



SYAMA PRASAD MOOKERJEE PORT, KOLKATA

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता

(Erstwhile KOLKATA PORT TRUST)

(AN AUTONOMOUS BODY UNDER THE MINISTRY OF PORTS, SHIPPING AND WATERWAYS,
GOVERNMENT OF INDIA)

KOLKATA DOCK SYSTEM

TENDER FOR

“इंडेंट्योर मेमोरियल क्षेत्र के निकट केडीएस, एसएमपी, कोलकाता में रिवरफ्रंट सौंदर्यीकरण कार्यों के साथ-साथ
रिवर क्रूज़ टर्मिनल और नदी पर्यटन सुविधा का विकास”

Development of River Cruise terminal and river tourism facility
alongwith riverfront beautification works at KDS, SMP, Kolkata –
adjacent to Indenture Memorial area

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Civil Engineering Department

सिविल इंजीनियरिंग विभाग

SYAMA PRASAD MOOKERJEE PORT, KOLKATA

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता

TENDER NO.: SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

TENDER NO.: SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

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SYAMA PRASAD MOOKERJEE PORT, KOLKATA

श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता

(Formerly KOLKATA PORT TRUST)

Civil Engineering Department

1.0 NOTICE INVITING TENDER

NIT NO.: SMPK/KDS/CIV /T/2830/12

DT. 08.03.2024

E-Tender is invited from reliable, bonafide & experienced agency with required experience as per Prequalification criteria stipulated in Tender Document for “Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, Kolkata – adjacent to Indenture Memorial area.” as per Bill of Quantities. The Bid Document may be seen from the website www.smporkolkata.shipping.gov.in and <https://kopt.enivida.in>. Corrigenda or clarifications, if any, shall be hosted on the above- mentioned websites only.

SCHEDULE OF TENDER (SOT)

a.TENDER NO. निविदा संख्या	SMPK/KDS/CIV /T/2830/11 DT. 08.03.2024
b. MODE OF TENDER निविदा का तरीका	e-Procurement System (Online two part Techno-Commercial Bid and Price Bid through Enivida Portal https://kopt.enivida.in). The intending bidders are required to submit their offers electronically through e-tendering portal ONLY. No physical tender would be accepted by SYAMA PRASAD MOOKERJEE PORT, KOLKATA.
c. i) Estimated Cost Of the Work अनुमानित लागत Of कार्य	Rs. 53.53 Crore (Rupees Fifty Three Point Five Three Crore only)
ii) Earnest Money Deposit बयाना राशि	Rs. 63.53 Lakh (Rupees Sixty Three Point Five Three lakh only) payable through Bank Guarantee or through DD / RTGS / NEFT to be transferred on A/C: Syama Prasad Mookerjee Port, Kolkata A/c No: 067502000000491 IFSC: IOBA0000675 Bank Name: Indian Overseas Bank Branch Name: STRAND ROAD Branch

<p>iii) Tender Document fee (Non-refundable)</p> <p>निविदा दस्तावेज शुल्क (अप्रतिदेय)</p>	<p>The intending bidders should submit the tender cost of Rs.2950/-(Rupees two thousand nine hundred and fifty only including @18% GST) to KoPT through DD/Banker's Cheque in favour of Syama Prasad Mookerjee Port, Kolkata on any scheduled/Nationalised Bank payable at Kolkata otherwise their offer will be summarily rejected. As per cl. 2, page no.12 payable through DD / RTGS / NEFT to be transferred on</p> <p>A/C: Syama Prasad Mookerjee Port, Kolkata A/c No: 067502000000491 IFSC: IOBA0000675 Bank Name: Indian Overseas Bank Branch Name: STRAND ROAD Branch</p>
<p>iv) Railtel Tender Processing Fee (Non-refundable) Mode of Payment: - E-payment Only through Debit/Credit Card or Net Banking.</p> <p>रेलटेल टेंडर प्रोसेसिंग शुल्क(नॉन रिफंडेबल)</p> <p>भुगतान का प्रकार:- ई-पेमेंट केवल के माध्यम से डेबिट/क्रेडिट कार्ड या नेट बैंकिंग।</p>	<p>TPF- 0.1% of estimate cost (Minimum 750/- Maximum 7500/-+GST Registration Charges Rs.2000/- +Applicable GST Per Year</p>
<p>d. Date of NIT available to parties to download पार्टियों को डाउनलोड करने के लिए उपलब्ध एनआईटी की तिथि</p>	<p>18.03.2024 to 12.04.2024 (up to 15:00 hrs.)</p>
<p>e. Pre – Bid Meeting Date & Time</p> <p>प्री-बिड मीटिंग की तारीख और समय</p>	<p>29.03.2024 at 11-00 hrs (at Chief Engineer's office)</p>
<p>f. Last date of submission of EMD & Tender Document fee at Syama Prasad Mookerjee Port, Kolkata</p> <p>श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता में ईएमडी और निविदा दस्तावेज शुल्क जमा करने की अंतिम तिथि</p>	<p>15.04.2024 (up to 15:00 hrs.)</p>
<p>g. Date of Starting of e-Tender for submission of online Techno-Commercial Bid at Enivida Portal</p> <p>के लिए ई-निविदा शुरू होने की तिथि</p> <p>Enivida पोर्टल पर ऑनलाइन टेक्नो-कमर्शियल बिड और प्राइस बिड जमा करना</p>	<p>19.03.2024 (From 14:00 hrs. onwards)</p>

h.Date of closing of online e-tender for submission of Techno-Commercial Bid & Price Bid. तकनीकी-वाणिज्यिक बोली और मूल्य बोली जमा करने के लिए ऑनलाइन ई-निविदा बंद करने की तिथि	12.04.2024 (Up to 15:00 hrs.)
i.Date & time of opening of Techno-Commercial Bid and Price Bid. तकनीकी-वाणिज्यिक बोली और मूल्य बोली खोलने की तिथि और समय।	15.04.2024 (After 13:00 hrs) (The Techno Commercial Part will be opened on the date)

Note: In the event of any unforeseen closure of work / holiday on any of the above days, the same will be opened / held on the next working day without any further notice.

List of Annexures

Important Instructions for E- procurement : - Annexure - A
 Commercial Terms & Conditions : - Annexure - B
 Techno Commercial Bid : - Annexure - C
 List of Scanned Documents required to be uploaded: - Annexure
 – D (Document consisting Annexure A to Annexure D
 To be treated as Techno Commercial Part)

Price Bid (Financial Part) : - Annexure – E
 (Both the Techno Commercial Part &
 Financial Part will be uploaded separately
 & will be available both in the SMPK website & Enivida Portal)
 General Conditions of Contract : - Annexure – F

Chief Engineer
Civil Engineering Department
SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Tender Inviting Authority

Important Instructions for e-Tender

Bidders are requested to use internet Browsers Firefox version below 50 / Internet Explorer version 8 or above, and Java 8 Update 151 or 161.

Further, bidders are requested to go through the following information and instructions available on the Enivida Portal <https://kopt.enivida.in> before responding to this e-tender:

- Bidders Manual Kit
- Help for Contractors
- FAQ

Contact Persons (Syama Prasad Mookerjee Port, Kolkata):

1. A Bagchi, Superintending Engineer (Contract) M.N.-96747 20079
2. A Shil ,EE(c) M.N.-70052 92265

E-mail IDs :- a.bagchi@kolkataporttrust.gov.in &
ce@kolkataporttrust.gov.in

Contact persons (Enivida Portal):

Phone No.7278929467/8448288981

E-Mail IDs: - enividahelpdesk@gmail.com/ ewizardkumar@gmail.com

1	All entries in the tender should be entered in online Technical & Commercial Formats without any ambiguity.
2	E-tender cannot be accessed after the due date and time mentioned in NIT.
3	SMPK reserves the right to cancel or reject or accept or withdraw or extend the tender in full or part as the case may be without assigning any reason thereof.
4	Any order resulting from this tender shall be governed by the terms and conditions mentioned therein.
5	No deviation to the technical and commercial terms & conditions are allowed.
6	The bidders must upload all the documents required as per terms of tender. Any other document uploaded which is not required as per the terms of the tender shall not be considered.
7	The bid will be evaluated based on the filled-in technical & commercial formats.
8	Bidder has fully read and understood the entire Tender Document, GCC, Corrigendum and Addenda, if any downloaded from under the instant e-tender and no other source, and will comply to the said document, GCC, Corrigendum and Addendum. A declaration in this regard is to be made by the bidder.
9	(A) Tender will be opened electronically on specified date and time as mentioned in the NIT. Bidders can witness electronic opening of Bid. (B) Necessary addendum/corrigendum (if any) of the tender would only be hoisted in the Enivida Portal .

10	<p>Bidder has fully read and understood the entire Tender Document, GCC, Corrigendum and Addenda, if any downloaded from under the instant e-tender and no other source, and will comply to the said document, GCC, Corrigendum and Addenda</p> <p>A declaration in this regard is to be made by the bidder.</p>
11	<p>(A) Part-I i.e. Techno commercial bid will be opened electronically on specified date and time as mentioned in the NIT. Bidder's can witness electronic opening of Bid.</p> <p>(B) Part-II i.e. Price Bid will be opened electronically of only those bidder(s) whose offer will be techno commercially qualified and accepted by SMPK. Such bidder(s) will be intimated the date of opening of Price Bid(Part-II) in due course through valid email confirmed by them.</p> <p>Necessary addendum/corrigendum (if any) of the tender would only be hoisted in the in the Enivida Portal</p>

Annexure –B

SYAMA PRASAD MOOKERJEE PORT, KOLKATA
Office of the Chief Engineer,
6, Fairlie Place (Fairlie Warehouse, 2nd floor),
Kolkata 700 001.

Tele – 033 2230-3451 Extension: 398,399,400

Fax - (033) 2230-0413

**E-mail id: a.bagchi@kolkataporttrust.gov.in &
ce@kolkataporttrust.gov.in**

3.0 Commercial Terms & Conditions

SL. NO.	TERMS
1	Mere participation in e-tender will not mean that a particular bidder will be automatically considered qualified and their bids will be entertained. Such qualification will be reviewed at the time of techno-commercial evaluation of bids also.
2	Copy of valid NSIC Certificate or MSME Certificate under MSME has to be submitted along with the bid.
3	EARNEST MONEY: As Per NIT
4	E-Tenderers submitted without requisite Earnest Money are liable to be rejected excepting in case of Micro & Small Enterprises (MSEs) registered with NSIC (under single point registration scheme) or MSME for items for which the tender is invited.
5	<u>SCOPE OF WORK: As per E-Tender Document</u>
6	The Terms and Conditions of E-Tender shall be read in conjunction with the General Conditions of Contract, Specifications, Bill of Quantities and other documents forming part of this Contract wherever the Contract so requires.
7	The several documents forming the Contract shall be taken, as mutually explanatory to one another and in case of any discrepancies; the Bill of Quantities shall prevail over the Specifications and the Terms and Conditions over the General Conditions of Contract of SMP, Kolkata. In case of any dispute, question or difference either during the execution of the Contract or any other time as to any matter or thing connected with or arising out of this Contract, the decision of the Chief Engineer, SYAMA PRASAD MOOKERJEE PORT, KOLKATA, thereon shall be final and binding upon all parties.

- 8 The Contract will include the Client's Bid Documents with the General Conditions of Contract and the Bidder's Offer as finally accepted by the Client, together with Addenda, if there be any. Trustees' General Conditions of contract is the integral part of the tender / contract. The above-mentioned General Conditions of Contract may be inspected at the office of the undersigned on any working day before quoting for the Tender.
- 9 The Trustees are not bound to accept the lowest or any Tender and reserve the right to accept a tender in full or in part and / or reject a tender in full or in part without assigning any reason thereof.
- 10 The contract shall be governed by all relevant Indian Acts applicable only within the jurisdiction of the High Court at Calcutta.
- 11 Intending bidders must take into account any cost or expense incurred by them in connection with the preparation and submission of their bids or for any other expenses incurred in connection with such bidding.
- 12 Bidders are advised to visit the site of work prior to submission of their bid. Bidder shall get himself thoroughly familiarized with the site conditions, existing road facilities for carrying materials etc. before submission of the e-tender. He may contact the Chief Engineer/**Superintending Engineer (NSD/South/DEV)** or his authorized representative at his office at 15, Strand Road, Kolkata 700001/51,CGR Road Kolkata-43 in this regard. Non-compliance of the same will in no way relieve the successful bidder of any of his obligations in performing the work in accordance with this Bid Document within the quoted price.
- 13 **VALIDITY: -**
The tender shall remain open for acceptance for a period of **4 months** from the date of opening of techno-commercial bid.

If before expiry of this validity period, the Bidder amends his quoted rates or tender, making them unacceptable to the Trustees and / or withdraws his tender, the Earnest Money deposited shall be liable to forfeiture at the option of the Trustees / sanctioning Authority.

14 **NON- RESPONSIVE BIDDER: -**

The offer/tender shall be treated as non-responsive, if it:

- (i) is not accompanied by requisite Earnest Money /valid NSIC Registration Certificate /MSME Registration Certificate.
- (ii) is not accompanied by requisite tender paper cost / or valid NSIC/MSME Registration Certificate.
- (iii) validity of the offer is less than tender stipulation,
- (iv) does not meet the Qualification Criteria as stipulated in the NIT.
- (v) The bidder submits conditional offer / impose own terms and conditions / does not accept tender conditions completely/offer or tender if submitted with any deviation from the tender terms & conditions.

In addition to above, a bidder may be disqualified if –

- a) The bidder provides misleading or false information in the statements and documents submitted.
- b) Record of unsatisfactory performance during the last seven years, such as abandoning of work or rescinding of contract for which the reasons are attributable to the non-performance of the contractor or inordinate delays in completion or financial bankruptcy etc.

The decision of Syama Prasad Mookerjee Port, Kolkata in this regard shall be final and binding on the Bidder.

Offer / tender is submitted with any deviation from the tender terms & conditions.

15 EARNEST MONEY AND SECURITY DEPOSIT: - : As per tender Document

16. PERFORMANCE GUARANTEE:-

The Contractor should submit a Performance Guarantee in the form of B.G. for **10 %** of contract value in SMPK's proforma from a Scheduled/ Nationalized Bank within 21 days from the date of receipt of LOI/Work Order, failing which the contract would be rescind without any further notice. The P.G. should be obtained for the full period covering defect liability period of 12 (Twelve) months. In all cases , any dispute will be adjudicated under the jurisdiction of The Calcutta High Court.

The P.G shall be accepted with effect from the date of W.O/LOI. The SMPK bank account details to which amount is to be transferred (accepted only online payable through DD / RTGS / NEFT is mentioned below:

A/C: Syama Prasad Mookerjee Port, Kolkata

A/c No: 067502000000491

IFSC: IOBA0000675

Bank Name: Indian Overseas Bank Branch Name: STRAND ROAD Branch, Kolkata

Refund of performance Guarantee:

The Performance Security Deposit shall be held by the Chief Engineer, SMP, Kolkata as security for the performance of the Contractor's obligation under the contract.

The performance guarantees to be refunded to the contractor without interest, after he duly performs and completes all obligations under the contract but not later than 90 days of completion of the Defect Liability Period (DLP).

17 In the event of the successful bidder fails to execute the order within the stipulated delivery period without sufficient reasons acceptable to the Trustees, the Security Deposit may be forfeited and the order be cancelled at the option of the Trustees' **apart from other actions.**

18 PRICES: - As per BOQ given in the tender document.

19 The bidder shall quote his price as per the Bill of Quantities in the Price bid

20 Orders may be placed in full/part to the lowest bidder.

21 Price(s) to be quoted should remain firm over the contract period.

22 **The prices quoted shall be including all statutory levies excluding GST, which shall be paid extra.**

23 EVALUATION CRITERIA: As per relevant clause of Tender document.

24 PAYMENT: - As per Tender document.

25 LOCATION: As per Tender document.

26 TIME OF COMPLETION: As per Tender document.

27 Work is to be carried out as per terms & condition of the contract document.

28 JURISDICTION OF COURT: -

The contract shall be governed by all relevant Indian Acts applicable within the jurisdiction of Kolkata.

- 29 PERSONAL PROTECTIVE EQUIPMENT (PPE): - Contractor and their workmen including driver & helper must use PPE i.e. safety helmet etc. at the time of work inside the dock premises. For safety measure Cl. No.25, page-23 may be referred to.
- 30 Compensation (Liquidated Damages) against failure to complete the work within the stipulated time as per tender condition.
- 31 PRICE ADJUSTMENT CLAUSE: As per Tender document.
- 32 TECHNICAL CAPACITY: As stipulated in Tender document.
- 33 FINANCIAL CAPACITY: As stipulated in Tender document.
- 34. DOCK PERMITS: As per tender document.
- 35. The bidder may offer a Bank Guarantee in the Trustees' specified proforma from any Scheduled/ Nationalized Bank of India having Branch at Kolkata in lieu of Earnest Money /Security Deposit beyond **Rupees 10 (Ten) lakhs**.

Besides the above conditions all other conditions as stated in the NIT, BOQ, Special Conditions of Contract, Instruction to the tenderers, G.C.C. shall have to be agreed by the Bidders.

Annexure –C

**SYAMA PRASAD MOOKERJEE PORT, KOLKATA
CIVIL ENGINEERING DEPARTMENT
6, Fairlie Place (Fairlie Warehouse, 2nd floor),
Kolkata 700 001.**

NIT No.: SMPK/KDS/CIV /T/2830/12 DT. 08.03.2024

NOTE: Last Date of Download of tender documents: 08.04.2024 (up to 14.00 hours)

Tender is due for submission by 15.00 Hrs. On 08.04.2024

Tender is due to open after 13.00 Hrs. On 09.04.2024

Techno Commercial Bid

इंडेंट्योर मेमोरियल क्षेत्र के निकट केडीएस, एसएमपी, कोलकाता में रिवरफ्रंट सौंदर्यीकरण कार्यों के साथ-साथ रिवर क्रूज़ टर्मिनल और नदी पर्यटन सुविधा का विकास”

Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, Kolkata – adjacent to Indenture Memorial area

SHORT TENDER NOTICE

E-Tender is invited from reliable, bonafide & experienced agency with required experience as per Pre-Qualification Criteria stipulated in Tender Document for the following work at Syama Prasad Mookerjee Port, Kolkata.

Name of work कार्य का नाम	:	Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, Kolkata – adjacent to Indenture Memorial area.
NIT No एनआईटी नंबर	:	SMPK/KDS/CIV /T/2830/12 DT. 08.03.2024
Estimated Cost अनुमानित लागत	:	Rs 53.53 Crores (Rupees Fifty Three Point Five Three crore)
Time Of Completion निष्पादन की अवधि	:	24(Twenty Four) Months.
EMD (Earnest Money Deposit)/Bid Security ईएमडी (बयाना राशि जमा)/बोली सुरक्षा	:	Rs. 63.53 Lakh (Rupees Sixty Three Point Five Three Lakh) payable through Bank Guarantee DD / RTGS / NEFT to be transferred on A/C: Syama Prasad Mookerjee Port, Kolkata.
Period of Download of E-Tender (Both Days Inclusive) ई-निविदा के डाउनलोड की अवधि (दोनों दिन सम्मिलित)	:	18.03.2024 to 12.04.2024 (UPTO 14:00 hrs.) (Bid document will be available on website https://kopt.enivida.in). Bidders will have to participate in bidding process through website https://kopt.enivida.in) only.
Date and Time for pre-bid meeting & site visit प्री-बिड मीटिंग और साइट विज़िट के लिए दिनांक और समय	:	29.03.2024 at 11-00 hrs (details of Pre-bid meeting will be intimated through website later on)

Last date of submission of e-tender and opening of the tender	:	Submission on 12.04.2024 Up to 15:00 hrs. Opening on 15.04.2024 after 15:300 hrs. (Techno Commercial Part will be opened on that date)
ई-निविदा जमा करने और निविदा खोलने की अंतिम तिथि		
Cost of Tender Document(Non-refundable)	:	Rs.2950/-(Rupees two thousand nine hundred and fifty only) including @18% GST) payable through DD / RTGS / NEFT to be transferred on
निविदा दस्तावेज की लागत (अप्रतिदेय)		A/C: Syama Prasad Mookerjee Port, Kolkata
Contact Person.	:	A Bagchi, Superintending Engineer(Contract)
संपर्क व्यक्ति।		M.N.-96747 20079 S Shil ,EE(c) M.N.-70052 92265

4.0: INSTRUCTIONS TO BIDDER

E-TENDER FOR “Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, Kolkata – adjacent to Indenture Memorial area.”

NIT NO: SMPK/KDS/CIV /T/2830/12 DT. 08.03.2024

1.0 GENERAL

The work as described in the tender shall be executed in Kolkata and in accordance with the attached General Conditions of Contract, Special Conditions of Contract, Particular Specifications, and Drawings (if any) & detailed Bill of Quantities. Location Plan of the place of work might be inspected at the office of the **Superintending Engineer (NSD/South/DEV)** on any working day before quoting for the tender.

Cost of tender paper and EMD are to be physically deposited at the office of Chief Engineer by vendors/contractors through Bank Draft/Banker’s Cheque/Demand Draft/Pay Order etc. On any scheduled/nationalised Bank, in favour of Syama Prasad Mookerjee Port, Kolkata, payable at Kolkata, as mentioned in the tender.

EMD beyond Rs 10.00 Lakh may be accepted in the form of Bank Guarantee issued by an Indian Nationalized / Scheduled bank.

Details of cost of e-tender paper remitted should be entered by the participating vendor/contractor in the space provided in the e-tender as indicated hereunder:

- a) Name of remitting vendor/contractor :
- b) Tender No. :
- c) Amount remitted :
- d) Date of remittance :
- e) Bank Draft / Cheque No. :

Details of Earnest money remitted should be entered by the participating vendor/contractor in the space provided in the e-tender as indicated hereunder:

- a) Name of remitting vendor/contractor :
- b) Tender No. :
- c) Amount remitted :
- d) Date of remittance :
- e) Bank Draft / Cheque No. :

Tender submitted without requisite cost of tender paper will be liable for rejection.

MODE OF SUBMISSION OF BID:

All bidders must submit their offers through e- tendering in accordance with the terms and conditions set out in the bid documents and no deviation will be accepted.

