfeited in addition to the other penal clauses, if any to be imposed.

RSCL has already been appointed Project Management Consultant to supervise “Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis” project under Rourkela Smart City on Percentage Basis and his role & responsibility as follows :

- Project Planning and Construction Supervision
- Supervision Manual
- Design, drawings and tender specifications
- Material Testing Quality Control
- Environmental Protection and Safety during Construction
- Certification of Interim and final payments
- Contract Administration
- Operation & Maintenance Manual Approval
- As Built Drawing approval
- Certification in Defect Liability Period
- Any Contract Dispute and assist in case of Arbitration.

The contractor has to assist and obey the technical assistants and guidance's of the consultant.

62. Sample of all material - The contractor shall supply sample of all materials fully before procurement for the work for testing and acceptance as may be requiring by the concerned Engineer in Charge.
63. All reinforced cement work should conform to Odisha Detailed specification and should be of proportion as per Contract Agreement having desired compressive strength (in work test) in 15 Cm cubes at 28days, after mixing and test conducted in accordance with IS 456 and IS 516.
64. Bailing out of water from the foundation, pipeline trenches S. Tanks/ Soak pits/ Sumps/ M.H. etc. either rainwater or sub-soil water if necessary should be borne by the contractor. No payment will be made for benchmarks. Level pillars, profiles and benching and levelling the ground wherever required. The rates quoted should be

- for finished items of works inclusive of these incidental items of work. It should be understood clearly that no claims whatsoever would be entertained.
65. The tenderer shall have to abide by the C.P.W.D. safety code rules introduced by the Government of India, Ministry of work Housing and Supply in their standing order No-44150 dt .25.11.57.
66. The Contractor will have to submit to the PMC monthly return of labour both skilled and unskilled employed by him on the work.
67. All fittings for doors and windows , P.H. ,Fire & Electrical works as supplied by the Contractor should be of best quality and conform to relevant I.S. specification and should be got approved by the Engineer-in-charge/PMC of the respective wing before they are used on the work.
68. After completion of the work the contractor shall arrange at his own cost all requisite equipments for testing buildings, if found necessary and bear the entire cost of such test, including the inspection of Electrical Inspectorate.
69. The Tenderer should furnish along with their tender 1. A list of works, which are at present in their hand Schedule-F 2. List of work executed (Schedulele-C) in the prescribed proforma(s) enclosed herewith in appropriate place of bid document.
70. All reinforced cement concrete works should be finished smooth Extra charges for plastering if required to any R.C.C. structures like roof slab, Columns, Chajjas, fins, parapets, shelves etc. shall not be paid.
71. Deleted
72. Deleted
73. The tenderer may at his option quote reasonable rate for each item of work carefully so that the rate for one item should not be unworkable low and for others too high.
74. The contractor has to arrange the samples of materials required for execution to be got tested and approved by the Department before taking up the work and during course of execution required from time to time. All such samples will be tested at any of the Govt. of Odisha /Govt. Of India accredited Laboratory, at the cost of the Contractor with no extra cost to the Department.
75. If there is any damage to the work due to natural calamities like flood or cyclone or any other cause during the course of execution of work or up to 24 months after completion of work or if any, imperfection becomes apparent to the work within 24 months from the date of final certificate of completion of work the contractor shall make good of all such damages at his own cost with no extra cost to the Department. No claims, whatsoever, in this regard will be entertained.
76. The K. B. Bricks should be well burnt and of good qualities. The bricks should be approved by the Engineer-in-Charge before use in the work and should confirm to the minimum strength and other criteria as per National Building Code.
77. Under Section 1 of contract labour Regulation and Abolition Act 1970 the contractor who undertakes execution of work through labour should produce valid license from the licensing authority of labour Department.
78. Standard co-efficient for linear measurement will be adopted while calculating consumption of steel and no claim whatsoever regarding difference in co-efficient of steel will be entertained. The rates quoted shall be inclusive of any eventuality of difference for co-efficient for linear measurements.
79. Engineer Contractor desirous to avail the facility of exemption of E.M.D is

required to submit an affidavit to the effect that he has not yet availed the facility / participated in the tender for more than two works (Excluding this work) during the current financial year. The name of work for which participated and the authority to whom the tender was submitted must be mentioned in the affidavit, failing which the tender will be rejected.

80. That for the purpose of jurisdiction in the event of disputes if any of the contract would be deemed to have been entered in to within the State of Odisha and it is agreed that neither party to the contract will be competent to bring a suit in regard to the matter by this contract at any place outside the State of Odisha.

81. SPECIAL CONDITIONS (PART OF THE CONTRACT)

- (I) All materials before they are being used in the items of works as per this Schedule of quantities and also the finished items of work where tests are applicable shall have to be tested through the Engineer-in-charge of the respective wing at appropriate Laboratories according to the relevant I.S. specifications of the materials and the said items of works and the cost of all such tests shall have to be borne by the Contractor and the rates of the items of works should be inclusive of cost of such tests.
- (II) The tests have to be planned & carried out such that the progress of work is not hampered
- (III) The tests are mandatory as per the prescribed frequencies and I.S. specifications. However, these are not exhaustive and the Engineer-in-charge/PMC has the right to prescribe other required test if any as will be considered from time to time.
82. In case of ambiguity between clauses of this D.T.C.N. and the P-1 contract form, the relevant Clauses of the P-1 contract form shall prevail over the D.T.C.N. The clauses not covered under P-1 contract form shall be governed by the clauses of the D.T.C.N.
83. Schedule of quantities is accompanied in Cover-II (Price Bid). It shall be definitely understood that the Government does not accept any responsibility for the correctness or completeness of this schedule and that this schedule is liable for alternation or omissions, deductions or alternations set forth in the conditions of the contract and such omissions, deductions, additions or alternations shall no way invalidate the contract and no extra monetary compensation, will be entertained.
84. In case of any complaint by the labour working about the non-payment or less payment of his wages as per latest minimum Wages Act, the Engineer in Charge will have the right to investigate and if the contractor is found to be in default, he may recover such amount due from the contractor and pay such amount to the labour directly under intimation to the local labour office of the Govt. The contractor shall not employ child labour. The decision of the Engineer in Charge is final and binding on the contractor.
85. The contractor should arrange the materials like Steel, Cement, paint and bitumen etc. of approved quality and specification at his own cost for completion of the work with the time schedule. No extension of time will be granted on the application of the contractor due to delay in procurement of materials.
86. Wastage of bars and unnecessary lapping will not be considered for measurement and payment).

87. The contractor is required to pay royalty to Govt. as fixed from time to time and produce such documents in support of their payment to the concerned Engineer in Charge with their bills, falling which the amount towards royalties of different materials as utilized by them in the work will be recovered from their bills and deposited in the revenue of concerned department.
88. Trial Boring - The foundation level as indicated in the body of the drawings are purely Tentative and for the general guidance only. The RSCL has no responsibility for the suitability of actual strata at the foundation level. The contractor has to conduct his own boring before starting the work and get the samples tested at his own cost to ascertain the S.B.C. and credibility of the strata at founding level while quoting his rates for tender the contractor shall take in to account of the above aspects.
89. Any defects, shrinkage or other faults which may be noticed within 24 (Twenty four Month) months from the completion of the Construction/Installation/Fixing work arising out of defective or improper materials or workmanship timing are upon the direction of the Engineer-in-Charge to be amended and made good by the contractor at his own cost unless the Engineer for reasons to be recorded in writing shall be decided that they ought to be paid for and in case of default Department may recover from the contractor the cost of making good the works.. The RSCL will deduct retention money /ISD which will be Retention Money (5%) five percent from each running bill after correction if any by RSCL + Additional percentage to be deducted & withheld from each payment invoice after correction , if any by RSCL for repair/replacement of the work during defect liability period of 730 days from the date of completion of original work. Performance Security will be release after the Completion of Defect Liability Period (DLP) 730 days. Additional Performance security will be release after the Completion/Implementation of work.
90. From the commencement of the works to the completion of the same, they are to be under the contractors charge. The contractor is to be held responsible to make good all injuries, damages and repairs occasioned or rendered necessary to the same by fire or other causes and they hold the RSCL harmless for any claims for injuries to person or structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the contractor or any one in his employment during the execution of the work. Also no claim shall be entertained for loss due to earthquake, flood, cyclone, epidemic, riot or any other calamity whether natural or incidental damages so caused will have to be made good by the contractor at his own cost.
91. Gradation of ingredients: The coarse and fine aggregate shall meet the grade requirement as per the latest provision of relevant. I.S. Code / I.R.C. code / MoRT&H specifications.
92. Where it will be found necessary by RSCL, the Officer-in-Charge of the work shall issue an order book to the contractor to be kept at the site of the work with pages serially numbered. Orders regarding the work whenever necessary are to be entered in this book by the Rourkela Smart City Corporation Limited Officer-in-Charge with their dated signatures and duly noted by the contractor or his authorized agents with their dated signature. Orders entered in this book and noted by the contractor's agent shall be considered to have been duly given to the contractor for following the instructions of the Department. The order Book

- shall be the property of the Rourkela Smart city Limited and shall not be removed from the site of work without written permission of the Engineer In Charge and to be submitted to the Engineer-in charge every month.
93. The contractor should attach the certificate in token of payment deposit with the registration authority as per recent circular of the Government relating to his registration.
94. In case of any discrepancy in printing or omissions of statutory specifications or any other part or portion of the approved document during download of the bid document, the decision of the officer inviting the bid will be binding on the bidder.
95. The rates quoted by the contractor shall cover the latest approved rates of SOR excluding GST i.e., Labours, Materials, P.O.L. and Royalties. Arrangement of borrow areas i.e. Land, Approach Road to the building site etc. are the responsibility of the contractor.
96. The rate for each work of concrete items wherever dewatering is imperatively necessary the term dewatering shall mean the execution or operation of the items due to standing water as well as due to percolation of water. The quoted rates will be inclusive of this.
97. The contractor shall make requisition of claim book from the date of commencement of the work from the RSCL and shall maintain in proper P.W.D. form with pages serially numbered in order to record items of works are not covered by his contract and claimable as extra. Claims shall be entered regularly in this book under the dated signature of the contractor or his duly authorized agents at the end of each month. A certificate should be furnished along with the claim to the effect that he has no other claim beyond this claim up-to-date. If in any month there are no claims to record, a certificate to that effect should be furnished by the contractor in the claim book. Each claim must be defined and should be given as far as possible regarding the quantities as well as the total amount claimed. The claim book must be submitted by the contractor regularly by 10th and 16th days of each month for orders of the Engineer-in- Charge or competent authority. Claims not made in this manner or the claim book not maintained from the commencement of the work is liable to be summarily rejected. The claim book is the property of the Rourkela Smart city Limited and shall be surrendered by the contractor to the Engineer-in-charge after completion of the work or before recession of the contract by the Department whichever is earlier for record.
98. Number of tests as specified in I.R.C. / MoRT&H / I.S.I specification required for the construction of roads / bridges / buildings or any other structural works or any work will be conducted in any Govt. of Odisha /Govt. Of India accredited Laboratory to be decided by the Engineer-in-charge. Testing charges including expenditure for collection / transportation of samples /specimens etc. will be borne by the contractor. The collection of samples and testing are to be conducted for both prior to execution and during execution as may be directed by the Engineer-in-charge and on both the accounts the cost shall be borne by the contractor.
99. Even qualified criteria are met, the bidders can be disqualified for the following reasons, if enquired by the Department

a) Making a false statement or declaration.

- b) Past record of poor performance.
- c) Past record of abandoning the work half way/ recession of contract.
- d) Past record of in-ordinate delay in completion of the work.
- e) Past history of litigation.

100. In case the 1st lowest tenderer or even the next lowest tenderers withdraw in series one by one, thereby facilitating a particular tender for award, then they shall be penalized with adequate disincentives with forfeiture of EMD unless adequate justification for such back out is furnished. Appropriate action for black listing the tenderers shall also be taken apart from disincentives against the tenderer.

101. The following documents which are not submitted with the Bid, will be deemed to be part of the Bid :

S.No.	Particular
1	Notice Inviting tender
2	Instruction to the Bidder
3	Conditions of Contract
4	Contract data
5	Specifications
6	Drawings
7	Pre-Bid Meeting Minutes

102. ELIGIBILITY CRITERIA:

I.

To be eligible for qualification, applicants shall furnish the followings. Non-furnishing of the following particulars shall be treated as ineligible. The facility for exemption of EMD & ISD, either in full or in part, as per instruction/guidelines of Govt. of Odisha / OPWD Code/Govt of India/direction of Hon'ble Courts in India (with specified limitation and liberty) can be availed by intending and eligible class/category of Bidder (Contractors with Physical Disabilities/Engineer Contractors/ ST or SC Contractors/Such other Agency(s) conferred with this exemption facility if any). However this facility availed by any bidder for the above mentioned work shall be treated as genuine and admissible / Acceptable subject to submission of required documentary evidence/support in hard copy as described in DTCN and subsequent Verification of the same by RSCL..

II. Scanned copy of required E.M.D as per the Clause No. 5 (i) and Clause No.20 of DTCN.

III. Scanned copy of demand draft towards cost of tender paper as per Clause No.4 and 5(i) of DTCN.

IV. After the date & time of receipt of bid is over, the original Bid security and Demand draft towards cost of Bid documents shall be submitted in the office of the undersigned on or before date & time of opening of Bid as specified at Contract data above, and as per date mentioned in contract Data during office hours on working days failing which the bid will be rejected.

V. Scanned copy of valid Registration Certificate, PAN card along with the tender documents and the originals of all scanned documents & VAT clearance certificate in form VAT 612/GST Clearance Certificate of the successful lowest bidder only are to be produced within 5(five) days after opening of Cover-II of the tender in the office of the Chief Executive Officer, RSCL otherwise his/her bid shall be declared as non-responsive he will

suspend/prohibit/debar/blacklist from participating in bidding in any contract of the State as per OPWD Code and /or Cancellation of Empanelment (registration of from OPWD) action will be taken by the competent authority. In such a situation, successful L-2 bidder will be required to produce his original documents for consideration of his tender at the negotiated rate equal to L-1 bidder

VI. License criteria as per Clause No.8 of DTCN and Schedule-H need to be furnished

VII. Joint Ventures are not accepted

VIII. 1. Bidder/ Firm should furnish list of similar works executed during last five years stating the Agreement No., date of commencement and completion, actual date of completion duly certified by the employer. The certificate to that effect has to be obtained from an officer not below the rank of Executive Engineer concerned with the work under report. The bidder must have completed /Substantial Completed (80 % of awarded cost) any one or more Construction of any type of Building " Works /Projects during last five years from one month prior of bid due date up to value of 80% of the Project cost i.e. Rs. 13.48 Cr.”.

Bidder should submit all the credentials along with all experience certificates. Copy of Completion Certificate / Work order / Agreement any other document in support of successful completion of job along with Reference of person under whom jobs are executed. Substantial Completion shall be based on 80 (eighty) percent value wise or more works completed under the contract and Completed value must be equal or more than **Rs. 13.48 Cr.**

2. The Bidder should have average annual turnover of **Rs. 13.48 Cr. (Rs. Thirteen Crore and Forty Eight Lakhs)**.in during last five (5) financial years. Turnover of previous year will be escalated @10% per financial year (on compound basis) shall be considered on the value of annual turnover of the preceding years and cost of completed / executed similar nature of work shall be given additional weightage of percentage per year to bring them to current price level to account for price escalation as illustrated below:

Year	Turnover	Effective cost executed work at previous completed financial year's price level
2019-20	E	1.61 x E
2020-21	D	1.46 x D
2021-22	C	1.33 x C
2022-23	B	1.21 x B
2023-24	A	1.10 x A

Similar work of previous year will be escalated @10% per financial year (on compound basis) shall be considered on the value of executed similar nature of work shall be given additional weightage of percentage per year to bring them to current price level to account for price escalation as illustrated below:

Year	Similar Work	Effective cost executed work at previous completed financial year's price level
2019-20	E	1.61 x E
2020-21	D	1.46 x D

2021-22	C	1.33 x C
2022-23	B	1.21 x B
2023-24	A	1.10 x A

Note: 1. Technical Bud must be accompanied by the annual turnover Certificate along with Financial Statement (P/L and B/S) of the Bidder for the last 5 (five) financial years, preceding the year in which the bid is submitted. In case the annual accounts for the latest financial year i.e. 2023-24 is not audited and therefore the bidder cannot make it available, the Bidder shall give an undertaking to this effect and the statutory auditor/Chartered Accountant shall certify the same. In such case, the Bidder shall provide the annual turnover for 5 (five) years preceding the year for which the Audited Annual Report is not being provided. i.e.

2019-20	2020-21	2021-22	2022-23	2023-24
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- I. Scanned copy for information regarding current litigation, debarring / expelling of the applicant or abandonment of work by the applicant in schedule "D" and scanned copy of affidavit to that effect including authentication of tender documents in schedule "E" & furnish the original affidavit in Schedule-E within 5 (five) working days of opening of Cover-II as per clause 49.
- II. No Relationship Certificate in Schedule – A
- III. List of projects under execution in Schedule-F
- IV. List of projects executed that are similar in nature to the work as per Schedule-C
- V. Affidavit of eligibility from schedule –K to O
- VI. Certificate of employment of unemployed Engineering Graduate as per format Schedule-G for 'A' Class and above Regd. Contractor
- VII. Undertaking of Bidder as per format Schedule G.
- VIII. Declaration of relation in the Dept. if any in Schedule I
- IX. MOU with Electrical Contractor in Schedule –J
- X. List of equipment on Owned/lease basis in Schedule K
- XI. Affidavit for SC/ST Bidder in format Schedule-L
- XII. Affidavit for Physically Handicapped Bidder in format Schedule-M
- XIII. Affidavit for Engineering Contractor in format Schedule-N
- XIV. Affidavit for Bidder not registered in EPFO in format Schedule-O
- XV. BID CAPACITY Declaration:- Vide Works Department Office Memorandum No.6300 dtd. 16.06.2011)

Applicants who meet the minimum qualification criteria will be qualified only if their available bid capacity at the expected time of bidding is more than the

total estimated cost of the Project.

The available Bid Capacity will be calculated as under.

Assessed Available Bid Capacity= $(A*N*2-B)$, where

A = Maximum value of Civil Engineering works executed in any one year during the last five years (updated to the current price level) rate of inflation may be taken as 10% per year(escalation factor) which will taken into account the completed as well as works in Progress.

N = 1.50 Year (In word One and half Year) Number of years prescribed for completion of the works for which the bids are invited.

B = Value of Current price level of the existing commitments and on-going works to be completed during the next years(Period of completion of work for which Bids are invited. The Statement showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer-In-Charge not below the rank of an Executive Engineer. Escalation factor: Following enhancement factors will be issued for the Cost of works executed and the financial figures to a common base value for works completed in India.

Year Before	Multiplying Factor
One	1.10
Two	1.22
Three	1.33
Four	1.46
Five	1.61

(Applicant should indicate actual figures of costs and amounts for the works executes by them without accounting for the abovementioned factors)

In case the financial figures and value of completed works are in foreign currency the above enhanced multiplying factors will be applied . Instead , current market exchange rate (State Bank of India BC selling rate as on the last date of submission of the Bid) will be applied for the purpose of conversion of amount in foreign currency into Indian Rupees.

103. Time Control :- (Vide Works Department Office Memorandum No.24716 dtd.24.12.2005 and No.8310 dtd.17.05.2006) Progress of work and Re-scheduling programme.

a)

- i. The Engineer-in-Charge shall issue the letter of acceptance to the successful contractor.
The issue of the letter of acceptance shall be treated as closure of the Bid process and commencement of the contract.
- ii. Within 15 days of issue of the letter of acceptance, the contractor shall submit to the Engineer-in- Charge for approval a Programme showing the general methods, arrangements, and timing for all the activities in the Works along with monthly cash flow forecast.
- iii. To ensure good progress during the execution of the work the contractors shall be bound in all cases in which the time allowed for any work exceeds one month to complete, 1/4th of the whole time allowed under the contract has elapsed, 1/2 of the whole of the work before 1/2 of the whole time allowed under the contract has elapsed, 3/4th of the whole of the work before 3/4th of

the whole time allowed under the contract has elapsed.

- iv. If at any time it should appear to the Engineer-in-Charge that the actual process of the work does not conform to the programme to which consent has been given the Contractor shall produce, at the request of the Engineer-in-Charge, a revised programme showing the modifications to such programme necessary to ensure completion of the works within the time for completion. If the contractor does not submit an updated Programme within this period, the Engineer-in-Charge may withhold the amount of 1% of the contract value from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Programme has been submitted.
- v. An update of the Programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.
- vi. The Engineer-in-Charge's approval of the Programme shall not alter the Contractor's obligations. The Contractor may revise the Programme and submit it to the Engineer-in-Charge again at any time. A revised Programme is to show the effect of Variations and Compensation Events

c) **Extension of the Completion Date.**

If the contractor fails to maintain the required progress in terms of clause-2 of P-1 Contract or to complete the work and clear the site on or before the contract or extended date of completion, he shall, without prejudice to any other right or remedy available under the law to the Government on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the Municipal Commissioner (whose decision in writing shall be final and binding) may decide on the amount of tendered value of the work for every completed day / month (as applicable) that the progress remains below that specified in Clause-2 of P-1 Contract or that the work remains incomplete. This will also apply to items or group of items for which a separate period of completion has been specified. Compensation @ 1.5% per month of for delay of work, delay to be completed on per Day basis. Provided always that the total amount of compensation for delay to be paid under this condition shall not exceed 10% of the Tendered Value of work or to the Tendered Value of the item or group of items of work for which a separate period of completion is originally given. The amount of compensation may be adjusted or set-off against any sum payable to the Contractor under this or any other contract with the Government. In case, the contractor does not achieve a particular milestone mentioned in contract data, or the rescheduled milestone(s) in terms of Clause-2.5, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied at the final grant of extension of time. Withholding of this amount on failure to achieve a milestone shall be automatic without any notice to the contractor. However, if the contractor catches up with the progress of work on the subsequent milestone(s), the withheld amount shall be released. In case the contractor fails to make up for the delay in subsequent milestone(s), amount mentioned against each milestone missed subsequently also shall be withheld. However no interest whatsoever shall be payable on such withheld amount.

d) **Bonus for early completion**

Deleted

e) Management meetings

- i. Either the Engineer or the Contractor may require the other to attend a management meeting. The business of management meetings shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
- ii. The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

Rescission of Contract (Amendment as per letter No.10639 dt.27.05.2005 of Works Department, Odisha):- To rescind the contract (of which rescission notice in writing to the contractor under the hand of the Municipal Commissioner shall be conclusive evidence), 20% of the value of left over work will be realized from the contractor as penalty.

104. Building and other Construction Workers Welfare Cess @ 1% of the estimated cost as per tender notification read with latest corrigendum if any will be proportionately deducted from the contractor's bill at the time of making payment of each bill.

105. The tenderers are required to go through each clause of P.W.D. Form P-1 carefully in addition to the clauses mentioned here in before tendering.

106. A Contractor may be black listed as per amendment made to Appendix XXXIV to OPWD Code Vol.-II on rules for black listing of Contractors vide letter no.3365 dt.01.03.2007 of Works Department, Odisha.

As per said amendment a Contractor may be blacklisted

- a) Misbehaviour/threatening of Departmental & supervisory officers during execution of work/tendering process.
- b) Involvement in any sort of tender fixing.
- c) Constant non-achievement of milestones on insufficient and imaginary grounds and non-adherence to quality specifications despite being pointed out
- d) Persistent and intentional violation of important conditions of contract.
- e) Security consideration of the State i.e. any action that jeopardizes the security of the state.
- f) Submission of false/ fabricated / forged documents for consideration of a tender.

107. The safety certificate of the E.I. work will be furnished by the agencies after getting necessary verification from the electrical inspector / equally competent authority responsible for the work prior to Energisation of the building.

108. Percentage rate contract (vide Works Department letter no.8310 dt.17.05.2006) In case of percentage rate tender:-

- i. The Contractor has to mention percentage excess or less over the estimated cost (In figures as well as words) in the prescribed format appended to the tender document.
- ii. Contractors participated in the tender for more than one work may offer conditional rebate. Rebate offers submitted in separate sealed envelope

shall be opened, declared and recorded first. The rebate so offered shall be considered after opening of all packages called in the same Tender Notice. The Contractors who wish to tender for two or more works shall submit separate tender for each. Each tender shall have the Bid Identification No., Name & Sl. No. of the work (as per IFB) to which they refer, written on the envelope.

- iii. Only percentage quoted shall be considered. Percentage quoted by the Contractor should be accurately filled-in figures and words, so that there is no discrepancy.
- 1) If any discrepancy is found in the percentage quoted in words and figures, then the percentage quoted by the Contractor in words shall be taken as correct
 - 2) If any discrepancy is found in the percentage quoted in percentage excess/ less and the total amount quoted by the Contractor, then percentage will be taken as correct.
 - 3) The percentage quoted in the tender without mentioning excess or less and not supported with the corresponding amount will be treated as excess.
 - 4) The percentage quoted in the tender without mentioning excess / less supported with corresponding amount does not tally with either to percentage excess or less then it will be treated as percentage excess.
 - 5) The percentage quoted in the tender without mentioning excess / less supported with corresponding amount if tallied with the percentage then it will be treated as to which side the amount tallies.
 - 6) The Contractor will write percentage excess/ less up to two decimal points only.
 - 7) The tender shall be written legibly and free from erasures, over writings or corrections of figures. Corrections, over writings & interpolations where unavoidable should be made by making out, initialing, dating and rewriting.
- iv. In the contract P1 time is the essence. The contractor is required to maintain a certain rate of progress specify in the contract.
- v. The quantity mentioned can be increased or reduced to the extent of 10% for individual items subject to a maximum of 5% over the estimated cost. If it exceeds the limit stated above prior approval of competent authority is mandatory before making any payment.
- vi. The period of completion is fixed and cannot be altered except in case of exceptional circumstances with due approval of next higher authority.
- vii. Bills for percentage rate tenders shall be prepared at the estimated rate for individual items only and the percentage excess or less shall be added or subtracted from the gross amount of the bill.

APPROVED

Chief Executive Officer
Rourkela Smart City Ltd.

Tenderer (s) is/are required to submit the information in the following Schedules

SCHEDULE - A
CERTIFICATE OF NO RELATIONSHIP

/We hereby certify that I/We* am/are* related / not related(*) to any officer of Rourkela Smart City Limited of the rank of Assistant Engineer & above and any officer of the rank of Assistant /Under Secretary and above of the Works Department, Govt. of Odisha I/We* am/are* aware that, if the facts subsequently proved to be false, my/our* contract will be rescinded with forfeiture of E.M.D and security deposit and I/We* shall be liable to make good the loss or damage resulting from such cancellation.

(*) - Strike out which is not applicable

Signature of the
Tenderer Date:-

SCHEDULE – B

A. Brief Company profile

SL.NO.	PARTICULARS Name of Bidder	DESCRIPTION OR DETAILS
1	Name of Bidder	
2	Legal status of Bidder (company, Pvt. Ltd., LLP etc.)	
3	Main business of the Bidder	
4	Registered office address	
5	Incorporation date and number	
6	GST Registration Certificate (State And Central)	
7	PAN details	
8	Primary Contact Person (Name, Designation, address, mobile number, fax, email)	
9	Secondary Contact Person (Name, Designation, address, mobile number, fax, email)	
10	EMD	

B. Certificate of Incorporation

(To be submitted by sole Bidders)

C. Financial Turnover

(To be submitted by Sole Bidder)

The financial turnover of the company is provided as follows as per Clause no 102 of DTCN

	2019-20 (Y5)	2020-21 (Y4)	2021-22 (Y3)	2022-23 (Y2)	2023-24 (Y1)
Annual Turnover					

Copy of audited financial statements of last five financial years along with declaration from the appointed Chartered Accountant to be provided as proof of the financial turnover with UDIN no. on its certificate.

SCHEDULE – C

WORK EXPERIENCE

LIST OF SIMILAR NATURE OF PROJECTS EXECUTED AS PER CLAUSE NO 102 OF

i.

Name of Employer	Name of location and name of work	Contract price in Indian Rupees/Agreement no.	Major Items of works	Date of starting the work as per Agreement	Stipulated date of completion of the work as per Agreement	Actual date of completion of the work	Reasons for delay in starting/completion if any
1	2	3	4	5	6	7	8

ii.

S.no	Name of the Projects Code	Year 1-2023-24 Total Receipt from Project	Year-2 Total Receipt from Project	Year-3 Total Receipt from Project	Year-4 Total Receipt from Project	Year-5 Total Receipt from Project
1	A					
2	B					
3	C					
Total		Total of Year 1	Total of Year 2	Total of Year 3	Total of Year 4	Total of Year 5
Escalation						
Total (After Multiplying with)						

Note: The above information is to be certified by the Engineer in Charge / Employer not below the rank of Executive Engineer vide Completion Certificate.

Signature of the Tenderer

Date.

SCHEDULE – D

**INFORMATION REGARDING CURRENT LITIGATION, DEBARRING EXPELLING
OF
TENDERER OR ABANDONMENT OF WORK BY THE TENDERER**

1	a)	Is the tenderer currently involved in any litigation relating to the works.	Yes / No
	b) If Yes : given details:		
2		Has the tenderer or any of its constituent partners been debarred/ expelled by any agency in India during the last 5 years.	Yes / No
3	a)	Has the tenderer or any of its constituent partners failed to perform on any contract work in India during the last 5 years.	

b) If yes, give details

Note:

If any information in this schedule is found to be incorrect or concealed, qualification application will summarily be rejected.

Signature of Tenderer

SCHEDULE – E

AFFIDAVIT

1. The undersigned do hereby certify that all the statements made in the required attachments are true and correct.
2. The undersigned also hereby certifies that neither my / our firm / company / individuals _____ nor any of its constituent partners have abandoned any road/ bridge/Irrigation /Buildings or other project work in India nor any contract awarded to us for such works have been rescinded during the last five years prior to the date of this bid.
3. The undersigned hereby authorise(s) and request(s) any bank, person, firm or Corporation to furnish pertinent information as deemed necessary and as requested by the Department to verify this statement or regarding my (our) competency and general reputation.
4. The undersigned understands and agrees that further qualifying information may be requested and agree to furnish any such information at the request of the Department.

(Signature of
Tenderer)
Title of Officer
Name of Firm
Date:

Original Affidavit sworn before Notary Public or Executive Magistrate\

Schedule-F

EXISTING COMMITMENTS AND ON-GOING WORKS:

i.

Description of works	Place & State	Contract No.	Name & Address of Employer	Value of Contract (In lakh)	Stipulated Period of Completion	Value of works* remaining to be completed (In lakh)	Anticipated date of completion

ii.

S.no	Name of the Projects Code	Year 1 Total Receipt from Project	Year-2 Total Receipt from Project	Year-3 Total Receipt from Project	Year-4 Total Receipt from Project	Year-5 Total Receipt from Project
1	A					
2	B					
3	C					
Total		Total of Year1 st	Total of Year 2 nd	Total of Year 3 rd	Total of Year 4 th	Total of Year 5 th
Escalation		1.10	1.21	1.33	1.46	1.61
Total (After Multiplying with escalation)						

Schedule-G

**Certificate of Employment of Unemployed Graduate Engineer
(For Above A Class Contractors only)**

I/We hereby certify that at present , the following Engineering Personnel are working
with me/in our firm/Company and their bio-data are furnished below:

:

S.No.	Name of Engineering Personnel appointed for supervising Contractor's work with Address	Qualification	Date of Appointment	Monthly Emoluments	Whether full time engagement and continuous	if they are superannuated/retired/dismissed or removed personnel from State Govt./Central Govt./PSU/Pvt. Companies or any one ineligible for Government Service
1	2	3	4	5	6	7
2						
3						
4						
5						
6						
7						

Schedule-H

UNDERTAKING

This is to certify that

1. My firm has neither been associated , directly or indirectly , with the Consultant or with any other entity that has prepared the design ,specifications, and other documents for the Project nor has any person associated with been proposed as Project manager for the Contract.
2. My firm has not engaged any agency and any of its affiliates engaged by the Engineer in Charge to provide Consulting services for the preparation or supervision of this work.
3. My firm has not engaged any Engineer of Gazetted rank employed in Engineering or Administrative duties in an Engineering Department of the Government of Odisha or other Gazetted Officer retired from Government Service during last two years without prior permission of the Government of Odisha in wining before submission of this tender. I am aware that my contract is liable to cancelled if either i or any of my employees is found any time to be such a person who had not obtained the permission of the Government of Odisha as aforesaid.
4. I/We have visited the site and have fully acquainted with the local condition regarding the materials labour and factors pertaining to work for completion in all respect before submitting the tender.
5. I/We have carefully studied the conditions of the Construction ,specification, contract condition and all other documents relating to this work and agree to execute the same accordingly.
6. I/We solemnly pledge that I/We shall sincere in discharging my/our duties as responsible contractor and complete the work within the prescribed time limit. In case there are deviation from the Construction Programme , I/We shall abide by the decision of Engineer –In-Charge for revision of programme and arrange for the labours, materials, equipments etc accordingly.
7. In the event of award of the work to me/us. I/We undertake the entire responsibility for the structural stability to reconstruct/replace the whole or part of the Component of the structure in the event of failure or improper functioning /Improper Construction within a period of one year from the date of completion without asking extra payment from the account of department.
8. I/We undertake that I/We shall not claim any escalation of cost on account of material,labour taxes from any account in connection with work with execution of the work till the actual completion period and shall not be entertained by Rourkela Smart City Limited,
9. In case of vaiolation of contents of department's tender documents in shape of extra conditions or in any form , my offer/tender shall be rejected by the department without any intimations to me/us.

Signature of the
Tenderer

Date:

SCHEDULE –I
RELATIONSHIP DECLARATION

To,

Chief Executive officer,

Rourkela Smart City Limited

Subject: (Name of Work”..... Bid reference number)

Sir,

Pursuant to clause 2 of the ITB, it is to inform that I have relative(s) employed as an Officer in the rank of an Assistant Engineer/Under Secretary under the

Department. His (Their) details are as follows.

Relationship			
Name:			
Office			
Address			
Pursuant to clause 2 of the ITB, I am to submit herewith the names of persons who are working under my firm having near relatives to any gazetted officer in the rank of an Assistant Engineer/Under Secretary in the _____ Department.			
S.No	Name of the my employee and his designation in the firm	Presently working at	Details of his relatives working in the Department
			Relationship
			Name:
			Designation
			Office
			Address
			Relationship
			Name:
			Designation
Office			
Address			

I am also duty bound to inform the relationship of any subsequent employment with any gazetted officer in the rank of an Assistant Engineer/Under Secretary in the

Department. I am aware that any breach of this condition would render my firm liable for penal action for suppression of facts.

Yours Sincerely
Signature of the Tenderer

SCHEDULE –J

MEMORANDUM OF UNDERSTANDING

First Party I Sri/Smt....., Aged years, S/O-,

At / P.O. / Dist-..... (Hereinafter called the First Part)

AND

Second Party I Sri/Smt....., Aged years, S/O-

....., At / P.O. / Dist-..... (Hereinafter called the Second Part) having M.V.
license registration No..... valid up to

AND WHEREAS the First Party of 1st part is the managing partner of AND WHEREAS
the First Party willing to appoint the Second Party to execute the E.I. portion for the tender work,
“.....”

AND WHEREAS the Second Party accepted the offer of First Party.

NOW THIS DEED OF AGREEMENT WITNESSES AS FOLLOWS;

- 1) That, the Second Party shall do all E.I. works, if the tender is awarded to First Party.
- 2) That, the Second Party shall fulfill all the E.I. works as per the tender schedule by instruction of Engineer-in-Charge.
- 3) That, the First Party shall receive payment, signing the bill the document for the concerned work.
- 4) That, the Second Party shall abide the rules, regulations and specification of E.I. works of above said matter.

In witness where of both the party have signed in presence of

WITNESS

W₁—

W₂—

Schedule-K

Information (Machineries owned/possessed on lease/hire) Details of machinery possessed owned / leased/ hired

SL No	Name of the Machineries	No of Machineries	Owned/Hired/Leased
1	10/7 Concrete Mixer	2	
2	Excavator	1	
3	Vibrator	5	
4	Tractor /Tipper	2	
5	Water Tanker	1	
6	Transit Vehicle	2	
7	Mini Batching Plant	1	
8	Concrete Pump with pipeline	1	
9	Earth compactor/ baby roller	2	
10	Dewatering pump 5 HP	2	
11	Quality control set up	1	

NB. Scan copies of Owned or leased or hired receipts/Agreements of the above machineries must be uploaded into Technical Cover.

Schedule-L
AFFIDAVIT
(Applicable for SC/ST Bidders)

1. I, Sri/Smt/Ms.....,Son/Daughter/Wife of,
hereby declare that;
 - a. I am a registeredClass ST/SC Contactor under Govt. of Odisha
Or
 - b. The Partnership Firm/Private Ltd Company named/titled, as “.....
.....” is a registered SC/ST Contractor under Govt. of Odisha within the ambit
specified in Works Department Resolution No. 27748 dt. 11.10.77 and I,
Sri/Smt/Ms....., Son/ Daughter/ Wife of
....., is authorized signatory on behalf of the Firm/Company (scanned
authorization copy with my signature duly certified and attested/identified has been
submitted on-line with our tender).
[Tick (a) or (b) above whichever is applicable and fill up accordingly.]
2. As per Works Department, Govt. of Odisha Resolution No.27748 dt.. 11.10.77, I/My
Firm am/is entitled for exemption of 50% EMD & ISD and accordingly, I/My Firm have/has
submitted tender for the work.
3. I/My Firm hereby submit willingness to avail price preference as ST/SC category
Civil Contractor as entitled in the aforesaid resolution.
4. Necessary documentary evidence(s) as prescribed in the Tender Notice at * in
support of my/our aforesaid claim for exemption of EMD & ISD have/has been
duly up-loaded on-line/submitted along with my/our tender for the aforesaid work.
5. In addition to those, other documents and original(s), as required by CEO, RSCL to
sustain my/our aforesaid claim shall be submitted by me/us within a week from
the date of instruction/intimation of CEO,, RSCL through telephone/letter/e-mail failing
which my/our tender shall be liable for rejection .
(*) –Strike out which is not applicable.

(Deponent)
(Signature of the Tenderer/Authorised Signatory
in case of
Partnership Firm/Company with Seal of the
Firm/Company) . Original Affidavit sworn before Notary Public or
Executive Magistrate

Schedule-M

AFFIDAVIT

(Applicable for Contractors with Physical Disabilities)

1. , Sri / Smt / Ms , Son / Daughter / Wife of
....., hereby declare that I am a registered Class Contactor with Physical Disabilities within the ambit prescribed in Works Department, Odisha- Resolution No.23934 dt.8.11.91
2. As per the said Resolution, I am entitled for exemption of EMD & ISD and accordingly , I have submitted tender for the work.
3. Necessary documentary evidence(s) as prescribed in the Tender Notice at in support of my aforesaid claim for exemption of EMD & ISD have/has been duly up-loaded on- line/submitted along with my tender for the work.
4. In addition to those, other documents and original(s), as required by CEO, RSCL to sustain my aforesaid claim shall be submitted by me within a week from the date of instruction/intimation of CEO, RSCL through telephone/letter/e-mail failing which my tender shall be liable for rejection.

(Deponent)

Original Affidavit sworn before Notary Public or Executive Magistrate

Schedule-N

AFFIDAVIT

(Applicable for Engineer Contractors Intending to Avail Exemption of EMD & ISD as per OPWD Code)

1. I, Sri/Smt/Ms..... hereby declare as the Contractor/as the authorized signatory on behalf of the Contractor,”.....”(Strike out whichever is not applicable) do hereby solemnly affirm and state as follows.
2. That, I/we am/are a registered Class Engineer Contractor
3. That, I/we herewith claim exemption of EMD during the Year..... For participation in the tender for this work.
4. That, I/we have not exhausted the facility available to me/us as Engineer Contractor during the year..... for exemption of EMD & ISD as per Works Deptt. Guideline & OPWD Code.
5. That, I/we shall ensure production of my/our valid Original Contractor's Registration Certificate (license) after or during opening of bids (as per direction of CEO, RSCL for the above work for verification and also for subsequent entry of exemption of EMD and ISD (if selected as the contractor for this work and availed the exemption of EMD and ISD in my/our license as per direction of CEO,RSCL, within such time as directed by him failing which action, as decided by RSCL, may be taken against me/us and appropriate steps may be taken by RSCL to facilitate execution of the tendered work

(*)- Strike out which is not applicable

(Deponent)

(Signature of the Tenderer /Authorised Signatory in case of
Partnership Firm/Company with Seal of the
Firm/Company)

Original Affidavit sworn before Notary Public or Executive Magistrate

Schedule-O

Affidavit

(Applicable for the Bidder not registered under EPF)

I, Sri/Smt/ Ms.....hereby declare as the Contractor
/as the authorised signatory on behalf of the Contractor
.....(Strike out whichever is not applicable) do hereby solemnly affirm and state as follows.

1. That as on date, I/We am/are not registered with RPFC(Regional Provident Fund Commission) and solemnly affirm that, I/We shall follow the “ Employees Provident Fund and Misc Provision Act, 1952 & Rules /Schemes” made there under, in case the work is awarded to me/us
2. That I/We shall submit, after execution of work and before payment of any bill, the detail list of labours, such as
 - a) Name:
 - b) Father's name:
 - c) Place of Permanent Residence:
 - d) Statement of W ages paid to them till the completion of the Work
3. The RSCL Authority will be at liberty to deduct 26% of the labour component amount of the Contract & shall retain it as an additional security with RSCL.
4. That. In case I/We submit the EPF Registration Certificate, then the said additional security shall be released to me /us by RSCL without any interest subject to fulfilment of other Compliances/conditions.
5. That , this affidavit is required to be produced before the authority of Rourkela Smart City Limited for tender purpose.

That the facts stated above are true to the best of my /our knowledge.

(Deponent
(Signature of the Tenderer/Authorised Signatory in case of Partnership Firm/Company with Seal of the Firm/Company)

Original Affidavit sworn before Notary Public or Executive Magistrate

ANNEXURE-I
FORM OF AGREEMENT

(First page to be filled up and signed in non-judicial stamp paper of worth Rs.100/-)

This contract made on Dt.....between Rourkela Smart City Limited (RSCL), hereinafter called "the employer" and(name and address of the selected bidder), hereinafter called "the Contractor"

Whereas, the employer is desirous that the Contractor shall execute "Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis. ".

vide Bid Reference no...../Dt....., (hereinafter called "the work") and the employer has accepted the bid of the Contractor for execution and completion of such works and rectifications of defects, if any, at an accepted tender/contract price of Rs.....(Rupees) only.

Now, therefore, it is hereby agreed upon by RSCL and the Contractor as follows:

1. In this contract, words and expressions shall have the same meanings as are respectively assigned to those in this DTCN and the Contract form as a whole. The DTCN and agreement shall be deemed to form and be read as construed as part of this contract with a view to maintaining the sanctity of this contract for successful execution and completion of the work unless otherwise clarified/redefined at a later stage during the Contract remains in force including the defect liability period.
2. In consideration of the payments to be made by the employer, the Contractor hereby covenants with the employer to execute and complete the work and rectify the defects therein, if any, in conformity with the provisions of this contract.
3. The employer hereby covenants to pay the Contractor in consideration of the execution and completion of the work and for rectification of defects, if any, wherein the contract price or such other sum, as may become payable under the provisions of the contract and in the manner prescribed under this Contract.
4. The following documents shall be deemed to form, read and construed in conjunction with other portions/clauses/conditions of this contract and DTCN.
 - I. DTCN invited for the work including the Short Notice
 - II. Contractor's Bid and negotiation correspondence, if any
 - III. Letter of Acceptance/Letter of Intent for the Work (LOA/LOI)
 - IV. Notice to proceed with the work (Work Order) to be issued by RSCL and subsequent instructions of RSCL to the selected Bidder subject to confirmation of the same, if required, by RSCL through written notice to the selected bidder.
 - V. P1 Agreement which includes Items, Quantities, Rates and Amounts of the work to be duly signed by RSCL and the Contractor.
 - VI. Copy of agreements drawn by the contractor with electrical Contractor vide scope of work of DTCN for Electrical Works.

- VII. Instruction/intimation of RSCL for execution of extra work/item/quantity found essential for the work and corresponding rates not covered in the agreement/DTCN /Financial Bid and also curtailment/exclusion of any items of the Financial Bid from execution.
- VIII. Drawing, design, work programme or part thereof submitted by the contractor and duly approved by RSCL with or without modification.
- IX. Letter/ Intimation/ Instruction(including physically and over telephone) of RSCL for repair/replacement/ defect rectification, if any, with respect to modified quality/specification for such repair/ replacement/ defect rectification work and allowed time to accomplish the same either during the execution of the work or during the defect liability period of 1825 days from the officially declared /notified/noted date of completion of the whole work including additional/curtailed items/ quantities of the work as per direction of RSCL. RSCL reserve the right to declare/ note the date of completion of the original work and date of expiry of defect liability period which will be binding upon the Contractor.

In witness whereof , the aforesaid two parties have entered into this contract on the date mentioned above.

Binding Signature of Employer signed by.....
(for and on behalf of Rourkela Smart City Limited-Employer)

Binding Signature of Contractor signed by.....
(authorised signatory in case of firm/company with applicable authorisation letter/declaration attached to this Contract)

In presence of witnesses

1. Name:

Address:

Tel No:

Signature

2. Name:

Address:

Tel No:

Signature

Signature of Contractor
(Authorised Signatory with Seal)
(Authorised Signatory with Seal)

Signature of Employer
(Authorised Signatory with Seal)

Annexure-III

All Financial Transaction Related to the Project must be abide with the Following Instruction

Category-1(Banks with composite score 55 and above with Branches 100 and above)

As per Govt. of Odisha Finance Department No. 32775 /F Dt.30.11.2023 or any amendment “Selection of Banks for handling business and deposits of State Public Sector Undertakings (SPSUs) and State Level Autonomous Societies (SLASs) for the years 2021-22 followings banks have been selected for handling Business & Deposits (Copy attached) for Ref.:-

Public Sector Banks		Private sector banks	
1	Bank of Baroda	11	Axis Bank Ltd
2	Bank of India	12	Bandhan Bank
3	Canara Bank	13	HDFC Bank
4	Central Bank of India	14	ICICI Bank
5	Indian Bank	RRBs & OSCB	
6	Indian Overseas Bank		
7	Punjab National Bank		
8	State Bank of India	15	Odisha Gramya Bank
9	UCO Bank	16	Utkal Grameen Bank
10	Union Bank of India	17	Odisha State Co-Op. Bank
Category-II (Bank with composite score 65 and above with Branches 50-99)			
Private Sector Bank		Small Finance Bank	
18	DCB Bank	19	IDBI Bank
20	Jana Small Finance Bank		
CATEGORY.III: Category III Banks with Branches 30 to 49			
21	Bank of Maharashtra		
22	IDFC First Bank		

Annexure-IV

FORM OF BANK GUARANTEE

[Performance Security/Additional Performance Security]

To

_____ [name of Authority]

_____ [address of Authority]

WHEREAS _____ [name and address of Contractor]

(hereafter called the “Contractor”) has undertaken, in pursuance of Letter of Acceptance (LOA) No. _____ Dated _____ for construction of _____ [name of the Project] (hereinafter called the “Contract”).

AND WHEREAS the Contract requires the Contractor to furnish an {Performance Security/ Additional Performance Security} for due and faithful performance of its obligations, under and in accordance with the Contract, during the {Construction Period/ Defects Liability Period and Maintenance Period} in a sum of Rs. Lakhs. (Rupees Lakhs) (the “**Guarantee Amount**”¹).

AND WHEREAS we, through our branch at (the “**Bank**”) have agreed to furnish this Bank Guarantee (hereinafter called the “**Guarantee**”) by way of Performance Security.

NOW, THEREFORE, the Bank hereby, unconditionally and irrevocably, guarantees and affirms as follows:

1. The Bank hereby unconditionally and irrevocably guarantees the due and faithful performance of the Contractor’s obligations during the {Construction Period/ Defects Liability Period and Maintenance Period} under and in accordance with the Contract, and agrees and undertakes to pay to the Authority, upon its mere first written demand, and without any demur, reservation, recourse, contest or protest, and without any reference to the Contractor, such sum or sums up to an aggregate sum of the Guarantee Amount as the Authority shall claim, without the Authority being required to prove or to show grounds or reasons for its demand and/or for the sum specified therein.
2. A letter from the Authority, under the hand of an officer not below the rank of General Manager of Rourkela Smart City Ltd., that the Contractor has committed default in the due and faithful performance of all or any of its obligations under and in accordance with the Contract shall be conclusive, final and binding on the Bank. The Bank further agrees that the Authority shall be the sole judge as to whether the Contractor is in default in due and faithful performance of its obligations during and under the Contract and its decision

¹ Guarantee Amount for Performance Security and Additional Performance Security shall be calculated as per Contract.

that the Contractor is in default shall be final and binding on the Bank, notwithstanding any differences between the Authority and the Contractor, or any dispute between them pending before any court, tribunal, arbitrators or any other authority or body, or by the discharge of the Contractor for any reason whatsoever.

3. In order to give effect to this Guarantee, the Authority shall be entitled to act as if the Bank were the principal debtor and any change in the constitution of the Contractor and/or the Bank, whether by their absorption with any other body or corporation or otherwise, shall not in any way or manner affect the liability or obligation of the Bank under this Guarantee.
4. It shall not be necessary, and the Bank hereby waives any necessity, for the Authority to proceed against the Contractor before presenting to the Bank its demand under this Guarantee.
5. The Authority shall have the liberty, without affecting in any manner the liability of the Bank under this Guarantee, to vary at any time, the terms and conditions of the Contract or to extend the time or period for the compliance with, fulfillment and/ or performance of all or any of the obligations of the Contractor contained in the Contract or to postpone for any time, and from time to time, any of the rights and powers exercisable by the Authority against the Contractor, and either to enforce or forbear from enforcing any of the terms and conditions contained in the Contract and/or the securities available to the Authority, and the Bank shall not be released from its liability and obligation under these presents by any exercise by the Authority of the liberty with reference to the matters aforesaid or by reason of time being given to the Contractor or any other forbearance, indulgence, act or omission on the part of the Authority or of any other matter or thing whatsoever which under any law relating to sureties and guarantors would but for this provision have the effect of releasing the Bank from its liability and obligation under this Guarantee and the Bank hereby waives all of its rights under any such law.
6. This Guarantee is in addition to and not in substitution of any other guarantee or security now or which may hereafter be held by the Authority in respect of or relating to the Contract or for the fulfillment, compliance and/or performance of all or any of the obligations of the Contractor under the Contract.
7. Notwithstanding anything contained hereinbefore, the liability of the Bank under this Guarantee is restricted to the Guarantee Amount and this Guarantee will remain in force for the period specified in paragraph 8 below and unless a demand or claim in writing is made by the Authority on the Bank under this Guarantee all rights of the Authority under this Guarantee shall be forfeited and the Bank shall be relieved from its liabilities hereunder.
8. The Guarantee shall cease to be in force and effect on ****\$. Unless a demand or claim under this Guarantee is made in writing before expiry of the Guarantee, the Bank shall

§Insert date at least 12 (Twelve) Month from the date of issuance of this Guarantee (in accordance with Clause 29 of the DTCN).

be discharged from its liabilities hereunder.

9. The Bank undertakes not to revoke this Guarantee during its currency, except with the previous express consent of the Authority in writing, and declares and warrants that it has the power to issue this Guarantee and the undersigned has full powers to do so on behalf of the Bank.
10. Any notice by way of request, demand or otherwise hereunder may be sent by post addressed to the Bank at its above referred branch, which shall be deemed to have been duly authorized to receive such notice and to effect payment thereof forthwith, and if sent by post it shall be deemed to have been given at the time when it ought to have been delivered in due course of post and in proving such notice, when given by post, it shall be sufficient to prove that the envelope containing the notice was posted and a certificate signed by an officer of the Authority that the envelope was so posted shall be conclusive.
11. This Guarantee shall come into force with immediate effect and shall remain in force and effect for up to the date specified in paragraph 8 above or until it is released earlier by the Authority pursuant to the provisions of the Contract.
12. This Guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.
13. This guarantee shall also be operable at our..... Branch at Rourkela , from whom, confirmation regarding the issue of this guarantee or extension / renewal thereof shall be made available on demand. In the contingency of this guarantee being invoked and payment thereunder claimed, the said branch shall accept such invocation letter and make payment of amounts so demanded under the said invocation
14. Bank Detail of Rourkela Smart City Ltd.

S.No.	Particulars	
1	Name of Bank	State Bank of India
2	Name of Branch	Udit Nagar Branch
3	A/c No	36450132867
4	Type of A/c	Saving Bank A/c
5	IFSC	SBIN0007474

Signed and sealed this day of, 20..... at

SIGNED, SEALED AND DELIVERED

For and on behalf of the Bank by:

(Signature)

(Name)

(Designation)

(Code Number)

(Address)

Annexure-IV

Format for Power of Attorney for signing of BID (Refer Clause Annexure-II)

Know all men by these presents, We..... (name of the firm and address of the registered office) do hereby irrevocably constitute, nominate, appoint and authorize Mr./ Ms (name), son/daughter/wife of and presently residing at, who is presently employed with us/ the Lead Member of our Joint Venture and holding the position of....., as our true and lawful attorney (hereinafter referred to as the “Attorney”) to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our BID for the “Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis” . (the “Authority”) including but not limited to signing and submission of all applications, BIDs and other documents and writings, participate in Pre-BID and other conferences and providing information/ responses to the Authority, representing us in all matters before the Authority, signing and execution of all contracts including the agreement and undertakings consequent to acceptance of our BID, and generally dealing with the Authority in all matters in connection with or relating to or arising out of our BID for the said Project and/ or upon award thereof to us and/or until the entering into of the EPC Contract with the Authority. AND we hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE,, THE ABOVE NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS DAY OF 2.....

For
(Signature, name, designation and address)
of person authorized by Board Resolution
(in case of Firm/ Company)/ partner in case
of : Partnership firm “Copy enclosed”

Witnesses

1.

2.

Accepted

.....

(Signature)

(Name, Title and Address of the Attorney)

(Notarised)

(Person identified by me/ personally appeared before me/)

Attested/ Authenticated*

(*Notary to specify as applicable)

(Signature Name and Address of the Notary)

Seal of the Notary

Registration No. of the Notary

Date:.....



Scope of work and Technical Specification

For

Design Construction of Banquet Hall at Civil Township on Percentage Rate Basis

(1) SCOPE OF WORK & DESIGN CRITERIA

1.1 GENERAL SCOPE OF WORK

The scope of works consists of preparation **of Design, GFC (Construction) drawings, construction of Banquet Hall**. The building is proposed to be developed as a modern banquet as well as the elevation treatment will be for a classical building.

The Contractor shall establish a design liaison office at site to facilitate preparation and submission of designs, drawings, construction documents, etc., for review and approval by the Employer's Representative. The design liaison office shall preferably be located near the Employer's office to facilitate communications and frequent interactions with the Employer's Representative and the Employer. The Contractor shall provide full-time design staff and continuously maintain the design liaison office until such time as all necessary designs and Construction Documents have been completed, reviewed, and approved by the Employer's Representative. The Contractor will be fully responsible for ensuring that its designs, drawings, and construction documents satisfy all requirements for constructing Works that are complete and fully functional in all respects. Contractor shall be responsible for making the facility fit for the intended purpose while performing all of its obligations covered under the Contract Document in its entirety. The work shall be done in accordance to the BOQ, drawings approved by the statutory authorities.

Brief scope of works is outlined as follows;

- Banquet hall (double height)
- Party halls
- 10 guest rooms
- Part lawn with toilet facility
- Car Parking at stilt floor and open space
- Fire fighting
- Electrical works
- HVAC
- Water supply and sewerage including plumbing & sanitary installations
- Packaged Sewage Treatment Plant
- Site drainage and rain water harvesting
- Landscaping work
- Other misc. Works such as site development, compound wall, gate, watchman cabin, land grading, dismantling of existing structures etc.

The scope under design includes but not limited to

- Preparation of details design and analysis of structural elements including getting it approved from any NIT/IIT.
- Preparation of GFC drawings of all components.
- Preparation of detail design drawings for Plumbing, electrical, fire fighting and HVAC components.
- Obtaining NOC from departments such as Fire, Electrical, Planning

The scope of works shall be read along with the drawings provided in tender document. The Contractor shall submit a detailed work plan considering the project completion time frame mentioned in the tender document.

1.2 PARTICULAR SCOPE OF WORK

1.2.1 Architecture

1.2.1.1 Architecture, Interiors, Softscape & Hardscape

The Architecture, Interiors, Softscape & Hardscape scope includes design, detailing, procure, supply, construction, installation, furnishing, equipping, testing, commissioning and execution for "Banquet hall" building complex that includes boundary wall, entry gate, Stilt floor parking, party lawn, Double height Banquet hall, party hall, Kitchen facility, Guest rooms, hard-scaping and soft-scaping, classical elevation design.

The Architectural layout is finalized for this building. The contractor has to prepare the detail GFC drawings for construction including all architectural detailing.

1.2.1.2 Architectural design criteria

The contractor shall prepare architectural design of all the components and get it approved prior to start the detailed design of the works. The area and facility requirements have been provided below for all buildings.

STILT FLOOR:

PARKING: 2264 SQM AND PARTY LAWN: 1371 SQM

- Parking facility
- Firefighting system
- Water supply and fire tanks with supporting infrastructure
- Landscape and hardscape
- Boundary wall
- Service yard

- Loading and unloading area
- Guest toilet facility
- Driver's toilet facility
- Guest entrance lobby
- Service entrance lobby
- Staircase from stilt floor to terrace (Guest)
- Staircase from stilt floor to terrace (Service)
- 2 guest lift from stilt to first floor (15 passenger each)
- Service lift from stilt to first floor

Ground floor: 880 SQM

- Lobby
- Double height banquet hall
- Toilet area separate for male, female and handicapped
- Kitchen

Mezzanine floor: 370 SQM

- Lobby
- AHU and electrical room (service area)
- Kitchen

First floor: 880 SQM

- | | |
|---|--|
| <ul style="list-style-type: none">• 10 Guest rooms• Party Hall 1• Party Hall 2• Collapssable partition between two party halls | <ul style="list-style-type: none">• Meeting room• Toilet area (separate for ladies, gents and Physical challenge) |
|---|--|

Terrace floor: 880 SQM

- OHT
- All outdoor units
- Mumty
- Machine room
- Laundry room

ELEVATION:

The elevation of Banquet building shall be designed using massing in concrete, GRC and brick work. The elevation finishes shall be a combination of GRC Pilaster and moulding (dry cladding as per Specification), structural glazing and a combination of textured plaster/paint surface (as per Specification).

1.2.1.3 Approval Drawings / Documents for Subsequent Approvals

Contractor shall prepare and submit approval drawings, documents, calculations, certificates, etc, and do necessary changes in the drawing if required as may be necessary by the statutory authorities, at the relevant stages. The contractor shall prepare and modify the GFC drawings based on the drawings approved by the statutory authorities.

1.2.1.4 Construction Drawings / Documents Approval Process

Contractor shall submit at least following number of sets for approval of Employer's Representative.

- A. Construction Documents - 05 sets
- B. Samples, datasheets etc - 05 sets

Each of the submission should clearly identify the Work, purpose of the submission, document number etc. as approved in the procedure referred above. Upon review of the said submission Employer's Representative shall return the submission with following codes

- a. Work may proceed.
- b. Revise and Resubmit. Work may proceed subject to resolution of indicated comments.
- c. Revise and Resubmit. Work may not proceed.
- d. Review not required. Work may proceed.

Although Work may proceed on receipt of a drawing coded 2, Contractor must resolve the comments indicated, resubmit and obtain a Code 1 before release for shipment or completion of the affected Work.

Employer/ Employer's Representative review and permission to proceed does not constitute acceptance or approval of submittals including, but not limited to, design details, calculations, analyses, test methods, construction methods, plans, certificates or materials developed or selected by Contractor and does not relieve Contractor from full compliance with the Contract requirements.

1.2.1.5 Technical Standards and Regulations

Contractor shall refer and implement all relevant and all applicable codes, technical standards, regulations, as amended, required for performance of Work covered under this Contract. Also, all the conditions of

statutory approval already taken by the Employer need to be complied during construction stage, the same need to be complied for future approval required if any.

1.2.1.6 Samples

Contractor shall necessarily submit samples of all finishing materials that may affect the look and feel of the project, especially those for which basic rates are indicated in the BOQ and where generic materials are indicated. Submission of samples shall not be limited to the above, and the Employer/ Employer's Representative and Consultant/PMC reserves the right to demand any sample of materials, as deemed necessary.

Where samples are required, they shall be submitted by and at the expense of Contractor allowing at least fourteen (14) calendar days for review by Employer/ Employer's Representative and Consultant/PMC/Architect unless otherwise shown on the Contract Schedule. The materials represented by such samples shall not be manufactured, delivered to the Site or incorporated into the Work without Employer/ Employer's Representative and Consultant/PMC review.

Each sample shall bear a label showing Contractor's name, Work name, Contract number, name of the item, manufacturer's name, brand name, model number, supplier's name, and reference to the appropriate drawing number, technical specification section and paragraph number, all as applicable.

Samples, which have been reviewed, may at Employer's option, are returned to Contractor for incorporation into the Work.

1.2.1.7 MOCK-UP

As deemed necessary by the Employer/Employer's Representative/PMC/Architect, Contractor shall execute necessary mock-ups of all items/activities related to the Work performed required under this Contract as indicated below and the cost for the same shall be deemed to be included in the Contract price.

THE FOLLOWING MOCK-UPS SHALL BE EXECUTED BY THE CONTRACTOR:

Item	Extent / Size
1. Facade / Glazing systems	Height - One floor Width - 03 modules [including one operable module, if any]
2. GRC Pilaster, bracket, cornice, moulding.	-
3. Paint, brick jali including window glazing, aluminium louvers, flashings, and interface details	6.0 x 6.0 M
4. All finishing items including but not limited to toilets, flooring, wall cladding, doors & windows, false ceiling, etc.	Toilets - 01 module including all fittings, fixtures and modular partitions Hard & soft finishes - approx 50 sqft, including all typical interfaces and details.
5. Railings and other metal fabrication works (SS and cement)	Min 2.0 RM including all types of details [turns, bends, ends, etc]

1.2.1.8 Documents at Site

The contractor shall maintain in a conspicuous place on the site a copy of development permission and a copy of approved drawings and specifications.

1.2.1.9 AS-BUILT DRAWINGS.

Progress As-Built / GFC drawings

During construction, Contractor shall keep a marked-up-to-date set of progress as-built / GFC drawings and specifications on the Site as an accurate record of all deviations between Work as shown and Work as installed. These drawings and specifications shall be available to Employer for inspection at any time during regular business hours.

Final As-Built.

- A. Contractor shall at his expense and not later than thirty (30) calendar days from Taking over Certificates and before Final Payment furnish to Employer a complete set of marked-up as-built reproducible drawings and specifications with "AS-BUILT" clearly printed on each sheet and on the specification cover.
- B. Contractor shall accurately and neatly transfer all deviations from progress as-built to final as built drawings and all annotations from progress as-built to final as-built specifications.

- C. Contractor will provide four (4) copies of the as-built drawings of which one (1) is in fully editable electronic format in a form acceptable to the Employer. Employer shall provide editable electronic copy of the requisite drawings such as floor plans, to facilitate preparation of electronic as-built-drawing.

Endorsement.

- A. Contractor shall sign each final as-built drawing and the cover of the as-built specifications and shall note thereon that the recording of deviations and annotations is complete and accurate.

1.2.1.10 Specifications

The specifications forming part of this Contract have been drawn up with all possible care and are intended to cover the supply of all the materials, tools, plants and equipment, labour and the execution of all works necessary to complete the entire Work in all respects under this Contract. In case there are any details of construction or materials which have not been referred to in the specifications, detailed descriptions of items, schedule quantities, or the drawings but which are usual or essential in the true completion of the purpose of the Work, the same shall be deemed to have been included in the price quoted by the contractor. Wherever specifications are not stipulated, the Work shall be as per latest ISI specifications and/or directed by the Employer/ Employer's Representative and Consultant/RSCL following good Engineering practice.

1.2.2 Civil

DESIGN AND DRAWINGS

- Geotechnical investigation: The contractor shall carryout the geotechnical investigation as per relevant IS codes and submit the report to client.
- Contractor shall carryout the structural analysis and design of the building. The scope includes getting it approved from reputed institute such IIT/NIT. After getting approved from IIT/NIT, the same shall be submitted to RSCL for their review and approval.
- Contractor shall prepare all GFC drawing, barbending schedule etc and submit for approval.

SUBSTRUCTURE CONSTRUCTION

- The contractor shall be responsible for cleaning of debris at site and surface preparation as per Architectural and Structural construction dwgs.
- In case of dewatering at site. contractor shall be responsible for all pump arrangements and to channelize that pumped out water.
- Contractor shall be responsible for demolition for existing structure like chamber, toe wall etc .as per direction of Engineer in charge.
- The contractor shall be responsible for making access to the work areas and shall keep the project site unobstructed and clear so to minimize any sort of hinderance to the work of others.

- The contractor shall be responsible for preparation of temporary access roads, (if required), suitable for plying heavy machineries like boring rigs, dumpers, etc
- The contractor shall be responsible for Shifting of existing temporary structures to near by proposed location as per provided layout in direction of Engineer-in-charge.
- Excavation for Substructure with adoption of appropriate Shoring methodology.
- During Deep underground Excavation contractor shall be responsible for shoring arrangement. Sheet piling with appropriate size and shape shall be provided if required.
- The Contractor shall develop all the desire surface which shall include all subbase works, PCC works, finishing and other allied works with appropriate material as per approved structural drawings.
- The contractor shall be responsible for construction of foundation arrangement like Isolated, strip, raft, plumbing works and all allied works for trenches as per Master Plan/ architectural and structural drawings.
- The contractor shall submit the program for Quality Assurance and Quality Control to the Engineer-in-Charge for approval, that will be adopted for the work the Prior to mobilization, for enabling enforcement of QA-QC program.
- The Contractor shall submit the calibration certificates of all the equipment that will be used in the project work.
- The contractor shall supply and install directional signage, Cautionary, Regulatory and Informatory Sign Boards, street name signs & re-setting of such existing signs & other road signs to be retained, inclusive of support & foundation as per Employers Requirement
- The Contractor shall undertake all necessary surveys, investigation and laboratory tests like Field Dry Density, Optimum Moisture Content.
- The Contractor shall undertake all necessary construction material lab tests like concrete, Reinforcement, Sand, cement, aggregate, structural steel, aggregates etc.
- The contractor shall be responsible for doing backfilling with well compacted earth with good quality soil which must compliance to relevant IS code in direction of Engineer in charge.

SUPERSTRUCTURE CONSTRUCTION

- Complete building shall comprise of various elements. The Construction of building shall be done as per the drawings and specification provided.
- The Construction works shall include all the structural works like Trenches rcc wall, columns, beams, slab, walls, staircase, and other allied work. The Contractor shall make sure that the correct grading on concrete is used for different items.
- The Work shall include all the interior finishes like plaster, painting, tile works, etc. as per schedule of finishes and specifications provided.
- Before Construction Contractor shall coordinate with MEP Contractors to plan the construction sequence.

CONSTRUCTION OF PATHWAYS

The contractor shall construct subbase work for pathways, natural trails etc as per layout and structural drawings.

CONSTRUCTION OF STEPS AND RAMP

The contractor shall construct steps and ramps at various with necessary foundation with toe wall arrangement as per structural drawings.

CONSTRUCTION OF STORM WATER DRAIN

The contractor shall construct storm water drain and its outfall arrangement for all zones as per layout and as per structural drawings.

APPLICATION OF WATER PROOFING

The Contractor shall be responsible for the waterproofing design, proper installation and performance of waterproofing systems to make the sub grade and superstructure completely watertight. The Contractor shall engage a qualified waterproofing specialist sub-contractor, preferably manufacturer authorized applicator to install the waterproofing system, all in accordance with the manufacturer's recommendations & approved water proofing details. .

Grade slab structures in contact with earth or water (including foundations, footings, water tanks, pumping station, all sunken pits, trenches, etc.) shall be protected by a waterproofing system on all exposed surfaces, of the type complying with Clause. Retaining walls forming part of an enclosed usable space and in contact with earth and / or water shall similarly be waterproofed by an approved membrane system.

1.2.3 ELECTRICAL

The scope consists of design, engineering and manufacturing; testing at Manufacturer's works, packing, forwarding and delivery to site; unloading and handling at site (shifting from unloading point to the storage area, storage and shifting from the place of storage to the place of installation), assembly, erection, cleaning & touch up painting; testing & commissioning at site for Electrical system of Banquet Hall under the Rourkela Smart City Limited:

List of Major Equipment and system;

- Metering equipment as per OERC Net Metering / CERC regulation.
- 11/0.433 kV 11/0.433kV 500kVA Oil type Transformer. It shall be Outdoor type.
- 415V, 500kVA DG Set with AMF Panel. It shall be in outdoor.
- 3 Phase, 415 Volts, 50 Hz Main LT panel
- 3 Phase, 415 Volts, 50 Hz, 120KVAR Automatic Power Factor Control (APFC) Panel
- Building Panel, External Lighting Panel for Façade & Outdoor Lighting, Common Area DB, Toilet DB & UPS DB for power supply distribution.
- 3 Phase 10KVA UPS for 30% Indoor lighting & 100% outdoor lighting.
- HT and LT cables and associated cables laying and interconnection system
- Cable Tray with accessories
- Earthing and Lightning Protection System
- DWC HDPE pipes for underground MV & LV cable laying.

- LED based Indoor Illumination System for buildings. Lighting and Receptacle system controlled by lighting panels and raw power panels installed in respective areas.
- Point wiring system for Lighting, Raw power.
- Necessary fencing and gate arrangement for 11 kV Substation and Panel Yard & MS supporting structures for cable trench, cable laying, lighting fixture etc.
- All Outdoor Lighting Luminaires and its associated wiring / cabling; and receptacle system with accessories.
- Other necessary works requisite for completion of work such as embedment, chipping, punching, making holes, openings in walls, pipe sleeves, fire/ waterproof sealing, concealed conduiting etc.
- Miscellaneous statutory equipment as per requirement.

Measurement of soil resistivity at site by Wenner's four electrode method as per IS: 3043 and its latest amendments, at minimum two (2) locations per plot. The measurements shall be carried in the presence of the PURCHASER and the results/ report shall be certified by Govt Authorized Laboratories or agencies.

All mounting, foundation supports and hardware accessories for the electrical equipment/ system installations.

All civil works associated with equipment/system electrical installations like embedment, chipping, punching, making holes, openings in walls, pipe sleeves, fire/ water proof sealing, concealed conduiting etc.

Equipment furnished shall be complete in every respect with all mountings, fittings, fixtures, and standard accessories normally provided with such equipment and / or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the DPR unless included in the list of exclusions.

Take necessary statutory approvals for the electrical systems installed. The bidder shall take necessary steps for getting new connection from DISCOM.

CONTRACTOR shall ensure that design of equipment shall be as per specification requirements.

CONTRACTOR shall submit Quality Assurance Plan within 15 days after finalization of order. The QAP shall be discussed between RSCL and the CONTRACTOR before the QAP is finalized.

The CONTRACTOR shall carry out detailed engineering including schematic lighting solution and prepare construction purpose drawings to make its own estimate of ratings & quantities in accordance with the design criteria provided in the technical specification and data sheets, for entire system including illumination system, electrical equipment, cabling system, earthing, and civil works required for completion of works.

The above drawings with plans, elevations, sections or any details (as required) shall be submitted to RSCL or its representative for approval.

3D rendered views of the proposed illumination plans shall be provided for approval for the entire project before supply and execution of the same.

Light fixtures selected by the CONTRACTOR shall be submitted to RSCL for approval.

The CONTRACTOR shall submit detailed electrical load calculation, sizing calculation of electrical equipment and explanation on how the fixtures identified are energy efficient before supply and execution of work.

CONTRACTOR shall take due care of the site Seismic conditions while designing all equipment/ components used in lighting and electrical systems covered in this specification. CONTRACTOR shall furnish list of design parameters considered in design to fulfill the above requirement.

Design and detailed engineering of the materials procured by CONTRACTOR is included in scope. CONTRACTOR shall submit each document/ calculations of system which is included in scope to RSCL or its representative for final review/ approval. All design documents/ calculations prepared by CONTRACTOR shall be duly signed by CONTRACTOR and stamped. Documents submitted without fulfillment of this requirement will not be considered as a submission and will be rejected.

Design documents/ calculations prepared by Sub-CONTRACTOR shall be approved by CONTRACTOR and stamped copy of approval along with no-deviation sheet from Sub-CONTRACTOR shall be submitted by the CONTRACTOR to RSCL or its representative for final review/ approval. Documents submitted without fulfillment of this requirement will not be considered as a submission and will be rejected.

Expert or manufacturer supervision for Sub-CONTRACTOR supplied material shall be provided by BIDDER and included in offer.

CONTRACTOR shall be solely responsible for any shortages or damages in transit for his supply scope, handling and/ or in storage of any materials and erection of the equipment, supply of erection tools at site. CONTRACTOR shall ensure that it will not affect any activity or project schedule. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc. shall be to the account of the CONTRACTOR.

Obtaining approval including load sanction/ load release from TPWODL shall be in the scope of CONTRACTOR. All the statutory fees for the above approvals shall be borne by RSCL. Such payments shall be reimbursed to the CONTRACTOR upon submission of stamped receipts to the RSCL. The approvals will include consent for commencement of work and obtaining permission to charge/commission.

All the cost towards liaison with statutory Bodies for seeking all necessary statutory approvals and other activities involving Govt. Agencies viz., drawing approval, testing and commissioning et. shall be borne by the CONTRACTOR.

The CONTRACTOR shall also liaison with Govt. Bodies if required like TPWODL, PWD, CEIG, RMC etc. for obtaining required permission to work.

CONTRACTOR's scope shall also include all civil works and structural works required for installation of all electrical equipment/ systems such as equipment foundations, Pole foundations and all excavation and backfilling works including those for lighting, earthing, cabling systems etc.

BIDDER should visit site and get ascertained regarding the complete scope of work before submission of Bid.

This specification is the minimum requirement and should be read in conjunction with relevant latest specifications, requirements, rules and regulations of the Local Authority. Any additional requirements as per Local Authority or latest Standards shall be considered by BIDDER

All SAFETY considerations in design and manufacturing for safe operation & maintenance and safe practices during installation at site shall be in the scope of the CONTRACTOR. Cost towards accomplishing the same shall be included in the BID price and no extra claim shall be entertained later.

Equipment furnished/ supplied under this scope of works shall be complete in every respect with all mountings, fittings, fixtures, and standard accessories normally provided with such equipment and / or needed for erection, completion and safe operation of the equipment as required by applicable codes though they may not have been specifically detailed in the Technical Specification. Materials and component not

specifically stated in the specification but which are necessary for commissioning and satisfactory operation shall be deemed to be included in the scope of specification and shall be supplied without any extra cost. All similar standard components/ parts of similar standard equipment provided shall be inter-changeable with one another.

The CONTRACTOR shall be responsible for the selection and design of appropriate equipment to provide the best co-ordinated performance of the entire system. The design of various components, sub-assemblies and assemblies shall be so done that it facilitates easy field assembly and maintenance.

The material supplied by the CONTRACTOR shall be subject to approval of the designated Authorities of RSCL. Samples of the Supply material under the scope of works shall be inspected by RSCL or their representatives either at site or at Manufacturer's works and approve them for supply and execution. Notwithstanding any approval/ instruction given otherwise, if the RSCL, during random check up, finds any nonconformance with the quality of material supplied by the CONTRACTOR with respect to the technical specifications, RSCL shall have the Authority to reject the entire lot/ batch of that particular material and ask to replace without any cost and time impact to RSCL.

During the construction at site, it shall be the CONTRACTOR's responsibility to take care of the safety and security of its person and material at site. The CONTRACTOR shall be self-reliant with all the requirements including tools and tackles for digging, filling, erecting, lifting, etc. and consumables required for construction like electricity and water at his own cost.

The CONTRACTOR shall carryout the installations in a safe and responsible manner without any inconvenience or danger to public. The CONTRACTOR shall take care not to damage any public/ private property by mistake or by intention during the course of work with its actions and shall be well insured to compensate the owner in case any such incidence happens.

CONTRACTOR shall plan and carry out all supply, installation, testing and commissioning of the entire electrical system conforming to the approved drawing, technical specification and good engineering practices.

Even if all components of a system included in this specification are not explicitly identified and/ or listed herein, these shall be supplied under this contract to ensure completeness of the system and facilitate proper operation and easy maintenance. Any and all other works not indicated above but necessary/ required to complete the job in all aspects, are included in the CONTRACTOR's scope.

RSCL reserves the right to issue addendum to the technical specification to indicate modification/ changes in the requirements, if so required at a later date.

1.1 General

The proposed Electrical Power Distribution and Lighting System for Banquet Hall shall be designed to provide:

- Electrical supply to equipment and machinery within the design operating limits.
- Safety to Personnel and equipment during both operation and maintenance.
- Reliability & Continuity of Service.
- Minimal fire risk with fail safe feature.
- Ease & flexibility of maintenance and operation.
- Adequate provision for future expansion and modification.
- Maximum inter-changeability of equipment.
- Suitability for applicable environmental factors.

- Service Condition

All the components of the electrical system shall be sized to suit the maximum load under the most severe operating conditions. Accordingly, the maximum simultaneous consumption of power, required by continuously operating loads shall be considered and an additional margin shall be taken into account for intermittent service loads, if any. The amount of electrical power consumed by each area shall be calculated for its operation at the design capacity.

The equipment shall be designed and manufactured in accordance with the best engineering practices and shall be suitable for the intended purpose.

1.2 Applicable Codes and Standards

The design, material, construction, manufacture, inspection, installation, testing and performance of electrical equipment & systems should conform to the latest applicable Central Electrical Authority (CEA) guidelines, all currently applicable IS, IEC and IEEE standards, Central PWD (CPWD) Specifications, National Building Code, National and International codes of practice, statutes, regulations and safety codes in the locality where the equipment or system will be installed.

1.3 System Design Parameter

The electrical system shall be designed as per relevant standards and local regulations with the stringent of the two regulations being the governing parameter.

Following System Parameter shall be adopted for designing the electrical system:

Nominal (Rated) System Voltage	11kV	0.415kV
Highest System Voltage	12kV	1.1kV
Lightning Impulse Withstand Voltage (1.2/ 50 microsecond)	75 kVp	-
Power Frequency Withstand Voltage for 1 minute	28 kV rms	3 kV rms
System Neutral Earthing	Solidly Earthed	Solidly Earthed
Fault Level of System	21kA for 3sec.	Bidder to calculate
Frequency	50 Hz	50 Hz
Dynamic Short Circuit Current Rating	52.5 kA peak	As calculated

1.4 Service Condition:

- Design Ambient Temperature – 45 °C.
- Relative Humidity – 10 - 90%

1.5 System Design Criteria

The system shall be designed taking in to consideration the following system variation:

- Voltage: +10% to -10%

- Frequency: +3% to -3%
- Combined absolute voltage and frequency variation: +10% to -10%

The load distribution should be such that the load unbalances does not exceed 5% at the point of commencement of supply.

The system power factor shall be at least greater than 0.99.

In normal operating condition, cumulative voltage drop from Main LT Panel to the last equipment in the topmost floor shall not exceed 5% (measured at load end).

Voltage dip at the Motor terminals during motor starting of the highest rating motor with regular base load shall not exceed 15%.

Fault level for HT shall be considered as 21kA for 3 sec or actual calculated during detailed design stage by the Contractor, the stringent being applicable.

The fault level for LT system at transformer terminal shall be calculated based on the transformer rating and its impedance as per relevant IS 2026. The transformer losses shall be limited as per ECBC. However, minimum short circuit rating of switchgear and cable withstanding capacity shall be considered as 36kA for 1 sec for MCCB, 50kA for 1 sec for ACB switchgear and as per SLD for Busbar or actual calculation.

For Lighting, Air conditioning and other Miscellaneous Power outlets following shall be the parameters to be considered:

Nominal Voltage	240V
Phases	1
Frequency	50Hz
Connection	3 wires (Phase, Neutral & Earth)

1.6 Estimation of Load / Maximum Demand

The following factors shall be considered while arriving at the load demand:

- Load Factor

Motors (Fire Hydrant system)	:	0.1
Auxiliary load (Elevator, Crane/ Hoist, etc.)	:	0.5
Lighting load	:	1.0
Miscellaneous Power loads	:	0.7
Watering Pump	:	0.9
Ventilation System	:	0.9
Power factor of Motors	:	As per the Manufacture's Data sheets
Efficiency of IE2 motors	:	As per the Manufacturer's Data sheets
- Overall Diversity for final Demand calculation shall be considered as 1.1.

- A design margin of 10% shall be considered.
- The improved factor shall be considered as 0.99.

Considering the above assumptions, the load requirement for Banquet Hall has been estimated as 337 kVA.

1.7 Electrical Power Supply

The Orissa Electricity Regulatory Commission Distribution (Conditions of Supply) Code, 2004 provides for the following supply voltage connection based on contract demand:

Sr. No.	Contract Demand (kVA)	Supply Voltage
1	Not exceeding 5.55kVA	1ph, 2wire, 230V
2	Above 5.55kVA upto and including 70kVA	2ph, 3wire or 3ph, 3 or 4 wire, 400V (L-L)
3	Above 70kVA but below 555kVA	3ph, 3wire, 11000V (L-L)
4	555kVA and above but below 1110kVA	3ph, 3wire, 11000V (L-L) or 33000V (L-L)

Since the load requirement of Banquet Hall is 337 kVA, as per OERC regulation, the supply shall be provided at Medium Voltage (3ph, 3 wire, 11kV) level.

Power requirements to meet the demand of Banquet Hall shall be tapped & arrange by contractor from the nearby overhead 11kV line or substation.

The power within the Banquet Hall shall be stepped down to 0.433 kV by 1 no. of 11/0.433kV Oil type transformer.

The power from Secondary end of transformer shall be supplied to Main LT Panel by LT Cable.

Further the power from Main LT Panel shall be distributed to Building Panel, External Lighting Panel and Common & Toilet DB etc. To ensure the maintenance of power factor greater than 0.99 automatic power factor correction using APP type capacitors shall be provided at the Main LT Panel level.

For all the mechanical loads like plumbing, ventilation and firefighting system only a power feeder has been provisioned. All the details will be provided in their respective chapter.

The tariff meters shall be installed as per OERC or CERC guidelines amended as on date. The Bidder shall take necessary approval from DISCOM after installation of the meters.

1.8 Oil Type Transformer

Sub-Station shall comprise 1 No of 11/0.433 **500kVA** Oil type distribution transformer.

As per CEA regulations, if the length of cable exceeds 15m from point of supply to the consumer breaker then a point of supply isolator shall be provisioned. Depending on the distance from nearest HT pole / RMU to metering room & metering room to Transformer, the HT breaker provision needs to be checked at the time of detailed engineering by contractor. If the distance exceeds 15m, there shall be a need for breaker protection / isolation mechanism. Since it is proposed to have the Transformer located close to the metering room, provision of a HT breaker at Transformer shall suffice for the isolation at point of supply requirement.

The 11/0.433kV transformer shall be Oil type with Off-circuit tap changer (OLTC) with tap changing ranging from +5% to -10% in steps 2.5% complying with IS 2026, ECBC and other relevant standards as amended till date.

The transformer shall be sized taking into the following consideration:

- Connected loads
- Load factor, Diversity factor as indicated above
- 10% contingency factor over cumulative maximum demand
- 80% loading on the transformer
- Voltage dips at the largest motor terminal during its starting on base load condition shall be less than 15% taking into consideration motor starting method.
- Power factor improvement to 0.99
- No HVAC motors have been considered for largest motor starting. In case any HVAC motor is not VFD or DOL or Star-Delta started, the same shall be considered.

Considering the above factors, the adequate size of transformer has been estimated as 500kVA, 11/0.433kV Oil type transformer with 4% as transformer impedance.

1.9 Emergency Power Supply – Diesel Generator (DG) Set

The capacity of the DG shall be calculated based on the total simultaneous maximum demand of all the loads (calculated based on the load factors, efficiency and diversity indicated above). A contingency factor of 10% over the cumulative maximum demand (MD) shall be considered. The size of the selected DG set shall be calculated such that the maximum loading shall not exceed 80% at 0.8 PF.

The adequacy of DG sizing shall also be checked on the basis of voltage dip at the motor terminal during the starting of the largest motor considering base loading condition, i.e., all other loads except the highest rated motor. The voltage dip at motor terminal shall not exceed 15% taking into consideration the use of appropriate starter.

The step loading of the engine of the DG shall not exceed 40% of the maximum load catering capacity, i.e., 80% of rated capacity.

The DG set shall have acoustic enclosure ensuring the noise level shall be 75dB (A) at 1m from enclosure, as per relevant state pollution control board regulation. The enclosure shall provide IP55 protection to the DG set.

100% emergency backup shall be provided for Banquet Hall with **1No. of same rating LT DG set** with AMF Panel.

DG Exhaust Height calculation

As per NBC standard, for DG set up to 1000kVA, the height of exhaust stack shall be

calculated based on the below mentioned formula:

$$H = h + 0.2 \times \sqrt{\text{(kVA rating of DG set)}}$$

where,

H= Height of exhaust stack.

h= Height of nearby building.

1.10 Fault Level

Fault level at transformer secondary and at 415V LT panels shall be calculated based on the transformer rating and impedances of transformer and cables.

1.11 Power Factor Improvement

The required capacitor rating shall be calculated based on the system power factor requirement of achieving 0.99 power factor, i.e., 0.80 or actual (whichever is lesser) to be corrected for 0.99.

APFC Panel shall be selected considering following design criteria:

- Optimum no of steps to ensure proper regulation with minimum two (2) nos. of spare steps subject to a maximum of 12 steps
- Minimum steps of 5 kVAR and 10 kVAR bank in adequate nos. for fine regulation of power factor at low loads shall be considered. Balance capacity can be considered with 25 kVAR, capacitor bank.
- Capacitor banks shall be All Poly Propylene (APP), double layer type.
- 6% of the capacity shall be provided separately at the Main LT Panel for no load compensation of transformer.

Considering the above condition, the APFC requirement has been estimated to be 120kVAr.

1.12 LT Panels

All Panels shall be indoor / outdoor type having incoming sectionalisation and outgoing switchgears as specified. The design shall be cubical type. The degree of enclosure protection shall be IP 52 for indoor and IP55 for outdoor as per IS: 13947 (Part-I). All LT Panels except for Main LT Panel shall conform to FORM 3B whereas Main LT Panel shall conform to FORM 4B as per IS 61439. The LT Panels shall be as per the standards IEC 61439.

Main LT Panel shall be of internal arc type tested with Internal Arc withstands level at rated fault level or 50kA, higher value, for 0.3s.

1.12.1 Busbar

All panels shall be provided with Aluminum busbar. Distribution boards with incomers below and including 63A shall be provided with tinned copper bus bars.

The bus-bars shall be sized considering the following criteria:

- Sleeves made of insulating material on all bus bars.
- Design ambient temperature 45°C.
- Final temperature of the bus-bars complying with requirements of relevant standards.
- Bus bars being inside the panel; De- ration for enclosure and ventilation.
- Bus bar suitability for carrying rated current continuously. The current density (A/mm²) of the bus bar shall not exceed 0.8 for Aluminium bus and 1.2 for Copper bus.
- Configuration of bus bars and Proximity effect.
- The main bus shall be designed based on the load rating as well as the actual fault level for specified duration at the location of the panel with 10% positive tolerance.
- Earth bus of the panel shall be sized suitable for the above fault level for the same duration.

1.12.2 Switchgear Sizing/ Selection:

Switchgear shall be sized/ selected considering the following:

- Rating suitable for carrying full load current of the equipment / feeder.
- Suitability for Short Circuit Rating for specified duration.

- Switchgear for motors shall be suitable for motor duty application with Type 2 co-ordination.
- In panel de-rating of minimum 20% or as provided in Manufacturer's catalogue, whichever is higher shall be considered.
- Switchgear rating for individual capacitor bank shall be sized at 1.5 times the rated current rating.
- ACBs shall be considered for switchgear ratings above 630A and MCCB shall be considered up to 630A. All ACBs and MCCBs shall be rated for Bus fault level with $I_{cs}=I_{cu}=I_{cw}=100\%$ for ACB and $I_{cs}=I_{cu}=100\%$ for MCCBs.
- Miniature Circuit Breaker (MCB) shall be considered where fault level is below 10kA.
- All panels shall be provided with Microprocessor based overload (O/L), Short circuit (SC) and Earth fault (E/F) release at the panel incomer and outgoing.
- Surge Protection Device (SPD) shall be provided at incoming power panels and sub- distribution boards. SPDs shall be selected to meet the requirements of relevant LPZs. Lifts, escalators and fire panels shall be protected with SPD in control panels. All electrical and control panels related to safety and security of building shall be protected with appropriate SPDs. All SPDs should have status indication to show their healthy state for discharging the lightning current.
- Multi-function meter for measuring current, voltage, power, frequency, active and reactive power, and harmonics shall be provided for all the incomers (Transformer as well as DG), Multi-function meter for measuring current, voltage, power, frequency, active and reactive power for outgoing power / tie feeders. Ammeter shall be provided for other load feeder such as motor feeder, lighting feeder, etc.
- Motor starter selection shall be done as follows:
 - i. Direct On Line (DOL) Starter – For motors rated up to 5.5 kW
 - ii. Star- Delta Starter - For motors rated above 5.5 kW to 45 kW or as per local Electricity board requirements
 - iii. DOL starter shall be provided for the main Fire Pump.
 - iv. DOL starter shall be provided for Jockey pumps.
- Motor feeders shall have the following protection and components:
 - i. Motor Protection Circuit Breakers (MPCBs) with inbuilt thermal overload, air break contactors and single phase preventer for motors up to and including 50 kW rating suitable for type 2 co-ordination.
 - ii. MCCB with separate thermal overload, air break contactors and single phase preventer for motors above 50kW up to and including 100 kW rating suitable for type 2 co-ordination.
 - iii. ACB/MCCB and Composite motor protection relay (a minimum of protections such as over current, short circuit, earth fault, locked rotor, Negative phase sequence, thermal alarm and single phase preventer etc.) for motors above 100kW rating.
 - iv. For fire pump, overload relay shall be provided with a plug setting of 110%.
 - v. Motor feeders less than or equal to 5.5kW shall have direct connected ammeter in y phase and motor >5.5kW will be provided with one CT and ammeter.

- vi. In case the fault level at transformer LT side increases to more than 10kA, cascading of breakers so as to accommodate MCBs in the PMCC shall be adopted. This shall ensure cost saving.

- 20% spare capacity shall be considered on each panel for future.

1.13 Cabling System

HT cables shall be 11kV earthed grade, multi-core, stranded and compacted aluminium conductor, extruded XLPE insulated (dry cured), extruded semi conducting compound screen with a layer of non-magnetic metallic tape screen, extruded PVC inner sheath (Type ST-2), armoured and extruded overall sheath with Fire Retardant Low Smoke (FRLS) PVC compound (Type ST-2). The cables shall conform to IS-7098 Part -II.

LT Cables shall be 1100V earthed grade, single/multi-core, stranded and compacted aluminium conductor, extruded XLPE insulated, extruded PVC inner sheath (Type ST-2), armoured and extruded overall sheath with Fire Retardant Low Smoke (FRLS) PVC compound (Type ST-2). The cables shall conform to IS-7098 Part -I.

Cables up to & including 6 mm² shall be Copper multi-stranded conductor with PVC insulation galvanized steel round wire armoured & cables beyond 6 mm² shall be Aluminium multi-stranded conductor with XLPE insulation & galvanized steel flat strip armoured.

All LT cable shall be conforming to IS 7098 Part I for XLPE cables and IS 1544 – Part I for PVC cables.

All control cables shall be 650 V grade copper conductors FRLS PVC insulated cables conforming to IS 1544- Part I. For cables above 7 cores, minimum two spare cores shall be considered.

The following main aspects shall also be considered while deciding the size of the cables/ wires:

- Supply voltage and frequency.
- Corresponding full load current under site conditions, i.e, necessary de-rating considerations.
- Route length and method of laying of cables.
- Maximum allowable temperature rise under normal full load condition based on the material of cable insulation (XLPE/ PVC).
- Maximum short circuit current duration (fault clearing time) and final temperature of cable during short circuit current flowing through the cable.
- Following shall be the fault clearing time consideration:
 - (i) From HT breaker to Transformer Primary shall be 0.16s.
 - (ii) From transformer secondary to Power Control Centre (Main LT Panel) incomer shall be 1s.
 - (iii) From ACB outgoing of the Main LT Panel shall be considered as 0.16s (for Tie feeders if any it shall be 0.5s).
- Appropriate de-rating factors as per cable manufacturer's catalogue and enlisted below shall be considered for sizing the cable:
 - (i) Ambient Air Temperature (minimum 45°C).
 - (ii) Ambient ground temperature (minimum 40°C to be considered).
 - (iii) Method of cable laying.

- (iv) Depth of cable burial (minimum 750 mm for LT and 900 mm for 11kV HT).
- (v) Thermal Resistivity of Soil (minimum 150°C Cm/ W to be considered).
- (vi) No. of cables in a group
- (vii) No. of cable trays in tier
- (viii) Any other de-rating factors as applicable & as per Manufacturer's catalogue.

Bending radius of 12D and 15D shall be provided for LT & Control Cables and HT cables respectively where D is the outer diameter of the cable.

RCC pipes shall be provided where cables need to cross the roads, drive ways. For HT cables, one cable shall be laid in one pipe section of minimum 150mm internal diameter. LT, control and ICT cables shall be laid in separate pipes.

1.14 Earthing & Lightning Protection system

The earthing system shall comprise of one or more earth electrodes, earthing network, mesh or a combination of these in order to obtain grid resistance of less than 1Ω.

Latest version of following standards and codes shall be referred to for designing the Earthing and Lightning protection system:

a)	IS 3043	Code of practice for Safety Earthing
b)	IS/ IEC 62305	Code of Practice for the protection of buildings and allied structures against lightning.
c)	CEA guidelines 2010	Measures related to safety & electric supply.
d)	IEEE 80-2000-2013	IEEE Guide for Safety in AC Substation
e)	CPWD Specifications - 2013	General Specifications for Electrical Works Part I - Internal

Soil Resistivity: The earthing system shall be designed by considering measured soil resistivity during detailed engineering and the earthing calculation shall be done.

Size of Earthing Conductors: The earthing conductor sizes shall be calculated as per IS 3043.

Following factors will be considered for sizing the earthing conductor:

Design Ambient Temperature	50°C
Allowable temperature rise	500°C
For steel welded joints	1.0 s
Fault clearing time	

Overall earthing resistance of the grid	Less than 1Ω
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The maximum values of earth fault current for the design of the earthing system will be considered based on system requirement as follows:

- 11 kV system : 21kA for 1s
- 415 V system : 50kA for 1s (will be decided as per actual fault level calculation)

1.14.1 Equipment Earthing

GI pipe electrode as specified in IS 3043 or as per local electricity board, CEIG, CPWD requirements, whichever is stringent, shall be provided for the earthing of non-current carrying parts and enclosures of all electrical equipment such as Transformer, LT panels, motors, Lighting Distribution Boards, Outdoor Feeder Panels, cable trays, socket outlets, steel structural supports and high mast etc.

2 nos. dedicated copper plate electrode shall be provided for neutral grounding of the transformer.

A grid earthing network shall be provided, laid buried 600mm deep in the ground at a distance of 1500mm from the building connecting all the dedicated Earth electrodes for all equipment and systems.

Materials used for earth electrodes shall be designed to suit the ground conditions and shall be galvanized.

Earthing network shall also be connected / formed through the cable trays. Double run GI strips shall be laid on the cable tray depending upon whether it will be connected to the earth network ahead. The strips shall be welded to the cable tray at every 10m interval. For multi tier trays, the strip can be laid in one tray and connected to all at 10 M interval. The minimum size of Galvanized Steel Strip shall be 25x6 mm.

Earthing requirements for Conduit wiring for Sub main, circuit and point wiring shall be carried out as per CPWD guidelines.

Earth pits & Earthing conductor shall be laid around the building with a minimum clear distance of 300mm with respect to the other utilities and at least 1500mm from the building plinth.

1.15 Lightning Protection

The need for lightning protection system shall be established by calculating the risk factor value of each building, structure etc. as per methodology/ procedure prescribed in IS/IEC 62305 - 2010. This will be provided for building(s) whose risk factor is exceeding the limiting values. The Risk factor shall be evaluated for Level 3 risk.

Based on the calculation, if found necessary, air termination system comprising of horizontal roof conductors shall be provided. The horizontal mesh shall be provided as per IEC 62305 - 2010 above the roof. The down conductors for this system shall be fixed and run along the outer surface of the building and connected to the earth electrodes.

The function of the air-termination systems of a lightning protection system is to prevent that direct lightning strikes damage the volume to be protected. They must be designed to avoid uncontrolled lightning strikes to the building / structure to be protected. Air-termination systems can consist of the following components and can be combined with each other as required;

- Roof conductor / rods / Meshed conductors / Air termination
- Down conductors
- Earth termination

All connection between the conductors shall be welded/brazed type. Metallic pipe, conduit, structures shall be bonded to lightning protection conductors to prevent the side flashover. But no metallic pipe, conduit, structure shall be used as air termination conductor or down conductor.

Earth pits provided for down comers of lightning protection will be connected with general earth pits through earth strips below ground to reduce the overall earthing resistance of the grid.

Level-2 Lightning Protection System as per IS/IEC- 62305 has been considered for following Building-

- Banquet Hall

1.16 Point Wiring

The internal lighting installation shall be installed using single core of 1.5mm², PVC insulated FRLS copper wires enclosed in non-metallic PVC flexible conduit. The non-metallic PVC flexible conduit shall be of minimum 20mm size. The contractor shall size the required size of conduit considering 70% occupancy by wires. Lighting in external areas shall be installed using multi-core armoured cable of suitable sizes. The wiring shall be using multicore cable such that alternate fixtures are on different phases.

The 6A and 16A outlets installation shall be installed using 2.5mm² and 4mm², PVC insulated FRLS copper wires respectively enclosed in MS conduit. Necessary plug sockets as per requirement and applicable standards shall be provided.

1.17 Illumination System

Latest version of related IS standards, NBC and National Lighting Code (NLC) shall be referred for designing Illumination for different areas.

All lighting design shall be carried out on Dialux latest version or OEM specific software.

All lighting fixtures shall be of LED type.

The basis of design shall be based on the following lighting engineering criteria, as per relevant standards or specified herewith:

- Lighting lux level
- Luminance distribution
- Glare restriction
- Direction of incidence of light and shadow effect
- Color appearance and color rendering of the light source
- Uniformity

1.18 Illumination Level:

The following LED luminaries shall be provided for various areas in order to achieve the average illuminance as per various relevant lighting standards or those indicated below, which ever be stringent:

Sr. No.	AREA	Average Illuminance (Lux)
•	Electrical Room, Shop etc.	300

Sr. No.	AREA	Average Illuminance (Lux)
•	Common areas – Corridor and Lobby, Passage, Toilets, Staircase	100
•	Car Parking	50
•	Landscape including Street lighting	20
•	Kitchen and Food Preparation Area	300-500
•	Banquet & Party Hall	300-500

Following factors shall be considered while arriving at the utilization factor to determine the number of fixtures for each area/buildings:

Maintenance Factor

- Indoor Area Lighting with LED Luminaire :0.8
- Outdoor Area Lighting with LED Luminaire :0.7

Reflection factor for Indoor Lighting to be considered are as follows:

- Ceiling : 0.5
- Walls : 0.3
- Floors : 0.1

However, Reflection factor can be selected based on the Color of the wall and Ceiling as given below:

- White and very light colors :0.7
- Light colors :0.5
- Middle tints : 0.3
- Dark colors : 0.1

Room index at applicable surface reflection factors need to be considered.

The working plane shall be considered at 0.75 m from the floor level.

Uniformity factor shall be considered as per National Lighting code/NBC/IS code.

The power supply for lighting shall be distributed from External Lighting Panel.

1.2.4 AIR CONDITIONING & VENTILATION SYSTEM

SCOPE

This section covers Air-conditioning & Ventilation system proposed for different areas of Banquet Hall at Civil Township, Rourkela. The scope of work covers design, manufacture, supply,

installation, inspection, testing, commissioning and carrying out performance guarantee tests at site for Air-conditioning & Ventilation systems, as per the Specification requirements.

The Bidder shall satisfy himself regarding the equipment capacity required for maintaining the end conditions inside air conditioned and ventilated spaces before submitting their offer. The Bidder shall have to guarantee the end conditions mentioned in following clauses. The location of air conditioning & ventilation equipment, layout of ducting, piping etc. shall be designed by the Bidder and approved by the Consultant / Owner. Bidder to check location of indoor & outdoor units, AHU rooms, adequacy of shafts for refrigerant pipe routing, exhaust of air etc. as per architectural drawings. In case of any observations / modifications required on the same, Bidder to indicate along with their technical offer. Afterwards no changes / modifications will be entertained in the layout.

Any items or parts whether specifically mentioned or not but required for functional completeness of the system, shall be provided by the successful Bidder as a part of the contract.

The scope of work for the entire Air Conditioning & Ventilation (HVAC) system of the Banquet Hall shall comprise of the followings but not limited to:

- Air cooled full inverter VRF type air-conditioning system for the Banquet Hall, Party Halls etc. with R-410a / R407C / Eco friendly refrigerant having Zero Ozone Depletion Potential (ODP) and Low Global Warming Potential (GWP) complete with Indoor Unit with filters; evaporator cooling coil, fan with motor & drive arrangement; power & control components with wiring, Air cooled condensing unit with compressor(s), multi row deep air cooled condenser coil; condenser fan with motor & drive; controls; power & control components with wiring, Stands for Outdoor Condensing Units, Initial charge of refrigerant and oil, Electronic remote control unit, Refrigerant Piping with fittings & insulation, Filter Dryer, Refrigerant Solenoid / Manual Valves, Expansion Valve etc. Outdoor units shall be capable for smooth running at outside ambient temperature of 48°C.
- Wall mounted split AC units for individual rooms at 1st floor complete with electronic expansion valve, drain connections, stainless steel (18G) drain pan with PUF insulation, pre-filter, fan section, DX cooling coil section, wireless remote, inter-connecting refrigerant pipe work along with outdoor units. The units shall be 5-star rated compatible with R410A / R407C / R32/ Eco friendly refrigerant only.
- Ceiling suspended ducted inline cabinet fans for fresh air supply to Party Halls & exhaust system of Common Toilet area complete with mounting arrangement, gravity louvers, ductwork with grilles / diffusers, door mounted intake louvers / grilles, bird screen, cowl etc.

- Propeller type exhaust air fans for exhaust ventilation of small Toilets, Kitchen, Lift m/c rooms etc. of capacities as specified in specification for reference only, complete with fan, electrical motor, mounting accessories, bird screen, cowl etc. along with door mounted / wall mounted air intake louver / grilles, as per layout requirements.
- Air Distribution System comprising of galvanized steel ductwork conforming to IS:655 / SMACNA as applicable & shall have minimum zinc deposition of 180 gm/sq.m or better as per IS:277, Motorised UL listed Fire Dampers, Manual Volume Control Duct Dampers, Grilles, Grille Collar Dampers, Air Transfer Grilles, Jet Diffusers, Diffuser Collar Dampers, Louvers, Non Return Dampers etc. – All complete with fittings, flanges, bracings & supports.
- Condensate Drain Water Piping complete with Supports, Valves, Fittings Insulation and all Related Accessories.
- Thermal Insulation of Supply & Return Air Ducting complete with all accessories and finishes (including Protective Coating on the insulated ducts exposed to atmosphere) as per specifications.
- Acoustic Insulation of Supply & Return Air Ducting complete with all accessories and finishes as per specifications.
- Underdeck insulation of the exposed roofs complete with all accessories.
- Power Cabling / Wiring, Control Cabling / Wiring & Earthing of Various HVAC Equipment / Motors complete with Cables / Wires, Bare GI strips/ wires, cable trays, supports, installation, saddles, cable ties, cable tags, ferrules, cable glands, lugs, nuts/ bolts/ hardware etc.
- Local Electrical Isolators for Outdoor Condensing Units & Other HVAC Equipment.
- For specific electrical requirements, refer separate section of this specification.
- Base Frame with foundation bolts for equipment and vibration isolators, mounting frames for fans, cooling coils, louvers & other HVAC equipment, as required.
- Grouting & Finishing of Foundations.
- Painting of Equipment, supports etc.
- One Set of Special Erection & Maintenance Tools & Tackles.
- Start Up & Essential Spares.
- All accessories required for system completion and required for normal operation of equipment.
- Shop Inspection & Testing.

- Packing, marking and forwarding.
- Completion erection of all equipment covered under this contract.
- Testing and trial run of equipment.
- Pre-commissioning checks and commissioning of all equipment.
- Carrying out field performance testing of equipment at site as per relevant standards, air balancing and demonstrating guaranteed performance parameters and handing over the systems.
- Associated minor civil works including but not limited to making & repairing of openings in brick works, etc. to be executed by the contractor
- HVAC systems to have interface with fire alarm panel to trip the system in case of fire.
- Factory Acceptance Tests (FAT) and Site Acceptance Tests (SAT) including loop checking & commissioning, trial runs of all the above systems to meet the design specifications & functional requirements.
- Operation and comprehensive maintenance including all consumables is included in the scope of work after handing over for a period mentioned elsewhere in the Contract Document

GENERAL NOTES FOR SCOPE OF WORKS

- Engineering Responsibility of the System: The responsibility of system design, manufacturing, erection, working and safety will solely be responsibility of the Contractor for the parameters as mentioned in the tender documents. The Contractor shall study design depicted in these documents thoroughly and point out reservations, if any, at tender stage only.
- Codes and Standards: A reference made to various codes and standards in these Contract document shall imply reference to the latest version of that standard, including such revisions/amendments as may be issued by the relevant Authority during the duration of the contract and the corresponding clause(s) therein shall hold valid in place of those referred to.
- Performance Tests: The contractor shall guarantee the satisfactory functioning of the system to maintain the specified design conditions. The contractor shall also give summer, monsoon and winter performance tests of the system after the same is completed and commissioned. These tests shall be carried out during the first summer, monsoon and winter following the completion and commissioning. Before taking over the installation, the system will be run by the contractor continuously for 72 hours to demonstrate the satisfactory functioning and performance of the system installed.
- Samples: Before undertaking fabrication and/or installation, the contractor shall manufacture, at his own cost, a sample of every type of item. The PMC / Authority will approve these

samples. The contractor shall proceed further only after the above referred approval.

- Noise and Vibration Levels: Noise & vibration level shall be as per specification requirements. Necessary provisions of duct Sound Attenuators and/or acoustic insulation are to be included by the HVAC contractor whether or not forming part of the specifications and/or basis of design. All HVAC equipment shall be provided with proper vibration isolators to ensure vibration free operation.
- The Contractor will be required to submit the detailed shop drawings indicating P & I drawings, Ducting layouts, Foundation details, Dimensional drawings of entire AC & Ventilation system. These detailed shop drawings shall be submitted to PMC / Authority for their comments & approval.

1.2.5 FIRE FIGHTING

1.2.5.1 Scope of Work

The scope of this section consists detail design as per NBC, preparation GFC drawings for execution. of but is not necessarily limited to supply, installation, testing and commissioning of the fire protection system. The philosophy of the system is as follows:

- The System shall be designed as per NBC for Group D assembly building.
- Fire Suppression System shall comprise the Fire Hydrants System, Sprinkler system, Hand Appliances.
- Water from the RCC Fire Water Storage tanks shall be supplied for the Fire Hydrant System (Pressurized) both for the internal landing valves and the hose reels at landings.
- The Hydrant System shall be provided with one electric pump sets and one diesel engine driven pump.
- The starting and stopping of the Jockey pump shall be automatic based on the pressure switches at preset low and high pressure.
- The electric motor driven Pump starts automatically at a preset pressure by means of a pressure switch. As soon as the main electric Pump starts, the Jockey Pump Stops. If for any reason the electric motor driven main Pump does not start at the preset pressure or is unable to maintain the pressure, the diesel engine driven Pump starts at the preset pressure.
- The main Pump, whether electric motor driven or the diesel engine driven shall be stopped only manually.
- Contractor shall ensure Hydro Testing for the complete system.
- The Contractor shall obtain the necessary approval of the drawings and the schemes from the local authority(Fire Noc) as called for.

- The contractor shall design and after approval of employer display near each staircase landing at floor levels, a glass covered framed floor plan clearly showing the locations of all landing valves, hose reels, hand appliances, as well as the DO's and DON'T's for the personnel and the exit direction in case of an emergency. The dimensions of the floor plan, its scale, lettering size, color scheme etc shall be as directed by the Engineer-in-charge.

1.2.5.2 Applicable Codes & Standards

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practice given below as amended up to the date of submission of Tender. All equipment and material being supplied shall meet the requirements of BIS and other relevant standard and codes.

MS Tube upto 150mm	-	IS:1239
MS Tubes above 150mm	-	IS:3589
Malleable Iron Fittings	-	IS:1239 - 1982 (Part-I&II)
Cast Iron Sluice Valves	-	IS: 780 - 1984
Check Valves	-	IS:5312 - 1984
Internal/External Fire Hydrant Valve		IS:5290 - 1993
Rubberized Fabric Lined Hose	-	IS: 636 - 1988
Couplings, Branch Pipe, Nozzles	-	IS: 903 - 1993
First Aid Fire Hose (Rubber)	-	IS:5132 - 1969
First Air Hose Reel Drum	-	IS: 884 - 1985

1.2.5.3 Basic Concept Design

Type of the Building -- Business building .

Categories as per NBC -- Assembly building

Max. Height of Building -- Less than 24 mtr.

The entire firefighting installation shall be compliant with the most stringent codes / standard for the entire premise to ensure the highest safety standard and uniformity of system. Further, before property is opened to work, the firefighting shall be fully operated and tested under simulated conditions to demonstrate compliance with the most stringent standards, codes and guidelines. Following functional system shall be provided; strictly in compliance with the listed reference standards:

a.	Piping System	:	Piping system confirming to IS: 1239, IS: 3589 (for pipe size > 150NB) & IS 10221 M.S /GI. Heavy Class for Hydrant system (Pipe material to be verify with Fire NOC)
b.	Fire water static Storage	:	Fire water static storage has been provided in accordance to NBC requirement.
c.	Fire Pumping system	:	Pumping system comprising of independent pumps for hydrant system & jockey application has been provided.
d.	Hydrant system	:	External & internal hydrant complete with hose reel.
e.	Hand held fire Extinguishers	:	Strategically placed at designated areas.

1.2.6 PLUMBING, WATER SUPPLY & SEWERAGE

1.1.1. Scope

This section covers design and execution of internal & external water supply works for all utility buildings, landscaping irrigation, sanitary installations, etc. The brief items of works included are;

- The system shall be designed as per NBC
- External Water Supply System includes Underground tank, Tube wells, pumping machineries, electrical works, rising main, distribution system etc.
- Internal plumbing
- Sanitary fixtures and accessories.
- Soil, Waste, and vent pipe system.
- Rainwater piping system for terrace floor.

- g) Landscape irrigation

1.1.2. Design Objectives

1. Minimize water consumption and maximize the water efficiency within Buildings, to reduce the burden on Municipal water supply and wastewater supply.
2. Maintaining self-cleaning and no scouring velocities in the sewer lines and maintains other important parameters as per reference codes and standards.
3. Establish piping network designs to ensure that adequate pressure available at all the user points.

1.1.3. List of Indian Standard

All services being planned generally in conformity with the requirement/recommendation contained in the following Indian standards (BIS)

- a) National Building Code - 2016
 - b) SP: 35: Hand Book on Water Supply & Drainage
 - c) UPC – Uniform Plumbing Code
 - d) CPHEEO – Manual on Water Supply and Treatment
 - e) CPHEEO – Manual on Sewer and Sewage Treatment
- IS 1172: 1993 – Code of basic requirements for water supply, drainage and sanitation.

1.3 SURVEY AND INVESTIGATIONS:

All the necessary surveys and investigations such as Geotechnical investigations, topographical survey, etc. need to be carried out by the contractor as per the project requirement under the concurrence of Engineer in charge.

1.4 SAFETY

- Contractor has to take care of all safety measures as per Owner / Engineer-in-charge's HSE requirements.
- Proper management of loose earth, mud, water, oily material is to be ensured to avoid making the area messy and slippery.
- Working area needs to be properly cordoned off and proper care is to be taken so that surrounding equipment, instruments etc. are not damaged during the construction.

- An experienced safety engineer shall be deployed to site to ensure that the construction work is carried out in a safest manner and shall work in coordination with Owner / Engineer-in-charge's safety Engineer.

Following codes shall be followed as applicable as per direction of engineer.

CONSTRUCTION SAFETY	IS 3696 (Part 1):1987 Reaffirmed 2017	Safety code of scaffolds and ladders: Part 1 Scaffolds(first revision)
CONSTRUCTION SAFETY	IS 3696 (Part 2):1991 Reaffirmed 2017	Safety code of scaffolds and ladders: Part 2 Ladders(first revision)
CONSTRUCTION SAFETY	IS 7969:1975 Reaffirmed 2017	Safety code for handling and storage of building materials.
CONSTRUCTION SAFETY	IS 8989:1978 Reaffirmed 2015	Safety code for erection of concrete framed structures.

1.5 CO OPERATIONS WITH OTHER CONTRACTORS:

The contractor shall provide all facilities and give complete co-operation for the execution of various other works, if required to be carried out simultaneously by other agencies, while his own work is in progress. Other contractors are also likely to work in the same area during the construction stage.

1.6 PREAMBLE TO BILL OF QUANTITIES:

- The Bill of Quantities shall be read in conjunction with the Instructions to Bidders, Conditions of Contract, Technical Specifications, and Drawings.
- The quantities given in the Bill of Quantities are estimated and provisional, which may be varied, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.
- General directions and descriptions of work and materials are not necessarily repeated or summarized in the bill of Quantities. The contractor shall refer to the relevant sections of the contract documentation before entering rates or prices against each item in the Bill of Quantities.
- The method of measurement of completed work for payment shall be in accordance with the Particular Specifications, guidelines issued by Bureau of Indian Standards as per order of precedence and also as per the method mentioned in the contract and standard specification.
- The amount provisioned in BOQ for design and drawing will be as below:

- After completion of survey and soil investigation-4%
- Approval of Architectural drawing (Plan, elevation, section, blowup details) - 20%
- After approval of GRC drawings-5%
- After approval of RCC/civil structure drawings-30%
- Approval electrical drawings- 7%
- Approval of Fire fighting drawings – 7%
- Approval of Plumbing drawings- 5%
- Approval of HVAC drawings – 7%
- After approval of Landscape and Hard Scape Plan-5%
- At submission of as built drawing-10%

(f) Unless stated otherwise, all rates and prices entered in the Bills of Quantities shall be deemed to include the following:

- Labour and all costs in the connection with the execution and maintenance of the work.
- The supply of materials, goods, storage and all costs in connection therewith including wastages, shrinkage and delivery to site.
- Sampling and testing materials and goods, checking workmanship, providing, storing, packing and transporting samples to and from the place of testing.
- Fixing, erecting, installing or placing of material and goods and excavated materials, including stacking, storing, loading, transporting and unloading.
- All Temporary works.
- Construction, maintenance of temporary access roads within the sites and any roads required for the access to any part of the site for the purpose of carrying out the Works , taking into account that the access roads under the Contractor's maintenance control will also be used by the Employer and his staff vehicles.
- Construction , maintenance and removal , if required , of temporary Sites drainage on the Site and for ensuring that all drains are kept clear of debris and blockages at all times.
- Survey, Investigation, design and drawings.
- All general obligations, liabilities and risks involved in the execution and maintenance of the works set forth or reasonably implied in the documents on which the Bid is based.
- Establishment charges, overheads and profits.
- Co-operating with other Contactors.

The price for transportation included in any of the items in the Bills of Quantities are to include for all labour and equipment required for unpacking , loading , conveying , unloading , storing and multiple handling of all and every item to be transported.

B. TECHNICAL SPECIFICATION

The works shall be performed conforming to the Indian Standard codes, specifications as per P.W.D, PHED, OERC, NBC, etc as applicable. Wherever such specifications are not available, CPWD specifications, relevant references, manuals etc. shall be followed as directed by Employer.

ARCHITECTURE

1. ITEM OF WORK

1. Concrete shall be with conformity to I.S.456.
2. Foundation shall be with conformity to I.S.1080.
3. C.R. Masonry shall be with conformity to I.S.1597.
5. Brick masonry shall be with conformity to I.S.2212.
6. Cement plastering shall be with conformity to I.S.9103 & 6925.
7. Mortar shall be with conformity to I.S.2250
8. White and colour washing shall be with conformity to I.S.6278.
9. CC in foundation shall be with conformity to I.S.2571.
10. Anti-Termite Treatment shall be with conformity to I.S.6313. (Part I & Part II)
11. Painting to all surfaces shall be with conformity to I.S.2395 (Part I & Part II)
12. DPC shall be with conformity to I.S.3067
13. Tar felt treatment shall be with conformity to I.S.1346
14. Steel painting shall be with conformity to I.S.1477 (Part I & Part II) I.S.1661

2. BRIEF SPECIFICATION OF ITEMS USED

It is the intent of these specifications to establish acceptable standards of quality and to provide the Contractor with complete and detailed information and subsequent instructions necessary to enable him to submit a well planned Tender, to carry out the design, where and when required, and to execute properly the work prescribed. This specification covers the general requirements for civil and architectural works comprising of masonry, flooring, skirting, dado, plastering for wall and ceilings, painting, doors, windows, ventilators, Builders hardware, ironmongery, Glass and glazing, Partition works, False ceiling works, toilet cubicles, sanitary fixtures and fittings, waterproofing, Metal sheet cladding, grills and railing works.

Standards and Codes

- i. The Contractor shall follow the Indian Codes and specifications for his work.
- ii. All standards and codes employed or referred to shall be the latest current issue in effect at the date 28 days prior to the Tender submission date.
- iii. In case of discrepancies between these Specifications and national or international standards and codes, these Specifications being only indicative in nature shall not govern, unless otherwise established by the Authority in each particular case.

Termite Treatment:

Providing and injecting chemical emulsion for pre - constructional ant termite treatment as per IS specification and creating a chemical barrier in bottom and sides of foundation trenches, top surface of plinth filling junction of walls and floors along with external perimeter of the building expansion joints surrounding the pipes and cables etc. complete using approved quality of chemical emulsion of requisite quantity prescribed by the manufacturer as directed by the Engineer-in-charge including cost of all materials and labour taxes etc. complete. (Indemnity bond for warranty for 10 years to be furnished)

Vitrified Tile Flooring:

Providing laying and fixing of vitrified tile flooring using double charged (either heavy duty or glazed as per the schedule of finish) vitrified tiles of premium grade of approved make having thick of 10 to 12 mm conforming to IS 13756 of size as mentioned below and coloured / digitally printed series (homogeneous) of approved quality, colour in all floors at all height with tile adhesive on bed of cement mortar of mix (1:4) laid in proper slope and gradient with screened and washed sharp sand for mortar and grouted with epoxy grout with required quantities of pigments of approved marks to match the shades of the vitrified tile if required; watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work, complete in all respect as per specification and direction of Engineer-in charge. The transition with other materials like carpet/ granite etc. to be provided with standard profile systems (either aluminium or wood or stainless steel) as per the best practise in managing the level difference if any.

Vitrified Tile Skirting and wall cladding:

Supplying, fitting and fixing of double charged vitrified tiles in skirting of premium grade of approved make conforming to IS 13756 of size as mentioned above and coloured / digitally printed series (homogeneous) of approved quality, colour and size in skirting / dadoes in all floors at all heights using tile adhesive and minimum 12mm thick screened and washed sharp sand for mortar with grouted Epoxy grout to match the shade of the tiles including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, curing-sundries and T&P, etc. required for the work complete as per specification and direction of Engineer-in-charge.

Antiskid floor Tile:

Providing 30cmx30cm size special anti skid rectified floor tiles of premium grade of approved make (to be applied mainly in toilet and bathroom areas) having minimum thickness 8mm having water absorption $E > 10\%$, modulus of rupture $> 15 \text{ N/sqm}$ and breaking strength $> 600 \text{ N}$ of approved quality, colour and size in all floors at all height with tile adhesive on bed of cement mortar of mix (1:4) laid in proper slope and gradient, grouted with neat white cement slurry jointing the tile with neat white cement slurry mixed with required quantities of pigments of approved marks to match the shades of the ceramic tile if required, watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work, complete in all respect as directed by the Engineer-in-charge.

Granite for kitchen countertop:

Providing 18 mm to 20mm thick avg. granite (type of finish required as/use like flame or honed finish or polished as per approved sample by the Architect/Engineer in charge) on kitchen counter top with vertical granite band (bullnose edge finishing) of approved quality, colour and size on minimum 25mm thick cement mortar of mix (1:1) laid in proper slope and gradient with screened and washed sharp sand for mortar and grouted with neat white cement slurry jointing the stone with neat white cement slurry mixed with required quantities of pigments of approved marks to match the shades of the granite tile if required watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work including rubbing mechanically and wax polishing etc. complete in all respect as per specification and direction of Engineer-in-charge.

Teak wood Shutter: Banquet door

Supplying, fitting and fixing in position 38 mm thick decorative Teak wood shutter 38mm style and 22mm to 25mm thick panel well-seasoned and well-dressed fitted and fixed to sal wood choukaths in all floors at all heights including providing ornamental design as per approved drawing with necessary beadings, cutting grooves in choukaths and for lapping portion of shutter where necessary, including fitting and fixing of Godrej make Mortise lock having model no 9168, Godrej make Door closure heavy duty type having model no 8340, 125mm brass hinges, handle, tower bolt, stopper including cost of all materials, labour, all taxes, transportation, loading & unloading etc. complete as per specification and direction of Engineer -in-charge.

Aluminium Door & Window: double height window

Providing & fixing of DOMAL - 40 or equivalent Aluminium Building Systems, made from 6063 T-6 alloy and tempered euro groove aluminium profile, in approved surface coating, mechanically mitered & joined with corrosion resistance DOMAL accessories and hardware. Glass infill, of desired thickness, shall be fixed onto using non-aging siliconized microwave treated DOMAL gaskets depending upon on the structural conditions, functions and statistical load requirements. All glasses will be toughen glass from Saint Gobin make, thickness will be 12mm.

Semiunitized Structural Glazing:

Designing, fabricating, installing and fixing in position semi unitized system of structural glazing for linear portions of the building for all heights and all levels including:

Structural analysis & design and preparation of shop drawings for the specified design loads conforming to IS 875 part III (the system must pass the proof test at 1.5 times design wind pressure without any failure), including functional design of the aluminum sections for fixing glazing panels of various thicknesses, aluminium cleats, sleeves and splice plates etc. gaskets, screws, toggles, nuts, bolts, clamps etc., structural and weather silicone sealants, EPDM gaskets for water tightness.

Fabricating and supplying serrated M.S. hot dip galvanised brackets of required sizes to accommodate 3 Dimensional movement for achieving perfect verticality and fixing structural glazing system rigidly to the RCC/ masonry/ structural steel framework of building structure using stainless steel anchor fasteners/ bolts, nylon separator to prevent bimetallic contacts with nuts and washers etc. in required numbers.

Providing and filling structural silicone sealant and weather silicone sealant compatible with the structural silicone sealant of required bite size in a clean and controlled environment , including double sided spacer tape, setting blocks and backer rod, all of approved grade, brand and manufacture, as per the approved sealant design, within and all around the perimeter for holding glass.

Making provision for drainage of moisture/ water that enters the structural glazing system to make it watertight, etc. complete. This item includes cost of all inputs of designing, labour for fabricating and installation of aluminium grid, installation of glazed units and other incidental charges including wastages etc, as described above and as specified. The item includes the cost of getting all the structural and functional design including shop drawings checked by a structural designer, approved by Engineer-in-charge.

Providing and supplying aluminium extruded tubular and other aluminium sections as per the architectural drawings and approved shop drawings , the aluminium quality as per grade 6063 T5 or T6 as per BS 1474, including super durable powder coating of 60-80 microns conforming to AAMA 2604 of required colour and shade as approved by the Engineer-in-Charge. (The item includes cost of material such as cleats, sleeves, screws etc. necessary for fabrication of extruded aluminium framework. Nothing extra shall be paid on this account).

Transom & Mullion - 131*67*2mm

End Mullion size -131*39*1.7mm

Sub Frame size - 68*28*1.5mm

Providing, assembling and supplying vision glass panels (IGUs) comprising of hermetically-sealed 8-12-8 mm insulated glass (double glazed) vision panel units of size and shape as required and specified, comprising of an 8mm thick clear toughened glass, spacer tube 12mm wide, 8mm thick clear toughened glass, including primary seal and secondary seal (structural silicone sealant) etc., all complete for the required performances, as per the Architectural drawings, as per the approved shop drawings, as specified and as directed by the Engineer-in-Charge.

The IGUs shall be assembled in the factory/ workshop of the glass processor. (including the areas of the grooves and weather silicone sealant) provided and fixed in position, shall be measured in sqm. All glasses will be toughen glass from Saint Gobin make, thickness will be 8mm.

Glass Partition:

Supplying and fixing of manually operated 12mm thick toughened glass partition cum door including floor spring of requisite weight (floor plate fixed flush with floor) lock (DORMA Cat. no. Agile 150 or equivalent), handles &

screws etc. (DORMA or Equivalent) including all labour charges for fixing and all applicable taxes etc., and as per approved drawing of the Architect / consultant and as directed by Engineer-in-charge.

Wood Polymer Composite Door

Raw

materials

Natural fibers: wood waste, saw mill waste, wood powder, wood flour, wood chips, bagasse, bamboo, coir fibers, rice husk, cotton stalks

Polymers: PVC virgin and PVC recycled

WPC Profile Door material density: 650 Kg/m³ to 800 Kg/m³

Door Frame size – 50 x 125mm

Thickness of door panel – 30mm

Work description:

Supply of WPC door frame of size 50 x 125mm of required length and width, fixing on brick/RCC surface with 6 nos anchor fastener (3 nos each side) including stainless steel screw.

Supply of 30mm thick WPC door panels of required width and height, fixing with WPC door frame by fixing of 3 nos 6 inch stainless steel hinges. The door panel shall be provided with two 25 x 125mm bright finished stainless steel handle (One on front and another on back side) and three nos 200mm bright finished stainless steel tower bolt (one on front side, one on back side horizontal and one on back side vertical top) and all required locking arrangements.

Stainless Steel Railing:

Supplying, Fitting and fixing of stainless steel of 304 grade in hand railing using 50mm dia of 2mm thick circular pipe with Balustrade of size 50mm dia of 2mm thick @ not more than 0.90mtr C/C (spaced equally as per site) and stainless pipe bracing of size 32mm dia of 2mm thick in 3 rows in stair case all in satin finish as per approved design and specification buffing polishing etc with cost conveyance taxes of all materials labour T&P etc required for the complete in all respect and as per the direction of Engineer -in-charge.

Paver Block:

Supplying and laying of M40 grade heavy duty factory made hydraulically pressed and mechanically compacted free cast interlocking TUFF STONE brand pavers of 80mm thick, coral

shaped or as per approved design along with preparation of sub base with 50mm sand and levelling, laying of interlocking paver block with sand binding and final compaction with plate vibrator finishing the surface including cutting of blocks at the edges with all labour and materials etc complete as per direction of Engineer-in charge.

GRC Façade work(Classical design):

Providing Supply and Installation of GFRC (Glass Fibre Reinforced Concrete). Elements as per approved Design and sizes as per site. The GFRC Elements will be made of White Portland Cement (Birla White Cement), Quartz Silica Sand (Aryan Minerals), AR Glass fibre roving 61.2 (Cemfil/Nipon), acrylic based Polymer MC-76 (Dow/BASF) Super plasticizer HP-3 (Samrock/BASF) and the pigments as per the approved colour of (BASF/TATA). The casting

of the elements will be done with the spray machine in approved thickness with the layer method and compaction of the layers in the GFRP or Rubber molds manufactured in HS Architectural Solutions Only. The installation of the GFRC Elements shall be done as per the approved shop drawing by using the anchor fasteners, nut bolts, screws and cleats as per the site requirements.

Exterior texture plaster or paint

Finishing the exterior wall with texture finish plaster made up of acrylic co polymer resins combined with quartz silica, mineral aggregate, synthetic inorganic pigment and all to give a feel of real stone or any other natural texture to be applied on smooth plaster or concrete surface with minimum thickness 0.75 mm.

SCHEDULE OF FINISHES FOR BANQUET BUILDING

SCHEDULE OF FINISHES FOR BANQUET BUILDING										
SI NO	FLOOR DETAIL DESCRIPTIO N	FLOORING		SKIRTING	CLADDING / WALL FINISH		DOOR / WINDOW		CEILING	REMARK
		TILE / SLAB	DIMENSION		PAINT / SLAB	DIMENSION	DOOR	WINDOW		
	STILT FLOOR									
i	ENTRANCE LOBBY and all guest lobby and Corridor	Vitrified Tiles	600 x 600	Vitrified Tiles up to 100 mm	Acrylic Emulsion Paint	Up to CEILLING	Frameless floor mounted Glass door with adequate hardware fittings	Structural Glazing	Plane gypsum ceiling with coves	
iii	SERVICE LOBBY	Vitrified Tiles	600 x 600	Vitrified Tiles up to 100 mm	Acrylic Emulsion Paint	Up to CEILLING	WPC door or TATA pervesh door As/per Specs	Structural Glazing	Plane gypsum ceiling	
iv	BOTH STAIRCASE	Vitrified Tiles	300 x 1200	Vitrified Tiles up to 100 mm	Acrylic Emulsion Paint	Up to CEILLING	MS Door with fire rating 2hr	Aluminium sliding window		

SCHEDULE OF FINISHES FOR BANQUET BUILDING

SI NO	FLOOR DETAIL DESCRIPTIO N	FLOORING		SKIRTING	CLADDING / WALL FINISH		DOOR / WINDOW		CEILING	REMARK
		TILE / SLAB	DIMENSION		PAINT / SLAB	DIMENSION	DOOR	WINDOW		
	(stilt floor to terrace)					and bottom of staircase slab				
v	TOILET AREA (ALL)	Anti-skid vitrified tile	300x600	-	Vitrified wall tile up to false ceiling high. OBD above false ceiling	450x600	PVC DOOR & WPC(Main door) with Powder coated MS louvers at bottom	Aluminium ventilator with louvers	Combinatio n of calcium silicate board and 600 X 600 calcium silicate ceiling	
vi	PARKING	Vitrified Parking Tiles	400X400(11mm thk)		-					
vii	HARDSCAPE	Vitrified Parking Tiles	400X400(11mm thk)		-					
viii	PUMP ROOM	kota stone	560X560	kota stone up to 100 mm	White Wash	Up to CEILLING	MS Door with fire rating 2hr	Aluminium sliding window	White wash	

SCHEDULE OF FINISHES FOR BANQUET BUILDING

SI NO	FLOOR DETAIL DESCRIPTIO N	FLOORING		SKIRTING	CLADDING / WALL FINISH		DOOR / WINDOW		CEILING	REMARK
		TILE / SLAB	DIMENSION		PAINT / SLAB	DIMENSION	DOOR	WINDOW		
2	GROUND FLOOR									
ii	PRE- FUNCTION AND DOUBLE HEIGHT BANQUET HALL	Vitrified Tiles	800x1600	Vitrified Tiles up to 100 mm	Acoustical treatment as/specs	As/Specs	As/Specs	As/Specs	Acoustical false ceiling as/specs	
iii	GUEST ROOM	Vitrified Tiles	600X600	Vitrified Tiles up to 100 mm	Acoustical treatment as/specs	As/Specs	As/Specs	As/Specs	Acoustical false ceiling as/specs	Vitrified Tiles

SCHEDULE OF FINISHES FOR BANQUET BUILDING

SI NO	FLOOR DETAIL DESCRIPTIO N	FLOORING		SKIRTING	CLADDING / WALL FINISH		DOOR / WINDOW		CEILING	REMARK
		TILE / SLAB	DIMENSION		PAINT / SLAB	DIMENSION	DOOR	WINDOW		
iv	PARTY HALL	Vitrified Tiles	800x1600	Vitrified Tiles up to 100 mm	Acoustical treatment as/specs	As/Specs	As/Specs	As/Specs	Acoustical false ceiling as/specs	Vitrified Tiles
v	KITCHEN	Anti-skid vitrified tile	300x600	-	Vitrified wall tile up to false ceiling high. OBD above false ceiling	450x600	PVC DOOR & WPC(Main door) with Powder coated MS louvers at bottom	Aluminium ventilator with louvers	Combinatio n of calcium silicate board and 600 X 600 calcium silicate ceiling	
vi	SERVICE LIFT LOBBY	Vitrified Tiles	Suitable size as/site or as directed by	Granite	Acrylic Emulsion Paint	Up to CEILLING	Decorative WPC door as/Specs	Aluminium sliding window	600X 600 gypsum ceiling	

SCHEDULE OF FINISHES FOR BANQUET BUILDING

SI NO	FLOOR DETAIL DESCRIPTIO N	FLOORING		SKIRTING	CLADDING / WALL FINISH		DOOR / WINDOW		CEILING	REMARK
		TILE / SLAB	DIMENSION		PAINT / SLAB	DIMENSION	DOOR	WINDOW		
			Eng in charge							
vii	BALCONY	Anti-skid heavy duty tile as/specs	300x300	Vitrified tile	Vitrified wall tile up to false ceiling high. OBD above false ceiling	450x600	PVC DOOR & WPC(Main door) with Powder coated MS louvers at bottom	Aluminium ventilator with louvers	Combinatio n of Plane calcium silicate ceiling & 600 X 600 calcium silicate ceiling	
ix	LAUNDRY AND HOUSE KEEPING at terrace	Kota stone	560X560	kota stone up to 100 mm	Acrylic Emulsion Paint	Up to CEILLING	Hard core wooden Flush door	Aluminium sliding window		

SCHEDULE OF FINISHES FOR BANQUET BUILDING

SI NO	FLOOR DETAIL DESCRIPTIO N	FLOORING		SKIRTING	CLADDING / WALL FINISH		DOOR / WINDOW		CEILING	REMARK
		TILE / SLAB	DIMENSION		PAINT / SLAB	DIMENSION	DOOR	WINDOW		
x	STORE	kota stone	560X560	kota stone	White Wash	Up to CEILLING	Hard core wooden Flush door	Aluminium sliding window	-	
3	MEZZANINE FLOOR									
ii	AHU AND ELECTRICAL ROOM	Vitrified tile	600x600	Vitrified tile	Acrylic Emulsion Paint	Up to CEILLING	MS Door with Vision panel fire rating 2hr	Aluminium sliding window	Combination of plane gypsum ceiling and 600X 600 gypsum ceiling	

3. List of Approved Make

Following list of approved vendors are provided for different materials. However contractor may procure from other equivalent vendors after approval from employer.