A Bid shall contain the following scanned copies of which are to be uploaded (Refer Annexure D):-

- i) GST registration certificate.
- ii) a) Valid Trade License (Valid for current period & also for type of work).

iii) Valid Professional Tax Clearance Certificate / Up to date tax payment challan If this is not applicable, the bidder must submit a declaration in this regard.

iv) Proof of possessing valid Employees' Provident Fund (EPF) Account. EPF Registration Certificate.

v) Proof of being registered with Employees' State Insurance Corporation (ESIC), ESI Registration Certificate.

vi) Details of the firm as per Schedule-O (in Part-I) of the tender document duly filled up.

vii) Credentials in the form of copies of Letters of Award of Works along with corresponding/successful Completion Certificates from owners to justify that the intending bidder satisfies the earlier mentioned pre-qualification criteria.

viii) Last three years balance sheet and profit & loss account in support of Annual Financial turnover (i.e. 2020 –21, 2021-22 and 2022-23). The same should be audited as per relevant norms wherever required along with UDIN of the Auditor.

ix) PAN Card

x) Bank Draft/ Pay order / Bank Transfer Details etc. regarding Cost of EMD and cost of Tenderdocuments/valid NSIC certificate/MSME Certificate .

xi) A list of technically qualified and skilled persons would be engaged to supervise and execute the work.

xii) Self declaration of the bidder that the Bidding Firm has Not been debarred / de-listed by any Govt / Quasi Govt. / Public Sector undertaking in India (to be mentioned in the letter head of the Firm).

xiii) Self-declaration regarding the proprietor/partner(s)/authorized signatory of the bidding firm (in the case of proprietorship firm /partnership firm /limited company, as the case may be) is/are not associated with any other firm bidding for the same work (to be mentioned in the letter head of the Firm).

xiv) A list of works which are in hand at the time of submitting the offer as per the enclosed proforma titled 'Concurrent Commitments of The Bidder' vide 'Schedule –T' in Part-I of the tender document.

xv) Undertaking of the tenderer to be submitted as per enclosed Pro-forma (ANNEXURE –D-1) in lieu of submission of signed copies of the full Tender document, G.C.C, addenda & corrigendum in the letter head of the Firm.

xvi) Last page of "Bill of Quantities" & the "Form of Tender" duly filled up (without price quoted) shall be duly signed and stamped by the Bidder.

xvii) Copy of duly Filled up Integrity Pact in Stamp Paper of valued Rs. 100.00

xviii) TDS certificate including 26 AS should essentially be submitted to validate the legitimacy of the work completion certificate.

N. B.-1 The bidder will have to produce the original documents or any additional documents, if asked for, to satisfy the Authorities for clarification of his documents or credibility.

N.B.-2 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements and their EMD will be Forfeited for such action.

All the bidders should submit the e-tender in accordance with the Mode of submission of Bid as afore-said.

SECURITY DEPOSIT: -

For the successful Bidder, the Security Deposit will be recovered from the contractors each and every On-Account Bill [including the final bill, if necessary] at the percentage of each such bills as set forth in **Clause. 3.4, 3.5 & 3.6 of the General Conditionsof Contract.**

Refund of S.D. and forfeiture S.D. shall be guided by Cl. 3.5 (i) & (ii) of the G.C.C.

5.0 Delay/ Extension of time/ Liquidated Damage/ Termination of Contract.

Clause 8.0 of G.C.C. to be referred regarding Delay/ Extension of time/ Liquidated Damage/Termination of Contract.

6.0 REFUND OF EARNEST MONEY: - The Earnest Money received, will be refunded or released as the case may be to the unsuccessful Bidders without any interest after opening of Price bid (Part – II) of the tender.

7.0 VALIDITY OF OFFER: -

The e-tender shall remain valid for a period of **4 (four) months** from the date of opening the same. If before expiry of this validity period, the Bidder amends his quoted rates or tender, making them unacceptable to the Trustees and / or withdraws his e-tender, the Earnest Money deposited shall be liable to forfeiture at the option of the Trustees/ Sanctioning Authority/Engineer.

8.0 DETAILED SCRUTINY OF E-TENDERERS:

During the course of examination of Part-I of the bid, the bidders, if asked for, shall furnish any or additional document(s) for the purpose of evaluation of his / their bids.

9.0 During Techno-Commercial Evaluation, i.e. evaluation of Part-I of tender, an offer shall be considered non-responsive in case it: -

- (i) is not accompanied by requisite Earnest Money / valid NSIC Registration Certificate /MSME Registration Certificate.
- (ii) is not accompanied by requisite tender paper cost / or valid NSIC/MSME Registration Certificate.
- (iii) validity of the offer is less than tender stipulation,
- (iv) does not meet the Qualification Criteria as stipulated in the NIT.
- (v) The bidder submits conditional offer / impose own terms and conditions / does not accept tender conditions completely/offer or tender if submitted with any deviation from the tender terms & conditions.

a) The bidder provides misleading or false information in the statements and documents submitted.

b) Record of unsatisfactory performance during the last seven years, such as abandoning of work or rescinding of contract for which the reasons are attributable to the non-performance of the contractor or inordinate delays in completion or financial bankruptcy etc.

The decision of Syama Prasad Mookerjee port, Kolkata in this regard shall be final and binding On the Bidder.

10. An amount of **Cess for Building & Other Construction Workers' Welfare Cess** [BOCW W Cess] calculated at the rate of **1% of the billed amount** shall be progressively recovered from each running bill as well as from the final bill of the contractor for onward transmission of the same by the appropriate authority statutory deductions will also be made as applicable at the time of payment.

11. For Micro & Small Enterprises (MSEs) registered with NSIC & or MSME: -

Micro & Small Enterprises (MSEs) registered with NSIC (under single point registration scheme) **or MSME** are exempted from depositing Cost of Tender Document.

If Micro & Small Enterprises (MSEs) registered with **NSIC or MSME** intends to participate in the tender, for the items they are not registered with NSIC OR MSME , then they will have to deposit cost of Tender Document, as per NIT. **Otherwise their offer will not be considered.**

Copy of valid NSIC Certificate for MSEs has to be submitted along with bid.

12. EVALUATION CRITERIA: -

During evaluation of Part-II i.e. Price Part, provided that the bidder submits his offer following e-tender stipulations & specifications, the overall lowest offer received shall be considered for acceptance by the Board.

13.ACCEPTANCE OF TENDER: -

Syama Prasad Mookerjee Port, Kolkata reserves the right to accept / reject any / all offer(s) without assigning any reason thereof and also reserve the right to accept the tender in part or as a whole.

Any attempt to exercise undue influence in the matter of acceptance of Tender is strictly prohibited and any Tenderer who resorts to this will render his tender liable to rejection.

The successful Tenderer will be notified in writing of the acceptance of his tender. The "Tenderer" then becomes the "Contractor" and he shall forthwith take steps to execute the Contract Agreement within six weeks of issue of Letter Of acceptance and fulfil all his obligations as required by the Contract.

14.0 MISCELLANEOUS:

i) Bidder shall submit his offer for complete scope of work, strictly in accordance with the tender documents. Any deviation from the tender documents and / or any incomplete tender shall not be considered.

ii) The bidder shall not impose his own terms & conditions in his offer or quote his rates based on his own terms and conditions, such E-Tenderers are liable to rejection at the option of the Trustees without further reference to the bidder.

All materials shall have to be procured by the successful Bidder and shall be of the best and approved quality conforming to relevant specifications. The successful Bidder shall also arrange for the supply of all labour, tools and plants as stipulated in the Special Conditions of Contract,
iii) required for efficient execution of the work.

iv) All measuring units are in Metric System and rates and sums in the tender are in Indian currency. The language used throughout shall be in English.

v) The Tender Documents with all the enclosures, appendices, Abstract Form of Tender and Form of Tender shall be required to be complete, duly filled in and signed and uploaded.

vii) The Bidder shall give a declaration about the names of their relations employed in Syama Prasad Mookerjee Port, Kolkata. It is not the intention to debar the Contractors from working if their relatives are working in SMPK, but such a declaration is necessary in the interest of Trustees against any possible lapses.

Tender for “ Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, Kolkata – adjacent to Indenture Memorial area. “

NIT No:- SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

SPECIAL CONDITIONS OF CONTRACT

1. GENERAL:

These provisions though given in a separate section are part of the tender documents which must be read as a whole, the various sections being complementary to one another and are to be taken as mutually explanatory. These provisions shall be read in conjunction with the other parts of the tender documents viz. General Conditions of Contract, Notice Inviting E-Tender, and Instructions to Bidder, Particular Specifications, Drawings, Bill of Quantities and other documents forming part of the Contract. In case of any discrepancy or ambiguity in the documents, the order of precedence of the documents as stated below will apply. In particular, these provisions will override those in the General Conditions provided there is discrepancy between them.

2. Priority of Contract Documents: -

The several documents forming the Contract are to be taken as mutually explanatory to one another, but in case of ambiguity or discrepancies, the same shall be explained and adjudicated by the Engineer of the Contract (EIC), who shall thereupon issue to the Contractor instructions thereon which will be final and binding on the Contractor. Unless otherwise provided in the Contract, if the stipulations in the various documents forming a part of the Contract are found to be in variation in any respect then, unless a different intention appears, the provision(s) of one will override others (but only to the extent these are at variance) in order of precedence as given in the list below i.e. a particular item in the list will take precedence over all those placed lower down the list:

The following order of documents of the Contract Agreement will be in the following sequence of Precedence i.e. any particular item placed in the list will take precedence over all other items placed lower down the list.

- a) Letter of Intent (LoI) / Work Order
- b) Bill of Quantities
- c) Drawings
- d) Particular Specifications in Scope of Work
- e) Special Conditions of Contract
- f) General Conditions of Contract

2.1. Custodian Certificate: After delivery at site the supplied materials are to be verified by KoPT Officials and the custodian certificate is to be issued by the Contractor in this regard, for consumption of such materials in the instant work.

2.2 Termination of contract and Risk Purchase Clause: Will be applicable as per clause No. 8 of KoPT's General Conditions of Contract.

2.3. Special / Additional Security may be arranged by the contractor at the site at no extra cost to KoPT over and above the General Security provided within KoPT premises by Port Security Authority.

2.4. In case of any dispute, question or difference either during the execution of the work or any other time as to any matter or thing connected with or arising out of this Contract, the decision of the Engineer in Charge, SMPK, thereon shall be final and binding upon all parties.

2.5 All other terms and conditions excepting those mentioned separately shall be governed by KoPT's General Condition of Contract.

The execution of work shall conform minutely to the approved & assigned drawings & specification & any other details drawings which shall be provided /duly approved by the Engineer during the progress of the work as to such other drawings those have formed part of the contract documents.

3. PRE-QUALIFICATION CRITERIA FOR BIDDERS: -

Satisfactorily completed as Prime Contractor during last seven years ending on the last day of the month previous to one in which NIT is issued similar work # of cost not less than,

(i) One similar completed work costing not less than amount equal to 80% of the estimated cost (i.e: **Rs 42.82 Crore**)

or

(ii) Two similar completed works costing not less than amount equal to 50% of the estimated cost (i.e: **Rs. 26.77 Crore** each)

or

(iii) Three similar completed works costing not less than amount equal to 40% of the estimated cost (i.e: **Rs. 24.41 Crore** each)

similar work means **Composite** Construction / Renovation / Rehabilitation/ Repairs / Upgradation Works including at least Civil , Electrical components related to area development , buildings , parks etc.

(a) Annual turnover:

Should have Average Annual Financial Turnover of **Rs. 16.06 Cr.** on works during the last three financial years ending 31st March 2023. A certificate by registered Chartered Accountant shall be uploaded,

(b) Net Profit:

Net profit (after deducting tax, depreciation and interest) in at least 3 financial years during the last 5 years shall be positive. A certificate by registered Chartered Accountant shall be uploaded.
not less,

(d) Work experience as a sub -contractor shall not be considered as the requisite qualification.

4. BRIEF SCOPE OF WORK:

GENERAL: Landscaping , Civil , Electrical , Firefighting , Outdoor drainage , plumbing and sewage , CCTV work.

WORK CONTENT

4.1.1 Brief Scope

The scope of work, inter-alia, includes the following but not limited to:-

The scope of work is broadly mentioned in Architectural design brief Report and BOQ as per site requirement any other work as directed by Engineer In charge.

01. Construction, Repairs and rehabilitation.
02. Boat sculpture Water Bodies and Feature wall
03. Hardscape, Kerb and Railing.
04. Restaurant Tensile roof, flooring works, Staircase steel works
05. External Tensile Roof structures
06. Board Walk way flooring
07. Open Air Theater and surrounding area
10. (Structural works for Extension towards jetty)
11. Provision for Watch tower as per design intent
12. Landscaping and Plants
13. Provision for Signages and Statue as per Architectural design intent
14. Provision for Demolishing and dismantling works as per site requirement as directed by Engineer In charge
15. Internal Electrical works
16. External Electrical works
17. Internal and External PHE works
18. Internal and External Fire fighting works

The value of the work shall be on item rates accepted in letter of acceptance subject to such additions there to or deductions there from as may be made under the provisions of the Contract.

The Construction Agency shall execute the complete project including land Development& landscaping as per BOQ & GFC, cutting/filling, construction of buildings, including on- site water supply lines, drainage lines, etc (as per BOQ& GFC drawings).On turnkey basis with his own materials/designs as approved. Before handing over the site, the construction agencies shall obtain certificate for (a) drainage completion & fire fighting installation (b) completion of buildings (c) malaria/ Public Health department (d) building occupation (e) assessment (f) fire safety from CFO/MCGM (g) Necessary certificate (h) garden superintendent and certificates from other authorities like Reliance Energy Ltd/TATA power, HSE Certificate, NOC from PCB,IGBC certificate, etc. BEST and all other relevant agencies/ Govt. offices as may be required.

4.1.2 The rates are inclusive of all cost but not limited to the cost such as for Plants, Equipments, tools, all types of labour, supervision, all materials from the source of supplies as approved by Engineer/Employer including all lead and lifts, transport, all temporary works, erection, maintenance, contractors profits & establishment/overheads together with preparation of designs, structural & architectural drawings etc, all general risks, taxes, royalties, duties, cess, octroi and other levies, insurance liabilities and all other obligations set out or implied in the contract for completion of work except otherwise specified in Bill of Quantities.

2.2 Work Contents:

2.2.1 Scope of Works

I. The Scope of works shall, inter-alia, include the following but not be limited to:

- (a) All kind of necessary surveying work including closed traverse, TBM's with co-ordinates & level.
- (b) Temporary access roads, fencing, watching, security, electricity, water and lighting;
- (c) All necessary arrangements for labour including labour camp, vehicle, water, electricity, adequate lighting;
- (d) Safety precautions and all measures to prevent erosion and suppress fire and other hazards;
- (e) interference to the Works by persons ,vehicles and the like being legitimate users of the facilities on or in the vicinity of the Site;
- (f) supplying, maintaining and removing on completion ,the Contractor's own accommodation, offices, stations, stores ,workshops, transport, welfare services and other facilities including telephones and facsimile machines and all charges in connection there with;
- (g) Maintaining public thorough fares and footpaths and maintaining access upon existing recognized routes;
- (h) providing, transporting to the Site, operating costs (including all fuel and consumable stores), maintaining and removing from the Site upon completion ,all construction plant and Contractor's equipment necessary for the Execution of the Works and including the cost of all lab tests and other requirements in respect of such plant and equipment;
- (i) Working adjacent to or across is services and installations;
- (j) Complying with the requirements of the Employer with respect to ear thing and bonding works for safety of human beings or assets, safety (including all cost of barricading, working in the vicinity of energized over headlines, etc. of the properties, utilities, public and/or employees, health, quality assurance, environmental, and project implementation plans and making periodical submissions;
- (k) Coordination and interface of the Works with the works of the Designated Contractors on or in the vicinity of the Site;
- (l) Remedying of defect sand shrinkage, and works of amendment, reconstruction, replacement of other faults, fair wear and tear expected, during defects liability periods;
- (m) Protections to be implemented against electromagnetic interference effects following line energization;
- (n) Insurance as per the provisions of the Contract;
- (o) All required machineries, cranes, derrick, tools, and equipment required for Execution of Works;
- (p) Various bank guarantees/ warranties /undertakings, as per the provisions of the Contract;
- (q) Traffic management; and
- (r) Erection, maintenance and removal of all Temporary Works and building.

II. The entire system and its basic components shall comply in all respect to the standard and regulations of National Building Code of India (NBC), and Bureau of Indian Standards.

2.2.2 INTERFACES:

- i. The Contractor shall interface and liaise on a timely basis with the Designated Contractors in accordance with the requirements of this General Specification and the other documents forming part of the Contract.
- ii. The Contractor shall notify the concerned authority in case of any deviations found on the site from the approve drawings and design.
- iii. The Contractor shall coordinate with PMC/Employer for any further assistance & support if required.

2.3 DESIGNCRITERIA

Deleted

2.4 REFERENCE TO THE STANDARD CODES OF PRACTICE

2.4.1 All Standards, Technical Specifications and Codes of practice referred to shall be latest editions including all applicable official amendments and revisions. The Contractor shall make available at site all relevant Indian Standard Codes of practice and IS & NBC Codes as applicable.

2.4.2 Wherever Indian Standards do not cover some particular aspects of design/construction, relevant appropriate/updated building code will be referred to. The Contractor shall make available at site such standard codes of practice.

2.4.3 Incase of discrepancy among Standard codes of practice, Technical Specifications and provisions in sub clauses in this NIT, the order of precedence will be as below:

- i) Provision in NIT & BOQ,
- ii) Technical Specifications,
- iii) PWD/ CPWD specifications
- iv) Standard Codes of Practice.

In case of discrepancy among Standard Codes of Practice, the order of precedence will be NBC, IS, BS.

2.5 DIMENSIONS

2.5.1 As regards errors, omissions and discrepancies in Specifications and Drawings, relevant clause of Special Conditions of Contract will apply.

2.5.2 The levels, measurements and other information concerning the existing site as shown on the conceptual/layout drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or strata turning out different from what is shown on the drawings.

2.6 FABRICATIONDEPOT

Deleted

2.7 ASSOCIATED WORKS

Works to be performed shall also include all general works preparatory to the construction and works of any kind necessary for the due and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and technical specifications, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment ,sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the erection of work sand the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

2.8 PRELIMINARY DRAWINGS

Preliminary drawings are enclosed represent Employer's proposal based on preliminary design.

2.9 TIME SCHEDULE & MONITORING OF PROGRESS:

The agency shall submit with the tender "Time Schedule" for completion of various portions of works. This schedule is to be within the overall completion period as stated in NIT. The detailed programme in the form of a quantified bar chart or CPM network shall include all activities starting from design to completion

In compiling its Works Programme and in all subsequent updating and reporting, the Contractor shall make provision for the time required for coordinating and completing the design, testing, commissioning and integrated testing of the Works, including, inter alia, design co-ordination periods during which the Contractor shall co-ordinate its design with those of Designated Contractors, there view procedures, determining and complying with the requirements of all Government Departments and all others whose consent, permissions, authority or license is required prior to the execution of any work.

The Contractor shall submit to the Engineer Four copies of a Monthly Progress Report (MPR), describing the progress and current status of the Works. The MPR shall address the matters set out in the Works Programme.

The MPR shall be submitted by the end of each calendar month. It shall account for all works actually performed from twenty sixth day of the last month and up to twenty fifth day of the current month.

A monthly/biweekly meeting to monitor the progress of the project shall be convened by the Engineer, Contractor's site agent and site agent of all interfacing contractors shall attend the meeting. The Employer may also be present in the meeting.

All the partners those who are holding power of attorney must remain present in quarterly review meeting in MMDRA, Mumbai.

2.10 TRAFFIC MANAGEMENT

The Contractor should inspect the site for this purpose and shall carry out the traffic studies. He will propose suitable traffic diversion plan and get such plan approved by the local authorities. Employer shall facilitate to contractor in getting such approvals, however responsibility of getting approvals shall rest with the Contractor. Lump-sum quoted for Schedule 'A' shall deemed to include the cost involved in such study, preparation of the proposal and getting the approval from the concerned authorities.

2.11 STANDARDS

Deleted

2.12 Site Establishment

(i) Site Laboratories

The Contractor shall provide a laboratory, as per the requirement as decided by the Engineer.

(ii) Contractor's Site Accommodation

The contractor shall provide and maintain its own site accommodation at locations consented to by the Engineer. Offices, sheds, stores, mess rooms, garages, workshop, latrines and other accommodation on the site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the site. The contractor shall comply with the requirements.

(iii) Site Office

The contractor shall provide and maintain site office with facilities and details as specified, at locations consented to by the Engineer for staff with toilet, rest room and electricity, water supply facility including attendant services for office upkeep, consumable/stationary, PC & one plotter, one printer, pantry room with accessories, facility, Furniture, security, Air Conditioning, Ventilation etc as directed by the Engineer. Offices on the site shall be maintained in a clean, stable and secure condition. And Two vehicle service for employer & two vehicle for PMC team.

2.13 Time Schedule

The agency shall submit with the tender "Time Schedule" for completion of various portions of works. This schedule is to be within the overall completion period of **24 Months**. The detailed programme in the form of a quantified bar chart or CPM network shall include all activities starting from design to completion.

2.14 Tender Price

The tender price shall include all the above listed items as per Bill of quantities.

2.15 Inspection

Employer may appoint an independent agency to ensure the quality checking of design, supply, fabrication, erection and construction of all works under scope of work. The Contractor shall ensure the complete co-operation with the agency to perform their work satisfactorily. In addition Employer also reserves right to undertake quality check and inspection directly by itself.

The contractor shall at all times keep the site and working areas free from all surplus materials, rubbish, other excavated/ offensive matter etc all of which shall be disposed off in a manner to be approved by the Engineer's Representative.

On completion of the works the contractor shall reinstate & make good at his own expense any property or land which might have been disturbed and/or damaged by his works. He should also clean the site as required during execution and fully clear the site after completion of all the works.

The contractor shall forward any usable materials found during the course of construction at the work site or its vicinity to KoPT stores/yards, dispose off the debris beyond the port area all at his own expenses by his own transport and labour and clean out all part of the work and leave everything clean and tidy to the entire satisfaction of the Engineer, failing which suitable deduction will be made from final bill as per discretion of the Engineer/ Engineer's representative

Including all appurtenant works as described & set forth in the Bill of Quantities, Special Conditions of Contract, Technical Specifications of work as per latest IS / IRC etc guidelines with all additional or varied works which may thereafter be required in accordance with clause – 7 of General Conditions of Contract & as per direction and upto the satisfaction of the Engineer or his representatives.

The intended tenderer shall inspect the site of work in consultation with the S.E (KPD), Civil Engineering Department and acquaint him with the nature of the work before preparing tender. The Tenderers attention is drawn to Clause No. 3.1 of the General Conditions of Contract in this regards. No excuse or ignorance as to the site conditions, or change in site due to natural factor or availability of space for storing material and approaches to the site etc. will be entertained.

Unless otherwise specified, the work to be provided for by the contractor shall include but not be limited to the following:-

a) Provide all materials, supervision, services, scaffolding, shoring, strutting, form work, reinforcements, vibrators, other tools and plants, transportation, water supply, temporary drainage, dewatering of surface, necessary approaches, temporary fencing and temporary lighting as required for safety and work purposes etc.

- b) Prepare and submit for review and assessment to the Engineer documents, bar chart etc showing how the work is actually going to be done including storage of materials, fencing etc., as well as sequence of construction and all other details as may be required by him.
- c) Providing all survey equipment with competent personnel to carry out survey works required for execution of the work.
- d) Providing temporary drainage diversion works during execution of the work.
- e) To exercise rigid quality control in execution of the work and to carry out sampling, testing, and furnishing the test results to the Engineer for the quality of construction materials and the quality of the work done.
- f) The contractor shall at all-time carry out work in a manner creating least interference to the existing services/Traffic operation while consistent with the satisfactory execution of the same. For all works , the Contractor shall, in accordance with the direction of the Engineer-In-Charge provide and maintain during the execution of the work, measures taken for safety of workers and the users of the facilitation.
- g) The contractor shall carry out the work in phased manner as per availability of the site as the roads & the areas are very busy & cannot be blocked wholly at a time & also for a long period so that normal day to day activities are not affected for which no such extra payment will be entertained.

5. LOCATION:

The site is located near 8, Garden Reach Road,Kolkata-43.

6. ACCESS TO THE SITE:

- (a) By Road: Garden Reach Road
- (b) By Circular Rail : Kidderpore Railway Station

7. WORK SITE:

The site is located near 8,Garden Reach Road,Kolkata-43. The building consists of two parts: A. Main Building, B. Annex Building. The Main Building is a three-storied heritage building of colonial style whereas the Annex building is seven stories high & modern in style The intending tenderer should contact **Superintending Engineer (KPD) & Superintending Engineer (Elec-I) for electrical works** to make the site inspection along with his representative.

8. INSPECTION OF SITE:

The Bidder shall inspect the site of work and thoroughly familiarise himself with the nature of work, site conditions, and access to the site and location before submission of the tender. He should contact the **Superintending Engineer (KPD) & Superintending Engineer (Elec-I) for electrical works** for collecting information about the site before submission of the tender. No excuse will be entertained afterwards on the above ground. In case any part of the site cannot be handed over to the successful Bidder in time, no compensation for loss of labour or any other cause nor any claim will be entertained by the Trustees. Suitable extension of time shall, however, be granted to the successful Bidder on that ground if applied for which shall be strictly at the consideration of the EIC.

9. SITE CONDITIONS & METHOD OF WORK:

The site is located near 8,Garden Reach Road,Kolkata-43 as detailed in the Scope of Work & B.O.Q. The contractor shall take adequate measures so as to execute the work with due regard to the above. The cost of which shall have to be included in the quoted rates.

Further, if so required by the Engineer in the interests of normal working of the Port Office, if it is found necessary to shift / suspend some construction activity for some duration, this shall be done in compliance with the instructions of the Engineer and as per relevant clause of the G.C.C. The bidder shall consider all the above points while quoting as no separate claim for idle charges towards labour, material will be considered for payment.

Proper care should be taken to provide adequate protection to the existing structures and cables (telephone, computer, etc.) all such installations against any damage at the Contractor's risk and expense. Any damage / defect to existing structures arising due to the faulty execution of the work shall have to be rectified forthwith as directed to the satisfaction of the Engineer, without charging extra.

10. TIME OF COMPLETION

The work is urgent in nature and must be commenced immediately on receipt of the work order and to be completed in all respects within 24(twenty four) months including preliminary time from the date of placement of work order.

11. SUFFICIENCY OF TENDER:

i) The tender drawings and all data / information as furnished herein or inspected and / or collected by the tenderer for the purpose of the work should be properly assessed or utilised in his offer at his own responsibility and KoPT does not guarantee sufficiency or adequacy of the data / information so supplied to him or collected or understood by the tenderer.

ii) The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the works and of the rates stated in the priced Bill of Quantities and the rates shall cover all his obligations under the contract and all matters and things necessary for the proper construction, completion, commissioning and maintenance of the work.

iii) In case rate of particular item is printed erroneously in B.O.Q., the rate stated in the schedule of rates will prevail over the rate misprinted in BOQ.

12. ACCESSIBILITY FOR CHECKING AND SUPERVISION:

The engaged Contractor is to provide necessary arrangement for free access to the KoPT officer's and personnel for supervision and checking of the subject work at his own cost.

13. PROGRAMME AND PROGRESS:

The contractor shall submit a detailed programme of work within 7 [seven] days from the date of Work Order / L.O.I. showing the commencement, duration and completion time of all major items of work including procurement of all materials etc,. The sequence of work shown in the programme must be practicable and compatible with technical specifications and conditions prevailing at site.

The contractor shall maintain the progress of work as per the approved programme. In case of any slippage of programme the engineer may require the contractor to augment the input of plant, equipment, labour of any item as he may deem fit. The contractor shall comply with the engineer's directive in this regard, without any extra charge whatsoever.

In case of delays caused due to conditions or circumstances beyond the control of the contractor, the delays must individually be informed to the Engineer forthwith in writing and his acceptance in writing obtained.

14. RESPONSIBILITY OF THE CONTRACTOR FOR METHODOLOGY OF WORKS:

i) The Contractor shall be solely responsible for the methodology and detailed working for the whole of the works, keeping in mind the site conditions and shall supply to the Engineer such particulars thereof as he may require from time to time.

ii) The Contractor shall submit within the time stipulated by the Engineer in writing, the details of actual methods that would be adopted by the Contractor for the execution of each item of the work supported by necessary details.

iii) Approval , for the Drawings and sketches, if necessary including those of the plant and machinery that would be used, their locations, arrangements for conveying and handling materials etc., should be obtained from the Engineer well in advance for starting each item of work. The Engineer reserves the right to suggest modifications or make concrete changes in the methods proposed by the Contractor whether accepted previously or not at any stage of the work, to obtain the desired accuracy, quality and progress of the work, which will be final and binding on the Contractor.

15. MATERIALS:

It will be the responsibility of the contractor to make timely procurement of all materials for both temporary and permanent works required in accordance with the Bill of Quantities or for any extra/additional work required as per the directions of the Engineer. The contractor shall procure

cement, reinforcement steel, Lime, Surki and other materials from manufacturers approved by the Consultant/Architect/Engineer in keeping with the list of approved make for all the materials. The contractor will be allowed to take away surplus materials on completion of the work, subject to Engineer's verification of contractor's records of entry and consumption of materials in the works.

16. QUALITY CONTROL:

Quality control is an essential part in the construction of and must be based on proper objective and qualitative measurement. The Contractor will have the full responsibility for quality control and delivering the acceptable quality in the field. Regular appraisal of the quality control to the Engineer should be made for effecting improvements in the construction techniques to ensure satisfactory quality of work. The quality control function shall include but not be limited to the following items.

17. SAMPLING AND TESTING OF CONSTRUCTION MATERIALS:

For Civil Part: Sampling and testing essentially to be carried out on the materials brought to site for construction work unless permitted otherwise by the Engineer. The Contractor shall undertake all field tests and laboratory tests for all such materials and workmanships as directed by the Engineer or his representative at his own cost. The samples shall be taken for test jointly by the representatives of the Engineer and the contractor at the worksite and tested /sent to a Govt. registered laboratory or Institutional laboratory as may be decided by the Engineer for testing. In case of field test, the contractor shall undertake the test by his own testing equipments or by any approved agency in presence of the representatives of the Engineer and the contractor at the worksite. All the testing charges and all incidental charges like packaging and transporting the test samples, equipments etc. shall be borne by the Contractor.

For Electrical Part: Inspection and testing will be carried out by KOPT Engineer. Inspection will be carried out as applicable as per relevant Standard/ Technical Specification/Approved Drawing etc. Manufacturer's Test and guarantee certificate as applicable will have to be submitted for verification.

Inspection and testing will comprise prototype testing including mechanical and electrical measurements such as stress, temperature, voltage, current, and moisture test. Non- destructive test techniques such as ultrasonic test should be shown to indicate the thermal cycle, accelerated life cycle, mechanical impact, fatigue ,etc of the panel prior commissioning are to be carried out . Insulation Resistance, Earth Continuity and Earth Resistance tests etc. as applicable prior to commissioning are to be carried out for LT cable. All pre commissioning tests of the panels/equipments etc as applicable shall be carried out by the authorized representative of the firm having valid Supervisor's Certificate of Competency

18. SPECIFICATIONS/ CODES AND STANDARDS:

All works under this contract will be executed according to the Trustees' Specification for works. Whenever the details are not specifically covered in the specifications, relevant provisions in the latest revision and/ or replacements of the Indian Standard Specifications (IS) or any other International Code of Practice/ CPWD specifications will be followed. The Contractor shall have to procure copies of such codes/ standards for ready reference of his own personnel as well as the Engineer or his representative at site at his own cost and without any additional reimbursement.

19. TEMPORARY WORKS:

The successful tenderer shall allow for providing labour and materials for the construction and removal of all temporary works, e.g. site office, site store, scaffolding, fencing lighting; watching, tube well and pipe lines etc. required for constructional purpose as well as for drinking water purpose of contractor's men, water supply, vats, platform, etc. as may be necessary for the successful execution, completion and maintenance of works without any extra cost to the Trustees and the rates should be quoted accordingly. No rent shall, however, be charged to the contractor for construction/erection of such temporary sheds and structures.

20. PLANT & CONSTRUCTIONAL EQUIPMENT:

The contractor shall supply his tools, plants and constructional equipment within his quoted rates. A list of plant as intended to be employed by the tenderers in this construction must be furnished with full details along with the tender.

21. CONTRACT PRICE:

The "Contract Price" for this contract means the sum named in the tender subject to such additions thereto, deductions there from or reductions due to supply of any materials by the Trustees' as provided for in the Contract.

22. SETTING OUT OF WORK AND INITIAL MEASUREMENTS:

The Engineer shall provide the initial reference and Bench Mark for the setting out of work. It will be the contractor's responsibility to set out the work accurately and get them checked by the Engineer. The Contractor shall provide at his own expense all necessary instruments, staff and labour for the checking of the survey.

The Contractor shall be responsible for the true setting out of the work and for the correctness of all dimensions, levels, lines, positions and alignment. Any error in any part of the works shall be rectified by the Contractor at his own cost. The Contractor would set up inspection facilities at Site at his own cost.

23. FORWARDING OF MATERIALS:

The contractor shall have to arrange transport for forwarding any usable/ saleable materials that may be found during the process of execution of the work to the Trustees' Sales yard or any other site/ godown including labourers, transportation, loading, unloading all complete as per the direction of the Engineer or his representative at site. No separate payment will be made to the contractor on this account unless specifically mentioned in the B.O.Q.

24. PARTICULARS OF EXISTING WORKS:

Such information as maybe given in the specification as to the existing features and works other than those now under construction as part of "SMPK" given without warranty of accuracy and neither the Trustees nor the Engineer will be liable for any discrepancies therein.

25. SAFETY MEASURES:

The contractor shall adhere to safe construction practice, guard against hazardous and unsafe working conditions and follow all safety precautions for prevention of injury or accidents and safeguarding life and property. The contractor shall further comply with any instruction issued by the Engineer, Trustees' Safety Officer, Safety Inspector in regards to safety which may relate to temporary, enabling or permanent works, working of tools, plants, machineries, equipment, means of access or any other aspect.

The contractor shall provide all necessary first aid measures, rescue and lifesaving equipment to be available in proper condition.

The contractor shall provide PPE's (Personal Protective Equipment) such as, **helmet, safety shoe** etc. to all workers and shall also provide job specific PPE's e.g. safety belts for working at heights; protective face and eye shield, goggles, hand gloves for welding / gas cutting works; protective foot wear and gloves for hot works; facemasks, gloves and overalls for painting works, mixing and handling materials etc , as directed by the Engineer.

All safety rules shall be strictly followed while working on live electrical systems or installations as stipulated in the relevant safety codes.

Use of hoisting machines and tackles including their attachments, construction tools, machineries and equipment shall comply to the relevant safety codes.

Before allowing workers in sewers, manholes, any duct or covered channel etc, the manhole covers shall have to be kept open and ventilated at least one hour in advance and necessary safety torches / lamps should be inserted first before allowing entry to the worker. Suitable hand gloves and other safety gear will be provided to the worker during handling / removing of slushes / sludge etc. without any extra cost. The contractor shall adopt all the above safety measures at his own cost.

The successful bidder shall also ensure that -

- (i) No damage is caused to plants and vegetation unless the same is required for execution of the project proper.
- (ii) The work shall not pollute any source of water / land / air surrounding the work site so as to affect adversely the quality or appearance thereof or cause injury or death to animal and plant life.
- (iii) His office & labour hutment etc. shall be maintained in a clean and hygienic condition throughout the period of their use and different effluents of the labour hutment shall have to be disposed of suitably.

26. HOLIDAY OR SUNDAY WORK:

Subject to provisions in local Acts and any statutes of the State, the Contractor shall arrange for working on Holidays and Sundays whenever so desired by the Engineer to expedite progress and complete the works in time.

The Contractor shall not be entitled to any additional payment for taking up works on Holidays and Sundays. The Contractor should be prepared to resort to round-the-clock working by following shift timings for labour.

27. POWER SUPPLY:

If available and if required, suitable power supply may be arranged by the Trustees at the nearest existing supplies point of the site of work on receipt of request letter from the Contractor to that effect. All necessary arrangements for the distribution at site will have to be made by the Contractor at his own cost as approved by the Trustees' Engineer or his representative.

Charges for consumption of power shall be periodically recovered from the Contractor's Bill at the rates of KoPT as prevalent amended from time to time including installation and hire charges for meters. The Trustees do not guarantee uninterrupted power supply from the above sources and Contractor shall not be compensated for any delay in providing / irregularity of power supply. The Contractor shall have to arrange for the supply of power at his own cost during such periods.

28. WATER:

The Contractor will arrange for supply of water both for drinking and for construction purposes. However, on written request from the Contractor, water for drinking purposes may be made available free of cost from the exiting water line of the Trustees at a point near the site of work. The contractor will have to arrange for laying pipelines, as necessary, as per approval of the Engineer or his representative, for storing and distributing the same to the work point at his own cost.

- h) Under no circumstances, the contractor would be allowed to use such drinking water for constructional works.

29. KEEPING THE SITE AND WORKING AREA CLEAR:

The Contractor shall at all times keep the site and working areas free from all surplus materials, rubbish and offensive matter all of which shall be disposed off in a manner to be approved by the Engineer's Representative.

30. PROTECTION OF EXISTING SERVICES:

The contractor must pay full attention to the fact that the existing service facilities for users are not distributed at any time due to storing of materials and rubbish and take every precaution to keep the entrance passage clear if the same are being used by the laborers.

The contractor shall be held liable for all damage and interference to the existing service, caused by him in execution of works. Should any damage be done to the existing services, in general, the contractor shall make good the same and any further work considered necessary by the Engineer's representative without any delay otherwise the cost of such repairing shall be recovered for his running bill for which Engineer's decision shall be final and binding.

31. CLEANING DURING EXECUTION AND AFTER COMPLETION:

On completion of the works the contractor shall reinstate and make good at his own expense any property or land which might have been disturbed and/or damaged by his works. He should also clean the site as required during execution and fully clear the site after completion of all the works.

The contractor shall forward any usable materials found during the course of construction at the work site or its vicinity to KoPT stores/yards, dispose off the debris beyond the port area all at his own expenses by his own transport and labour and clean out all part of the work and leave everything clean and tidy to the entire satisfaction of the Engineer, failing which suitable deduction will be made from final bill as per discretion of the Engineer/Engineer's representative.

32. METHOD OF MEASUREMENT:

Unless otherwise specified in the Particular Specifications and Bill of Quantities, the work shall be measured according to the current P.W.D.'s (Building, S&P & Road) Schedule of Rates (2017), Govt. of West Bengal with latest amendment and analysed rate. For details of measurement not covered by the above S.P.-27 1987 of B.I.S. shall be referred to.

33. ON ACCOUNT PAYMENT:

On account payment to the Contractor shall be arranged as and when required at the discretion of the Engineer on the basis of measurements of completed works at the quoted rates in the Bill of Quantities. The terms of payment shall be in accordance with Clause-6 of the General Conditions of Contract. The Bills should be submitted by the contractor in **quadruplicate** to the Office of the respective **Superintending Engineer (KPD) & Superintending Engineer (Elec-I) for electrical works** with necessary documents in original. Subject to the availability and feasibility of system, KoPT may make payment directly to the contractor's designated bank account. For this purpose, the contractor will have to indicate (i) name of bank (ii) branch name (iii) branch code and (iv) designated account number in the "Abstract Form Of Tender". In case payment is made directly through bank, the contractor may be required to submit a pre-receipt as per instruction of KoPT.

34. LABOUR, TOOLS & PLANTS:

The Contractor shall supply all necessary labour, tools and plants required for satisfactory execution of the work.

35. ESCALATION / VARIATION ON PRICES:

No Escalation / Variation on the prices on any account will be considered for adjustment /payment.

36. CONTRACT LABOUR LAWS AND INDEMNITY OF KoPT:

The contractor shall be required to comply with the Minimum wages Acts 1948, Employees Liability Act, 1938, Industrial Disputes Act, 1947, and The Contract Labour (Regulation and Abolition) Act, 1970, or statutory amendments and the modifications thereof, any other laws relating thereto and the rules made there under from time to time. Payment to the labourers to be made as per the minimum wage rates fixed by Chief Labour Commissioner (Central) and as per M.W.A. Govt. of W.B. whichever is higher and revised from time to time.

It will be the duty of the contractor to abide by the provisions of the Act. Ordinances, Rules, Regulations, Byelaws and Procedures as are lawfully necessary in the execution of the works. The contractor will be fully responsible for any delay/damage etc. and keep the Engineer indemnified against all penalties and liabilities of any kind for noncompliance or infringement of such Acts, Ordinances, Rules, Regulations By-laws and Procedures. The Contractor shall comply to the Employees' Bonus rules & to pay Bonus once a year to his workmen accordingly, for which no extra payment shall be made to the Contractor.

The contractor shall indemnify the KoPT against payment to be made under or for the observance of the laws aforesaid without prejudice to his right to claim indemnity from his subcontractor.

The aforesaid regulations shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a Breach of Contract. It will be obligatory on the part of Contractor to obtain necessary Labour Licence from the Competent Authority for deploying requisite Nos. of labours in the work and submit to the Engineer-In-Charge prior to commencement of the work.

The contractor shall also be required to comply regarding 'Workmen Compensation Act, 1923 as amended by Amendment Act No.65 of 1976'

In addition to the above, the Personal Injuries (Compensation Insurance) Act, 1963 and any modifications thereof and rules made there under from time to time. The contractor shall take into account all the above said financial liabilities in his quoted rates and nothing extra, whatsoever, shall be

payable to him on this account.

The Contractor shall indicate maximum number of workmen to be engaged on any day for execution of the work in the appropriate place in the ABSTRACT FORM OF TENDER & he shall have to obtain a regular /permanent license as per sec12(1) of the Contract Labour Act.

Further, whenever a contract work has commenced or completed, the contractor has to intimate the same to the Assistant Labour Commissioner(Central) /labour Enforcement Officer (Central) in Form IV-A, within 15 days of such commencement or completion.

The contractor has to arrange for displaying the name of the Regional Labour Commissioner (Central), Asst. Labour Commissioner (Central) & Labour Enforcement Officer (Central) at his worksite(s). The contractor shall inform the Principal Employer the date, time & venue of disbursement to be made by him to his workers.

The successful bidder shall also be required to put up a notice at the site of work mentioning the date, time & venue of disbursement to be made by him to his workers and he or his authorized representative shall have to be present during period of disbursement.

37. COMPLIANCE WITH E.P.F & M. P. ACT & ESI Act 1948:

The successful contractor will have to comply with provision of EPF & MP Act 1952 and also for Employees State Insurance Act 1948 (along with amendments, if any), issued from time to time as applicable.

If asked for by the Employer, the contractor will be required to submit photocopy of all payment challans and produce the original for verification to the representative of the principal employer, i.e. **Superintending Engineer (KPD)**.

38. INDEMNIFICATION:

The successful bidder shall be deemed to indemnify and keep indemnified the Trustees from and against all actions, claims, demands and liabilities whatsoever under and in respect of the breach of any of the provisions of any law, rules or regulations having the force of law, including but not limited to –

- a) The Minimum Wages Act, 1948.
- b) The Building And Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996
- c) The Payment of Wages Act, 1936.
- d) The Workmen's Compensation Act, 1923.
- e) The Employees Provident Fund Act, 1952.
- f) The Contract Labour (Regulation and Abolition) Act, 1970; Rules 1971.
- g) The Equal Remuneration Act, 1976.
- h) The Employees State Insurance Act, 1948 & Employees State Insurance (Amendment) Act, 1989
- i) Child Labour (Prohibition and Regulation) Act, 1986.
- j) The Maternity Benefits Act 1961
- k) Interstate Migrant Workmen (Regulation Of Employment & Conditions Of Service) Act, 1979.
- l) Motor Vehicle Act, latest revision.
- m) The payment of Bonus Act, 1965.

39. TAXES & DUTIES: -

The prices quoted shall be including all statutory levies excluding GST, which shall be paid extra. Supplier/service provider to confirm that the GST amount charged in invoice is declared in its returns and payment of taxes is also made.

The Supplier/ Service Provider agrees to comply with all applicable GST laws, including GST acts, rules, regulations, procedures, circulars & instructions thereunder applicable in India from time to time and to ensure that such compliance is done within the time prescribed under such laws. Supplier/Service Provider should ensure accurate transaction details, as required by GST laws, are timely uploaded in GSTN. In case there is any mismatch between the details so uploaded in GSTN by Supplier/ Service Provider and details available with SMPK, then payments to Supplier/Service Provider to the extent of GST relating to the invoices/s under mismatch may be retained from due payments till such time SMPK is not sure that accurate tax amount is finally reflected in the GSTN to KoPT's Account and is finally available to SMPK in terms of GST laws and that the credit of GST so taken by SMPK is not required to be reversed at a later date

along with applicable interest.

SMPK has the right to recover monetary loss including interest and penalty suffered by it due to any non-compliance of tax laws by the supplier/service provider. Any loss of input tax credit to SMPK for the fault of supplier shall be recovered by SMPK by way of adjustment in the consideration payable.

Supplementary invoices/Debit note/credit note for price revisions to enable SMPK to claim tax benefit on the same shall be issued by bidder for a particular year before September of the succeeding Financial Year.

The purchase order/ work order shall be void, if at any point of time bidder is found to be a black listed dealer as per GSTN rating system and further no payment shall be entertained.

40. SETTLEMENT OF DISPUTES:

If a dispute of any kind whatsoever arises between the Employer and the Contractor in connection with or arising out of the contract or the execution of the works, the same shall be dealt as per relevant provisions of the General Conditions of Contract.

41. CONTRACTOR TO EXECUTE CONTRACT AGREEMENT:

The contractor after acceptance of his tender shall be required to enter into and execute a Contract Agreement to be prepared in the form annexed to the General Conditions of Contract together with such modifications as may be necessary within one month from the date of placement of the order. The contractor shall have to submit copies in sextuplets of all documents; correspondence, connected papers etc. as detailed in the above form of Contract Agreement together with the instrument of Contract Agreement prepared on Non-Judicial stamped paper of requisite denomination having five more copies made on plain paper all at his own cost. The successful tenderer shall have to submit three sets of such Contract Agreement duly executed, sealed, signed and witnessed for execution by the Trustees. The other three sets shall be completed in all respects but not signed. If the successful tenderer or tenderers are a partnership concern, they will have to get Agreement signed by all the partners or by the partner who is authorized to sign for and on behalf of the other partners.

The contractor shall also comply with the requirements of Security Deposit for the due fulfilment of the contract. The blank proforma of tender documents shall be supplied in sextuplets to the successful tenderer free of charge for preparing the documents of the aforesaid Contract Agreement.