SR. NO.	PRODUCT	BRAND, AGENCY
1.	AAC / flyash blocks	Charbuja, Aerocon, Siporex, Ecolite, CEEFpro, BLIT, First Build, Pasoblock
2.	GRC	Unistone, Birla White
3.	Concrete, Stone Sealar	Degussa, Wacker, Hytek, Aquamix, Laticrete, Kerakoll
4.	Fire Check Wood, Steel Doors	Signum, Godrej, Guardian, Navair, Shakti Hormann, Promat, Alhada,
5.	Flush Doors	Tata Conswood, Greenwood, Garnet, Merino, Century
6.	Door seals [dust / fire]	Lorient, Enviroseals, Pemko, Assorted
7.	Structural, Weather Sealant	Dow Corning, GE, Dupont
8.	Glazed, Ceramic & Vitrified Tiles	Euro, Naveen, Kajaria, Nitco, Jhonson, Somany
9.	Pigmented Joint fillers	Laticrete, Pidilite
10.	Cement Putty	Birla White, J K white
11.	Paint	Nerolac, Asian Paints, Dulux, Jenson & Nicholson, Berger, ICI, Oikos, Akzonobel, MRF
12.	Glass	Saint Gobain, AIS, Pilkington, Emirates
13.	Glazing Systems	Hydro, Domal, Kawneer
14.	Fire rated glass	Schott, Saint Gobain, ASI
15.	Doors, Window Fittings And Fixtures	Dorma, Giesse, Dline, Union, Yale, Assa Abloy brands

SR. NO.	PRODUCT	BRAND, AGENCY
16.	Toughening Agencies	Sejal, GSC, Gold Plus, Impact
17.	Lamination Films	Garware, Dupont
18.	Polycarbonate sheet	Lexan, Danpalon, GE, Tuflite, Plaram
19.	Gypsum & Mineral Fibre boards, systems, access panels & accessories	Saint Gobain, India Gypsum, Rondo, Armstrong, AMF, Knauf, Rehau, Lafarge, Gypsema, USG
20.	False Floor	Unitile, Solidfeel
21.	Handrails	Technorails, Dline, Dorma, Carlf India,
22.	Polypyopylene Rungs	Pranali, Mase Safety Works, StepX
23.	Paver Blocks	As per OPWD Norms
24.	Thermoplastic Road Marking Paint	Asian Paint PPG-Apcomark, Automark Technologies (India) Pvt. Ltd.
25.	Fire Stop Mortar & Foam	Firestop, Hilti, Promat, Newkem
26.	Expansion Joints	CS expansion joints, BASF Eabco, Excel Tech
27.	Cast in Channels	Halfen Deha, Jordhal
28.	Sanitary wares	Hindware, Parryware, Cera, HR Jhonson
29.	Concealed flush tanks / valves	Gebrit, Jaquar, Schell, Commander, Viega, Parryware
30.	Faucets /sanitary fittings	Jaquar, Grohe, Schell,
31.	HDPE drain boards	Doerken, Green global, Pidilite
32.	CPVC plumbing pipes & adhesives	Flowgaurd, Astral ,Ashirwad, Prince
33.	Manhole covers	Neco, Muncast,
34.	Light Fittings	Corvi, Bajaj, Philips, Trilux, Schreder,
35.	Gate automation & control	Gandhi automation, Boon Edam
36.	AAC / flyash blocks	Charbuja, Aerocon, Siporex, Ecolite, CEEFpro, BLIT

SR. NO.	PRODUCT	BRAND, AGENCY
37.	Waterproofing Treatment	Pidilite, BASF, FOSROC
38.	Anchor Fastener	Fischer, Hilti
39.	Entry Mat	Euronics, 3M
40.	High Pressure Laminate Panels	Fundermax, Wonder Alu Board, Viva Composite Panel, Greenlam
41.	WPC door	Vijayas, Ecoste WPC, Hardy Smith, Vinayak Enterprises, Anteak doors.
42.	Exposed Brick	Pioneer, Jindal
43.	Exterior textured plaster	Asian, Berger, Unistone and equivalent
44.	Furnitures	Godrej, Durian Furniture, HomeTown, Pepperfry
45.	Sound system	Britsih aqustic, BOSCH, JBL

DESIGN CRITERIA

(Civil Works)

CODES, STANDARDS AND SPECIFICATIONS

The design shall comply with the latest editions and revisions of the codes, specifications, and standards listed below:

Table 1: Latest edition and revision of codes

1	NBC	National Building Code of India.
2	IS: 1893 (Part 1)	Criteria for Earthquake Resistant Design of Structures (Part 1 – General Provisions and Buildings).
3	IS: 1893 (Part 2)	Criteria for Earthquake Resistant Design of Structures (Part 2 – Liquid retaining tanks – Elevated and ground supported).
4	IS: 1893 (Part 3)	Criteria for Earthquake Resistant Design of Structures (Part 3 – Bridges and retaining walls).
5	IS: 1893 (Part 4)	Criteria for Earthquake Resistant Design of Structures (Part 4 – Industrial Structures including Stack-Like Structures).
6	IBC	International Building Code.
7	IS 3414	Code of practice for design and installation of joints in buildings

Table 2 : Latest edition and revision of RCC

1	IS: 432	Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement.
2	IS: 456	Plain and Reinforced Concrete – Code of Practice.
3	IS: 1786	High strength deformed steel bars and wires for concrete reinforcement.
4	IS: 2502	Code of Practice for Bending and Fixing of Bars for Concrete Reinforcement.
5	IS: 4326	Code of practice for earthquake resistant design and construction of buildings.
6	IS:13920	Code of practice for ductile design and detailing of reinforced concrete structures subjected to seismic forces.
7	IS: 1904	Code of practice for design and construction of foundations in soils: General requirements.
8	IS: 3370 (Part 1 to 4)	Concrete structures for the storage of liquids - Code of Practice.
9	IS: 5249	Determination of dynamic properties of soil, method of test.
10	IS: 8009 (Part 1 & 2)	Code of practice for calculation of settlements of foundations.
11	IS: 3414	Code Of Practice For Joints In The Buildings.
12	SP: 16	Design Aids for Reinforced Concrete to IS 456: 1978.

13	SP: 24	Explanatory Hand Book on Indian Standard Code of Practice for Plain and Reinforced Concrete (IS 456: 1978).
14	SP: 34	Hand Book of Concrete Reinforcement and Detailing.
15	SP: 20 (S & T)	Explanatory Hand Book on Masonry Design and Construction.

MATERIAL, WORKMANSHIP AND DESIGN CRITERIA

The proposed structure will consist of concrete and steel reinforcement as main materials used for construction of the structures.

Structural design of RCC elements

The design aims to achieve an acceptable probability that structures being designed will perform satisfactorily during their intended life. With an appropriate degree of safety, they should sustain all the loads and deformations of normal construction and use and have adequate durability and resistance to the effects of earthquake, wind as well as misuse and fire. Structures and structural elements will be designed by Limit State Method. Due consideration will be given to the accepted theories, experience and modern design philosophy and practices

Construction joint

Construction joints and shrinkage strips to be planned by the contractor, at design stage (as per IS code: 3414) itself and only be used in locations pre-approved by consultants. Water stops shall be provided in all construction joints below ground level in addition to any joint which may be detailed on the drawing.

Expansion joint

To relieve the structure from temperature stresses, expansion joints are provided at several locations as per the IS requirements. As per BIS code requirement expansion joints are proposed if the length of the structure exceeds 45m. Depending upon geometry of building and for lateral load resisting system expansion joint may be provided for the RCC structures like retraining wall as recommended by IS codes. Gap for the expansion / separation joint shall be provided as per the provisions mentioned in IS 1893 part IV.

Permissible deflections

Permissible deflections shall be as per IS: 456 clauses 23.2. Total deflection of various structural members shall be calculated as per ANNEX C of IS 456. Provisions of IS 1893 and IS 875 shall be followed for lateral deformations.

- The final vertical deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members should not normally exceed span/250.
- The part deflection including the effects of temperature, creep and shrinkage should not normally exceed span/350 or 20 mm whichever is less.
- Under wind load, the lateral sway at the top of building should not exceed height/500.

CRACK WIDTH

Various structural members shall be designed for crack width mentioned as below as per clause no. 35.3.2 IS 456:2000 & clause no. 4.4.1.2, IS 3370(Part-2):2009.

For structural members exposure to serve exposure condition = 0.1mm

- For water retaining structures = 0.2 mm
- For members exposed to soil or ground water = 0.2 mm
- All other structural members = 0.3 mm

DESIGN LOADS

The design of various structural members for this building should follow the following loads and also effects due to shrinkage, creep, temperature, etc., where applicable.

Dead load

The dead loads should be calculated on the basis of unit weights of materials given in IS: 875 (Part 1). The dead load considered in the structural design shall consist of the full weight of all known fixed structural and architectural elements. The unit weight of materials will be used as follows.

Table 4: Unit weight of material

	Particulars	Weight
1	Reinforced concrete	25.00 kN/m ³
2	Plain concrete	24.00 kN/m ³
3	Light weight concrete	12.00 kN/m ³
4	Concrete block work	18.00 kN/m ³
5	Brickwork	20.00 kN/m ³
6	Autoclaved Aerated Concrete Blocks	8.00 kN/m ³
7	Stone cladding	25.00 kN/m ³
8	Floor finishes	20.00 kN/m ³
9	Glass	23.50 kN/m ³
10	Structural steel	78.50 kN/m ³
11	Water	09.81 kN/m ³
12	Dry Soil	16.00 kN/m ³
13	Saturated Soil (Garden load with roots)	21.00 kN/m ³

Typical Dead loads considered in the design are as follows:

Self-weight of slabs, beams, columns & walls - As per sectional sizes of the members.

Additional dead loads

- Floor finishes at Typical floors -1.5 kN/m²
- Water Proofing at Terrace -3.0 kN/m²

Live load

All the live loads should be followed as per IS: 875 (Part 2).

Seismic load (sl)

All buildings, structures, foundations should be designed to resist the effects of earthquakes in accordance with IS: 1893 - Criteria for Earthquake Resistant Design of Structures for Design Basis Earthquake. The structure is primarily column and beam framing system and Retaining wall, since due considerations will be given to the major suggestions/ clauses from IS: 13920. The Retaining wall are to be designed to carry lateral loads.

Seismic design forces should be determined based upon the following parameters. Buildings of different materials of construction and lateral force resisting systems shall be investigated separately.

➤ **SEISMIC WEIGHT CALCULATION**

The seismic weight of building includes all permanent rigidly attached structural and non-structural components of a building, such as walls, floors, roofs, total weight of permanent equipment etc. The contribution of live load to be considered in the seismic weight calculation shall be taken as per Clause 7.3.1 and as specified in Table – 8 of IS 1893 (part 1).

➤ **PERMISSIBLE STRESSES**

- Whenever seismic forces are considered along with other normal design forces, the permissible stresses in material shall be governed by the respective codes as per which the structure/ equipment is being designed.
- For the other provisions of the code Cl.No.6.3.5 of IS: 1893 (part-1) and Cl.No. 7.4 of IS: 1893 (Part-4) shall be followed.
- Earthquake loads shall not be considered to act simultaneously with wind.

➤ **DUCTILE DETAILING**

The ductility details of reinforced concrete members should be provided as per the provisions of IS: 13920 to avoid premature failure during earthquake.

Surcharge load

Minimum surcharge of 10KN/m² and as per IRC whichever is higher shall be considered for design of all underground structures to take in to account the construction load and vehicular traffic in the vicinity of structure.

Earth pressure

Earth pressure for walls of basement/ tanks etc. with propped support condition will be calculated using coefficient of earth pressure at-rest. Earth pressure for cantilever walls like cable trenches and Retaining wall will be calculated based on active earth pressure. Unit weight of soil shall be as per section 8.1. Other soil parameters such as cohesion and angle of internal friction shall be considered as per soil investigation report.

Hydrostatic pressure

If envisaged, the ground water load shall be applied on the substructure as super imposed dead load in addition to the earth pressure. The dry density of soil shall be considered in this combination.

Construction loads

Loads produced by the materials of construction plus the equipment required to construct the facility (crane loads, rigging loads, earth moving equipment, temporary bracing, etc.) as applicable shall be considered.

Load combinations

Each element of a building or structure shall be provided with sufficient strength to resist the most critical effects resulting from the following combination of loads.

Load cases and load combination shall be as follow:

Static load cases

- Dead load (DL)
- Live load (LL)
- Seismic load (Spectra) in X-direction (EQX)
- Seismic load (Spectra) in Y-direction (EQY)

(X and Y directions are mutually orthogonal in plan area, to define the direction of seismic forces with reference to building)

The following Load Combinations have been considered for the analysis.

- 1.5 DL
- 1.5 (DL + LL)
- 1.2 (DL + LL + EQX)
- 1.2 (DL + LL – EQX)
- 1.2 (DL + LL + EQY)
- 1.2 (DL + LL – EQY)
- 1.5 (DL + EQX)
- 1.5 (DL – EQX)
- 1.5 (DL + EQY)
- 1.5 (DL – EQY)
- 0.9 DL + 1.5 EQX
- 0.9 DL -1.5 EQX
- 0.9 DL + 1.5 EQY
- 0.9 DL - 1.5 EQY

Load Combinations for Serviceability

- DL+ LL
- DL + 0.8 LL + 0.8 EQX
- DL + 0.8 LL – 0.8 EQX
- DL + 0.8 LL + 0.8 EQY
- DL + 0.8 LL - 0.8 EQY
- DL + EQX
- DL – EQX
- DL + EQY
- DL - EQY

The design shall be governed by worst load combinations, keeping in view the probability of Each load case acting together and Their disposition in relation to other loads and severity of stresses or deformations caused by combinations of the various loads is necessary to ensure the required safety and economy in the design of a structure.

The allowable stresses and soil bearing values shall not be increased for any condition of dead, live loads acting alone or in combination with each other.

TECHNICAL SPECIFICATION OF CIVIL WORKS

General

The works shall be performed conforming to the Indian Standard codes, P.H.D & P.W.D. specifications of the State Government. Wherever such specifications are not available, CPWD specifications, relevant references, manuals etc. shall be followed as directed by Owner.

1. EARTHWORK

1.1 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with earthworks of all underground supplies and services and for all structural units, stock piling, of specifications and applicable drawings, and subject to terms and conditions of the contract. The scope of this section of specifications is also covered with detailed specifications as laid down herein.

1.2 GENERAL

The Contractor shall acquaint himself with the nature of the ground, existing structures, foundations and subsoil which might be encountered during excavation of earthworks. The Employer does not guarantee or warrant in any way that the material to be found in the excavation will be similar in nature to that of any samples which may have been exhibited or indicated in the report, drawings or in any other contract documents or to material obtained from boring or trial holes. The contractor shall be deemed to have made local and independent inquiries and shall take the whole risk of the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive any extra or additional payment nor to be relieved from any of his obligations by reasons of the nature of such ground subsoil or material.

All excavations, cutting, and fills shall be constructed to the lines, levels and gradients specified with any necessary allowance for consolidation, settlement and drainage so that at the end of the period of maintenance the ground shall be at the required lines, levels and gradients.

During the course of the Contract and during the period of maintenance any damage or defects in cuttings and fills, structures and other works, caused by slips, falls or basins or any other ground movement due to the Contractor's negligence shall be made good by the Contractor at this own cost.

1.3 SITE PREPARATION

The Contractor shall construct and maintain accurate bench marks so that the lines and levels can be easily checked by the Project Engineer. The Contractor shall Construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction.

The Contractor shall perform a joint survey with the Project Engineer's representative of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from him before starting the earthwork.

The Contractor shall Construct and maintain such ditches, in addition to those shown on the plans,

as will adequately drain areas under construction.

1.4 EXCAVATIONS

Excavation shall include the removal of all material of every name and nature. Excavations shall be carried out in accordance with excavation plans and sections shown on the Drawings and as directed by the Project Engineer.

The major portion of excavations shall be carried out by mechanical excavators and excavated materials disposed off to stock on spoil as per drawings or as directed by the Project Engineer. The excavation which cannot be done by mechanical means including leveling, trimming and finishing to the required levels and dimensions shall be done manually. The material suitable for fill and back fill shall be stock piled within the free haulage limit of the 200m of the works.

The Contractor shall give reasonable notice that he intends to commence any excavation and he shall submit to the Project Engineer full details of his proposals. The Project Engineer may require modifications to be made if he considers the Contractor's proposals to be unsatisfactory and the Contractor shall give effect to such modifications but shall not be relieved of his responsibility with respect to such work.

For major excavations, the Contractor shall submit for the prior approval of the Project Engineer full details and drawings showing the proposed method of supporting and strutting etc. The design, provisions construction, maintenance, and removal of such works shall be the responsibility of the Contractor and all cost in these respects shall be included in the unit rates for the permanent work.

The Contractor's attention is drawn particularly to his obligations under the general conditions in respect of those works which are in close proximity to existing buildings.

The Contractor shall preserve the complete excavation from damage from slips and earth movements, ingress of water from any source what so ever and deterioration by exposure to the sun and the effects of the weather.

All excavation of every description, in whatever material encountered shall be performed to the elevations and dimensions shown on the drawings in such a manner as to avoid interruption to work in other parts of the site. The Contractor shall be responsible for injury to the permanent works caused by excavation on other parts of the works.

Excavation shall extend to sufficient distance from walls and footing to allow for placing and removal of forms, installations of services and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces.

All excavations in foundations shall be taken to 150mm and shall be trimmed carefully to a smooth and level surface, immediately after trimming to the final elevation a layer of building concrete shall be placed to the thickness shown on the drawings. All excavations for foundations which have been trimmed and disturbed shall be compacted and covered by concrete by the end of the day. It is specifically brought to the notice of the Contractor that any excavation taken down to the trimmed elevation which is left overnight or for any length of time thereafter, uncovered by the blinding concrete, shall be required to be trimmed to such lower elevation as directed by the Project Engineer and any extra work or any consequent increase in the quantities caused thereby shall not be paid to the Contractor.

No excavation shall be refilled nor any permanent work commenced until the foundation has been inspected by the Project Engineer and his permission to proceed given. If excavation for sub-structures is carried below the required level, as shown in the drawings or as directed by the Project

Engineer, the surplus depth shall be filled in with concrete of same grade as of blinding concrete at the sole cost of the Contractor.

All excavation shall be performed in the dry. The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry and the Contractor shall have sufficient equipment for this purpose. Adequate precautions shall be taken to prevent any corrosion due to undercutting from underneath the previously constructed adjoining foundations.

Existing utility lines to be retained, as well as utility lines constructed during excavation and backfilling, and if damaged, shall be required to be repaired by the Contractor at his expense. Any existing utility lines which are not known to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor and adjustment in payment will be made as approved by the Project Engineer. When utility lines which are to be removed, are encountered within the area of operations the Contractor shall notify the Project Engineer in ample time for necessary measures to be taken to prevent interruption of the service.

Excavated material suitable for use as filling material shall be stock piled within the free haulage limit 200m of works as directed by the Project Engineer. This stock piled material shall be transported back to places requiring fill or backfill. Surplus or material unsuitable for use as filling shall be disposed of by the Contractor at locations approved by the Project Engineer within specified free haulage limit.

The Contractor shall make independent enquiries and perform and make independent observations to ascertain the water table in the areas of excavations during the period when the construction works are in progress. The Contractor shall take whole risk of any nature for fluctuation of the water table from his own findings. The Employer is not bound in any way and shall not be responsible for any information given by him or any information, observations or values obtained from his reports, drawings and documents.

Excavation for Recharge pits, Recharge trenches shall be taken out to the levels and dimensions as the Project Engineer may direct.

Before starting the excavations, the Contractor shall ensure the correct alignment of the recharge trenches and location of recharge pits on the ground, the depth and width of excavation of the trench and pits, all in accordance with the drawings and instructions of the Project Engineer.

The Contractor at his cost shall provide to the satisfaction of the Project Engineer all timbering, approved supports and shores and bracings to the sides of the excavated trench and foundations in such a manner to secure the sides of the trench and excavations from falling or adverse movement. All responsibility connected with such shoring shall rest with the Contractor. Adequate clearance / working space on both sides of the structure/pipe line shall be provided for which no payment shall be made.

Without the written permission of the Project Engineer no more than 50.0m the trench shall be opened in advance of the completed pipe line. The bottom of all excavations shall be carefully leveled. Any pockets of soft or loose material in the bottom of the pits and trenches shall be removed and the cavities so formed filled with lean concrete at the Contractor's expense.

The Project Engineer may require the Contractor to excavate below the elevations shown on the drawings or he may order him to step above the elevations shown depending upon the suitable foundation material encountered.

If for any reasons, the levels grades or profiles of the excavations are changed adversely, the Contractor shall at his own cost be liable to bring the excavations to the required levels and profiles as shown on the drawings or as directed by the Project Engineer.

1.5 EXCAVATION TOLERANCES

Excavation shall be performed within the tolerances for excavation limits indicated on the drawings. Where no tolerance limits are indicated excavation shall be performed to tolerances established by the Project Engineer as accepted for the design and type of work involved.

2. BACK FILLING

After completion of foundation footing, foundation, walls, and other construction below the elevation of the final grades and prior to backfilling, forms shall be removed and the excavation shall be cleaned of trash and debris.

The backfilling shall include filling around the foundations, trenches.

Filling shall be approved selected material from excavation or other predominantly granular material and free from slurry, mud, organic or other unsuitable matter and capable for compaction by ordinary means.

The excavated material if found suitable shall be stock piled within the free haulage limit of the site of the works. This material shall be used for backfilling if approved by the project engineer and shall be transported by the contractor any where required for the purpose of backfilling work in this contract.

The contractor shall provide the approved quality fill and backfilling material as required to complete the fill/backfilling work. Filling in trenches and foundation shall be placed in 200 mm layers and compacted at optimum moisture content by mechanical means or other means as approved by the project engineer.

Fill in around trenches and pits- shall be carefully placed with fine material to cover the completely before the normal infilling is done.

Material for back filling shall be as approved by the project engineer and shall be placed in layers of 150 mm measured as compacted material and saturated with sufficient water and compacted to produce in-situ density not less than 95% of the maximum density at optimum moisture content, achieved in test no.15 of IS 1377:1975 or similar clause of relevant is code.

All filled areas shall be left neat, smooth and well compacted with the top surface consisting of the normal site surface soil unless otherwise directed.

Depending on the depth of fill the project engineer may instruct increased thickness of successive layer to be placed.

Fill shall not be placed against foundation walls prior to approval by the project engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

Depending on the depth of fill the project engineer may instruct increased thickness of successive layer to be placed.

Fill shall not be placed against foundation walls prior to approval by the project engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

In case the contractor is instructed to arrange for the fill material the quality of the fill material will be subject to the approval of the project engineer. The project engineer shall require the contractor to carry out various tests of the fill material. All such tests shall be made at an approved laboratory at the cost of the contractor. Once a material from a specific source has been approved, the material for the same quality and from that source only shall be used. Any fill material from borrow pits which has not been approved or the quality of which differs from the approved material shall be rejected out rightly. The project engineer reserves the right to order removal of any such materials brought to the site of works at his discretion at contractor's expense. In order to ensure satisfactory compaction, it will be necessary to carry out, depending upon the type of material, particle size distribution tests, determination of organic content tests, maximum and minimum density tests and determination of optimum moisture content for the filling material.

The method of compaction, namely type of compactor, type of roller, weight of roller and number of passes proposed by the contractor for any particular fill material shall be subject to the approval of the project engineer after completion of satisfactory field tests, subsequent to the laboratory analyses, using the materials and equipment proposed to be used for the earth work in conditions similar to those likely to be encountered during construction.

The final selection of the soil moisture content, the thickness of layers, the type of compaction equipment and the number of passes shall be decided after these tests, which shall be conducted at contractor's expense.

Having established the method of compaction to be used, no departure from this approved method shall be permitted without the prior approval of the project engineer. Adequate control of the fill and compacting operations shall be ensured by in-situ density tests and in order to obtain significant results, not less than two measurements shall be carried out per one hundred square meters of area compacted. The frequency of tests shall be determined on site and may be varied at the discretion of the project engineer. Compaction shall not be less than 95% in-situ density with respect to the maximum density, at optimum moisture content.

The exact thickness of layers and the method of placing and compacting the fill shall be determined by the field tests, as stated above, but notwithstanding the results of these trials, fill shall not be placed in layers exceeding 200mm in thickness. In order to maintain control of the thickness of layers, timber profiles shall be used wherever feasible. The travelers of such profiles for each layer of fill shall be checked by the supervisory staff of the project engineer. The contractor shall provide adequate supply of water and sufficient capacity of mechanical water carriers to ensure uniform and uninterrupted operation of compaction. The project engineer may forbid the contractor to proceed with placing and/or compaction of fill and/or order removal and re-compaction of such fill when he finds that the contractor has insufficient or defective equipment or that the fill has been improperly laid and/or compacted.

If it is found necessary to alter the moisture content of the fill material in any way, then very strict control shall be exercised over the wetting and/or the drying process and frequent moisture content tests.

The fill material should be well graded non-cohesive and nearly silt-free (silt content between 5 to

10 percent) salt free and free of organic materials (less than 2%). It should also be free of stones larger than 100 mm. Maximum dimension. It should be of such nature and characteristics that it can be compacted to the specified densities in reasonable length of time. It shall be free of plastic clays, of all materials subject to decay, decomposition or dissolution and or cinder or other material which corrode piping and other metals.

TOLERANCES

The stabilization of compacted backfill/fill surfaces shall be smooth and even and shall not vary more than 100mm in 3 meters from true profile and shall not be more than 12.5mm from true elevation.

DISPOSAL OF SURPLUS MATERIAL

The rejected unsuitable material and surplus excavated material shall be disposed of within 200 m free haulage limit measured from boundary of the works to places or as directed by the Project Engineer.

The disposal of surplus excavated material shall include loading, unloading, transporting, stacking, spreading as directed by the Project Engineer.

3. PLAIN AND REINFORCED CEMENT CONCRETE

The work covered by this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials, and in performing all operations in connection with the supply and installation of plain and reinforced concrete work, complete in strict accordance with this section of the Specifications and relevant documents, subject to the Conditions of the Contract.

GENERAL

Full co-operation shall be given to other trades to install embedded items and/or any associated services.

Embedded items shall have been inspected, and tests for concrete and other material or for mechanical operations shall have been completed and approved, before concrete is placed.

Formwork shop drawings shall be designed and prepared by the Contractor at his own cost. Approval of shop drawings as well as those of mock-ups /actual samples of finished concrete shall be obtained before Work is commenced.

Contractor shall prepare bar bending schedules, and get the same approved by the Project Engineer, prior to commencement of work.

RELATED SPECIFICATIONS

The codes and standards generally applicable to the work of this section are listed herein after.

IS 269	:	Ordinary and low heat Portland Cement
IS 8041	:	Rapid Hardening Portland Cement
IS 455	:	Portland slag cement
IS 1489	:	Portland Pozzolana Cement
IS 8112	:	High Strength Ordinary Portland Cement
IS 383	:	Coarse and fine aggregates from natural sources for concrete

IS 456	:	Code of practice for plain and reinforced concrete
IS 516	:	Method of sampling and analysis of concrete
IS 1199	:	Method of sampling and analysis of concrete
IS 1139	:	Hot rolled deformed bars
IS 23896	:	Methods of testing of aggregates for concrete (Part I to III)
IS 2751	:	Recommended Practice for welding for reinforcement bars
IS 9103	:	Admixtures for concrete
IS 10262	:	Recommended guide lines for concrete mixed design

MATERIALS

CEMENT

- a. Cement shall conform to standards listed in section 2 of IS:456, latest edition as per the work requirement and direction of engineer.
- b. Only one brand of each type of cement shall be used for concrete in any individual member of the structure. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed.
- c. There shall be sufficient cement at site to ensure that each section of Work is completed without interruption.
- d. Cement reclaimed from cleaning of bags or from leaky containers shall not be used.
- e. Contractor shall provide and erect, at his own cost, in a suitable place, dry, well ventilated, and water proof shed of sufficient capacity to store the cement.
- f. The cement shall be used as soon as possible after delivery, and cement which the Project Engineer considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise shall be rejected and removed immediately from the site at Contractor's expense.
- g. The mixing together of different types of cement shall not be permitted.

AGGREGATES

- a. The sources of supply of all fine and coarse aggregates shall be subject to the approval of Project Engineer.
- b. All fine and coarse aggregates shall be clean and free from clay, loam, silt, and other deleterious matter. If required, Project Engineer reserves the right to have them washed by the Contractor at no additional expenses. Coarse and fine aggregates shall be delivered and stored separately at Site. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated.
- c. Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings and shall conform to requirements of IS: 383 latest edition.
- d. Coarse aggregate shall be gravel or broken stone or hard, durable material free from laminated structure and conforming to IS: 383 latest edition. The aggregates shall be graded as follows for use in mass concrete as in foundations:

TOTAL PASSING PERCENT BY WEIGHT

2" B.S. Sieve (50.00 mm)	100
1-1/2" Sieve (38.10 mm)	95-100
3/4" Sieve (19.00 mm)	35- 70
3/8" Sieve (9.50 mm)	10- 30
No. 4 Sieve (4.75 mm)	0- 5

Coarse aggregate for all cast-in-place concrete other than mass concrete as for foundations shall be graded with the following limits:-

TOTAL PASSING PERCENT BY WEIGHT

1" Sieve (25.00 mm)	100
3/4" Sieve (19.00 mm)	90-100
3/8" Sieve (9.50 mm)	20- 55
No. 4 Sieve (4.75 mm)	0- 10

Water:

Only clean potable water from the city supply, tube well installed at the Site or from other sources approved by Project Engineer shall be used. Contractor shall supply sufficient water for all purposes, including mixing the concrete, curing and cleaning plant and tools. Where doubts exist as to the suitability of the water, it shall be tested in accordance with IS: 3025. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, Project Engineer may refuse to permit use. As a guide, the following concentrations represent the maximum permissible values:

- a. To neutralize 200 ml sample it should not require more than 2 ml of 0.1 normal NaOH.
- b. To neutralize 200 ml sample it should not require more than 10 ml of 0.1 normal HCL.
- c. Percentage of solids should not exceed the following:

	PERCENT
Organic	0.02
Inorganic	0.30
Sulphates	0.05
Alkali Chlorides	0.10

In case of doubt, Project Engineer may require that concrete mixed with water proposed to be used should not have a compressive strength lower than 90 percent of the strength of concrete mixed with distilled water.

Reinforcement

- a. Reinforcement for concrete shall conform to the respective IS or other standards as specified in the

drawings and Contract Documents or as may be specified by Project Engineer.

- b. Unless otherwise specified, all plain reinforcing bars shall comply with the requirements of IS: 432, and shall have a minimum yield stress of 248 N/sq mm.
- c. Unless otherwise specified, all deformed reinforcing bars shall comply with the requirements of IS: 1786 for deformed cold worked steel bars and shall have minimum characteristic stress of 415 N/sq mm.
- d. Reinforcement shall be obtained only from manufacturer's approved by Project Engineer. If and when required Contractor shall provide all necessary facilities to Project Engineer for the selection of test pieces and shall cause these to be prepared and submitted where directed for tests at Contractor's cost.
- e. If the reinforcement is to be supplied by Employer, Contractor shall inform Project Engineer of his requirements much before its use in construction.
- f. Reinforcement of all types is to be stored at Site in an approved manner so as to avoid damage.
- g. Contractor shall report immediately on receipt of any consignment, having any deviation in the standard weights of the reinforcing bars beyond those allowed in respective standards mentioned in clause (3.3.3.4.b) and (3.3.4.4.c) herein before.

4. CONCRETE MIX PROPORTIONS

General:

The proportions of ingredients shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the Work, but without permitting the materials to segregate or excessive free water to collect on the surface. Specific approval of the Project Engineer is required to waive limitations on mixture proportions.

The proportions of ingredients shall be selected in accordance with Section 5.7 to produce the proper placeability, durability, strength and other required properties.

Strength

The Specified compressive strength of the concrete cube, shall be 15 N/sq mm. or 20 N/sq mm.. Samples from fresh concrete shall be taken as per IS: 1199 and cubes shall be made, cured and tested at 28 days in accordance with IS: 516.

Durability

Requirements of Clause 7 of IS: 456-1978 shall be followed.

Slump

Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 100 mm or less. A tolerance of up to 25 mm above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit.

Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

Note: If S.R. Cement is used, permissible water-cement ratio may be increased by 0.05.

Slump shall be determined by the "Test for slump for Portland Cement Concrete" as per relevant IS

code.

Maximum Size of Coarse Aggregate:

The nominal maximum size of the aggregate shall be 20mm for all portions of the structure except footings which may be 38 mm. These limitations may be waived if, in the judgment of the Project Engineer, workability and methods of consolidation are such that the concrete can be placed without honeycomb or voids.

Admixtures:

If required or permitted, admixtures used shall be in accordance with the manufacturer's instructions except as otherwise specified herein.

Methods of Obtaining Mix Design:

For concrete of normal weight, mix proportions to provide the desired characteristics shall be developed using the methods/procedure covered by the Recommended Practice for Selecting Proportions for Normal Weight Concrete ACI-211.1-77/ IS:456- 1978.

Trial mixtures having proportions and consistencies suitable for the Work shall be made based on above codes, using at least three different water-cement ratios which will produce a range of strengths encompassing those required for the Work. Trial mixes shall be designed to produce the specified slump. The temperature of concrete used in trial batches shall be reported.

For each water-cement ratio, compression test of cube shall be made, cured, and tested in accordance with IS:1199 and IS:516. From the results of these tests a curve shall be plotted showing the relationship between the water-cement ratio and compressive strength. From this curve, the water-cement ratio to be used in the concrete shall be selected to produce the required design strength. The cement content and mixture proportions to be used shall be such that this water- cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content and slump.

5. STEEL REINFORCEMENT

SCOPE OF WORK

The work to be done under this section consists of furnishing, cutting, fabricating, bending, placing and tying steel reinforcement in concrete structures or elsewhere as shown on the drawings or directed by the Project Engineer. The scope of this section of this section of specifications as laid down herein.

MATERIAL AND SIZE OF BARS

Reinforcement for concrete shall conform to the respective Indian or other standards as specified in the drawings and in the contract documents or as may be specified by the Project Engineer.

Unless otherwise specified, all plain mild steel reinforcing bars shall comply with the requirements of IS: 432 (Part- I) and shall have a minimum yield stress of 250 N/mm.sq.

Unless otherwise specified, all deformed reinforcing bars shall comply with the reinforcements of IS: 1786 for deformed cold twisted steel bars and shall have a minimum characteristic strength of 415 N/mm.

Reinforcement shall be obtained only from manufacturers approved by the Consultant/Project Engineer. Each consignment of reinforcement steel shall be accompanied by a manufacturer's

certificate or shall refer to a previous certificate, if the consignment is from the same batch, showing that the reinforcement steel complies with the following requirement

If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

Reinforcement of all types is to be stored on site in approved manner so as to avoid damage.

Reinforcement shall be free from all loose or flaky rust and mill scale or coating, including ice, and other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

Reinforcement of all types is to be stored on site in approved manner so as to avoid damage.

Reinforcement shall be free from all loose or flaky rust and mill scale or coating, including ice, and other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

Steel wire mesh reinforcement shall conform to requirement of relevant Indian codes or those of ASTM: A 185-64 or BS. 4483, 1969: Standard Specifications for welded steel wire fabric for concrete reinforcement. It shall be used where shown on the drawings.

Applicable standards

Latest editions of Indian Standards as per 4.3 or other International Standards

DELIVERY & STORAGE

Delivery

Steel reinforcement bars shall be delivered in bundles firmly secured and tagged. Each bars or bundle of bars shall be identified by marks stamped on hot or cold or painted on or by any other means. The identifying marks shall contain the following information:

- a. Name of the producer or his trade.
- b. Standard to which the bars have been manufactured.
- c. The clause, type and strength respectively.
- d. The diameter.
- e. The number of the test certificate (if available).

Storage

The method of storage shall be approved by the Project Engineer. Reinforcing bars shall be stored in racks or platforms above the surface of ground and shall be protected free from scaling, rusting, oiling, coatings, damage, contamination and structural defects prior to placement in works. Bars of different diameters and grades of steel reinforcement shall be kept separate.

BAR BENDING SCHEDULES

The Contractor shall prepare bar bending schedule of all the reinforcing steel bars and these bar bending schedules will be supplied to the Consultants/Project Engineer in duplicate on the basis of which the work shall be carried out. However, the Contractor shall be responsible to satisfy himself as to the correctness and accuracy of the bar bending schedule. Any discrepancy shall immediately be notified to the Consultant / Project Engineer before commencing work.

MEASUREMENT & PAYMENT

Except otherwise specified herein or elsewhere in the Contract documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities. Providing and installing chairs, supports, hooks, spacers, binding wires, and laps not shown on drawings including wastage and rolling margin.

6. BRICK MASONRY

GENERAL

Brick Masonry shall consist of all work required in connection with constructing brick masonry at locations shown on drawings including, but not limited to, furnishing brick, portland cement and sand for mortar and all other materials, and mixing, placing brick masonry as per bill of quantities.

MATERIALS

All portland cement for mortar shall be furnished by the Contractor and shall conform to the applicable requirements specified in the section "Plain and Reinforced Concrete". All sand for mortar shall be furnished by the Contractor and shall conform to the applicable requirements for sand specified in the section "Plain and Reinforced Concrete".

All water used in the manufacture of bricks and in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali, salts and other impurities, and will be tested and approved by the Project Engineer as per the guidelines of IS: 456.

MORTAR

- a. MIX: Mortar for all brick masonry, except where otherwise directed by the Project Engineer, shall consist of one part cement to six parts of damp loose mortar sand by volume for brickwork 230mm and above. For brick piers, half brick walls, honeycombed brickwork and hollow (cavity) walls, the mortar mix shall consist of one part cement and four parts of sand. Quantity of water shall be just sufficient enough to produce proper consistency for the intended use. Where directed and approved by the Project Engineer, hydrated lime putty, shall be added to the mortar for increased workability. The putty shall, however, not exceed 25% by volume of the dry cement.
- b. Methods and equipment used for mixing mortar be such as will accurately determine and

control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Project Engineer. Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of the water to the mix shall be wasted. Re-tempering of mortar will not be allowed. The mixers shall be thoroughly cleaned and washed at the end of each day's work.

BRICK

- a. All bricks shall be of first class quality made from good brick earth, free from saline deposits and shall be sand moulded. They shall be thoroughly burnt without being vitrified, shall be regular, uniform in shape and size with sharp and square edges parallel faces and of deep red or copper colour. First class bricks shall be homogeneous in texture and emit a clear ringing sound when struck, and shall be free from flaws, cracks, chips, stones and nodules of lime. First class brick in an oven dried condition shall not absorb more than 1/5 of its weight of water when immersed for one hour in water at 21 to 27 degrees centigrade and shall show no signs of efflorescence on subsequent drying. The average compressive strength of five representative first class bricks shall be 15N/mm. sq. and shall no result shall fall below 10 N/mm sq. The bricks in general shall conform to the requirements of IS: 1077.
- b. All bricks shall be manufactured by the Trench Kiln method or other standard methods approved by the Project Engineer. The earth used in manufacturing bricks shall be carefully selected and shall be free from objectionable quantities of lime, gravel coarse sand, roots, or other organic matter salts shall not exceed 0.3% and calcium carbonate shall not exceed 2.0%.
- c. The moulds used in the manufacture of bricks shall be thoroughly sanded before each use and shall be sufficiently larger than the size of the bricks being manufactured to allow for shrinkage in drying and burning. The size ready for use shall be 9" by 4 3/8" by 2 3/4" (229X 112X 70mm) and shall weigh between 3.2 to 4.2 Kilograms. All bricks shall have a "Frog" 1/4" deep on one face.

PLACING

- a. The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the brick nor delay the use of mixed mortar. Brick shall not be placed during rains sufficiently heavy or prolonged to wash the mortar from the brick. Mortar which becomes diluted by rain shall be removed and replaced before continuing with the work. All bricks to be used in brick masonry shall be moistened with water for three to four hours before they are used. The chosen method of wetting shall ensure that all bricks are thoroughly and uniformly wetted. All bricks shall be free from water adhering to their surface when they are placed in the brick masonry.
- b. Bricks shall be laid "Frog" upward with mortar joints and in English bond as directed by the Project Engineer. Both bed and vertical joints shall be 6mm in thickness completely filled with cement mortar as specified herein, and each brick shall be bedded by firmly tapping with the handle of the trowel. All horizontal joints shall be parallel and all vertical joints in alternate courses shall be directly over one another. Excess mortar at the outer edges shall be removed and joints drawn straight with the edge of a trowel and a straight edge. All anchors and similar work required to be embedded in the brick masonry shall be installed as the work progresses. At the completion of the work all holes or defective mortar joints shall be cut out and repointed.
- c. The exterior faces of the walls shall be finished by striking the joints as the work proceeds.

The joints shall be struck by raking the green mortar after the brick work has been laid and finishing the joint with a pointing tool. Horizontal joints shall be struck to form weathered joints and vertical joints shall be struck with a V notch. Care shall be taken that the striking tools do not develop a cutting edge as the object of striking the joint is to compress the mortar into the joints.

CURING AND REPAIR

- a. All brick masonry shall be water cured and shall be kept wet for least seven days by an approved method which will keep all surfaces continuously wet. Water used for curing shall meet the requirements of these specifications for water used in the manufacture of bricks.
- b. If, after the completion of any brick masonry work, the brick are not in alignment or level or does not conform to the lines and grades shown on the drawings, or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Project Engineer grants permission, in writing to patch or replace the defective area.

TOLERANCES

The brickwork shall be erected plumb and true to line at level with the maximum variation in any storey height of any length of wall being one meter. The maximum tolerance in the length, height or width of any single masonry unit shall be +/- 3mm.

MEASUREMENT AND PAYMENT

GENERAL

Except otherwise specified herein or elsewhere in the contract documents, the measurement and payment will be made for the under mentioned specified works related to the relevant items of the bill of quantities.

MEASUREMENT

Measurement of acceptable completed works of brick masonry will be made on the basis of cubic meters provided and installed in position as shown on the drawing or as directed by the Project Engineer.

PAYMENT

Payment will be made for acceptable measured quantity of brick masonry on the basis of unit rate per cum quoted in the bill of quantities and shall constitute full compensation for all the works related to the items.

7. FINISHING

General

All plaster work shall be of the best workmanship and in strict accordance with the dimensions of the drawings. All plastering shall be finished to true levels including plumbs, without imperfections, and square with adjoining work. It shall form proper foundations for finishing materials such as paint etc. Masonry and concrete surface to which plaster is to be applied shall be clean, free from efflorescence, sufficiently rough and keyed to ensure proper bond.

All chasing, installation of conduits, boxes, etc. shall be completed before any plastering is commenced on a surface. Chasing or cutting of plaster will not be permitted. Broken corners shall be cut back less than 150 mm on both sides and patched with plaster of Paris as directed. All corners

shall be rounded to a radius. Contractor shall get samples of each type of plaster work approved by the Architect/Project Manager.

All chasing, installation of conduits, boxes, etc. shall be completed before any plastering is commenced on a surface. Chasing or cutting of plaster will not be permitted. Broken corners shall be cut back less than 150 mm on both sides and patched with plaster of Paris as directed. All corners shall be rounded to a radius. Contractor shall get samples of each type of plaster work approved by the Architect/Project Manager.

The materials used for plastering shall be proportioned by volume by means of gauge boxes. Alternatively it may be required to proportion the materials by weight.

PLASTER WORK

The joints in the brick work, concrete blocks, shall be raked to a depth of 15 mm while the masonry is green. Concrete surfaces to receive plaster shall be suitably roughened. All walls shall be washed with water and kept damp for 10 hours before plastering.

The plaster unless specified otherwise shall be average of 12 mm thick on walls. The finished texture shall be as approved by the Architect/Project Manager. The mix for plaster unless otherwise specified, shall be one part cement and four parts sand, to walls and one part cement, 3 parts sand to ceiling.

The interior plaster shall be applied in one coat only. The surface shall be trowelled smooth to an approved surface. All plaster work shall be kept continuously wet for seven days

The external plaster shall be of two coats on an overall thickness of minimum 20 mm. Preparations of walls to receive plaster work shall be the same as in internal plaster. Backing coat shall be 12 to 15 mm thick with cement mortar 1:5 and finishing coat shall be with cement mortar 1:3.

Backing coats shall be combed on wet surface to form keys for finishing coat. All external plaster shall be waterproofed with approved water proofing powder added to cement in proportion of 1.5 Kg. to 50 Kg. of cement as per the manufacturers' instruction, for both the coats. Cost of waterproofing powder per Kg. shall be paid for separately.

For sand faced cement plaster, the finishing coat shall be in cement mortar 1:3, sand used shall be of selected color, properly graded and washed so as to give a grained texture. Finishing plaster coat shall be 8 mm thick, uniformly applied and surface finished with special rubbing by sponge pads and other tools and recommended by the Architect/Project Manager.

8. Paver Blocks / Interlocking Concrete Block Pavement:

Shall confirm to IRC 63

Providing and fixing pre-cast Rubber Dye inter locking concrete block 60mm thick with grade of concrete M-30 compressed by mechanically pressed and as per approved design including 50 mm Sand layer for levelling and filling the joint with sand in proper line and level etc complete.

The scope of work includes supplying and laying of precast paver blocks at site, as mentioned in the Item. All relevant provisions of IS 15658:2006 shall apply. Laying of paver blocks at site as per requirement in technical specification, within shortest possible time. The work shall be executed in perfect line and level as per instructions of Engineer in charge. Colored concrete paver blocks shall be manufactured as per specifications using approved color pigment. The color shade shall be as selected by employer before commencement of the work. The contractor shall guarantee that all material and components designed, fabricated, supplied and laid by him shall be free from any type

of defect due to faulty material and/Workmanship/erection For a period of One year from the date of completion of work.

9. Grass Pavers

The grass pavers should have perpendiculars after release from the mould and the same should be retained until the laying. The surface should be of anti-skid and anti-glare type. The grass pavers should have minimum 50% opening for grass ,uniform chamfers to facilitate easy drainage of surface run off. The pavers should have uniform interlocking space of 2mm to 3mm to ensure compacted sand filling after vibration on the paver surface.

The concrete mix design should be followed for each batch of materials separately and automatic batching plant is to be used to achieve uniformity in strength and quality.

The pavers shall be manufactured in single layer only.

Skilled labour should be employed for laying blocks to ensure line and level for laying, desired shape of the surface and adequate compaction of the sand in the joints.

The pavers are to be skirted all round with kerbing using solid concrete blocks of size 100mm x 200mm x 400mm or as directed by the Engineer. The kerbing should be embedded for 100mm depth.

The concrete used for kerbing shall be cured properly for 7 days minimum.

10. Kota stone flooring

2 Materials

The stone shall be hard, sound, durable, homogeneous in texture and resistant to wear. These shall be without any soft veins, cracks or flaws and shall have uniform colour. They shall have natural surface free from broken flakes on top. Hand cut/ machine cut for exposed edges and machine polished. Kota stone shall be of the best quality and of the specified thickness, size and the shade, which shall be got approved by the Engineer-in-charge. The slabs / tiles shall be rectangular or square in shape or as per pattern shown in drawing and as directed by the Engineer-in-charge. The sizes given in schedule of quantities are tentative and can vary only slightly as per the availability in the market. The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the item. Tolerance of (+/-) 2 mm shall be allowed for the thickness. In respect of length & width, tolerance in length & width shall be permissible upto (+/-) 5 mm for hand cut slabs & (+/-) 2 mm for machine cut slabs. At its thinnest, no stone shall be thinner than the specified thickness.

Uniformity of size and colour / shade shall generally be maintained for the stones used in any one room. The exposed surface shall be machine polished to a smooth, even and true plane and the edges hand cut and dressed true and squares. The evenness of the surface of slabs and edges of the slab shall not be marred by careless dressing or handling, and no patching up shall be allowed for the slab. The edges shall be quite straight. The under face may be left as required or rough dressed. Before taking up the work, samples of stone slabs to be used and their dressing and polishing shall be got approved by the Engineer-in-charge and kept in his office as approved sample and the stone slabs to be used shall conform to the same.

3 Bedding/ Backing Coat

Kota Stone floorings when laid on ground , a base course of lean concrete mixCement Mortar 1:4:8 (Cement, Course Sand, Stone Aggregate 40mm nominal size) is to be provided between flooring and well compacted sub-base. The minimum thickness of Base-Course will be 100 mm for floors of buildings/ Platform/Concourse/Pathway etc.

4 Construction Details

Cement mortar as specified for bedding shall be uniformly mixed. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Care shall be taken in preparing the mortar to ensure that there are no hard lumps that would interfere with the even bedding of the stones. Before spreading the mortar, the sub-floor or base shall be cleaned of all dirt, set mortar scum or laitance and of loose materials by hacking and brought to original levels and then well wetted without forming pool of water on surfaces.

5 Fixing the stone slab/ tile:

Before laying, the stone shall be thoroughly wetted with clean water, neat cement grout (2.75 kg/ sqm.) of honey like consistency shall be spread on the mortar bed over as much areas as could be covered with the slabs within half an hour. The specified type of stone shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope in the mortar bed. Each stone shall be gently tapped with wooden mallet till it is firmly and properly bedded.

6 Curing

The work shall be kept well wetted with damp sand or water for seven days.

7 Polishing and cleaning

When the bedding and joints have completely set and attained required strength, the surface shall be machine polished to give smooth, even and true plane to the flooring. All flooring shall be thoroughly cleaned and handed over free from any mortar stains etc. Polishing shall be done as per relevant IS and IS-14223 (Specification for polished building stones).

11. Bedding Sand Course

The bedding sand shall consist of a clean well graded sand passing through 4.75mm sieve and suitable for concrete. The bedding . should be from either a single source or blended to achieve the following grading.

Bedding Sand Requirement

In Sieve Size	% Passed
9.52mm	100
4.75mm	95-100
2.36mm	80-100

1.18mm	60-100
600 Microns	25-60
300 Microns	10-30
150 Microns	5-15
75 Microns	0-10

- Contractor shall be responsible to ensure that single-sized, gap-graded sands or sands containing an excessive amount of fines or plastic fines are not used. The sand particles should preferably be sharp not rounded as sharp sand possess higher strength and resist the migration of sand from under the block to less frequently areas even though sharp sands are relatively more difficult to compact than rounded sands, the use of sharp sands is preferred for the more heavily trafficked driveways. The sand use for bedding shall be free of any deleterious soluble salts or other contaminants likely to cause efflorescence.
- The sand shall be of uniform moisture content and within 4% - 8% when spread and shall be protected against rain when stock piled prior to spreading. Saturated sand shall not be used. The bedding sand shall be spread loose in a uniform layer as per drawing. The compacted uniform thickness shall be of 45mm and within +/- 5mm thickness variation shall not be used to correct irregularities in the base course surface.
- The spread sand shall be carefully maintained in a loose dry condition and protected against pre-compaction both prior to and following screening. Any pre-compacted sand or screened sand left overnight shall be loosened before further laying of paving blocks take place.

Sand shall be slightly screened in a loose condition to the predetermined depth only slightly ahead of the laying of paving unit.

12. Painting

SCOPE

These specifications cover the use of paints for the plastered and concrete surfaces. It also includes the painting of wood and metal surfaces.

GENERAL

The provisions of the latest revisions of the following IS : Codes shall form a part of this specification.

IS: 63	Whiting for Painting Ready mixed paint, brushing, grey filler, for Enamels, for use over primers.
IS: 426	Specification for paste filler for colour coats.
IS : 428	Specification for Distemper, Oil Emulsion, colour as required.
IS : 710	Marine Plywood
IS : 1200 (Part XIII)	Method of Measurement of Building & Civil Engg. Works - White Washing colour washing, distemping & other finishes.

IS : 1477 (Part I)	Code of practice for painting for ferrous metals in buildings Pretreatment.
IS : 1477 (Part II)	Code of practice for finishing of ferrous metals in building. Painting
IS : 2338 (Part I)	Code of practice for finishing of wood and wood based materials Operations and workmanship for finishing.
IS : 2338 (Part II)	Code of practice for finishing of wood and wood based materials, Schedule.
IS : 2395 (Part I)	Code of practice for painting concrete masonry and plaster surfaces. Operation & workmanship
IS : 2395 (Part II)	Code of practice for painting concrete, masonry and plaster surfaces. Schedule.
IS : 159	Specification for ready mixed paint, brushing, acid resistant.
IS : 2524 (Part I)	Code of practice for painting of non-ferrous metal in building Pre-treatment.
IS : 2524 (Part III)	Code of practice for painting of non-ferrous metal in building Painting.
IS : 3140	Code of practice for painting asbestos cement buildings.
IS : 5410	Specification for cement paints, colour as required.IS:15489-04 Specification for External Paint

Other IS Codes not specifically mentioned here, but pertaining to painting form part of these specifications.

MATERIALS

Materials shall strictly conform to the relevant IS: Specifications.

PLASTERED OR CONCRETE SURFACES

General

Wherever scaffolding is necessary, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be painted..

For painting on external surfaces secured double scaffolding to be used.

Where ladders are used, pieces of old gunny bags shall be tied at top and cotton to prevent scratches to the walls and floors. For painting of ceilings, proper stage scaffolding shall be erected, where necessary.

Preparation of surfaces

The surface shall be thoroughly cleaned off all dirt, dust, mortar dropping and other foreign matter, before paint is to be applied. New plaster surfaces shall be allowed to dry for at least 2 months, before applying paint. All unnecessary nails shall be removed. Pitting in plaster shall be made good

with putty. The surface shall then be rubbed down again with a fine grade sand paper and made smooth.

The surface shall be allowed to dry thoroughly before the regular cost of paint is allowed.

The surface affected by mounds moss, fungi, algae lichens, efflorescence shall be treated in accordance with IS 2395 (Part I) before applying paint. The Adjoining surfaces/finishes shall be protected with either masking tape / plastic to avoid damages to other finishes.

The masking tape / plastic shall be removed without damaging the finishes.

WATER PROOF CEMENT PAINT

PREPARATION OF SURFACES

The surfaces shall be thoroughly wetted with clean water before the waterproof cement paint is applied.

PREPARATION OF PAINT

Portland cement paints are made readily by adding paint power to water and stirring to obtain a thick paste, which shall then be diluted to a brushable consistency. Generally equal volumes of paint powder and water make a satisfactory paint. In all cases the manufacturer's instructions shall be followed. The paint shall be mixed in such quantities as can be used up within an hour of mixing as otherwise the mixture will set and thicken, affecting flow and finish.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly air set due to its hygroscopic qualities.

APPLICATION OF PAINT

No painting shall be done when the paint is likely to be exposed to a temperature of below 7 degree within 48 hours after application.

When weather conditions are such as to cause the paint to dry rapidly, work shall be carried out in the shed as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

To maintain a uniform mixture and to prevent segregation the paint shall be stirred frequently in the bucket.

For undercoated surfaces, the surface shall be treated with minimum two coats of water-proof cement paint. Not less than 24 hours shall be allowed between two coats and the second or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather the preceding coat shall be slightly moistened before applying the subsequent coat.

The finished surface shall be even and uniform in shade without patches, brush marks, paint drops, etc.

Cement paints shall be applied with a brush with relatively short stiff hog or fibre bristles. The paint shall be brushed in uniform thickness and shall be free of excessively heavy brush marks. The laps shall be well brushed out.

CURING

Painted surfaces shall be sprinkled with water two or three times a day. This shall do between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to be damaged by the sprinkling of water, say about 12 hours after its application.

PAINTING WOOD AND METAL SURFACES

GENERAL REQUIREMENT

The material required for the execution of painting work shall be obtained directly from approved manufacturers and brought to the site in maker's drums, with seals unbroken. All paints of low VOC shall conform to relevant Indian Standards as mentioned under sub-head "Material".

All materials not in actual use shall be kept properly protected. Lids of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. Materials, which have become stale or fat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in the smaller container. No left over paint shall be put back into stock tins. When not in use, the containers shall be kept properly closed.

If for any reason thinning is necessary, in case of ready mixed paint, the brand of thinner recommended by manufacturer shall be used.

Painting except the priming coat shall generally be taken in hand after all other builder's work is practically finished. The rooms shall be thoroughly swept out and the entire building cleaned up at least one day in advance of the paintwork being started. The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt scales, smoke and grease shall be thoroughly removed before painting is started.

No painting on exterior or other exposed parts of the work shall be carried out in wet, humid or otherwise unfavorable weather and all the surfaces must be thoroughly dry before painting work is started.

BRUSHING OF PAINT

The brushing operations are to be adjusted to the spreading capacity advised by the manufacturers of the particular paint. The painting shall be applied evenly and smoothly by means of crossing and laying off, the later in the direction of the grain of wood. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternatively in the opposite directions two to three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute out coat.

During painting, every time after the paint has been worked out of the brush bristles or after the brush has been unloaded, the bristles of the brush. (Which are drawn together due to the high surface tension) shall be opened up by striking the brush against a portion of the unpainted surface with the end of the bristles held at right angles to the surface, so that bristles thereafter will collect the correct amount of paint when dipped again into the paint container.

SPRAYING

Where so stipulated, the painting shall be done with spray. Spray machine used may be (a) high pressure (small air aperture) type or (b) a low-pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner.

Spraying should be done only when dry conditions prevail. During spraying the spray gun shall be held perpendicular to the surface to be coated and shall be passed over the surface in a uniform sweeping motion. Different air pressures and fan adjustment shall be tried so as to obtain the best application with the minimum wastage of paint. The air pressure shall not be kept too high as otherwise the paint will clog up and will be wasted.

Spots that are inaccessible to the spray pattern shall be touched up by brush after spraying.

At the end of the job, the spray gun shall be cleaned thoroughly so as to be free from dirt. Incorrect adjustments shall be set right, as otherwise they will result in variable spray patterns, runs, sags and uneven coats.

Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved 'from the Engineer-in-charge before next coat is started.

Each coat except the last coat shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is applied.

No hair marks from the brush or clogging of paint puddles in the corner panels, angles of mouldings, etc. shall be left on the works. In painting doors and windows, the putty round the glass panes shall also be painted but care shall be taken to see that no paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting.

In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

The additional specifications for primer and other coats of paints shall be according to the detailed specifications under the respective headings.

BRUSHES AND CONTAINERS

After work, the brushes shall be completely cleaned off paint and linseed oil by rinsing with turpentine. After cleaning, brushes are wrapped in heavy paper or waterproof paper for storage. It is to be used the next day; it shall be hung in a thinner or linseed oil in a container. On no account shall brushes be made to stand on bristles. A brush in which paint has dried up is ruined and shall on no account be used for painting work.

The containers, when not in use, shall be kept closed and free from air so that paint does not thicken and also shall be kept guarded from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, before they can be used again.

WHITE WASHING

GENERAL

The item refers to whitewashing over old and new concrete, stone masonry brick plastered surfaces and asbestos cement sheets.

White wash shall be prepared from fresh burnt white stone lime or shell lime. This lime shall be of class type as per IS: 712. Surkhi lime or lime of equivalent quality may be used. The lime shall be dissolved in a tub with sufficient quantity of water (about 4.5 liters/Kg. Of lime) and the whole shall be thoroughly mixed and stirred until it attains the consistency of thin cream. The white wash shall be taken out in small quantities and strained through a clear course cloth. Alternatively with IS : 63 may also be used. Clean gum dissolved in hot water shall then be added in suitable proportion of 2 gm of gum Arabic to a little of lime or whiting to prevent the white-wash coming off easily when rubbed. Rice may be used instead of gum.

SCAFFOLDING

This may be double or single according to requirements. If ladders are used, pieces of old gunny bags or cloth rags shall be tied on their tops to avoid damage or scratches to the wall. Proper stage scaffolding shall be created when whitewashing ceiling. The contractor shall be responsible for accidents if any taken place.

PREPARATION OF SURFACE

The surface shall be prepared by removing all mortar dropping and foreign matter and thoroughly cleaned with wire or fiber brush or other means as may be ordered by the Engineer to produce an

approved clean and even surface. All loose pieces and the scales shall be scraped off and holes stopped with mortar. In case where the surface has been previously colour washed, the old colour wash must be entirely removed before the white-wash is applied. In the case of surface, which has once been white-washed, the old loose white-wash shall be broomed down. In case, the loose whitewash cannot be removed by brooming, the Engineer may order scraping of the surface. After cleaning the surface as specified above, the unwanted nails shall be removed and all nail holes, cracks and crevices stopped with mortar similar in composition to the surface to be stopped. The mortar should be cured.

APPLICATION OF WHITE-WASH

On the surface so prepared, the whitewash shall be laid. Each coat shall be laid on with a brush. The first stroke of the brush shall be from the top downward, another from bottom upwards over the first stroke, and similarly, one stroke from the right and another from the left over the first brush before it dries. This will form one coat. Each coat must be allowed to dry and shall be subject to inspection before the next coat is applied. When dry, the surface shall show no signs of cracking. It shall present a smooth and uniform finish free from brush marks and it should not come off easily when rubbed with a finger.

No portion in the surface shall be left out initially, to be patched up later on. For new work, the white washed surface shall present a smooth and uniform finish.

For old work, patches and repairs shall be white washed first. Thereafter, the whole surface shall be white washed with the required number of coats.

Doors, windows, floors and other articles of furniture, etc. shall be protected from being splashed upon. Splashing and droppings, if any, shall be removed and the surfaces cleaned.

PREPARING THE SURFACE FOR WHITE WASH INCLUDING THE SCAFFOLDING

Applying the white wash in required number of coats as specified above and prior white washing of repaired patched.

PAINTING TO EXTERNAL SURFACES

GENERAL

Weather shield paint of low VOC from the approved brand shall be applied over plastered surfaces as directed by the EIC.

Other specifications including preparation of surfaces, application of paint etc. shall conform to section 7.0 above and as directed by EIC. The priming coat, anti-fungal treatment, preparation of paint etc. shall be carried out as per manufacturer's specification /as directed by EIC. General Acrylic weather shield paint shall be applied on surfaces which are liable to external condensation and are to be used generally on masonry or plastered surfaces. Suitable primer as per manufacturer shall be provided.

PAINT

Weather shield paint of approved brand and manufacture as per the required shade shall be used.

PREPARATION OF SURFACE

The surface shall be thoroughly cleaned of dust, old white or colour wash by washing and scrubbing. The surface shall then be allowed to dry for at least 48 hours. It shall then be sand papered to give a smooth and even surface. Any unevenness shall be made good by applying

external putty mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry.

APPLICATION

The number of coats shall be as stipulated in the item.

The paint will be applied in the usual manner with brush or roller.

The paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non-absorbent surfaces.

The thinning of paint is to be done with water and not with turpentine.

Thinning with water will be particularly required for the undercoat, which is applied on the absorbent surface. The quantity of thinner to be added shall be as per manufacturer's instructions.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance.

PRECAUTIONS

Old brushes if they are to be used with paints should be completely dried of turpentine or oil paints by washing in warm soap water.

Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the paint from hardening on the brush.

In the preparation of walls for painting, no oil base putties shall be used in filling cracks, holes etc it should be only the external putties.

Splashes on floors etc. shall be cleaned out without delay, as they will be difficult to remove after hardening.

Washing of surfaces treated with emulsion paints shall not be done within 3 to 4 weeks of application.

13. Erection of Structural Steel

This specification covers the general requirements for erection of structural steel. In addition to provision of erection and transport equipment, the scope of work includes supply of tools and tackles, consumables, materials, labor and supervision and shall cover the following:

- Storing and staking of all fabricated structural components/units/assemblies at site storage yards till the time of erection.
- Transportation of structures from storage yard to site of erection, including multiple handling, if required.
- All minor rectifications/ modifications such as:-
 - i. Removal of bends, kinks, twists etc for parts damaged during transportation and handling
 - ii. Reaming of holes which do not fit properly, or which are damaged, for use of next higher size bolt.
 - iii. Plug-welding and re-drilling of holes which do not register, and which cannot be reamed for use of next higher size bolt.
 - iv. Drilling of holes which are either not drilled at all or are drilled in incorrect position during fabrication.
- Fabrication of minor missing items as directed by the Employer
- Verification of the position of embedded anchor bolts and inserts w.r.t lines and levels, installed by others based on Geodetic Scheme /Bench Mark/Reference co-ordinates to be furnished by Employer.

- Verification of actual dimensions of structures (erected by others) which would have bearing on the cutting lengths, end connections etc of those members which are to be erected under this scope of work.
 - Assembly at site of steel structural components wherever required, including temporary supports and staging
 - Making arrangements for providing all facilities for
 - i. Conducting Ultrasonic Testing (UT) by reputed testing laboratories approved by Employer.
 - ii. Making available test films / graphs, with reports / interpretation.
 - Rectifying at site damaged portions of shop primer by cleaning and application touch-up paint.
 - Erection of structures including making connections by bolts/ High strength Friction Grip bolts / welding as per drawing.
 - Alignment of all structures true to line, plumb and dimensions within specified limits of tolerance.
 - Application at site after erection, required number of coats of primer and finishing paint as per specification.
 - Rectification of structures as per preliminary acceptance report and Final acceptance report.
- All necessary items of work required for satisfactory completion of job on schedule.

13.1 APPLICABLE CODES STANDARDS & SPECIFICATIONS

The pertinent clauses of the following Indian Codes, Standards and Specification (latest editions including all applicable official amendments, reaffirmations and revisions) shall apply to the material and workmanship covered by this specification. In the event of the conflict of certain requirements between this specification and the codes referred herein, this specification shall govern. It is not the intent to specify herein all the codes and standards required for the satisfactory completion of work. The list of codes and standards indicates certain primary codes & standards and not all the codes required for the work under the contract. It is understood that all the pertinent codes and standards shall form the part of this specification whether explicitly indicated or not.

Reference codes and standards:

IS 800 General Constructions in Steel –Code of Practice.

IS 806 Code of Practice For Use Of Steel Tubes In General Building Construction.

IS 822 Code of Procedure for Inspection of Welds.

IS:1363 Hexagonal Head Bolts, screw and nut of Product grade C

IS:1367 Technical Supply Conditions for threaded fastener (all parts)

IS 4000 Code of Practice High strength bolts in Steel Structures.

IS 7205 Safety code for erection of structural steel

IS 7969 Safety code for handling and storage of building Materials

IS:9595 Metal Arc Welding of Carbon and Carbon manganese steel.

IS 12843 Tolerances for erection of steel structures.

SP:6(1) Structural Steel Sections.

AWS D1.1 Structural Welding Code: Steel

13.2 REGULATORY REQUIREMENTS

The work covered in this specification, shall comply with all relevant government and local laws, regulations and standards. For subjects not covered by regulations, codes, standards or specifications, the materials and construction shall be based on good engineering practice, subject to approval by EMPLOYER.

13.3 ERECTION SCHEME

CONTRACTOR after the award of work shall submit a detailed erection scheme covering the period of completion of all the works covered under the specification for ENGINEER's approval. The erection scheme shall include but not limited to the following.

- i. Methods proposed to be employed for transporting his equipment's, tools, tackles, gas cylinders, electrodes and all that is necessary to site.
- ii. Type, capacity and quantity of equipment that the CONTRACTOR proposes to bring to site for unloading, transporting within the site, handling, assembling, hoisting and erecting of the structural steel components for all these operations.
- iii. Strength and trade wise composition of the work force and supervisory personnel that will be deployed by the CONTRACTOR for the various operations.
- iv. Any special specific scheme being adopted for erection of special / complicated structural elements such as roof trusses etc.

A brief write-up covering the above activities shall be submitted along with the bid document by the Bidder during submission of his bid. ENGINEER reserves the right to direct the CONTRACTOR either at the start or during the contract period, to mobilize additional resources in terms of labour, material, equipment, tools and plant etc at no cost to the EMPLOYER if in his opinion that the resources employed by the CONTRACTOR does not meet the schedule of completion.

13.4 ERECTION PROGRAMME

Within two (2) weeks of acceptance of bid the CONTRACTOR shall submit a detailed erection programme with dates and estimated completion time for various parts of the work for ENGINEER's approval. This programme shall broadly comprise the following:

- i. Layout plan identifying the areas proposed for unloading, main storage, Subsidiary storage and assembly
 - ii. Transportation of fabricated material between the storage and work areas.
 - iii. Layout to indicate the points at which proposed erection begins, direction in which it is proposed to progress, the deployment of equipment, access route for cranes to reach work areas, etc.
 - iv. The locations and extent of site offices and stores, labor quarters if any.
 - v. Layout of electrical cables and water pipes from the tap-off points.
 - vi. Details of the method of handling, transport, hoisting and erection including false work/staging, temporary bracing, guying, etc. along with complete details of the quantity and capacity of the various items of erection equipment that will be used.
 - vii. Site organization chart showing the number of supervisory personnel, and the number and composition of the various gangs.
 - viii. Safety measures to be adopted at site of erection and organization chart showing safety personnel.
- Any modifications to the erection programme directed by ENGINEER for the reasons of inadequacy of
- i. The quantity and/or capacity of the erection equipment.
 - ii. Erection personnel and supervisors, temporary bracing, guying etc.,
 - iii. Safety of the erection methods, or stability of the erected portions of structures, or unsuitability of the erection sequence due to interference with the work of other agencies.
 - iv. Any other unforeseen events which may delay the schedule.
 - v. Safety measures proposed.

Shall be incorporated by CONTRACTOR and the work shall be carried out in accordance with the revised programme. Approval by ENGINEER shall not relieve the CONTRACTOR from the responsibility for the safe, sound, accurate and timely erection of structural steel work as required by ENGINEER/EMPLOYER.

CONTRACTOR shall also make no extra claims for bringing additional equipment to site for erection, if so directed by ENGINEER. CONTRACTOR shall be deemed to have visualized all erection problems while bidding for the work and no additional compensation shall be claimed on this account.