The successful tenderer shall have to copy out and prepare the documents of the Contract Agreement neatly and correctly. The necessary amendments, corrections etc. (if any) have to be done at his own cost. The successful contractor shall be required to keep close co-ordination and liaison with the Traffic Department while executing the works. The Superintending Engineer in charge of the construction will direct the representatives of the contractor to maintain liaison with different sections of the other departments and the contractor must keep the concerned Superintending Engineer of the Civil Engineering Department informed and/or posted with the programme contemplated with other departments. The Superintending Engineer of the Civil Engineering Department shall be nodal authority in all these co-ordination and / or liaison and all programmes must be vetted by him. In cases of exigencies, the contractor or his representatives may establish direct liaison/co-ordination but in all such case the Superintending Engineer should be informed promptly.

42. EMPLOYMENT OF LOCAL RESOURCES:

The contractor shall pay special attention to engage the maximum possible number of local Engineer, other technical personnel, office workers; labourers (skilled, semiskilled, unskilled) both at site and in office, details of such recruitment etc. shall be submitted to the Engineer periodically or as and when called for.

43. CALCUTTA PORT TRUST / KOLKATA PORT TRUST :

The expression "KOLKATA PORT TRUST" / "CALCUTTA PORT TRUST" appearing anywhere in the tender documents, shall be construed to read as "SMPK" i.e SYAMAPRASAD MOOKERJEE PORT , KOLKATA.

44. CLARIFICATION OF BIDS:

To assist in the examination and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakup/analysis of unit rates. The request for clarification and the response shall be in writing, but no change in the price or substance of the Tender shall be sought, offered, or permitted except as required to conform the correction of arithmetic errors discovered by the Employer in the evaluation of the Tenders.

No Tenderer shall contact the Employer personally on any matter relating to his Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, he should do so in writing.

Any effort by the Tenderer to influence the Employer's Tender evaluation, Tender comparison or contract award decisions, may result in the rejection of his Tender.

45. WORKMEN AND WAGES:

The Contractor shall deliver, if ordered, a weekly return for all labour employed in writing in the requisite form as instructed by the Engineer or his representative.

The contractor shall have to engage sufficient number of technically qualified and skilled persons to supervise and execute the work and this should be mentioned in the "Schedule-T" of the Contract.

46. RATE FOR PAYMENT AGAINST EXTRA ITEMS:

For any unforeseen work not covered under the Bill of Quantities and Condition of Contract, depending on contingent situation at site, if required for successful completion of the work, extra items have to be carried out by the Contractor. If those items are already available in Trustees' Schedule of rate, payment will be made on the basis of Trustees' Schedule of rate; including surcharge in force at the time of acceptance of the tender, if any adopted by the Trustees with due regard to the accepted contractual percentage, if any, thereon, otherwise, if the rates are not available in the KoPT Schedule of Rates, then the Special Rates will be prepared as follows:-

(i) The rate of payment of work involving labour & material shall be fixed on the following basis.

a) Cost of materials consumed including transport and wastage, plus

b) Cost of labour actually engaged in the works, plus

c) Taxes and Duties as applicable, plus

d) 16% on the aggregate of (a) and (b) towards overhead, profit and cess.

(ii) For any work involving only labour, rate of payment shall be fixed on cost of labour actually engaged in the work plus 11% towards profit and cess.

(iii) For only supply of any material at site, rate of payment shall be fixed on actual cost of material plus transport, loading & unloading (if any) plus 11 % towards profit and cess.

47. WORKING PERIOD:

Normally the work will be carried out between 8 A.M. to 5 P.M. on the Trustees' working days only. However, the tenderer should note that he might be required to carry out the job on Sundays, holidays and after normal working hours and at night in addition to the normal working hours to expedite the progress of the work if permitted by Competent Authority. The tenderer should include in his rates the cost, if any, involved on those accounts.

48. BANK GUARANTEE IN LIEU OF CASH SECURITY DEPOSIT:

Security deposit shall be recovered from the On A/C. Bill as per Clause – 3.4 and 3.5 of General Conditions of Contract. However, Bank Guarantee may be considered in lieu of Cash Security Deposit. In that case, the Contractor shall have to submit to the Engineer a performance Bond in the form of an irrevocable guarantee from any Nationalized Bank at Kolkata in the proforma as given in the G.C.C. In this context Clause 3.6 of G.C.C. may be referred to.

49. MEASURES AGAINST POLLUTION: -

The contractor shall have to take proper measures against environmental pollution during execution of work as directed by the Engineer.

The contractor shall, abide by all the regulations and rules of SMPK and those that may be issued from time to time without any extra cost to the KoPT.

50. DEFECT LIABILITY PERIOD:

The defect liability period for the work is 1 (One) year from the date of completion. During this period, if any defect arises the contractor is bound to repair the same or take any other action as directed by the Engineer including replacement of the defective portion and redoing the same at his own cost within 7 days in case of repairing and 21 days in case of replacement and re-doing from receipt of such instruction failing which the work may be done by the Trustees' by some other agencies and the cost of which including 19 1/4 % departmental charges plus GST will be recovered from the security deposit or any other dues of the contractor.

51. ERRORS IN THE B.O.Q :

In case rate of particular item is printed erroneously in BOQ, the rate stated in the Schedule of rates will prevail over the rate misprinted in BOQ.

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SPECIAL CONDITIONS OF CONTRACT-2

1 Water Supply:

The Contractor has to make his own arrangements for water suitable and required for the work and to the colonies and work sites, which are to be established by the Contractor.

2 Electrical Power:

The Contractors will have to make their own arrangements for drawing electric power from the nearest power line after obtaining permission from the State Electricity Board at his own cost. In case of failure of electricity, the Contractor has to make alternative arrangements for supply of electricity by Diesel Generator sets of suitable capacity at place of work. If the supply is arranged by the Department, necessary Tariff rates shall have to be paid based on the prevailing rates.

The contractor will pay the bills of Electricity Board for the cost of power consumed by him.

The contractor shall satisfy all the conditions and rules required as per Indian Electricity Act as amended from time to time and other pertinent rules.

The power shall be used for Departmental works only.

2.1 Electric Power for Domestic Supply:

a) The contractor has to make his own arrangements for the supply of electric power for domestic purposes and the charges for this purpose have to be paid by him at the rates as fixed by the State Electricity Board from time to time.

b) The contractor will have to make his own arrangements to lay and maintain the necessary distribution lines and wiring for the camp at his own cost. The layout and the methods of laying the lines and wiring shall have the prior approval of the **Employer/Employer's representative**. All camp area shall be properly electrified. All lines, streets, approaches for the camp etc., shall be sufficiently lighted for the safety of staff and labour of the contractor, at the cost of the Contractor and it will be subject to the approval of the **Employer/Employer's representative**.

3 Land:

3.1 Land for Contractor's use:

The contractor will be permitted to use KOPT land for execution of work. The contractor shall have to make his own arrangements for acquiring and clearing the site, leveling, providing drainage and other facilities for labour staff colonies, site office, work-shop or stores and for related activities. The Contractor shall apply to the Department within a reasonable time after the award of the contract and atleast 30 days in advance of its use, the details of land required by him for the work at site and the land required for his camp and should any private land which has not been acquired, be required by the contractor for his use. The same may be acquired by the contractor at his own cost by private negotiations and no claim shall be admissible to him on this account.

The Department reserves the right to refuse permission for use of any KOPT land for which no claim or compensation shall be admissible to the contractor. The contractor shall, however, not be required to pay cost or any rent for the land given to him.

3.2 Surrender of Occupied Land:

- (a) The land as here in before mentioned shall be surrendered to the **Employer/Employer's representative** within seven days, after issue of completion certificate. Also no land shall be held by the contractor longer than the Engineer-in-Charge shall deem necessary and the contractor shall on the receipt of due notice from the **Employer/Employer's representative**, vacate and surrender the land which the Engineer-in-Charge may certify as no longer required by the Contractor for the purpose of the work.
- (b) The contractor shall make good to the satisfaction of the **Employer/Employer's representative** any damage to areas, which he has to return or to other property or land handed over to him for purpose of this work. Temporary structures may be erected by the contractor for storage sheds, offices, residences etc., for non-commercial use, with the permission of the **Employer/Employer's representative** on the land handed over to him at his own cost. At the completion of the work these structures shall be dismantled site cleared and handed over to the **Employer/Employer's representative**. The land required for providing amenities will be given free of cost from Government lands if available otherwise the contractor shall have to make his own arrangements.

3.3 Contractor not to dispose off Soil etc.:-

The contractor shall not dispose off or remove except for the purpose of fulfillment of this contract, sand, stone, clay ballast, earth, trees and shrubs or other materials obtained in the excavation made or lying on the site of the work, and all such materials and produce shall remain property of the Government. The Department may upon request from the contractor, or if so stipulated in the conditions of the contract allow the contractor to use any of the above materials for the works either free of cost or after payment as may be specifically mentioned or considered necessary during the execution of the work.

4 Payment for Camp Construction:

No payment will be made to the contractor, operation and maintenance of camp and other camp facilities and the entire cost of such work shall be deemed to have been included in the tendered rate for the various items of work in the schedule of quantities and bids.

5 Labour:

The contractor shall, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.

Labour importation and amenities to labour and contractor's staff shall be to the contractor's account. His quoted percentage shall include the expenditure towards importation of labour amenities to labour and staff;

The contractor shall, if required by the **Employer/Employer's representative**, deliver to the **Employer/Employer's representative** a written in detail, in such form and at such intervals as the **Employer/Employer's representative** may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the contractor on the Site and such information respecting Contractor's Equipment as the **Employer/Employer's representative** may require.

6.1 Transportation of Labour:

- (a) The contractor shall make his own arrangement for the daily transportation of the labour and staff from labour camps colonies to the work spot and no labour or staff of the contractor shall stay at the work spot. No extra payment will be made to the contractor for the above transportation of the labour and his quoted percentage to the work shall include the transportation charges of labour from colonies to work spot and back.
- (b) The contractor will at all times duly observe the provisions of employment of children Act XXVI of 1938 and any enactment or modification of the same and will not employ or permit any person to do any work for the purpose under the provisions of this agreement in contravention of said Act. The contractor here by agrees to indemnify the department from

and against all claims, penalties which may be suffered by the department or any person employed by the department by any default on the part of the contractor in the observance and performance of the provisions of the employment of children Act. XXVI of 1938 or any enactment or modification of the same.

As per Govt. memo No.721/Gr.(1)/81-35, dt:17.11.87. The contractor shall obtain the insurance at his own cost to cover the risk on the works to labour engaged by him during period of execution against fire and other usual risks and produce the same to the Executive Engineer concerned before commencement of work.

6 Safety Measures:

1. The contractor shall take necessary precautions for safety of the workers and preserving their health while working in such jobs, which require special protection and precautions. The following are some of the measures listed but they are not exhaustive and contractor shall add to and augment these precautions on his own initiative where necessary and shall comply with directions issued by the **Employer/Employer's representative** or on his behalf from time to time and at all times.
2. Providing protective foot wear to workers situations like mixing and placing of mortar or concrete sand in quarries and places where the work is done under much wet conditions.
3. Providing protective head gear to workers at places like underground excavations to protect them against rock falls.
4. Providing masks to workers at granulates or at other locations where too much fine dust is floating about and sprinkling water at frequent intervals by water hoses on all stone crushing area and storage bins abate to dust.
5. Getting the workers in such jobs periodically examined for chest trouble due to too much breathing in to fine dust.
6. Taking such normal precautions like fencing and lightening in excavation of trenches, not allowing rolls and metal parts of useless timber spread around, making danger areas for blasting providing whistles etc.
7. Supply work men with proper belts, ropes etc., when working in precarious slopes etc.
8. Avoiding uninsulated electrical wire etc., as they would electrocute the works.
9. Taking necessary steps towards training the workers concerned on the machinery before they are allowed to handle them independently and taking all necessary precautions in around the areas where machines hoists and similar units are working.

7 Fair Wage Clause:

1. The contractor shall pay not less than fair wages to laborer's engaged by him on the work.
2. "Fair" wages means wages whether for time or piecework notified by the Government from time to time in the area in which the work is situated.
3. The contractor shall not with-standing the revisions of any contract to the contrary cause to be paid to the labour, in directly engaged on the work including any labour engaged by the sub-contractor in connection with the said work, as if the labourers had been directly employed by him.
4. In respect of labour directly or indirectly employed in the works for the purpose of the contractors part of the agreement the contractor shall comply with the rules and regulations

on the maintenance of suitable records prescribed for this purpose from time to time by the Government. He shall maintain his accounts and vouchers on the payment of wages to the labourers to the satisfaction of the **Employer/Employer's representative**.

5. The **Employer/Employer's representative** shall have the right to call for such record as required to satisfy himself on the payment of fair wages to the labourers and shall have the right to deduct from the contract amount a suitable amount for making good the loss suffered by the worker or workers by reason of the "fair wages" clause to the workers.
6. The contractor shall be primarily liable for all payments to be made and for the observance of the regulations framed by the Govt. from time to time without prejudice to his right to claim indemnity from his sub-contractors.
7. As per contract labour (Regulation and abolition) Act. 1970 the contractor has to produce the license obtained from the licensing officers of the labour department along with the tender or at the time of agreement.
8. Any violation of the conditions above shall be deemed to be a breach of his contract.
9. Equal wages are to be paid for both men and women if the nature of work is same and similar.
10. The contractor shall arrange for the recruitment of skilled and unskilled labour local and imported to the extent necessary to complete the work within the agreed period as directed by the **Employer/Employer's representative** in writing.

8 Compliance With Labour Regulations:

During continuance of the contract, the contractor and his sub contractors shall abide at all times by all existing labour enactment and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notifications that may be issued under any labour law in future either by the State or the Central Government or the local authority and also applicable labour regulations, health and sanitary arrangements for workmen, insurance and other benefits. Salient features of some of the major labour laws that are applicable to construction industry are given below. The contractor shall keep the Department indemnified in case any action is taken against Department by the competent authority on account of contravention of any of the provisions of any Act or rules made there-under, regulations or notifications including amendments. If the Department is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-observance of the provision stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the contractor, the Engineer-in-charge /Department shall have the right to deduct any money due to the contractor including his amount of performance security. The Department/Engineer-in-Charge shall also have right to recover from the contractor any sum required or estimated to be required for making good the loss or damage suffered by the Department.

The employees of the Contractor and the Sub-contractor in no case shall be treated as the employees of the Department at any point of time.

9 Salient features of some major labour laws applicable to establishment engaged in buildings and other construction work:

The bidder shall implement the following Acts and Amendments thereon invariably and any violation in this regard will lead to penal action as per the provisions of Act.

- (a) **Workmen compensation Act 1923:**The Act provides for compensation in case if injury by accident arising out of and during the course of employment.
- (b) **Payment of Gratuity Act 1972:** Gratuity is payable to an employee under the Act on

satisfaction of certain conditions on separation if any employee has completed 5 years service or more, or on death, the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments, employing 10 or more employees.

- (c) **Employees P.F. and Miscellaneous provision Act 1952:**The Act provides for monthly contributions by the Department plus workers. The benefits payable under the Act are:
 - (i) Pension or family pension on retirement or death, as the case may be.
 - (ii) Deposit linked insurance on the death in harness of the worker.
 - (iii) Payment of P.F. accumulation on retirement/death etc.,
- (d) **Maternity Benefit Act 1951:**The Act provides for leave and some other benefits to women employees in case of confinements or miscarriage etc.
- (e) **Contract Labour (Regulation & Abolition) Act 1970:**The Act provides for certain welfare measures to be provided by the contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided by the Principal Department by Law. The Principal Department is required to take certificate of Registration and the contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Department if they employ 20 or more contract labour.
- (f) **Minimum wages Act 1948:**The Department is supposed to pay not less than the Minimum wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment construction of Buildings, Roads, Runways are scheduled employment.
- (g) **Payment of wages Act 1936:**It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- (h) **Equal Remuneration Act 1979:**The Act provides for payment of equal wages for work of equal nature to Male or Female workers and for not making discrimination against Female employee in the matters of transfers, training and promotions etc.
- (i) **Payment of Bonus Act 1965:**The Act is applicable to all establishments employing 20 or more employees.
- (j) **Industrial Disputes Act 1947:** The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock- out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- (k) **Industrial Employment (Standing Orders) Act 1946:**It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the State and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Department on matters provided in the Act and get the same certified by the designated Authority.
- (l) **Trade Unions Act 1926:**The Act lays down the procedure for registration of trade unions of workmen and Departments. The Trade Unions registered under the act have been given certain immunities from civil and criminal liabilities.
- (m) **Child Labour (Prohibition & Regulation) Act 1986:**The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes, Employment Child Labour is prohibited in Building and Construction Industry.
- (n) **Inter-State Migrant workmen's (Regulation of Employment & Conditions of service) Act 1979:** The Act applicable to an establishment, which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another State). The inter State migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home up to the

establishment and back, etc.

- (o) **The Building and Other Construction workers (regulation of Employment and conditions of service) Act 1996 and the Cess Act of 1996:** All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Department of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First-aid facilities, Ambulance, Housing accommodations for workers near the work place etc. The Department to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.
- (p) **Factories Act 1948:** The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 person or more with aid of power or 20 or more persons without the aid of power engaged in manufacturing process.

10 Liabilities of the Contractor:

10.1 Accident Relief and workmen compensation:

The contractor should make all necessary arrangements for the safety of workmen on the occurrence of the accident, which results in the injury or death of any of the workmen employed by the contractor, the contractor shall within 24 hours of the happenings of the accident and such accidents should intimate in writing to the concerned **Employer/Employer's representative** of the Department the act of such accident. The contractor shall indemnify Government against all loss or damage sustained by the Government resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines if any payable by Govt. as a consequence of Govt. failure to give notice under workmen's compensation Act or otherwise conform to the provisions of the said Act in regard to such accident.

10.2 In the event of an accident in respect of which compensation may become payable under the workmen's compensation Act VIII 23 whether by the contractor, by the Government it shall be lawful for the Executive Engineer to retain such sum of money which may in the opinion of the **Employer/Employer's representative be sufficient to meet such liability. The opinion of the **Employer/Employer's representative** shall be final in regard to all matters arising under this clause.**

10.3 The contractor shall at all times indemnify the Govt. against all claims which may be made under the workmen's compensation act or any statutory modification thereafter or rules there under or otherwise consequent of any damage or compensation payable in consequent of any accident or injuries sustained or death of any workmen engaged in the performance of the business relating to the contractor.

11 Contractor's Staff, Representatives and Labour:

The contractor shall, at all times, maintain on the works, staff of qualified Engineers, and Supervisors of sufficient experience of similar other jobs to assure that the quality of work turned out shall be as intended in the specifications. The contractor shall also maintain at the works, a Work Manager or sufficient status, experience and office and duly authorize him to deal with all aspects of the day-to-day work. All communications to any commitments by the Work Manager shall be considered as binding on the Contractor.

The Contractor shall at all times submit details of skilled and unskilled labour and equipment employed to the Engineer-in-Charge in prescribed proforma as he may require to assess and ensure the proper progress of work.

If the contractor does not employ the technical person agreed to on the work a fine of **Rs.25,000/-**

per day will be imposed. If he does not employ for 30 days, thereafter it becomes a fundamental breach of contract.

12 Accommodation and food:

The contractor should arrange accommodation he needs, at his own cost. The contractor shall make his own arrangements for supply of food grains, fuel and other provision to his staff and labourers including controlled commodities.

13 Relationship:

Contractor shall have to furnish information along with tender, about the relationship he is having with any officer of the Department, of the rank Assistant Engineer and above engaged in the work and any officer of the rank of Assistant Secretary and above of the Department of Government.

14 Protection of adjoining premises:

The contractor shall protect adjoining sites against structural, decorative and other damages that could be caused by the execution of these works and make good at his cost any such damages.

15 Work during night or on Sundays and holidays:

The works can be allowed to be carried out during night, Sundays or authorized holidays in order to enable him to meet the schedule targets and the work shall require MORT&H round the clock working keeping in view:

- (i) The provisions of relevant labour laws being adhered to:
- (ii) Adequate lighting, supervision and safety measures are established to the satisfaction of the **Employer/Employer's representative**

16 Layout of materials stacks:

The contractor shall deposit materials for the purpose of the work on such parts only of the ground as may be approved by the **Employer/ Employer's representative** before starting work. A detailed survey, clearly indicating position and areas where materials shall be stacked and sheds built is to be conducted by the contractor at his own cost and only after obtaining necessary approval of the plan for use of sites by the **Employer/ Employer's representative**, the Contractor can use the sites accordingly.

17 Use of blasting materials:

The contractor is to act in accordance with Indian Explosive Act and other rules prevailing, during the execution of work.

18 Plant and Equipment:

18.1 The contractor shall have sufficient plant, equipment and labour and shall work such hours and shifts as may be necessary to maintain the progress on the work as per the approval progress schedule. The working and shifts hours shall comply with the Govt. Regulations in force.

18.2 It is too expressly and clearly understood that contractor shall make his own arrangements to equip himself with all machinery and special tools and plant for the speedy and proper execution of the work and the department does not undertake responsibility towards their supply.

18.3 The department shall supply such of the machinery that may be available on hire basis but their supply cannot be demanded as matter of right and no delay in progress can be attributed to such non-supply of the plant by the department and the department cannot be made liable for any damage to the contractor. The Contractor shall be responsible for safe custody of the departmental machinery supplied to him (which will be delivered to contractor at the machinery yard at site of work) and he has to make good all damages and losses if any other than fire, wear and tear to bring it to the conditions that existed at the time of issue to the contractor before handing over the same to the department. The hire charges for the machinery handed over to

the contractor will be recovered at the rate prevalent at the time of supply. The contractor will have to execute supplemental agreement with Executive Engineer at the time of supply of the machinery.

18.4 The acceptance of departmental machinery on hire is optional to the contractor.

19 Steel forms (Acrow Steel forms)

Acrow Steel forms or equivalent forms approved by Engineer-in-charge should be used for all items involving and use of centering and shuttering shall be leak proof and single plane without any dents and undulations.

20 Inconvenience to public:

The contractor shall not deposit materials at any site, which will cause inconvenience to public. The Engineer-in-Charge may direct the contractor to remove such materials or may undertake the job at the cost of the contractor.

21 Contract documents and materials to be treated as confidential:

All documents, correspondences, decisions and orders, concerning the contract shall be considered as confidential and/or restricted in nature by the contractor and he shall not divulge or allow access to them by any unauthorized person.

22 General obligations of Contractor:

22.1 The contractor shall, subject to the provision of the contract and with due care and diligence, execute and maintain the works in accordance with specifications and drawings.

22.2 The contractor shall promptly inform the Department and the **Employer/ Employer's representative** of any error, omission, fault and such defect in the design of or specifications for the works which are discovered when reviewing the contract documents or in the process of execution of the works.

22.3 If Contractor believes that a decision taken by the **Employer/ Employer's representative** was either outside the authority given to the **Employer/ Employer's representative** by the Contract or that the decision was wrongly taken, the decision shall be referred to the technical expert within 14 days of the notification of the **Employer/ Employer's representative** decisions.

22.4 Pending finalisation of disputes, the contractor shall proceed with execution of work with all due diligence.

23 Security measures:

23.1 Security requirements for the work shall be in accordance with the Government's general requirements including provisions of this clause and the Contractor shall conform to such requirements and shall be held responsible for the actions of all his staff, employees and the staff and employees of his sub-contractors.