13.5 ACCEPTANCE, HANDLING AND STORAGE

The fabricated material received at erection site shall be verified with respect of marking on the key plan / marking plan or shipping list. Any material found damaged or defective shall be stacked separately and the damaged or defective material shall be painted in distinct colour for identification and the same shall be brought to the notice of ENGINEER. No dragging of steel shall be permitted. All fabricated items shall be stored 300mm above ground on suitable packing to avoid damage. It shall be stored in the order required for erection, with erection marks visible. All storage areas shall be prepared and maintained by CONTRACTOR. Steel shall not be stored in the vicinity of areas where excavation or grading will be done and, if so stored temporarily, this shall be removed by CONTRACTOR well before such excavation and/or grading commences to a safe distance to avoid burial under debris. Scratched or abraded steel shall be given a coat of primer in accordance with TCE specification M4-405-04 (painting of structural steel) after unloading and handling prior to erection. All milled and machined surfaces shall be properly protected from rust/corrosion by suitable coating and also from getting damaged.

13.6 ANCHOR BOLTS, EMBEDDED PARTS AND FOUNDATIONS

CONTRACTOR shall carefully check the location, level and layout of anchor bolts embedded in foundations constructed by others, to ensure that the structures can be properly erected as shown on the drawings. Any discrepancy in the anchor bolts/foundation shall be reported to ENGINEER. CONTRACTOR shall carefully check the actual dimensions of structures and also the location, level and sizes of embedded parts a) in the RC beam /column and/ or b) cleats / plates provided in steel beam /column constructed by others to receive structures covered under this scope of work. CONTRACTOR shall take note of discrepancies if any, shall be reported to ENGINEER and fabricate the structures covered under this contract suitably before the commencement of erection.

Levelling of column bases to the required elevation may be done either by providing shims or three nuts on the upper threaded portion of the anchor bolt. All shim stock required for keeping the specified thickness of grout and in connection with erection of structures on foundations, crane brackets or at any other locations shall be of good M.S. plates and shall be supplied by CONTRACTOR at his cost.

A certain amount of chipping/cleaning of foundations and preparing the area is considered normal and shall be carried out by CONTRACTOR at no extra cost. Where beams bear in pockets or on walls, bearing plates shall be set and levelled as part of the work. All grouting under column base plates or beam bearing plates will be carried out by CONTRACTOR, unless the grouting is specifically excluded from the CONTRACTOR's scope.

13.7 ASSEMBLY AND CONNECTIONS

Field connections may be affected either by bolting, welding or by use of high strength friction grip bolts as shown in the design and erection drawings. All bolts, nuts, washers, rivets, electrodes required for field connections shall be supplied by CONTRACTOR free of cost. The materials shall have prior approval from the EMPLOYER /ENGINEER and necessary test certificates shall be furnished to ENGINEER's approval.

Materials shall be procured from the reputed manufacturers with prior approval from EMPLOYER/ENGINEER. All assembling shall be carried out on a level platform. Drifts shall be used only for drawing the work to proper position and must not be used to such an extent as to damage the holes. Size

of drifts larger than the nominal diameter of hole shall not be used. Any damaged holes or burrs must be rectified to the satisfaction of ENGINEER.

Corrections of minor misfits and reasonable amount of reaming shall be considered as a part of erection. Any error in the shop, which prevents proper fit on a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to ENGINEER.

13.8 ERECTION

Erection work shall be taken up after receipt of clearance from the ENGINEER. All structural steel shall be erected as per approved Design / fabrication drawings.

For safety requirements during erection, provisions of IS: 7205, IS: 7969, IS 800 and other relevant codes shall be strictly followed.

Erection shall be carried out with the help of maximum mechanization possible. Prior to commencement of erection, all the erection equipment, tools, tackles, ropes etc shall be tested for their load carrying capacity. Such tests may be repeated at intermediate stages also if considered necessary. Frequent visual inspection shall be done of all vulnerable areas and

components to detect damages or distress in the erection equipments, if any. Temporary bracing, whenever required, shall be provided to sustain forces due to erection loads and equipment etc. Erected parts of the structure shall remain stable during all stages of erection when subjected to action of wind, dead weight and erection forces etc. Such bracings shall be left in place as long as may be required for safety and stability. Specified sequence of erection of vertical and horizontal structural members shall be followed. Erected members shall be held securely in place by bolts to take care of dead load, wind / seismic load and erection load. All structural members shall be erected with erection marks in the same relative position as shown in the appropriate erection and shop drawings.

All connections shall achieve free expansion and contraction of structures wherever provided.

No final bolting or welding of joints shall be done until the structure has been properly aligned and approved by ENGINEER. For positioning beams, columns and other steel members, the use of steel sledges is not permitted.

Instrumental checking of correctness of initial setting out of structures and adjustment of alignment shall be carried out in sequence and at different stages as required using precision survey instruments. The final levelling and alignment shall be carried out immediately after completion of each section of a building.

The CONTRACTOR shall design, manufacture, erect and provide false work, staging temporary support etc, Required for safe and accurate erection of structural steelwork and fully responsible for the adequacy of the same.

The CONTRACTOR shall also provide facilities such as adequate temporary access ladders, gangways, tools & tackles, instruments etc. to EMPLOYER for his inspection at any stage during erection. Proper size steel cable slings, etc., shall be used for hoisting. Guys shall not be anchored to existing structures, foundations, etc. unless so permitted by ENGINEER in writing. Care shall be taken to see that ropes in use are always in good condition. Steel columns in the basement, if any, are to be lowered and erected carefully with the help of a crane and/or derrick without damaging the basement walls steel or floor.

Structural steel frames shall be erected plumb and true. Frames shall be lifted at such points that they are not liable to buckle and deform. Trusses shall be lifted only at node points. Trusses which are very slender in the lateral direction shall be provided with temporary lateral

supports till the horizontal bracings are erected. All steel columns and beams shall be checked for plumb and level individually before and after connections are made.

Chequered plates shall be fixed to supporting members by welding or by countersunk bolts as shown/specified in relevant drawings and/or as directed by ENGINEER. The edges shall be made smooth and no burrs or jagged ends shall be left. While splicing, care should be taken so that there is continuity in pattern between the two portions. Care should also be taken to avoid distortion of the plate while welding. The erection of chequered plates shall include:

- a. Welding of stiffening angles/vertical stiffening ribs as per drawings
- b. Cutting to size and making holes to required shape wherever necessary to allow service lines such as piping, cables etc to pass through
- c. Splicing as shown in relevant drawings
- d. Smoothing of edges
- e. Fixing of chequered plates by welding and/or countersunk bolts
- f. Providing lifting hooks for ease of lifting.

Cutting, heating or enlarging holes may be carried out only with prior written Approval from the ENGINEER.

13.9 FIELD CONNECTIONS:

Assembly by Permanent Bolts:

- The number of washers on permanent bolts shall not be more than two (2) and not less than one (1) for the nuts and one (1) for the bolt head.
- Only wooden rams or mallet shall be used in forcing members into position in order to protect the metal from injury or shock.
- Where bolting is specified on the drawing, the bolts shall be tightened to the maximum limit.
- The threaded portion of each bolt shall project through the nut by at least one thread. Tapered washers shall be provided for all heads and nuts to achieve uniform bearing on sloping surface.
- To prevent loosening of nuts, spring washers or lock-nuts shall be provided as specified in the design / shop drawings.
- All machine fitted bolts shall be perfectly tight and the ends shall be checked to prevent nuts from becoming loose. No unfilled holes shall be left in any part of the structure.

ASSEMBLY BY WELDING:

- All field assembly by welding shall be executed in accordance with the requirements for shop fabrication. Where the steel has been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joints to be welded.
- All other requirements of welding and its acceptance standards shall be in accordance with clauses specified in TCE.M4-405-01(Supply and Fabrication of structural steel).

Assembly by High Strength Friction Grip Bolts (HSFG Bolts)

- Assembly of structures with HSFG bolts shall conform to IS:4000
- The mating surface shall be prepared in accordance with the requirements of design in order to achieve required properties to develop adequate friction between the surfaces.
- The mating surfaces shall be absolutely free from grease. Lubricant, dust, rust etc and shall be thoroughly cleaned before assembly. The nuts shall be tightened up to the specific torque with the help of torque wrench or by half-turn method with the help of pneumatic wrench lever.
- The direction of tightening of the nuts shall be from the middle towards the periphery of assembly.

- After desired tightening the bolt heads, nuts and edges of the mating surfaces shall be sealed with a coat of paint to obviate entry of moisture.
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13.10 INSPECTION

ENGINEER/EMPLOYER or their authorised representatives shall have free access to all parts of the job during erection and all erection shall be subjected to their approval. In case of faulty erection, all dismantling and re-erection required will be at CONTRACTOR's cost. No paint shall be applied to rivet heads or field welds or bolts until these have been approved by ENGINEER.

13.13 TOLERANCES

Tolerances mentioned below shall be achieved after the entire structure or part thereof is in line, level and plumb. The tolerances specified below do not apply to steel structures where the deviations from true position are intimately linked with and directly influence technological process. In such cases, the tolerances on erected steel structures shall be as per recommendations of process technologists/suppliers which will be indicated in the drawings.

COLUMNS

- ☐ Deviation of column axes at foundation top level with respect to true axes
 - (a) In longitudinal direction: ± 5 mm
 - (b) In lateral direction: ± 5 mm
 - ☐ Deviation in the level of bearing surface of ± 5 mm
- Columns at foundation top with respect to True level Out of plumbness (verticality) of column Axis from true vertical axis, as measured at Column top:
- (a) For columns up to and including $15 \pm 1/1000$ of column height in mm or ± 15 mm Meters in height whichever is less.
 - (b) For columns exceeding 15 meters $\pm 1/1000$ of column height in mm or ± 20 mm in height Whichever is less.
- ☐ Deviation in straightness in $\pm 1/1000$ of column height in mm or ± 10 mm Longitudinal and transverse planes of whichever is less. Column at any point along the height
 - ☐ Difference in erected position of adjacent Pairs of columns along length or across ± 10 mm
- Width of building prior to connecting width of building prior to connecting Trusses/beams with respect to true distance
- ☐ Deviation in any bearing or seating level ± 5 mm with respect to true level
 - ☐ Deviation in differences in bearing levels of a member on adjacent pair of columns both ± 10 mm Across and along the building

TRUSSES AND BEAMS

- ☐ Shift at the centre of span of top chord $\pm 1/250$ of height of truss in mm or ± 15 Member with respect to the vertical plane mm Whichever is less. Passing through the centre of bottom chord
- ☐ Lateral shift of top chord of truss at the Centre of span from the vertical plane whichever $\pm 1/1500$ of span of truss in mm or ± 15 passing through the centre of support of the truss mm whichever is less
- ☐ Lateral shift in location of truss from its true Vertical position ± 10 mm
- ☐ Lateral shift in location of purlin true Position ± 5 mm
- ☐ Deviation in difference of bearing levels of Trusses or beams from the true difference
 - i) ± 20 mm for trusses
 - ii) For beams:
 - Depth < 1800 mm: ± 6 mm
 - Depth > 1800 mm: ± 10 mm

- ☐ Deviation in sag in chords and diagonals of Truss between node points 1/1500 of length in mm or 10mm whichever is smaller
- ☐ Deviation in sweep of trusses, beams etc in 1/1000 of span in mm subject The horizontal plane to a maximum of 10 mm

CRANE GIRDERS & RAILS

- ☐ Shift in the centre line of crane rail with respect to centre line of web of crane girder ± 5 mm
- ☐ Shift in plan of alignment of crane rail with respect to true axis of crane rail at any point ± 5 mm
- ☐ Difference in alignment of crane rail in plan measured between any two points 2 ± 1 mm meters apart along rail
- ☐ Deviation in crane track with respect to time gauge
 - (a) For track gauges up to and including ± 5 mm 15 meters
 - (b) For track gauges more than 15 Meters $\pm [5 + 0.25 (S-15)]$ where S in meters is true gauge
- ☐ Deviation in the crane rail level at any Distance point from true level 1/1200 of the gauge or ± 10 mm whichever is less
- ☐ Difference in the crane rail actual levels Between any two points 2 meters apart Along the rail length ± 2 mm
- ☐ Difference in levels between crane track Rails at
 - (a) Supports of crane girders ± 15 mm
 - (b) Mid span of crane girders ± 20 mm 2 mm subject to grinding of surfaces
- ☐ Relative shift of crane rail surfaces at a smooth transition. joint in plan and elevation
- ☐ Relative shift in the location of crane stops end buffers) along the crane tracks with 1/1000 of track gauge S in mm subject to track gauge S in mm maximum of 20mm

13.40 PAINTING

After steel has been erected, all bare and abraded spots, field welds, bolt heads and nuts shall be spot painted. Before paint is applied, the surface shall be dry and free from dust, dirt, scale and grease.

13.15 CLEAN UP OF WORK SITE

During erection, the CONTRACTOR shall without any additional payment, at all times keep the working and storage areas used by him, free from accumulation of waste materials or rubbish. Before completion of erection, he shall remove or dispose of in a satisfactory manner all temporary structures, waste and debris and leave the premises in a condition satisfactory to EMPLOYER/ENGINEER.

13.16 PAINTING OF STRUCTURAL STEEL

- ☐ This specification covers the general requirements for shop and field painting for Structural Steel works using hot /cold rolled steel sections joined by using bolting and/or welding.
- ☐ Briefly the scope of works covered under this specification are;
 - i. Supply of all primers, paints and all other materials required for painting other than Employer's supply.
 - ii. Furnishing of all labor, materials, tools & equipment and the performance of all operations and incidentals necessary for surface preparation, painting, handling, storing, transporting, scaffolding etc.
 - iii. Testing of paints as per the relevant codes in the Standard Laboratory identified by the Employer and furnishing of required test certificates for Employer's approval.
 - iv. Repair work of damaged / pre-erection / fabrication shop primer and weld joints at field.
 - v. Inspection of painting system after its application to conform to the specification requirement.

vi. Any other requirement as required for satisfactory completion of specified work.

□ Reference shall be made to Data Sheet-A for Paint system and Data Sheet-B for the structures covered in the scope of works.

13.17 EXCLUSIONS

This specification excludes paintings of the following structures /equipment. Mechanical & electrical equipment and parts.

- i. Buried & Overhead piping works
- ii. Storage tanks
- iii. Insulated parts

13.18 APPLICABLE CODES, STANDARDS

The pertinent clauses of the following Indian / International Codes, Standards And Specification (latest editions including all applicable official amendments, Reaffirmations and revisions) shall apply to the material and workmanship covered by this specification. In the event of the conflict of certain requirements between this specification and the codes referred herein, this specification shall govern.

It is not the intent to specify herein all the codes and standards required for the satisfactory completion of work. The list of codes and standards indicates certain primary codes & standards and not all the codes required for the work under the contract. It is understood that all the pertinent codes and standards shall form the part of this specification whether explicitly indicated or not.

Indian Standard Codes

1. IS:5 Colours for ready mixed paints and Enamels
2. IS:101 Methods of sampling and test for paints, varnishes and related products (all parts & all sections).
3. IS:104 Ready mixed paint, brushing, zinc chrome, priming
4. IS:158 Ready Mixed paint, Brushing, Bituminous, Black, Lead free, Acid, Alkali and heat resisting.
5. IS:1303 Glossary of Terms relating to paints
6. IS:1477 Code of practice for painting of ferrous metals in Buildings.
7. IS:2932 Enamel, synthetic, exterior:(a) undercoating (b) finishing- Specification
8. IS: 9954 Pictorial Surface Preparation Standards for Painting of Steel Surfaces.
9. IS:13183 Aluminium paint, Heat resistant-specification.
10. IS:2074 Ready Mixed Paint, Air Drying, Red Oxide Zinc Chrome, Priming -Specification.

International Standard Codes

- i. SSPC Society for Protective Coatings (USA) Volt I & II
- ii. NACE National Association of Corrosion Engineers, USA(NACE)
- iii. ISO 8501 Preparation of Steel Substrates before application of Paints and related products. Visual assessment of Surface cleanliness. (Part 1&2)
- iv. ISO 8502 Preparation of Steel Substrates before application of Paints and related products-Tests for assessment of Surface cleanliness. (Part 1-4)
- v. ISO 8503 Preparation of Steel Substrates before application of Paints and related products-Surface roughness Characteristics of blast-cleaned steel substrates. Part 1& 2

Following list of approved vendors are provided for different materials. However contractor may procure from other equivalent vendors after approval from employer.

SR. NO.	PRODUCT	BRAND, AGENCY
46.	Cement	Konark, ACC, Ultra Tech
47.	Steel	Bhusan, Jindal, SAIL

TECHNICAL SPECIFICATION OF FIRE FIGHTING WORKS

QUALITY ASSURANCE AND QUALITY CONTROL:

The work shall conform to high standard of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system.

At the site, the Contractor shall arrange the materials and their stacking/ storage in appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of material, assemblies etc. as directed by the Project Manager's Representative. The test shall be conducted continuously and the result of tests maintained. In addition the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.

The Project Manager's Representative shall be free to carry out such tests as may be decided by him at this sole direction, from time to time, in addition to those specified in this Document. The Contractor shall provide the samples and labor for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.

The test shall be conducted at the site laboratory that may be established by Project Manager's Representative or at any other Standard Laboratory selected by Project Manager's Representative. Contractor shall keep the necessary testing equipment such as hydraulic testing machine, smoke testing machine, gauges and other necessary equipment required.

The Project Manager's Representative shall transport the samples to the laboratory.

Testing may be witnessed by the Contractor or his Authorized Representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

Prior to shipment, complete unit shall be tested under actual load conditions for performance and proper functioning of component parts.

EXCLUSIONS:

Civil Works for Water Tank.

Pumps to be installed at below basement levels

PIPE WORK

General Requirements

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Consultants.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

Pipes shall be securely fixed to walls and ceilings by suitable clamps and supports (galvanised after fabrication) at intervals specified. Only approved type of anchor fasteners shall be used for RCC slabs and walls / floors etc.

Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

Pipe accessories such as gauges, meters, control devices, etc. shall have the same working pressure rating as the associated pipe work. All pipe work shall be free from burrs, rust and scale and shall be cleaned before installation. All personnel engaged on welding operations must possess a certificate of competence issued by an acceptable / recognized authority.

Piping

Pipes of following types are to be used:

Mild steel black pipes as per IS:1239 heavy grade(for pipes of sizes 150 mm N.B. and below) suitably lagged on the outside to prevent soil corrosion. M.S. pipes buried below ground shall also be suitably be lagged with 2 layers of PYPKOTE/COTAK polythene sheet over 2 coats of bitumen.

Steel pipelines upto 150 mm dia shall be as per IS: 1239, Part-II (heavy grade) while pipelines above 150 mm dia shall be as per I.S.:3589.

All pipe clamps and supports shall be fabricated from MS steel sections and shall be factory galvanized before use at site. Welding of galvanised clamps and supports shall not be permitted.

Pipes shall be hung by means of expandable anchor fastener of approved make and design. The hangers and clamps shall be fastened by means of galvanised nuts and bolts. The size/diameter of the anchor fastener and the clamps shall be suitable to carry the weight of water filled pipe and dead load normally encountered.

Hangers and supports shall be thoroughly galvanised after fabrication. The selection and design of the hanger & support shall be capable of carrying the sum of all concurrently acting loads. They shall be

designed to provide the required supporting effects and allow pipeline movements as necessary. All guides, anchor braces, dampener, expansion joint and structural steel to be attached to the building/structure trenches etc. shall be provided. Hangers and components for all piping shall be approved by the Consultants.

The piping system shall be tested for leakages at 2 times the operating pressure or 1.5 time shut-off pressure, which ever is highest including testing for water hammer effects.

Flanged joints shall be used for connections for vessels, equipment, flanged valves and also on two straight lengths of pipelines of strategic points to facilitate erection and subsequent maintenance work.

For pipes underground installation the pipes shall be buried at least one meter below ground level and shall have 230 mm x 230 mm masonry or concrete supports at least 300 mm high at 3m intervals. Masonry work to have plain cement concrete foundation (1 cement: 4 coarse sand : 8 stone aggregate) of size 380x380x75 thick resting on firm soil.

Mains below ground level shall be supported at regular intervals not exceeding 3.0 metres and shall be laid at least 2.0 metre away from the building.

Piping Installation & Support

Tender drawings indicate schematically the size and location of pipes. The Contractor, on the award of the work, shall prepare detailed working drawings, showing the cross-sections, longitudinal sections, details of fittings, locations of isolating and control valves, drain and air valves, and all pipe supports.

He must keep in view the specific openings in buildings and other structure through which pipes are designed to pass.

Piping shall be properly supported on , or suspended from , on stands, clamps, hangers as specified and as required. The Contractor shall adequately design all the brackets, saddles, anchor, clamps and hangers, and be responsible for their structural stability.

Pipe work and fittings shall be supported by hangers or brackets so as to permit free expansion and contraction. Risers shall be supported at each floor with Galvanised steel clamps. To permit free movement of common piping support shall be from a common hanger bar fabricated from Galvanised steel sections.

Pipe hangers shall be provided at the following maximum spacings:

Pipe Dia (mm)	Hanger Rod Dia (mm)	Spacing between Supports (m)
Up to 25	6	2
32 to 50	8	2.5
65 to 80	8	2.5

80 to 100	10	2.5
125 to 150	10	3.0
200 to 300	12	3.5

The end of the steel rods shall be threaded and not welded to the threaded bolt.

All pipe work shall be carried out in a proper workman like manner, causing minimum disturbance to the existing services, buildings, roads and structure. The entire piping work shall be organized in consultation with other agencies work, so that area can be carried out in one stretch.

Cut-outs in the floor slab for installing the various pipes area are indicated in the drawings. Contractor shall carefully examine the cut-outs provided and clearly point out wherever the cut-outs shown in the drawings, do not meet with the requirements. Pipe sleeves, larger diameter than pipes, shall be provided wherever pipes pass through walls and slab and annular space filled with fibreglass and finished with retainer rings.

The contractor shall make sure that the clamps, brackets, saddles and hangers provided for pipe supports are adequate or as specified / approved by Consultants. Piping layout shall take due care for expansion and contraction in pipes and include expansion joints where required.

All pipes shall be accurately cut to the required sizes in accordance with relevant BIS codes and burrs removed before laying. Open ends of the piping shall be closed as the pipe is installed to avoid entrance of foreign matter. Where reducers are to be made in horizontal runs, eccentric reduces shall be used for the piping to drain freely. In other locations, concentric reduces may be used.

Automatic air valves shall be provided at all high points in the piping system for venting. All valves shall be of 15mm pipe size and shall be associated with an equal size gate valves. All pipes shall be pitched towards drain points. Pressure gauges shall be provided as shown on the approved drawings. Care shall be taken to protect pressure gauges during pressure testing.

Pipe Fittings

Pipe fittings mean tees, elbows, couplings, unions, flanges, reducers etc and all such connecting devices that are needed to complete the piping work in its totality.

Forged steel screwed type fitting shall be used for pipes of 50 mm dia & below. Fabricated fittings shall not be permitted for pipes diameters 50mm and below. Fabricated fittings used on pipe size 65 mm & above shall be fabricated, welded in workshops. They shall be inspected by Project Manager before dispatch from the workshop. The welding procedures of the workshop should have been approved by the rules for hydrant system. For “T” connection, pipes shall be drilled and reamed. Cutting by gas or electrical welding shall not be permitted.

Procedure for Pypkote / Cotak Application

- a. Surface Preparation - The pipe surface shall be cleaned by a wire brush.
- b. Application of Primer - Pypkote / Coatek primer is to be applied on pipes immediately after cleaning. This is to prevent any further accumulation of rust on the pipe. This is a cold applied primer and is applied by brush.
- c. Application of Pypkote / Coatek 4 mm Tape - After the primer is applied on the pipe, it is allowed to dry for about 30 min. till it becomes touch dry. Before adhering the tape to the pipe, it is advisable to gently heat the primer coated pipe by a run of LPG torch. Remove the bottom polyethylene from the tape & then heat bottom surface of the tape by LPG torch or any heat source & start wrapping the tape to the pipe by heating the primer coated pipe & by removing the bottom polyethylene from the tape before wrapping better adhesion between the tape & pipe is obtained. Overlaps are maintained with a minimum of 12.5 mm.
- d. Tape coating of weld joints - The tape is applied over the weld joints after the necessary welding & testing methods of the joints is completed. The procedure for application of tape shall be the same as bare pipe procedure. Overlaps on each side of the weld joints shall be 50 mm. A final coat of White wash with water based cement paint is done immediately over the entire coated pipe.

Jointing

Welded Joints

All pipes above 65mm dia and above shall be jointed with welded joints. Joints between MS pipes and fittings shall be made with the pipes and fittings having “V” groove and welded with electrical resistance welding in an approved manner. But welding without “V” groove shall not be permitted.

Screwed Joints

All joints in the pipe line with screwed fittings shall be seal welded after testing and the weld plus the adjoining portion shall be given two coats of zinc rich primer.

Flanged joints (65 mm dia and above)

Flanged joints with flanges conforming to IS: 6392 shall be provided on

- a. Straight runs at intervals not exceeding 25-30m on pipe lines of 50 mm dia and above and as directed by the Project Manager.
- b. For jointing all types of valves, appurtenances, pumps, connections with other type of pipes, to water tanks and other places necessary and as required for good engineering practice and as shown/noted on the drawings.
- c. Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

Unions (upto 50 mm dia)

Approved type of dismountable unions shall be provided on pipe lines of 50 mm dia and smaller dia, in locations similar to those specified for flanges.

Air Vessel

The air vessel shall be provided to compensate for slight loss of pressure in the system and to provide an air cushion for counter-acting pressure, surges, whenever the pumping sets come into operation. Air vessel shall conform to IS:3844. It shall be normally half full of water, when the system is in normal operation. Air vessel shall be fabricated with 8 mm thick M.S. plate with dished ends and suitable supporting legs. It shall be provided with one 100 mm dia flanged connection from pump, one 25 mm drain with valve, one water level gauge and 25 mm sockets for pressure switches. The air vessel shall be tested to pressure for 12 hours at 2 times the operating pressure or 1.5 times the shut-off.

Fire Brigade Connection

The storage tank shall be provided with a 150 mm fire brigade pumping connection to discharge at least 2275 litres / minute into it. This connection shall not be taken directly into the side of the storage tank, but arranged to discharge not less than 150 mm above the top edge of the tank such that the water flow can be seen. The connection shall be fitted with stop valve in a position approved by the Project Manager. An overflow connection discharging to a drain point shall be provided from the storage tank.

The fire brigade connection shall be fitted with four numbers of 63mm instantaneous inlets in a glass fronted wall box at a suitable position at street level, so located as to make the inlets accessible from the outside of the building. The size of the wall box shall be adequate to allow hose to be connected to the inlets, even if the door cannot be opened and the glass has to be broken. Each box shall have fall of 25mm towards the front at its base and shall be glassed with wired glass with "FIRE BRIGADE INLET" painted on the inner face of the glass in 50 mm size block letter. Each such box shall be provided with a steel hammer with chain for breaking the glass. In addition to the emergency fire brigade connection to the storage tank, a 150mm common connection shall be taken from the four 63mm instantaneous inlets direct to hydrant main so that the fire brigade may pump to the hydrants in the even of the hydrant pumps being out of commission. The connection shall be fitted with a sluice valve and reflux valve. Location of these valves shall be as per the approval of the Project Manager.

System Drainage

The system shall be provided with suitable drainage arrangement with drain valves complete with all accessories.

Valves

Butterfly Valve

The butterfly valve shall be suitable for waterworks and rated for PN 1.6. The body shall be of cast iron in circular shape and of high strength to take the water pressure. The disc shall be heavy duty cast iron with anti corrosive epoxy or nickel coating. The valve seat shall be of high grade elastomer or nitrile rubber. The valve in closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be EN 8 grade carbon steel. The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages. Valve above 150mm dia shall be provided with Gear assembly. Codes for different material used in valves shall be as under:

- a. General Design and Manufacture:EN593/API609
- b. Valve face to face ISO 5752
- c. Top flange drilling:ISO 5211
- d. Valve Inspection & testing:API 598
- e. Flange Standard Conformity-ANSI 150/ANSI125/BS 10TAB D&E IS6392 NP 06/1.0/1.6

Ball Valve

The ball valve shall be made forged brass and suitable for test pressure of pipe line. The valve shall be internally threaded to receive pipe connections. The ball shall be made from brass and machined to perfect round shape and subsequently chrome plated. The seat of the valve body-bonnet gasket and gland packing shall be of Teflon. The handle shall be provided with PVC jacket. The handle shall also indicate the direction of 'open' and 'closed' situations. The gap between the ball and the teflon packing shall be sealed to prevent water seeping. The handle shall also be provided with a lug to keep the movement of the ball valve within 90°. The lever shall be operated smoothly and without application of any unnecessary force.

Non-Return Valve

All Non-Return valves used in pump's delivery shall be suitable for water works cast iron double flanged with cast iron body and gunmetal internal parts conforming to IS:5312.

MATERIAL OF CONSTRUCTION

Body Disc Cover : Cast Iron

Hinge Pin : SS AISI 316

Disc Face : SS AISI 316

End connection:BS 10 Table D, E & F

Wafer Type Check Valve

All check valve used before flow switches shall be spring loaded dual plate check valves with following specifications:

Body:CI, Plate:SS304, Stop pin:SS316, Hinge Pin:SS316, Spring:SS316, Seat:EPDM,

Suction Strainers

Flanged 'Y' strainers are suitable for water. The design is compact and full flow, with large filtration area for low pressure drop and more debris collection. It is provided with drain Ball valve for frequent blow off. Element is strengthened for rigidity and long life and fitted in machined seats. Flanges provided are as per ANSI B16.5 150#, DIN10 suitable for working pressure or upto 250 PSI (16 KG/cm²), Hydraulically tested to 30Kg/cm².

Foot Valve

Used in suction side of pump to avoid flow reversal from pump to UG tank in case on negative suction. Manufacturing Standard : IS 4038. Pressure Rating : PN 2

MATERIAL OF CONSTRUCTION

Housing, Seat, Strainer, Door, Strainer : Cast Iron IS:210, Gr. FG 200

Door Plate : Cast Iron IS:210, Gr. FG 200 / MS IS:2062, Gr.Fe 410 WA

Hinge Pin : SS ASTM A 276, Type 410

Door Face : Natural Rubber with reinforcement of cotton canvas

End Flange:IS:1538, Table 4 & 6

PRESSURE SWITCH

The pressure switches shall be employed for starting and shutting down operation of pumps automatically, dictated by line pressure. The Pressure Switch shall be diaphragm type. The housing shall be die cast aluminium, with SS 316 movement, pressure element and socket. The set pressure shall be adjustable. The Switch shall be suitable for consistent and repeated operations without change in values.

It shall be provided with IP:55 water and environment protection.

PRESSURE GAUGE

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves. Pressure gauge shall be 100 mm dia gunmetal bourdon type with gunmetal isolation ball valve, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate height for easy readability.

PAINTING

All Hydrant pipes shall be painted with post office red colour paint. All M S pipes shall first be cleaned thoroughly before application of primer coat. After application of primer coat two coats of enamel paint shall be applied. Each coat shall be given minimum 24 hours drying time. No thinners shall be used. Wherever required all pipe headers shall be worded indicating the direction of the pipe and its purpose such as "TO RISER NO.1" etc. Painting shall be expertly applied, the paint shall not over run on surfaces not

requiring painting such as walls, surfaces etc. Nuts and bolts shall be painted black, while valves shall be painted blue.

EXCAVATION

Excavation for pipe lines shall be in open trenches to levels and grades shown on the drawings or as required at site. Pipe lines shall be buried with a minimum cover of 1 meter or as shown on drawings. Wherever required Contractor shall support all trenches or adjoining structures with adequate timber supports, shoring and strutting. On completion of testing in the presence of the Project Manager and pipe protection, trenches shall be backfilled in 150 mm layers and consolidated. Contractor shall dispose off all surplus earth as directed by the Project Manager.

ANCHOR / THRUST BLOCK

Contractor shall provide suitably designed anchor blocks in cement concrete/steel support to cater to the excess thrust due to work hammer and high pressure Thrust blocks shall be provided at all bends, tees and such other location as determined by the Project Manager. Exact location, design, size and mix of the concrete blocks/steel support shall be as shown on the drawings or as directed by the Project Manager prior to execution of work.

FIRE HYDRANTS

External Hydrants

Contractor shall provide external hydrants. The hydrants shall be controlled by a cast iron wheel. Hydrants shall have instantaneous type 63mm dia outlets. The hydrants shall be single outlet conforming to IS:5290 with bend and riser or required height to bring the hydrant to correct level above ground.

Contractor shall provide for each external fire hydrant two numbers of 63mm dia. 15 m long

controlled percolation hose pipe with SS male and female instantaneous type couplings machine wound with copper wire (hose to IS:636 type certification) , SS branch pipe with nozzle to IS:903. This shall be measured and paid for separately.

Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

Internal Hydrants

Contractor shall provide on each landing and other locations as shown on the drawings double headed SS landing valve with 100 mm dia inlet as per IS:5290, with shut off valves having cast iron wheels as shown on the drawings. Landing valve shall have flanged inlet and instantaneous type outlets as shown on the drawings.

Instantaneous outlets for fire hydrants shall be standard pattern and suitable for fire hoses.

Contractor shall provide for each internal fire hydrant station two numbers of 63 mm dia. 15 m long rubberized fabric lined hose pipes with SS male and female instantaneous type coupling machine would with copper wire (hose to IS:636 type A and couplings to IS:903 with IS certification), fire hose reel, SS branch pipe with nozzle to IS:903. This shall be measured and paid for separately.

Contractor shall provide standard fire hose reels of 20mm dia high pressure rubber hose 30 m long with gunmetal nozzle, all mounted on a circular hose reel of heavy duty mild steel construction having cast iron brackets. Hose reel shall be connected directly to the wet riser with an isolating valve. Hose reel shall conform to IS:884 and shall be mounted vertically.

Each internal hydrant hose cabinet shall be provided with a drain in the bottom plate. The drain point shall be lead away to the nearest general drain. Each internal hydrant hose cabinet containing items as above shall also be provided with a nozzle spanner and a Fireman's Axe. The cabinet shall be recessed in the wall as directed. This shall be measured and paid for separately. Each hose cabinet shall be conspicuously painted with the letters "FIRE HOSE".

Hose Reel

Hose reel shall conform to IS : 884, heavy duty, 20 mm dia length shall be 30 metre long fitted with SS chromium plated nozzle, mild steel pressed reel drum which can swing upto 170 degree with wall brackets of cast iron finished with red and black enamel complete.

Fire Hose

All hose pipes shall be of 63 mm diameter RRL as required, conforming to IS : 636. The hose shall be provided with SS delivery coupling. The hose shall be capable of withstanding a bursting pressure of 35.7 Kg/Sq.cm without undue leakage or sweating. Hose shall be provided with instantaneous spring-lock, type couplings.

Branch Pipe, Nozzle

Branch pipes shall be of SS with loaded tin bronze ring at the discharge and to receive the nozzle and provided at the other with a leaded tin bronze ring to fit into the instantaneous coupling. Nozzle shall be of spray type of diameter of not less than 16 mm and not more than 25 mm. Nozzle shall be of loaded tin bronze branch pipe and nozzle shall be of instantaneous pattern conforming to Indian Standard -

Hose Cabinet

Hose cabinet shall be provided for all internal and external fire hydrants. External Hose cabinets shall be fabricated from 14 gauge MS powder coated sheet of fully welded construction with hinged double front door partially glazed (3 mm glass panel) with locking arrangement, stove enamelled fire red paint (shade No. 536 of IS:5) with "FIRE HOSE" written on it prominently (The word 'FIRE HOSE' shall be in letters of at least 35mm in height. The words shall be painted white on red back ground). Cabinet surfaces in

contact with the walls shall not be powder coated but instead given two coats of anti-corrosive bitumastic paint.

Internal Hose Cabinet

Hose cabinet shall be of glass fronted with hinged door & lock. The cabinet shall be made of hollow box section, powder coated to shade No. 536 of IS:5. The hose cabinet shall be of size to accommodate the following and size is :

- i. Landing Valves (Single headed)
- ii. Hose pipe
- iii. Hose reel (30 mtr.)
- iv. Branch pipes, nozzles (1 sets)
- v. Fire man's axe and hand appliances

External Hose Cabinet

The hose cabinet shall be of size to accommodate the following:

- i. Single/Double headed yard hydrant valve
- ii. Hose pipe (2 length of 15 m)
- iii. Branch pipes, nozzles (1 sets)
- iv. Fire man's axe

HAND HELD FIRE EXTINGUISHERS

Scope

Work under this section shall consist of furnishing all labour, materials, appliances and equipment necessary and required to install fire extinguishing hand appliances as per relevant specification of various authorities.

Without restricting to the generality of the foregoing, the work shall consists of the following:

Installation of fully charged and tested fire extinguishing hand appliances of A B C powder type as required and specified in the drawings and schedule of rates.

General Requirements

Hand appliances shall be installed in easily accessible locations with the brackets fixed to the wall by suitable anchor fasteners.

Each appliance shall be provided with an inspection card indicating the date of inspection, testing, change of charge and other relevant data.

All appliances shall be fixed in a true workmanlike manner truly vertical and at correct locations.

Distribution / installation of fire extinguisher to be in accordance to IS:2190.

Measurement

Fire extinguishers shall be counted in numbers and include installation of all necessary items required as given in the specifications.

ABC Type Dry Powder Extinguisher

The Extinguisher shall be filled with ABC grade 40, Mono Ammonium Phosphate 40% from any approved manufacturer.

The capacity of the extinguisher when filled with Dry Chemical Powder (First filling) as per IS 15683-2006, shall be 5 Kg +/-2% or 10 Kg +/- 3%.

The distribution of fire extinguishers to be as per IS 2190 – 1992.

It shall be operated upright, with a squeeze grip valve to control discharge. The plunger neck shall have a safety clip, fitted with a pin, to prevent accidental discharge. It shall be pressurised with Dry Nitrogen, as expellant. The Nitrogen to be charged at a pressure of 15 Kg/cm² Body shall be of mild steel conforming to relevant IS Standards. The neck ring shall be also mild steel and welded to the body. The discharge valve body, shall be forged brass or leaded bronze, while the spindle, spring and siphon tube shall be of brass. The nozzle shall be of brass, while the hose shall be braided nylon. The body shall be cylindrical in shape, with the dish and dome welded to it. Sufficient space for Nitrogen gas shall be provided inside the body, above the powder filling.

The Neck Ring shall be externally threaded - the threading portion being 1.6 cm. The filler opening in the neck ring shall not less than 50 mm. Discharge nozzle shall be screwed to the hose. The design of the nozzle shall meet the performance requirement, so as to discharge at least 85% of contents upto a throw of 4 mtrs, continuously, at least for 15 seconds. The hose, forming part of discharge nozzle, shall be 500 mm long, with 10 mm dia internally for 5 Kg capacity and 12 mm for 10 Kg capacity. It shall have a pressure gauge fitted to the valve assembly or the cylinder to indicate pressure available inside. The extinguisher shall be treated with anti-corrosive paint, and it shall be labelled with words ABC 2.5 cm long, within a triangle of 5 cm on each face. The extinguisher body and valve assembly shall withstand internal pressure of 30 Kg/cm² for a minimum period of 2 minutes. The pressure gauge shall be imported and suited for the purpose.

Water Type Extinguisher (Gas Pressure Type)

The Extinguishing medium shall be primarily water stored under normal pressure, the discharge being affected by release of Carbon Dioxide Gas from a 120 gms cylinder. The capacity of Extinguisher, when filled upto the indicated level, shall be 9 ltr +/- 5%. The skin thickness of the Cylinder shall be minimum 4.0 mm, fabricated from Mild Steel sheet, welded as required, with dish and dome, being of same thickness, and of size not exceeding the diameter of body. The diameter of body to be not less than 150 mm and not exceeding 200 mm. The neck shall be externally threaded upto a minimum depth of 16 mm, and leaded tin bronze. The cap shall be of leaded tin bronze, and screwed on the body upto a minimum of 1.6 cm depth, with parallel screw thread to match the neck ring. The siphon tube to be of brass or G.I. and the strainer of Brass. The cartridge holder, knob, discharge fittings and plunger to be of Brass/Leaded tin bronze, and plunger of stainless steel, spring of stainless steel. The cap to have handle fixed to it. The discharge hose shall be braided nylon, of 10 mm dia and 600 mm long, with a nozzle of brass fitted at end.

The extinguisher shall be treated for anti-corrosion internally and externally, and externally painted with Fire Red paint. The paint shall be stove enamelled/powder coated. The cartridge shall be as per IS, and have 60 gm net carbon dioxide gas for expelling. The extinguisher, body and cap shall be treated to an internal hydraulic pressure of 25 Kg/cm². It shall have external marking with letter A, of 2.5 cm height, in block letters within a triangle of 5 cm each side. The extinguisher shall be upright in operation, with the body placed on ground and discharge tube with nozzle held in one hand to give a throw of not less than 6 mtr, and continue so for atleast 60 secs. The extinguisher body shall be clearly marked with ISI stamp (IS 15683-2006).

Carbon Dioxide Extinguisher

The Carbon Dioxide Extinguisher shall be as per IS: 15683:2006

The body shall be constructed of seamless tube conforming to IS:7285 and having a convex dome and flat base. Its dia shall be maximum 140 mm, and the overall height shall not exceed 720 mm.

The discharge mechanism shall be through a control valve conforming to IS:3224. The internal siphon tube shall be of copper aluminium conforming to relevant specifications. Hose Pipe shall be high pressure braided Rubber hose with a minimum burst pressure of 140 Kg/cm² and shall be approximately 1.0 meter in length having internal dia of 10 mm. The discharge horn shall be of high quality unbreakable plastic with gradually expanding shape, to convert liquid carbon dioxide into gas form. The hand grip of Discharge horn shall be insulated with Rubber of appropriate thickness. The gas shall be conforming to IS:307 and shall be stored at about 85 Kg/cm². The expansion ratio between stored liquid carbon dioxide to expanded gas shall be 1:9 times and the total discharge time (effective) shall be minimum 10 secs and maximum 25 secs. The extinguisher shall fulfill the following test pressures:

Cylinder: 236 Kg/cm²

Control Valve: 125 Kg/cm²

Burst Pressure of Hose: 140 Kg/cm² minimum

It shall be an Upright type. The cylinder, including the control valve and high pressure Discharge Hose must comply with relevant Statutory Regulations, and be approved by Chief Controller of Explosives, Nagpur and also bear IS marking. The Extinguisher including components shall be IS marked.

Mechanical Foam Type Extinguisher

The capacity of Extinguisher, when filled upto the indicated level, shall be 9 ltr +/- 5%. The skin thickness of the Cylinder shall be minimum 4.0 mm, fabricated from Mild Steel sheet, welded as required, with dish and dome, being of same thickness, and of size not exceeding the diameter of body. The diameter of body to be not less than 150 mm and not exceeding 200 mm. The neck shall be externally threaded upto a minimum depth of 16 mm, and leaded tin bronze. The cap shall be of leaded tin bronze, and screwed on the body upto a minimum of 1.6 cm depth, with parallel screw thread to match the neck ring. The siphon tube to be of brass or G.I. and the strainer of Brass. The cartridge holder, knob, discharge fittings and plunger to be of Brass/Leaded tin bronze, and plunger of stainless steel, spring of stainless steel. The cap to have handle fixed to it. The discharge hose shall be braided nylon, of 10 mm dia and 600 mm long, with a nozzle of brass fitted at end.

The extinguisher shall be treated for anti-corrosion internally and externally, and externally painted with Fire Red paint. The paint shall be stove enamelled/powder coated. The extinguisher, body and cap shall be treated to an internal hydraulic pressure of 25 Kg/cm². It shall have external marking with letter C, of 2.5 cm height, in block letters within a triangle of 5 cm each side. The extinguisher shall be upright in operation, with the body placed on ground and discharge tube with nozzle held in one hand to give a throw of not less than 6 mtr, and continue so for atleast 60 secs. The extinguisher body shall be clearly marked with ISI stamp (IS 15683-2006).

FIRE PUMPS AND ALLIED EQUIPMENTS

Scope

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install electrically operated and diesel driven pumps and as required by design drawings .

- a. Electrically operated pumps with motors and diesel engine driven pumps with diesel engine, common base plates, coupling, coupling guard and accessories.
- b. Automatic starting system with all accessories, wiring and connections and pressure switches.
- c. Motor control centre.
- d. Annunciation system with all accessories wiring and connections.
- e. Pressure gauges with isolation valves and piping, bleed and block valves.
- f. Suction strainers and accessories.
- g. Vibration eliminator pads and foundation bolts.
- h. Leak-off drain shall be led to the nearest floor drain.

General Requirements

Pumps shall be installed true to levels on suitable concrete foundations. Base plate shall be firmly fixed by properly grouted foundation bolts.

Pumps and motors shall be truly aligned by suitably instruments. Record of such alignment shall be furnished to the Project Manager.

All pump connections shall be standard flanged type with number of bolts as per relevant standard requirement for the working pressure. Companion flanges shall be provided with the pumps Manufacturers' instructions regarding installation, connections and commissioning shall be strictly followed.

Contractor shall provide necessary test certificates, type test certificates, performance curves and NPSH curves of the pumps from the manufacturer when called for. The contractor shall provide facilities to the Project Manager & Consultant for inspection of equipment during manufacturing and also to witness various tests at the manufacturer's works without any cost to the Project Manager or Consultant.

Seismic isolation and clamping for each pump and flexible connection on the suction as well as the discharge side shall be provided.

The contractor shall submit with this tender a list of recommended spare parts for three years of normal operation and quote the prices for the same as a separate submittal / annexure.

Electric Fire Pump

The electric fire pump shall be suitable for automatic operation complete with necessary electric motor and automatic starting gear, suitable for operation on 415 volts, 3 phase, 50 Hz. A.C. system. Both the motor and the pump shall be factory assembled on a common base plate, fabricated M.S. channel type or cast iron type.

Drive

The pump shall be direct driven by means of a flexible coupling. Coupling guard shall also be provided.

Fire Pump

The fire pump shall be horizontally mounted multistage centrifugal type. It shall have a capacity to deliver 2280 lpm as specified, and developing adequate head so as to ensure a minimum pressure of 3.5 Kg/Sq.cm at the highest and the farthest outlet.

The pump shall be capable of giving a discharge of not less than 150 per cent of the rated discharge, at a head of not less than 65 per cent of the rated head. The shut off head shall be within 120 per cent of the rated head.

The pump casing shall be of cast iron to grade FG 200 to IS: 210 and parts like impeller, shaft sleeve, wearing ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be of stainless steel. Provision of mechanical seal shall also be made. Bearings of the pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

The pump shall be provided with a plate indicating the suction lift, delivery head, discharge, speed and number of stages. The pump casing shall be designed to withstand 1.5 times the working pressure.

Provision of Jockey Pump shall be made. The pump shall be vertical SS type and of detail as in schedule of quantity. Contractor shall verify that the capacity of the Jockey pump shall not be less than 3% (Minimum 180 LPM) and not more than 10% of the installed pump capacity.

Motor

The motor shall be squirrel cage A.C. induction type suitable for operation on 415 volts 3 phase 50 Hz. system. The motor shall be totally enclosed fan cooled type conforming to protection clause IP 55. The class of insulation shall be F. The synchronous speed shall be 1500 RPM as specified. The motor shall be rated for continuous duty and shall have a horse power rating necessary to drive the pump at 150 per cent of its rated discharge with at least 65 per cent rated head. The motor shall conform to I.S.325-1978.

Motor Starter

The motor starter shall be as per detail in MCC. The unit shall include suitable current transformer and ammeter of suitable range on one line to indicate the current. The starter shall not incorporate under voltage, no voltage trip overload or SPP.

The starter assembly shall be suitably integrated in the power and control panel for the wet riser system.

Diesel Fire Pump

General

The diesel pump set shall be suitable for automatic operation complete with necessary automatic starting gear, for starting on wet battery system and shall be complete with all accessories. Both engine and pump shall be assembled on a common base plate.

Drive

The pump shall be only direct driven by means of a flexible coupling. Coupling guard shall also be provided. The speed shall be 1500 RPM as specified.

Fire Pump

The fire pump shall be horizontally mounted centrifugal multi stage. It shall have a capacity to deliver as specified, and developing adequate head so as to ensure a minimum pressure of 3.5 Kg/Sq.cm at the highest and the farthest outlet. The pump shall be multi stage as specified. The pump shall be capable of giving a discharge of not less than 150% of the rated discharge at a head of not less than 65% of the rated head. The shut off head shall be within 120% of the rated head. The pump casing shall be of cast iron to grade FG 200 to IS 210 and parts like impeller, shaft sleeves, wearing-ring etc. shall be of non-corrosive metal like bronze/brass/gun metal. The shaft shall be stainless steel. Provision of mechanical seal shall also be made. The pump casing shall be designed to withstand 1.5 times the working pressure. Bearing of pump shall be effectively sealed to prevent loss of lubricant or entry of dust or water.

Diesel Engine

Engine Rating - The engine shall be cold starting type without the necessity of preliminary heating of the engine cylinders or combustion chamber (for example, by wicks, cartridge, heater, plugs etc.). The engine shall be multi cylinder/vertical 4 stroke cycle, aircooled, diesel engine, developing suitable HP at the operating speed specified to drive the fire pump. Continuous capacity available for the load shall be exclusive of the power requirement of auxiliaries of the diesel engine, and the after correction for altitude, ambient temperature and humidity for the specified environmental conditions. This shall be at least 20% greater than the maximum HP required to drive the pump at its duty point. It shall also be capable of driving the pump at 150% of the rated discharge at 65% of rated head. The engine shall be capable of continuous non-stop operation for 8 hours and major overhaul shall not be required before 3000 hours of operation. The engine shall have 10% overload capacity for one hour in any period of 12 hours continuous run. The engine shall accept full load within 15 seconds from the receipt of signal to start. The diesel engine shall conform to BS 649/IS 1601/IS 10002, all amended up to date.

- a. **Engine Accessories** - The engine shall be complete with the following accessories:-

Fly wheel dynamically balanced.

Direct coupling for pump and coupling guard.

Corrosion Resistor.

Air cleaner.

Fuel service tank support, and fuel oil filter with necessary pipe work.

Elect. starting battery (2X24 v).

Exhaust silencer with necessary pipe work.

Governor.

Instrument panel housing all the gauges, including Tachometer, hour meter and starting switch with key (for manual starting).

Necessary safety controls.

- b. **Fuel System** - The fuel shall be gravity fed from the engine fuel tank to the engine driven fuel pump. The engine fuel tank shall be mounted either over or adjacent to the engine itself or suitably wall mounted on bracket. The fuel filter shall be suitably located to permit easy servicing.

All fuel tubing to the engine shall be with copper, with flexible hose connections where required. Plastic tubing shall not be permitted.

The fuel tank shall be of welded steel construction (3 mm. thick) and of capacity sufficient to allow the engine to run on full load for at least 8 hours. The tank shall be complete with necessary wall mounted supports, level indicator (protected against mechanical injury) inlet, outlet, overflow connections and drain plug and piping to the engine fuel tank. The outlet shall be so located as to avoid entry of any sediments into the fuel line to the engine.

As semi rotary hand pump for filling the daily service tank together with hose pipe 5 mtr. Long with a foot valve etc. shall also form part of the scope of supply.

- c. **Lubricating Oil System**- Forced feed Lub. Oil system shall be employed for positive lubrication. Necessary Lub. oil filters shall be provided, located suitably for convenient servicing.
- d. **Starting System**- The starting system shall comprise necessary batteries (2x24v), 24 volts starter motor of adequate capacity and axle type gear to match with the toothed ring on the fly wheel. Bi metallic relay protection to protect starting motor from excessively long cranking runs suitably integrated with engine protection system shall be included within the scope of the work. The capacity of the battery shall be suitable for meeting the needs of the starting system. The battery capacity shall be adequate for 10 consecutive starts without recharging with cold engine under full compression. The scope shall cover all cabling, terminals, initial charging etc.
- e. **Exhaust System** - The exhaust system shall be complete with silencer suitable for indoor installation and silencer piping including bends and accessories needed for a run of 5 metre

from the engine manifold.(Adjustment rates for extra lengths shall also be given). The total back pressure shall not exceed the engine manufacture's recommendation. The exhaust piping shall be suitably supported.

- f. **Engine shut down mechanism-** This shall be auto/ manually operated and shall return automatically to the starting position after use.
- g. **Governing System-** The engine shall be provided with an adjustable governor to control the engine speed within 5% of its rated speed under all conditions of load up to full load. The governor shall be set to maintain rated pump speed at maximum pump load.
- h. **Engine Instrumentation-** Engine instrumentation shall include the following:-
 - i) Lub. oil pressure gauge.
 - ii) Lub. oil temperature gauge.
 - iii) Water pressure gauge.
 - iv) Water temperature gauge.
 - v) Tachometer.
 - vi) Hour meter.
 - vii) The instrumentation panel shall be suitably resident mounted on the engine.
 - viii) **Engine Protection Devices-** Following engine protection and automatic shut down facilities shall be provided:-
 - i) Low lub.oil pressure.
 - ii) High cooling water temp.
 - iii) High lub.oil temperature.
 - iv) Over speed shut down.
- i. **Pipe Work** - All pipe lines with fittings and accessories required shall be provided for fuel oil, lub.oil and exhaust systems, copper piping of adequate sizes, shall be used for Lub.oil and fuel oil. M.S. piping will be permitted for exhaust.
- j. **Anti Vibration Mounting-** Suitable vibration mounting duly approved by Project Manager shall be employed for mounting the unit so as to minimize transmission of vibration to the structure. The isolation efficiency achievable shall be clearly indicated.

- k. Battery Charger**-Necessary float and boost charger shall be incorporated in the control section of the power and control panel, to keep the battery in trim condition. Voltmeter to indicate the state of charge of the batteries shall be provided.

Pump Sets Assembly

On the main fire hydrant headers near pump sets a 150 mm dia by-pass valve located in an accessible location shall be provided along with a rate of flow rota meter calibrated in 1 pm and able to read 200% of the rated pump capacity. The delivery shall be connected to the fire tank. Each and every pump set assembly shall be provided with suction valve (only for positive suction head), discharge valve, non-return valve and 150 mm dia Bourdon type pressure gauge with isolation valve.

Flexible Connectors

On all suction and delivery lines double flanged reinforced neoprene flexible pipe connectors shall be provided. Connectors should be suitable for maximum working pressure of each pipe line on which it is mounted and tested to a test pressure of 1:5 time the operating pressure. Length of the connector shall be as per manufacturers standard.

Interlocking

The following inter-locking between the two main fire pumps (i.e. wet riser pump), the jockey pump and the diesel engine driven pump.

Only one category of pumps will work at a time i.e. either jockey pump or main fire pumps (wet riser can come up at a time) or diesel driven pump.

	JOCKEY PUMP	WET RISER PUMP	DIESEL DRIVEN PUMP
i.	ON	OFF	OFF
ii.	OFF	ON	OFF
iii.	OFF	OFF	ON
iv.	OFF	ON	ON
v.	OFF	OFF	ON
vi.	OFF	OFF	OFF
vii.	OFF	ON	OFF

Pressure Switches mounted on the pressure vessel would be set as under (all figures in kg/cm²).

Operating Conditions for the Service Pumps

Fire Service Pump	Nos.	Cut in Pressure	Cut Out Pressure	Remarks
Jockey pump	One	5 Kg/cm ²	5.6 g/cm ²	To auto start and auto stop on pressure switch on air vessel to stop.
Main pump	One	4.5 Kg/cm ²	Push button manual	To auto start on pressure switch on air vessel and manual off.
Diesel Fire Pump	One	4.0 Kg/Cm ²	Push button manual	To auto start on pressure switch on air vessel and manual off.

Annunciation Panel

One solid state electronic annunciation panel, fully wired with visual display and audible alarm unit shall be provided to indicate:

- a. Flow condition in any flow switch indicating the area of distress and fire alarm.
- b. Starting and stopping of each hydrant pump.
- c. Starting and stopping of each jockey pump.
- d. Failure of Hydrant pump to start.
- e. High level in fire water storage tank compartment.
- f. Low level in fire water storage tank compartment.
- g. Low level in HSD day tank of the fire pump.

The panel shall be factory fabricated, wired and tested. All details shall be submitted with the tender.

The annunciation panel shall be located in the security office / reception on the ground floor or as instructed by the Project Manager.

Vibration Isolation

The pump set shall be mounted on rolled steel channels and 150 mm thick inertia block spring and ribbed neoprene vibration isolation mounting shall support the inertia block onto a 100 mm thick concrete plinths. The spring mountings shall have a maximum deflection of 15 mm. Reference shall be made to the section on “Nose and Vibration” for further technical requirements.

COMMISSIONING & GUARANTEE

Work under this section shall be executed without any additional cost. The rates quoted in this tender shall be inclusive of the works given in this section.

Contractor shall provide all tools, equipment, metering and testing devices required for the purpose.

On award of work, Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

All tests shall be made in the presence of the Consultants or his representative or any inspecting authority.

At least five working days notice in writing shall be given to the inspecting parties before performing any test.

Water flow rates of all equipment and in pipe lines through valves shall be adjusted to design conditions.

Complete results of adjustments shall be recorded and submitted.

Contractor shall ensure proper balancing of the hydraulic system and for the pipes / valves installed in his scope of work by regulating the flow rates in the pipe line by valve operation. The contractor shall also provide permanent Tee connection (with plug) in Fire water lines for ease of installing pressure gauge, temperature gauge & rota meters. Contractor shall also supply all required pressure gauge, temperature gauge & rotameter for system commissioning and balancing. The balancing shall be to the satisfaction of Consultant / Project Manager.

Three copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

PRECOMMISSIONING

On completion of the installation of all pumps, piping, valves, pipe connections, insulation etc. the Contractor shall proceed as follows:

- a. Prior to start-up and hydraulic testing, the Contractor shall clean the entire installation including all fitments and pipe work and the like after installation and keep them in a new condition. All pumping systems shall be flushed and drained at least once through to get rid of contaminating materials. All pipes shall be rodded to ensure clearance of debris, cleaning and flushing shall be carried out in sections as the installation becomes completed.
- b. All strainers shall be inspected and cleaned out or replaced.
- c. When the entire systems are reasonably clean, a pre-treatment chemical shall be introduced and circulated for at least 8 hours. Warning signs shall be provided at all outlets during pretreatment. The pre-treatment chemical shall remove oil, grease and foreign residue from the pipe work and fittings; Pre-condition the metal surfaces to resist reaction with water or air. Establish an initial protective film; After pre-treatment, the system shall be drained and refilled with fresh water and left until the system is put into operation. Details and procedures of the pre-treatment shall be submitted to the Consultant/Client for approval.
- d. Check all clamps, supports and hangers provided for the pipes.
- e. Check all the equipment, piping and valves coming under hot water system and operate each and every valve on the system to see if the valves are functioning properly. Thereafter conduct & hydro test of the system.
- f. Fill up pipes with water and apply hydrostatic pressure to the system as given in the relevant section of the specification. If any leakage is found, rectify the same and retest the pipes.

Fire Protection System

- a. Check all hydrant valves by opening and closing : any valve found to be open shall be closed.
- b. Check all the piping under hydro test.
- c. Check that all suction and delivery connections are properly made for all pump sets.
- d. Check rotation of each motor after decoupling and correct the same if required.
- e. Test run each pump set.
- f. All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).

Commissioning and Testing

- a. Pressurise the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump , then.

- b. Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.
- c. Open hydrant valve and allow the water to below into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However the jockey pump shall cut-out as soon as the main pump starts.
- d. Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.
- e. When the fire pumps have been checked for satisfactory working on automatic controls, open fire hydrant valves simultaneously and allow the hose pipes to discharge water into the fire tank to avoid wastage.
- f. Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replace by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.
- g. Check all annunciations by simulating the alarm conditions at site.

STATUTORY AUTHORITIES' TESTS AND INSPECTIONS

As and when notified in writing or instructed by the Consultants, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Local Fire Authorities, Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the CFO as a result of such tests and inspections where these indicate non-compliance with Statutory Regulations. Some of these tests may take place after the issue of Practical Completion of the Main Contract and the Contractor shall make all allowances in this respect.

The Contractor shall be responsible for the submission of all necessary forms and shop drawings to the Statutory Authorities which shall conform in layout to the latest architectural plans submitted to and kept by these Authorities.

The submission shall comply with the requirements set forth in the current Codes of Practice and circular letters of the Statutory Authorities. The shop drawings to be submitted shall be forwarded to the Architect/Consultants for checking before submission.

The Contractor shall allow for at least two submissions of complete sets of shop drawings to the Authorities, one to be made within six months after the award of the Contract but not less than six weeks before the inspection. The Consultants may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Consultants at least seven days in advance of his application for local Authority tests and inspections. On receipt of a confirmed date for test and inspection the Contractor shall inform the Consultants without delay.

FINAL ACCEPTANCE TESTS

Following commissioning and inspection of the entire installation, and prior to issue of the Completion Certificate, the Contractor shall carry out final acceptance tests in accordance with a programme to be agreed with the Consultants.

Should the results of the acceptance tests show that plant, systems and/or equipment fail to perform to the efficiencies or other performance figures as given in this Specification, the Contractor shall adjust, modify and if necessary replace the equipment without further payment in order that the required performance is obtained.

Where acceptance tests are required by the relevant Authorities having jurisdiction, these tests shall be carried out by the Contractor prior to the issue of Completion Certificate to the acceptance of the Authorities.

REJECTION OF INSTALLATION / PLANT

Any item of plant or system or component which fails to comply with the requirements of this Specification in any respect whatsoever at any stage of manufacture, test, erection or on completion at site may be rejected by the Consultants either in whole or in part as he considers necessary/appropriate.

Adjustment and/or modification work as required by the Consultants so as to comply with the Authority's requirements and the intent of the Specification shall be carried out by the Contractor at his own expense and to the satisfaction of the Authority/Consultants.

After works have been accepted, the Contractor may be required to carry out assist in carrying out additional performance tests as reasonably required by the Consultants/Employer.

WARRANTY AND HANDOVER

The Contractor shall warrant that all plant, materials and equipment supplied and all workmanship performed by him to be free from defects of whatsoever nature before handover to the Owner.

HANDING OVER OF DOCUMENTS

All testing and commissioning shall be done by the Contractor to the entire satisfaction of the Owner's site representative and all testing and commissioning documents shall be handed over to the Owner's site representative.

The Contractor shall also hand over all maintenance and operation manuals, all certificates and all other documentation as per the terms of the contract to the Owner's site representative.

CHECK LIST FOR COMMISSIONING

Fire Protection System

Check all hydrant & other valves by opening and closing. Any valve found to be open shall be closed.

Check all clamps, supports and hangers provided for the pipes.

All the pump sets shall be run continuously for 30 minutes (with temporary piping back to tank from the nearest hydrant, using canvas hose pipes).

Fire Hydrant System - Pressurise the fire hydrant system by running the jockey pump and after it attains the shutoff pressure of the pump, then Open bypass valve and allow the pressure to drop in the system. Check that the jockey pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve. Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump shall cut-in at the preset pressure and shall not cutout automatically on reaching the normal line pressure. The main fire pump shall stop only by manual push button. However the jockey pump shall cut-out as soon as the main pump starts. Operate booster pump continuously for 30 minutes with piping back to underground tanks from the hydrant nearest to plant room.

Check each landing valve, male and female couplings and branch pipes, for compatibility with each other. Any fitting which is found to be incompatible and do not fit into the other properly shall be replaced by the Contractor. Each landing valve shall also be checked by opening and closing under pressure.

SECTION-III

TECHNICAL DATA SHEETS

FIRE PROTECTION SYSTEM

FIRE PUMPS & MOTOR

1. Electrical Driven Main Fire Pumps

Make / Manufacturer	:
Quantity	:
Liquid Handed	:
Liquid Temp deg.C	:
Special Gravity of Liquid	:
Suction	:
Rated Discharge	:
Actual Discharge	:
Model	:
Horizontal / Design	:
Speed / No. of Stages	:
Impeller Dia (Maximum)	:
Suction / Delivery Size	:
Efficiency at Rated Capacity & Head	:
KW required at rated capacity & head	:
Shut Off Head	:

Material of Construction

Pump Casing	:
Impeller	:
Pump Shaft	:
Shaft Sleeve	:
Casing Wearing Ring	:
Base Plate	:
Mechanical Seal	:
Make of Mechanical Seal	:
Whether pumps is capable of discharging 150% of rated capacity at a head not less than 65% of rated head.	:
Whether automatic priming arrangement Included	:

Description of Motors

Make	:
Model No.	:
Type	:
Frame size	:
Speed (RPM)	:
Rated Capacity (Power)	:
Full load current	:
Enclosure	:
Coupling / Pulley	:
Class of Insulation	:
Size of Foundation	:
For complete coupled set mounted over MS base frame	:

2. Diesel Engine Driven Pump

Make / Manufacturer	:
Quantity	:
Liquid Handed	:
Liquid Temp deg.C	:
Special Gravity of Liquid	:
Suction	:
Rated Discharge	:
Actual Discharge	:
Model	:
Horizontal / Design	:
Speed / No. of Stages	:
Impeller Dia (Maximum)	:
Suction / Delivery Size	:
Efficiency at Rated Capacity & Head	:
KW required at rated capacity & head	:
Shut Off Head	:

Material of Construction

Pump Casing	:
Impeller	:
Pump Shaft	:
Shaft Sleeve	:
Casing Wearing Ring	:

Base Plate :

Mechanical Seal :

Make of Mechanical Seal :

Whether pumps is capable of
discharging 150% of rated capacity at a
head not less than 65% of rated head. :

Whether automatic priming arrangement
Included :

Description of Engine

Make :

Model No. :

Type :

Frame size :

Speed (RPM) :

Rated Capacity (Power) :

Full load current :

Enclosure :

Coupling / Pulley :

No of Cylinder :

Fuel Pump & Water pump detail :

Engine Cooling & Oil System :

Diesel Oil tank capacity :

Fuel Oil storage shall ensure working of
pump for number of hours :

Size of Foundation

For complete coupled set mounted over
MS base frame :

3 Jockey Pump

(Please submit separate data sheet for each type of pump)

Liquid Handed :

Liquid Temp deg.C :

Special Gravity of Liquid :

Suction :

Rated Discharge at Low Zone Head :

Rated Discharge at High Zone Head :

Actual Discharge at Low Zone Head :

Actual Discharge at High Zone Head :

Model :

Horizontal / Design :

Speed / No. of Stages :

Impeller Dia (Maximum) :

Suction / Delivery Size :

Efficiency at Rated Capacity & Head :

KW required at rated capacity & head :

Shut Off Head :

Material of Construction

Pump Casing :

Impeller :

Pump Shaft :

Shaft Sleeve :

Casing Wearing Ring :

Base Plate :

Mechanical Seal :

Make of Mechanical Seal :

Description of Motor

Make :

Model No. :

Type :

Frame size :

Speed (RPM) :

Rated Capacity (Power) :

Full load current :

Enclosure :

Coupling / Pulley :

Size of Foundation

For complete coupled set mounted over MS

base frame :

4. PIPING

15 NB TO 50 NB :

15 TO 50 NB Fittings :

65 NB TO 150 NB Pipes :

65 NB TO 150 NB Fittings :

200 NB ONWARDS Pipes	:
200 NB ONWARDS Fittings	:
Flanges	:
Gaskets	:

5. HYDRANT VALVES

Technical Specifications :

Make	:
Working Pressure	:
Code for Design Mft.	:

Construction Features

Type of Stem	:
Type of Inlet	:
Type of Outlet	:
Flange Drilling	:

Material of Construction

Body and Bonnet	:
Stop Valve, Valve Seat	:
Check nut & gland nut	:

6. PRESSURE GAUGE

Technical Specifications :

Make	:
Working Pressure	:
Code for Design Mft.	:
Scale range	:

Construction Features

Case :
Pointer :
Dial Size :
Dial Lettering :
Process Connection :

Material of Construction

Case :

Movement :

Block :

7. PRESSURE SWITCHES

Technical Specifications

Make :

Working Pressure :

Scale range :

Construction Features

Protection :

Cable Entry :

Process Connection :

Repeatability :

Switch :

Type :

No. of contacts :

Contact Rating :

Material of Construction

Enclosure :

Pressure element :

Wetted Parts :

8. ELECTRICAL ACCESSORIES

MAKE OF THE FOLLOWING

a. Motor Control Centre (Electrical Panel) :

b. Vacuum circuit breaker :

c. Air circuit breaker :

d. MCCB :

e. MCB :

f. Rotary switch :

g. Soft Starter :

h. Auto-transformer Starter :

j. Automatic Star Delta Starter :

k. Direct on line Starter :

l. Contactor :

m. Current Transformer (cast resin type)	:
n. Single phase preventor	:
o. Push Button	:
p. Change over switch :	
q. Ammeter & Voltmeter	:
KWH meter	
r. Relay	:
s. Indication lamp	:
t. Cables	:
u. Wires	:
v. Variable Frequency Drive.	:

SECTION-IV

LIST OF BUREAU OF INDIAN STANDARDS CODES

All equipment, supply, erection, testing and commissioning shall comply with the requirements of Indian Standards and code of practices given below as amended upto 30th April, 2002. All equipment and material being supplied by the contractor shall meet the requirements of IS, electrical inspectorate and Indian Electricity rules and other Codes / Publications as given below:

1. Pipes and Fittings

IS : 1239 (Part 1)	Mild steel, tubes, tubulars and other wrought steel fittings: Part 1 Mild Steel tubes.
IS : 1239 (Part 2)	Mild Steel tubes, tubulars and other wrought steel fittings: Part 2 Mild Steel tubulars and other wrought steel pipe fittings.
IS : 1879	Malleable cast iron pipe fittings.
IS : 3468	Pipe nuts.
IS : 3589	Seamless or electrically welded steel pipes for water, gas and sewage (168.3 mm to 2032 mm outside diameter).
IS : 4346	Specifications for washers for use with fittings for water services.
IS : 4711	Methods for sampling steel pipes, tubes and fittings.
IS : 6392	Steel pipe flanges
IS : 6418	Cast iron and malleable cast iron flanges for general engineering purposes.