23.2 All contractors' employees, representatives and sub-contractor's employees shall wear identifications badges provided by the contractor. Badges shall identify the contractor, showing and employee's number and shall be worn at all times while at the site. Individual labour will not be required to wear identification badges.

23.3 All vehicles used by the contractor shall be clearly marked with contractor's name.

23.4 The contractor shall be responsible for the security of the works for the duration of the contract and shall provide and maintain continuously adequate security personnel to fulfill these obligations. The requirements of security measures shall include, but not limited to maintenance of order on the site, provision of all lighting, fencing, guard flagmen and all other measures necessary for the protection of the works within the colonies, camps and elsewhere on the site, all materials delivered to the site, all persons employed in connection with the works continuously throughout working and non-working period including nights, Sundays and holidays

for duration of the contract.

- 23.5 Other contractors working on the site concurrently with the contractor will provide security for their own plant and materials. However, their security provisions shall in no way relieve the contractor of his responsibilities in this respect.
- 23.6 Separate payment will not be made for provision of security services and its cost shall be deemed to have been included in the offer of tender / contract.

24 Fire fighting measures:

- (a) The contractor shall provide and maintain adequate firefighting equipment and take adequate fire precaution measures for the safety of all personnel and temporary and permanent works and shall take action to prevent damage to destruction by fire of trees shrubs and grasses.
- (b) Separate payment will not be made for the provision of fire prevention measures.

25 Provisions of Health and Sanitation:

- 25.1 The contractor shall implement the sanitary and watch and ward rules and regulations for all forces employed under this contract and if the Contractor fails to enforce these rules, the **Employer/ Employer's representative** may enforce them at the expenses of the Contractor.
- 25.2 **First Aid:** At the work site there shall be maintained in a readily accessible place, first aid appliances and medicine including adequate supply of sterilized dressing and sterilized cotton wool. The appliance shall be kept in good order. They shall be placed under the charge of a responsible person, who shall be readily available during working hours.

25.3 Drinking water:

Water of good quality for drinking purpose shall be provided for the worker on a scale of not less than 2 gallons per head per day.

- (a) Where drinking water is obtained from an intermittent public water supply each work site shall be provided with a storage tank, where such drinking water shall be stored.
- (b) Every water supply storage shall be at a distance of not less than 10 M. from any latrine drain or other source of pollution where water has to be drained. Any existing well, which is within such proximity of any latrine, drain or other source of pollution, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be dust and water proof.
- (c) A reliable pump shall be fitted to each inner well. The trap door shall be keep locked and opened only for inspection or cleaning which shall be done at least once a month.

25.4

Washing and bathing place:

Adequate washing and bathing places shall be provided separately for men and women. Such place shall be keep clean and well drained, bathing or washing should not be allowed in or near any drinking water well.

25.5 Latrine and Urinals:

There shall be provided within the area of every work site latrines and urinals in an accessible place to men and women separately. For each of them shall be on the following scales or the scale as directed by Engineer-in-charge in any particular case.

- (a) Where the number of persons employed does not exceed 50 –2 No's
- (b) Where the number of persons employed exceeds 50 but does not exceed 100–3 No's
- (c) For every additional 100 –3 No's

If women are employed, separate latrines and urinals separated from those for men shall be provided on the same scale.

Except in work site provided with water flushed latrines connected with a water borne sewage systems all latrine shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. The receipt scales shall be tarred inside and outside at least once a year.

The excrete from the latrines shall be disposed off at the contractors expenses in a way approved by the local public health authority. The contractor shall also employ adequate number of scavengers and conservancy shall to keep the latrines and urinals in a clean condition.

25.6 Shelters during Rest:

At the work site there shall be provided free of cost two suitable sheds, one for meals and other for rest for the use of workers.

25.7 Creches:

At every work site at which 50 or more women workers are ordinarily employed there shall be provided two huts of suitable size for use of children under the age of 6 years. One hut shall be used for infants games and other as a bed room. The hut shall be constructed on a standard not lower than the following.

1. Thatched roofs
2. Mud floors and wall
3. Planks spread over the mud floor and covered with matting. The use of huts shall be restricted to children their attendants and mothers of the children.

25.8 Land should be acquired temporarily for Storing Contractor's materials or for housing their staff. The contractor should make his own arrangements for temporary acquisition of land required for storing his materials and for the housing of his staff at his own expenses.

26 Training of personnel:

The contractor, shall, if and as directed by the **Employer/ Employer's representative** provide free of any charge adequate facilities, for vocational training of Government Officers, students, Engineers, supervisors, foremen, skilled workmen etc. not exceeding six in number at any one time on the contractor's work. Their salaries, allowances etc. will be borne by the Government and the training schemes will be drawn up by the **Employer/ Employer's representative** in consultation with the contractor.

27 Ecological balance:

(a) The contractor shall maintain ecological balance by preventing de-forestation, water pollution and defacing of natural landscape. The contractor shall so conduct his operation as to prevent any unnecessary destruction, scarring, or defacing of the natural surrounding in the vicinity of the work. In respect of the ecological balance, Contractor shall observe the following instructions.

(i) Where unnecessary destruction, scarring, damage or defacing may occur, as result of the operation, the same shall be repaired replanted or otherwise corrected at the contractor's expense. The contractor shall adopt precautions when using explosives, which will prevent scattering of rocks or other debris outside the work area. All work area including borrow areas shall be smoothed and graded in a manner to conform to the natural appearances of the landscape as directed by the **Employer/ Employer's representative**.

(b) Separate payment will not be made for complying with the provisions of this clause and all cost shall be deemed to have been included in the unit rates and prices included in the contract if any provision is not complied with within a reasonable time even after issue of a notice in this respect, the necessary operations would be carried out by the **Employer/ Employer's representative** at the cost of the Contractor, Orders of the **Employer/ Employer's representative** in this respect would be final and binding on the contractor.

28 Preservation of existing vegetation:

- (a) The contractor will preserve and protect all existing vegetation such as trees, on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the **Employer/ Employer's representative**. The contractor will be held responsible for all

unauthorized cutting or damage of trees, including damage due to careless operation of equipment, stockpiling of materials or trekking of grass areas by equipment. Care shall be taken by the Contractor in felling tress authorised for removal to avoid any unnecessary damages to vegetation and tress that are to remain in place and to structures under construction or in existence and to workmen.

- (b) All the produce from such cutting of trees by the contractor shall remain the property of Government and shall be properly stacked at site, approved by the **Employer/ Employer's representative**. No payment whatsoever shall be made for such cutting and its stacking by the Contractor. If any produce from such cutting is not handed over to the Government by the contractor, he shall be charged for the same at the rates to be decided by the **Employer/ Employer's representative**. The recovery of this amount shall be made in full from the intermediate bill that follows.
- (c) The contractor shall also make arrangements of fuel deposits for supply of required fuel for the labourer to be employed for cooking purpose at his own cost in order to prevent destruction of vegetation growth in the surrounding area of the work site.

29 Possession prior to completion:

The **Employer/ Employer's representative** shall have the right to take possession of or use any completed part of work or works or any part thereof under construction either temporarily or permanently. Such possession or use shall not be deemed as an acceptance of any work either completed or not completed in accordance with the contract with in the interest of Clause except where expressly otherwise specified by the Engineer-in-charge.

30 Payment upon termination:

If the contract is terminated because of a fundamental breach of contract by the contractor, the **Employer/ Employer's representative** shall issue a certificate for the value of the work done less advance payment received upon the date of the issue of the certificate and less the percentage to apply to the work not completed as indicated in the contract data. Additional liquidated damages shall not apply. If the total amount due to the Department exceeds any payment due to the contractor the difference shall be a debt payable to the Department. In case of default for payment within 28 days from the date of issue of notice to the above effect, the contractor shall be liable to pay interest at 12% per annum for the period of delay.

31 Access to the contractor's books:

Whenever it is considered necessary by the Engineer-in-Charge to ascertain the actual cost of execution of any particular extra item of work or supply of the plant or material on which advance is to be made or of extra items or claims, he shall direct the contractor to produce the relevant documents such as payrolls, records of personnel, invoices of materials and any or all data relevant to the item or necessary to determine its cost etc. and the contractor shall when so required furnish all information pertaining to the aforesaid items in the mode and manner that may be specified by the Engineer-in-Charge.

32 Drawing to be kept at site:

One copy of the drawings furnished to the contractor shall be kept by the contractor on the site and the same shall at all reasonable time be available for inspection and use by the Engineer-in-Charge and the Engineer-in-Charge's representative and by any other persons authorised by the Engineer-in-Charge in writing.

33 B.I.S. [I.S.I.] books to be kept at site:

A complete set of Indian Standard specifications, CPHEEO manual and also conform to the standard specifications like BIS Specifications/MoRTH/ NBC/NEC/GOI Manuals/GOI advisories etc., on sewerage and treatment and any other relevant literature referred to in "Technical Specifications" shall be kept at site for reference.

34 Site Order Book:

An order book shall be kept at the site of the work. As far as possible, all orders regarding the work are to be entered in this book. All entries shall be signed and dated by the Project Manager of PMC, Department Officer in direct charge of the work and by the contractor or by his representative. In important cases, the Executive Engineer or the Superintending Engineer will countersign the entries, which have been made. The order book shall not be removed from the work, except with the written permission of the Executive Engineer.

35 Variations by way of modification, omissions or additions:

For all modifications, omissions from or additions to the drawings and specifications, the **Employer/ Employer's representative** will issue revised plans, or written instructions, or both. No modification, omission or addition shall be made unless approved by the Department.

The **Employer/ Employer's representative** shall have the privilege of ordering modifications, omission or additions at any time before the completion of the work and such orders shall not operate to annul those portions of the specifications with which said changes do not conflict.

Employer/ Employer's representative Decision:

It shall be accepted as in separable part of the contract that in matters regarding materials, workmanship, removal of improper work, interpretation of the contract drawings and contract specification, mode of the procedure and the carrying out of the work, the decision of the **Employer/ Employer's representative**, which shall be given in writing, shall be binding on the contractor.

36 Care and diversion of river/stream:

The contractor shall submit details regarding the diversion and care of river or stream during construction of the work along with a separate print-out of the time table showing earliest and latest start and finish dates of various activities. He should submit a detailed layout plan with drawings for the diversion and care of river during construction of work. The above arrangements shall be at contractor's cost.

37 Goods and Service Tax (GST) on works contract:

The percentage quoted by the contractor is exclusive of Goods and Service Tax (GST) but inclusive of other taxes on all materials that the contractor will have to purchase for performance of this contract.

GST component loaded in Part 'B' of the estimate shall be added in each bill of the contractors who opt for composition scheme and recovered.

The contractor should produce a valid GST Clearance Certificate before the payment of the final bill, otherwise payment to the contractor will be withheld.

Any revision in Tax rates will be implemented as per rules from time to time.

Any revision in Tax rates will be implemented as per rules.

38 Labour Cess: As per the Building and other Construction Workers Welfare CESS Act, 1996, Section 3 of CESS Act, read with rule 4(3) of the cases rules and in accordance with S.O.No.2899, dt.28-03-1996 of Government of India, 1% CESS will be deducted from the bills payable to the contractor.

39 Supply of materials:

- (i) The contractor has to make his own arrangements for procurements, supply and use of materials.
- (ii) All materials so procured should conform to the relevant specifications indicated in the bidding documents.
- (iii) The contractor shall follow all regulations of the Department/Government of India in respect of import licenses etc., of the procurement of the materials is through imports and he shall be responsible for the payment of applicable duties and taxes, port clearances, inland transportation etc.

40 Setting Out

40.1 The contractor shall establish, maintain and assume responsibility for grades, lines, levels and bench marks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions to the Engineer-in-Charge before commencing work. Commencement of work shall be regarded as the contractor's acceptance of such grades, lines, levels and dimensions and no claim shall be entertained at a later date for any errors found.

40.2 In order to set the alignment of buildings / foundations and to mark the same on the ground, the agency is to adopt "total station" surveying method. The agency is to engage a well versed and well experienced surveyor in "total station" survey. Nothing extra for this total station survey is payable.

If at any time, any error in the respect of setting out appears during the progress of the work, the contractor shall, at his own expense rectify such error if so required, to the satisfaction of the Engineer-in-Charge.

Though the site levels are indicated in the drawings, the contractor shall ascertain himself and confirm the site levels with respect to GTS bench mark from the concerned authorities. The contractor shall protect and maintain temporary/ permanent benchmarks at the site of work throughout the execution of the work. These bench marks shall be got checked by the Engineer-in-Charge or his authorized representatives.

The work at different stages shall be checked with reference to bench marks maintained for the said purpose. Nothing extra shall be payable on this account.

The approval by the Engineer-in-Charge, of the setting out by the contractor, shall not relieve the contractor of any of his responsibilities and obligation to rectify the errors/defects, if any, which may be found at any stage during the progress of the work or after the completion of the work.

40.3 The contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignments, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the contractor at his own cost to the instructions and satisfaction of the Engineer-in-Charge.

40.4 The Contractor shall carry out survey of the work area, at his own cost, setting out the layout of building in consultation with the Engineer-in-Charge & proceed further. Any discrepancy between the architectural drawings and actual layout at site shall be brought to the notice of the Engineer-in-charge. It shall be responsibility of the Contractor to ensure correct setting out of alignment.

Total station survey instruments only shall be used for layout, fixing boundaries, and center lines, etc., along with theodolites. Nothing extra shall be payable on this account.

40.5 Contractor shall provide permanent bench marks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of work. All such reference points shall be in relation to the levels and locations, given in the Architectural and plumbing drawings.

41 General cleanliness of the site and Stacking & Storage of Materials:

41.1 The site of work shall be always kept clean in general strictly adhering to approved job layout and green building parameters. The Contractor shall take all care to prevent any water- logging at site. The waste water shall not be allowed to be collected at site. It may be directly pumped into the public drainage system with prior approval of the concerned authorities. For discharge into public drainage system, necessary permission shall be obtained from concerned authorities after paying the necessary charges, if any, directly to the authorities. The work shall be carried out in such a way that the area is kept clean and tidy. All the fees/charges in this regard shall be borne by the Contractor. Nothing extra shall be payable on this account.

41.2 The contractor shall take instructions from the Engineer-in-Charge regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, compound wall, services etc. are to be constructed.

41.3 The contractor shall construct suitable godowns, yard at the site of work for storing all other materials so as to be safe against damage by sun, rain, damages, fire, theft etc. at his own cost and also employ necessary watch and ward establishment for the purpose at his cost.

42 Scaffolding & Staging (General):

- 42.1 Wherever required for the execution of work, all the scaffolding shall be provided and suitably fixed, by the contractor. The scaffolding shall be provided strictly with steel double scaffolding system, suitably braced for stability, with all the accessories, gangways, etc. with adjustable suitable working platforms to access the areas with ease for working and inspection. Single scaffolding system is strictly prohibited and shall invite necessary action. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. Nothing extra shall be payable on this account. It shall be ensured that no damage is caused to any structure due to the scaffolding.
- 42.2 The contractor should submit the shop drawings of staging and shuttering for approval of Engineer-in-Charge before actually commencing the execution of work under the item. Nothing extra shall be payable on this account.

43 SECRECY

- 43.1 The contractor shall take all steps necessary that all persons employed on any work in connection with the contract have noticed that the Indian Official Secrets Act 1923 applies to them & will continue so to apply even after the execution of such works under the contract.
- 43.2 The contract is confidential and must be strictly confined to the contractor's own use (except so far as confidential disclosure to sub-contractors or suppliers as necessary) and to the purpose of the contract.
- 43.3 All documents, copies thereof & extracts there from furnished to the contractor shall be returned to the Engineer-in-Charge on the completion of the work / works or the earlier determination of the contract.

44 LABOUR AND SECURITY

- 44.1 In the event of the contractor(s) committing a default or breach of any of the provisions of the Contractor's Labor Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing any statement under the provisions of the above Regulations and Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the Government a sum not exceeding Rs.500/- for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to Rs.500/- per day for each day of default. The decision of the Engineer-in-Charge shall be final and binding on the parties.

No payment shall be made for construction of labor housing.

- 44.2 The Contractor shall display all permissions, licenses, registration certificates, other statements etc. under various labor laws and other regulations applicable to the works, at his site office.
- 44.3 Contractor should provide his plan for labor huts as per his requirement and get it approved from the Engineer-in-Charge. The contractor will be provided space for labor huts etc. inside the campus at a suitable place, but the space requirement and location, as assessed by Engineer-in-Charge shall be final and binding.
- 44.4 If as per the rules of the local authority, the huts for labor are not to be erected at the site of work by the contractors, the contractors are required to provide such accommodation as is acceptable to local bodies and nothing extra shall be paid on this account.
- 44.5 Contractor has to follow the security requirement of the campus and obtain necessary entry passes for the labor and vehicles and follow security checks at entry / exit gates, restriction on movement of vehicle, restricted timings of working etc. The Department however shall assist the contractor in obtaining such passes for movement of vehicles and labor. No claim whatsoever shall be entertained on account of delay in entry of vehicles and labor including restrictions in working hours, if there is any.
- 44.6 The contractor shall employ only Indian Nationals after verifying their antecedents and loyalty. The contractor shall, on demand submit list of his agents, employees and work people concerned & shall satisfy as to the bonafides of such people.
- 44.7 The contractor & his work people shall observe all relevant rules regarding security promulgated

in which work is to be carried out by the Controlling Administrative Authority of the campus/area (hereinafter referred to as "Administrator").

- 44.8 The contractor, his representative, workman shall be allowed to enter through specified gates & timing as laid down by the controlling authority. They shall be issued an identity card or an individual pass in accordance with the standing rules & regulations & they should possess the same while working. The contractor shall be responsible for the conduct & actions of his workmen, agents/ representatives.
- 44.9 Normally contractor shall be allowed to carry out work between 7 AM to 6 PM. However, he may also be allowed to carry out the work beyond 6 PM & up to 7 AM if the site conditions / circumstances so demand with prior written permission from the "Administrator". However, if the work is carried out in more than one shift or at night, no claim on this account shall be entertained.
- 44.10 Normally contractor's material / vehicles etc. shall be allowed to move in / go-out between 7 AM to 7 PM only & no movement of material / vehicles out of site of work shall be allowed during night hours unless specific permission is obtained from the "Administrator".
- 44.11 In case if a separate entry has been allowed, the contractor has to make all arrangement for making a separate entry gate and barricading of the working area to segregate/separate the same from other areas. All these have to be done by the contractor at his own cost including safeguarding any untoward incident in the restricted area due to separate entry gate and barricading arranged by the contractor. No extra amount on this account shall be payable by the department.
- 44.12 In the event of any restrictions being imposed by the Security agency, movement of labor /material, the contractor shall strictly follow such restrictions and nothing extra shall be payable to the contractor on such accounts. The loss of time on these accounts, if any, shall have to be made up by augmenting additional resources whatever required. Nothing extra shall be payable on this account.

45 DOCUMENTATION

The Contractor shall render all help and assistance in documenting the total sequences of this project by way of photography, slides, audio / video recording & other records etc. Nothing extra shall be payable to Contractor on this account. However, cost of photographs, slides, audio / video graph etc. shall be borne by the Department. The original films shall be the property of the Department. No copy shall be prepared without the prior approval of the Engineer- in – Charge.

46 PROGRESS CHART: -

- 46.1 The contractor shall submit a Time and Progress Chart for each mile stone. **The Engineer-in-charge may within 15 days thereafter, if required modify, and communicate the program approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved by the Engineer-in-charge. The work programme shall include all details of balance drawings and decisions required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work.** The chart shall be prepared in direct relation to the time stated in the Contract documents for completion of items of the works. It shall indicate the forecast of the dates of commencement and completion of various trades of sections of the work and may be amended as necessary by agreement between the Engineer-in-charge and the Contractor within the limitations of time imposed in the Contract documents, and further to ensure good progress during the execution of the work, the contractor shall in all cases in which the time allowed for any work, exceeds one month (save for special jobs for which a separate programme has been agreed upon) complete the work as per mile stones given elsewhere in this tender document.

46.2 The contractor shall submit the **Time and Progress Chart**

46.3 The program chart should include the following: -

- a) Descriptive note explaining sequence of various activities.
- b) **PERT or CPM** of programming using **MS Project or Primavera** or in other format decided by Engineer-in-charge which will indicate resources in financial terms, manpower and specialized equipment's or every important stage.
- c) Program for procurement of materials by the contractor.
- d) Program for arranging and deployment of manpower both skilled and unskilled so as to achieve targeted progress.
- e) Program of procurement of machinery / equipment's having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the contractor. In addition, to the above to achieve the progress of work as per programme, the contractor must bring at site adequate shuttering material required for cement concrete and RCC works etc. The contractor shall submit shuttering schedule adequate to complete the structure work within the laid down physical milestones.
- f) Programme for achieving milestones.

46.4 The submission for approval by the Engineer-in-charge of such programme or such particulars shall not relieve the contractor of any of the duties or responsibilities under the contract. This is without prejudice to the right of Engineer-in-charge to take action against the contractor as per terms and conditions of the agreement.

47 PROGRESS AND MONITORING OF WORK:

47.1 The progress report shall contain the following, apart from whatever else may be required as specified:-

- (i) Progress chart of the various components of the work that are planned and achieved, for the month as well as cumulative up to the month, with reason for deviations, if any in a tabular format.
- (ii) Plant and machinery statement, indicating those deployed in the work.
- (iii) Man-power statement, indicating individually the names of all the staff deployed on the work, along with their designations. Number of skilled workers and unskilled workers deployed on the work and their location of deployment.
- (iv) Financial statement, indicating the broad details of all the running account payment received up to date, such as gross value of work done, advances taken, recoveries effected, amount withheld, net payments details of cheque payment received, extra /substituted /deviations items if any, etc.

47.2 The contractor shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other contractor(s) or by the Engineer-in-Charge and shall as far as possible arrange his work and shall place and dispose of the materials being used or removed so as not to interfere with the operations of other contractor or he shall arrange his work with that of the others in an acceptable and coordinated manner and shall perform it in proper sequence to the complete satisfaction of Engineer-in-charge.

47.3 The Contractor shall do proper sequencing of the various activities by suitably staggering the activities within various pockets in the plot so as to achieve early completion. The agency may deploy adequate equipment, machinery and labor as required for the completion of the entire work within the stipulated period specified. Also ancillary facilities shall be provided commensurate with requirement to complete the entire work within the stipulated period. Nothing extra shall be payable on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machineries etc.

provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work.

- 47.4 All material shall only be brought at site as per program finalized with the Engineer-in-Charge. Any pre-delivery of the material not required for immediate consumption shall not be accepted and thus not paid for.

48 PROJECT REVIEW MEETINGS:

The contractor, immediately on award of work shall submit details of his key personnel to be engaged for the work at site. In addition, he shall furnish the Engineer-in-charge detailed organization involved with the work.

The contractor shall present the programme and status at various review meetings as required.

Monthly Review Meetings: Shall be attended by Project - in - charge and the Management Representative who can take independent decisions along with Client.

Agenda

- a) Progress Status/Statistics.
- b) Completion Outlook.
- c) Major hold ups/slippages.
- d) Assistance required.
- e) Critical issues.
- f) Any decision on queries raised either by Contractor/PMC.
- g) Anticipated cash flow requirement for next two months.