2. Valves

IS : 778	Specification for copper alloy gage, globe and check valves for water works purposes.
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IS : 780	Specification for sluice valves for water works purposes (50 mm to 300 mm size).
IS : 1703	Specification copper alloy float valves (horizontal plunger type) for water supply fittings.
IS : 3950	Specification for surface boxes for sluice valves
IS : 5312 (Part 1)	Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 5312 (Part 2)	Specification for swing check type reflux (non return) valves : part 2 Multi door pattern.
IS : 13095	Butterfly valves for general purposes.

3. **Fire Fighting Equipment**

TAC Tariff Advisory Committee fire protection manual Part-I.

TAC Rules of Tariff Advisory Committee for automatic sprinkler system.

NFPA : 13 Installation of Sprinkler System

NFPA : 14 Installation of Standpipe & Hose System

NFPA : 20 Installation of Stationary pump for Fire Protection

IS : 636 Non-percolating flexible fire fighting delivery hose.

IS : 884 Specification for first aid hose reel for fire fighting.

IS : 901 Specification for couplings, double male and double female, instantaneous pattern for fire fighting.

IS : 902 Suction hose couplings for fire fighting purposes.

IS : 903 Specification for fire hose delivery couplings, branch pipe, nozzles and nozzle spanner.

IS : 904 Specification for 2-way and 3-way suction collecting heads for fire fighting purposes.

IS : 907 Specification for suction strainers, cylindrical type for fire fighting purposes.

IS : 908 Specification for fire hydrant, stand post type.

IS : 909 Specification for underground fire hydrant, sluice valve type.

IS : 910 Specification for portable chemical foam fire extinsisher.

IS : 933 Specification for portable chemical foam fire extinguisher.

IS : 1648 Code of practice for fire safety of building (general): Fire fighting equipment and its maintenance.

IS : 2171 Specification for portable fire extinguishers dry powder (catridge type)

IS : 2190 Selection, installation and maintenance of first aid fire extinguishers– Code of practice.

IS : 2871 Specification for branch pipe, universal, for fire fighting purposes.

IS : 2878 Specification for fire extinguishers, carbon dioxide type (portable and trolley mounted).

IS : 3844 Code of practice for installation and maintenance of internal fire hydrants and hose reel on premises.

IS : 5290 Specification for landing valves.

IS 5714 Specification for coupling, branch pipe, nozzle, used in hose reel tubing for fire fighting.

IS : 8423 Specification for controlled percolation type hose for fire fighting.

IS : 10658 Specification for higher capacity dry powder fire extinguisher (trolley mounted).

IS : 11460 Code of practice for fire safety of libraries and archives buildings.

IS : 13039 Ex

LIST OF APPROVED MAKES

Following list of approved vendors are provided for different materials. However contractor may procure from other equivalent vendors after approval from employer.

1. FIRE FIGHTING SYSTEM

S.NO.	DESCRIPTION	MANUFACTURER'S NAME
1	Hydrant Valves / Fire Brigade Inlet / Drawout	Newage / Safeguard / Padmini / Getech
2	Sluice Valves / Butterfly valves / Non Return Valves	AIP / Lehry / CIM / SANT
3	Ball Valves	AIP / Lehry / Leader / SANT
4	Air Release Valves	Newage / CIM / Leader / Sant
5	Strainers	Advance / Audco / SKS / AIP / Lehry
6	Fire Extinguishers	Minimax / Cease Fire / Safex / Safeguard / UFS
7	Fire Mans Axe	Newage / Safeguard / Padmini / Getech
8	Air Release Valve	CIM / Newage / Leader / Sant
9	Pressure Reducing Valve	AIP / Lehry / CIM / SANT
10	Branch Pipe and Nozzle	Newage / Safeguard / Padmini / Getech
11	Galvanized Iron Pipe / MS Pipe - IS : 1239	Jindal / Tata/ SAIL
12	G.I./ MS / M.I. Fittings	UNIK / Jainsons
13	Ductile Iron Fittings	Jainsons Industries
14	Fire Hose Pipe	Newage / Jayshree / Padmini / Safeguard / Getech / Mitras

15	Hose Reel	Newage / Safeguard / Padmini / Getech / Mitras
16	Fire Fighting Pumps	Kirloskar / Mather+Platt
17	Diesel Engine	Kirloskar / Cummins/Greaves
18	Electric Motors	Kirloskar / Crompton / Siemens
19	Pressure Switches	Danfoss / Indfoss
20	Pressure Gauge	H Guru / FIBIG
21	Flow Switches	System sensor / Honeywell
22	Sprinkler Annunciator Panel	Safeway / Agni Suraksha (ASES) / Daksh / Morley / Agni Devices
23	Sprinklers	Tyco / HD / Globe / Viking / Reliable
24	Sprinklers Flexible Hose	Tyco / HD / Globe / Viking / Padmini / Newage
25	Installation Control valve / Deluge Valve	Tyco / HD / Newage / Viking / Globe
26	Anchor Fastener / U clamp / Clevis / sprinkler hangers	Hilti / Intello Tech / Hightech / Fisher / Easy flex
27	Anti Vibration Mounting / Expansion Joint	Easyflex / Resistoflex / Kanwal / Precise
28	Paint	Asian / Berger / Nerolac / ICI
29	Any Other Itmes	On Approval of Consultant or Engineer-In-Charge
NOTE :		
The choice of the Final makes shall be made by the owner / consultant.		

2. **Pump House Equipments**

Pumps / Equipments	
Equipment / Material / Component	Manufacturers Name
Centrifugal Pumps Horizontal	Kirloskar / Mather+Platt / Wilo / Grundfos / Xylem

Submersible Pumps	Grundfos / Wilo / Xylem / KSB
Dosing Pumps	Asia LMI / Toshcon / Emec Italy
WTP	Ion Exchange / Thermax
Piping	
Equipment / Material / Component	Manufacturers Name
G I / MS Pipes	Jindal / TATA
GI Pipe Fittings	Unik / UNCO / R Brand
HDPE Pipes	Reliance / Duraline / Jain / Supreme
uPVC & cPVC Sch 40 & 80 Water Supply Pipe & Fittings	Astral / Supreme / Ashirwad
Butterfly Valves	Audco / Advance
NRV	DS Engg / Sant / Emerald
Strainer	CIM / Audco / Advance / AIP
Instrumentation	
Equipment / Material / Component	Manufacturers Name
Pressure Indicator	Manometer India / H Guru Instruments/ General Instruments/AN Instruments/ Forbes Marshall / Bells / Emerald / Japson / Waree Instruments
Level Sensor & Indicator	Toshniwal Bros./ABB/ Bells Controls / Forbes Marshal / Pune Techtrol / Level tech / Elegant
Flow Instrument System	Resemount (I) Pvt. Ltd/ABB/ E&H/ Forbes Marshall / SB Electromech /Waree Instruments/ Level tech Systems
pH meters	A-LMI/ Rosemont / Toshniwal /E&H/ Fobres Marshal / Ultraline

Bulk Water Meter	Aquamet / Kaycee / Kent
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TECHNICAL SPECIFICATIONS FOR HEAT, VENTILATION, AIR CONDITIONING SYSTEM

AIR-CONDITIONING SYSTEM

Variable Refrigerant Flow (VRF) type air-conditioning system shall be considered to meet the air-conditioning requirements of the Banquet Hall & other areas of the building except individual rooms at 1st floor, where hi-wall split AC units shall be considered. All outdoor units shall be located at the Terrace of the building. Interconnecting insulated refrigerant pipework from respective Outdoor units (ODU) to individual indoor units (IDU) shall be routed through vertical shaft inside the building.

AREAS TO BE AIR CONDITIONED & TYPE OF UNITS

Air-conditioning shall be considered for the various areas as indicated below along with types of AC indoor (IDU) & outdoor (ODU) units.

Sl. No.	Location	Occupancy (Nos.)	Total Dehumidified Air Quantity (CMH)	Total TR	IDU Quantity (Nos.)	Type of IDU	Total ODU Capacity (HP)
1.0	Ground Floor						
	Banquet Hall	500	23,500	45	2	Floor Mounted Ductable AHU	66
	Pre function Area		3,000	6	2	4-way Cassette	
2.0	Mezzanine Floor						
	Office Area	10	2,000	4	1	4-way Cassette	44
3.0	1st Floor						
	Party Hall-1	100	4,800	12	3	-Do-	
	Party Hall-2	100	5,300	12	3	-Do-	
	Corridor		3,800	8	4	-Do-	
	Rooms-10 Nos.		2 TR x 10 Nos.			Hi-wall Split	-

Notes:

Capacity & quantity of each item, mentioned above are tentative & for reference only. The same shall be finalised based on detail heat load calculations during engineering stage, to be submitted by the Contractor, as per latest architectural drawings and equipment heat loads of respective area.

Static pressure AHUs shall be calculated by the Contractor based on layout drawing & to be submitted for approval during engineering stage.

Exact location of respective ODU shall be finalised during engineering stage, based on latest architectural drawings & fulfilling architectural requirements.

Any additional area requiring air-conditioning as per latest architectural drawings during engineering stage, shall be considered without any price implications.

EQUIPMENT SPECIFICATION

Details of AC equipment shall be as indicated below:

VRF UNITS

Variable Refrigerant Flow (VRF) type system shall be considered to meet the air-conditioning requirements of the areas, as mentioned in the specification. The indoor and outdoor units shall be inter-connected by insulated refrigerant copper piping and electrical cabling. Access doors shall be provided for volume control dampers installed in branch ducts for service and maintenance purpose.

The Air cooled full inverter VRF outdoor units shall be factory assembled, powder coated GI sheet metal cabinets, all hardware of anti-rust quality, conformal coating on PCB to protect from duct & humidity, hydrophilic blue fin material for better corrosion resistance with Brushless DC Motor only. Outdoor Units shall be top discharge type or as per site requirement. Brief design parameters of VRF units shall be as under:

Maximum Ambient Temperature	48 °C
Refrigerant	R410A / R407C / Eco friendly
Compressor Type	All inverter Hermetic/Semi-hermetic Scroll
Min. COP	As per ASHRAE 90.1 latest Standard

VRF outdoor unit must have bigger condenser coil face area with higher capacity fan resulting in improved efficiency, less deration due to higher ambient temperatures.

Each outdoor unit shall consist of single / multiple full Inverter Scroll Compressor. There should not be any fixed compressor or Partial inverter.

The VRF system must compatible with R410A / R407C / Eco friendly green Refrigerant only. System must be pre-charged at Factory. If required additional, based on the site, then it will be charged additional at site.

All Inverter VRF must be designed with the new generation Refrigerant Cooled PCB, which helps maintain the drive within allowable temperature range. It enhances the reliability of the system when it is working under very high ambient conditions.

Each indoor unit must be connected (with VRF outdoor unit) by means of individual Copper Refrigerant network or Y distribution joints only. The mentioned “Y” joint or refnet joints must factory make & tested by OEM. The individual size of refnets or “Y” joints connecting to individual indoor units, to be calculated & supplied by OEM / Bidder / OEM approved bidder only.

All Inverter VRF should have emergency back operation. In-case of double compressor ODUs, it must operate or function even if there is a failure or maintenance downtime of one compressor.

In modular VRF, where multiple units have been combined to run, as one larger unit, the system must operate even in case of failure or maintenance downtime or shutdown of one VRF ODU. It will help to ensure that cooling remains largely unaffected even during servicing.

As all the indoor units are interconnected by the communication cable, if there is any break in any communication cable, subsequent IDUs are affected and must not function. By activating the IDU emergency operation on the Next Generation All Inverter VRF, the other IDUs must function despite of such break.

Indoor Units:

Ductable Indoor Unit - Floor Mounted Double Skinned AHU, compatible with VRF outdoor units, shall consist of the following and having extruded Aluminium section frame construction, Outer Skin with 0.6 mm thick Pre-coated GI, Inner Skin with 0.6 mm thick Plain GI, Insulation with 25 mm thick PUF of density 40kg/ Cu. Mtr. AHU shall also consists with the following:

Fan Section with Forward/Backward curve fan having required capacity of TEFC Sq. Cage Induction Motor (IE-2)

Coil Section with 6 Row deep DX Cooling Coils

Filter Section comprises of Washable Pre-filter (Efficiency 90% down to 10 Microns)

Sandwich Drain Pan with 25mm thick PUF injection in between 22G SS Inner & 24G GI Outer Sheet

Mixing Chamber, as required

Cassette type Indoor Unit - The indoor units shall be ceiling suspended 4-way cassette type with electronic expansion valve, inbuilt drain connections, stainless steel (18G) drain pan with PUF insulation, drain pump, pre-filter, fan section, DX cooling coil section & wireless remote.

Refrigerant piping:

The Refrigerant pipe material shall be of hard seamless copper tubes with pipes material being hard drawn copper pipe. Forged copper fittings shall be used for the refrigerant piping. The refrigerant piping arrangements shall be in accordance with good engineering practice as applicable to the air-conditioning industry, and shall include charging connections, suction line insulation and all other items normally forming part of proper refrigerant circuits except Y- joint/separation tubes.

Before joining any copper pipe or fittings, its internals shall be thoroughly cleaned by passing a clean cloth via wire or cable through its entire length. The piping shall be continuously kept clean of dirt etc. while constructing the joints. Subsequently it shall be thoroughly blown out using nitrogen gas.

After completion of installation of the refrigerant piping, the refrigerant piping system shall be pressure tested using nitrogen gas at a suitable pressure as specify by OEM (Original Equipment Manufacturer). Pressure shall be maintained in the system for 48 hours. The system shall then be evacuated to a vacuum of not less than 700 mm Hg and held for 24 hours.

The supplier of air-conditioning system shall choose sizes as designed and erect proper interconnections of the complete refrigerant circuit the thickness of copper piping shall not be less than 18 SWG for pipes upto 19.1 mm and 16 SWG for larger dia.

The suction line pipe size and the liquid line pipe sizes shall be selected according to the manufacturer's specified diameter. All refrigerant pipes shall be properly supported and anchored to the building/structure using steel hangers, fastener, brackets and supports from the building/structure.

The refrigerant piping should be laid in such a way that it should not distort the interior of the room, wherever the refrigerant pipe has to be laid across the room, it should be laid in a concealed manner by making appropriate boxing arrangement matching with the interior of the room. All associated minor Civil Engineering works (like chasing on wall, ceiling & re-plastering and repainting etc.) related with the above items are to be included .

Entire liquid and suction refrigerant pipe lines including all fittings, valves and strainer bodies etc. Shall be insulated with 19-mm/ 13 mm thick elastomeric Nitrile rubber as applicable.

Fresh air shall be drawn into AHU room by means of intake air louvers through pre- filters. The air filter shall be 3 Ply HDPE (pleated construction) with GI/Aluminum frame of preferable size 610 x 610 x 50 mm thick. The filter shall be housed in a frame with GI intake louver. The efficiency of filter shall be 90% down to 10 micron dust. The face velocity of filter shall not be more than 2.5 m/s. The quantities of the filters shall be as per the fan capacity envisaged.

Fresh & filtered air supply (90% down to 10 micron) for Party Hall-1 & 2 at 1st floor shall be considered through ductwork upto individual Cassette type indoor units.

Insulated condensate drain from each indoor unit shall be terminated to the nearest drain/nearby pantry/toilet wash basin block/risers at each floor.

HI-WALL SPLIT AC UNITS

Wall mounted split AC units shall be complete with electronic expansion valve, drain connections, stainless steel (18G) drain pan with PUF insulation, pre-filter, fan section, DX cooling coil section, wireless remote, inter-connecting refrigerant pipe work along with outdoor units. The units shall be 5-star rated compatible with R410A / R407C / R32/ Eco friendly refrigerant only

VENTILATION SYSTEM

AREAS TO BE VENTILATED

Dry type mechanical ventilation system shall be considered for different areas at individual floors of Banquet Hall area, as mentioned below:

Sl. No.	Location	Air Qty (Each) (CMH)	SP (mm WC)	Qty (Nos.)	Type of Exhaust Fan
1.0	Ground Floor				
	Toilets-Male, Female & Handi.	2,000	20	1	Ceiling suspended Ducted Cabinet Fan
	Kitchen	3,500	-	2	Propeller Fan
	Mezzanine Floor				
	Kitchen	3,500	-	2	Propeller Fan
	1st Floor				
	Small Toilets	200	-	10	Propeller Fan
	Common Toilet	750	-	1	Propeller Fan
	Fresh Air Fan for Party Hall-1 & 2	2,000	20	1	Ceiling suspended Ducted Cabinet Fan
	Terrace				
	Lift m/c Rooms	1,000	-	2	Propeller Fan

Notes:

Capacity, Static Pressure of Ventilation fans mentioned above are indicative & for reference only. Exact capacity & quantity of each fan shall be finalized based on detail load calculations during engineering stage, to be submitted by the Contractor, as per latest architectural drawings and equipment heat loads of respective area.

Static pressure of exhaust air fans shall be calculated by the Contractor based on layout drawing & to be submitted for approval during engineering stage.

Any additional area requiring ventilation as per architectural drawings during engineering stage, shall be considered without any price implications.

EQUIPMENT SPECIFICATION

PROPELLER FAN

Propeller fan shall be direct-driven, three or four blade type, mounted on a steel mounting plate with orifice ring. Mounting Plate shall be of steel construction, square with streamlined venture inlet (reversed for supply applications) coated with baked enamel paint. Mounting plate shall be of standard size, constructed of 12 to 16 gauge sheet steel depending upon the fan size.

Fan blades shall be constructed of aluminium or steel. Fan hub shall be of heavy welded steel construction with blades bolted to the hub. Fan blades and hub assembly shall be statically and dynamically balanced at the manufacturer's works. Shaft shall be of steel, accurately ground and shall be of ample size for the load transmitted and shall not pass through first critical speed thru the full range of specified fan speeds. Fans shall be provided with gravity louvers. Motors shall be suitable for $220 \pm 10\%$ volts, 50 cycles, single phase power supply.

AIR INTAKE GRILLES/LOUVERS

Air intake grilles/louvers shall be provided for supply air inlet at the lower level of respective doors. The grilles/louvers shall consist of parallel metallic blades suitable for door fittings.

COWL WITH BIRD SCREEN

Cowl with bird screen shall be provided for exhaust air fans. Bird screen of 10 sq.mm and minimum 16 G wire mesh shall be provided on the outer face. Gravity louver dampers shall be provided for all the exhaust fans.

DUCTWORK & INSULATION

DUCTWORK

All galvanized steel ductwork shall conform to IS:655 / SMACNA as applicable & shall have minimum zinc deposition of 180 gm/sq.m or better as per IS:277. All duct seams shall be filled with bitumastic cold emulsion or equivalent vapor seal.

All duct supports shall be provided at centre preferably not exceeding 2.5 Meter. The duct supports shall consist of structural steel angles and if required flats and jointed by bolting. Whenever duct support angles are to be fixed with reinforced concrete roof/floor slab, the anchoring screw shall be connected with duct support angles by means of intermediate angle plates with bolted connection, so as to facilitate early erection and dismantling. All items of duct support including MS rods, MS angles, double angles, auxiliary or special steel members, hooks, dash fasteners and all other supporting material required shall be provided by the BIDDER.

Fire proof Canvas or equal flexible connection shall be provided at each connection between duct work and AHU so as to isolate vibration.

Splitters & dampers shall be provided for equipment/area isolation & for proportional volume control of air. The same shall be min 16 gauge GS sheet of quadrant type with suitable locking device, mounted outside the duct in accessible position.

Suitable vanes shall be provided in the duct collar to have uniform & proper air distribution.

Coating shall be of approved colour to match interiors.

Selection and placing of diffusers, grilles etc. shall be by the Contractor matching the lighting fitting and the décor of the respective area.

INSULATION

Duct Thermal Insulation

Supply and return air sheet metal ducting shall be thermally insulated with Factory Pasted Al. Foil Faced Fire retardant 19 mm thick Closed Cell Nitrile Rubber Insulation (UL/FM approved) with necessary Adhesive as recommended by the Manufacturer.

Duct Acoustic Insulation

The supply air ducting from the outlet of each AHU up to 6 meters will be acoustically insulated from inside with 10mm thick Open Cell Nitrile Rubber insulation on the ducts after applying two coats of cold setting adhesive (CPR X compound), to maintain noise level as mentioned.

The insulating material shall have ODP (Ozone Depletion Potential) and GWP (Global Warming Potential) of Zero.

Roof Insulation

Under deck insulation shall be provided by the Contractor for the exposed roof for air-conditioned spaces.

DAMPERS, GRILLS, DIFFUSERS

All ducted indoor units shall have fusible link type fire damper as per UL 555 for 90 minutes rating for supply/ return duct (as applicable). Fire dampers shall be provided wherever duct crosses any wall / roof to isolate the respective AC unit in the event of fire. The space around the ducts and refrigerant / drain pipes shall be sealed with fire retardant material.

Jet diffusers shall be considered for Banquet Hall. All supply air grills / diffusers of air-conditioned areas shall be provided with volume control dampers.

The grills / diffusers will be of extruded aluminium powder coated.

PREFERRED MAKE LIST

Sr. No.	Description	Make
1	VRF System	Blue Star / Daikin / Mitsubishi / Toshiba / Voltas / LG / Samsung
2	Hi-wall Split AC	Blue Star / Daikin / Mitsubishi / Toshiba / Voltas / LG / Samsung
3	Air Filters	Clean filter /FMI / Spectrum
4	Fan / Blower	Kruger / Nicotra / Systemair / Greenheck / Comefri
5	GI Duct Sheet	Jindal / SAIL / Tata Steel

Sr. No.	Description	Make
6	Grilles / Diffusers / Fire Damper / VCD	Air Master / Dynacraft / TSC/ Systemair / Carryaire
7	Refrigerant copper Piping	Nippon / Nissan / Rajco
8	Insulation	
	EPS	Beard sell / Lloyd
	Nitrile Rubber	Aeroflex / Armaflex / Kflex / Armacell

Note:

Bidder to take written approval from Purchaser / Consultant regarding make of items other than as listed above.

PERFORMANCE GUARANTEE

GENERAL

All equipment and systems of the Air-conditioning & Ventilation system shall be guaranteed for workmanship & materials and satisfactory performance for a period of 12 months from the date of successful commissioning/ handing over. The guarantee for performance shall cover individual items/units and systems including electrics for their rated outputs as well as for integrated operations of the entire Air-conditioning & Ventilation system.

PERFORMANCE GUARANTEE PARAMETERS

Actual Capacity at site for each AC & Ventilation equipment measured for a period of at least 7 days

Total Power Consumption at design conditions / part load conditions

Actual Capacity of each system at design conditions/simulated operating conditions

Noise level

Vibration level

OVERALL PERFORMANCE:

At an appropriate time in consultation with purchaser the successful Bidder shall demonstrate performance at rated capacity over a period of 6 working days on continuous operating hours.

Contractor will furnish performance guarantee for Air Conditioning & Ventilation System in respect of all items listed in Table below. The values indicated in Table below and the guaranteed performance curve will be the basis for evaluation of the performance tests by the Owner and/or acceptance of the equipment.

The following Performance Guarantees shall be confirmed by the Bidder:

Sl. No	Particulars	Value
1.0	Actual Capacity at site condition for each AC & Ventilation equipment	To be indicated by the Bidder
2.0	Electrical power consumption of each AC unit	To be indicated by the Bidder
3.0	Electrical shaft power of each ventilation unit	To be indicated by the Bidder
4.0	Noise level of each equipment	As per Spec
5.0	Vibration level of each rotating equipment	As per ISO Standard

Performance guarantees under correction

The following items of performance on air conditioning system shall be guaranteed under correction with instrument tolerances as specified below:

Sl. No	Particulars	Value
1.0	Room inside temp. of each air-conditioned space	$\pm 1.0\%$
2.0	Shaft power of each motor	$\pm 1.0\%$
3.0	Noise level	85 dBA at 1.5 m distance of any rotating equipment & 65 dBA at 1.5 m distance at supply air grilles inside AC space
4.0	Vibration level	As per zones A and B of ISO 10816-1

Note:

The values indicated by the Bidder should be the minimum guaranteed values without any negative tolerance.

MANPOWER

The manpower to be utilized for demonstration of performance guarantee shall be arranged by the Bidder.

MODIFICATIONS OF DEFECTS

If the tests specified above show that the performance of Air-conditioning & Ventilation system has failed to achieve all the guaranteed parameters or some of them, the successful Bidder shall rectify the defects

and carry out modifications if necessary to meet the guaranteed figures and the guarantee tests shall be repeated at no extra cost.

However, protocol on this subject jointly agreed by the Purchaser and the successful Bidder will be prepared before the performance guarantee test.

DATA TO BE FURNISHED ALONG WITH THE BID

GENERAL

- Write-up on technical features of equipment offered.
- Filled-in Data Sheet as called for in the Technical Specification.
- Actual user's performance certificates in respect of equipment of systems covered under contract.
- Name of manufacturers of all major mechanical equipment.

Operation & maintenance requirements for next five (05) years.

List of recommended spare parts with price list.

- Bar Chart/PERT Network schedule incorporating the following major activities

Design and Engineering

Supply of equipment and accessories

Erection schedule

Testing and commissioning schedule

MECHANICAL

Offer shall be submitted as per enquiry specification.

Duly filled-in and stamped Data Sheets for all HVAC equipment.

Unit selection with product catalogue.

Confirmation of outdoor unit location & space provided.

Equipment Selection and schedule with model no. make and Motor List.

List of deviations if any.

Experience list for similar type of equipment supplied, which should indicate the name of customer, date of ordering, date of commissioning.

DATA TO BE FURNISHED AFTER AWARD OF CONTRACT

Successful Bidder to submit following document after award of contract for approval of Purchaser:

List of drawings/documents to be submitted for review, approval and information with scheduled submission dates.

Detail Heat Load Calculations for Air conditioning & Ventilation systems.

Air-conditioning Layout drawings of each floor.

Ventilation Layout drawings of each floor / area.

Air-conditioning schematic layout.

Refrigerant piping layout drawings for each VRF system.

GA drawings, Data Sheets of each equipment.

Equipment Schedule with Electrical Load List.

Vibration isolator selection, inertia block selection, sound attenuator selection, equipment sound power level and sound pressure level data.

Quality Assurance Plan (QAP)

PG test procedure.

Internal inspection documents/test reports of equipment before despatch clearance.

Billing schedule.

In addition to this, Bidder shall provide sample for the following items along with catalogue and sample approval must be taken before procurement of items:

Grilles, Diffusers.

Volume control dampers.

Fire dampers.

Thermal insulation for ducts as well as refrigerant pipes.

EQUIPMENT DATA SHEETS

VRF UNIT

SL. NO.	ITEM	UNIT	
1.0	GENERAL		
1.1	DESIGNATION		VRF SYSTEM FOR
1.2	MAKE AND MODEL NUMBER		
1.3	NUMBER OFFERED	(W+S)	
1.4	TAG NUMBERS		

SL. NO.	ITEM	UNIT	
1.5	COOLING CAPACITY	(BTU/Hr)	
1.6	POWER INPUT AT COOLING CAPACITY	KW	
1.7	CONDENSING TEMPERATURE AND PRESSURE	Deg.C and bar	
1.8	TEMPERATURE OF LIQUID REFRIGERANT AT THE OUTLET OF SUB-COOLER	Deg.C	
1.9	PLACE OF MANUFACTURE		
1.10	CAPACITY OF EACH VRF SYSTEM AT DESIGN CONDITIONS	TR	
1.11	REFRIGERANT		R407C / R410A
1.12	EACH VRF UNIT SIZE (L ×W× H) AND NUMBER OF UNITS	Mm	
1.13	CLEARANCE REQUIRED		
1.13.1	FRONT	Mm	
1.13.2	BACK	Mm	
1.13.3	SIDE	Mm	
1.13.4	TOP	Mm	
1.14	DRY WEIGHT	Kg	
1.15	OPERATING WEIGHT	Kg	
1.16	NOISE LEVEL AT 1.5 m DISTANCE		
1.16.1	OUTDOOR UNIT	dBA	
1.17	NUMBER OF REFRIGERATION CIRCUITS	Nos.	
1.18	TOTAL INPUT POWER AT DESIGN CONDITIONS/VOLTAGE	kW/V	
2.0	COMPRESSOR		

SL. NO.	ITEM	UNIT	
2.1	TYPE		HERMETIC/ SEMI-HERMETIC/SCROLL
2.2	NUMBER OF COMPRESSORS	Nos.	
2.3	MAKE AND MODEL NUMBER		
2.4	PLACE OF MANUFACTURE		
2.5	SUCTION TEMPERATURE	OC	
2.6	SUCTION PRESSURE	kg/cm2(g)	
2.7	CONDENSING TEMPERATURE	OC	
2.8	CONDENSING PRESSURE	kg/cm2(g)	
2.9	OPERATING SPEED	RPM	
2.10	INPUT POWER AT DESIGN CONDITION	KW	
2.11	MOTOR RATING	KW	
2.12	CAPACITY CONTROL AVAILABLE		YES / NO
2.13	IN STEPS OF IF YES		
3.0	BLOWER SECTION		
3.1	FAN		
3.1.1	NUMBER OF FANS		
3.1.2	MAKE AND MODEL NUMBER		
3.1.3	CAPACITY OF EACH FAN	m3/hr	
3.1.4	STATIC PRESSURE	mm WC	
3.1.5	STATIC PRESSURE EXTERNAL TO THE PAC	mm WC	
3.1.6	DISCHARGE DIRECTION		HORIZONTAL/VERTICAL UP/DOWN
3.1.7	IMPELLER SPEED	RPM	

SL. NO.	ITEM	UNIT	
3.1.8	OUTLET VELOCITY	m/s	
3.1.9	IMPELLER MATERIAL		
3.1.10	BRAKE POWER	kW	
3.1.11	POWER INPUT TO MOTOR AT DUTY POINT	kW	
3.1.12	MOTOR RATING	kW	
3.1.13	MOTOR MAKE		
3.2	DX COOLING COIL		
3.2.1	NUMBER OF COOLING COILS	Nos.	
3.2.2	SENSIBLE COOLING CAPACITY AT DESIGN CONDITIONS	kCal/hr	
3.2.3	LATENT COOLING CAPACITY AT DESIGN CONDITIONS	kCal/hr	
3.2.4	FACE AREA	m ²	
3.2.5	TUBE OUTSIDE DIAMETER AND THICKNESS	mm	
3.2.6	NUMBER OF ROWS DEEP	Nos.	
3.2.7	NUMBER OF FINS PER CENTIMETER	Nos.	
3.2.8	AIR FACE VELOCITY	m/s	
3.2.9	AIR SIDE PRESSURE DROP	mm WC	
3.3	FILTERS		
3.3.1	NUMBER OF FILTERS		
3.3.2	MAKE AND MODEL NUMBER		
3.3.3	FILTER MATERIAL		
3.3.4	OVERALL SIZE OF EACH FILTER- L×W	mm	
3.3.5	AIR SIDE PRESSURE DROP AT RATED CAPACITY	mm WC	
3.3.6	EFFICIENCY OF FILTER		

SL. NO.	ITEM	UNIT	
4.0	CONDENSER		
4.3.1	NUMBER OF CONDENSERS		
4.3.2	MAKE AND MODEL NUMBER		
4.3.3	HEAT REJECTION CAPACITY AT DESIGN CONDITIONS	kCal/hr.	
4.3.4	OVERALL SIZE OF FAN AND COIL UNIT OF EACH CONDENSER: L × W × H	mm	
4.3.5	MAXIMUM PERMISSIBLE DISTANCE BETWEEN CONDENSER AND INSIDE UNIT (VERTICAL & TOTAL)	m	
4.3.6	CONDENSER FANS		
a)	NUMBERS IN EACH CONDENSER	Nos.	
b)	CAPACITY OF EACH FAN	m ³ /hr.	
c)	STATIC PRESSURE	mm WC	
d)	IMPELLER MATERIAL		
e)	BRAKE POWER OF EACH FAN	kW	
f)	INPUT POWER OF EACH FAN	kW	
g)	MOTOR RATING OF EACH FAN	kW	
5.0	ACCESSORIES		
5.1	TYPE OF VIBRATION ISOLATORS		
5.2	REMOTE CONTROLLER		
5.3	FUNCTIONS		
5.4	FILTER MAINTENANCE TIME		
5.5	FAULT CODE DISPLY		
5.6	FACILITY TO CONNECT TO A SECOND (SUB) CONTROLLER		
6.0	MAKES		
6.1	THERMOSTATIC EXPANSION VALVE		

SL. NO.	ITEM	UNIT	
6.2	HIGH AND LOW PRESSURE CUT OUTS		
6.3	THERMOSTAT		
6.4	HUMIDISTAT		
7.0	PERFORMANCE GUARANTEE		
7.1	CAPACITY AT DESIGN CONDITIONS	TR	
7.2	TOTAL POWER INPUT AT DESIGN CONDITIONS	kW	
7.3	BLOWER		
7.4	STATIC PRESSURE EXTERNAL	mm WC	
7.5	DEHUMIDIFIED AIR FLOW CAPACITY AT SPECIFIED EXTERNAL STATIC PRESSURE	m3/hr.	
7.6	NOISE LEVEL AT 1.5m DISTANCE FROM		
7.6.1	VRF OUTDOOR UNIT	dBA	

PROPELLER FAN

	DATASHEET A		
	GENERAL		
	DESIGNATION		FANS FOR SUPPLY / EXHAUST
	NUMBER REQUIRED		
	TAG NUMBERS		
	LOCATION		
	DUTY		CONTINUOUS
	LOCATION IN HAZARDOUS AREA		
	HAZARDOUS AREA CLASSIFICATION		
	DESIGN DATA		

DATASHEET A			
	CAPACITY AT SUCTION CONDITIONS		
	NORMAL	M3/Hr	
	MINIMUM	M3/Hr	
	MAXIMUM	M3/Hr	
	GAS HANDLED		AIR
	GAS CONDITION AT SUCTION		
	TEMPERATURE		
	RELATIVE HUMIDITY		AMBIENT
	DENSITY	kg/M3	
	STATIC PRESSURE	mmWC	
	MAXIMUM FAN SPEED		
	FOR IMPELLER DIAMETER 450 mm AND LESS		1500 RPM
	FOR IMPELLER DIAMETER ABOVE 450 mm		1000 RPM
	DESIGN AMBIENT TEMPERATURE		
	ELEVATION ABOVE MEAN SEA LEVEL	M	
	CONSTRUCTION FEATURES		
	TYPE		TUBE AXIAL / PROPELLER
	SPARK PROOF CONSTRUCTION TYPE		AS PER AMCA A / B / C
	DRIVE		DIRECT
	ADJUSTABLE PITCH BLADES REQUIRED		NO
	TYPE OF MOUNTING		WALL / IN DUCT

DATASHEET A			
	PAINTING		AS PER IS STANDARD
	MATERIAL OF CONSTRUCTION		
	CASING		CS
	IMPELLER		CAST AL
	SHAFT		EN 8
	INLET CONE OR BELL		MS
	OUTLET CONE		MS
	GUIDE VANE		
	ACCESSORIES		
	FLEXIBLE CONNECTION AT FAN OUTLET		FOR TUBE AXIAL FAN - YES
	SOLATION DAMPERS AT FAN INLET /		YES
	INLET CONE OR BELL AND OUTLET CONE		FOR SUPPLY AIR FAN YES
	LOUVERED SHUTTERS		FOR EF YES
	WALL COWL WITH BIRD SCREEN		FOR SUPPLY AIR FAN YES
	FLEXIBLE COUPLING AND COUPLING GUARD		NO
	WOODEN BLOCK FOR MOUNTING		NO
	COMMON BASE FRAME OR SUPPORTING FRAME FOR MOUNTING		YES
	NEOPRENE RUBBER PADS		YES
	FOUNDATION BOLTS		YES
	VIBRATION ISOLATORS		YES
	RIBBED NEOPRENE RUBBER PADS BETWEEN FOUNDATION		NO

	DATASHEET A		
	BLOCK AND FLOOR FOR FLOOR MOUNTED FANS		
	MOTOR DATA		
	MOTOR BY		
	STARTER BY		
	TESTING & INSPECTION		
	TESTING & INSPECTION		AS PER IS STANDARD

	DATASHEET B		
	GENERAL		
	DESIGNATION		AXIAL FANS FOR
	NUMBER REQUIRED		
	TAG NUMBERS		
	LOCATION		
	DUTY		
	DESIGN DATA		
	CAPACITY AT SUCTION CONDITIONS		
	NORMAL	M3/Hr	
	MINIMUM	M3/Hr	
	MAXIMUM	M3/Hr	
	GAS HANDLED		AIR
	GAS CONDITION AT SUCTION		
	TEMPERATURE		
	RELATIVE HUMIDITY		
	DENSITY	kg/m3	
	STATIC PRESSURE	mmWC	

	DATASHEET B		
	MAXIMUM FAN SPEED		
	FOR IMPELLER DIAMETER 450 mm AND LESS		
	FOR IMPELLER DIAMETER ABOVE 450 mm		
	DESIGN AMBIENT TEMPERATURE		
	ELEVATION ABOVE MEAN SEA LEVEL	M	
	CONSTRUCTION FEATURES		
	TYPE		
	SPARK PROOF CONSTRUCTION TYPE		
	DRIVE		
	ADJUSTABLE PITCH BLADES REQUIRED		
	TYPE OF MOUNTING		
	PAINTING		
	MATERIAL OF CONSTRUCTION		
	CASING		
	IMPELLER		
	SHAFT		
	INLET CONE OR BELL		
	OUTLET CONE		
	GUIDE VANE		
	ACCESSORIES		
	FLEXIBLE CONNECTION AT FAN OUTLET		FOR TUBE AXIAL FAN - YES
	SOLATION DAMPERS AT FAN INLET /		YES

	DATASHEET B		
	INLET CONE OR BELL AND OUTLET CONE		FOR SUPPLY AIR FAN YES
	LOUVERED SHUTTERS		FOR EXHAUST YES
	WALL COWL WITH BIRD SCREEN		FOR SUPPLY AIR FAN YES
	COMMON BASE FRAME OR SUPPORTING FRAME FOR MOUNTING		YES
	NEOPRENE RUBBER PADS		YES
	FOUNDATION BOLTS		YES
	VIBRATION ISOLATORS		YES
	RIBBED NEOPRENE RUBBER PADS BETWEEN FOUNDATION BLOCK AND FLOOR FOR FLOOR MOUNTED FANS		NO
	ELECTRICAL		
	MOTOR BY		
	STARTER BY		
	POWER REQUIREMENT		
	POWER INPUT TO FAN AT DUTY POINT (BKW)	kW	
	MAXIMUM POWER REQUIREMENT AT SELECTED SPEED	kW	
	MOTOR RATING	kW	
	POWER INPUT TO MOTOR AT DUTY POINT	kW	
	DOCUMENTS TO BE ENCLOSED		WHETHER ENCLOSED
	GENERAL ARRANGEMENT DRAWING WITH MAJOR DIMENSIOND		YES / NO

	DATASHEET B		
	PART LIST WITH CODES AND MATERIALS OF CONSTRUCTION		YES / NO
	RATING CHARTS OR TABLES WITH SELECTION MARKED		YES / NO
	PERFORMANCE CURVE WITH DUTY POINT MARKED		YES / NO
	PERFORMANCE GRARANTEES		
	CAPACITY AT SUCTION CONDITIONS	M3 /Hr	
	STATIC PRESSURE	mmWC	
	POWER CONSUMPTION	kW	

AIR DISTRIBUTION SYSTEM

	DATASHEET A		
	GENERAL		
	DESIGNATION		AIR DISTRIBUTION SYSTEM
	DUCTING		
	RECTANGULAR DUCTING		YES
	MATERIAL		GSS
	QUANTITY		
	DUCT GAUGE		
	24 G	SQ.M	
	22 G	SQ.M	
	20 G	SQ.M	
	18 G	SQ.M	
	DIFFUSERS		
	DIFFUSERS WITH VOLUME CONTROL DAMPER		YES

DATASHEET A			
	TYPE		SQUARE
	PATTERN		FLUSH
	MATERIAL		AL WITH POWDER COATED
	QUANTITY		
	TYPE	NOS	SIZE, mm
	RECTANGULAR/SQUARE		
	RECTANGULAR/SQUARE		
	SQUARE DIFFUSERS	SQ.M	
	SLOT DIFFUSER	SQ.M	
	DIFFUSERS WITHOUT VOLUME CONTROL DAMPER		FOR RETURN AIR
	TYPE		SQUARE (S)
	PATTERN		FLUSH
	MATERIAL		AL WITH POWDER COATED
	QUANTITY		
	TYPE	NOS	SIZE, mm
	RECTANGULAR/SQUARE		
	RECTANGULAR/SQUARE		
	ROUND DIFFUSERS	SQ.M	
	SQUARE DIFFUSERS	SQ.M	
	LINEAR DIFFUSERS	SQ.M	
	SLOT DIFFUSERS	SQ.M	
	GRILLES		
	GRILLES WITH VOLUME CONTROL DAMPER		
	TYPE		DOUBLE ACTING

DATASHEET A			
	MATERIAL		CS WITH RUST RESIST. PRIMER/AL WITH POWDER COATING
	QUANTITY	M2	
	GRILLES WITHOUT VOLUME CONTROL DAMPER		
	TYPE		FIXED BLADE / ADJUSTABLE BLADE
	MATERIAL		CS WITH RUST RESIST. PRIMER/AL
	QUANTITY	M2	
	DAMPERS		
	OPPOSED BLADE TYPE VOLUME CONTROL DAMPER FOR RECTANGULAR DUCT WITH BRASS BUSHING	M2	
	MOTORIZED DAMPER		YES
	SHAFT BLADE TO BE PROVIDED WITH		BRASS BUSHING / TEFLON BUSHING / SEALED BALL BEARING
	FOR RECTANGULAR DUCT	M2	
	FIRE DAMPERS		YES
	TYPE		MOTORISED
	QUANTITY	QTY	
	INSULATION		
	ACOUSTIC INSULATION		YES
	MATERIAL		REF. TECHNICAL SPECIFICATION
	DENSITY	kg/M3	
	THICKNESS	mm	REF. TECHNICAL SPECIFICATION

DATASHEET A			
	QUANTITY	M2	
	THERMAL INSULATION		YES
	COMPANION SPECIFICATION		REF. TECHNICAL SPECIFICATION
	MISCELLANEOUS		
	PLENUM		YES
	QUANTITY		AS PER AC LAYOUT
	ACCESS DOORS TO BE PROVIDED		YES
	FLEXIBLE CONNECTION OTHER THAN AT EQUIPMENT INLET AND OUTLET	M2	
	FRAME WORK FOR, GRILLES, WALL MOUNTED VCD AND FIRE DAMPERS		CS / SS BY BIDDER
	DUCT SUPPORTS QUALIFIED FOR SEISMIC FORCES		YES
	TESTING & INSPECTION		
	TESTING & INSPECTION		AS PER IS STANDARD

DATASHEET B			
	GENERAL		
	DESIGNATION		AIR DISTRIBUTION SYSTEM FOR
	DUCTING		
	TYPE		RECTANGULAR
	MATERIAL		GSS / AL / SS 304
	TYPE		ROUND
	MATERIAL		GSS / AL / SS 304

	DATASHEET B		
	SEAM		SPIRAL / LONGITUDINAL
	DIFFUSERS		
	DIFFUSER WITH VOLUME CONTROL DAMPER		YES / NO
	TYPE		ROUND / SQUARE / LINEAR / SLOT
	PATTERN		FLUSH / STEPPED
	MATERIAL		CS WITH RUST RESISTANT PRIMER / AL WITH POWDER COATED / SS 304
	DIFFUSER WITHOUT VOLUME CONTROL DAMPER		YES / NO
	TYPE		ROUND / SQUARE / LINEAR / SLOT
	PATTERN		FLUSH / STEPPED
	MATERIAL		CS WITH RUST RESISTANT PRIMER / AL WITH POWDER COATED / SS 304
	GRILLES		
	GRILLES WITH VOLUME CONTROL DAMPER		YES / NO
	TYPE		SINGLE ACTING / DOUBLE ACTING
	MATERIAL		CS WITH RUST RESIST. PRIMER / AL WITH POWDER COATING / SS304
	QUANTITY	M2	
	GRILLES WITHOUT VOLUME CONTROL DAMPER		
	TYPE		FIXED BLADE / ADJUSTABLE BLADE
	MATERIAL		CS WITH RUST RESIST. PRIMER/AL
	QUANTITY	M2	
	DAMPERS		
	OPPOSED BLADE TYPE VOLUME CONTROL DAMPER		YES / NO

	DATASHEET B		
	FOR RECTANGULAR DUCT WITH BRASS BUSHING	M2	
	MOTORIZED DAMPER		YES / NO
	SHAFT BLADE TO BE PROVIDED WITH		BRASS BUSHING / TEFLON BUSHING / SEALED BALL BEARING
	FOR RECTANGULAR DUCT	M2	
	FIRE DAMPERS		YES / NO
	TYPE		MOTORISED
	INSULATION		
	ACOUSTIC INSULATION		YES / NO
	MATERIAL		
	DENSITY	kg/M3	
	THICKNESS	mm	
	QUANTITY	M2	
	THERMAL INSULATION		YES / NO
	MATERIAL		REF. TECHNICAL SPECIFICATION
	DENSITY	kg/M3	
	THICKNESS	mm	
	THERMAL CONDUCTIVITY	Kcal / hr m deg C	
	MISCELLANEOUS		
	PLENUM		YES / NO
	ACCESS DOORS		YES / NO
	FLEXIBLE CONNECTION OTHER THAN AT EQUIPMENT INLET AND OUTLET	M2	YES / NO
	FRAME WORK FOR, GRILLES, WALL MOUNTED VCD AND FIRE DAMPERS		CS / SS

	DATASHEET B		
	DUCT SUPPORTS QUALIFIED FOR SEISMIC FORCES		YES / NO
	PAINTING		YES / NO
	DUCTS		UNPAINTED /EPOXY / SYNTHETIC ENAMEL
	DUCT SUPPORTS		RED OXIDE PRIMER / EPOXY / SYNTHETIC ENAMEL
	DIFFUSERS IN CASE OF CS		UNPAINTED / EPOXY
	GRILLES IN CASE OF CS		UNPAINTED / EPOXY

INSULATION

	DATASHEET A		
	GENERAL		
	PIPES : REFRIGNERANT SUCTION AND LIQUID LINES		REF. TECHNICAL SPECIFICATION
	AIR-CONDITIONING SYSTEMS ENTIRE SUPPLY AND RETURN AIR DUCT		REF. TECHNICAL SPECIFICATION
	INSULATION ADHESIVE		CPR X COMPOUND
	FINISHING		AS PER IS STANDARD

	DATASHEET B		
	GENERAL		
	INSULATION MATERIALS		
	EQUIPMENT		
	PIPING SYSTEMS		
	AIR-CONDITIONING DUCT		
	INSULATION ADHESIVES		
	VAPOUR BARRIERS		

DATASHEET B			
	FINISHING MATERIALS		
	EQUIPMENT		
	PIPING SYSTEMS		
	AIR-CONDITIONING DUCT		
	DENSITY OF EACH OF THE INSULATING MATERIALS	kg/M3	
	IS ANY INSULATION MATERIAL CORROSIVE TO CARBON STEEL OR ALLOY STEEL SURFACE IN CONTACT		YES / NO
	INSULATION THICKNESSES FOR ALL INSULATION MATERIALS SELECTED, IN THE FORMAT SIMILAR TO THAT IN DATA SHEET A, TO BE ENCLOSED.		WHETHER ENCLOSED YES / NO

FILTER

DATASHEET A			
	GENERAL		
	DESIGNATION		
	SERVICE		AMBIENT AIR FOR AC SYSTM / /VENTILATION SYSTEM
	APPLICATION		
	TYPE		CASSETTE / FLANGE
	CLEANING METHOD		CLEANABLE
	DESIGN DATA		
	TOTAL AIR FLOW RATE	M3/Hr	
	TEMPERATURE OF AIR	°C	
	RELATIVE HUMIDITY	%	

DATASHEET A			
	DUST LOADING	gm/M3	
	EFFICIENCY		90% DOWN TO 10 MICRONS
	TYPE OF CONTAMINATION		RADIO ACTIVE / CORROSIVE
	MAXIMUM FILTER FACE VELOCITY	M/sec	2.5 FOR PRE FILTER 1.8 FOR FINE FILTER (FOR 150 MM) 2.4 FOR FINE FILTER (FOR 300 MM)
	TOTAL FACE AREA OF FILTERS REQUIRED		
	FILTER MEDIA		SYNTHETIC FIBRE / HDPE / GLASS FIBRE PAPER
	LIFE OF FILTER MEDIA FOR THROW AWAY	Hrs	
	PREFERRED SIZE OF EACH FILTER PANEL :		610 mm x 610 mm x 50 mm THK
	NUMBER OF FILTER PANELS		
	WEIGHT OF EACH FILTER	kg	
	MAXIMUM ALLOWABLE PRESSURE DROP FOR DESIGN FLOW RATE IN		
	CLEAN CONDITION	mmWC	
	CLOGGED CONDITION	mmWC	
	MATERIAL OF CONSTRUCTION		
	MOUNTING FRAME / SUPPORTING FRAME WORK FOR FILTER ASSEMBLY		GSS/ HOT DIP GALVANISED
	GASKETS FOR FILTER ASSEMBLY		NEOPRENE RUBBER
	FASTENERS		GS / SS
	TESTING & INSPECTION		

	DATASHEET A		
	TESTING AT WORKS		EFFICIENCY AND PRESSURE DROP FOR ALL FILTERS
	TESTING AT SITE		EFFICIENCY AND PRESSURE DROP, LEAKAGE AND FILTER BANK LEAKAGE

	DATASHEET B		
	GENERAL		
	DESIGNATION		
	APPLICATION		PRE / FINE
	TYPE		CASSETTE/FLANGE
	MANUFACTURER		
	MODEL NUMBER		
	WHETHER CLEANABLE		YES / NO
	CLEANING METHOD		
	REMOVAL AND CLEANING IN REMOTE PLACE BY AIR JET / WATER		YES / NO
	AIR/WATER PRESSURE REQUIRED	kg/cm2g	
	MECHANICAL CLEANING IN-SITE (WITHOUT REMOVING FILTERS) BY REVERSE COMPRESSED AIR JET		YES / NO
	AIR PRESSURE REQUIRED	kg/cm2g	
	FILTER MEDIA		SYNTHETIC FIBRE / HDPE /
			GLASS FIBRE PAPER
	LIFE OF FILTER MEDIA FOR THROW AWAY TYPE	Hrs	
	DUST LOADING CAPACITY	gms	PER FILTER
	DESIGN DATA		

	DATASHEET B		
	TOTAL FACE AREA OF FILTERS	M2	
	NUMBER OF FILTERS		
	SIZE OF EACH FILTER L x B x THK	mm	x x
	DESIGN AIR FLOW RATE PER FILTER	M3/Hr	
	WEIGHT OF EACH FILTER	kg	
	PRESSURE DROP AT DESIGN FLOW RATE IN		
	CLEAN CONDITION	mmWC	
	CLOGGED CONDITION	mmWC	
	EFFICIENCY	%	DOWN TO MICRONS
	MATERIAL OF CONSTRUCTION		
	FILTER PANEL FRAME		
	MOUNTING FRAME / SUPPORTING FRAME WORK FOR FILTER ASSEMBLY		
	GASKETS FOR FILTER ASSEMBLY		
	FASTENERS		
	MISCELLANEOUS		
	TYPE AND METHOD OF TESTS AS SPECIFIED ARE ACCEPTABLE		YES / NO
	WHETHER FILTER IS COMPATIBLE WITH THE TYPE OF CONTAMINATION		YES / NO
	SELECTION CHARTS WITH DUTY POINT MARKED FOR CLEAN AND CLOGGED FILTER CONDITION TO BE ENCLOSED		WHETHER ENCLOSED YES / NO

TECHNICAL SPECIFICATIONS OF ELECTRICAL WORKS

1.1 TRANSFORMER (OIL TYPE) SCOPE

This specification covers the requirements and tests including standard loss levels of oil immersed, natural air-cooled, outdoor type, double wound distribution transformers and accessory equipment.

CODES AND STANDARDS

The design, material, construction, manufacture, inspection, testing and performance of equipment shall comply with all currently applicable standards, codes of practice, regulations and safety codes in the locality where the equipment will be supplied & installed. Nothing in this specification shall be construed to relieve the CONTRACTOR of this responsibility.

The codes and standards mentioned in the various specifications and requirements specified in the enquiry document shall be latest as on the day of award of contract of the works unless otherwise specified. Contractor shall be responsible to inform to the Consultant/ Owner in case of any revisions/reaffirm/amendment in the relevant codes and standards after the date of award of contract within 30 days of the issue of such revision/re-affirm/amendment of the code/ standard. Consultant/ Owner may approve use of the earlier code/ standard if the revisions do not materially affect the statutory requirements of the project or does not impact safety practices. Any cost impact arising out of such revisions shall be mutually agreed.

The VENDOR shall ensure that instruments and gauges to be used for testing and inspection shall have valid calibration and the accuracy can be traced to National and International Standards as applicable

GENERAL CONSTRUCTIONAL FEATURES

All material used shall be of best quality and of the class, most suitable for working-under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over-excitation, shortcircuits as per specified standards, without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform.

The transformer construction shall be suitable for seismic data as specified in section B or elsewhere in the specifications.

TANKS

The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied.

The second colour from the prime and finish coats. The final coat shall be of a glossy, oil and weather resisting non-fading paint of shade. The interior of the tank shall be cleaned by shot blasting and painted with two coats of heat resistant and oil insoluble paint.

Steel bolts and nuts exposed to the atmosphere shall be galvanised.

VACUUM AND PRESSURE TEST

Vacuum & Pressure Tests for tank, conservator, radiator, pipes etc. shall be as per standard.

The tank cover shall be suitably sloped so that it does not retain rainwater.

The material used for gaskets shall be cork neoprene or approved equivalent.

CORE

The magnetic circuit shall be constructed from high grade cold-rolled nonageing grain oriented silicon steel laminations and shall be of 'core' type.

The insulation structure for the core to bolts and core to clamp plates shall be such as to withstand BIL & Lightning Impulse Voltage.

WINDING

Windings shall be of electrolytic Copper of 99.99% purity unless specifically approved by the PURCHASER.

Winding shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service.

The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.

INTERNAL EARTHING

The framework and clamping arrangement of core and coil shall be securely earthed inside the tank by Copper strap connection to the tank.

TERMINATION

Transformers shall be fitted either with bushing insulators or air insulated cable box with air insulated disconnecting chambers.

The neutral of the star-connected winding shall be brought out to a separate bushing terminal. The neutral bushing shall be provided on the tank side to facilitate lead of the earth conductor down to the ground level. For transformers 1000 kVA and above, tank mounted Epoxy resin cast insulators shall be provided for supporting the neutral earthing bar of required section, along its run from the neutral bushing to ground level. Neutral shall also be extended to cable box /bus duct flange as applicable.

CABLE TERMINATION

A flanged bushing connection shall be provided to suit the PURCHASER'S cable. The winding terminations shall be brought out on outdoor type of bushings.

BUSHINGS

Bushings shall be designed and tested to comply with the applicable standards. If type test certificates are not available, these tests shall also be carried out in addition to the routine tests.

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

Fittings made of steel or malleable iron shall be galvanized.

bushings shall be supplied with terminal connector clamp suitable for connecting the bushing terminal to the PURCHASER's specified conductor/cable.

BUSHING CURRENT TRANSFORMERS

Bushing shall be supplied with current transformers.

Secondary leads, including tapings, shall be brought to a weatherproof terminal box near the bushing.

Bushing C.T. nameplate shall be mounted on the tank adjacent to the terminal box.

CABLE BOXES AND DISCONNECTING CHAMBER

Cable boxes shall be supplied to suit the PURCHASER'S specified cables.

Disconnecting chamber shall be provided to enable the transformer to be removed without unsealing the cables. The disconnecting chamber shall be air insulated and complete with seal-off bushings, removable flexible connectors/links and removable covers.

Phase to phase and phase to ground clearances within the chamber shall be such as to enable either the transformer or cable to be subjected separately to Basic Insulation Level (BIL). Clearances shall be subject to the PURCHASER's approval.

MARSHALLING BOX

Whenever optional fittings as per clause 13.0 (e.g. temperature indicators with auxiliary contacts, Buchholz relay) and bushing CT, the VENDOR shall provide a marshalling box and marshal to it all the contacts/terminals of electrical devices mounted on the transformer. It shall be in the VENDOR'S scope to provide:

- (a) The interconnection cabling between the marshalling box and the accessory devices by either PVC insulated FR wires in GI conduits or PVC insulated inner extruded PVC, Outer sheath PVC FR armoured cable and
- (b) Necessary compression type, brass cable glands (at easily accessible location) at the marshalling box for the above mentioned cables.

The marshalling box shall be tank mounted, outdoor type, IP55 protected, weather-proof, sheet-steel (2 mm thick) enclosed, with hinged door having padlocking facility. Colour finish shall be epoxy paint, powder coated with minimum thickness of 50 microns and dark gray shade RAL 632. All doors, covers and plates shall be fitted with neoprene gaskets. Bottom shall be at least 600 mm from floor level and provided with gland plate and cable glands as required. Top surface shall be sloped.

All contacts for alarm, trip and indication circuits shall each be potential free, wired for auxiliary D.C. supply as specified and brought out to separate terminals at the terminal blocks in the marshalling-box. Terminals shall be rated for 10A. Wiring shall be FRLS/HFFR with multistranded, copper conductors of sizes not smaller than 1.5 sq.mm for control and 2.5 sq.mm for CT circuits. CT terminals shall be provided with shorting & earthing facility.

The marshalling box shall be provided with glass window so as to make the WTI and the OTI dials visible from the outside without opening the door.

The marshalling box shall house the winding temperature indicator (WTI, 150 mm dial 240 degree scale), the oil temperature indicator (OTI, 150 mm dial 240 degree scale), terminal block, 60W anti-condensation heater, 5/15A industrial type five pin socket and a LED fixture, suitable for operating on 230 V AC. Contacts of Buchholz relay, WTI, OTI, magnetic level gauge, PRD, OSR shall be wired up to the terminal block.

ELECTRICAL AND PERFORMANCE REQUIREMENTS

Transformers shall operate without injurious heating at the rated kVA at any voltage within + 10 percent of the rated voltage of that particular tap.

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

Overloads shall be allowed within the conditions defined in the loading guide of the applicable standard. Under these conditions, no limitations by terminal bushings, tap/changers or other auxiliary equipment shall apply.

Noise level of transformers shall be as per relevant standard.

OIL

Transformers shall be supplied complete with transformer oil, It shall be "PCB free and polycyclic Aromatic Hydrocarbons free mineral oil" OR Synthetic ester Oil.

FITTINGS AND ACCESSORIES

The following standard fittings shall be provided:

- (a) Two earthing terminals with the earthing symbol
- (b) Oil level gauge indicating oil level at minimum, 300C and maximum operating temperature
- (c) Air release device (for non sealed type transformer)
- (d) Rating and terminal marking plate
- (e) Plain breathing device for non-sealed type transformer which would not permit ingress of rain water and insects up to 200kVA transformers. Above 200kVA transformers dehydrating breather shall be provided
- (f) Drain cum-sampling valve (3/4" nominal size thread) preferably steel with plug for three phase transformer.
- (g) Thermometer pocket with cap
- (h) Oil filling holes having (1 1/4" nominal size thread) with cover (for sealed type transformers without conservator)
- (i) An extended pipe connection on upper end with welded cover for sealed type transformers. The pipe should be suitably threaded over a sufficient length to enable use of a refilling/siphon connection after removing the welded cover or any other similar arrangement capable of reuse
- (j) Lifting lugs for the complete transformer as well as for core and winding assembly
- (k) Nitrogen / air filling device / pipe with welded cover capable of reuse (for sealed type transformer)
- (l) Pressure relief device with trip contact or explosion vent above 200kVA
- (m) One filter valve on the upper side of the tank(for transformers above 200kVA)
- (n) Unidirectional flat rollers(for transformers above 200kVA)
- (o) Inspection hole(for transformers above 200kVA)
- (p) Pressure gauge for sealed transformers with radiators and nitrogen cushion(for transformers above 200kVA)
- (q) HV Side neutral grounding strip(Where one of the HV bushing terminal is connected to earth)
- (r) LV earthing arrangement for single phase transformers
- (s) Buchholz relay for transformers above 1000Kva

OPTIONAL FITTINGS

The following shall be available as additional fittings at the option of the user whenever specified:

- (a) Dehydrating breather in lieu of plain breathing device for transformer up to 200kVA
- (b) Filter valve (1 1/4" nominal size thread) for transformers up to 200kVA
- (c) Arcing horns or suitable rating lightning arrestors for HT side – 3 Nos. For transformers up to 200 kVA
- (d) Bird guard
- (e) Terminal connectors
- (f) Oil temperature indicator and winding temperature indicators for transformers above 200kVA
- (g) Jacking pads (for transformer above 1600kVA)

- (h) Buchholz relay (for transformers above 200kVA)
- (i) Magnetic oil level gauge (for transformer above 1600kVA) with low oil level alarm contact
- (j) Non return valve (for conducting pressure test)
- (k) Pressure relief device or explosion vent (up to 200kVA)
- (l) Protection relay for sealed type transformers for internal parameters that is pressure, temperature, oil level and gas detection (above 1000kVA)
- (m) 4 Nos anti-theft stainless steel fasteners with breakaway nut shall be provided at top cover(up to 200kVA)

TESTS

ROUTINE TESTS

- (a) Measurement of winding resistance
- (b) Measurement of voltage ratio and check of phase displacement
- (c) Measurement of short circuit impedance (principal tapping, when applicable) and load loss at 50 percent & 100 percent load
- (d) Measurement of no load loss and current
- (e) Measurement of insulation resistance
- (f) Induced over voltage withstand test
- (g) Separate source voltage withstand test
- (h) Pressure test
- (i) Oil leakage test

TYPE TEST

Bidder shall quote unit prices for carrying out the following type tests:

- (a) Lightning impulse test
- (b) Temperature rise test
- (c) Short-circuit withstand test
- (d) Pressure test

SPECIAL TESTS

The following shall constitute the special tests which shall be carried out by mutual agreement between the user and the supplier:

- (a) Determination of sound levels
- (b) Short-circuit withstand test above 200kVA
- (c) No load current at 112.5 percent voltage
- (d) Paint adhesion tests.
- (e) BDV and moisture content of oil in the transformer

LOSSES

Transformer losses and impedance values shall be as specified as per specified standard.

For the purpose of evaluation of bids, the quoted load losses and iron losses shall be increased to take in to consideration tolerance as permitted by applicable standard.

Should the losses as measured on the transformer after manufacture be found in excess of the values of the guaranteed losses with plus tolerance indicated,

REJECTION

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

- (a) Maximum total losses exceed the energy efficiency level as assigned
- (b) Impedance value differs the guaranteed value by $\pm 10\%$ or more.
- (c) Oil or winding temperature rise exceeds the specified value by 50C.
- (d) Transformer fails on impulse test.
- (e) Transformer fails on power frequency voltage withstand test.
- (f) Transformer is proved to have been manufactured not in accordance with the agreed specification.

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

Alternatively, the VENDOR shall repair or replace the transformer within a reasonable period to the PURCHASER's satisfaction at no extra cost to the PURCHASER.

SPARES

BIDDER shall quote item wise prices for the spares recommended for 2 years trouble free operation. All start up spares shall be deemed to be included in the main offer.

QUALITY ASSURANCE PLAN (QAP)

QAP shall list and define in sequential order all process control activities, inspection and tests proposed to be performed on the equipment/ material starting from component procurement and from testing stages to product dispatch. The QAP shall indicate and identify the applicable standards, detailed description with diagram the procedure, acceptance criteria, extent of check and record to be generated. Transformer Vendor has to get approval for QAP, from Purchaser / Consultant.

TRAINING OF PERSONNEL

Training of Purchaser's personnel (at least 2 Nos.) shall be free of cost to enable them to operate, troubleshoot and maintain the offered equipment/ components. The general guidelines for the training requirement, description of type of training required and the duration of training shall be indicated by the Bidder to fulfil the above objective.

STORAGE OF EQUIPMENT

Vendor shall indicate the specific requirements, if any for proper storage of the equipment supplied at site.

In general, while shipping the equipment to site, Vendor shall ensure that each assembly or component shall be crated, boxed or otherwise suitably protected against damage or loss during shipment and to facilitate site storage. All openings shall be effectively sealed with temporary closures to prevent entry of dust, dirt, moisture and other foreign matter.

DOCUMENTATION

Both hard and soft copies (AutoCAD) of all Vendor drawings shall be furnished right from approval stage.

The Vendor shall plan his manufacturing schedule so as to allow at least two weeks time for approval of the drawings after their receipt by the Purchaser.

Upon completion of the installation, the Vendor shall furnish a complete set of As built drawings in soft form.

Drawings prepared by the Vendor and approved by the Purchaser shall be considered as a part of the Contract Specification. However, examination and approval of the drawings by the Purchaser shall not relieve the Vendor of his responsibility for engineering, design, workmanship, materials and construction under the Contract.

The Purchaser shall reserve the right to comment on drawings and documents under information category and inform the Vendor to treat these drawings and documents as approval category.

Following Documents are to be submitted along with the bid document-

- (a) Tentative GA of the transformer.
- (b) Data sheets as asked for in the Specifications.
- (c) List of makes for all components including bought out items.
- (d) Type test certificates as asked for transformer.
- (e) Type test reports of OLTC (if applicable)

1.2 DIESEL GENERATOR SET GENERAL

- a. The equipment shall be complete with all necessary accessories and components as required as per IS standard for trouble free installation & operation.
- b. The generator shall have output rating sufficient to evacuate the output of the engine at rated power factor over complete range of site ambient conditions.
- c. The DG set shall be supplied with acoustic enclosure conforming to relevant standards.
- d. The generator shall be capable of satisfactory continuous operation at rated kVA and power factor at any voltage from 90% to 110% and within a frequency range of 47.5 Hz to 52.5 Hz.
- e. The generator shall have overload capacity as per applicable standards. The generator shall be capable of withstanding a three-phase short circuit at generator terminals when operating at rated kVA and power factor, 5% over voltage and with fixed excitation for 3 seconds.

EARTHING

- a. In DG, 4-point earthing system are to be considered out of which 2 points are for body earthing with GI strip and 2 point is for alternator neutral earthing with Copper strip.

PIPING

- a. All other associated piping, valves and other item necessary for completeness of equipment shall be supplied by the Contractor.

UNLOADING

- a. Gensets without Acoustic Enclosure.
 - Genset should not be lifted from engine and alternator hooks. These are designed for lifting individual items only. Normally, provision for Genset lifting is provided on base- rails. The Genset should be unloaded from base rail by lifting with proper Genset lifting tackle or nylon sling/steel rope of suitable capacity and crane so as to ensure no damage to oil sump, air cleaner, radiator pipes etc.
 - Genset should be covered with polyethylene or tarpaulin during installation to ensure that water does not enter inside.
 - Spreader bar/ spacer plate of suitable size may be required to avoid damages to Genset components.

- b. DG set with Acoustic enclosures are provided with lifting hooks.