49 Rates and other conditions for payment:

The rates quoted by the Contractor are deemed to be inclusive of the following--

- 49.1 All labor, material, tools and other inputs involved in the item.
- 49.2 For completing the work in time, the Contractor might be required to work in two or more shifts (including night shifts). No claim whatsoever shall be entertained on this account, notwithstanding the fact that the Contractor may have to pay extra amounts for any reason, to the laborers and other staff engaged directly or indirectly on the work according to the provisions of the labor and other statutory body regulations and the agreement entered upon by the Contractor with them.
- 49.3 The Contractor shall keep himself fully informed of all acts and laws of the Central & State Governments, all orders, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and bye-laws shall be adhered to, by the contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the local authorities. The Contractor shall arrange to give all notices as required by any statutory / regulatory authority and obtain all requisite licenses wherever required and shall pay to such authority all the fees that are required to be paid for the execution of work. He shall protect and indemnify the Department and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts. The fee payable to statutory authorities for obtaining the various permanent service connections and Occupancy Certificate for the building shall be borne by the Department.
- 49.4 The rates of the items indicated in the BoQ are exclusive of the Seigniorage Charges. Appropriate Seigniorage Charges for relevant materials will be calculated and paid by the PM to the concerned department at the time of payment of bills to the contractor.
- 49.5 All ancillary and incidental facilities required for execution of work like labor camp, stores, fabrication yard, offices for Contractor, watch and ward, temporary ramp required to be made

- for working at the basement level, temporary structure for plants and machineries, water storage tanks, installation and consumption charges of temporary electricity, telephone, water etc. required for execution of the work, liaison and pursuing for obtaining various No Objection Certificates, completion certificates from local bodies etc., protection works, barricading, testing facilities / laboratory at site of work, facilities for all field tests and for taking samples etc. during execution or any other activity which is necessary (for execution of work and as directed by Engineer-in-Charge), shall be deemed to be included in rates quoted by the Contractor, for various items in the schedule of quantities. Nothing extra shall be payable on these accounts. Before start of the work, the Contractor shall submit to the Engineer-in-Charge, a site / construction yard layout, specifying areas for construction, site office, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, etc.
- 49.6 The Contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and indemnify the Department from any and all damages and claims that may arise on any account. The Contractor shall indemnify the Department against all claims in respect of patent rights, royalties, design, trademarks of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the Department in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account.
- 49.7 The Contractor shall make all necessary arrangements for protecting from rain or likewise extreme weather conditions, the work already executed and for carrying out the further work, during monsoon including providing and fixing temporary shelters, protections etc. Nothing extra shall be payable on this account. Also, no claims for hindrance shall be entertained on this account.
- 49.8 In case of flooding of site on account of rain or any other cause and any consequent damage, whatsoever, no claim financially or otherwise shall be entertained notwithstanding any other provisions elsewhere in the contract agreement. Also, the Contractor shall make good, at his own cost, the damages caused, if any. Further, no claims for hindrance shall be entertained on this account.
- 49.9 No payment shall be made for any damage caused by fire, rain, snowfall, flood or any other natural calamity, whatsoever during the execution of the work. The contractor shall be fully responsible for any damage to the govt. property and the work for which payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The contractor shall be fully responsible for safety and security of his material, T&P/Machinery brought to the site by him. The contractor shall maintain all the work in good condition at his own cost till the completion of the entire work.
- 49.10 In case the same item appears more than once in the schedule of work under the same sub head or among the different sub heads of works, the lowest rate quoted for that item shall be taken for other items also and tender will be evaluated accordingly.
- 49.11 The ESI and EPF contribution on the part of employer in respect of this contract shall be paid by the contractor. These contributions on the part of employer paid by the contractor shall be reimbursed by the Engineer in charge to the contractor on actual basis. The applicable and eligible amount of EPF& ESI shall be reimbursed preferably within 7 days but not later than 30 days of submission of documentary proof of payment which are in order.
- 50** The defect liability / maintenance period shall be 36 months after the date of completion of work for this contract agreement. The Security Deposit shall be released after the defect liability period of 36 months after completion of work and for this, the contractor shall have to produce a certificate stating that no defects are pending for rectification from the Engineer-in-charge, but subject to other provisions specified elsewhere in the contract agreement.
- 51** The appellate authority is Superintending Engineer in respect of designs and drawings approved by Engineer-in-charge.
- 52** The appellate authority is Chief Engineer in respect of designs and drawings approved by Superintending Engineer.

- 53** The appellate authority is the Committee constituted by the Government in respect of designs and drawings approved by Chief Engineer.
- 54** M. Books and L.F. Books have to be issued by the Executive Engineer to contractor duly certified and numbered for recording measurements and levels. The M. Books and L.F. Books shall be maintained by contractor and bills are to be submitted to the Engineer in Charge by the contractor along with a true extract of the entire set for checking and making payment. The Engineer-in-charge has to keep the full set of true extract with him and return the originals to the contractor for further use. The entire original record shall be finally handed over for record to the Engineer-in-charge by the contractor.
- 55** Wherever Quality Control agencies are in existence, such agency has to furnish certificates as prescribed separately. The designs are to be submitted by the executing agency which shall be approved by the competent authority. The contractor responsible for the technical features of designs. The competent authority approving the designs is accountable to the department.
- 56** The Contractor shall prepare monthly work bills based on measurements of work done and submit to Engineer-in-charge.
- 57** Payments shall be regulated in accordance with Clause of general conditions of contract Schedule of Payments component wise.
- 58** The eligibility for payment shall be limited to completed portions of works, subject to other conditions envisaged in the agreement and executive instructions from time to time.
- 59** The Sub Divisional Officer and Engineer-in-charge shall exercise check to see that the bill submitted by contractor is in accordance with agreement conditions and certified by the departmental Quality Control Authorities (or) 3rd Party Quality Control Agency (or) by both if both are deployed on the work.
- 60** Engineer-in-charge (E.E) should check the claim with reference to the measurements recorded to see that the percentage at which the bill is claimed is clearly traceable into the documents on which payments are to be made. Payments shall be adjusted for recovery of advance payments, liquidated damages in terms of agreement conditions, security deposit for due fulfillment of the contract.
- 61** **ROLES AND RESPONSIBILITIES OF CONSTRUCTION STAFF, QUALITY CONTROL WING AND THIRD PARTY QUALITY CONTROL AGENCY IN EXECUTION OF PROJECT**

62.1 **FIELD STAFF**

- (i) The field staff (construction staff) has to associate with the contractor while conducting the tests. In case of necessity they may conduct tests independently whenever required. The field staff play a vital role in quality assurance of the works.
- (ii) The field staff shall invariably check and produce all the following Records and OK cards maintained by contractor at the site to the Inspecting Officers.

62.2 **Registers**

- (a) Site Order
- (b) Register of Bench Marks
- (c) Material OK Register
- (d) Register of Foundations
- (e) Register of placement for concrete, Embankment, reinforcement and other test reports.
- (f) Register of laying pipelines, testing.
- (g) Register of test reports of comprehensive strength of concrete specimens

(h) Cement Day Book

In case of Earthwork excavation embankment, the field staff have to check and record the pre levels 25% of the pre levels taken by the contractor. In case of cut-off and foundations the field staff have to check and record 100% levels.

62.3 Department Quality Control Staff.

- (i) The Department Quality Control staff shall verify the records maintained at site by contractor and the third party quality control agency. The filed quality control staff have to check 25% of works such as pipes, laying, jointing, testing including pumping machinery and record independently.
- (ii) Wherever the Third Party Quality Control agency is not appointed, the department Quality Control staff have to issue the quality certificates for releasing payment to the contractor during construction and other completion.

62.4 Third Party Quality Control Agency

- (i) The Third Party Quality Control agency or PMC should possess all the Testing facilities as per agreement and conduct independent testing to assure the quality of work. They should also verify 10% of the tests being done by the Contractor independently.
- (ii) The third party quality control agency has to submit the reports and records to the Engineer-in-Charge vide appendix "E".

62.5 Recording of measurements and certifying payments to the Contractor.

- (i) Measurements are to be recorded by the contractor in the Measurement Book and LF Books.
- (ii) The measurement book and LF book are to be issued by the concerned Executive Engineer duly certified and numbered.
- (iii) Field Engineer have to verify and record
 - a) 1/3rd of pre levels taken by Contractor.
 - b) 100% Levels in case of cut off & foundations.
 - c) 25% of intermediate work done levels
 - d) 100% for final levels recorded by contractor
- (iv) All measurements recorded by the contractor in the M. Books shall be checked to 100% extent by AEs/AEEs.
- (v) DEEs, EEs & SEs have to check the above levels and measurements as per standing codal provisions and orders.
- (vi) Wherever quality control agencies are in existence, such agency has to record its findings in M. Books/L.F. Books besides furnishing certificates as prescribed separately.
- (vii) The Department QC Staff have to check 25% of the work such as pipes, laying, jointing, testing, concrete work, etc.
- (viii) Measurement will be recorded by the contractor for the finished work duly certifying that all tests are conducted and work done by the agency in accordance with specifications and contracts conditions by using the material specified in the contract.
- (ix) The contractor shall prepare monthly work bills based on the recorded measurement of work done and submit to the Engineer-in-charge duly signed by them or his authorized signature for arranging
- (x) The Engineer-in-Charge shall recommend for release of payment duly ensuring quality certificate by the third party quality control agency / Department quality control staff (in absence of third party quality control).

- (xi) **If a PMC is appointed by the Authority, the guidelines shall be followed as per the PMC agreement.**

NOTE: The above guidelines have to be followed duly inter relating with the relevant conditions / clauses of the respective Agreements concluded.

62.6 Reporting procedure for adverse remarks of 3rd party Quality Control Agency and Departmental Quality Control Staff or PMC whichever is applicable.

- (i) The third party quality control agency shall submit reports in four sets for specific cases of deficiencies for corrective action to the Engineer-in-charge soon after verification. The sub-standard material shall be rejected and got them removed from the site. In case necessity, Engineer-in- Charge shall arrange to stop the work till the deficiencies are rectified to the satisfaction of the 3rd party Quality control Agency / departmental quality staff / PMC.
- (ii) The Engineer-in-Charge shall communicate the above remarks of 3rd party quality control agency to the Contractor for compliance of corrective action.
- (iii) The Contractor shall furnish compliance report to the Engineer-in-Charge, who in turn forward the same to the third party quality control agency / department quality control as the case may be for verification.
- (iv) Soon after receipt of report on the compliance to the remarks of the third party quality control agency by the Contractor, evidence of compliance of corrective action has to be furnished to the Engineer-in-Charge to proceed with further work.
- (v) In addition to the above, the observations made by the third party quality control and the Department quality control staff have to be invariably completed with before the next bill is present for payment and certificate to that effect has to be recorded in bills presented by the Contractor duly countersigned by their field construction staff before making payments.
- (vi) On completion of the works, the third party control agency and Department Quality Control staff have to certify that the work has been executed as per design and specifications satisfying intended scope of project as indicated in the agreement before making final payments to the Contractor.

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PREAMBLE

These Specifications cover the items of work in structural and non- structural parts of the works coming under Preview of this document. All work shall be carried out in conformation with this. In general, provisions of Indian Standards, Indian Roads Congress Codes and other national standards have been followed. These specifications are not intended to cover the minute details. The work shall be executed in accordance with best modern practices. All codes and standards referred to in these specifications shall be the latest thereof.

INCLUSIVE DOCUMENTS

The provision of Special Conditions of Contract, General Conditions of Contract, those specified on the tender as well as execution drawings and notes or other specifications issued in writing by the PMC / Engineer shall form part of these specifications.

ORDER OF PRECEDENCE, CLARIFICATION AND INTERPRETATION

When the various specifications and codes referred to in preceding portion are at variance with these specifications and each other the following order of precedence will generally be accepted.

- 1.1. Special conditions of contract, item wise technical specifications if provided and execution drawings.
- 1.2. Provisions of general specifications.
- 1.3. I. S. Codes.
- 1.4. IRC Codes, M. O. S. T./ M.O.R.T.H, Specifications etc.

The attention of the contractor is drawn to those clauses of IS codes which require either specification by Engineer or the mutual agreement between the supplier and purchaser. In such cases it is the responsibility of the contractor to seek clarification on any uncertainty and obtain previous approval of the Engineer before taking up the supply/ construction.

MEASUREMENT AND PAYMENTS

The methods of measurement and payment shall be as described under various items and in the bill of quantity. Where specific definitions are not given, the methods described in IS 1200 will be followed. Should there be any detail of construction or materials which has not been referred to in specification or in the bill of quantities and drawings but the necessity for which may be implied or inferred wherefrom, or which are usual or essential to the completion of the work in the trades, the same shall be deemed to be included in the rates and prices quoted by the contractor in the bill of quantities.

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UNACCEPTABLE WORK

All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the Engineer-in-charge, the cost of repairs will be borne by the contractor. In the event of the work being accepted by giving 'Design Concession', arising out of but not limited to under sizing, under strength, shift in location and alignment, etc. and accepting design stresses in members which are higher than those provided for in the original design or by accepting materials not fully meeting the specifications etc. the contractor will be paid for the works actually carried out by him at the suitable reduced rate of the tendered rates for the portion of the work thus accepted.

GENERAL SPECIFICATION

- 1.5.** These specifications are for work to be done, item to be supplied and materials to be used in the works as shown and defined on the drawings and herein to the satisfaction of the Owner/ Architect.
- 1.6.** The workmanship is to be the best possible and of a high standard. The contractor shall take all steps immediately to make up deficiency if any noticed by the Owner/ Architect. Use must be made of special tradesmen in all aspects of the work and allowance must be made in the rates for the same.
- 1.7.** The materials to be provided by the contractor shall be in accordance with the samples already got approval from the Owner / Architect by the contractor and in conformity with specification and approved is list of manufacture and brand. The contractor shall produce all invoices, vouchers or receipts for any materials if called upon to do so by the Owner/ Architect.
- 1.8.** A sample of all materials is to be submitted to the Owner/ Architects for their approval before the contractor orders or delivers the material to the site. Samples together with their packing are to be provided free of charge by the contractor and should any materials be rejected they will be removed from the site at the contractor's expense. All samples will be retained by the Owners / Architects for comparison with materials which will be delivered at site. Also the contractor will be required to submit specimen finishes colours, Glass, etc., for approval of the Owners/ Architects before proceeding with the works.
- 1.9.** The contractor shall be responsible for providing and maintaining temporary coverage required for the protection of finished work. He is also to clean out all wood shavings; cut ends and other waste from all parts of the works before covering of infillings are constructed.
- 1.10.** Contractor shall maintain uniform quality and consistency in workmanship throughout the execution of the work.
- 1.11.** The contractor shall provide: All materials, labour, maintenance, fixing, carrying, cleaning, and making good, etc. temporary canvas, plastics and any other requisite protection of the works, all the necessary equipments, labour and removal of the same at the completion of the work. The Architect will be the sole judge in deciding as to the suitability of the tools or plants that may be brought on the works by the contractors, for the proper execution of the work.
- 1.12.** The head masons and the supervisors on the works shall always carry with them a two feet rule, a measuring tape (15 mts.) a spirit level, a plumb bob and a square and shall check that the work is being done according to the drawings and specifications.

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The Architect or its representative will use any OR all measuring instruments/ tools belonging to the Contractors in checking the works executed.

- 1.13.** All measuring tapes shall be of steel and scaffolding and ladders that may be required for taking measurements shall be supplied by the Contractors.
- 1.14.** The Contractor shall place at the disposal of the Employer and the Architect and the advice of himself and his firm, and their staff or Foreman of trades or other skilled person employed by him or them for the conduct of the works comprised in the Contract.
- 1.15.** The Contractors are to take care in loading and unloading materials for the works, so that the roads and footpaths are not obstructed, damaged or the traffic impeded, and they must conform with the Police Regulations for carrying, loading and unloading all materials, plant, earth, debris, etc. to and from the buildings.
- 1.16.** The Architect shall have full powers and authority to issue such instructions as to the order of proceeding with or carrying out the work as he may deem necessary for the guidance of the Contractor and contractor shall be bound by such instructions of the Architect or any person authorized by the Architect to give such instructions.
- 1.17.** The levels and measurements of the existing site, as shown in the drawings, are believed to be correct, but the Contractor should verify them for himself. No claim or allowance whatsoever will be entertained hereafter on account of any errors or omission in the description of the site turning out different from what was expected or shown in the drawings.
- 1.18.** All floors, paving, staircase, etc. are to be scrubbed, all glasses to be cleaned on both sides of windows/curtain wall including its members, screens, doors, sky-lights, roof lights, etc., all gully, gutters, pipe heads, etc. to be cleaned out and the premises left clean, perfect and water tight upon completion. However, a proper care needs to be taken during such cleaning works that the original finishing such as polishing, painting, anodizing, powder coating etc. are not scratched/damaged. In case of any such damage, the contractor shall have to reinstate the same as original as per the instructions of Employer/Architects, without any cost to Employer.
- 1.19.** The Contractor shall work in co-ordination with all electrical, Air-Conditioning/HVAC, Fire Fighting/Detection, Security System and any other contractors working for other works involved in the project and provide all necessary assistance to them for successful completion of the project.
- 1.20.** Any loss or damage caused due to fault or negligence on the part of Contractors labours, staff etc. during working in the premises will be made good by contractor at no extra cost or the damage and repair cost will be reimbursed in full to the Employer.
- 1.21.** The contractor shall be responsible to provide and maintain temporary coverage required for the protection of finished work. He is also required to clean out all wood shavings; cut ends and other waste from all parts of the works before covering of infillings are constructed.
- 1.22.** The contractor shall be responsible for providing and maintaining any boxing or other temporary coverage's required for the protection of dresses or finished work if left un-protected. He is also to clean out all shavings, cut ends and other waste from all parts of the work before coverings or in-fillings are constructed.

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- 1.23. Templates, boxes and moulds shall be accurately set out and rigidly constructed so as to remain accurate during the time they are in use.
- 1.24. All unexposed surfaces of timber e.g. backing fillets, backs of door frames, cupboard framing, grounds, etc., are to be treated with two coats of approved timber preservative before fixing or covering.
- 1.25. All the contractors should consider the below mentioned points before quoting for the job.
 - 1.25.1. All vitrified tiles/granite/marble samples to be approved prior to fix the same wherever mentioned.
 - 1.25.2. The expenses for paying Municipal Taxes for dumping materials on/off site, etc. to be borne by the contractor.
 - 1.25.3. Expenses of bearing ward officer's sanction, etc. To be borne by the contractor.
 - 1.25.4. Contractor should be responsible for the security of the materials on site.
 - 1.25.5. Contractor should be responsible for lifting of the material to the respective floors and expenses of the same should be borne by him.

GENERAL SPECIFICATIONS FOR MATERIAL AND WORKMANSHIP

- 1.26. All materials brought on the site of works and meant to be used for the said project site, shall be as per the approved makes mentioned and shall be deposited with architect before the order for the materials is placed with the suppliers / manufacturers and should be prior approved from the Architect before execution.
- 1.27. The workmanship is to be the best available and of a high standard, use must be made of a special tradesman in all aspects of the work and allowances must be made in the rates for so doing.
- 1.28. Workmanship: All works shall be to true line, level, plumb and square corners, edges and arises in all cases shall be unbroken and finished neat. Only first class workmanship will be accepted. Contractor shall maintain uniform quality and consistency in workmanship throughout the execution of the work.
- 1.29. Skilled head masons/ tradesman for the respective trades shall be employed by the contractors to check the work in progress and to instruct and extract the right kind of workmanship from the men employed on the works. Instructions given to such Head masons by the Architect or his Representative shall be carried out with a view to get the work executed in a neat and workman like manner, according to the specifications.
- 1.30. The Architect may order for the inspection of any finished work as he chooses and in a manner he decides, and the contractors shall bear all expenses in this connection. If the results of such inspection prove that the material used and/or workmanship is not of the standard required, the work will be rejected and removed forthwith and be replaced by works of the accepted standard of quality and material. The rejected material must be stored in separate room created to keep such non standard/ rejected materials with proper labelling of "REJECTED MATERIAL STORE" and will be there till it gets disposed off from site. This is done to demark the rejected material properly.
- 1.31. The contractor shall produce all invoices vouchers or receipts for any materials if called upon to do so by the Employer /Architects.
- 1.32. Samples together with their packing are to be provided free of charge by the Contractor and

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should any materials be rejected, they will be removed from the site at the Contractor's expense. All samples will be retained by the Employer/Architects for comparison with materials, which will be required to submit specimen finishes of colours, fabrics, etc., for the approval of the Architects before proceeding with the work.

STACKING AND STORING OF MATERIALS

1.33. CEMENT

In case cement is received in bags. Cement shall be stored at the work site in a building or a Shed which is dry, leak-proof and as moisture proof as possible. The building or shed for storage should have minimum number of windows and close fitting doors and these should be kept closed as far as possible.

Cement shall be stored and stacked in bags and shall be kept free from the possibility of any Dampness or moisture coming in contact with them. Cement bags shall be stacked off the floor on wooden planks in such a way as to keep about 150 mm to 200 mm clear above the floor. The floor may comprise of lean cement concrete or two layers of dry bricks laid on well consolidated earth. A space of 600 mm minimum shall be left all-round between the exterior walls and the stacks. In the stacks the cement bags shall be kept close together to reduce circulation of air as much as possible. Owing to pressure on the bottom layer of bags sometimes 'warehouse pack' is developed in these bags. This can be removed easily by rolling the bags when the cement is taken out for use. Lumped bags, if any should be removed and disposed off.

The height of stack shall not be more than 10 bags to prevent the possibility of lumping up under pressure. The width of the stack shall be not more than four bags length or 3 metres. In stacks more than 8 bags high, the cement bags shall be arranged alternately length-wise and cross-wise so as to tie the stacks together and minimize the danger of topping over. Cement bags shall be stacked in a manner to facilitate their removal and use in the order in which they are received; a label showing date of receipt of cement shall be put on each stack to know the age of cement.

For extra safety during the monsoon, or when it is expected to store for an unusually long period, the stack shall be completely enclosed by a water proofing membrane such as polyethylene, which shall close on the top of the stack. Care shall be taken to see that the waterproofing membrane is not damaged any time during use.

Cement in gunny bags, paper bags and polyethylene bags shall be stored separately.

In case cement is received in drums these shall be stored on plane level ground, as far as possible near the concrete mixing place. After taking out the required quantity of cement, the lid of the drum shall be securely tied to prevent ingress of moisture.

In case cement is received in silos the silos shall be placed near the concrete batching plant. Proper access shall be provided for the replacement of silos.

Different types of cements shall be stacked and stored separately.

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1.34. BRICKS

Bricks shall be stacked in regular tiers as and when they are unloaded to minimize breakage and defacement. These shall not be dumped at site.

Bricks stacks shall be placed close to the site of work so that least effort is required to unload and transport the bricks again by loading on pallets or in barrows. Building bricks shall be loaded or unloaded a pair at a time unless palletized. Unloading of building bricks or handling in any other way likely to damage the corners or edges or other parts of bricks shall not be permitted.

Bricks shall be stacked on dry firm ground. For proper inspection of quality and ease in counting the stacks shall be 50 bricks long, 10 bricks high and not more than 4 bricks in width, the bricks being placed on edge, two at a time along the width of the stack. Clear distance between adjacent stacks shall not be less than 0.8 m. Bricks of each truck load shall be put in one stack.

Bricks of different types, such as clay bricks, clay fly ash bricks, fly ash lime bricks, sand lime (calcium silicate) bricks, auto-clave bricks etc. shall be stacked separately. Bricks of different classification and size consideration (such as, conventional and modular) shall be stacked separately. Also bricks of different types, such as, solid, hollow and perforated shall be stacked separately.

1.35. BLOCKS

Blocks are available as hollow and solid concrete blocks, hollow and solid light weight concrete blocks, autoclaved aerated concrete blocks, concrete stone masonry blocks and soil based blocks.

Blocks shall be unloaded one at a time and stacked in regular tiers to minimize breakage and defacement. These shall not be dumped at site. The height of the stack shall not be more than 1.2 m. The length of the stack shall not be more than 3.0 m, as far as possible and the width shall be of two or three blocks.

Normally blocks cured for 28 days only should be received at site. In case blocks cured for less than 28 days are received, these shall be stacked separately. All blocks should be water cured for 10 to 14 days and air cured for another 15 days; thus no blocks with less than 28 days curing shall be used in building construction.

Blocks shall be placed close to the site of work so that least effort is required for their Transportation. The date of manufacture of the blocks shall be suitably marked on the stacks of blocks manufactured at factory or site.

1.36. FLOOR, WALL AND ROOF TILES

Floor, wall and clay roof tiles of different types, such as, cement concrete tiles (plain, coloured and terrazzo) and ceramic tiles (glazed and unglazed) shall be stacked on regular platform as far as possible under cover in proper layers and in tiers and they shall not be dumped in heaps. In the stack, the tiles shall be so placed that the mould surface of one faces that of another. Height of the stack shall not be more than one metre. During unloading, these shall be handled carefully so as to avoid breakage.

Tiles of different quality, size and thickness shall be stacked separately to facilitate easy removal for use in work. Tiles when supplied by manufacturers packed in wooden crates shall be stored in crates. The crates shall be opened one at a time as and when required for use. Ceramic tiles and clay roof tiles are generally supplied in cartons which shall be handled with care. It is preferable to transport these at the site on platform trolleys.

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1.37. AGGREGATES

Aggregates shall be stored at site on a hard dry and level patch of ground. If such a surface is not available, a platform of planks or old corrugated iron sheets, or a floor of bricks, or a thin layer of lean concrete shall be made so as to prevent contamination with clay, dust, vegetable and other foreign matter.

Stacks of fine and coarse aggregates shall be kept in separate stock piles sufficiently removed from each other to prevent the material at the edges of the piles from getting intermixed. On a large job, it is desirable to construct dividing walls to give each type of aggregates its own compartment. Fine aggregates shall be stacked in a place where loss due to the effect of wind is minimum.

Unless specified otherwise or necessitated by site conditions stacking of the aggregates should be carried out in regular stacks. The suggested sizes for stacks are as follows:

Sl. No.	Material	Size of Stack (in m)		
		Length	Breadth	Height
(i)	Soling stone	5	2	1
	Or			
	Soling stone	5	1	1
(ii)	Coarse aggregates	2	2	1
	Or			
	Coarse aggregates	5	1	1
(iii)	Fine aggregates	2	2	1
	Or			
	Fine aggregates	5	5	1

1.38. FLY ASH

Fly ash shall be stored in such a manner as to permit easy access for proper inspection and Identification of each consignment. Fly ash in bulk quantities shall be stored in stack similar to fine aggregates as specified in to avoid any intrusion of foreign matter. Fly ash in bags shall be stored in stacks not more than 10 bags high.

1.39. STEEL

For each classification of steel, separate areas shall be earmarked. It is desirable that ends of bars and sections of each class be painted in distinct separate colours.

Steel reinforcement shall ordinarily be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. It is desirable to coat reinforcement with cement wash before stacking to prevent scaling and rusting.

Bars of different classification, sizes and lengths shall be stored separately to facilitate issues in such sizes and lengths so as to minimize wastage in cutting from standard lengths.

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In case of long storage, reinforcement bars shall be stacked above ground level by at least 150mm. Also in coastal areas or in case of long storage a coat of cement wash shall be given to prevent scaling and rusting.

Structural steel of different classification, sizes and lengths shall be stored separately. It shall be stored above ground level by at least 150 mm upon platforms, skids or any other suitable supports to avoid distortion of sections. In coastal areas or in case of long storage suitable protective coating of primer paint shall be given to prevent scaling and rusting.

1.40. ALUMINIUM SECTIONS

Aluminium sections of different classification, sizes and lengths shall be stored separately, on a level platform under cover. The aluminium sections shall not be pulled or pushed from the stack nor shall be slid over each other, to protect the anodizing layer.

1.41. DOORS, WINDOWS AND VENTILATORS

While unloading, shifting handling and stacking timber or other lingo-cellulosic material based, metal and plastic door and window frames and shutters, care shall be taken that the material is not dragged one over the other as it may cause damage to the surface of the material particularly in the case of decorative shutters. The material should be lifted and carried preferably flat avoiding damage of corners or sides.

Metal and plastic doors, windows and ventilators shall be stacked upright (on their sills) on level ground preferably on wooden battens and shall not come in contact with dirt and ashes. If received in crates they shall be stacked according to manufacturer's instructions and removed from the crates as and when required for the work.

Metal and plastic frames of doors, windows and ventilators shall be stacked upside down with the kick plates at the top. These shall not be allowed to stand for long in this manner before being fixed so as to avoid the door frames getting out of shape and hinges being strained and shutters drooping.

During the period of storage all metal doors, windows and ventilators shall be protected from

Loose cement and mortar by suitable covering such as tarpaulin. The tarpaulin shall be hung loosely on temporary framing to permit circulation of air to prevent condensation.

All timber and other lingo-cellulosic material based frames and shutters shall be stored in a dry and clean covered space away from any infestation and dampness. The storage shall preferably be in well ventilated dry rooms. The frames shall be stacked one over the other in vertical stacks with cross battens at regular distances to keep the stack vertical and straight. These cross battens should be of uniform thickness and placed vertically one above the other. The door shutters shall be stacked in the form of clean vertical stacks over the other and at least 80 mm above ground on pallets or suitable beams or rafters. The top of the stack shall be covered by a protecting cover and weighted down by means of scantlings or other suitable weights. The shutter stack shall rest on hard and level ground.

If any timber or other lingo-cellulosic material based frame or shutter becomes wet during transit, it shall be kept separate from the undamaged material. The wet material may be dried by stacking in shade with battens in between adjacent boards with free access of dry air generally following the guidance laid down in IS 1141.

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Separate stacks shall be built up for each size, each grade and each type of material. When Materials of different sizes grades and types are to be stacked in one stack due to shortage of space; the bigger size shall be stacked in the lower portion of the stacks. Suitable pallets or separating battens shall be kept in between the two types of material.

1.42. ROOFING SHEETS

Roofing sheets shall be stored and handled in such a manner as not do damage them in any Way. Plain and corrugated asbestos cement sheets shall be stacked horizontally to a height of not More than one meter on a firm and level ground, with timber or other packing beneath them. If stacked in exposed position, they shall be protected from damage by the winds. Asbestos cement sheets of same variety and size shall be stacked together. Damage sheets shall not be stacked with sound materials. All damaged sheets shall be salvaged as early as possible.

Corrugated galvanized iron sheets and aluminium sheets shall be stacked horizontally to a height of not more than 0.5 m on a firm and level ground, with timber or other packing beneath them. To protect them from dust and rain water, these shall be covered with tarpaulin or polyethylene sheets.

Plastic sheets and glass reinforced plastic (GRP) sheets shall be stacked under a shed to a

Height of not more than 0.5 m on a firm and level ground with timber or other packing beneath them.

1.43. GYPSUM BOARDS, PLYWOOD, FIBREBOARD, PARTICLE BOARD, BLOCK BOARD, ETC.

These boards shall be stored flat in a covered clean and dry place. Different sizes and types of each of these boards shall be stacked separately. The board shall be stacked on a flat platform on which a wooden frame shall be constructed with 50mm x 25 mm battens in such a way that it will give support to all four edges and corners of the boards with intermediate battens placed at suitable intervals to avoid warping. The boards shall be stacked in a solid block in a clear vertical alignment. The top sheet of each stack shall be suitably weighed down to prevent warping wherever necessary. The boards shall be unloaded and stacked with utmost care avoiding damage to the corners and surface. In case of decorative plywood and decorative boards, the surfaces of which are likely to get damaged by dragging one sheet over another it is advisable that these are lifted as far as possible in pairs facing each other.

1.44. GLASS SHEETS

It is important that all glass sheets whether stored in crates or not shall be kept dry. Suitable Covered storage space shall be provided for the safe storage of the glass sheets. In removing glass sheets from crates, great care shall be taken to avoid damages. The glass sheets shall be lifted and stored on its long edges against a vertical wall or other support with the first sheet so placed that its bottom edge is 25 mm from the vertical support. The stacks shall be of not more than 25 panes and shall be supported at two points by fillets of wood at 300 mm from each end. The whole stack shall be as close and as upright as possible. The glass sheets of different sizes, thickness and type shall be stacked separately. The distance between any two stacks shall be of the order of 400 mm.

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1.45. CAST IRON, GALVANIZED IRON AND ASBESTOS CEMENT PIPES AND FITTINGS

The pipes shall be unloaded where they are required when the trenches are ready to receive them. Storage shall be done on firm, level and clear ground and wedges shall be provided at the bottom layer to keep the stack stable.

The stack shall be in pyramid shape or the pipes length-wise and cross-wise in alternate layers. The pyramid stack is advisable in smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5 m.

Each stack shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible.

Cast iron detachable joints and fittings shall be stacked under cover separately from the asbestos cement pipes and fittings.

Rubber rings shall be kept clean, away from grease, oil heat and light.

1.46. UNPLASTICIZED PVC PIPES

The pipe should be given adequate support at all times. Pipes should be stored on a reasonably flat surface free from stones and sharp projections so that the pipe is supported throughout its length. In storage, pipe racks should be avoided. Pipe should not be stacked in large piles, especially under warm temperature conditions as the bottom pipes may distort, thus giving rise to difficulty in jointing. Socket and spigot pipes should be stacked in layers with sockets placed at alternate ends of the stacks to avoid lopsided stacks.

It is recommended not to store pipe inside another pipe.

On no account should pipes be stored in a stressed or bent condition or near the sources of

Heat. Pipes should not be stacked more than 1.5 m high. Pipes of different sizes and classes should be stacked separately. The ends of pipe should be protected from abrasion particularly those specially prepared for jointing either spigot or socket solvent welded joints or shouldered for use with couplings.

In tropical conditions, pipes should be stored in shade. In very cold weather, the impact strength of PVC is reduced making it brittle and more care in handling shall be exercised in wintry condition. If due to unsatisfactory storage or handling a pipe becomes kinked, the damaged portion should be cut out completely. Kinking is likely to occur only on very thin walled pipes.

1.47. WATER

Wherever water is to be stored for construction purposes this shall be done in proper storage tanks to prevent any organic impurities getting mixed up with it.

1.48. OILPAINTS

All containers of paints, thinners and allied materials shall preferably be stored in a separate room on floors with sand cushions. The room shall be well-ventilated and free from excessive heat, sparks of flame and direct rays of sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using. The containers of paints have expiry date marked by the manufacturers, which should be highlighted so as to facilitate use of paint within due period.

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1.49. SANITARY APPLIANCES

All sanitary appliances shall be carefully stored under cover to prevent damage. When accepting and storing appliances, advance planning shall be made regarding the sequence of removal from the store to the assembly positions. Supporting brackets shall be so stored as to be readily accessible for use with the appliances.

1.50. OTHER MATERIALS

Small articles like nails, screws, nuts and bolts, door and window fittings, polishing stones, protective clothing, spare parts of machinery, linings, packing, water supply and sanitary fittings, electrical fittings, insulation board, etc, shall be kept in suitable and properly protected store rooms. Valuable small material such as, copper pipes and fittings shall be kept under lock and key.

GREEN BUILDING REQUIREMENTS FOR CIVIL INTERIOR CONTRACTOR

Section includes general requirements, submittals and execution procedures for compliance with USGBC (United States Green Building Council) for the project to obtain LEED Green Interior Design and Construction 2009 Gold rating at a minimum of 60 points.

Documentation mentioned below shall not be limited to what is mentioned in the Technical specifications below. The Contractor to submit any other certificates/ documents as when required

GENERAL REQUIREMENTS AND SUBMITTALS

- 1.50.1. To provide the total materials cost (excluding labour). Provide a tabulation of each recycled/regional/ rapidly renewable /certified wood materials used using the master material sheet.
- 1.50.2. To reuse salvaged, refurbished or used building materials for 5%/10% of total materials cost, excluding cost of furniture and furnishings. Vendor's certificate to support the amount of reuse content within materials to be provided. Provide photographs of building materials in pre-modified condition, if the said materials are to be reused at the same project site. Provide cost of comparable material available in the local market (replacement value) for all materials to be reused.
- 1.50.3. To reuse salvaged, refurbished or used furniture and furnishings for 30% of total value of new and reused furniture and furnishings used on the project. Vendor's certificate to support the reuse content of the materials to be provided. Provide photographs of furniture and furnishings in pre-modified condition, if the said materials are to be reused at the same project site. Provide cost of comparable products available in the local market (replacement value) for all furniture and furnishings to be reused.
- 1.50.4. To use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10%/20% of the total value of the materials in the project. Listing of all materials having recycled content and manufacturer's/vendor's certificate to be provided to show the percentage of post consumer and post industrial

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- recycled content.. Provide cost of each item containing post consumer and/or post industrial content and total cost of items containing recycled content.
- 1.50.5. To use a minimum of 20% of building materials that are manufactured regionally within a radius of 500 miles (800kms) from the project site. Of the regionally manufactured materials at least 50% of them used in the project must be extracted, harvested or recovered as well as manufactured within 500 miles of the project site. Listing of all materials that are regionally manufactured, listing of all materials that are regionally extracted, harvested or recovered and vendor's certificates/ manufacturer's certificates providing distance of manufacturing plant location/extraction, harvesting or recovery location from the project site for all the regional materials to be provided. recycled content. Provide cost of each item that has been regionally manufactured and/or regionally extracted, harvested or recovered.
 - 1.50.6. To utilize rapidly renewable materials (materials made from plants which have less than 10-year harvesting life cycle such as bamboo, MDF, linoleum, wool etc.) for 5% of the total value of building materials. Vendor's certificate/ manufacturer's product data to support material life cycle period to be provided. Provide listing of all items and cost of each item that is rapidly renewable.
 - 1.50.7. At least 50% of the wood used in the project must be certified by the Forest Stewardship Council (FSC) .A narrative indicating the list of materials/components/products claimed as FSC certified including product type, manufacturer, and appropriate entity's COC (chain of custody) certification number needs to be attached. Provide listing of all items and cost of each item that is FSC certified.
 - 1.50.8. The **VOE** (volatile organic compound) content of adhesives and sealants used on the interior of the building must be less than **VOE** content limits mentioned below. A list of all the adhesives and sealants used for the project is to be submitted along with the manufacturer's certificate supporting the **VOE** content.

Architectural Applications	VOE Limit(g/1 minus water)
Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Wood Flooring Adhesives	100
Rubber Floor Adhesives	60
Sub floor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50
Cove base adhesives	50
Structural Glazing Adhesives	100
Multipurpose Construction Adhesives	70

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Substrate Specific Application	VOE Limit(g/1 minus water)
Metal to Metal	30
Porous Material(except wood)	50
Plastic Foams	50
Wood	30
Fibreglass	80

Specialty Application	VOE Limit(g/1 minus water)
PVC Welding	510
CPVC Welding	490
ABS Welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Top and Trim Adhesive	250
Contact Adhesive	80
Special purpose Contact Adhesive	250
Structural wood member adhesive	140
Sheet applied rubber lining operations	850
Sealants	VOE Limit(g/1 minus water)
Architectural	250
Non Membrane Roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
Sealant Primers	
Architectural, nonporous	250

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Architectural, porous	775
Other	750
Aerosol Adhesives	
General purpose mist spray	65% VOC's by weight
General purpose web spray	55% VOC's by weight
Special purpose aerosol adhesives (all types)	70% VOC's by weight

- 1.50.9. Architectural paints and coatings used in the interior of the building should not exceed the VOC content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993. A list of all the paints and coatings used in the project is to be submitted along with the manufacturer's certificate not exceeding the prescribed **VOE** limit mentioned below.
- 1.50.10. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates used in the interior of the building should not exceed the VOC content limit of 250g/L established in Green Seal Standard GS-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.
- 1.50.11. Clear wood finishes, floor coatings, stains, primers and shellacs applied to interior elements must not exceed the **VOE** content limits established in SCAQMD (South Coast Air Quality Management District, Rule 1113, Architectural Coatings, effective January 1, 2004.
- 1.50.12. A list of all the architectural paints, coatings, anti-corrosive or anti-rust paints, clear wood finishes, floor coatings, stains, primers and shellacs used for the project is to be submitted along with the manufacturer's certificate complying with the **VOE** content limit.

Paints	VOE Limit(g/1 minus water)
Non Flat	150 g/L
Flat(Mat)	50 g/L
Anti Corrosive/anti rust	250 g/L

Coatings (whichever applicable)	VOC Limit(g/1 minus water)
Gloss	250
Semi-Gloss	250
Flat	250
	VOE Limit(g/1 minus water, minus exempt compounds)
Bond breakers	350

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Clear wood finishes	350
Varnish	350
Sanding	350
Lacquer sealer	680
Clear brushing lacquer	680
Concrete - curing compounds	350
Concrete - curing compounds for roadways and bridges	350
Dry-fog coatings	400
fire proofing exterior coatings	450
Clear fire-retardant coatings	650
Pigmented fire-retardant coatings	350
Flats	250
jFloor coatings	1420
j Graphic arts(sign) coatings	j500
Industrial maintenance (im) coatings, High temperature (im) coatings,	420
jzinc-rich im primers	1420
Japans/faux finishing coatings	700
Magnesite cement coatings	600
Mastic coatings	300
Metallic Pigmented coatings	500
Multicolour coatings	420
Nonflat coatings	250
Nonflat high gloss	250
Pigmented lacquer	1680
Pre-treatment wash primers	780
Primers, sealers, under coaters	350

Quick-dry enamels	400
Quick-dry primers, sealers, under coaters	350
Recycled coatings	250
Roof coatings	300
Aluminium roof coatings	500
Bituminous roof primers	350
Preventive coating for rust	420
Clear shellac	730
Pigmented shellac	550
Specialty primers	350
Stains	350
Interior Stains	250
Swimming pool coatings - repair	650
Swimming pool coatings - other	340
Traffic coatings	250
Waterproofing sealers	400
Waterproofing concrete, masonry sealers	400
Wood preservatives - below ground	350
Other	350
Low solids coating	127 parts per billion

- 1.50.13. Concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish must meet the requirements of SCAQMD (South Coast Air Quality Management District) Rule 1113, Architectural Coatings, effective January 1, 2004. Tile setting adhesives and grout must meet SCAQMD Rule 1168 as of July 1, 2005 and rule amendment date of January 7, 2005. A list of all floor finishes used for the project is to be submitted along with the manufacturer's certificate providing compliance with voe content limit.
- 1.50.14. All carpet and carpet cushion installed in the building interior must meet the testing and product requirements of the CRI (Carpet and Rug Institute) Green Label Plus program. All carpet adhesive must have less than 50g/L VOE. A list of the different carpet types and adhesive used for the project is to be submitted along with the manufacturer's certificate confirming CRI Green Label Plus compliance and compliance of VOE content of carpet adhesive.

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- 1.50.15. All hard surface flooring must be certified by an independent third-party as Floor score standard compliant.
- 1.50.16. Composite wood and agrifiber products used on the interior of the building must contain no added urea formaldehyde resins. Composite wood and agrifiber products are defined as particleboard, medium density fibreboard (MDF), plywood, wheat board, strawboard, panel substrates and door cores. A list of all the composite wood materials used in the project should be submitted along with the manufacturer's certificate supporting that the materials contain no urea formaldehyde resins.
- 1.50.17. All furniture and seating are Green guard Indoor Air Quality Certified. Provide a list of all furniture and seating in the project along with manufacturer's certificate showing Green guard Indoor Air Quality seal
- 1.50.18. If task lighting is provided at workstations, provide a list of number of task lights and product data of the luminaries and lamp type used.
- 1.50.19. If individual thermal controls are provided in the project, submit a list of number of controls and product data of the controls used.
- 1.50.20. For USGBC LEED Interior buildings it is mandatory to provide water fixtures which will reduce water consumption in buildings by 20% than the water use baseline. To reduce water consumption in buildings by 20% than the water use baseline, water closets specified on the project must have dual flush valves and not consume more than 3 litres per half flush and 4.8 litres per flush. Urinals specified on the project must not consume more than 3.0 litres per flush. Faucets must not consume more than 1.98 litres per minute at pressure of 60psi. Commercial prerinse spray valves must not consume more than 4.8 litres per minute (no pressure requirement). Shower heads must not consume more than 7.5 litres per minute at a pressure of 80 pounds per square inch. Provide a listing of the number of the total number of fixtures and product data mentioning water consumption.
- 1.50.21. In order to obtain six, eight or eleven points - refer to water consumption requirements as mentioned in the table below. Provide a listing of the number of the total number of fixtures and product data mentioning water consumption.

Commercial fixture	20% (mandatory)	30%(6 points)	35%(8 points)	40%(11 points)
Water closet (litres per flush)	3.0/4.8	4.2	3.9	3.6
Urinals (litres per flush)	3.0	2.6	2.4	2.2
Restroom faucets (litres per minute) at a pressure of 60 pounds per square	1.98	1.3	1.2	1,1

inch.				
Prerinse spray valves (litres per minute - no pressure requirements)	4.8	4.2	3.9	3.6

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Showerheads (litres per minute) at a pressure of 80 pounds per square inch.	7.5	6.6	6.1	5.6
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CONSTRUCTION WASTE MANAGEMENT

Develop a waste management plan that results in recycling of 50%/75% of waste generated during construction, calculated either by weight or volume of total waste generated by the work. Materials that maybe included are aerated concrete blocks, brick masonry, wood trim, composite wood products, agrifiber boards, gypsum board, metals, piping electrical conduit and packaging such as paper, cardboard, boxes, plastic sheet and film, polystyrene packaging, wood crates and plastic packaging. Provide separate garbage areas or containers to separate concrete or brick masonry, paper, plastic, metals, gypsum board, plywood, flooring and carpet on the project site.

Submit waste management report consisting of material category, total quantity of waste in kgs, tons or cubic metre, quantity of waste recycled and quantity of total waste. Provide receipt of each batch of disposal with weight or volume mentioned on the receipt. Use same units of measure throughout waste management plan.