LOCATION

- a. DG Sets with Acoustic Enclosure

- DG sets are required to be supplied with acoustic enclosure. DG Set with acoustic enclosure shall preferably be installed outside the building (including terrace subject to structural feasibility) & location should be finalized in consultation with the Architect. However, DG set should be as near to the substation as possible i.e. as near to Essential LT Panel as possible. Associated AMF panel/ Electrical panel of the DG Set can be located inside the acoustic enclosure or outside the acoustic enclosure as per manufacturer standard. In case, AMF/ Electrical panel has to be installed outside the acoustic enclosure, location of room to house AMF/ Electrical panel should be decided in consultation with the Architect so that it shall be as near to the acoustic enclosure as possible. Specially, in case of connection through bus trunking, care should be taken for aesthetics.

NOMINAL RATINGS OF DG SETS

- a. DG Sets are normally available in following standard capacities: (Ratings in KVA)

7.5	10	12.5	15	17.5	25	30	35	40	50	62.5
75	82.5	110	125	140	200	225	250	320	350	380
415	450	500	550	600	625	700	750	1010	1250	1500

CLIMATIC CONDITIONS

- a. The output of DG Set shall be specified in tender documents under actual site conditions. The tenderer has to certify that the engine & alternator meets the capacity requirement after de-rating as per IS/ BIS. DG Set should be type tested for Noise and Emission.

DIESEL ENGINE

- a. The engine shall be of standard design of the original manufacturers. It should be 4 stroke cycles, water cooled, naturally aspirated/ turbo charged (as per manufacturer standard), diesel engine developing suitable BHP for giving a power rating as per ISO 8528- Part-1 in KVA at the load terminals of alternator at 1500 rpm at actual site conditions.
- b. The engine shall be capable for delivering specified Prime Power rating at variable loads for PF of 0.8 lag with 10% overload available in excess of specified output for one hour in every 12 hours. The average load factor of the engine over period of 24 hours shall be 0.85 (85%) for prime power output.
- c. The engine shall conform to IS: 10000/ ISO 3046/ BS:649/ BS 5514 amended up to date.
- d. Necessary certificate indicating the compliance of the above capacity requirement for the engine model so selected along with compliance of Noise and Emission norms as per latest CPCB guidelines for DG set capacity up to 1000 KVA, should be furnished from the manufacturers along with the technical bid. However above 1000 KVA DG set, manufacturers shall furnish certificate that the Engine for the DG set complies with the CPCB Emission norms.
- e. The engine shall be fitted with following accessories subject to the design of the manufacturer:
- Dynamically balanced Fly wheel.
 - Necessary flexible coupling and guard for alternator and engine (applicable only for double bearing alternator).

- Air cleaner (dry/ oil bath type) as per manufacturer standard.
- A mechanical/ electronic governor to maintain engine speed at all conditions of load.
- Daily fuel service tank of minimum capacity as per Table below, fabricated from M.S. sheet with inlet, outlet connections air vent tap, drain plug and level indicator (gauge) M.S. fuel piping from tank to engine with valves, unions, reducers, flexible hose connection and floor mounting pedestals, twin fuel filters and fuel injectors. The location of the tank shall depend on standard manufacturers design.

- f. Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.
- g. Dry exhaust manifold with suitable exhaust residential grade silencer to reduce the noise level.
- h. Suitable self-starter for 12 V/ 24 V DC.
- i. Battery charging alternator unit and voltage regulator, suitable for starting batteries, battery racks with interconnecting leads and terminals.
- j. Necessary gear driven oil pump for lubricating oil, priming of engine bearing as well as fuel systems as per manufacturer recommendations.
- k. Naturally aspirated/ turbo charger (as per manufacturer standard).
- l. Lubrication oil cooler.
- m. Lubrication oil filters with replaceable elements.
- n. Crank case heater as per manufacturer recommendations.
- o. Fuel injection: Engine should have suitable fuel injection system in order to achieve low fuel consumption.
- p. Fuel control solenoid.
- q. Fuel pump with engine speed adjustment.
- r. Engine Control Panel fitted and having digital display for following:
 - Start/stop key switch
 - Lube oil pressure indication
 - Water temp. indication
 - RPM indication
 - Engine Hours indications
 - Battery charging indication
 - Low lub. Oil trip indication
 - High water temp. indication
 - Over speed indication
- s. All moving parts of the engine shall be mechanically guarded in such a manner that a human finger cannot touch any moving part.
- t. Radiator/ Heat Exchanger System/ Remote Radiator (delete whichever is not applicable).
- u. Any other item not included/ specified but is a standard design of the manufacturer.

8 GOVERNOR

- a. Mechanical governor of class A2 for up to and including 200 KVA capacity and Electronic governor of class A1 for capacity above 200 KVA, as per ISO 3046/ BS 5514 with actuator shall be provided as per standard design of manufacturer. Governor shall be a self-contained unit capable of monitoring speed.

FREQUENCY VARIATION

- a. The engine speed shall be so maintained that frequency variation at constant load including no load shall remain within a band of 1% of rated frequency.

FUEL SYSTEM

- a. It shall be fed through engine driven fuel pump. A replaceable element of fuel filter shall be suitably located to permit easy servicing. The daily service tank shall be complete with necessary supports, gauges, connecting pipe work etc. In case of Top Mounted tanks, non-return valves are must in fuel supply and return line of specified value. Pipe sealant should be used for sealing for all connections. No Teflon tape to be used. If piping length is more than 10 meters, detail engineering is required in consultation with OEM.

LUBRICATING OIL SYSTEM

- a. It shall be so designed that when the engine starts after a long shut down lubrication failure does not occur. Necessary priming pump for the lub. oil circuit as per recommendation of manufacturer shall be installed, to keep bearings primed. This pump shall be normally automatically operative on AC/ DC supply available with the set.

STARTING SYSTEM

- a. This shall comprise of necessary set of heavy-duty batteries 12V/ 24V DC (as per manufacturer standard), and suitable starter motors, axial type gear to match with the toothed ring on the fly wheel. A timer in the control panel to protect the starter motor from excessively long cranking runs shall be suitably integrated with the engine protection system and shall be included within the scope of the work. Battery capacity shall be suitable for meeting the needs of starting system (as three attempts starting), as well as the requirements of control panel, indications and auxiliaries such as priming pump as applicable etc. The scope shall cover all cabling, terminals, including initial charging etc. The system shall be capable of starting the DG set within 20-30 sec., even in winter condition with an ambient temperature down to 0°C.

BATTERY CHARGER

- a. The battery charger shall be suitable to charge required numbers of batteries at 12V/ 24V complete with, transformer, rectifier, charge rate selector switch, indicating ammeter & voltmeter etc. Connections between the battery charger & batteries shall be provided with suitable copper leads with lugs etc.

PIPING WORK

- a. All pipe lines and fittings and accessories requirement inside the room/ enclosure and outside for exhaust piping shall be provided by the Contractor. This shall include necessary flexible pieces in the exhaust, fuel, lub. oil and water lines as are necessary in view of the vibration isolation requirement in the installation. Piping of adequate size shall be used for lub. oil of the material as per manufacturer standard. However, only M.S. pipes for the exhaust shall be used. For fuel lines within the acoustic enclosure, PVC braided pipe as per manufacturer recommendations can be used. However, for fuel lines outside the acoustics enclosure only MS pipe be used.
- b. The pipe work shall be inclusive of all fittings and accessories required such as bends, reducers, elbows, flanges, flexible connections, necessary hardware etc. The installation shall cover clamps, supports, hangers etc. as are necessary for completing the work. However, the work shall be sectionalized with flanged connections as are necessary for easy isolation for purposes for maintenance of unit as approved by Engineer-in-charge.

COMMON BED PLATE

- a. Engine and alternator shall be directly coupled or coupled by means of flex plate/ flexible coupling as per manufacturer standard design and both units shall be mounted on a common bed plate together with all auxiliaries to ensure perfect alignment of engine and alternator with minimum vibrations. The bed plate shall be suitable for installation on suitable anti-vibration mounting system.

EXHAUST SYSTEM:

- a. Exhaust Piping: All M.S. Pipes for exhaust lines shall be conforming to relevant IS. The runs forming part of factory assembly on the engine flexible connections up to exhaust silencer shall be exclusive of exhaust piping item. The work includes necessary cladding of exhaust pipe work using 50 mm thick Loosely bound resin (LBR) mattress/ mineral wool/ Rockwool, density not less than 120 kg/m³ and aluminium cladding (0.6 mm thick) for the complete portion. The exhaust pipe work includes necessary supports, foundation etc. to avoid any load & stress on turbo charger / exhaust piping. The exhaust pipe shall run along the existing wall of the building duly clamped/supported on independent structure for which, the design and Drawing for such structure shall be got approved from the Engineer-in-charge.
- b. Exhaust system should create minimum back pressure.
- c. Number of bends should be kept minimum and smooth bends should be used to minimize back pressure.
- d. Pipe sleeve of larger dia. should be used while passing the pipe through concrete wall & gap should be filled with felt lining.
- e. Exhaust piping inside the Acoustic Enclosure/ Genset room should be lagged with asbestos rope along with aluminium sheet cladding / insulated to avoid heat input to the room.
- f. Exhaust flexible shall have its free length when it is installed. For bigger engines, 2 flexible bellows can be used.
- g. For engines up to 500 KVA, only one bellow is required. However, if exhaust pipe length is more than 7 m then additional bellow/ provision for expansion should be provided.
- h. 'Schedule B' MS pipes and long bend/elbows should be used.
- i. The exhaust outlet should be in the direction of prevailing winds and should not allow exhaust gases to enter air inlet/ windows etc.
- j. When tail end is horizontal, 45 Degree downward cut should be given at the end of the pipe to avoid rain water entry into exhaust piping.
- k. When tail end is vertical, there should be rain trap to avoid rain water entry. If rain cap is used, the distance between exhaust pipe and rain cap should be higher than diameter of pipe. Horizontal run of exhaust piping should slope downwards away from engine to the condensate trap. Silencer should be installed with drain plug at bottom.
- l. Optimum Silencer Location: Location of the silencer in exhaust system has very definite influence on both reduction of noise and back pressure imposed on the system. The preferred silencer locations are given in the Table below, where L is length of the total exhaust system measured from exhaust manifold in meters. Please note that locating the silencer as per optimum silencer location is not mandatory. For high rise buildings, suitable arrangements may have to be provided in consultation with acoustics engineer.

Table – 1 Optimum Location of Silencer (In meters)		
	In-line Engine	'V' Engine
Best	2L/5	(4L – 1.5) / 5
Second best	4L/5	(2L – 4.5) / 5
Worst Location of	L/5 or 3L/5 or at tail end of	(3L - 10)/ 5 or at the tail end of

Table – 1 Optimum Location of Silencer (In meters)		
	In-line Engine	‘V’ Engine
Silencer	Exhaust piping	Exhaust piping

m. Exhaust Stack Height:

- In order to dispose exhaust above building height, minimum exhaust stack height should be as follows: -
- FOR DG SET UP TO 1000 KVA: -
 $H = h + 0.2$
 Where H = height of exhaust stack h = height of nearby building
- FOR DG SET ABOVE 1000 KVA: -
 30 m High or 3 m above the building height, whichever is higher.
- Care should be taken to ensure that no carbon particles emitted due to exhaust leakage enters and deposits on alternator windings and on open connections.
- Support to Exhaust Piping: Exhaust piping should be supported in such manner that load of exhaust piping is not exerted to turbocharger.

n. Exhaust Stack Height shall strictly comply with local regulations.

AIR SYSTEM

- a. It is preferable to provide vacuum indicator with all engines to indicate choked filter. Maximum air intake restrictions with clean and choked filters should be within prescribed limit as per OEM recommendation for the particular model of the engine. Gensets should be supplied with medium duty/ heavy duty air cleaners (specify one only). (Heavy duty air cleaner should be used for installations in dusty or polluted surroundings.)

COOLING SYSTEM

- a. System should be designed for ambient temperature of 45oC.
- b. Water softening/ demineralizing plants should be used, if raw water quality is not acceptable.
- c. Coolant should be used mixed with additive (in suitable proportion) as per recommendation of OEM for various engine models.
- d. Radiator fan flow should be free from any obstruction.
- e. For radiator cooled DG Set, proper room ventilation should be planned at the time of construction of DG room.
- f. Remote Radiator can be used in case of basement installation where fresh air may not be available. The proper location of remote radiator is very essential for the successful and efficient operation of remote radiator. In this the cooling media is ambient air. So, in order to obtain maximum efficiency from remote radiator, it is necessary to get fresh air in its surrounding. The horizontal distance of remote radiator from engine should not exceed 10 Meter.
- g. For the dusty or polluted surroundings (as radiator gets clogged) and/ or bigger capacity Gensets (say 1000 KVA and above), installation of Cooling System with Heat Exchanger system may be used.
- h. Optional items as under may be included as per site requirement at the discretion of Technical Sanctioning authority:
- Cooling System

- Remote Radiator
- Jacket Water Heater
- Crankcase Oil Heater
- After cooler jacket turbo charger electrical pre heat systems.
- Fuel System
- Fuel Water Separator
- Auxiliary Fuel Pump
- Exhaust System
- Industrial Grade Muffler
- Residential Grade Muffler
- Critical Grade Muffler
- Super Critical Grade Muffler
- Start System
- Battery Warmer Plate
- Battery Charger
- Automatic Float Equalizing
- Trickle

ALTERNATOR

- a. Synchronous Alternator: Self-excited, screen protected, self-regulated, brush less alternator, Horizontal foot mounted in Single/Double bearing construction (specify one only) suitable for the following:

Table - 2 Alternator data sheet

Rated PF	:	0.8 (lag)
Rated voltage	:	415 volts
Rated frequency	:	9 50 Hz
No. of Phases	:	3
Enclosure	:	SPDP
Degree of protection	:	10 IP-23
Ventilation	:	Self ventilated air cooled
Ambient Temperature	:	45° C Maximum
Insulation Class	:	F/H
Temperature Rise	:	Within class F/H limits at rated load
Voltage Regulation	:	+/- 1%
Voltage Variation	:	+/- 5%
Overload duration/capacity	:	10% for one hour in every 12 hours of continuous use.
Frequency variation	:	11 As defined by the Engine Governor (+/- 1%)
Excitation	:	Self / separately excited (Self excitation upto 750 KVA and separately excited system above 750 KVA)
Type of AVR	:	Electronic
Type of Bearing and Lubrication arrangement	:	Anti-friction bearings with Grease lubrication

Standard	:	IS 4722 & IEC:34 as amended upto date.
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- b. Alternator should be able to deliver output rating at actual site conditions.
- c. The alternator above 500 KVA capacity shall be fitted with suitable Nos. Resistance Temperature Device (RTD) & Bearing Temperature Device (BTD) alongwith space heaters. The terminal of space heaters will be wired to terminal box and the temperature scanner shall be provided in control panel for scaling the winding and bearing temperature.
- d. Excitation: The alternator shall be brushless type and shall be self/ separately excited, self-regulated having static excitation facility. The exciter unit be mounted on the control panel or on the alternator assembly. The rectifier shall be suitable for operation at high ambient temperature at site.
- e. Automatic Voltage Regulators (AVR): In order to maintain output terminal voltage constant within the regulation limits i.e. +/- 1%, Automatic voltage regulator unit shall be provided as per standard practice of manufacturer.
- f. Fault Tripping: In the event of any fault e.g. over voltage/ high bearing temperature/ high winding temperature or an external fault, the AVR shall remove the excitation voltage to the alternator. An emergency trip shall also be provided.
- g. Standards: The alternator shall be in accordance with the following standards as are applicable.
 - IS 4722/ BS 2613: 1970. The performance of rotating electrical machine.
 - IS 4889/ BS 269 rules for method of declaring efficiency of electrical machine.
- h. Performance: Voltage dip shall not exceed 20% of the rated voltage for any step load or transient load as per ISO 8528 (Part-1). The winding shall not develop hot spots exceeding safe limits due to imbalance of 20% between any two phases from no load to full load.
- i. Generator shall preferably be capable of withstanding a current equal to 1.5 times the rated current for a period of not more than 15 seconds as required vide clause 14.1.1 of IS 4722:1992.
- j. The performance characteristics of the alternator shall be as below:
 - Efficiency at full load 0.8 P.F.
 - i. Upto 25 KVA – not less than 82%
 - ii. Above 25 KVA and upto 62.5 KVA – not less than 86%
 - iii. Above 62.5 KVA & upto 250 KVA – not less than 90%
 - iv. Above 250 KVA – not less than 93.5%
 - v. Total distortion factor Less than 3 %
 - Overloading
 - i. 10% overload - One hour in every 12 hrs of continuous use.
 - ii. 50% overload - 15 seconds.
- k. Terminal Boxes: Terminal boxes shall be suitable for U.G. cables/ Bus Trunking. The terminal box shall be suitable to withstand the mechanical and thermal stresses developed due to any short circuit at the terminals.
- l. Earth Terminals: 2 Nos. earth terminals on opposite side with vibration proof connections, non-ferrous hardware etc. with galvanized plate and passivated washer of minimum size 12 mm dia. hole shall be provided.

- m. Space Heaters: Alternators of capacity more than 500 KVA shall be provided with suitable space heaters to maintain the winding temperature automatically such that it does not absorb moisture during long idle periods. The heater terminals shall be brought to a separate terminal box suitable for 230 V AC supply and a permanent caution notice shall be displayed.

AMF PANEL, BATTERIES AND ELECTRICAL SYSTEM

a. Battery/ Electrical System

- Batteries supplied with Genset are generally dry and uncharged. First charging of uncharged batteries is very important and should be done from authorized battery charging centre. Initial charging should be done for 72-80 hours.
- Batteries should be placed on stands and relatively at cool place.
- Battery capacity and copper cable sizes for various engine capacity are recommended as indicated in the table below. Cable sizes shown are for maximum length of 2 m. If length is more, cable size should be selected in such a way that voltage drop does not exceed 2 V. However, capacity as recommended by manufacturer may be taken.
- For AMF applications, a static battery charger working on mains supply is recommended to keep the batteries charged at all times.
- 1.5 sq.mm copper wire should be used for wiring between junction box and Control Panel.

Cabling

- Power cabling between alternator and control panel and change over switch to mains should be done with recommended cable sizes.
- Overheating due to loose thimbling / undersize cables causes most of electrical failures, hence correct size of cable and thimbles should always be used, if cable is specified.
- While terminating cables, avoid any tension on the bolts/ busbars (if cable is specified). While terminating R, Y& B phase notations should be maintained in the alternator and control panel for easy maintenance.
- Crimped cables should be connected to alternator and control panel through cable glands, if cable is specified.
- Multi-core copper cables should be used for inter connecting the engine controls with the switchgear and other equipment.
- For AMF application, multicore 1.5 sq.mm flexible stranded copper cable for control cabling should be used.
- It is recommended to support output cables on separate structure on ground so that weight of cables should not fall on alternator/ base rail.
- External wirings, when provided for remote voltage / excitation monitoring/ droop CT etc. shall be screened sheathed type. Maximum length of such wiring shall not exceed 5 meters.

Alternator Termination Links

- For proper terminations between links and switchgear terminals, the contact area must be adequate. The following situations should also be avoided as they lead to creation of heat sources at the point of termination:
- Point contact arising out of improper position of links with switchgear terminals.
- Gaps between busbars / links and terminals being remedied by connecting bolt/stud. In such cases the bolt will carry the load current. Normally these bolts / studs are made of MS and hence are not designed to carry currents.

- Adequate clearance between busbars / links at terminals should be maintained (IS 4232 may be referred to for guidelines).
- Improper termination will lead to local heat generation which may lead to failure.

FOUNDATION

a. Genset with Acoustic Enclosure

- For DG Sets installed inside the DG Set Room - A PCC foundation (1:2:4, M-20 grade) of approximate depth 150 mm above the finished Genset Room Floor level is required so as to provide levelled surface for placement of the acoustics enclosure. The length and breadth of foundation should be at least 250 mm more on all sides than the size of the enclosure. Genset should be mounted on AVM's inside the enclosure.
- For DG Sets installed outside in open area - A PCC (1:2:4, M-20 grade) foundation of weight 2.5 times the operating weight of the Genset with enclosure or as recommended by the Genset manufacturer OEM/OEA, whichever is higher, is required to be provided and is included in scope of work for SITC of Genset. 300 mm of this foundation height should be above the ground level. The length and breadth of foundation should be at least 250 mm more on all sides than the size of enclosure. Genset should be mounted on AVM's inside the enclosure.

ACOUSTIC ENCLOSURE

a. Installation

- Acoustic enclosures are supplied with built in Anti Vibration Mountings (AVMs). As such Genset can be installed directly on the levelled surface.
- Exhaust piping outlet should not be turned towards window / ventilator of home or occupied building. Provision of rain cap should be ensured.
- The acoustic enclosure placement should be such that there is no restriction in front of air inlet and outlet from canopy.

b. Service Accessibility

- Genset / Engine control panel should be visible from outside the enclosure.
- Routine / periodical check on engine / alternator (filter replacement and tappet setting etc.) should be possible without dismantling acoustic enclosure.
- For major repairs / overhaul, it may be required to dismantle the acoustic enclosure.
- Sufficient space should be available around the Genset for inspection and service.

c. General Design Guidelines

- To avoid re-circulation of hot air, durable sealing between radiator and canopy is must.
- Ventilation fans are must for the Gensets cooled by heat-exchanger/cooling tower system.
- Exhaust piping inside the enclosure must be lagged (except bellow).
- Temperature rise inside the enclosure should not be more than 5°C for maximum ambient above 45°C and it should be below 10°C for ambient below 45°C.
- There should be provision for oil, coolant drain and fill. Fuel tank should have provision for cleaning.
- The enclosure should be designed to meet the total air requirement for the D.G. Set at full load at site conditions as recommended by the engine manufacturer.

d. Specifications for Acoustic Enclosure

- The acoustic enclosure shall be designed and manufactured confirming to relevant standards suitable for outdoor installation exposed to weather conditions, and to limit overall noise

level to 75 dB (A) at a distance of 1 mtr. from the enclosure as per CPCB norms under free field conditions.

- The construction should be such that it prevents entry of rain water splashing into the enclosure and allows free & quick flow of rain water to the ground in the event of heavy rain. The detailed construction shall conform to the details as under:
 - The enclosure shall be fabricated out the CRCA sheet of thickness not less than 1.6 mm on the outside cover with inside cover having not less than 0.6 mm thick perforated powder coated CRCA sheet.
 - The hinged doors shall be made from not less than 16 SWG (1.6 mm) thick CRCA sheet and will be made air tight with neoprene rubber gasket and heavy-duty locks.
 - All sheet metal parts should be processed through 7-tank process.
 - The enclosure should be powder coated.
 - The enclosure should accommodate the daily service fuel tank of the D.G. Set to make the system compact. There should be provision of fuel gauge, which should show the level of the fuel even when the DG Set is not running. The gauge should be calibrated. The fuel tank should be filled from the outside as in automobiles and should be with a lockable cap.
 - The batteries should be accommodated in the enclosure in battery rack.
 - The canopy should be provided with high enclosure temperature safety device.
 - The acoustic lining should be made up of high-quality insulation material i.e. rockwool/ glass/ mineral wool/ PU foam of appropriate thickness & density for sound absorption as per standard design of manufacturers to reduce the sound level as per CPCB norms. The insulation material shall be covered with fine glass fiber cloth and would be supported by perforated M. S. Sheet duly powder coated / GI sheet/ aluminium sheet.
 - The enclosure shall be provided with suitable size & No. of hinged type doors along the length of the enclosure on each side for easy access inside the acoustic enclosure for inspection, operation and maintenance purpose. Sufficient space will be provided inside the enclosure on all sides of the D.G. set for inspection, easy maintenance & repairs.
 - The canopy should be as compact as possible with good aesthetic look.
 - The complete enclosure shall be of modular construction.
 - The forced ventilation shall be as per manufacturer design using either engine radiator fan or additional blower fan(s). If the acoustic enclosure is to be provided with forced ventilation, then suitable size of axial flow fan (with motor and auto-start arrangement) and suitable size axial flow exhaust fan to take the hot air from the enclosure complete with necessary motors and auto start arrangement should be provided. The forced ventilation arrangement should be provided with auto stop arrangement to stop after 5 minutes of the stopping of D.G sets.
 - The acoustic enclosure should be suitable for cable connection/connection through bus-trunking. Such arrangements on acoustic enclosure should be water proof & dust-proof conforming to IP-65 protection.
 - The inside of enclosure should be provided with at least two nos. 15 W-LED light luminaire controlled by a 5A switch for adequate lighting during servicing etc. of the DG Set. The power supply to this luminaire should be from the load side of the AMF Panel so that it can remain energized under all conditions.
- e. Specific Requirements of DG Panel: General operation philosophy
- No volt relays provided in the Main LT panel / DG controller will monitor the grid voltage. In the event of grid supply failure Controller will trip the grid incomer breakers and also give

initiating signal to DG for auto starting. For this, DG Local/Remote/Test mode selector switch is in Remote mode and DG Auto/Manual selection shall be selected for Auto.

- DG Controller shall perform the following function:
 - i. Automatic starting, load sharing and stopping of DG sets based on variation in load.
 - ii. There should be facility in panel to test the DG Sets.
 - iii. Facility for remote alarm indication for “AMF set in operation”, “AMF fails to start” shall be provided through potential free contact.
- f. The DGs will not run in parallel with State electricity board grid.
- g. Separate numerical relay for IDMT over current, short circuit fault and earth fault i.e. 51 & 51N protection shall be provided. Relays should have RS485 port at front side. Relays and protection shall be enabled for SCADA/BMS compatibility with IEC 61850 protocol.
- h. Generator protection relays shall be supplied with latest version software and hardware without any extra cost. It should be possible to set relay, view fault parameters, download information from relay to computer connected system.
- i. For DG incomer(s) separate master trip relay ‘86’ (VAJHM23), trip circuit supervision relay ‘95’ (VAX31) shall be provided. These shall be separate electromechanical relays and not as element of numerical relay.
- j. DG Set Controller shall be considered for integration with SCADA.
- k. DG controller shall be suitable for single genset operation as well as multi- genset operation which includes Island operation, Fixed power/ base load, AMF & ATS, peak shaving, Load takeover, AMF mode.
- l. The DG controller shall be a part of DG panel. DG controller shall have following minimum inbuilt electrical protections:
 - Reverse power (32)
 - Short Circuit (50P/N)
 - Overcurrent (51)
 - Negative phase sequence (46)
 - Unbalance Protection (47)
 - Under/ Over Voltage (27/59)
 - Under / Over Frequency (81R/81O)
 - DG controller shall have following minimum engine side protections:
 - Overspeed / Under speed shutdown
 - Low/ High Battery Voltage
 - Battery test alarm
 - Fail to Crank shutdown
 - Cranking lockout
 - Incomplete start after a preset time
 - Low fuel warning / shutdown
 - Jacket water high temperature
 - Low lube oil Pressure after the DG has attained 90% speed
 - DC control supply failure
 - Engine trip due to generator fault
- m. One Annunciator with Test, Accept, Reset & Mute push button and hooter along with following annunciations shall be provided for incomer feeder: Auxiliary voltage for the window type annunciation system shall be derived from the battery.

- Engine fails to start
 - DG on load test
 - Engine trip due to generator fault
 - High jacket water temperature
 - High lube oil temperature
 - High differential pressure across lube oil filter
 - Bearing temp. High alarm
 - Winding temp. High alarm
 - Emergency DG stop
 - Starting air pressure low (if applicable)
 - Diesel level low indication
 - Diesel level high indication
 - Low lube oil pressure and trip of the engine
 - High water temperature (if applicable)
 - Engine over-speed and trip
 - Engine / Alternator common fault
 - Multifunction relay (51, 51N) operated
 - Lube oil priming pump (if provided) in operation
 - Voltage out of limit
 - Ground fault in the system
 - AC/DC control supply failure
 - DG is paralleled with the main source (grid)
 - Battery fully discharged
 - Charger failure
 - Spare (4 Nos.)
 - The below mentioned signals shall also be provided as potential free contacts for remote annunciation.
 - DG over load
 - DG trouble (group annunciation)
 - Engine failed to start
 - Engine ON
 - Engine tripped on fault
- n. R, Y, B indication lamps, Local/Remote selector switch, Auto/Manual selector switch, Voltage Raise/Lower, Speed Raise/Lower selector switch, Lamp test push button, Emergency trip push button shall be considered for incomer. Trip shall be independent of local/remote.
- o. Incomer of panel shall be provided with analogue ammeter with ammeter selector switch, analogue voltmeter with voltmeter selector switch, analogue kW meter.
- Multifunction meters (MFM) shall be provided for all incomers/outgoing feeders.
 - Looping of all RS485 ports shall be done using 3 cores twisted & shielded 1.5 sq.mm Cu cables and shall be terminated at incomer
- SPARE PARTS
- a. The Bidder shall furnish a list of recommended spare parts for five years operation along with unit prices. .

MAINTENANCE REQUIREMENTS

- a. Easy access shall be provided for all components in the switchgear for maintenance.
- b. As far as possible the switchgear shall be so designed that no special tools are necessary for installation and maintenance. However, if special tools are required, the Bidder shall include price of one complete set in his bid.
- c. The Bidder shall recommend spares for Five (5) years trouble free operation.
- d. Vendor shall furnish detailed inter panel wiring diagrams, internal wiring diagrams, detailed component layout drawings to enable the Owner to carry out maintenance work.

1.3 **LIGHTING LUMINARIES**

1.3.1 Applicable Standard

Standard for LED Luminaries

Sr. No.	Brief Title	IS/IEC Code
1.	Testing procedure of photometric testing for LED luminaires	LM 79
2.	Testing procedure on the lifespan of LEDs	LM 80
3.	National Lighting Code	SP72-2007
4.	Method of Measurement of Lumen Maintenance of Solid State Light (LED) Sources	IS:16105-2012
5.	Method of Electrical and Photometric Measurements of Solid-State Lighting (LED) Products	IS:16106-2012
6.	Limits of Harmonic Current Emissions	IS 14700-3-2-2008
7.	DC or AC supplied electronic control gear for LED modules performance requirements	IEC 62384-2006
8.	Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules	IEC 61347-2-13-2014
9.	Environmental Testing: Test Z- AD: composite temperature/ humidity cyclic test	IEC 60068-2-38-2009
10.	Electro Magnetic compatibility (EMC)- Limits for Harmonic current emission— (equipment input current ≤ 16 A per phase)	IEC 61000-3-2-2018
11.	EMC Immunity requirement	IEC 61547-2009
12.	LED modules for general Lighting-Safety requirements	IEC 62031-2018
13.	Classification of degree of protections provided by enclosures (IP Codes)	IEC 60529-1989,Amd 2013
14.	Fixed general purpose luminaries	IEC 60598-2-1-1979
15.	General Lighting - LEDs and LED modules – Terms and Definitions	IS:16101-2012 / IEC TS 62504-2011
16.	LED Modules for General Lighting Part 1 Safety Requirements	IS:16103(Part1)-2012
17.	LED Modules for General Lighting Part 2 Performance Requirements	IS:16103(Part2)-2012

18.	Safety of Lamp Control Gear, Part 2 Particular Requirements Section 13 D.C. or A.C. Supplied Electronic Control gear for Led Modules	IS:15885(Part2/Sec13)-2012
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1.3.2 Environmental Conditions

The average atmospheric condition during the year is mentioned below. The equipment shall be designed to work in such environmental conditions:

- (a) Maximum ambient air temperature: 45° C
- (b) Minimum ambient air temperature: 5° C
- (c) Max. Relative humidity: 90%
- (d) Atmosphere: Dusty and Humid
- (e) The equipment shall be suitable to sustain and work in the humid and dusty atmosphere of Rourkela.

1.3.3 Luminary/Fixture Description

- (a) All Luminaires shall be UL/CE/BIS certified, robust & sturdy, manufactured out of Quality raw material/ inputs with proper Quality checks at each step designated to last long in the kind of application they are selected to work.
- (b) All selected Luminaires shall be minimum IP66 protected except indoor luminaires and certified for IK 08.
- (c) All RGB luminaires shall be manufactured from well binned LEDs to provide and maintain same Colour consistency over long duration of operations.
- (d) The Luminaires shall offer Flicker free output for long duration.
- (e) All Luminaires shall be Suitable to operate at auto-switching input voltage for 100 – 240 VAC, 50 Hz power supply with the tolerances as mentioned in the data sheet.
- (f) The luminaire light output (lumen) shall be constant and shall be able to withstand allowable supply source voltage variations/ fluctuations, spikes.
- (g) The entire fixture shall consume rated wattage as per data sheet maximum at full output.
- (h) The LED luminaries shall be single, self-contained device with integral electronic control gear, without requiring on-site assembly for installation.
- (i) Fixture shall have lens options.
- (j) All the Luminaire shall be complete with necessary accessories & mounting arrangements.
- (k) The Luminaries shall have housing as mentioned in datasheet.
- (l) The LED system should be digitally driven using noise-shaping pulse width modulation (PWM) techniques and use integral and differential nonlinear control.
- (m) LED fixture shall merge line voltage with control data and deliver them to the fixture over a single standard cable from the power and data interface to ensure minimum cabling work to aesthetic and safety purpose.
- (n) A microprocessor-controlled SSL driver shall be provided that efficiently and accurately will condition and manage power output to LED systems directly from line voltage.
- (o) The Luminaries Housing shall be suitable for termination of 4C X 2.5 sqmm copper conductor PVC insulated flexible Cable with Double Compression Cable Glands
- (p) All the connecting wires inside the Luminaire shall be low smoke halogen free, fire retardant cable.
- (q) Luminaires should conform to the IS standards for Safety & Performance and test certificates as per IS 16107-2012 should be provided by the manufacturer. In case of luminaires are imported, the CONTRACTOR shall conform to test parameters as per equivalent standards.
- (r) The electrical component of the LED and LED driver must be suitably enclosed in sealed unit to function in environment conditions mentioned earlier.
- (s) Design of the thermal management shall be done in such a way that it shall not affect

- the properties of the diffuser.
- (t) All LED fixtures shall undergo a minimum 24-hour burn-in test during manufacturing.
 - (u) The LED fixture shall be operated at constant and carefully regulated current levels. LEDs shall not be designed to be driven beyond their specified nominal voltage and current.
 - (v) High-power LED fixtures shall be thermally protected using metal core board, gap pad, and/or internal monitoring firmware thermal management techniques.
 - (w) LED fixture housing shall be designed to transfer heat from the LED board to the outside environment.
 - (x) The equipment should be compliant to IEC 60598-1, IEC 62031 and IEC/ PAS 62612 depending on the type of luminary.
 - (y) All the material used in the luminaires shall not contain any toxic material and fire retardant confirming to relevant standards.
 - (z) The control gear shall comply to the provisions of IEC 61347-2-13-2014, IEC 62031-2018 and IEC 62384-2006 as appropriate.
 - (aa) LED luminaires, should conform to the various National / International standards for safety & performance. Manufacturer should provide test reports as per LM 79 & LM80. The test report from NABL accredited laboratory shall be submitted along with the technical proposal/ Bid for LED as well as Luminaires.
 - (bb) Outdoor LED fixtures shall meet lumen maintenance standards as per LM-80, pass water ingress testing, and pass general endurance testing.
 - (cc) All hardwired connections to LED fixture shall be reverse-polarity protected and shall provide high-voltage protection in the event that connections are reversed or shorted during installation.
 - (dd) In Rourkela the switching surges are expected in the power supply system. Appropriate surge protection shall be provided by the CONTRACTOR for all the Luminaires offered by it. Such protections can either be provided centrally at the Feeder Pillar or at each individual luminaire level or a combination of both, as may be decided by the CONTRACTOR. No claim for failure of Luminaires, on account of voltage surges other than Lightning surges, will be considered.
 - (ee) The Luminaires shall be suitable for operation within the input supply voltage range specified. The driver of the light should be able to sense and cut-off power to the light in case of phase-to-phase/ 440 V fault. No claim in this regard shall be considered.
 - (ff) The lighting fixtures offered shall comply with the data sheet.
 - (gg) The luminaire shall have a warranty period of 5 years.
 - (hh) The CONTRACTOR shall develop and submit as built drawings of entire electrical system and operational manuals for all the fixtures installed to RSCL or its representative after the completion of work.
 - (ii) All Luminaires under CONTRACTOR's supply scope shall be guaranteed against quality (including any component failure and deterioration/appearance of corrosion symptoms. This shall also cover any fading (reduction)/ deterioration of reflector coating). In such case the defective luminaire shall be replaced without any cost. In case identical defects are observed on more than 5% of particular type of luminaire (installed quantity), then the complete lot of supplied/ installed luminaires of similar type shall be replaced free of charge).
 - (jj) Offer shall include comprehensive technical details of the luminaires being offered. The details must be sufficient to take in to consideration maximizing of energy efficiency and minimizing overall power consumption.

1.4

GI LIGHT POLE

- (a) The Product should be designed for the specific climatic and environmental conditions of the region to ensure full durability and safety throughout its designed life.
- (b) Poles shall be designed to withstand the maximum wind speed as per IS 875-

1987(Reaffirmed1997). The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BS EN 40-3-3:2013.

- (c) The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding of the pole shaft. The welding of the pole shaft shall be done by Submerged Welding process.
- (d) All pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing minimum 4 foundation bolts of size not less than M24. The base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside.
- (e) The materials of the pole as follows:
 - Pole - Conforming to grade S355J0,
 - Base Plate: - Fe 410 Conforming to IS 226-1975(Reaffirmed1983)/ IS 2062-2011,
 - Foundation Bolts: - 6.8 Gr. as per IS 1367-2002,
 - Ring Type Bracket
 - Pole Sections: - The Octagonal Poles shall be in single piece with single longitudinal welding joint,
 - Galvanization: - The poles shall be hot dip galvanized as per IS 2629-1985 (Reaffirmed1994) / IS 2633-1986 (Reaffirmed2006) / IS 4759-1996 (Reaffirmed2006) standards with average coating thickness of 65 micron. The galvanizing shall be done in single dipping. The zinc Ingot raw material shall be 99.99% pure and procured from reliable sources with Quality Test Certificates.
- (f) The pole manufacturing & galvanizing unit shall be ISO 9001: 2000 & ISO 14001 certified to ensure consistent quality & environmental protection.
- (g) The poles shall have integrated Junction box with openable door of adequate size at the elevation of 750 mm from the base plate. The door shall be hinged type with mechanical interlock, dust proof, weather proof and vandal resistant and shall ensure safety of inside connections and components. The door shall be flush with the exterior surface and shall have suitable locking arrangement. The pole shall be adequately strengthened at the location of the door to compensate for the loss in section.
- (h) The door of the Junction Box shall permit clear access to the components inside viz., termination strips, connectors, MCBs, cables etc. There shall also be suitable arrangement for the purpose of earthing.
- (i) For Light poles four-way connectors shall be provided along with Slide lock suitable for connecting 1.1 kV grade, minimum 4 core X16 sqmm AL cable. It shall also inhouse DP MCB's of suitable size, 2.5 sqmm connectors for looping with 2.5 sqmm Copper wires for connecting to the luminaries through 1.1 kV grade, 3 core X 2.5 mm² PVC insulated copper conductor flexible un-armoured Cable from the terminal block to the fixture within the pole. All the cables laid through the pipe shall be without any joint. The final sizes of cable shall be selected based on the voltage drop limitation.
- (j) Two nos. Earth Buss shall be provided at the bottom of the pole (diagonally opposite) suitable for connecting 25X6 mm GI/ CU earth strip or 8 SWG wire for earthing of the poles. Similar Earth Buss suitable for connecting 4 sqmm copper wire shall be provided on the control plate inside the Junction Box for earthing of the electrical components.
- (k) Two nos. 40mm DWC HDPE pipe sleeves of suitable length shall be provided

- through the foundation upto the Junction Box for entry of power cable.
- (l) Earthing of 5 set of pole shall be carried out with one dedicated earth electrode. The earth electrode shall be GI pipe electrode as recommended in the latest version of IS 3043-2018. The earth electrode shall be connected with GI strips to the two distinct earth bosses on the pole. Poles of each set shall be inter connected with minimum 8 SWG GI wire.
 - (m) Aesthetic appearance - All the grooves and carvings of the pole unit shall be free from any kind of distortion for a pleasing aesthetic appearance.
 - (n) The Poles shall be bolted on a pre-cast foundation with a set of foundation bolts of size not less than M24 for greater rigidity.
 - (o) All the material/equipment/accessories shall be supplied with manufacturer's test certificates.
 - (p) BIDDER shall submit the Proposed Product Catalogue, Detail Data sheet, spare parts list and drawing of Pole & accessories along with the BID for each product quoted.
 - (q) BIDDER shall arrange for all the tools and equipment's.
 - (r) Concrete foundations shall be provided for all the light poles as per design criteria mentioned for Civil work above.

1.5 **LT PANELS**

1.5.1 **SCOPE**

- The Scope of 415 V LT Panels include Design, engineering and manufacturing; testing at manufacturer's works, packing, forwarding and delivery to site; unloading and handling (shifting from unloading point to the storage area, storage and shifting from the place of storage to the place of installation) at site, assembly, erection, cleaning & touch up painting, testing, commissioning and performance demonstration at site of various ratings as per requirement.

1.5.2 **GENERAL**

- LT panel shall be (tested assembly - TTA) CPRI/Independent international test house tested for all the tests as per IS/IEC61439-1 & 2 and internal arc tests as per IEC 61641 V3, 50kA for 0.3 sec minimum at Horizontal bus bar, veridical bus bar and cable chamber.
- LT Panel shall also be tested of design as per Seismic Zone Vol IEC 60068-3-3.
- Panel shall be rated for Impulse withstand capability equal to or greater than the switchgears inside the panel.
- The metal enclosed switchgear shall be designed to operate continuously with reference of ambient temperature of 45°C without any de-rating.
- The equipment shall be designed and manufactured in accordance with the best engineering practice and shall be such that has been proved to be suitable for the intended purpose.
- Provision for interlocking of LV Incomer breaker with HV side breaker shall be provided such that if the HV breaker trips then the LV breaker will trip and it shall not be possible to close the LV breaker unless the HV side breaker is closed.
- The Panel shall be indoor type having incoming, sectionalisation, outgoing switchgears etc. as per requirement. The design shall be cubical type. The degree of enclosure protection shall be IP 52 for indoor up to 2000A rating and IP42 above 2000A rating and IP55 for outdoor as per IS: 13947 (Part-I).
- All panels shall be from same manufacturer.
- LV panel's manufacturer must have experience of manufacturing, supply and installation of LV panels of TTA or IS/IEC 61439 design for past 05 years as a qualifying requirement.

1.5.3 CONSTRUCTIONAL REQUIREMENTS

- All panel boards shall be free standing, metal enclosed, single front, fabricated with 2mm CRCA sheet steel for all doors, partitions and covers and 2 mm CRCA sheet steel for load bearing sections including all ACB feeders. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels.
- The gasket shall be suitable to withstand all weathers for long tenure of service. All hardware shall be HD Galvanized or stainless steel.
- **Main LT Panel**, APFC, DG panels shall conform to FORM 4B as per IS/IEC 61439 and metering, common services, street lighting panels shall conform to FORM 3B as per IS/IEC 61439.
- For operator safety IP2X (touch proof) protection to be available even after opening the feeder compartment door. The compartmentalization to be achieved by using metal separators.
- Each door & cover shall have adequate reinforcement of suitable ribs & stiffeners. All feeders and cable alleys shall have hinged type door with panel locks. All bus-bar covers and other panel covers shall be screw fixed. Cable alleys and bus-bar chamber shall have minimum width of 300mm.
- All doors shall be with concealed type hinges and captive screws. Rear doors of panels requiring rear access shall be provided with removable hinged doors. Side covers of panels shall be with removable panels.
- All doors shall be provided with durable and easy fitting locks with special keys to ensure opening by authorized personnel. Rubber grommets shall be provided at the cable entry.
- All mounting accessories like base channels, cross angles if required, nuts, bolts etc. shall be supplied by the Vendor.
- All the panels shall have uniform height. The operating height of all the panels shall not be less than 300mm and not more than 1800mm. Panel height should not be more than 2450mm.
- All the panel boards shall have cable entry from top/bottom as per requirement. Split gland plate of 2mm thick shall be supplied for termination of power, control and instrumentation cables sized as per the required no. of cable and 20% spare space for future addition.

1.5.4 BUS-BARS

- Bus-bar of the panels shall be rated for Continuous current at site conditions.
- All bus-bars shall be electrolytic grade copper or aluminium. Bidder shall specify the purity and conductivity of the bus bar along with the Bid.
- All the bus bars shall be sleeved with heat shrinkable black colour PVC sleeve or better insulation with coloured polyester tapes for phase identification at regular intervals/ locations.
- Bidder shall submit all calculations & documental proof of the adequacy of the bus bar sizes to meet the continuous and short time current ratings.
- Vertical bus-bars shall have S.C. rating same as main bus bar and shall be suitable for all connected load of vertical section.
- Bidder shall ensure that incoming feeder shall be suitably designed for terminating the required no. of runs of 1.1kV grade XLPE insulated armoured cables with 20% spare capacity. Bidder shall consider the necessary arrangement (dummy panel, adapter panel, rear extension etc.) if required, for terminating the cables within the limits specified above.

- The bus-bars shall be designed considering the following criteria:
- Current density of 0.8A/sq. mm maximum for aluminium and 1.2A/sq. mm for copper.
- Sleeves made of insulating material on all bus bars.
- Bus bars carrying rated current continuously at Design Ambient Temperature shall be considered as 45°C and temperature rise shall be considered as per latest relevant standard.
- Configuration of bus bars, Skin and Proximity effect
- Bus bars shall withstand the short time rating of the panel.
- The span between the two insulators shall be as per the approved TYPE TEST REPORT for short time rating. Joint positions and insulators shall be properly adjusted so that they don't interfere. Bus bar bending shall be carried out on appropriate machines designated for the same rather than doing manually.
- Neutral bus-bars of the panel boards shall be rated equal to the size of phase bus and shall be in same chamber with phase bus bar.
- All bus-bar shall be treated with anti-oxide paste wherever bi-metallic contact is required.
- The material and spacing of the busbar support should be same as per the type tested assembly.

1.5.5 EARTHING

- Earth bus bars of Aluminium/Copper material shall be run all along the panel, extended out at both ends of value equal to the rated symmetrical short circuit rating of the associated switchboard/ panel. The same shall be properly supported to withstand stresses induced by the rated symmetrical short circuit current.
- Earthing bus-bar shall be terminated at both ends of the switchgear to suit the connections to earthing conductor. The locations where the bus is protruding out of the panel boards, Contractor shall ensure that proper ingress protections are provided at all such locations.
- All doors and detachable components inside the feeder are required to be earthed individually with green (with yellow band) colour PVC insulated multi-stranded copper conductor wire of size 4 sq.mm duly crimped with ring type lugs and are to be looped & connected to horizontal earth bus.
- Earthing bus shall run continuously in panel drawn out suitably considering respective cable entry inside the panel.
- Al/Cu earth bus shall be provided at each cable alley for all the panels.

1.5.6 POWER WIRING (INSIDE THE FEEDER)

- All power wiring for rating upto and including 63A shall be carried out with 1.1kV grade coloured FRLS PVC insulated, coloured for phase identification, multi stranded copper wires duly crimped with ring type lugs.

1.5.7 CONTROL WIRING (FOR PANEL AND FEEDERS)

- All panel Control wiring shall be done by 1.1kV grade FRLS PVC insulated multi-stranded copper wire. CT circuit wiring shall be done with minimum 2.5 Sq.mm size wire of above specification. Control and Potential circuits shall be wired with minimum 1.5 sq. mm size wires of above specifications. Wires shall be gray coloured with suitable crimp able copper lugs. CT's & PT's wiring shall be colour coded for multi-phase identifications (R-Y-B-N).

1.5.8 GENERAL REQUIREMENTS

- DP MCB shall be provided for all control circuits where the fault level is less than 10kA. Else the control supply shall be tapped through a control transformer of adequate capacity supplied with MCCB/ MPCB of adequate short time rating. Independent DP MCBs shall be

provided for each circuit such that tripping due to fault in one circuit should not affect other functions adversely.

- Self-explanatory Wiring diagrams with terminal and wire numbers, component numbers shall be provided on the inner face of the door of each feeder. Drawing set in the panel shall be laminated.
- All labels for identification of feeders as well as internal and external components as per legends provided by Owner shall be on white acrylic sheet with black engraving. These labels shall be fixed by screws/rivets and shall not be pasted.
- Aluminum etched 415V Caution boards written in three languages (English, Hindi, Local) shall be riveted on the panel at locations where live bus bars are present and need isolation before any access to it. In case secondary covers have been provided inside the panel, then caution boards shall be also marked on these boards in addition to the external covers. Stickers are not acceptable.
- Selector/control switches shall have an 'Off' position. The 'Off' position shall not be wired in any circuit and shall be utilized to disconnect (or bypass) power supply to control circuit for any maintenance work.
- All electrical panels (internal components & arrangement) shall have finger touch protection, for human safety viz. working on one component shall not cause shock to the personnel due to any other live component in the panel. Also, the terminal live parts shall not be accessible by fingers (finger cannot come in contact with live parts of the terminals).
- No openings/ holes meant for fixing hardware shall be left open. All the hardware (esp. screws, nuts, bolts, and washers) shall be in all appropriate positions & properly tightened.
- Phase separators, shrouds, falling tool barriers shall be suitably provided. Any additional requirements as observed at any stage upto handing-over shall be provided (for safety and ease of maintenance) without any cost implication to the Owner.
- All PVC/engineering plastic-based items (including but not limited to conduits, casing-capping, trough, trunk, enclosures, covers, plugs, etc.) shall be with FR properties.
- Lifting hooks/eyes shall be provided in each shipping section of the equipment and shall be removable type. The equipment shall be given tropical and fungicidal treatment.
- Insulation mat of suitable standard width shall be provided in front of the HV and LV panels.
- At least one 230V, 1Ph, Space heater shall be provided for each vertical section of the switchboard. Each Space heater shall be provided with an isolating switch, a thermostat and dedicated MCB protection of appropriate rating. Heater shall be mounted at bottom of the panel with cover to avoid accidental contact of heater with skin.
- 230V 1Ph, Panel illumination (11W LED fixture with lamp, limit switch and isolation switch) along with 1 no. 5/15A, 5 pin socket with switch shall be provided for each vertical section. Bare holder with open lamp is not acceptable.
- Adequate space shall be provided for terminating the outgoing cables.
- Control transformer of adequate KVA rating with Changeover facilities shall be provide in the panel.

1.5.9 EQUIPMENT REQUIREMENT

a. MCCB

- All the panels shall have MCCBs upto 630Amp. All MCCBs shall be rated for 415V, 3 Ph, 50Hz, 25KA (Minimum).

- MCCBs in AC circuits shall be of triple/four pole construction arranged for simultaneous three/four pole manual closing and opening. Operating mechanism shall be quick-make, quick-break and trip-free type. The ON, OFF and TRIP positions of the MCCB shall be clearly indicated and visible to the operator. All MCCBs shall be provided with rotary operating handle with door interlock feature.
- The instantaneous short circuit release shall be so chosen by the Vendor as to operate at a current in excess of the peak motor inrush current and a range of settings shall be provided for the Owner's selection.
- MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit ratings.
- All MCCB feeders shall be provided with ON/OFF/TRIP indicating lamps through auxiliary contacts.
- All MCCB's shall be with $I_{cu}=I_{cs}=100\%$.
- All MCCBs shall be provided with 2 NO + 2 NC aux. contacts exclusively for Owner's use.
- All the MCCBs shall be of current limiting type and shall provide a cut off in, < 10 ms for prospective currents during faults.
- The MCCB's shall be provided with microprocessor-based overload, short circuit and earth fault releases. For four pole MCCB, the microprocessor-based earth fault release shall be inbuilt.
- For TPN MCCB the microprocessor-based earth fault release shall be inbuilt with a separate neutral CT input or the earth fault protection shall be provided by CBCT, ELR and shunt trip coil.

b. SPD

- The Internal Surge Protection Device shall be selected as per zone of protection described in IS/IEC 62305, 61643-11/12/21, 60364-4/5. Depending on Zone concept of provided in IS/IEC 62305 – 1 & 4.
- LPZ -OB & LPZ 1: At Mains entry point (Main LT Panel): Type 1 + 2, i.e. SPD Combined Arrester with Integrated Backup Fuse.
- LPZ1 & LPZ 2: Sub distribution panel 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.

1.6 **APFC PANELS**

1.6.1 **GENERAL**

- The equipment shall be complete with all necessary accessories and components as required as per IS standard.
- Supply, installation, Testing and Commissioning of automatic power factor improvement panel (indoor) with Capacitor Banks (APP Type), type test according to IS/IEC 61439-1&2, IEC 61921 including interconnection with LT panel with appropriate size of electric cable. The panel shall be indoor, factory fabricated, dust and vermin proof (IP42) type, suitable for 1100 V grade 3 phase 50 HZ AC supply, floor mounted in 14 stage (minimum two no. spare stage to be considered) controller with microprocessor-based relay along with fully ventilated both side opening.

- The capacitor banks shall be complete with all parts that are necessary or essential for efficient operation. Such parts shall be deemed to be within the scope of supply whether specifically mentioned or not.
- The capacitor bank may comprise of suitable number of single-phase units in series parallel combination. However, the number of parallel units in each of the series racks shall be such that failure of one unit shall not create an overvoltage on the units in parallel with it, which will result in the failure of the parallel units.
- The complete capacitor banks with its accessories shall be metal enclosed (in sheet steel cubicle), indoor floor mounting and free-standing type.
- All sheet steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and swarf by pickling, emulsion cleaning etc. The sheet steel shall be phosphate and then painted with two coats of zinc rich primer paint. After application of primer, two coats of finishing synthetic enamel paint oven baked/stove shall be applied.
- The assembly of the banks shall be such that it provides sufficient ventilation for each unit. Necessary louvers may be provided in the cubicle to ensure proper ventilation.
- Each capacitor unit/bank shall be fitted with directly connected continuously rated, low loss discharge device to discharge the capacitors to reduce the voltage to 50 volts within one minute.
- All panels of capacitor banks with MCCBs, Contactor, minimum 12 stage automatic power factor correction relay enclosed in IP42 compliant CRCA Sheet Steel enclosure.
- Capacitors shall be APP type having following specifications and conform to IS 13925.
- The capacitors shall have Low Dielectric Loss of 0.5 W/ kVAR (maximum).
- All capacitors shall be provided with 7% de-tuned copper filter along with all accessories and protections.
- Any change in rated voltage level of the capacitor bank due to the filter or otherwise shall be considered by the Contractor.
- The banks shall be switched ON and OFF in both Auto as well as Manual mode. An “Auto/Manual” Switch at the incomer feeder shall be provided.
- All necessary auxiliary contactors of suitable duty along with feeder accessories are included in scope. All power Contactors for capacitor switching shall be of required duty.
- Manual operation shall be done with recess type panel mounted ON/OFF pushbutton with delay timer.
- Minimum current rating under site conditions, of circuit breakers, Contactors, and cables shall be at least 150% of rated capacitor current.
- Capacitors shall be mounted in such a way that heat dissipation is proper and the capacitors are accessible for maintenance and inspections.
- Capacitor switching and automatic power factor correction panel shall be designed in such a way that power factor of 0.99 lagging shall always be maintained. Timings to cut in capacitors shall be provided in such a manner to facilitate capacitor discharging before next switching and shall also avoid hunting due to temporary fluctuations of load. The timer shall be provided in both auto and manual mode.
- The Automatic power factor correction panel and capacitor panel are integral type, prewired including power connections. Due consideration shall be given for adding/ removal of capacitor or other components and maintenance considerations.

- Each unit shall satisfactorily operate at 130% of rated KVAR including factors of overvoltage, harmonic currents and manufacturing tolerance. The units shall be capable of continuously withstanding satisfactorily any overvoltage up to a maximum of 10% above the rated voltage, excluding transients.

1.6.2 UNIT PROTECTION

- Each capacitor unit shall be individually protected by a MCCB Breaker suitably rated for load current and short circuit capacity, so that a faulty capacitor unit shall be disconnected by the breaker without causing the bank to be disconnected. Thus, the breaker shall disconnect only the faulty unit and shall leave the rest of the units undisturbed.
- The Inputs to the APFC system is Voltage input from two phases and current input from the third phase. Out of two phases of voltage, one phase voltage is taken as Reference 0 and other phase voltage as 440 V. APFC CT (Current Transformer) need to be installed on the third phase at main incomer ACB after transformer, which will give signal to the APFC Relay. Based on this input the ASIC (Application Specific Integrated Circuit) or Call it as Microprocessor internal to the APFC Relay will give output signal to relay outputs which will energize coil of the contactor so that the contactor come in line connecting the capacitor bank in circuit. However, this is step correction means PF is corrected in steps. The Voltage rise due to connection of capacitor banks is marginal. There will be no frequency correction with APFC System.

1.6.3 APFC PANEL ACCESSORIES

- Power capacitor and control panel shall be housed in metal enclosed cubicle. Power capacitor shall be housed in the lower compartment and capacitor control panel at top compartment.
- The control equipment including capacitors shall be mounted in a panel of cold rolled sheet steel. The panel shall be of indoor type.
- Bus bars shall be of aluminium conductor and high conductivity.
- Isolating switch.
- Contactor with overload element.
- APFC Relays responsive to current/voltage/kVAR/PF for automatic switching shall be of microprocessor based suitable for state board Electricity with reduced power factor.
- Sequencing devices, timers and auxiliary relays for automatic sequential switching of the capacitors in and out of the circuit.
- Auto-manual selector switches.
- Push button for opening and closing the power circuit.
- Red and green cluster LED lights for capacitors ON/OFF indication
- Protective numerical relays to protect the healthy capacitor units when one unit fails in a series connection.
- Space heater and cubicle lighting as per the requirements.

1.7 CABLING SYSTEM

All the LV Power cables shall be 1100V grade, multi-stranded, Al / Copper conductor, XLPE insulated, extruded inner & outer PVC sheath compound type ST2 and galvanized steel strip armoured cables with FRLS Properties.

All cables shall conform to IS 7098 –Part I-1988 (Reaffirmed 2003) and all armouring shall confirm to latest version of IS: 3975-1999.

For all LT power and control cables, double compression glands with aluminium lugs for Aluminium cables and tinned Copper lugs for Copper cables shall be used in indoor and outdoor

application.

The termination shall be inclusive of miscellaneous items such as clamps, cleats, cable tags, cable markers etc.

In general cable installation works shall be carried out in accordance with IS 1255 – 1983 (Reaffirmed 1996).

For Underground cables, all cables shall be laid in HDPE and DWC pipes laid by excavation. The top of the pipe shall be at least 1000mm below the finished ground level. There should not be any joints between two lighting fixtures.

Separate cables shall be provided for Landscaping & Facade lighting. The cables shall be laid in HDPE pipe of size not less than 40 mm by excavation 750mm below finished ground level.

The Cables for Landscaping lighting shall be laid in the HDPE DWC Pipe.

1.7.1 Cables within the Landscape area shall be laid buried in DWC pipe not less than 40mm dia. The cables shall be looped between the fixtures with the help of Junction box.

1.7.2 Cable Glands

- Double compression type cable glands with rubber hoods shall be used for the termination of all the power and control cables. Cable glands shall be brass casting, machine finished and Nickel-plated to avoid corrosion and oxidation. Rubber components used in cable gland shall be of neoprene.
- For single core cables, gland shall be with brass ring.
- Cable glands shall be with metric threads.
- Cable glands shall be conical (& not flange type).
- All glands shall be provided with rubber hoods.

1.7.3 Cable Lugs

- Cable lugs shall be of tinned Copper, solder less crimping type for Cu cables & Al lugs for the Al cables.
- The current rating of the lugs shall be same as that of the respective cable conductors.
- Ring type cable terminations shall be used.
- Insulated lugs are not acceptable for any cable terminations.
- Bi-metal strip/ Bi-metallic lug shall be used whenever two different metals are to be connected together.
- Fork terminals shall be used for luminaries & decorative switch/ socket. Pin terminals may be acceptable during execution only in case other terminals/ lugs cannot be accommodated.
- Reducer / wire pin terminals shall be avoided for MCB terminations. MCB terminations shall be with 'long palm terminals.
- All terminations in Feeder Pillars / enclosure for earthing & neutral busbars / terminals shall be with ring type terminals.
- All earthing terminations shall be with ring type lugs only.
- All control & interlock cable terminations shall be with ring type lugs.
- Anticorrosion/ anti-oxidation compounds shall be used for crimping lugs. This shall especially be ensured for Al cable terminations & any bimetallic terminations (Cu cable termination using tinned Copper lugs).

1.7.4 If termination is done with crimping tool employing crimping die then forming dies shall be used to make the sector shaped conductor into a round conductor before crimping the lugs on the conductor. The lug must not be crimped directly on the sector conductor. Before crimping the lug, the conductor shall be thoroughly cleaned and special jelly applied over it to prevent

further oxidation.

1.7.5 Point Wiring

- Point wiring work shall include the, PVC conduit, joints, connectors, conduit accessories, FRLS PVC insulated stranded copper conductor wires and earthing wires, pull boxes, ceiling rose, clamps, cleats, hardware, accessories, anchor fasteners, modular switch boards with cover plates, switches, sockets, box, blank plates, receptacles and all other necessary accessories as per specifications etc.
- Wiring shall be done in wire colour codes. Colour code of wire for Phases, Neutral and Earth shall be separate. The necessary connector if found required for looping of wires from one switchboard to another switchboard shall be included in the scope.
- Lighting fixtures and toilet exhaust fans shall be grouped on the single circuit wherever required. However, separate circuits shall be used for receptacles wiring.
- Wires of the different phases shall not be laid in the same conduit.
- Switchboard shall be recessed mounted.
- The switch boxes, receptacle boxes etc. shall be made up of 16 SWG sheet steel.
- The wire and cable indicated below for distribution of the power are the minimum requirement. The CONTRACTOR shall arrive at the actual size based of the design criteria mentioned above.
- Point wiring in the Shops, Electrical room, Admin office, Ticket & information centre and Public Toilet block shall be done as per the following points,
- Point Wiring for the luminaries from the DB to the switchboard and from the switchboard to the luminaries shall be done with 750V grade min 2.5 Sq.mm (2Nos.-Ph.+N) & 1.5 Sq.mm (for earthing of socket) PVC insulated, multistrand Cu conductor flexible wires running through 25mm inner dia.1.6mm thick, black stove enamelled painted PVC conduit running concealed/exposed in false ceiling and concealed on brick wall
- Point Wiring for the 6A Raw power socket from the DB shall be done with 750V grade 2.5 Sq.mm (2Nos.-Ph.+N) & 1.5 Sq.mm (for earthing of luminaire) FRLS PVC insulated, multistrand Cu conductor flexible wires running through 25mm inner dia.1.6mm thick black stove enamelled painted PVC conduit running concealed/exposed in false ceiling and concealed on brick wall.

1.8 **EARTHING SYSTEM**

1.8.1 Applicable Standard:

The general design shall be on the basis of following codes and standards (their latest amendments) in line with design criteria & specification requirements.

- IS 3043-2018 –Code of practice for Safety Earthing
- Central Electricity Authority (CEA) Regulations – 2010
- National Building Code 2016

The maximum values of earth fault current for the design of the earthing system shall be calculated as per the design criteria.

1.8.2 The design basis for designing earthing conductor is indicated under design criteria for electrical system.

1.8.3 GI Pipe electrodes shall be provided for all the equipment and system earthing.

1.8.4 The earth plate shall be buried in specifically prepared earth pit 4.5 mtr. below ground with alternate layers of charcoal and salt, 40 NB GI pipe with funnel with a wire mesh for watering and bricks masonry block CI Cover complete as per IS 3043-2018 with necessary length of double Copper earth flat bolted with lug to the plate complete connected to the transformer neutral with end socket as per direction and duly tested by earth tester

- conforming to IS as per drawing and specifications complete with 600 x 600 x 3.15 mm Copper earth plate or as specified by CEIG.
- 1.8.5 Earth electrodes shall be of heavy duty galvanized mild steel pipe of not be less than 40 mm NB or as specified by CEIG. The earth electrode shall be complete with alternate layers of charcoal/ coke, salt and Black cotton soil; GI pipe with meshed funnel for watering; brick masonry block and CI Cover, with necessary test link conforming to IS 3043-2018 or as specified by CEIG.
- 1.8.6 The minimum spacing between two adjacent earthing pits shall not be less than 3000mm and shall be kept 1500 mm away from footings of the structure.
- 1.8.7 Earthing chamber shall be of RCC/ brick chamber of 600 mm x 600 mm, with hinged cast Iron chequered cover plates. The covers shall have holes for handling. Earthing pits (chambers) shall be painted Green and the earth-pit number shall be marked on it.
- 1.8.8 Two separate earth pit shall be provided to outdoor feeder pillars with earth flat. Size of the flat shall be determined with respect to fault level.
- 1.8.9 GI Pipe electrodes shall be provided 1 No. for every consecutive 5 light poles and stone column lights as per IS 3043 - 2018 or better. Electrode shall be connected to the equipment by two runs of GI strip laid in HDPE/ DWC pipes. Size of the flat shall be determined with respect to fault level. Minimum 8 SWG wire looping shall be done for the group of 5 light poles/stone column lights.
- 1.8.10 Minimum 8 SWG GI wire shall be carried along with the cable in the HDPE pipe laid for distributing power to the landscape area.
- 1.8.11 Wherever earthing conductor passes through HDPE pipe, sleeves shall be provided. Both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.
- 1.9 **LIGHTNING PROTECTION SYSTEM**
- 1.9.1 **GENERAL**
- Supply & installation of Lightning Protection System shall be strictly in accordance with IS/IEC: 62305-2010 or latest.
- 1.9.2 **ZONE OF PROTECTION**
- The zone of protection of a lightning conductor defines the space within which a lightning conductor provides protection against a direct lightning stroke by diverting the stroke to itself. For a single vertical conductor, this zone is described as a cone with its apex at the highest point of the conductor and with an angle called as protective angle.
- 1.9.3 **MATERIAL AND DIMENSIONS**
- The materials of lightning conductor, down conductors, earth termination etc. shall be GI and shall be protected against corrosion.
 - All air terminations and down conductors shall be of GI and shall conform to IS/IEC: 62305-2010.
- 1.9.4 **Joints and Bonds**
- The lightning protective system shall have as few joints as far as possible. Wherever joints in the conductor are necessary they shall be mechanically and electrically effective and shall be riveted and brazed in case of copper and by welding / bolting in case of GI in an approved manner.
- 1.9.5 **Earth Terminations**
- Each down conductor shall have an independent earth termination. All the earth termination shall be inter-connected and shall be capable of isolation for testing. Test Link should be provided for isolation purpose.
- 1.9.6 **EARTH ELECTRODE**
- The earthing type (chemical / conventional) shall be as per electrical inspector or MGVCL or client requirement in line with the provisions of IS 3043.

1.9.7 DOWN CONDUCTOR

- In order to reduce probability of damage it is often necessary to have several parallel current paths. As recommended by IS/IEC: 62305-2010 equal spacing of down conductors, 25 x 6 mm GI external strip, around the building perimeter.
- The down conductor must be kept in constant physical contact with the structure via conductive mounting clamps.
- Each down conductor shall be directly connected at the dedicated earthing pit and the dedicated Earth pit shall be connected to the other earth pits in the earthing grid.
- Alternatively, steel reinforcement can be used as down conductor in line with IS/IEC: 62305-2010.

2.0 **MAKE LIST**

Sr. No	Description	Approved Make
1	Lighting Pole	Valmont/ Homdec/ Havells or Equivalent
2	LED Chip	Cree, Osram, Nichia, Philips Lumileds or Equivalent
3	Lighting Fixtures	Philips/ Wipro/ Bajaj/ Havells/Lighting Technology or Equivalent
4	Cable	KEI/ POLYCAB or Equivalent
5	Oil type transformer	OTPL/ POWER STAR or Equivalent
6	Gland/Lugs	As per OPWD Approved list or Dowells, Commet, Connectwell or Equivalent
7	Earthing Material	As per OPWD Approved list
8	MCCB , MCB, RCCB, RCBO and other Switchgears	Schneider, Siemens, ABB. L&T, Havells or Equivalent
9	Time Switch	L&T GIC, Siemens, Schneider, Legrand, Hager, ABB, Havells, C&S or Equivalent
10	Energy meter, MFM	L&T (Quasar) or Equivalent
11	Contactor and other switchgears	L&T, Siemens, Schneider, ABB or Equivalent
12	HDPE/ DWC Pipe	Astral, Duraline, Alcorr, Noble Polytex or Equivalent
13	Ceiling Fan	Crompton, ORIENT, Havells, Halonix or Equivalent
14	DG Set	Kirloskar, Jackson or equivalent
15	UPS	Vertiv, Numeric, Delta etc.
16	Junction Box	Hensel or Equivalent
17	LT Panels	Advance / Balaji / Adlec or equivalent

Note:-

- RSCL shall decide the above makes of the materials. The CONTRACTOR has to comply with the approved makes given in the tender document.
- The CONTRACTOR shall offer the equipment of makes mentioned above. Other makes are subjected to Client approval before procurement.

- (iii) Samples from all the approved makes shall be offered for selection.

3.0 LIST OF DRAWING AND DOCUMENTS

3.1 Following list of the documents and drawings shall be submitted to RSCL or its representative with Bid documents

- (a) SLD of Power distribution
- (b) Lighting Design & Calculations (Dialux IES Files shall be provided along with PDF)
- (c) Bill of quantity of identified fixtures.
- (d) UL/CE/BIS certification of selected luminaries.
- (e) Test report of luminaries as per LM79 & LM80.
- (f) NABL accredited test report of luminaries.
- (g) No Deviation certificate

3.2 Following list of the documents and drawings shall be submitted to RSCL or its representative after award of contract,

3.3 Calculations

- (a) Electrical Load List and demand Calculations
- (b) Transformer & Capacitor Calculations
- (c) Earthing & Lightning Protection Calculations for Electrical System
- (d) Cable schedule with Sizing Calculations
- (e) Lighting Calculations (Dialux IES Files shall be provided along with PDF)

3.4 For Light fixtures and luminaries

- (a) Illumination Concept for each element
- (b) Lighting Calculations for each Area - Dialux calculations, visualizations and glare control lumen maintenance. (Software Files shall be provided along with PDF)
- (c) Type of Fittings, Soft Copy of Catalogues, Data Sheet, Polar Diagrams, Cone Diagrams, IES Files of the luminaries should be submitted
- (d) Pictorial formations / digital renders themes/ Views from all angles and close ups using software.
- (e) Lighting layout of area as per application.
- (f) Rendered view of identified fixtures.
- (g) Bill of Quantities.
- (h) UL/CE/BIS certification of selected luminaries.
- (i) Test report of luminaries as per LM79 & L80.
- (j) NABL accredited test report of luminaries.

3.5 For Electrical equipment

- (a) Single Line Diagram for Power Distribution
- (b) Equipment Sizing calculations.
- (c) Cable layout, Earthing & Lightning Protection layout.
- (d) Bill of Quantities

3.6 Transformer

- (a) Transformer Sizing Calculation
- (b) Fault level Calculation
- (c) GA Drawing
- (d) Type test certificate for IP protection
- (e) Data sheet of major Equipments
- (f) Bill of Quantities
- (g) Makes Of Components offered
- (h) Foundation drawings and supporting arrangement drawing

3.7 Main LT Panel/ Metering Panel/ External Lighting Panel/ Common Area DB/ Indoor

LDB

- (a) GA Drawing
- (b) Type test Certificate for Short Circuit withstand capacity
- (c) Type test certificate for IP protection
- (d) Door open view of Distribution boards
- (e) Data sheet of major Equipments
- (f) Wiring Diagram
- (g) Bill of Quantities
- (h) Makes Of Components offered
- (i) Foundation drawings and supporting arrangement drawing

3.8

Octagonal Poles

- (a) GA Drawing
- (b) Type test Certificates
- (c) Foundation drawings

3.9

Construction Drawings of the following

- (a) Cable schedule
- (b) Circuit distribution scheme
- (c) Cable routing drawing
- (d) Equipment Layout
- (e) Power Distribution Scheme
- (f) Switch Board Schedule
- (g) Point Wiring Drawing for Lighting and power
- (h) General arrangement of equipment Layout of the shops / rooms/ Landscape area/ Pathways/ Walkways.

4.0

DATA SHEET

- a) **Recessed Downlighter – 1** - Supply, Testing, Installation & Commissioning of SMD LED, IP 40, 15W Recessed downlighter with System efficacy of 100lm/W and system lumen output 1500 lumen. Luminaire shall have aluminium pressure die cast housing in white with high transmittivity diffuser for uniform illumination and reduced glare. The LEDs used should be with CCT of 5700K Luminaire Dimension: 159 mm dia, 39 mm **height ; cut-out dimension : 149 mm**. Model - LD06X-171-XXX-57-XX or equivalent. Make shall be as per approved make list.
- b) **COB LED Downlight - 1** - Supply, Testing, Installation & Commissioning of 20W recessed, deep inset COB LED Downlight luminaire having 2000 lumens with dimensions of 125mm Dia and height of 85mm. The cut out dia (Φ) should not be more than 110mm. Luminaire shall be made up of pure polyester powder coated pressure die cast Aluminum housing with inbuilt heat sink to provide better thermal management to enhance LED life. The luminaire should be equipped with the secondary optics of high efficiency white coloured reflector. The luminaire should be available with beam angle 60. Model - LD56-251-060-40-XX or equivalent. Make shall be as per approved make list.
- c) **Recessed Downlighter – 2** - Supply, Testing, Installation & Commissioning of SMD LED, IP 40, 15W Recessed downlighter with System efficacy of 100lm/W and system lumen output 1500 lumen, operating in an ambient temperature of 0°C to 45°C at 50Hz frequency. Luminaire shall have aluminum pressure die cast housing in white with high transmittivity diffuser for uniform illumination and reduced glare. The LEDs used should be with CCT of 4000 K. Dimension: 159 mm dia, 39 mm height ; cut-out dimension : 149 mm. Model - LD06X-171-XXX-40-XX or equivalent. Make shall be as per approved make list.
- d) **Surface Mounted Downlighter – 1** - Supply, Testing, Installation & Commissioning of SMD LED, IP 20, 10W surface mounted downlighter with System efficacy of 100lm/W and

system lumen output 1000 lumen with CCT_6500K operating in an ambient temperature of 0°C to 45°C at 50Hz frequency. Model - LL20-111-XXX-65NE3 or equivalent. Make shall be as per approved make list.

- e) **COB LED Downlight – 2** - Supply, Testing, Installation & Commissioning of 30W recessed, deep inset COB LED Downlight luminaire having 2400 lumens with dimensions of 83mm dia and height of 91mm. The cut out dia (Φ) should not be more than 78mm. Luminaire shall be made up of pure polyester powder coated pressure die cast Aluminum housing with inbuilt heat sink to provide better thermal management to enhance LED life. The luminaire should be equipped with the secondary optics of high efficiency white coloured reflector. Model - LD07-381-060-40-WH or equivalent. Make shall be as per approved make list.
- f) **Outdoor Light Fixture** - Supply, Installation, Test & Commissioning of 35W LED Decorative Post Top type luminaire with (2800 lumens) with IP 65 and IK07. Luminaire shall be made up of pure polyester power coated RAL7021 pressure die cast Aluminum housing with tempered glass with polycarbonate lens, capable of producing diffused optics or street optics. Model - LP10N-431-XX-40-XX or equivalent. Make shall be as per approved make list.
- g) **Decorative Up- Down Type Fixture** - Supply, Installation, Test & Commissioning of 4W LED Decorative Up -Down type luminaire with IP 65 and IK07 and net weight 0.18. Luminaire shall be Aluminum die cast housing duly Powder coated in gray colour. Model - LW22-300-XX-30-UDX or equivalent. Make shall be as per approved make list.
- h) **Step Light** - Supply, Installation, Test & Commissioning of 6W LED Step Light with IP 20 and net weight 0.2. Luminaire shall be Aluminum die cast housing duly Powder coated in gray colour. Model - LT53-260-XXX-30-XX or equivalent. Make shall be as per approved make list.
- i) **Strip Light** - Supply, Installation, Test & Commissioning of 10W LED Strip Light with 700 lumens. Luminaire shall be Polyamide double sided PCB. Model - LS06-010-120-40-50 + Driver or equivalent. Make shall be as per approved make list.
- j) **Focus Light** - Supply, Installation, Test & Commissioning of 8W IP67 Compact and aesthetic, polyester coated aluminum, housed in ground/bush light, offers safe and vibrant parking areas, pathways and gardens, with high illumination and a soothing experience. Model - LF05-600-036-27-XX or equivalent. Make shall be as per approved make list.
- k) **Surface Mounted Downlighter – 2** - Supply, Testing, Installation & Commissioning of SMD LED, IP 40, 20W surface mounted downlighter with System efficacy of 100lm/W and system lumen output 2200 lumen with CCT_5700K operating in an ambient temperature of 0°C to 45°C at 50Hz frequency. Model - LL24-251-XXX-57 or equivalent. Make shall be as per approved make list.
- l) **GI Pole** - Supply, Testing, Installation & Commissioning of 3 Mtr. GI pole (Top Dia 60mm, Bottom Dia 114mm, 3mm thickness, Baseplate Die-casted base of 340 Dia. Make shall be as per approved make list.
- m) **Driver - 1** - Supply, Testing, Installation & Commissioning LG34 series CV driver. It is a constant voltage driver with application in LED strip light used in decorative lights with IP 66. Wide optimum performance Input voltage range from 150Vac to 300Vac. To ensure trouble-free operation, protection is provided against input surge, over voltage, short circuit and open circuit. Driver is potted type with fixed output voltage. Operating voltage range:

150Vac to 300Vac, Efficiency at full load: $\geq 80\%$, Surge protection: 5KV, Driver type: Constant Voltage, Life of driver is 35,000 hrs., Operational temperature range :0°C to 45°C, Operational relative humidity range: 10-85% Rh. Model - LG34-120-24-5AIP66 or equivalent. Make shall be as per approved make list.

- n) **Driver - 2** - Supply, Testing, Installation & Commissioning LG34 series CV driver. It is a constant voltage driver with application in LED strip light used in decorative lights with IP 66. Wide optimum performance Input voltage range from 140Vac to 300Vac. To ensure trouble-free operation, protection is provided against input surge, over voltage, short circuit and open circuit. Driver is potted type with fixed output voltage. Operating voltage range: 150Vac to 300Vac, Efficiency at full load: $\geq 80\%$, Surge protection: 5KV, Driver type: Constant Voltage, Life of driver is 35,000 hrs., Operational temperature range :0°C to 45°C, Operational relative humidity range: 10-85% Rh. Model - LG34-240-24-10IP66 or equivalent. Make shall be as per approved make list.
- o) **Linear Wall Washer** - Supply, Testing, Installation & Commissioning of 12W with Ambient Temperature (°C) - 0-45, Rated Voltage (V)(DC) - 24, Driver type (external/internal) - External, IP 66, IK 07 Aluminium die cast powder coated, cradle mount, high purity lenses, LED-RGBW, Electrical Insulation of Class I and Driver Efficiency(%)@Full load & Rated voltage* greater than equal to 80%. Model - LF01-151-15-CCWG2 or equivalent. Make shall be as per approved make list.
- p) **LED Floodlight** - Supply, Testing, Installation & Commissioning of 36W with Ambient Temperature (°C) - 0-45, Rated Voltage (V)(DC) - 24, Driver type (external/internal) - External, IP 66, IK 08 Aluminium die cast powder coated, Surface(On ground) Mount, high purity lenses, LED-RGBW, Electrical Insulation of Class I and Driver Efficiency(%)@Full load & Rated voltage* greater than equal to 80%. Model - LF04-361-15-CCW-G2 or equivalent. Make shall be as per approved make list.
- q) **Neon Flex Light** - Supply, Testing, Installation & Commissioning of 14W/Mtr. with Ambient Temperature (°C) - 0-45, Rated Voltage (V)(DC) - 24, Driver type (external/internal) - External, IP 67, construction of silicon extrusion, surface mount, PU Diffuser/optical material, LED-RGBW, Electrical Insulation of Class I and Driver Efficiency (%) @Full load & Rated voltage* greater than equal to 80%. Model - LS27-14-TB16-CCWG1 or equivalent. Make shall be as per approved make list.

5.0 PRE COMMISSIONING-TESTS ON ELECTRICAL SYSTEM EQUIPMENT TO BE CARRIED OUT AFTER INSTALLATION:

PRE-COMMISSION TESTS: Pre-commissioning tests in the specification requirements for various equipment but not limited to the following shall be carried out by CONTRACTOR in presence of Purchaser/ Purchaser's representative. Commissioning shall be carried out only

after obtaining satisfactory results, acceptable to the Purchaser/ Purchaser's representative.

5.1 Oil Type Transformer

- (a) Insulation resistance test HV side, LV side and HV - LV.
- (b) Magnetizing current test.
- (c) Winding resistance test.
- (d) Voltage Ratio & Tap continuity test at all tap.
- (e) Vector group test.
- (f) Magnetic Balance Test.
- (g) Buchholz Relay Test (if any)
- (h) Neutral CT Test (if any)
- (i) Winding Temperature Indicator / Oil Temperature Indicator Test
- (j) Polarization Index Test (For LV windings 3.3 KV and above)
- (k) Local / Remote operations of OLTC (if any)
- (l) Operational tests of RTCC panel (if any) as per schematic drawing.
- (m) No load test and performance observations

5.2 LT Distribution Boards:

- (a) IR Values of power & control circuits.
- (b) Interlocks circuits
- (c) Indication / Panel space heater circuit

5.3 Power and Control Cables:

- (a) IR Values before Hipot
- (b) Hipot Test - Measurement of leakage current
- (c) IR Values after Hipot

5.4 Lighting System:

- (a) Visual inspection for operating problems
- (b) System activation -burning in the lamps for 100 Hrs
- (c) Measuring light level & reflectance.

5.5 Earthing System:

- (a) Earthing resistance of each electrode.
- (b) Overall earthing resistance of the system for a group which is interconnected.

6.0 OPERATION & MAINTENANCE

O&M shall be initiated from the next day of the issue of the completion certificate by RSCL.

The CONTRACTOR shall be responsible for up-keeping/maintaining/ repair/ replacement, comprehensively, of all the Transformer, Luminaires, LT panels, cable and earthing and Lightning Protection systems during the tenure of the contract.

During the Contract period, if any hardware needs to be replaced, the same will be replaced with same or better OEM and with same or higher configuration free of cost.

The manpower and accessories required for O&M shall be provided by CONTRACTOR during relevant contract period. CONTRACTOR shall maintain a service team to take action immediately. The service team shall comprise of One Supervisor, One Electrician and one helper. The contractor shall be responsible for arranging replacement of manpower in case any of the team member is absent during the O & M period.

The CONTRACTOR shall make provision for adequate number of minimum 3m high Self-Supporting Ladder with anti-skid pads at the footings along with sets of all the required tools and instruments, duly calibrated from NABL Accredited Laboratory, to meet the maintenance requirements as per service benchmark.

The Non -availability of incoming power supply from TPWODL shall be intimated by CONTRACTOR within 24 hours. CONTRACTOR shall coordinate with TPWODL on behalf of RSCL and RSCL shall facilitate as and when required to expedite the response.

Any failure of luminaire due to lack of earthing, SPD, connector and loose connections shall be

replaced by CONTRACTOR free of cost.

The CONTRACTOR shall take adequate insurance to cover themselves for the cost of O&M during the tenure of the contract including the ones due to theft.

All the electrical parameters and illuminance level of the total stretch of 750mtr shall be monitored with calibrated Power Analyzer and Lux meter and documented for records and analysis at regular interval – Minimum Twice annually.

All the necessary modifications that are required to be carried out for the efficient working of the system and minimise the breakdowns and issues shall be carried out by CONTRACTOR from time to time at its own cost.

CONTRACTOR shall develop training material for the RSCL technicians, impart them training from time to time as may be decided by the RSCL.

All the responsibilities related to replacement of LED fixtures / cables / other accessories shall be borne by CONTRACTOR in respect of cost, managing the technical problems and other related aspect during the tenure of the project.

The maintenance work shall be carried out without disturbing and damaging the surrounding area of the River Front and with proper consent to work from RSCL.

1 TECHNICAL SPECIFICATIONS FOR UNINTERRUPTED POWER SUPPLY UNITS

1.1 SCOPE

Scope of this specification covers design, preparation of detailed drawings, manufacture, testing, inspection at manufacturer's/ vendors' works, supply, packing, forwarding and delivery from place of storage/ manufacturer's works to erection site including transit insurance, unloading, storage at site, assembly, erection, installation, testing, commissioning and performance demonstration of the UPS Systems mentioned below along with associated accessories and one set of spares recommended for specified no. of years of trouble free operation.

1.2 CODES AND STANDARDS

The equipment shall fully comply with the requirements of enclosed specifications and the latest editions of codes and standards not limited to the following;

Safety Standard:	IEC/EN 62040-1-1 IEC/EN 60950-1
Electromagnetic Compatibility Standard (EMC)	IEC/EN 61000-6-4 IEC/EN62040-2 IEC/EN 61000-6-2 IEC/EN 61000-4-2 IEC/EN 61000-4-3 IEC/EN 61000-4-4 IEC/EN 61000-4-5 IEC/EN 61000-4-6
Performance Standard:	EN 62040-3

In the event of any conflict between the codes and standards referred to elsewhere in the specification and the requirement of this specification, latter shall govern.

1.3 UPS SYSTEM : SPECIFIC REQUIREMENTS

- For Desktop/ Workstation Load : UPS system suitable for 415V 3 phase 4 wire as input and three phase output 415V, 50Hz, 3phase 4 wire, in Parallel Redundancy configuration. Each UPS shall be capable of independent 30 minutes battery backup facility.
- For Emergency Illumination: UPS system suitable for 240V 1-Phase Input / 240V 1-Phase Output, Rack mountable UPS with 30 minutes backup.
- This specification describes the operation and functionality of a continuous duty, solid-state, true on-line double conversion static Uninterruptible Power System (UPS).

1.4 RECTIFIERS

- a. The rectifier shall be capable of supplying the inverter full load, in addition to recommended by battery manufacturer and then maintain the battery on trickle charge mode.
- b. Input Current Total Harmonic Distortion: The input current THDI shall be within limit while providing conditioned power to the critical load bus and charging the batteries under steady-state operating conditions. This shall be true while supporting both a linear or non-linear load. This shall be accomplished without the requirement for additional or optional filters, magnetic devices, or other components.
- c. Soft Start: The rectifier shall be provided with soft start feature. Same shall be linear from 0-100% input current and shall not exhibit inrush. This shall take place over a user selectable 1-60 second time period with a factory default of 10 seconds.

1.5 INVERTERS

- a. The UPS output inverter shall constantly develop the UPS output voltage waveform by converting the DC bus voltage to AC voltage through a set of IGBT driven bi-directional power converters. In both normal operation and battery operation, the output inverters shall create an output voltage independent of the mains input voltage. Input voltage variation such as spikes, surges, sags and outages shall not affect the amplitude or sinusoidal nature of the output voltage sine wave of the inverters.
- b. Output Contactor: The output inverter shall be provided with an output mechanical contactor to provide physical isolation of the inverter from the critical bus. With this feature a failed inverter shall be isolated from the critical bus.
- c. Redundancy: The UPS shall be capable of being configured with redundant output inverters, each with semiconductor fusing, and logic-controlled contactors to remove a failed component from the input, DC and output critical bus.
- d. All UPS shall have IGBT technology for rectifier and inverter.

1.6 STATIC BYPASS

- a. The static switch shall comprise thyristors connected in anti parallel configuration, enabling loads on each branch circuit to be connected to the inverter of the other branch circuit or to the stand-by regulated AC supply.
- b. The current rating of the static switch shall be not less than the continuous full load rating of the branch circuit and short time rating of 1000% for 20 milliseconds.
- c. System static bypass shall provide no break transfer of the critical load from the Inverter output to the static bypass input source during times where maintenance is required, or the inverter cannot support the critical bus.
- d. Automatic initiation of the transfer from a faulty branch circuit to either a healthy branch circuit or the stand-by regulated source shall be accomplished during following conditions :
 - Inverter failure.
 - Loss of inverter AC output.
 - Load over current (in case of non-redundant UPS with static by pass to regulated supply).
- e. Automatic Transfers: An automatic transfer of load to static bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from static bypass back to normal operation shall take place when the overload condition is removed from the critical bus output of the system. Automatic transfers of load to static bypass shall also take place if for any reason the UPS cannot support the critical bus.

- f. Manual Transfers: Manually initiated transfers to and from static bypass shall be initiated through the UPS graphical user interface.
- g. Discrete LED indicators integrated in mimic diagram or multi line alpha numeric text display unit shall be provided for continuous monitoring of the UPS operation. The UPS control system shall be fully compatible for remote operation via communication link. Contractor to indicate the type of communication protocol supported by the system along with the details of links provided in the system. The control system shall operate on Windows or eqvt. Platform. The following operating conditions shall be annunciated.

1.7 ALARM

- System fault
- Rectifier charger failure
- Inverter failure
- Battery undervoltage
- Thyristor over temperature
- Fuse failure
- Over load
- Static transfer to stand-by
- Transfer inhibited
- Over load shutdown
- Emergency shutdown
- Battery circuit breaker / switch open
- AC Main failure
- AC stand-by source mains failure
- Manual bypass ON
- Fan failure
- Asynchronous condition
- Control power failure
- DC ground fault.
- Input Frequency outside configured range
- AC adequate for UPS but not for Bypass
- Number of Batteries changed since last ON
- Shutdown or unable to transfer to battery due to overload
- Load Shutdown from Bypass. Input Frequency Volts outside limits
- Fault, Internal Temp exceeded system normal limits
- Input Circuit Breaker Open
- Redundancy has been lost
- Redundancy is below alarm threshold
- Runtime is below alarm threshold
- Load is above alarm threshold
- Load is no longer above alarm Threshold
- Minimum Runtime restored
- Bypass is not in range (either frequency or voltage)
- Back feed contactor stuck in OFF position

- Back feed contactor stuck in ON position
- UPS in Bypass due to Internal Fault
- UPS in Bypass due to overload
- System in Forced Bypass
- Fault, Bypass Relay Malfunction
- High DC Warning
- High DC Shutdown
- Low Battery Shutdown
- Low Battery Warning

1.8 Controls: The following controls or programming functions shall be accomplished by the use of the user interface/ display unit. The touch screen display shall facilitate these operations:

- Silence audible Alarm
- Display or set the date and time
- Enable or disable the automatic restart feature
- Transfer critical load to and from static bypass
- Test battery condition on demand
- Set intervals for automatic battery tests
- Adjust set points for different alarms
- Potential Free (Dry) Contacts
- Status Indication on Mimic
- Mains on
- rectifier on
- Battery on load
- Inverter on
- AC Stand-by source on
- Inverter on –load
- Manual by-pass on
- Load on static by pass.
- Remote UPS monitoring shall be possible via MODBUS.
- Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explorer.

1.9 METERS

- a. Meters shall be suitable for semiflush mounting with flanges projecting in vertical panels.
- b. Meters shall have circular 240 Deg scale, 110 mm square, moving coil (taut band) type, conforming to IS: 1248 with accuracy class 1.0 or better.
- c. The following meters shall be provided :
 - Voltmeter with selector switch to measure input voltage / stand-by AC supply.
 - Ammeter with selector switch to measure input current.
 - DC Volt meter for rectifier
 - DC Ammeter for rectifier
 - Volt meter for inverter output.
 - Ammeter for AC output and regulated stand-by AC.

- Frequency meter for AC output of digital type.
- d. Alternatively an alphanumeric multi line display to indicate all the parameters listed above is acceptable.

1.10 CIRCUIT PROTECTION

The following devices shall be provided to protect the UPS system:

- AC input circuit breaker to Rectifier unit.
- DC circuit breaker for battery output.
- Fast acting semiconductor fuses.

1.11 BATTERY SYSTEM

- a. 12V, Lead Acid Sealed Maintenance Free (SMF) type battery, battery isolator & mounting stand shall be provided.
- b. Design Margin of 10% and Aging factor of 1.25% shall be considered for battery sizing calculations.
- c. First charging of the battery shall be carried out by the BIDDER.
- d. Batteries shall be provided with FR casing.
- e. Battery bank should be with 2 strings (100% x 2) per UPS with individual isolator/ protection for UPS
- f. In the event of a battery malfunction the affected string shall be automatically isolated from the system thereby ensuring battery autonomy is retained, albeit of a shorter duration.

1.12 EARTHING

- a. Dedicated Cu earthing shall be provided for UPS & isolation transformer neutral earthing.
- b. Body earthing shall be provided for UPS, Isolation transformer & battery rack.

1.13 UPS SYSTEM TECHNICAL PARTICULARS

a. WORKSTATION UPS

Sr. No.	Specifications	Requirement

1	Type	3-Phase Input / 3-Phase Output in Parallel Redundancy configuration. Each UPS shall be capable of independent 30 minutes battery backup facility.
2	Technology and Capability	a) True Online configuration with double conversion UPS System b) DSP based technology with reduction in electronic components. c) Fully rated power (kVA=kW) for maximum power availability. d) Possibility of enhancing UPS capacity / redundancy by operating UPS in N+X Parallel Redundant Configuration (PRS). e) Capability of Independent or Common battery bank operation of the UPS when operated in PRS. f) UPS should be designed at Rated PF of 1. g) Dual Input design. h) UPS should have IGBT topology for both PFC (power factor correction) and inverter. i) Should have Dual Aux power design.
3	Model Name & Number:	
	Make / Model / Part No to be specified by the vendor	
4	Input	
	Input facility -Phases / Wires	3-Phase / 4-Wire & Ground (3Phase & Neutral + Ground)
	Input Voltage	415V, 3 Phase, 4Wire
	Nominal Input Frequency	50 Hz
	Input Frequency Range	45 to 65 Hz
	Input Power Factor	> 0.99 (Full Load)
	Current Harmonic Distortion(ITHD)	< 3%
	Generator Compatibility	Compatibility to Genset supply required
	Input Protection (Through In-built 1P MCB)	Should be provided at the input of the UPS suitable for the full rated capacity of the UPS
5	Output	

	Nominal Output voltage	415V, 3 Phase, 4Wire
	Output Voltage Regulation	$\pm 1 \%$
	Nominal Output Frequency	50 Hz
	Output Frequency Regulation	$\pm 0.05\text{Hz}$
	Output Frequency Slew Rate	$< 1\text{Hz/sec}$
	Output Wave Form	Pure sine wave
	Output Voltage Distortion (THDu)	$< 1.5 \%$ (linear load)
	Crest Factor	3:1
	Output Short circuit Protection	Electronic Protection
6	Transient Response / Recovery	
	Transient Response: Dynamic Regulation for 10% to 90% step linear load	$\pm 7\%$
	Transient Recovery to steady state condition after 10% to 90% step linear load	< 1 cycle
7	Transfer Time	
	Transfer Time (Mode of operation)	Zero ms from Mains mode to Battery Mode Zero ms from Battery Mode to Mains mode
	Transfer Time (Inverter to Bypass / Bypass to Inverter)	$< 1\text{ms}$ (Synchronized Mode)
	Automatic & Bi-directional static bypass (In-built)	Bypass to Inverter $\pm 10 \%$ (Rated Voltage) Inverter to Bypass $\pm 7 \%$ (Rated Voltage)

	Maintenance Bypass	1. UPS should have option for manual maintenance bypass 2. Maintenance bypass cover removal sensing. 3. The maintenance bypass should provide for Hot-swap of the faulty UPS PWB for repairs / service.
8	Efficiency (At Nominal Voltage & Resistive Load up to kW rating of UPS)	
	Overall Efficiency (AC to AC) - Online (Double Conversion)	Upto 93%
	Overall Efficiency (AC to AC) - ECO Mode (Bypass feeding the load under normal conditions)	Upto 96%
9	Overload	
	Inverter Overload capacity	$\leq 105\%$: continuous, $106\% \sim \leq 125\%$: 10 minutes; $126\% \sim \leq 150\%$: 1 minute; $> 150\%$: 1 second
10	Display Panel (In-build LC Display & LED)	
	Measurements (On LCD)	Input: Voltage / Frequency, Bypass: Voltage / Frequency, Output: Voltage / frequency, Battery: Remaining time / Battery Level Indicator, Load: Percentage / Load Level Indicator, Battery Voltage Capacity/Status/Test Result, System Date/Time Setting, Current Time, PFC Fuse Open, Battery Temperature Too High, Battery Over Charge, Battery Out of Date, INV Short Circuit, Output Breaker Off, kVA, kW, output current, Battery current.
	Fault Indication (On LCD)	Main Input Sequence Fault, Battery Ground Fault, Bypass Static Switch Fault, Parallel Fault, System General Fault, Provide Bypass O/P Even If UPS Fault.
	Indications (LED)	Normal-Green/Battery-Orange/Bypass-Green/Fault-Red
11	Alarms	
	Audible Alarms	Battery Low beep / DC Fault beep/ UPS Overload beep/ o/p short ckt. fault beep/ Shutdown beep
12	Battery Backup / Battery Bank & Charger	
	Backup Required	30 Minutes
	Battery Bank Voltage	Vendor to indicate

	Battery Bank VAH	Suitable for 30 Minutes battery backup
	Batteries Type	Sealed Maintenance Free (SMF) - 12V Cells
	Battery Makes	Amara Raja / Exide / HBL / Hoppecke
	Number of Battery Banks	Maximum Two Banks in parallel
	Minimum Charger Rating (Including internal / external)	The charger should be able to deliver charging current equivalent to 10% of Battery Ah rating offered. (In case of external chargers, suitable monitoring of the chargers should be provided in the UPS. Also all external chargers taking AC input must have PFC - Power factor correction)
	Charger type / Charging Method & Charging Voltages	Constant Voltage Constant Current Solid state SMPS charger Float Charge 270V±(2V) Boost Charge 280V±(2%V)
	Battery recharge time (After complete discharge) to 90% capacity	10-12 hours
	Battery Housing (Vendor to provide the GA drawings of the offered Battery Rack)	Should be compact and space saving MS steel open racks complete with interconnectors
	Battery End Cell Voltage	1.85 V/cell
13	Interfaces	
	Serial Communication RS232 Port (Option of USB Port should be available)	RS232 Port should be provided as standard in the UPS. However, there should be provision for USB port also in the UPS.
	REPO (Remote Emergency Power OFF) / ROO (Remote ON - OFF) Port	Provide both onsite & remote EPO to shutdown UPS when emergency situation happens. REPO Port with a user-supplied switch
	Interface to BMS (Building Management System)	ModBus Card for connecting to UPS to BMS thru RS485 & monitoring thru BMS

	UPS status information presented as 3 contact closures	UPS should have configurable input signal as shutdown UPS or battery test dry contact.
14	Restart / Testing Capability	
	Cold Start	UPS should start up On AC Supply (Mains) without DC Supply (Batteries) On DC Supply (Batteries) without AC Supply (Mains)
	Automatic Restart	UPS should start up automatically on mains resumption after battery low shutdown
	Self-Diagnosis	UPS should be capable to carry out self-test of Rectifier / Charger / Battery & Inverter module during start-up
15	Physical	
	Operating Temperature	0°C ~ 40°C
	Storage Temperature	−20°C ~ 40°C
	Operating Humidity	< 95%
	Operating Altitude	0 to 3000m(0 To 10000ft)
	Type of Cooling	Forced Air
	Noise Level	< 60dBA at 1 Meter
	Air Filters	UPS should have internal anticorrosion air filters for dust filtration
	Dimension (w x d x h) in mm	To be furnished by the vendor
	Weight - in kg	To be furnished by the vendor
	Reliability	MTBF greater than 100000 hours
	Packaging Material / Vibration Withstand & Drop Test	Recyclable (No CFC) & 1. Vibration testing as per ISTA -1G Non-operational with Packing

	Standard Package of UPS to include the following minimum accessories	1.SMART Slot 2.MINI Slot 3.Parallel Port 4.RS232 Port 5.REPO Port 6.Charger Detection Port 7.Input Dry Contact 8.Output Dry Contact 9.USB Port
	Parallel Configuration	UPS should have capability for parallel 4 units.
	DC bus Capacitor	UPS DC bus capacitor have minimum life of 5 years@40°ambient.
16	Certifications	
	Manufacturer	QMS: As per ISO 9001: 2008 EMS: As per ISO 14001: 2004 OHSAS As per ISO 45001: 2018 LEED Certified Factory setup
	Product Safety Certifications (Mandatory)	ESD:IEC61000-4-2: level4 RS : IEC61000-4-3: level3 EFT: IEC61000-4-4:level4 SURGE: IEC61000-4-5:level4 CS: IEC61000-4-6: level3 IEC 61000-2-2 EN 62040-2 EN 61000-3-2
	ROHS & CE compliance	UPS should be ROHS compliance & CE Certified

b. ILLUMINATION UPS

Sr. No.	Specifications	Requirement
1	Type	1-Phase Input / 1-Phase Output Rack mountable UPS with 30 minutes backup.

2	Technology and Capability	a) True Online configuration with double conversion UPS & Zero transfer time. b) DSP based control with advanced technology. c) Wide Input voltage range from (80 ~ 280VAC) d) Auto restart & capability with the Independent battery bank operation of the UPS. e) UPS should be designed at Rated PF of minimum 0.9. f) Generator compatibility with cold start and AC start features. g) Automatic bypass to transfer the load on mains due to overload & internal fault. h) ECO mode should be available in the UPS.
3	Model Name & Number	
	Make / Model / Part No to be specified by the vendor	
4	Input	
	Input facility -Phases / Wires	Single-Phase / 2-Wire & Gnd. (1Phase & Neutral + Ground)
	Input Voltage	240V, 1 Phase, 2 Wire, AC
	Nominal Input Frequency	50 Hz
	Input Frequency Range	40 to 70 Hz
	Input Power Factor	> 0.99(@ full resistive load)
	Generator Compatibility	Compatibility to genset supply required
	Input Protection	Should be provided at the input of the UPS suitable for the full rated capacity of the UPS.
5	Output	
	Nominal Output voltage	240V, 1 Phase, 2 Wire, AC
	Output Voltage Regulation	± 1% for linear load
	Nominal Output Frequency	50 Hz

	Output Frequency Regulation	$\pm 0.1\text{Hz}$
	Output Frequency Slew Rate	$< 1\text{Hz/sec}$
	Output Wave Form	Pure sine wave
	Output Voltage Distortion (THDu)	$< 3\%$ for linear load & $< 5\%$ for non-linear load.
	Crest Factor	3:1 On Full Load (Minimum)
	Output Short circuit Protection	Electronic Protection
6	Transfer Time	
	Transfer Time (Mode of operation)	Zero ms from Mains mode to Battery Mode Zero ms from Battery Mode to Mains mode
	Transfer Time (Inverter to Bypass / Bypass to Inverter)	$< 4\text{ms}$
	Automatic Bypass switch	UPS should be capable of automatic change over to bypass.
7	Efficiency (At Nominal Voltage & Resistive Load up to kW rating of UPS)	
	Overall Efficiency (AC to AC) - Online (Double Conversion)	Upto 91% (at 100% load)
8	Overload	
	Inverter Overload capacity	$<105\%$: continuous ; $105\% \sim 125\%$: 1 minutes; $120\% \sim 150\%$: 30 seconds; $>150\%$: 0.5 seconds only
9	Display Panel (In-build LC Display & LED)	
	Measurements (On LCD)	Input Voltage & Frequency, Bypass, Output Voltage & frequency, Kilowatt, kVA, ECO mode, Battery & Load Level Indicator, Ambient temperature & Event code.
	Fault Indication (On LCD)	Charger warning, Fan fault, Temperature out of Range,+/-DC bus High/Low, Inverter Fault, DC-DC fault, abnormal output/Inverter voltage, output short circuit, charger fault, overload shutdown, battery low shutdown.

	Settable data	Inverter Voltage, Inverter Frequency, Standby bypass, ECO, Bypass Range, Buzzer, Battery Capacity, Battery String, & Overload alarm
	Indications (LED)	Green & Red
10	Alarms	
	Audible Alarms	Charger warning, Fan fault, Temperature out of Range, +/-DC bus High/Low, Inverter Fault, DC-DC fault, abnormal output/Inverter voltage, output short circuit, charger fault, overload shutdown, battery low shutdown.
11	Battery Backup / Battery Bank & Charger	
	Backup Required & required VAH	Suitable for 30 minutes backup time
	Battery Bank Voltage & VAH	24 V DC & VAH Suitable for 30 minutes backup time
	Batteries Type	Sealed Maintenance Free (SMF) - 12V Cells, VRLA
	Battery Makes	Amara Raja / Exide / HBL / Hoppecke
	Number of Battery Banks	Single Bank system.
	Minimum Charger Rating (Including internal / external)	The charger should be able to deliver charging current equivalent to 10% of Battery Ah rating offered. (In case of external chargers, suitable monitoring of the chargers should be provided in the UPS. Also all external chargers taking AC input must have PFC - Power factor correction)
	Charger type / Charging Method & Charging Voltages	Constant Voltage Constant Current Solid state SMPS charger
	Charger current	4A extended upto 8A with internal charger
	Battery Housing (Vendor to provide the GA drawings of the offered Battery Rack)	Should be compact and space saving MS steel open racks complete with interconnectors
	Battery End Cell Voltage	1.85 V/cell
12	Interfaces	

	USB Port should be available (Mandatory)	There should be provision for USB port also in the UPS.
	RS232 Port should be available (Mandatory)	There should be provision for RS232 port also in the UPS.
	Interface to Mini TVSS card	This card enable the UPS with the surge protection
	Interface to BMS (Building Management System)	ModBus Card for connecting to UPS to BMS thru RS485 & monitoring thru BMS
13	Restart / Testing Capability	
	Cold Start	UPS should start up On AC Supply (Mains) without DC Supply (Batteries) On DC Supply (Batteries) without AC Supply (Mains)
	Automatic Restart	UPS should start up automatically on mains resumption after battery low shutdown
	Self-Diagnosis	UPS should be capable to carry out self-test of Rectifier / Charger /Battery & Inverter module during start-up
14	Physical	
	Operating Temperature	0 to 40 deg C
	Storage Temperature	-15 to 50 deg C
	Operating Humidity	5% ~ 95%RH (No Condensing)
	Operating Altitude	0-1000m
	Type of Cooling	Forced Air
	Noise Level	< 40 dBa at 1 meter distance
	Dimension (w x d x h) in mm	To be furnished by vendor
	Weight - in kg	To be furnished by vendor

	Packaging Material / Vibration Withstand & Drop Test	Recyclable (No CFC) & 1. Vibration testing as per ISTA -1G Non-operational with Packing
	Standard Package of UPS to include the following minimum accessories	1. UPS 2. Input cable 3. Battery cable 4. USB cable 5. User Manual
15	Certifications	
	Manufacturer	QMS: As per ISO 9001: 2015 EMS: As per ISO 14001: 2015 OSHAS: As per ISO 18001: 2007 EMS: As per ISO 14064-1:2012
	Product Safety Certifications (Mandatory)	BIS Certification
	Product Safety Certifications (Mandatory)	CE Certification
	Product Safety Certifications (Mandatory)	RoHS Certification

1.14 CABLING

- a. Cables between UPS, battery and isolation transformer as well as between 3 phase input supply and UPS thru MCCB are included in the scope of work.
- b. All LT power cables shall be FRLS type with following specific requirements.
- c. Cu conductor, stranded, grade H4, class 2 as per IS 8130.
- d. Insulated with extruded XLPE compound.
- e. Provided with inner and outer sheath of extruded black PVC compound (Type ST-2).
- f. The control and annunciation cables will be 1100V grade, multicore, 2.5 sq.mm cross-section, annealed high conductivity stranded copper conductor, FRLS PVC insulated with inner and outer PVC sheath. The cables shall generally conform to IS: 1554-1988 with relevant parts thereof. All control cables shall be with following specific requirements:
 - Copper conductor stranded class 2.
 - Insulated with extruded PVC compound.
 - Provided with inner and outer sheath of extruded black PVC compound.
 - The construction, performance and testing of cables shall comply with IS: 7098 and IS: 1554-1988.

- Uninyvin cables shall be used for connection between battery & UPS system.
- All cables shall be terminated at both ends. Double compression glands with tinned copper lugs shall be used in indoor and outdoor application.

1.15 PERFORMANCE TESTS ON UPS

- a. Type and routine tests certificates for all components made use in the UPS system shall be furnished. Tests for components shall be as per relevant standard indicated.
- b. Contractor shall furnish his quality assurance plan for the equipment offered. The quality assurance plan shall include bought out components and assemblies used in the UPS system.
- c. Routine tests on the complete UPS system shall be carried out as per relevant standards for each major sub-system in the UPS, viz., Rectifier, Inverters, batteries, stand-by supply etc.
- d. System tests shall be performed on the completely assembled UPS system. System tests shall include frequency regulations. Voltage regulation, current limiting feature and harmonic content tests in addition to the tests to prove the functional requirements such synchronisation with range of adjustments, transfer of static switches for conditions of loss of square wave, overload and under voltage conditions.
- e. Type, routine and optional tests covered under clause 7.3 of IEC-60146-4 shall be conducted on the UPS system in addition to the system tests.
- f. Endurance test on static switches shall be performed for not less than 10 transfer / retransfer cycles at full load.
- g. Heat run test shall be carried out on each branch of UPS including bypass (if provided) and on overall UPS system at rated load under relevant ambient conditions for a period of 8 hours. This test shall be conducted as a routine test on all UPS being supplied.

1.16 TRAINING OF PERSONNEL

Training of GSCL's personnel shall be free of cost to enable them to operate, troubleshoot and maintain the offered equipment/ components. The general guidelines for the training requirement, description of type of training required and the duration of training shall be indicated by the Bidder to fulfil the above objective.

1.17 FACTORY ACCEPTANCE TESTS

- a. Contractor shall also include cost towards factory testing in presence of CONSULTANT/ GSCL's - 3 persons.
- b. The Contractor shall inform the CONSULTANT/ Engineer well in advance before delivering the equipment at site. It shall be discretion of GSCL to waive off the inspection of equipment.

1.18 STORAGE AT SITE

- a. Contractor shall indicate the specific requirements, if any for proper storage of the equipment supplied at site.
- b. In general, while shipping the equipment to site, Vendor shall ensure that each assembly or component shall be crated, boxed or otherwise suitably protected against damage or loss during shipment and to facilitate site storage. All openings shall be effectively sealed with temporary closures to prevent entry of dust, dirt, moisture and other foreign matter.

1.19 DOCUMENTATION (UPS)

- a. Both hard and soft copies (Auto- Cad) of all drawings shall be furnished right from approval stage.

- b. The Contractor shall plan his manufacturing schedule so as to allow at least two weeks' time for approval of the drawings after their receipt by the GSCL.
- c. Upon completion of the installation, the Contractor shall furnish a complete set of soft copies drawings (Auto- Cad version) in CDs and hard copies.
- d. Drawings prepared by the Contractor and approved by the GSCL shall be considered as a part of the Contract Specification. However, examination and approval of the drawings by the GSCL shall not relieve the Contractor of his responsibility for engineering, design, workmanship, materials and construction under the Contract.
- e. If, at any time before the completion of the work, changes are made necessitating revision of approved drawings, the Contractor shall make such revisions and proceed in the same routine as for the original approval.
- f. The GSCL shall reserve the right to comment on drawings and documents under information category and inform the Contractor to treat these drawings and documents as approval category.

2 BATTERY

2.1 SCOPE

This specification covers requirements of sealed VRLA lead acid battery complete with battery racks, inter-cell and inter-tier connectors and all other accessories.

2.2 CODES & STANDARDS

- a. The design, manufacture and performance of equipment shall confirm to the latest applicable electrical rules, all currently applicable standards codes of practice, regulations and safety codes of the locality where the equipment are to be installed. In case of conflict between these standards and specification, requirements of this specification shall govern. Nothing in this specification shall be construed to relieve the Contractor of his responsibility.
- b. All codes and standards referred to in the specification shall be understood to be the latest version on the date of offer made by the bidder unless otherwise indicated.
- c. The Contractor shall ensure that instruments and gauges to be used for testing and inspection of critical parameters as identified in the specification have valid calibration and the accuracy can be traced to National standards.

2.3 FEATURES OF CONSTRUCTION

The equipment offered shall be complete with all parts that are necessary or usual for the efficient operation of the equipment, whether specifically mentioned or not.

2.4 SEALED LEAD ACID BATTERY

The sealed batteries shall be starved electrolyte type (with electrolyte immobilised in a micro porous material) to allow recombining of generated oxygen internally. The battery shall be completely explosion resistant, shall tolerate freezing and shall not allow gases to escape during normal charging conditions. The battery shall not require any topping and be maintenance free. The batteries shall conform to IEC: 60896-2 or equivalent standard.

2.5 CONNECTORS AND TERMINAL POSTS

- a. Inter-cell and inter-tier connectors and terminal posts shall be of low resistance corrosion resistant alloy/copper. Terminal posts shall be designed to accommodate external bolted connection conveniently and positively. Each terminal post shall have two bolt holes of the same diameter, preferably at right angles to each other. The bottom hole shall be used to terminate the inter-cell connection. The top hole shall be left for PURCHASER'S terminal connection. All the metal parts of the terminals shall be lead coated if necessary. The VENDOR shall indicate this in the bid. The junction between terminal posts and cover and between cover, and container shall be so sealed as to prevent any seepage of electrolyte. All terminals shall be provided with FRLS insulated covers/shrouds.
- b. All inter row, inter cell and inter row connectors shall be covered with heat shrunk FRLS sleeves.
- c. The shrouds for Battery terminal shall be of FRLS (anti-static type).

2.6 CONTAINERS

- a. Containers, cell lids, safety vents, acid level indicators, separators, connectors, electrolyte, shall conform to the relevant IS/IEC standards. The cell containers and vent plugs, in addition, shall conform to the safety requirements of UL 924 or equivalent safety standard. The safety vent shall be self-Resealing pressure regulating with flame arrestor. In case the batteries are proposed to be housed in a sheet metal or polymeric enclosure, the same is deemed to be included in the scope of the bidder. The enclosure for battery shall conform to the safety provisions of UL 1778 or equivalent standard.
- b. Container should have adequate Mechanical strength to prevent bulging, cracking etc. during the life span of battery when operating under expected temperature range and due to action of static and dynamic loads and the action of electrolyte.
- c. Containers shall be transparent and of Flame-retardant material.

2.7 THERMAL RUNAWAY

In order to prevent thermal runaway an air flow distance of 10 mm shall be provided between the cells.

2.8 ACCESSORIES

- a. The battery shall be complete with accessories and devices, including but not limited to the following:
 - Battery racks
 - Cell and stand insulators.
 - Set of intercell, inter-tier and interbank connectors as required for the complete installation.

b. Accessories for testing and maintenance.

a)	One	±3 volts DC voltmeter with built in discharge resistor and suitable leads for measuring cell voltage.
b)	Three	Pocket thermometers
c)	Two	PVC aprons
d)	Four	PVC gloves Any other protective wearing apparatus if required, to be specified by VENDOR
e)	Two	Cell lifting straps
f)	One set	Terminals and cable boxes with glands for connecting cable as required. Spare connectors Spare vent plugs Spare nuts and bolts Suitable set of spanners PVC spill trays under the battery cells.
g)	One	Insulated wrencher

2.9 BATTERY LAYOUT

- The Contractor shall review the battery room dimensions/ Layout drawings included with the tender specifications and suggest suitable battery layout, providing dimensioned drawings.
- An air flow distance of 10 mm shall be provided between the cells to allow better heat dissipation and minimise chances of thermal runaway.
- No of battery banks shall be as specified under UPS section above.

2.10 BATTERY RACKS

- Battery racks shall be constructed from good quality teak wood and painted with two coats of polyurethane which acts as a strong resistant to sulphuric acid and fitted with cell number plates . Metallic stands MS Rack designed to withstand the seismic forces shall be provided suitable for the seismic zone. Metallic stands shall be painted with acid resistant paint after 2 coats of primer. The construction of the racks shall be suitable for fixing to a flat concrete floor. The racks shall be rigid, mechanically strong, free standing type and free from warp and twist. The completed racks shall be suitable for being bolted end to end to form a continuous row. Insulators shall be provided below the legs of the stands.
- The racks shall be of single tier/ two tier construction depending on the final layout based on space availability. The number of tiers shall be subject to GSCL's approval.

2.11 VENTILATION

Proper ventilation in the battery room shall be done by Bidder.

2.12 BATTERY SIZING

- a. The no. of cells in the battery shall be offered by Contractor. The Contractor shall guarantee the performance of the battery for the duty requirements indicated over the entire range of temperature and also at the minimum ambient temperature specified with the derating factors and ageing factor and temperature correction factors. The procedure for sizing the battery shall be as detailed in IEEE 485. Design margin to be considered has been specified in Design Criteria above.
- b. The DC system voltage at DC bus shall be specified by the Contractor.
- c. The Normal cell voltage shall be 2.0 V per cell
- d. The Max Float charge voltage shall be 2.25V per cell
- e. The Boost charge voltage shall be 2.75V per cell
- f. The End cell voltage shall be 1.85 V per cell
- g. The Total Momentary Load/Duration/Voltage at the end of this duration – To be defined by Contractor.
- h. For selecting the number of cells, bidder shall consider a voltage drop of 3 % between the battery and the UPS.
- i. Contractor shall demonstrate the performance of the battery at the specified duty cycle, at the specified min. ambient temperature during pre-dispatch inspection, by conducting test on a randomly selected cell.

Temperature Range

Min. Temp.	5 Deg. C
Max. Temp.	50 Deg. C
Ave. Temp.	32 Deg. C

2.13 CHARGING

- a. The proposed method of charging the battery shall be Float cum Boost.
- b. Contractor shall state whether an equalising charge is recommended for the battery. If so, the equalising charging voltage, current, duration and the interval between the equalising charging shall be specified in the BID. Contractor shall also indicate the requirements for boost charging.
- c. The charger shall be constant voltage, current limiting type unless otherwise stated.

2.14 LIFE

Contractor shall quote in his offer the guaranteed life of the battery when operating under the conditions specified.

2.15 TESTS

All tests shall be conducted as per the relevant standards. Tests shall include routine & acceptance tests.

- Routine Tests shall comprise of the following:

- i. Visual inspection
- ii. Dimensional check
- iii. Capacity
- iv. Retention of charge test
- v. Ampere-hour and watt-hour efficiency test.
- vi. Endurance test
- vii. Short circuit current and internal resistance measurement test.
- Test for suitability of floating battery operation.
 - i. In application where the first momentary discharge is high and, lasts for several minutes a high discharge test shall be conducted, in addition to the above tests.
 - ii. Type test report on an identical type and capacity of the battery shall be submitted for GSCL's review. If type tests reports are not available, then these Type tests shall be conducted on a minimum of one sample cell typical and identical with the cells forming the complete battery offered. However, the test cell shall not be one of the cells offered in the battery offered.
- ACCEPTANCE TESTS-Acceptance tests shall be conducted at site on completion of installation and commissioning and immediately prior to putting the battery in service. These tests shall comprise of:
 - i. Visual inspection
 - ii. Dimensional check
 - iii. Capacity test
 - iv. Test for voltage during discharge
 - v. Storage test
 - vi. Insulation resistance
 - vii. Vendor shall carry out the capacity test for the following conditions:-
 - viii. For the load cycle
 - ix. For 10 Hr discharge as per IS-1651
- The battery voltage at the end of the cycle time shall not be less than the values specified.
- The vendor shall ensure that instruments and gauges to be used for testing and inspection of critical parameters as identified in the specification have valid calibration and the accuracy can be traced to National/International standards.

2.16 TEST REPORTS

A copy of routine and type test results shall be submitted for approval before the dispatch of batteries. Specified number of bound copies of complete test results shall be furnished with the batteries.

2.17 SPARE PARTS

Contractor shall include the following items in his recommended list of spares:

- a. Inter-cell/ Inter-row/Inter-bank/connectors
- b. Battery stand insulators and cell insulators
- c. Nuts, bolts, washers, etc.
- d. Vent plugs/Vent plugs cum level indicators

2.18 IDENTIFICATION

- a. Each cell shall be marked in a permanent manner in accordance with relevant standard. In addition, each cell shall be legibly numbered serially to identify the cell during manufacture, testing, installation and operation of battery to identify after having assembled into battery bank in battery racks. A set of loose stickers shall be provided to mark the cells position in the assembled battery bank.
- b. Each cell shall be marked as per IS-1651 and IEC-486-1. Additionally, the polarity of the cells shall also be marked.

2.19 TRANSPORT

The sealed lead acid battery shall be transported with the electrolyte immobilised, sealed & fully charged.

TECHNICAL SPECIFICATIONS FOR WATER SUPPLY, SANITARY & DRAINAGE WORKS

1.0 SCOPE

1. This specification covers the general requirements of providing and laying water mains and water supply piping, providing and fixing sanitary fixtures and piping and providing and laying drainage lines.
2. For specifications, mode of measurements and scope of work covered under the respective items for the work included under this contract, following documents shall be referred to in the order of precedence as given below:
 - a) Description of the items and notes if any given in the Schedule of Quantities.
 - b) Scope of work
 - c) Drawings
 - d) Specifications.
 - e) Additional / Special Conditions of Contract.
 - f) General Conditions of Contract.
 - g) Applicable Codes and Standards as specified herein with amendments/ revisions issued till date.

In the event of any discrepancy among the documents referred above, the document in the higher order of precedence shall prevail.
3. In the event of any element of the specification not being available in any of the documents mentioned above, the instructions of the Engineer-in-Charge in writing shall be followed by the Contractor.
4. The Work shall be carried out in accordance with the drawings and designs as would be issued to the Contractor by the Engineer-in-Charge duly signed and stamped by him. The Contractor shall not take cognizance of any drawings, designs, specifications, etc. not bearing Engineer-in-Charge's signature and stamp. Similarly, the Contractor shall not take cognizance of instructions given by any other Authority except the instructions given by the Engineer-in-Charge in writing.
5. The Work shall be executed and measured as per approved drawings and schedules.
6. The Contractor shall acquaint himself fully with the partial provisions for supports that may be available in the structure and utilize them to the extent possible. In any case, the Contractor shall provide all the supports regardless of provisions that have been already made. Nothing extra shall be payable for situations where bed plates (for supports) are not available or are not useful
7. The Contractor shall incorporate seismic considerations of anchoring and isolation in the design of the systems as called for the different equipment.
8. Shop coats of paint that may be damaged during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.
9. In addition to the sectional testing carried out during the construction, the Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakage and shall replace all defective materials in the system. Any consequential damage is done, on account of Contractors carelessness, open or burst pipes or failure of fittings, during

testing and commissioning to the building, furniture and fixtures shall be made good by the Contractor

2.0 GENERAL PROVISION

2.1 Scaffolding

2.1.1 Only steel tube scaffolding of approved design shall be used for all works. The scaffold structure shall comply with the requirements of IS: 4014 and IS : 3696. An independent tied scaffold (double scaffold), which has two lines of standards, shall be provided with the inner line kept at least one board clear of the finished face with extended transoms, or hop up baskets to carry an inside board. Diagonal braces shall not prevent the material being moved along the scaffold run. The scaffolding shall be suitably packed at the ends to prevent damage to the finished work.

2.2 Protection

- 2.2.1 Protection against damage: Care shall be taken to avoid damage from any cause at all stages. Packing pieces used for protection shall not disfigure or otherwise permanently mark the Works.
- 2.2.2 Surface protection shall be afforded by careful handling and the avoidance of the use of hooks, crowbars, or other implements that are likely to damage the works.
- 2.2.3 During installation of piping, the open end of pipe shall be protected with temporary cover to prevent dust or other materials entering in it.
- 2.2.4 Protection during construction: Decorative surfaces shall be carefully protected during construction by a temporary cover.
- 2.2.5 Protection of finished work: At all stages of the Contract it is essential that all works are properly protected.
- 2.2.6 Suitable packing shall be used to ensure that scaffolding does not damage erected stone, marble, granite or other finished works.
- 2.2.7 Any disfigurement, discoloration or imperfection whatsoever due to any reason shall not be accepted and the Contractor shall either remedy the same or redo the work at no extra cost. The decision of the Engineer-in-Charge, as to whether any work either in whole or in part is acceptable or not shall be final and binding on the Contractor.

2.3 Guarantee

The Contractor shall guarantee and undertake to maintain and rectify the various components of the Plumbing work installed by him for successful performance for a period as indicated in the Datasheet-A. The Contractor shall indemnify the Engineer-in-Charge for a similar period against any damage to property and injury to persons on account of any defective work or maintenance carried out by the Contractor. The format and text of the Guarantee and the Indemnity Bond shall be given by the Engineer-in-Charge.

3.0 APPLICABLE CODES, STANDARDS, AND PUBLICATIONS

All equipment, supply, erection, testing, and commissioning shall comply with the requirements of Indian Standards and code of practices given below as amended till date. All equipment and material being supplied by the contractor shall meet the requirements of IS, and other Codes/ Publications as given below.

SP:6(1)	Structural steel sections
IS:325	Three phase induction motors
IS:554	Dimensions for pipe threads where pressure-tight joints are required on the threads
IS:694	PVC insulated cables for working voltages up to and including 1100 V.
IS:771	Part I to Part VII-Specification for vitreous china sanitary ware
IS:778	Specification for gunmetal gate, globe and check valves for water, steam and oil only
IS:779	Specification for water meters (domestic type)
IS:783	Code of practice for laying of concrete pipes
IS:800	Code of Practice for general construction in steel
IS:1068	Electroplated coatings of nickel plus chromium and copper plus nickel plus chromium
IS:1172	Code of Basic requirements for water supply drainage and sanitation
IS:1367	(Part 1) Technical supply conditions for threaded steel fasteners: Part I Introduction and general information
IS:1367	(Part 2) Technical supply conditions for threaded steel fasteners: Part 2 Product grade and tolerances.
IS:1554	PVC insulated (heavy duty) electric(Part 1) cables: Part 1 For working voltages up to and including 1100 V.
IS:1554 (Part 2)	PVC insulated (heavy duty) electric cables: Part 2 For working voltages from 3.3 kV up to and including 11 kV.
IS:1703	Specification for ball valves (Horizontal plunger type) including floats for water supply purposes
IS:1711	Specification for self closing taps for water supply
IS:1726	Specification for cast iron manhole covers and frames
IS:1742	Code of practice for building drainage
IS:2064	Selection, installation, and maintenance of sanitary appliances - Code of practice

IS:2065	Code of practice for water supply in buildings
IS:2104	Specification for water meter boxes(domestic type)
IS:2373	Specification for water meters (bulk type)
IS:2379	Colour code for identification of pipelines.
IS:2527	Code of practice for fixing rainwater gutters and downpipes for roof drainage
IS:2548 (Part I & II)	Specification for plastic seats and covers for water closets
IS:2629	Recommended practice for hot-dip galvanizing on iron and steel
IS:2685	Code of practice for selection, installation and maintenance of sluice valves
IS:2692	Specification of ferrules for water services
IS:3114	Code of practice for laying of cast iron pipes
IS:4038	Specification for foot valves for water works purposes
IS:4111 (Part 1)	Code of practice for ancillary structures in sewerage system: Part 1Manholes
IS:4127	Code of practice for laying glazed stoneware pipes
IS:4853	Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes
IS:4985	Unplasticised PVC pipes for potable water supplies – specification.
IS:5329	Code of practice for sanitary pipework above ground for buildings
IS:5455	Cast iron steps for manholes
IS:6159	Recommended practice for design and fabrication of material prior to galvanizing
IS:7558	Code of practice for domestic hot water installations
IS:8321	Glossary of terms applicable to plumbing work
IS:9668	Maintenance of water supplies and firefighting.
IS:9842	Preformed fibrous pipe insulation
IS:9912	Coal tar based coating materials and suitable primers for protecting iron and steel pipelines
IS:10221	Code of practice for coating and wrapping of underground mild steel pipelines

IS:10234	Recommendations for general pipeline welding
IS:10446	Glossary of terms relating to water supply and sanitation
IS:11149	Rubber Gaskets
IS:11790	Code of practice for preparation of butt welding ends for pipes, valves, flanges, and fittings
IS:12183 (Part 1)	Code of practice for plumbing in multi-storeyed buildings: Part 1 Water Supply
IS:12235 (Part 1 to 11)	Methods of test for unplasticized PVC pipes for portable water Supplies
IS:12251	Code of practice for drainage of building basements
IS:12701	Specification for rotational molded polyethylene water storage tanks
IS:13592	Specification for un plasticized PVC pipes for soil and waste discharge system inside building including ventilation and rainwater.
BS:5572	Code of practice for sanitary pipework
BS:6700	Specification for design, installation, testing, and maintenance of services supplying water for domestic use within buildings and their cartilages
BS:8301	Code of practice for building drainage
BSEN274	Sanitary tapware, waste fittings for basins, bidets, and baths. General technical specifications
IS:458	Specification for precast concrete pipes(with and without reinforcement)
IS:651	Salt-glazed stoneware pipes and fittings
IS: 1239 (Part 1)	Mild steel tubes, tubular and other wrought steel fittings: Part 1 Mild steel tubes
IS:1239	Mild steel tubes, tubular and other wrought steel fittings:
IS:1536	Centrifugally cast (spun) iron pressure pipes for water, gas, and sewage
IS:1538	Cast iron fittings for pressure pipes for water, gas, and sewage
IS:1729	Sand cast iron spigot and socket soil, waste and ventilating pipes, fittings, and accessories
IS:1879	Malleable cast iron pipe fittings
IS:1978	Line pipe

IS:1979	High test line pipe
IS:2501	Copper tubes for general engineering purposes
IS:2643 (Part 1)	Dimensions for pipe threads for fastening purposes: Part 1 Basic profile and dimensions
IS: 2643 (Part 2)	Dimensions for pipe threads for fastening purposes: Part 2 Tolerances
IS:2643 (Part 3)	Dimensions for pipe threads for fastening purposes: Part 3 Limits of sizes
IS:3468	Pipe nuts
IS:3589	Seamless or electrically welded steel pipes for water, gas, and sewage(168.3mm to 2032mm outside diameter)
IS:3989	Centrifugally cast (spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories
IS:4346	Specifications for washers for use with fittings for water services
IS:4711	Methods for sampling steel pipes, tubes, and fittings
IS:6392	Steel pipe flanges
IS:6418	Cast iron and malleable cast iron flanges for general engineering purposes.
IS:7181	Specification for horizontally cast iron double flanged pipes for water, gas, and sewage.
IS:778	Specification for copper alloy gate, globe and check valves for water works purposes
IS:780	Specification for sluice valves for water works purposes (50mm to 300mm size)
IS:1703	Specification copper alloy float valves (horizontal plunger type) for water supply fittings.
IS:2906	Specification for sluice valves for water works purposes (350mm to 1200 mm size)
IS:3950	Specification for surface boxes for sluice valves
IS:5312 (Part 1)	Specification for swing check type reflux (nonreturn) valves: Part 1 Single door pattern
IS:5312	Specification for swing check type reflux (non return) valves: Part 2 Multi door pattern

IS:12992	Safety relief valves, spring loaded: (Part 1) Part1Design
IS:13095	Butterfly valves for general purposes
IS:771(Part 1 to 3)	Specification for glazed fire-clay sanitary appliances
IS:774	Specification for flushing cistern for water closets and urinals (other than plastic cistern)
IS:775	Specification for cast iron brackets and supports for wash basins and sinks
IS:781	Specification for cast copper alloy screw down bib taps and stop valves for water services
IS:1700	Specification for drinking fountains
IS:2326	Specification for automatic flushing cisterns for
IS:2548 (Part 1)	Specification for plastic seats and covers for water closets: Part 1: Thermoset seats and covers
IS: 2548(Part 2)	Specification for plastic seats and covers for water closets: Part 2: Thermoplastic seats and covers
IS:2556(Part 1)	Specification for vitreous sanitary appliances (vitreous china): Part 1:General requirements
IS:2556(Part 2)	Specification for vitreous sanitary appliances (vitreous china) Part 2: Specific requirements of wash down water closets
IS:2556(Part 3)	Specification for vitreous sanitary appliances (vitreous china) Part 3: Specific requirements of squatting pans
IS:2556(Part 4)	Specification for vitreous sanitary appliances (vitreous china) Part 4: Specific requirements of wash basins
IS:2556 (Part 6 Sec 2)	Specification for vitreous sanitary appliances (vitreous china) Part 6: Specific requirements of urinals, Section 2 Half stall urinals
IS:2556 (Part 6 Sec 4)	Specification for vitreous sanitary appliances (vitreous china) Part 6 :Specific requirements of urinals, Section 4 Partition slabs
IS:2556 (Part 6 Sec 5)	Specification for vitreous sanitary appliances (vitreous china) Part 6 :Specific requirements of urinals, Section 5 waste fittings
IS:2556 (Part 6 Sec 6)	Specification for vitreous sanitary appliances (vitreous china) Part 6: Specific requirements of urinals, Section 6 Water spreaders for half stall urinals

IS:2556(Part 7)	Specification for vitreous sanitary appliances (vitreous china) Part 7: Specific requirements of half round channels
IS:2556(Part 8)	Specification for vitreous sanitary appliances (vitreous china) Part 8: Specific requirements of symphonic wash down water closets.
IS:2556(Part 11)	Specification for vitreous sanitary appliances (vitreous china) Part 11: Specific requirements for shower rose
IS: 2556(Part 12)	Specification for vitreous sanitary appliances (vitreous china) Part 12: Specific requirements of floor traps
IS:2556 (Part 15)	Specification for vitreous sanitary appliances (vitreous china) Part 15: Specific requirements of universal water closets
IS:2692	Specification for ferrule for water services
IS:2717	Glossary of terms relating to vitreous enamelware and ceramic metal systems
IS:2963	Specifications for copper alloy waste fittings for wash basins and sinks
IS:3311	Specification for waste plug and its accessories for sinks and wash basins.
IS:5961	Specification for cast iron gratings for drainage purposes.
IS:6249	Specification for flush valves and fittings for marine use
IS:6411	Specification for gel coated glass fibre reinforced polyester resin bathtubs
IS:8931	Specification for copper alloy fancy single taps, combination tap assembly and stop valves for water services
IS:9758	Specification for flush valves and fitting for water closets and urinals.
Manual for Water Supply & Treatment	CPHEEO Manual for Water Supply & Treatment -1999- MoUD, GoI
SP 7 (Part-9 Section-1) 1983	National Building Code of India
SP 35:1987	Hand book on water supply & drainage
IS 1172 :1993	Code of Basic requirements for water supply, drainage and Sanitation
IS: 8329-2000	Centrifugally Cast (spun) ductile iron pressure pipes for water, gas and sewage
IS: 5382-1985	Specification for Rubber sealing rings for gas mains, water mains and sewers.

IS: 1500	Code for Hardness test for DI pipes
IS 11906:1986	Recommendations for cement mortar lining for cast iron, Mild steel and Ductile Iron pipes and fittings for transportation of water
IS 12288:1987	Code of practice for laying of ductile iron
IS 2373:1981	Water meter (bulk type)
IS 15778	Chlorinated PVC pipe

4.0 QUALITY ASSURANCE AND QUALITY CONTROL

1. The Work shall conform to high standards of design and workmanship, shall be structurally sound and aesthetically pleasing. Quality standards prescribed shall form the backbone for the quality assurance and quality control system.
2. At the site level, the Contractor shall arrange the materials, their stacking/ storage in an appropriate manner to ensure the quality. Contractor shall provide equipment and manpower to test continuously the quality of materials, assemblies etc. as directed by the Engineer-in-Charge. The test shall be conducted continuously and the result of tests maintained. In addition, the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of surface.
3. The Engineer-in-Charge shall be free to carry out tests as may be considered necessary by him at his sole discretion, from time to time, in addition to those specified in this document. The Contractor shall provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.
4. The test shall be conducted at the site laboratory that may be established by Engineer-in-Charge or at any other Standard Laboratory selected by Engineer-in-Charge.
5. The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of Contractor failing to arrange transportation of the samples in proper time Engineer-in-Charge shall have them transported and recover two times the actual cost of the Contractor's bills.
6. Testing charges shall be borne by the Contractor.
7. Testing may be witnessed by the Contractor or his authorized representative. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.

5.0 SANITARY WARE AND OTHER APPLIANCES

5.1 SCOPE OF WORK

5.1.1 Without restricting to the generality of the foregoing, sanitary and other appliances shall inter-alia include the following:-

- Sanitary appliances and fixtures for toilets

- Chromium plated brass fittings
- Stainless steel sinks
- Accessories e.g. towel rods, toilet paper holders, soap dish, liquid soap dispensers, towel rails, coat hooks etc.
- Mirrors, hand dryers, drinking water fountains, etc.

5.1.2 Whether specifically mentioned or not the Contractor shall provide for all appliances and fixtures all fixing devices, nuts, washers, Teflon tape, sealant, cement, brackets, supports, paints, connectors, cp riser pipes, adapters, bolts, screws, hangers etc as required.

5.1.3 All exposed pipes within toilets and near appliances/ fixtures shall be of chromium plated brass or copper unless otherwise specified.

5.2 GENERAL REQUIREMENTS

5.2.1 All materials shall be new and of quality conforming to specifications and subject to the approval of the Engineer-in-Charge. Wherever particular makes are mentioned, the choice of selection shall remain with the Engineer-in-Charge.

5.2.2 All appliances, fixtures, and fittings shall be provided with all such accessories as are required to complete the item in working condition whether specifically mentioned or not in the Schedule of Quantities, specifications, and drawings. Accessories shall include proper fixing arrangement, brackets, nuts, bolts, washers, screws and required connection pieces.

5.2.3 Fixing screws shall be half round head chromium plated (CP) brass screws, with CP brass washers unless otherwise specified.

5.2.4 Porcelain sanitary ware shall be glazed vitreous china of first quality free from warps, cracks and glazing defects conforming to IS: 2556. The choice of the colour of the Sanitaryware shall be that of the Engineer-in-Charge and nothing extra shall be payable to the Contractor for fixing of Sanitary ware of any colour.

5.2.5 Sinks for kitchen shall be of stainless steel or as specified in drawing.

5.2.6 Chromium plated fittings shall be cast brass chromium plated of the best quality approved by the Engineer-in-Charge.

5.2.7 If the supply of sanitary appliances, fixtures & fittings are in client's scope, no damages shall occur to the same during shifting, transportation, installation till successful handing over. If any damage occurs, the same shall be replaced by the contractor at his own cost.

5.2.8 All appliances, fittings and fixtures shall be fixed in a neat workmanlike manner true to level and to heights shown in the drawings and in accordance with the manufacturer recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling, plaster, paint, insulation or terrace shall be made good by the Contractor at his own cost.

5.2.9 All materials shall be rustproofed; materials in direct or indirect contact shall be compatible to prevent electrolytic or chemical (bimetallic) corrosion.

5.2.10 Sanitary appliances, subject to the type of appliance and specific requirements, shall be fixed in accordance with the relevant standards and the following:

- a) Contractor shall, during the entire period of installation and afterward protect the appliances by providing suitable cover or any other protection in order to absolutely prevent any damage to the appliances until satisfactory handing over. (The original protective wrapping shall be left in position for as long as possible).
- b) The appliance shall be placed in correct position or marked out in order that pipework can be fixed or partially fixed first.
- c) The appliance shall be fixed in a manner such that it will facilitate subsequent removal if necessary.
- d) All appliances shall be securely fixed. Manufacturers' brackets and fixing methods shall be used wherever possible. Compatible rust proofed fixings shall be used. Fixing shall be done in a manner that minimizes noise transmission.
- e) Appliances shall not be bedded (e.g. WC pans, pedestal units) in the thick strong mortar that could crack the unit (e.g. a ceramic unit).
- f) Pipe connections shall be made with de-mountable unions. Pipework shall not be fixed in a manner that it supports or partially supports an appliance.
- g) Appliances shall be fixed so that waterfalls to the outlet (e.g. baths).
- h) All appliances shall be secured as per the recommendations of the manufacturer.
- i) Appliances shall be fixed true to level firmly fixed to anchor or supports provided by the manufacturer and additional anchors or supports where necessary.

5.2.11 Sizes of Sanitary fixtures given in the Specifications or in the Schedule of Quantities are for identification with reference to the catalogues of makes considered. Dimensions of similar models of other makes may vary within +/-10% and the same shall be provided and no claim for extra payment shall be entertained nor shall any payment be deducted on this account.

5.3 WATER CLOSET

- 5.3.1 WC shall be washed down or symphonic wash down type wall mounted set designed for low volume flushing from 3-6 litres of water, flushed by means of a flushing cistern or an exposed or concealed type (as detailed in the drawings, schedules or as directed by the Engineer-in-Charge) 32mm size CP brass flush valve with regulator valve. Flush pipe/ bend shall be connected to the WC by means of a suitable rubber adaptor. Wall hung WC shall be supported by CI floor mounted chair which shall be fixed in a manner as approved by the Engineer-in-Charge.
- 5.3.2 Each WC set shall be provided with a solid plastic seat, rubber buffers, and chromium-plated brass hinges. The plastic seat shall be so fixed that it remains absolutely stationary in a vertical position without falling down on the WC.
- 5.3.3 Each WC set shall be provided with a fixed type CP brass ablution jet if called for in schedule of quantities, complete with CP/ plastic piping, concealed type CP brass angle cock etc. all of

approved make and brand. The nozzle of the ablution jet and its holding down plate shall have smooth and rounded edges and shall not be capable of causing any injury to a user or cleaner.

5.4 PAN CONNECTOR

- 5.4.1 The WC pan connector shall be Flexible, soft and shall be made of single body construction with integral fins, made from EVA (Ethyl Vinyl Acetate). The pan connector must conform to the BS: 5627: 1984. The pan connector must be supplied with factory fitted spring loaded seal guard.
- 5.4.2 The connector shall not be allowed to come in contact with mineral oil, grease, putty or any compound containing mineral oil or grease.
- 5.4.3 The pan connectors must be stored away from the direct sunlight and flames.
- 5.4.4 While fixing of the pan connector with the Soil pipe, the pipe must be reasonably clean and smooth on the inner surface; in case the soil piping is in C.I. then supplier supplied bush/adaptor shall be used. The connector socket is pushed fully home onto the pan spigot; thereafter the WC is placed in position gently pushing the fitment to ensure that the connector end fits into the Spigot of the pipe. The pan connector must be pushed in such an easy as to ensure that the seals and fins turn inward to ensure proper sealing.

5.1 URINALS

- 5.1.1 Urinals shall be electronic sensor operated lipped type half stall white glazed vitreous china of size as paint of make, brand, and color as approved by the Engineer-in-Charge.
- 5.1.2 Half stall urinals shall be provided with 15mm diameter CP spreader, 32mm diameter CP domical waste and CP cast brass bottle/"P" trap with pipe and wall flange and shall be fixed to the wall by CI brackets, CI wall clips and CP brass screws as recommended by manufacturer complete as directed by the Engineer-in-Charge.
- 5.1.3 Flushing for urinals shall be by means of no hand operation, PVC or ceramic flushing cistern / electronic auto flush valve with all internal fittings, mounted on a C.I. bracket, and painted with two coats of approved paint of approved shade and confirming to IS: 2326.
- 5.1.4 Flush pipes shall be PVC pipes concealed in wall chase but with chromium plated bends at inlet and outlet or as given in Schedule of Quantities. These shall be measured and paid for separately.
- 5.1.5 PVC waste pipes shall be provided for urinals. Waste pipes may be exposed on the wall or concealed in the chase as directed by the Engineer-in-Charge. These shall be measured and paid for separately.

5.2 URINAL PARTITIONS

- 5.2.1 Providing and laying Urinal Partition (400 mm x 1,200 mm) of machine cut and both side machine pre-polished Granite Stone slab, Type: W14, 19 mm thick of size as per drawings set on backing

coat of cement mortar 1:3 not exceeding 19 mm thick, including pointing with matching cement paste with pigmented additives to match the shade of the slab

5.3 WASH BASIN

- 5.3.1 Wash basins shall be white glazed vitreous china of counter type (size 630 mm x 450 mm) and electronic sensor operated of make, brand, and color as approved by the Engineer-in-Charge /Architect.
- 5.3.2 Each basin (where counter type not possible) shall be provided with painted MS angle or C.I. brackets and clips and the basin securely fixed to the wall. Placing of basins over the brackets without secure fixing shall not be accepted. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand, and color as approved by the Engineer-in-Charge.
- 5.3.3 Each basin shall be provided with 32mm diameter CP waste with overflow, pop-up waste or rubber plug, CP angle valve, CP riser pipe with connectors/adaptors and CP brass chain as specified in the Schedule of Quantities, 32mm diameter CP brass bottle trap with CP pipe to wall flange.
- 5.3.4 Wash basin shall be provided with hot and cold water mixing fitting or as specified in the Schedule of Quantities.
- 5.3.5 Basins shall be fixed at proper heights as shown on drawings. If height is not specified, the rim level shall be 790mm from finished floor level or as directed by the Engineer-in-Charge.
- 5.3.6 All toilets to be completed in all respect including wc, wash basin (sensor operated), Urinal (sensor operated) and all other necessary arrangements like but not limited to taps, health faucet etc complete in all respect as per drawing, make and design as approved by the Engineer-in-Charge/Architect.

5.4 SINKS

- 5.4.1 Sinks shall be stainless steel or any other material as specified in the Schedule of Quantities.
- 5.4.2 Each sink shall be provided with painted MS or CI brackets and clips and securely fixed. Countertop sinks shall be fixed with suitable painted angle iron brackets or clips as recommended by the manufacturer. Each sink shall be provided with 40mm diameter CP waste, CP angle valve, CP riser pipe with connectors/adaptors and rubber plug with CP brass chain as given in the Schedule of Quantities. The MS angle shall be provided with two coats of red oxide primer and two coats of synthetic enamel paint of make, brand, and color as approved by the Engineer-in-Charge. Flow Rate = 4.5 to 6 Litres per minute @ 80 PSI

- 5.4.3 Supply fittings for sinks shall be deck mounted CP swivel faucets with or without hot and cold water mixing fittings as specified in the Schedule of Quantities. These shall be measured and paid for separately.

5.5 TOILETS FOR DIFFERENTLY ABLED

Where specified, in washroom facilities designed to accommodate physically disabled, accessories shall be provided as directed by the Owner's Site Representative.

Stainless steel garb brass of required size suitable for concealed or exposed mounting and opened non-slip gripping surface shall be provided in all washroom. The flushing cistern/valve shall be provided with chromium plated long handles.

5.6 FINAL INSTALLATION

The contractor shall install all sanitary fixtures and fittings in their final position in accordance with approved trial assemblies and as shown on drawings. The installation shall be complete with all supply and waste connections. The connection between building and piping system and the sanitary fixtures shall be through proper unions and flanges to facilitate removal/replacement of sanitary fixtures without disturbing the built-in piping system. All unions and flanges shall match in appearance with other exposed fittings.

6 SOIL, WASTE, VENT AND RAINWATER PIPES

6.1 SCOPE OF WORK

Soil, waste, vent, and rainwater disposal scope shall include Supply, Installation, testing, commissioning and successful handing over to the client as per the drawings, specifications, and schedule of quantities.

All soil, waste and storm water disposal for the portion above ground level to the public sewers shall be by gravity, whereas from the basements it shall be by pumping. Without restricting to the generality of the foregoing, the soil, waste, vent and rainwater pipes system shall inter-alia include the following:

- a) Vertical and horizontal soil, waste, vent and rainwater pipes and fittings, joints, supports, paints, and connections to fixtures.
- b) The connection of all pipes to sewer lines as shown in the drawings at ground level.
- c) Floor and urinal traps, clean out plugs, inlet fittings, and rainwater (roof) outlets.
- d) Testing of all pipes and fittings in the workshop.
- e) Testing, commissioning and handing over of all pipes lines after installation.

6.2 GENERAL REQUIREMENTS

- 6.2.1 Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- 6.2.2 Pipes shall be fixed in a manner so as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.
- 6.2.3 Pipes shall be securely fixed to walls, and ceilings with suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for fixing pipes on RCC ceilings and RCC/ masonry walls.
- 6.2.4 Access doors for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.
- 6.2.5 Long bends shall be used on all main pipelines as far as possible. Use of elbows shall be restricted for short connections.
- 6.2.6 Wherever piping is going across the separation/expansion joints of buildings, the piping shall be provided with flexible connectors on both sides of such joints or on the single side depending on whether any wall is to be crossed or not.

6.3 WASTE PIPE FROM APPLIANCES

- 6.3.1 Waste pipe from appliances e.g. washbasins, baths, sinks, and urinals etc. shall be of UPVC confirming IS 4985 as given in the Schedule of Quantities.
- 6.3.2 The internal diameter sizes of outlet branch waste pipes for different fittings shall be as follows:

Wash basin	-	32 dia
Urinals	-	50 dia
Sink	-	50 dia
Nahani Trap	-	75 diameter, 50 mm seal
Multi Floor Trap	-	75 or 100 dia. as required, with 50 mm or 75 mm seal / bolted aluminium grating in 25×25 MS angle
P Trap	-	75 mm water seal as required with bolted aluminum grating in 25×25 MS angle

- 6.3.3 All pipes shall be fixed in gradient towards the outfalls of drains. Pipes inside a toilet room shall be in chase unless otherwise shown on drawings. Where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps as directed by the Engineer-in-Charge. Spacing for the clamps shall be 3000mm for vertical runs and 2400mm for horizontal runs.

- 6.3.4 Pipes shall be UPVC tubes conforming to IS: 4985 and quality certificates shall be furnished. Pipes shall be provided with all required fittings conforming to IS: 4985 e.g. tees couplings, bends, elbows, unions, reducers, nipples, plugs etc. All UPVC waste pipes shall be terminated at the point of connection with the appliance with an outlet of suitable diameter. Pipes shall be painted as specified in tender.
- 6.3.5 The pipes shall be of class III, 6 Kg/cm². The pipes shall conform to IS 4985 - 2000. Fittings shall be of injection moulded PVC conforming to IS 7834 (Part1) - 1975.
- 6.3.6 Pipe sleeves and inserts, etc. through RCC wall of buildings either external or internal or for water tanks shall be of PVC provided with water bar flanged.
- 6.3.7 W.C. pan connectors shall suit the requirements as per drawing, with 40 dia. vent horn for connection to the anti-siphonage pipe. Pan connector shall be of C.I. or lead.
- 6.3.8 Connection to the sewer or stormwater collection sumps to be perfectly watertight and as specified in the drawing.
- 6.3.9 Rainwater flashing shall be of 150× 100 or 230× 150 fitted on to the bell mouth of rainwater pipes inlet and then covered with cast iron grating and extension piece.
- 6.3.10 All rainwater pipes and fittings shall be soil type variety conforming to I.S. 1729-1964 or equivalent. This shall apply to pipe outside buildings within the building or in separate shafts.
- 6.3.11 Bathroom C.P. grating shall be having bolted down design out of heavy cast brass with chromium plating of the best-approved standards.
- 6.3.12 Cast iron grating shall be flat with a perfect edge and of the best quality procurable of the specified width and thickness and in the available length.

6.4 PIPE LAYING AND FIXING

The pipe laying and jointing shall be done in accordance with IS 7634 (Part 3) – 1975. Pipes shall be cut to size and chamfered well. Burr's if any shall be removed. Pipes and fittings shall be joined using solvent cement or rubber ring joints. The pipes and fittings shall be jointed accurately without any stress to achieve leak proof joints.

6.5 TESTING

The method which is commonly in use is filling the pipe with water, taking care to evacuate any entrapped air and slowly raising the system to the test pressure at 3Kg/cm². The pressure testing may be followed as follows. The field test pressure to be imposed should be not less than the greatest of the following:

- One and half times of maximum sustained operating pressure.
- One and half times the maximum pipeline static pressure.
- Sum of the maximum sustained operating pressure and the maximum surge pressure.

- Sum of the maximum pipeline static pressure and the maximum surge pressure, subject to a maximum equal to the works test pressure for any pipe fittings incorporated.
- The field test pressure should wherever possible be not less than 2/3rd working pressure and should be applied and maintained for at least four hours. If the visual inspection satisfies that there is no leakage the test can be passed.
- A test register shall be maintained and all entries signed and dated by Contractor and Engineer-in-Charge. A Performa of the proposed test register shall be submitted to the Engineer-in-Charge for approval.
- All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

6.6 CUTING AND MAKING GOOD HOLES / CHASES

Pipes shall be fixed and tested as the building work proceeds. Contractor shall provide all necessary holes, cut outs and chases in structural members as the building work proceeds. Wherever holes are cut or left originally, they shall be made good with cement concrete 1:1:2 (1 cement: 1coarse sand :2 stone aggregate 20mm nominal size) or cement mortar 1:2 (1 cement :2 coarse sand) as directed by the Engineer-in-Charge and the surface restored as in original condition to the entire satisfaction of the Engineer-in-Charge at no extra cost.

6.7 DRAINAGE ACCESSORIES

a) Floor Trap / Urinal Trap Grating

Floor/ urinal traps grating shall be of stainless steel square / round of size 125 x 125 mm square/round as approved by client & shown in the drawing. Floor trap assembly shall be provided with round stainless steel strainer basket as a cockroach trap. Entire assembly shall be complete with ring, frame, outer cup, inner cup, grating, screws etc. of an approved make.

b) Floor Cleanout

Floor cleanout cover shall be of stainless steel square / round of size 125 x 125 mm square/round as approved by client & shown in the drawing. Floor cleanout assembly shall be complete with ring, outer frame, cover, screws etc. of an approved make.

c) Ceiling Cleanout

Ceiling cleanout cover shall be in nickel bronze / PVC plug type / GI flanged type of round shape matching pipe size as approved by client & shown in the drawing. Ceiling cleanout assembly shall be threaded with key hole for opening / flanged type suitable for pipe. Threaded cover shall be used up to 100 mm size & above shall be GI flanged type with GI nuts & bolts. PVC cover shall be used for PVC drainage piping only, whereas nickel bronze & GI flanged type cover shall be used for HDPE / CI / CI LA pipe work.

d) Cockroach Traps

Floor/ urinal traps shall sealed cover provided with 100-150mm square or round stainless steel cockroach trap assembly complete with ring, outer cup, inner cup, jali etc. of an approved make.

e) Wire Balloons / Grating For Rain Water Pipes

The wire balloons and the domical gratings shall conform to IS: 1729. The wire balloons shall be of galvanised steel. The CI domical gratings for the roof outlet shall be minimum 13mm thick.

Leaf and Gravel grates along with a perforated ring shall be made out of M.S. flat/bars of a design and dimension as shown in the drawing or as directed by the Engineer-in-Charge. These shall be painted with epoxy paint with a DFT of 200 microns.

Wire balloons/gratings for rainwater pipes shall be measured by numbers for different sizes. Leaf and gravel grates along with the perforated ring shall be measured in kgs.

6.8 RAINWATER PIPES

All rainwater pipes shall be of UPVC as shown in drawing & specified in specification. UPVC piping shall conform to IS: 13592 g or as specified in the schedule of quantities.

6.9 RAIN WATER OUTLET

- a) Rain water out shall be preferably scupper type drain with cast iron body & cast aluminium grating with stainless steel screws. Suitable adopter / connector shall be used to match the pipe. Wherever shafts are not available near rain water outlet, dome type rain water outlet shall be installed.
- b) Rain water outlet shall be tested for water leaking, prior to waterproofing treatment. Extreme care shall be taken, while sealing gap between rain water outlet & wall / slab.

6.10 CLAMPS

Wherever MS/GI clamps are required to be anchored directly to brick walls, concrete slabs, beams or columns, nothing extra shall be payable for clamping arrangement, RCC block and making good with cement concrete 1:2:4 mix (1 cement:2 sand:4stone aggregate 20mm nominal size) as directed by the Engineer-in-Charge.

6.11 ANGELS / CHANNELS

Slotted angles/ channels shall be measured per linear metre of finished length and shall include support bolts and nuts, length embedded in the cement concrete blocks of 1:2:4 (1cement: 2 coarse sand: 4 stone aggregate 20mm nominal size) formed in the masonry walls; nothing extra shall be paid for the cement concrete block and making good the masonry wall, anchor fasteners etc. complete.

6.12 INSTALLATION OF SOIL, WASTE & VENT PIPES

All Horizontal pipes running below the slab and along the ceiling shall be fixed on structural adjustable clamps, sturdy hangers of the design as called for in the drawings. The pipes shall be laid in uniform slope and proper levels. All vertical pipes shall be truly vertical fixed by means of stout clamps in two sections, bolted together, built into the walls, wedged and neatly jointed. The branch pipes shall be connected to the stack at the same angle as that of fittings. All connections between soil, waste and ventilating pipes and branch pipes shall be made by using pipe fittings with inspection doors for cleaning. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts. Where the horizontal run off the

pipe is long or where the pipes cross over building expansion joints etc. suitable allowance shall be provided for any movements in the pipes by means of expansion joint etc. such that any such movement does not damage the installation in any way.

Before joining, the interior of the socket and exterior of the spigots shall be thoroughly cleaned and dried. The spigot end shall be inserted into the socket right up to the back of the socket and carefully centered by two or three laps of threaded spun yarn, twisted into ropes of uniform thickness, well caulked into the back of the socket. No piece of yarn shall be shorter than the circumference of the pipe. The jointed pipe line shall be at required levels and alignment. The remainder of the socket is left for the lead caulking. Where the gasket has been tightly held, a jointing ring shall be placed round the barrel against the face of the socket. Molten Lead shall be poured to the remainder of the socket.

The joint shall not be covered till the pipeline has been tested under pressure. Rest of pipeline shall be covered so as to prevent the expansion and contraction due to variation in temperature.

Rainwater Pipes

All open terraces shall be drained by rainwater down takes.

Rainwater down takes are separate and independent of the soil and waste system and will discharge to rainwater harvesting tank and excess rainwater will be diverted to the external stormwater drain.

7 WATER SUPPLY SYSTEM

7.1 SCOPE OF WORK

The scope shall include supply, installation, testing, commissioning and satisfactory handing over of the complete water supply system to client as per drawings, specifications and schedule of quantities. The water supply system shall inter-alia include the following:

- a) Distribution system from main supply or overhead tank to all fixtures and appliances for cold water.
- b) Pipe protection and painting.
- c) Control valves, masonry chambers and other appurtenances.
- d) Connections to all plumbing fixtures, tanks, appliances and municipal mains
- e) Inserts, nozzles for R.C.C. tanks

The term water supply is used as indicative of all water supply work required and necessary for the building including such external work as may be necessary to make the system functional.

The scope of this section comprises the supply, installation, testing and commissioning of piping network for water supply for internal & external services as follows:

- a. Tapping from available main source / Tanker water supply/
- b. Domestic water supply.
- c. Flushing water supply

The contractor shall make all necessary application and arrangements for his work to be inspected by the Local Authorities.

The contractor shall be solely responsible for obtaining the Authorities approval of his works prior to the handing over of the complete water supply / distribution installation to the owner.

7.2 GENERAL REQUIREMENTS

- 7.2.1 If necessary and if approved by the Engineer-in-Charge, where unavoidable, bends may be formed by means of a hydraulic pipe bending machine for pipes up to 20mm dia. No bending shall be done for pipes of 25mm diameter and above. After bending zinc rich paint shall be applied wherever the zinc coating is damaged.
- 7.2.2 Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs. Valves shall be located at a height not exceeding 1.6m above their operating floor/ platform level. Where such a provision is not possible and the valve is to be frequently operated a MS chain shall be provided for its operation.

7.3 CPVC PIPE

Supplying, Installing, Testing and Commissioning of exposed and concealed Cold & Hot water Chlorinated Polyvinyl Chloride (CPVC) pipework. Pipes shall conform as per ASTM D 2846, SDR 11 up to 50 mm diameter and ASTM F441, Schedule 40 pipe for above 50 mm diameter. Fittings shall be as per ASTM F438, Schedule 40 for pipe up to 50 mm diameter and ASTM F439, Schedule 40 for pipe above 50 mm diameter. The fittings and specials such as tees, elbows, couplers, bends, enlargers, flanges, unions connectors, adapters etc. with CPVC brass threaded combination/ transition specials such as male adapters, brass threaded female adapters, brass FPT Tee, Brass FPT elbow, etc. where connection with metal is to be made including necessary drilling holes, chasing walls and making the same good in cement mortar 1:1, restore the same to original condition neatly as directed by the Engineer. Joints to be made with CPVC solvent cement shall be as per ASTM F493. Manufacturer's recommendation shall be followed for installation of pipe & jointing of CPVC pipework

7.4 GI PIPES, FITTINGS AND VALVES

- 7.4.1 All pipes inside the buildings and where specified, outside the building shall be M.S. galvanized steel tubes conforming to IS: 1239 of Class specified. When Class is not specified they shall be Heavy Class. All embedded / concealed pipes shall be of heavy duty.
- 7.4.2 Fittings shall be of malleable cast iron galvanized, of approved make. Each fitting shall have manufacturer's trade mark stamped on it. Fittings for GI pipes shall include couplings, bends, tees, reducers, nipples, unions, bushes etc. Fittings etc. shall conform to IS: 1879.
- 7.4.3 Pipes and fittings shall be jointed with screwed joints using Teflon tape suitable for water pipes. Care shall be taken to remove burr from the end of the pipe after cutting by a round file. All pipes shall be fixed in accordance with layout and alignment shown on the drawings. Care shall be taken to avoid air pockets. Necessary vents and drains shall be provided at all high and low points

respectively. GI pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be run inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors and other areas as shown on drawings. All pipe joints after testing of the line shall be seal welded and the weld plus the adjoining portion shall be given two coats of zinc rich primer.

7.4.4 Bib cocks and stop cocks

All bib cocks and stop cocks shall be of C.P. brass conforming to IS: 781 of tested quality and approved make and design, of diameter as specified in schedule of quantities.

7.4.5 Clamps

GI pipes in shafts and other locations shall be supported by GI clamps of design approved by the Engineer-in-Charge. Pipes in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from MS structures as described tender. Pipes in shafts shall be supported on slotted angles/ channels as specified/ as directed.

7.4.6 Unions

Contractor shall provide adequate number of unions on all pipes to enable easy dismantling later when required. Unions shall be provided near each gunmetal valve, stop cock or check valve and on straight runs as necessary at appropriate locations as required for easy dismantling and/ or as directed by the Engineer-in-Charge.

7.4.7 Flanges

Flanged connections shall be provided on pipes as required for maintenance/ ease in dismantling or where shown on the drawings, all equipment connections as necessary and required or as directed by the Engineer-in-Charge. Connections shall be made by the correct number and size of the GI nuts/ bolts as per relevant IS Standards and made with 3mm thick insertion rubber washer/gasket. Where hot water or steam connections are made insertion gasket shall be of suitable high temperature grade and quality approved by the Engineer-in-Charge. Bolt hole dia for flanges shall conform to match the specification for CI sluice valve as per IS: 780. Gaskets shall conform to IS: 11149.

7.4.8 Trenches

All GI/PVC/HDPE pipes running below ground shall have minimum cover of 600mm.

7.4.9 Excavation to be taken to proper depth

Excavation shall be done in all conditions of soil and to such a depth that the sewers / or other pipes shall rest as described in the several clauses relating thereto and so that the inverts may be at the levels given on the section. Should the contractor excavate the trench to a greater depth than is required the extra depth shall have to be filled up with concrete at the contractor's own cost to the requirements and satisfaction of the client / consultants.

7.4.10 Back filling (IS: 12288 – 19S87)

After the sewer or other piping work has been laid and proved to be water-tight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this so that no damage is caused to the sewer and other permanent works.

7.4.11 Painting

- a) All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality to give an even shade, or as specified by the Engineer-in-Charge.
- b) Hot water pipes in the chase:

All hot water pipes fixed in wall chase shall be properly insulated by elastomeric tape as per manufacturer's recommendation.

7.4.12 Pipe protection

Where specified, pipes below the floor or below ground shall be protected against corrosion by the application of two or more coats of solvent-based rubberized asphaltic primer to give a uniform coat covered with 'Pipe coat Hiper', a puncture resistant non woven polyester mat. The application of pipe coat primer and "Hiper" membrane shall be as specified by the manufacturer.

7.5 VALVES & FITTINGS

7.5.1 Sluice Valves

Sluice valve shall conform to IS 14846-2000 relevant internationally recognized standards.

They shall be of non-rising spindle type. The valve shall be furnished with a bushing arrangement for replacement of packing without leakage. They shall also have renewable channel and shoe linings. The gap between the shoe and channel shall be limited to 1.5 mm.

The gate face rings shall be securely pegged over the full circumference.

Valve of 450mm and above shall be provided with thrust bearing arrangement for ease of operation.

Valve of diameter 400 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear of all valves shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400N.

All valves, spindles and hand wheels shall be positioned to give good access for operational personnel.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels.

Specification for Sluice Valve

Standard: IS -14846:2000

Ends: Flanged and drilled as per IS-1538

Material of Construction

- (A) Body: Grey CI, IS-210, FG 260
- (B) Bonnet: Grey CI, IS-210, FG 260
- (C) Non rising Stem: High tensile brass, IS 320 / 6912, Gr.HTB-2 / FHTB-2
or Stainless Steel, IS 6603, Gr.12Cr1304Cr 18Ni10
04Cr17Ni.12 MO2
- (D) Wedge: Grey CI, IS 210, FG 260
- (E) Stem Nut: Leaded tin Bronze, IS: 318,Gr.LTB-2
- (F) Body seat ring, wedge face :: Leaded tin Bronze,
IS: 318,Gr.LTB-2 ring & bushes.
- (G) Gland packing: Jute & Hemp, IS: 5414
- (H) Hand Wheel: Grey CI , IS-210, Gr. FG-260
- (I) Nuts: Carbon steel, IS-1363(Part-3),Class 4.0
- (J) Bolts:: Carbon steel ,IS-1363 (Part-3),Class 4.6
- (K) Bonnet Gasket: Rubber, IS-638, Type -B

Hydro test Pressure as per IS-14846:2000

Rating	Test for	Test Pressure
PN 1.0	Body	15 kg / cm ² (1.5 MPa)
	Seat	10 kg / cm ² (1.0 MPa)
PN 1.6	Body	24 kg / cm ² (2.4 MPa)
	Seat	16 kg / cm ² (1.6 MPa)

7.5.2 Butterfly Valves

Resilient seated butterfly valve shall be as per IS 13095-1991/ BS 5155. Valve shall be suitable for mounting in any position.

The valve seat shall be of integrally cast or replaceable design. When the valve is fully closed, the seal shall seat firmly so as to prevent leakage. The seat surfaces shall be machined smooth to provide a long life for the seal.

All fasteners shall be set flush so as to offer the least resistance possible to the flow through the valve.

Valve shall be suitable for throttling purpose.

All valve, spindles and hand wheels shall be positioned to give good access for operational personnel.

Valve of diameter 450 mm and above shall be provided with enclosed gear arrangement for ease of operation. The operation gear shall be such that they can be opened and closed by one man against an unbalanced head 15% in excess of the maximum specified rating. Valve and any gearing

shall be such as to permit manual operation in a reasonable time and not exceed a required rim pull of 400 N.

All hand wheels shall be arranged to turn in a clockwise direction to close the valve, the direction of rotation for opening and closing being indicated on the hand wheels. Specification & M.O.C. of Butterfly valve :

General

a	Type	Both end flanged hand wheel / Gear operated
b	Rating of valves	PN 1.6
c	Manu. Standard	IS-13095:1991 / BS 5155
d	Sizes and quantity	As per Price schedule

Material of construction

a	Internal Hardware	S.S. AISI-304
b	Body./ Disc	CI. IS 210 FG260
c	Body ring(Retainer/seat)	Stainless steel ; AISI -304
d	Shaft Stainless steel;	AISI-410
e	Disc seat	EPDM rubber/ Nitrile rubber
f	Bush & Thrust Pad	G.M. IS :318 LTB-2 / Teflon
g	Body seat	S.S. AISI-304.

7.5.3 Non-Return Valve

The valve shall be suitable for mounting on a horizontal pipeline and flow direction shall be clearly embossed on the valve body.

Valves shall possess high speed closing characteristics and be designed for minimum slam condition when closing.

Dual plate check valves shall conform to API 594 and API 598. They shall have metal to metal sealing. The spring action shall optimize the equal closing rates of each plate especially when the friction coefficients are uneven due to one plate resting upon one another. The plates shall not drag on the seat while opening. The plates shall not vibrate under full or partial flow condition.

In case of the nozzle check valve, the disc shall be correctly positioned at all times to achieve fully non-slam closure. The spring shall be fully shielded from the flow stream by the central flow diffuser.

Tilting disc non-return valve shall incorporate a double offset shaft with a variable angle tilt disc configuration. Sealing shall be metal to metal. The disc shall be stable and shall not vibrate under full or partial load conditions.

Valve of diameter greater than 450 mm shall be provided, in addition to others, feet and jacking screws. Hinge pins / shaft shall preferably be square in section to ensure positive location of flaps and provide for secure fixing.

Specification for Reflux Valve (Non Return Valve)

Standard	IS-5312(Part – I):2004 with latest edition
Ends	Flanged flat face and drilled in accordance IS.
Type	Swing type

Materials of Construction for Reflux Valve (Non Return Valve)

(A)	Body, cover, door, bearing holder	Grey CI, IS-210, FG 260
(B)	Hinge pin, door pin & door Suspension pin	S.S., IS-6603, 12Cr12
(C)	Body seat rings	Leaded Tin Bronze, IS-318, Gr.LTB-2
(D)	Door face ring:	Leaded Tin Bronze, IS-318, Gr.LTB-2
(E)	Bearing bushes/ Bearing block	Leaded Tin Bronze, IS-318, Gr.LTB-2
(F)	Plugs for hinge pin / Air release Plug	Leaded Tin Bronze, IS-318, Gr.LTB-2
(G)	Nuts Bolts	Carbon steel, IS-1363(Part-3),Class4.0 (H) Carbon steel, IS-1363(Part-3),Class 4.6
(I)	Gasket	Rubber, IS : 638, Type –B

Hydro test Pressure as per IS-5312(Part – I):2000

Rating Test for	Test Pressure
PN 1.0 Body	15 kg / cm ² (1.5 MPa)
Seat	10 kg / cm ² (1.0 MPa)
PN 1.6 Body	24 kg / cm ² (2.4 MPa)
Seat	16 kg / cm ² (1.6 MPa)

Materials of Construction for DPCV

Sr. No.	Component	Material
(a)	Body Cast Iron :	IS 210 Gr. FG 260
(b)	Disc	Aluminum Bronze
(c)	Stop & hinge pin	SS AISI-410
(d)	Seat ring (Disc)	EPDM Rubber
(e)	Bearings (Body& Plate lug)	PTFE
(f)	Body Seat	SS AISI-410
(g)	Spring	Spring steel

7.5.4 Forged Brass Ball Valve

- (a) Valves of size 50 mm Dia. and below shall be full bore quarter turn lever operated female threaded forged brass hard chrome plated ball valves conforming to IS: 554. Valve shall

have PTFE body seat rings and gland packing, forged brass ball, stem and bonnet, carbon steel nut washer and lever and finished in chrome. Valves shall have the minimum working pressure of 16 bars. Valves shall be tested at manufacturer's works and the same stamped on it.

7.5.5 Air Release Valve (AV)

Tamper Proof Air Valves shall be cast iron body, cover and cowl. Temper Proof Air valve working temperature shall be upto 50° C.

Hydraulic Test Pressure shall be as mentioned below.

Sr. No.	Rating	PN 1.0	PN 1.6	Duration
1	Body Test	15 Kg/Sq.cm.	24 Kg/Sqq.cm.	5 Min
2	Seat Test	10 Kg/Sq.cm.	16 Kg/Sqq.cm.	2 Min

Technical Particulars of Temper Proof Air Valve

Sr. No.	Description	Particulars
	GENERAL	
1	Design and Manufacturing Code	AWWA C512
2	Size \Qty\Pressure Rating (PN)	As per Price Bid
3	Ends	Flanged
4	Type	Temper Proof
	MATERIAL OF CONSTRUCTION (M.O.C)	
1.	Body	Cast Iron
2.	Float	Stainless Steel
3.	Cover	Cast Iron
4.	Seat	Nitrile Rubber

5.	Nozzle	Bronze
6.	Bolts and Nuts	Carbon Steel
7.	Gasket	EPDM

7.5.6 Ball float valve

Ball valves with Heavy duty float to be fixed in storage tanks as shown in the drawing and shall consist of cast brass lever arm having copper balls (26 SWG) screwed to the arm integrally. The copper ball shall have bronze welded seams. The closing/opening mechanism incorporating the piston and cylinder shall be non-corrosive metal and include washers. The size and construction of ball valves and float shall be suitable for desired working pressure operating the supply system.

7.5.7 TESTING

- (a) All pipes, fittings, and valves shall be tested in accordance with IS: 2065 except as may be modified hereinunder. All pipes, fittings, and valves, after fixing at the site, shall be tested to a hydrostatic pressure of 10 kg/cm² or 1.5 times the shut-off head of the pump whichever is greater.
- (b) The test pressure shall be maintained for a period of at least thirty minutes without any drop in pressure.
- (c) A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and the Engineer.
- (d) After commissioning of the Water Supply System, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently and effectively. Valves which do not operate efficiently and effectively shall be replaced by new ones at no extra cost and the same shall be tested as above.
- (e) All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

7.6 PRESSURE REDUCING VALVE SET

Each pressure reducing valve set shall be complete with pressure reducing or pressure regulating valve, isolating valves, pressure gauges on inlet and outlet, pressure relief valve on outlet and filter on the inlet.

Each pressure reducing valve shall contain loading neoprene diaphragm and a full floating, self-aligning, ignition resistant seat and shall be of the single stage, pressure reduction type with provision for manually adjusting the delivery pressure. The valve shall fail safe to the low pressure.

Valves shall be capable of operating at the maintaining automatically the respective delivery pressure and flow rates as indicated and shall not be liable to creep. Valves shall also be capable of maintaining the pre-set downstream pressure under static condition.

The filter on each inlet to a pressure reducing valve shall be of a replaceable porous sintered metal type.

- (a) Pressure reducing valves are used to lower pipeline pressure to a predetermined set point. Pressure reducing valves protect installations against excessive pressure from the supply.
- (b) Pressure reducing valves automatically controls downstream pressure, from no flow to full open flow, without regard to changes in inlet pressure. Outlet pressure control is smooth and precise since the friction and hysteresis of the valve and pilot are negligible.
- (c) Because the valve will not chatter or slam under low flow conditions, it is not necessary to parallel pressure reducing valves with a second smaller size control valve to obtain accurate pressure control at low flow rates. In any size, pressure reducing valves will control pressure right down to shut off.
- (d) Spring loaded pressure reducing valves operate by means of a force equalizing system. The force of a diaphragm operates against the force of an adjustment spring. If the outlet pressure and therefore diaphragm force fall because water is drawn, the then greater force of the spring causes the valve to open. The outlet pressure then increases until the forces between the diaphragm and the spring are equal again. The inlet pressure has no influence in either opening or closing of the valve. Because of this, inlet pressure fluctuation does not influence the outlet pressure, thus providing inlet pressure balancing.

7.7 PRESSURE RELIEF VALVES

Each pressure relief valve shall be of the fully enclosed type and fitted with hand easing gear.

Each pressure relief valve in a pressure reducing station shall have a flow capacity equal to that of the pressure reducing valve. PRV shall be of Brass.

Pressure relief valves in locations other than reducing stations shall have flow capacities equal to that of the associated equipment.

7.8 LEVEL CONTROLLED SOLENOID VALVES

A solenoid valve is an [electromechanically](#) operated [valve](#). The valve is controlled by an [electric current](#) through a [solenoid](#); in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports.

Level sensor based solenoid valve will be installed at terrace level for automatic operation of the water transfer pump set.

7.9 UNDERGROUND / OVERHEAD STORAGE TANKS

7.9.1 Storage tanks for water supply shall be in RCC.

7.9.2 Each tank shall be provided with lockable type manhole cover fabricated from MS sheet or standard cast iron tank covers. Manhole covers shall be of an appropriate size as directed by the Engineer-in-Charge.

7.9.3 Each storage tank shall be provided with high and low-level annunciation by means of magnetic level switches.

7.9.4 One solid state electronic annunciation panel fully wired with a visual display and audible alarm unit shall be provided to indicate the following:

- High and low-level alarms for each water storage tank.
- On/ off status of all Pump sets namely domestic

7.9.5 All the necessary arrangements for fixing the panel shall be provided by the Contractor.

7.9.6 All the cabling from the respective level switches to the Annunciation Panel, MCC Switchgear to Annunciation Panel, including power supply from MCC shall be provided by the Contractor.

7.9.7 The number of outgoing terminals shall be equal to the number of incoming terminals from field/ MCC with 20% margin, so that necessary interconnection to BMS could be done at a later date.

7.10 TESTING

7.10.1 All pipes, fittings and valves shall be tested in accordance with IS: 2065 except as may be modified herein under. All pipes, fittings and valves, after fixing at site, shall be tested to a hydrostatic pressure of 10 kg/cm² or 1.5 times the shut off head of the pump whichever is greater.

7.10.2 The test pressure shall be maintained for a period of at least thirty minutes without any drop in pressure.

7.10.3 A test register shall be maintained and all entries shall be signed and dated by Contractor(s) and the Engineer-in-Charge.

7.10.4 After commissioning of the water supply system, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently and effectively. Valves which do not operate efficiently and effectively shall be replaced by new ones at no extra cost and the same shall be tested as above.

7.10.5 All pipes in wall chase or meant to be encased or buried shall be hydro tested before the chase is plastered or the pipe encased or buried.

7.11 INSULATION

7.11.1 All open hot water flow and return pipes shall be insulated with preformed fibrous pipe sections conforming to IS: 9842.

7.11.2 Insulation to pipes shall be with pre-moulded pipe sections, the thickness for sections shall be:

- a) Pipe 50mm diameter and below - 25mm thick
- b) Pipe 65mm diameter and above - 40mm thick

7.11.3 Application:

- a) All surfaces shall be thoroughly cleaned with a wire brush.
- b) One layer of approved primer shall be applied and pre-moulded pipe insulation sections shall be fixed.
- c) One layer of aluminum foil of thickness 0.711mm (20 SWG), shall be applied as a finish layer.

7.11.4 Insulation for hot water pipes in the chase:

All hot water pipes in chase shall be insulated with 3 mm elastomeric tape as per manufacturer's recommendations.

7.12 CONNECTION TO RCC WATER TANKS (PUDDLE FLANGE)

The contractor shall provide all inlets, outlets, washouts, vents, ballcocks, overflows control valves and all such other piping connections including a level indicator to water storage tanks as called for. All pipes crossing through RCC work shall have puddle flanges fabricated from GI pipes of required size and length and welded to 6/8 mm thick MS plate. All puddle flanges must be fixed in true alignment and level to ensure further connection in proper order.

Full way gate valves of an approved make shall be provided as near the tank as practicable on every outlet pipe from the storage tank except the overflow pipe. Overflow and vent pipes shall terminate with mosquito proof grating with the bronze screen on vent.

The overflow pipe shall be so placed to allow the discharge of water is readily seen. The overflow pipe shall be of a size as indicated. A stop valve shall also be provided in the inlet water connection to the tank. The outlet pipes shall be fixed approximately 75mm above the bottom of the tank towards which the floor of the tank is sloping to enable the tank to be emptied for cleaning.

The floor and the walls of the tank shall be tiled with glazed tiles up to the overflow level. Alternatively, food grade epoxy to be applied.

7.13 WATER METERS

Water meters of approved make and design shall be supplied for installation at locations as shown. The water meters shall meet with the approval of local supply authorities. Suitable valves and chambers or wall meter box to house the meters shall also be provided along with the meters.

The meters shall conform to Indian Standard IS: 779 and IS: 2373. Calibration certificate shall be obtained and submitted for each water meter.

Provision shall also be made to lock the water meter. The provision shall be such that the lock is conveniently operated from the top. Where the provision is designed for use in conjunction with padlocks, the hole provided for padlocks shall be a diameter not less than 4mm.

(Note: The water meters to be installed at every use of water such as Landscape irrigation, Domestic, Flushing, Firefighting etc.)

7.14 LEVEL SENSORS

Level sensor shall consist of the control unit, preamplifier and one full insulated probe-mounted vertically or two-part insulated probe mounted from tanks side wall adjustable switching system for pump control application, the same to be housed in stove enamel painted cast aluminium weatherproof suitable for black panel/wall mounting etc.,

The enclosure of probes shall be manufactured with the SS316 material. The least count of the central unit with amplifier should be $\pm 0.10\text{mm}$ for response value of 30 seconds.

7.15 LEVEL INDICATORS

A level control system with electronic level probes is mounted on the face of the reservoir. The top two level sensors provide the ON-OFF signal for the treated water transfer pumps. A third level sensor enunciates a low-level alarm condition to the paging system and a fourth sensor enunciates an alarm to the paging system and stops the domestic water pumps from operating.

PROCEDURE UNDER E-TENDERING

INSTRUCTIONS TO APPLICANTS

DEFINITIONS:

- a) Tender portal: The e-Procurement Portal of Government of Odisha introduced for the process of e-Tendering which can be accessed on <https://www.tendersodisha.gov.in>.
- b) Use of valid Digital Signature Certificate of appropriate class (Class II or class III) issued from registered certifying authorities (CA) as stipulated by Controller of Certifying Authorities (CCA), Government of India such as n- Code, Sify, TCS, MTNL, e-Mudhra is mandatory for all users.
- c) For all purpose, the server time displayed in the e-Procurement portal shall be the time to be followed by all the users.

Words in capital and not defined in this document shall have the same meaning as in the Request for Proposal ("BID").

1. PARTICIPATION IN BID:

1.1 PORTAL REGISTRATION:

The Contractor/Bidder intending to participate in the bid is required to register in the portal using his/her active personal/official e-mail ID as his/her Login ID and attach his/her valid Digital signature certificate (DSC) to his/her unique Login ID. He / She has to submit the relevant information as asked for about the firm/contractor. The portal registration of the bidder/firm is to be authenticated by the State Procurement Cell after verification of original valid certificates/documents such as (i) PAN and (ii) Registration Certificate (RC) / VAT Clearance Certificate (for procurement of goods) /GST Certificate of the concerned bidder. The time period of validity in the portal is at par with validity of RC/ VAT Clearance/GST Certificate. Any change of information by the bidder is to be re authenticated by the State Procurement Cell. After successful authentication bidder can participate in the online bidding process.

1.2 Bidders participating through Joint Venture shall declare the authorized signatory through Memorandum of Understanding duly registered and enroll in the portal in the name and style of the Joint venture Company. It is mandatory that the DSC issued in the name of the authorised signatory is used in the portal. For participating in the tender, the authorized signatory holding Power of Attorney shall be the Digital Signatory. In case the authorized signatory holding Power of Attorney and Digital Signatory are not the same, the bid shall be considered non-responsive.

1.3 Any third party/company/person under a service contract for operation of e- Procurement system in the State or his/their subsidiaries or their parent companies shall be ineligible to participate in the procurement process that are undertaken through the e-Procurement system irrespective of who operates the system.

2. LOGGING TO THE PORTAL:

The Contractor/Bidder is required to type his/her Login ID and password. The system will again ask to select the DSC and confirm it with the password of DSC as a second stage authentication. For each login, a user's DSC will be validated against its date of validity and also against the Certificate Revocation List (CRL) of respective CAs stored in system database. The system checks the unique Login ID, password and DSC combination and authenticates the login process for use of portal.

3. DOWNLOADING OF BID:

The bidder can download the tender of his choice and save it in his system and undertake the necessary preparatory work off-line and upload the completed tender at his convenience before the closing date and time of submission.

4. CLARIFICATION ON BID:

The bidder may ask question related to tender online in the e-procurement portal within the period of seeking clarification. The Officer inviting the bid /Procurement Officer-Publisher will clarify queries related to the tender.

5. PREPARATION & SUBMISSION OF BID

5.1 Detailed BID may be downloaded from Tender Portal for detail study and preparation of his bid and the Application may be submitted online following the instructions appearing on the screen.

5.2 The following shall be the form of various documents in the Application:

A. Only Electronic Form (to be uploaded on the Tender Portal)

- (a) Power of Attorney for signing the Application
- (b) If applicable, the Power of Attorney for Lead Member of JV;
- (c) Copy of Memorandum of Understanding between JV partners, if applicable.
- (d) Copy of Memorandum of Understanding with Associate, if applicable.
- (e) Technical proposal as per format prescribed as per clause no 102 of BID
- (f) Bid Security Declaration for validity of 180 day as mentioned in the Instruction to Bidder or as per DTCN
- (g) Price Bid as per BOQ.
- (h) Other documents as per requirement of BID.

5.3 The Applicant shall upload scanned copies of the documents as specified in

5.2(A) above on the Tender Portal in designated locations of Technical Proposal and Price Bid(BOQ) before 17:00 hours Indian Standard Time on the Application due date i.e. on 08.11.2024 (date to be specified).

5.4 It may be noted that the scanned copies can be prepared in file format i.e. PDF and/or JPEG only. The Applicants can upload a single file of size of 5 MB only but can upload multiple files.

5.5 The bidder shall log on to the portal with his /her DSC and more to the desired tender for up loading the documents in appropriate place one by one simultaneously checking the documents.

5.6 Bids cannot be submitted after due date and time. The bids once submitted cannot be viewed, retrieved or corrected. The Bidder should ensure correctness of the bid prior to uploading and take print out of the system generated summary of submission to confirm successful uploading of bid.

The bids cannot be opened even by the OIT or the Procurement Officer Publisher/ opener before the due date and time of opening.

5.7 Each process in the e-procurement is time stamped and the system can detect the time of log in of each user including the Bidder.

5.8 The Bidder should ensure clarity/legibility of the document uploaded by him to the portal.

5.9 The system shall require all the mandatory forms and fields filled up by the contractor during the process of submission of the bid/tender

5.10 The bidder should check the system generated confirmation statement on the status of the submission.

5.11 The Bidder should upload sufficiently ahead of the bid closure time to avoid traffic rush and failure in the network.

5.12 The tender inviting officer is not responsible for any failure, malfunction or breakdown of the electronic system used during the e-procurement process.

5.13 The Bidder is required to upload documents related to his eligibility criteria and qualification information and Price Bid(BOQ) duly filled in.

5.14 The Bidder will not be able to submit his bid after expire of the date and time of submission of bid (server time). The date and time of bid submission shall remain unaltered even if the specified date for the submission of bids declared as a holiday for the Officer Inviting the Bid.

6. SIGNING OF BID:

The 'online bidder' shall digitally sign on all statements, documents, certificates uploaded by him, owning responsibility for their correctness /authenticity as per IT ACT 2000. If any of the information furnished by the bidder is found to be false / fabricated / bogus, his EMD/ Bid Security shall stand forfeited & his name shall be recommended for blocking of portal registration and the bidder is liable to be blacklisted.

7. SECURITY OF BID SUBMISSION:

7.1 All bid uploaded by the Bidder to the portal will be encrypted.

7.2 The encrypted Bid can only be decrypted / opened by the authorized openers on or after the due date and time.

8. RESUBMISSION AND WITHDRAWAL OF BIDS:

8.1 Resubmission of bid by the bidders for any number of times before the final date and time of submission is allowed.

8.2 Resubmission of bid shall require uploading of all documents including price bid a fresh.

8.3 If the bidder fails to submit his modified bids within the pre-defined time of receipt, the system shall consider only the last bid submitted.

8.4 The bidder should avoid submission of bid at the last moment to avoid system failure or malfunction of internet or traffic jam or power failure etc.

8.5 The Bidder can withdraw his bid before the closure date and time of receipt of the bid by uploading scanned copy of a letter addressing to the Procurement Officer Publisher (Officer Inviting Tender) citing reasons for withdrawal. The system shall not allow any withdrawal after expiry of the closure time of the bid.

9 OPENING OF THE BID:

9.1 Bid opening date and time is specified during tender creation or can be extended through corrigendum. Bids cannot be opened before the specified date & time.

9.2 All bid openers have to log-on to the portal to decrypt the bid submitted by the bidders.

9.3 The bidders & guest users can view the summary of opening of bids from any system. Contractors are not required to be present during the bid opening at the opening location if they so desire.

9.4 In the event of the specified date of bid opening being declared a holiday for the Officer inviting the Bid, the bids will be opened at the appointed time on the next working day.

9.5 Combined bid security for more than one work is not acceptable.

10. EVALUATION OF BIDS:

10.1 All the opened bids shall be downloaded and printed for taking up evaluation.

The officer authorized to open the tender shall sign and number on each page of the documents downloaded and furnish a certificate that "the documents as available in the portal containing--- nos of pages".

10.2 The bidder may be asked in writing/ online to clarify on the uploaded documents provided in the Technical Bid, if necessary, with respect to any doubts or illegible documents. The officer inviting tender may ask for any other document of historical nature during Technical evaluation of the tender. Provided in all such cases, furnishing of any document in no way alters the Bidder's price bid. Non submission of legible documents may render the bid non-responsive.

10.3 The bidders will respond in not more than 7 days of issue of the clarification letter, failing which the bid of the bidder will be evaluated on its own merit.

10.4 The Technical evaluation of all the bids shall be carried out as per information furnished by Bidders.

10.5 The Procurement Officer-Evaluators; will evaluate bid and finalize list of responsive bidders.

10.6 The financial bids of the technically responsive bidders shall be opened on the due date of opening. The Procurement Officer-Openers shall log on to the system in sequence and open the financial bids.

10.7 The Financial Bid will be opened on the notified date & time in the presence of bidders or their authorised representative who wish to be present.

10.8 At the time of opening of "Price Bid(BOQ)", bidders whose technical bids were found responsive and qualified will be opened.

10.9 The responsive bidders' name, bid prices will be announced.

10.10 Procurement Officer-Openers shall sign on each page of the downloaded Price Bid(BOQ).

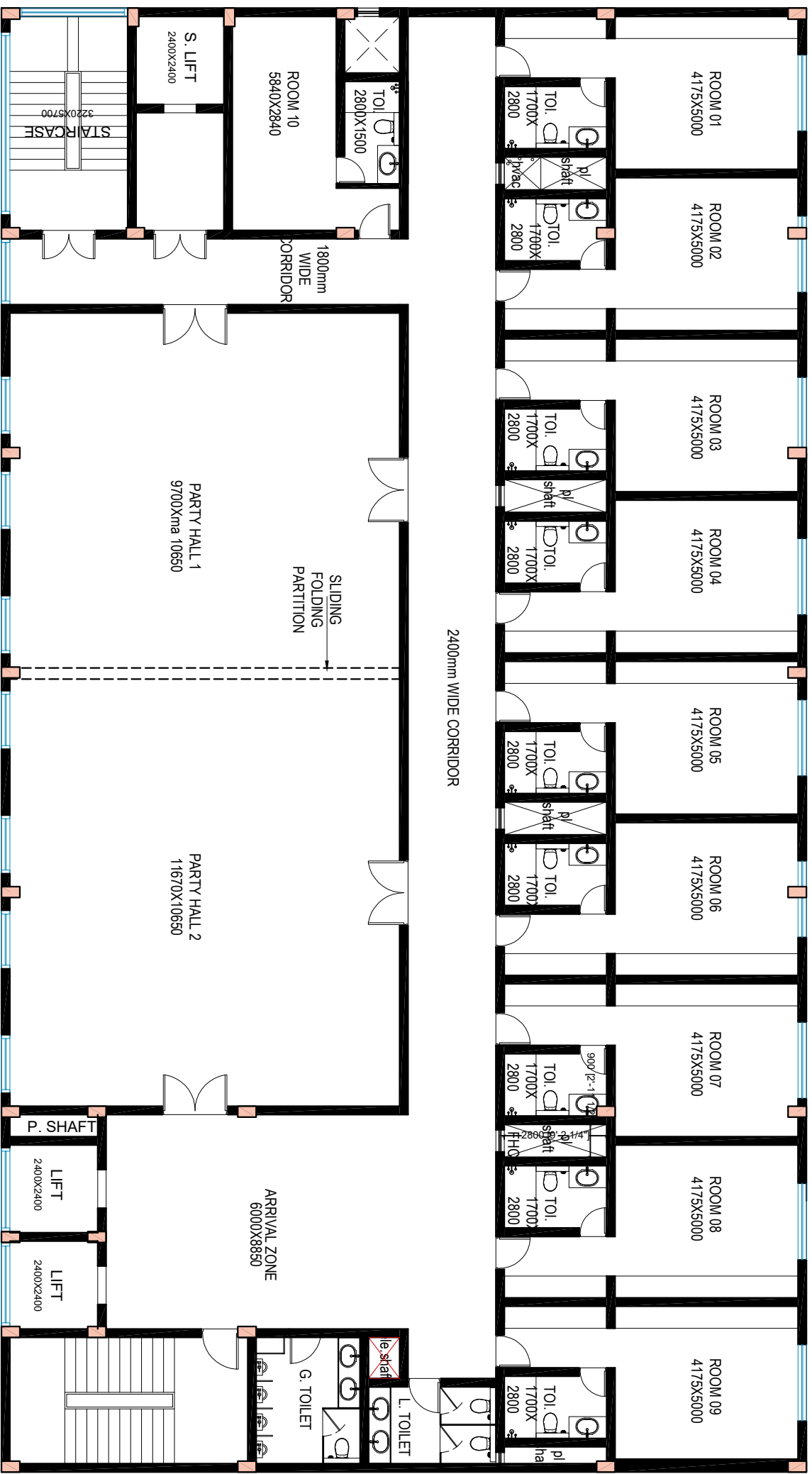
10.11 Bidder can witness the principal activities and view the documents/summary reports for that particular work by logging on to the portal with his DSC from anywhere.

10.12 System provides an option to Procurement Officer Publisher for reconsidering the rejected bid with the approval of concern Chief Engineer / Head of Department.

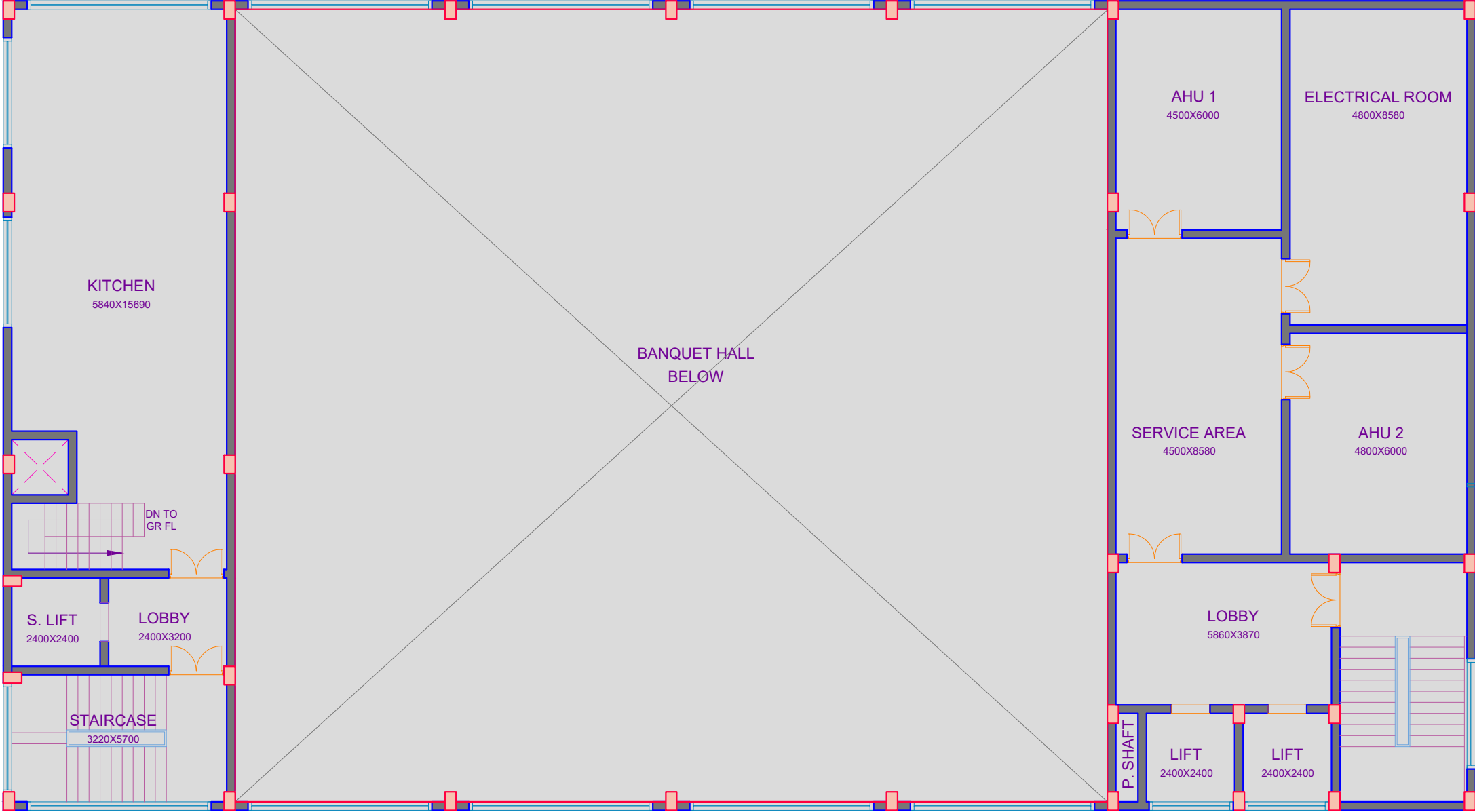
10.13 The L-1 bidder shall have to produce the original documents in support of the scanned copies and statements uploaded in the portal within 5 days of opening of price bid.

DISCLAIMER

The Applicant must read all the instructions in the BID and submit the same accordingly



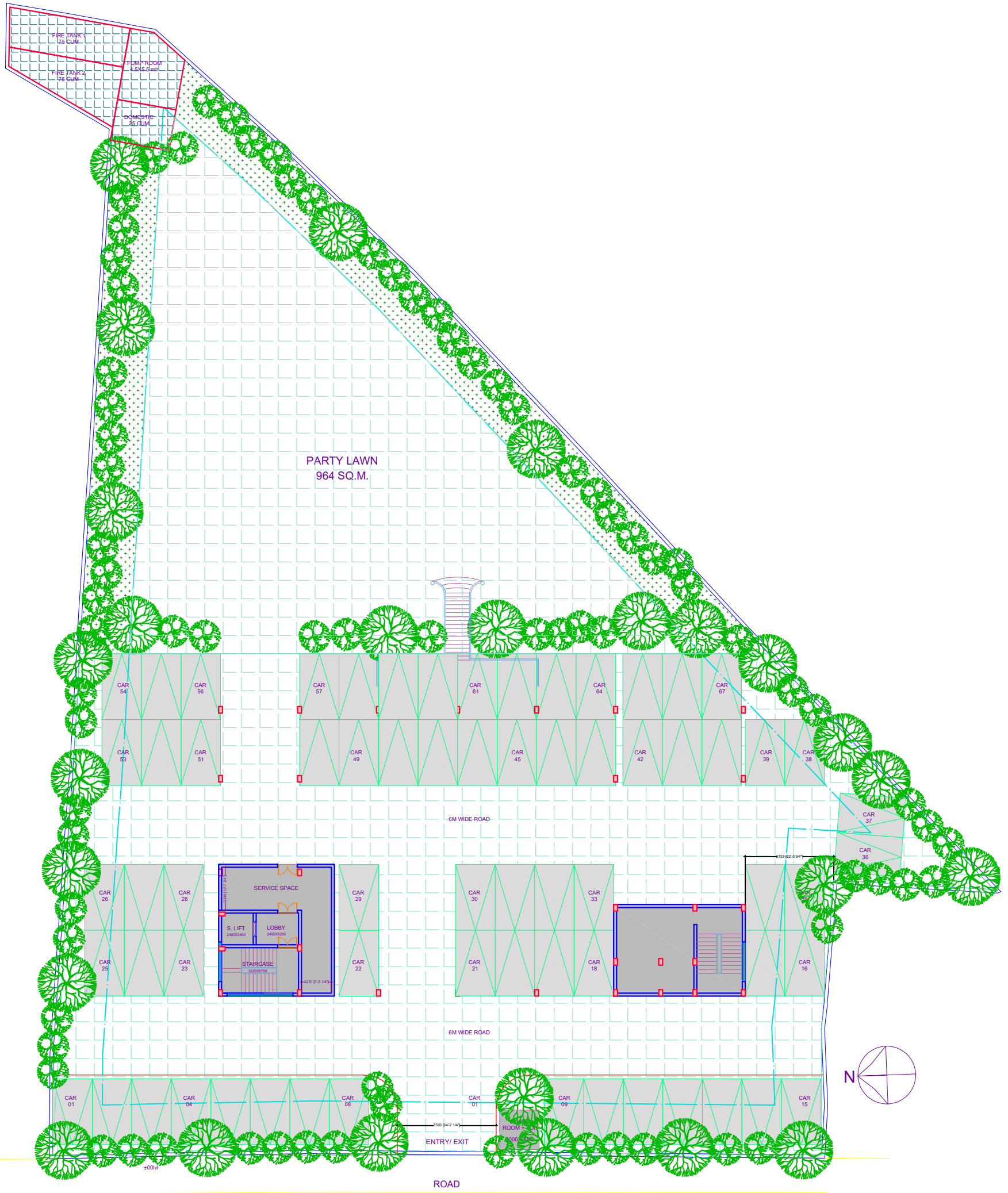
FIRST FLOOR



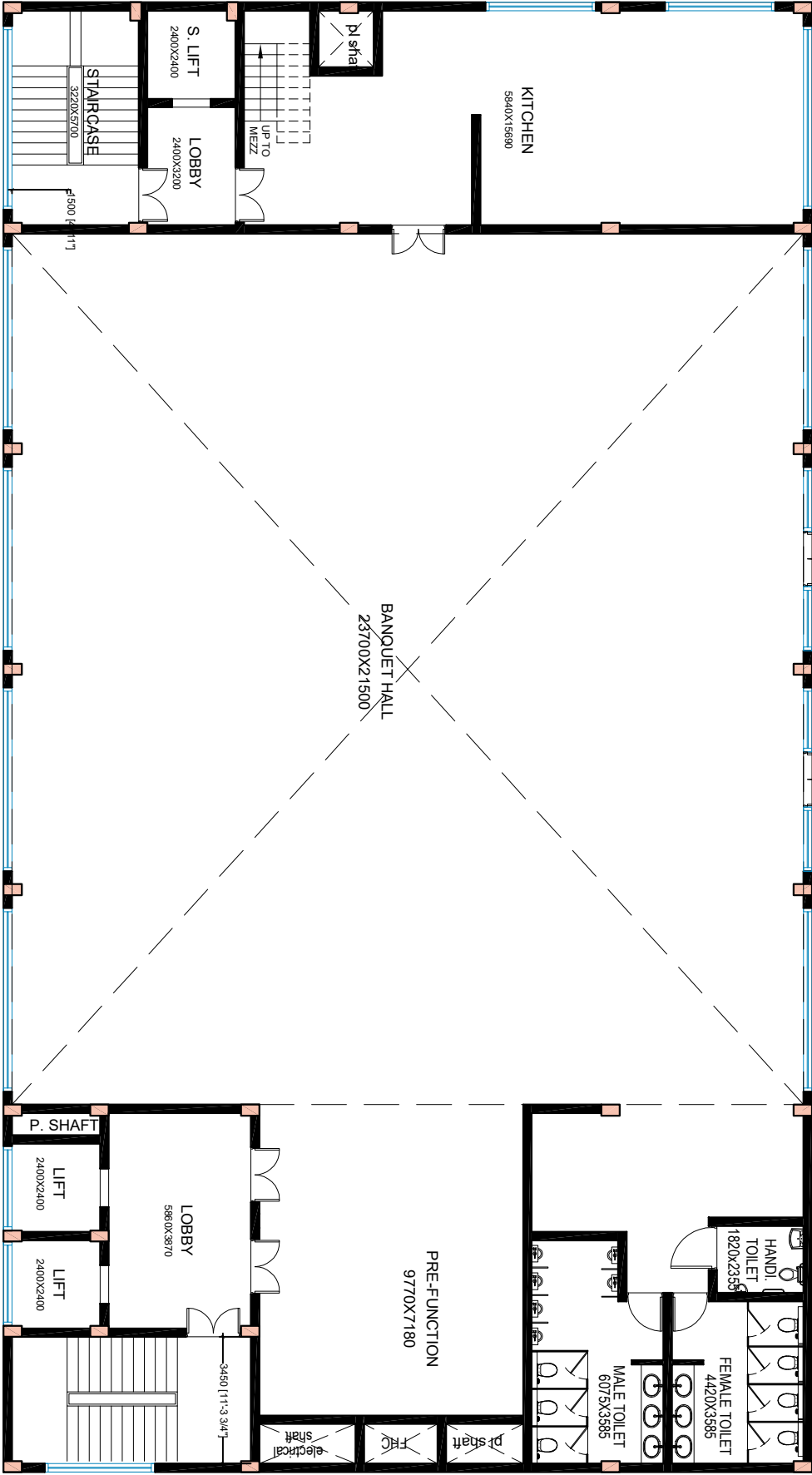
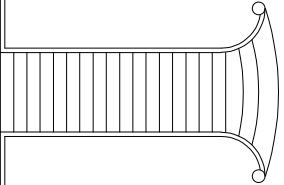
MEZZANINE FLOOR



SECTIONAL ELEVATION



STILT FLOOR AND SITE LAYOUT PLAN



UPPER GROUND FLOOR

UPPER GROUND FLOOR PLAN