- 1) Housekeeping
- 2) After construction, the entire work area (including walls, ceilings, floors, etc.) should be cleaned.
- 3) Building materials should be protected from weather and stored in a clean, dry area prior to unpacking for installation. Pay close attention to absorptive materials such as drywall and ceiling tile.
- 4) All coils, air filters, and fans should be cleaned before performing testing and balancing procedures and especially before conducting baseline air quality tests
- 5) No food or drink should be permitted in construction areas. An area away from the construction area has to be designated as a break/lunch area.
- 6) Scheduling
- 7) Specify construction sequencing to reduce absorption of VOC's by materials that act as sinks or contaminant sources
- 8) Complete applications of wet and odorous materials such as paints, sealants and coatings before installing "sink" materials such as ceiling tiles, carpets, insulation, gypsum products, and fabric-covered furnishings

MATERIAL SPECIFICATIONS

1.51. GENERAL

The contractor under this contract commits himself to use best quality material and assume full responsibility for the quality of all material incorporated or brought for incorporation in the work. The work shall be executed in accordance with the best engineering practice and as per instruction of Architect. All materials shall confirm to respective Indians Standards.

Contractor must allow in his rates for all the wastage in all the materials.

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1.52. CEMENT

All types and brands of cement as mentioned in the approved makes list can be used and these shall be subjected to the approval of the Engineer-in-charge.

1.52.1. All cement used for the work shall be ordinary Portland cement or such other cement as may be permitted by the Engineer-in-charge. Portland cement shall comply with requirements of the latest issue of IS 269. High alumina cement, rapid hardening cement and Portland Slag cement etc. can be used only when permitted by the Engineer-in-charge. Such cements shall be in accordance with relevant IS codes. Portland Pozzolana cement when permitted by the Engineer-in-charge shall conform to IS 1489.

1.52.2. Cement which has remained in bulk storage at the mill for more than 6 months, or which has remained in bags at the dealer's storage for over 3 months, or which has been stored at project site for more than 3 months shall be re-rested before use. Cement shall also be rejected if it fails to conform to any of the requirements of these specifications.

1.52.3. The Cement to be used in the work shall be of grade not less than Grade 43 which shall be got approved by the Engineer -in-charge.

1.52.4. The following other types of cement may be used in works if specified or with prior approval of the Engineer in Charge in writing purpose. Specialist literature shall be consulted for guidance regarding use of these types of cement.

1.52.4.1. 43 Grade ordinary Portland cement conforming to IS 8112

1.52.4.2. 53 Grade ordinary Portland cement conforming to IS 12269 (to be used only for RCC works on specific written approval from the Engineer-in-charge)

1.52.4.3. Portland slag cement conforming to IS 455

1.52.4.4. Portland pozzolana cement (fly ash based) conforming to IS 1489 (Part-

1.52.4.5. Portland pozzolana cement (calcined clay based) conforming to IS 1489 (Pt-2)

1.52.4.6. Sulphate resisting Portland cement conforming to IS 12330

1.52.4.7. Fly ash when used for partial replacement of cement, shall conform to the requirements of IS: 3812 (part 1)-1966.

1.53. FINE AGGREGATES

Fine aggregates shall consist of natural sand, manufactured sand, or an approved combination thereof and shall conform to IS: 383. The grading zone of sand proposed for use shall be supplied by the contractor and got approved by the Engineer-in-charge.

The sand shall be of siliceous material, sharp, hard, strong and durable and shall be free from adherent coatings, clay, dust, alkali, organic material, deleterious matter, lumps, etc. Either natural or manufactured sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter. Natural sand shall be washed, unless specific written authority is given by the Engineer-in-charge to use sand that meets specifications and standards of cleanliness without washing. The cost of screening and washing must be borne by the contractor. The fine aggregate shall be taken from a source approved by the Engineer-in-charge.

Some times Sand is obtained from crushed stone screening but often contains a high percentage of dust and clay. It tends to be flaky and angular. This type produces harsh concrete and should be avoided.

Sea sand should not be used unless approved by the EiC. If approved, the required treatment shall be

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done at the contractor's cost.

Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any appreciable amount of clay, Sand shall not contain harmful impurities such as iron, pyrites, coal particles, lignite, mica shale or similar laminated material, alkali, and organic impurities in such form or quantities as to affect the strength of durability of concrete or mortar. Also it should not contain any material liable to attack the steel reinforcement.

1.54. WATER

Water shall be potable. Fresh, clean and free from impurities and should be from an approved source. Contractor can provide and maintain sufficient storage accommodation for the water as and where directed by Architect. Water for mixing cement mortar or concrete shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil, acid and injurious alkali, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence. Sea water shall not be used. Water fit for drinking shall generally be found suitable for mixing cement mortar. Water fit curing mortar or concrete shall not be too acidic or alkaline. It shall have pH value above 6. Sea water shall not be used for curing purpose.

1.55. BRICKS

Bricks shall be of regular and uniform size, shape and colour, uniformly well burnt throughout but not over burnt. They shall have plane rectangular faces with parallel sides and sharp straight and right angled edges. They shall be free from cracks or other flaws. They shall have a frog of 10 mm. depth on one of their flat faces.

They shall give a clear metallic ringing sound when struck. They shall show a fine grained, uniform homogeneous and dense texture on fracture and be free from lumps of lime, laminations, cracks, air holes, soluble salts causing efflorescence or other defects which may in any way impair their strength, durability, appearance or usefulness for the purpose intended. They shall not have any parts under-burnt. They shall not break when thrown on the ground on their flat face in a saturated condition from a height of 60 cm.

Size of bricks The size of the conventional bricks may vary from 8 3/4" x 4 3/16" x 2 5/8" to 9" x 4 1/4" x 3". Only bricks of one standard size, shall be used on one work unless specially permitted by the Engineer. The following tolerances are permitted in the standard conventional size adopted on a particular work: Length - plus or minus 3 mm (about 1/8")

Breadth - plus or minus 1.5 mm (about 1/16")

Depth - plus or minus 1.5 mm (about 1/16")

(a) When metric bricks are used they shall comply with I. S: 1077 - 1976.

Absorption

After immersion in water, absorption by weight shall not exceed 20% of the dry weight of the brick when tested according to IS: 1077-1976.

Compressive Strength

The load to crush the brick when dry shall not be less than 50 Kg/sq.cm. and when thoroughly soaked shall not be less than 35 Kg/sq.cm. Please see table given below for details

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Class Designation (N/Sq.mm)	AVERAGE COMPRESSIVE STRENGTH			
	NOT LESS THAN		LESS THAN	
	N/Sq.mm	Kgf/Sq.cm	N/Sq.mm	Kgf/Sq.cm
10 (100)	10	100	12.5	125
7.5 (75)	7.5	75	10	100
5 (SO)	5	SO	7.5	75
3.5 (35)	3.5	35	5	SO

1.56. COARSE AGGREGATE

This shall be machine crushed from hard (granite) trap stone, grading of aggregate shall be within the limits to produce a dense mix. And shall conform to IS: 383 and IS: 515; mix will work into position without segregation and without excessive quantity of water being required it also shall be strong and durable and shall be free any clay films and other adherent/coating. It shall be washed with clean water if required by the Architect.

This shall be well graded between the limit as specified in the items of the work and the grading tests shall be carried out. Aggregates shall be screened. If required by Architect to obtain proper proportion to his approval. The quality shall confirm to IS: 383-1970.

1.57. SCAFFOLDING

Scaffolding shall be double and shall be erected with steel sections or pipes of adequate strength so as to be safe for construction operations. The contractor shall take all measures to ensure the safety of the work and working people. Any instructions of the Engineer in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach to every part of the work. Overhead work shall not be allowed.

1.58. TIMBER

Timber shall be considered as well seasoned in case its moisture free. Timber shall be of quality as specified in BOQ and well seasoned. It shall have uniform colour, be free from defects such as cracks, dead knots, soft spongy spots and waves of injurious open shakes. Grains shall be reasonably straight. The individual hard and sound knot shall not be larger than 6 sq. cm. The aggregate area of all knots shall not exceed 0.5% area of a piece. All timber shall be treated with chemical wood preservatives and be kiln seasoned to IS 1141 and conform to IS 287 for moisture content. Maximum permissible limit shall be +3% for average moisture content of all samples from a given lot and +5% for individual sample of the given lot. This is applicable when thickness of timber is more than 50 mm. Small size tolerance shall be +2% and +3% respectively. Timber used shall be treated with a 10 years guaranteed and approved anti-termite treatment. Wood work in contact with masonry of concrete shall be painted with hot bitumen coal tar before being placed in position. Timber received at site shall be marked and stamped for approval prior to being used at site. All timber shall be finished to required dimension and texture prior to being treated for chemical preservation.

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Timber is classified as under :

- (i) Teak wood
- (ii) Deodar wood
- (iii) Non-coniferous timbers other than teak
- (iv) Coniferous timber other than deodar.

The timber shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, splits and cracks. The timber shall be graded as first grade and second grade on the basis of the permissible defects in the timber. For both the grades, knots should be avoided *over* a specified limit.

Teak Wood (Tectona Grandis)

It is of outstanding merit in retention of shape and durability. The heart wood is one of the most naturally durable woods of the world. It usually remains immune to white ant attack and insect attack for very long periods. It is, however, not always immune from fungus attack (rot). Taken as a whole, good quality teak is very durable, it is relatively easy to saw and work. It can be furnished to a fare surface and takes polish well. It is generally used for making furniture and all important timber construction.

Superior Class Teak Wood such as Balarsha, Malabar and Dandeli: Individual hard and sound knot shall not be more than 12 mm in diameter and the aggregate area of all the knots shall not exceed one half per cent of the area of the piece. It shall be close grained.

Deodar Wood (Cedrus Deodars)

It is the strongest of the Indian conifers. Its weight and strength is 20% per cent less than teak. It is easy to saw and works to a smooth finish. It is not, however, a suitable wood for polish or paint work as the oil in the wood and especially near knots, always seeps through such finishes and discolours them. It is used for house building, furniture and other construction work. It is also suitable for beams, floors, boards, posts, window frames and light furniture etc.

Sal Wood (Shoera Robusta)

Sal is about 30 per cent heavier than teak, 50 per cent harder, and about 20 to 30 per cent stronger. In shock resistance it is about 45 per cent above teak. Its heart wood is a naturally durable wood, and usually remains immune to attack by white ants and fungi for a long period, while its sapwood is very perishable and should not be used. Well dried sal is not a really easy wood to saw and work. It is a rough constructional wood than a carpentry timber. No individual hard and sound knot shall exceed 25 mm in diameter and the aggregate area of all the knots shall not exceed 1% of the area of the piece. It can be used for a variety of purposes, such as for beams, rafters, flooring, piles, bridging, tool handles, picker arms and tent pegs, etc.

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Kail Wood (Pinus Roxburghie)

Kail Wood is not a very durable wood. But it is easy to saw and work and usually very popular in workshops. It can be brought to a fine smooth surface, but is more suitable for paint and enamel finishes than for polish work. It is useful for joinery works, constructional work, light furniture and house fittings

At least 50% of wood to be FSC (Forest Stewardship Council) certified Forests certified to be in compliance with the standards endorsed by the Forest Stewardship Council (FSC).

Products milled or otherwise altered by manufacturers certified to be in compliance with the standards endorsed by the Forest Stewardship Council (FSC).

1.59. FLUSH DOORS

Flush doors shall be of factory finished kiln seasoned timber, of solid core construction with frame, lock rail and well balanced backings and shall be faced with high quality commercial or teak veneering as specified. The flush doors shall be specified make and thickness as specified in the BOO/Drawings, with matching teak/veneer wood lipping glued and machine pressed along with core. The lipping to be finished in melamine polish, unless other wise specified in the BOO/Drawings

1.60. BLOCK BOARD

These boards are used for panelling on wall surface or door shutters, shall be grade I exterior grade, which is of the following types :

- i) Type I block boards, decorative type. These are block boards with ornamental veneers on one side or on both sides.
- ii) Type II block boards, commercial type. These are block boards with faces of commercial timber. The block boards grade I shall have been bonded with B.W.R. (Boiling Waterproofing) type synthetic resin adhesive.

1.61. PARTICLE BOARD

The particle board used for the panelling in door shutters, wall cladding, etc. shall be FPS (Flat Pressed Single layer board) or FPTH (Flat Pressed Three layer board) type. It shall have been bonded with B.W.R. (boiling Waterproofing) type synthetic resin adhesive. The shrinkage in thickness and length of particle shall not exceed 5 percent.

Types of particle boards :

- a) Flat pressed particle board :

This is manufactured by mixing wood particles of pre determined sizes and shapes with synthetic resins of Phenol formaldehyde or urea formaldehyde types and curing and pressing in a parallel platen hot press of the usual multiplayer types but may be pressed in a continuous band type of press. The applied pressure is perpendicular to the plane of the board which orientates the particles mainly with the larger dimension parallel with the plane of the board.

- b) Single layer particle board :

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A board made of one uniform layer or particles and resin mix and predominantly of uniform texture and strength in the whole depth of the board.

c) Three layer particle board :

A particle board made of three layers of particles and resin mix, usually with finer and thinner particles for the top and bottom layers and coarser and bigger particles for the core layer. Resin content in a three layer board is usually higher in the face layer than in the core layer leading to a sandwich construction with stronger and denser skin.

1.62. PLYWOOD

Plywood for general purpose shall be of three grades, namely, BWR, WWF and CWR, depending upon the adhesives used for bonding the veneers. The plywood used for panelling for door shutters, wall cladding, etc. shall be BWR grade and shall not be less than 10mm thickness for two or more panel shutters and 12mm thickness for single panel shutters. The thickness in case of wall cladding/false ceiling etc., all not be less than 6mm. The thickness of all veneers shall be uniform, within a tolerance of $\pm 5\%$.

Requirements of thickness of face and core veneers shall be as follows:

- i) In 3-ply boards, up to 5mm thick, combined thickness of the face veneers shall not exceed twice the thickness of centre ply.
- ii) In multiple boards, the thickness of any veneer shall not be more than thrice the thickness of any other veneer.
- iii) The sum of the thickness of the veneers in one direction shall approximate to the sum of the thickness of veneers at right angles to them and shall not be greater than 1.5 times the sum, except for 3 ply as specified above.

The thickness of plywood boards shall be specified as under:

BOARD	THICKNESS
3 ply	3mm, 4mm, 5mm
5 ply	6mm, 8mm, 9mm
7 ply	9mm, 16mm, 19mm
9 ply	13mm, 16mm, 19mm
11 ply	19mm, 22mm, 25mm

1.63. HARD BOARD

Hard boards are generally classified into the following three types according to their method of manufacture, density and other related mechanical and physical properties :

Medium hard board :

A homogeneous fibre building board having a density exceeding 480 kg/M³ but not exceeding 800 kg/M³.

Normal hard board :

Same as above, but having density exceeding 800 kg/M³, but not exceeding 1200 kg/M³.

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Tempered hard board :

Hard board further treated in the course of manufacture to increase its density, strength and water resistance is tempered hard board. The hard board used for panelling of door shutters, wall cladding, false ceiling, etc. shall be of tempered quality. The thickness of hard board panelling shall not be less than 12mm dia in case of single panel shutter and 10mm in the case of two or more panel shutters. The hard boards shall be regular and unless otherwise specified, shall have square edges. The length of the two diagonals of the board shall not differ by more than ± 3 mm per metre length of the diagonal. The tolerance in length, width shall be ± 3 mm and on thickness ± 0.3 mm. The boards shall be of uniform thickness subject to tolerance as above. They shall be free from warp. The surface shall be flat, free from cracks and lumps and of normal colour. At least one face shall be smooth.

1.64. GLASS

The glass shall be reasonably free from blisters, stains, scratches and bubbles, so as not to disturb the visibility through the glass. The glass shall be of good and durable quality conforming to IS:1761-1960. The glass shall be special selected/ selected ordinary quantity of approved make as specified and it shall be free from bubbles, flaws specks, waves, air holes, distortion, scratches or other defects. The glasses in bulk quantities shall be brought to site in Makers original packing and makers guarantee shall be predicted if called for by the Engineer-in-charge. The glass shall be required thickness as mentioned in the items of schedule of quantities and/ or shown in drawing. In case of windows, the beading shall be anodized aluminium beading of channel section as per sizes mentioned in the drawing. The junction of the beadings shall be mitre jointed. Irregular shaped or circular glass shall be measured as smallest rectangular area from which the irregular or circular pane can be cut. Glass panes shall be fixed by wooden beading having mitred joints. A thin layer of clear silicon sealant shall be applied between glass panes and the beading. Fixing of glass panes with simple putty and beads shall not be permitted.

1.65. INSULATING BOARD

Insulating board tile for suspended ceilings and walls shall be as specified and approved and shall be fixed according to manufacturer's instruction.

1.66. HOLDFASTS FOR DOORS AND WINDOWS

Holdfasts for steel or timber frame shall be as per specified makes.

1.67. NAILS ETC.

Nails and staples shall be of hard drawn galvanised wire and shall be of specified makes.

1.68. BOLTS NUTS ETC

Bolts, Nuts, and holdfast, shall be of mild steel painted with Bitumen based paints as specified before fixing. The threads of bolts, nuts and washers shall be truly fitting and shall be painted with zinc chromate before fitting the nuts.

1.69. SCREWS

Screws shall be of make as approved and specified.

1.70. PAINTS

Filler, primer enamels, paints and various and external finishing application to cement plaster shall be of an approved best quality, property brand similar shall be bituminous based. Distemper shall be either water bound or oil bound as stated in the schedule of quantities. These shall be approved brand in sealed drums of the packages.

1.71. SPECIAL MATERIALS

If materials of a particular brand are specified in the schedule of quantities these shall be procured accordingly from approved manufactures. These shall include materials like bitumen, bituminous compounds, waterproofing compounds and hardening compounds, special paints acoustic and insulation boards and other finishing materials. The responsibility for the use of these materials lies with the contractor and he should avail himself of the necessary guarantee as may be required by the architect and give the same to the Architect.

1.72. MDF

MDF/HDF is Medium Density And High Density Fibre board, with board densities ranging from 700 Kgs to 1000 Kgs per cubic meter. The range of MDF/HDF includes Plain Medium Density Fibre Board, Laminated Medium Density Fibre Board, Plain High Density Fibre Board, Laminated High Density Fibre Board for Flooring, etc. The thickness of the board range from 6 mm to 25 mm and board size of 8 ft. x 4 ft.

Sr. No.	Properties	Specification	
		Grade I	Grade II
1	Bulk Density Kg/M ³)	600- 900	600- 900
2	Density Variation (Max0 Percent	±10	±10
3	Moisture Content(%)	5-10	5-10
4	Variation From Mean Moisture	±3	±3
5	Water Absorption (%) Max		
	a. After 2 hours soaking	6	9
	b. After 24 hours soaking	12	18
6	Thickness swelling (Max) Percent, 2 Hours	4	7
7	Modulus of Rupture (Min) N/mm ²		
	a. Up to 20mm Thickness	28	28
	b. Above 20mm Thickness	25	25
	Modulus of Elasticity (Min) N/mm ²		
	a. Up to 20mm Thickness	2800	2800

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8	b. Above 20mm Thickness	2500	2500
9	Tensile Strength perpendicular to the surface (Min) N/mm ²		
	a. Up to 20mm Thickness	0.8	0.7
	b. Above 20mm Thickness	0.7	0.6
10	Tensile Strength perpendicular to the surface (Min) N/mm ²		
	a. After Accelerated water resistance test	0.25	Not applicable
	b. After Cyclic Test	0.4	
11	Screw Holding (Min), N		
	a. Face	1500	1500
	b. Edge	1250	1250
12	Abrasion resistance test (Min) in number of revolution		
	a. Type I	1000	1000
	b. Type II	450	450
	c. Type III	250	250
	d. Type IV	75	75
13	Resistance to steam	Should pass	Should pass
14	Resistance to cracks	Should pass	Should pass
15	Resistance to Cigarette Burn	Should pass	Should pass
16	Resistance to stain	Should pass	Should pass

1.73. TILES

Plain cement tiles, chequered tiles, mosaic tiles, shall conform to IS 1237. For neutral shade tiles grey cement shall be used. Tiles shall be compacted by mechanical vibration and hydraulically pressed. It shall be of choice shade and shall have desired pattern of chop distribution. The sizes of chips and proportion of chips to cement in Terrazzo or mosaic floor shall be as specified in IS 1237. The size and thickness of tiles shall be as approved by the Architect. White or coloured glazed tiles shall comply with IS 777. It shall be from an approved manufacturer and shall be flat and true to shape. They shall be free from cracks, crazing, spots, chipped edges and corners. The glazing and colour shall be of uniform shade and unless otherwise the tile shall have an average thickness of 5.50 mm or as given in the BOQ.

SPECIFICATIONS FOR CERAMIC TILES

Characteristics	CEN standards, ISO standards and Indian standards	Method of Testing
Deviation in Length	Max. +/- 0.5%	EN-98 / 150-10545-2/ IS: 13630 (Part-1)
		EN-98 / 150-10545.2/ IS:

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Deviation in Thickness	Max. +/- 0.5%	13630 (Part-1)
Wedging Warpage	Max. +/- 0.5%	EN-98 / 150-10545.2/ IS: 13630 (Part-1)
Squareness	Max. +/- 0.6%	EN-98 / 150-10545.2/ IS: 13630 (Part-1)
Water Absorption	3-6%	EN-99 / 150-10545.3/ IS: 13630 (Part-3)
Scratch Resistance (moh's Scale)	Min.5	EN-101/15:13630 (Part- 13)
Abrasion Resistance	As per the abrasion class indicated by the manufacturer	EN-154 / 150-10545.7/IS: 13630 (Part-II)
Crazing Resistance	In conformity with the norms	EN-105 / 150-10545.11/ IS : 13630 (Part-9)
Chemical Resistance	Resistant to all acids all alkalies (except Hydrofluoric Acid and its compounds)	EN-122 / 150-10545.13/ IS : 13630 (Part-8)
Bending Strength	≥ 220 Kgs./cm ²	EN-100 / 150-10545.4/ IS: 13630 (Part-6)
Thermal Shock	Resistant to 10 Cycles	EN-104 / 150-10545.9/ IS: 13630 (Part-5)

SPECIFICATIONS FOR VITRIFIED TILES

Property	International Std. ISO 13006 / EN 176 Group Bia	Method of Testing
Deviation in length	+/- 0.6%	EN 98
Deviation in thickness	+/- 5%	EN 98
Straightness of sides	+/- 0.5%	EN 98
Rectangularity	+/- 0.6%	EN 98
Surface flatness	+/- 0.5%	EN 98
Surface quality(%)	A minimum of 95% of the tiles shall be defects that would impair a major area of tile n1=30, Ac1=l, Re1=3	- free from visible the appearance of
Flexural Strength	> 27 N/mm ²	EN 100
Breaking Strength	1113 N	ASTM C-648

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Water Absorption	<0.5%	EN 99
Density (g/cc)	>2	DIN 51082
Mohs hardness	>6	EN 101
Abrasion Resistance	< 204 mm ³	EN 102
Stain Resistance	Resistant	ISO 10545-14
Chemical Resistant	No damage	EN 106
Colour Resistant	No damage	DIN 51094
Thermal Expansion	< 9 × 10 ⁻⁶	EN 103
Moisture Expansion	Nil	ISO 10545-10
Thermal Shock Resistant	No damage	EN 104
Glossiness		Gloss meter
Skid Resistance Coefficient friction)	> 0.4	ASTM C-1028

1.74. GLASS WOOL INSULATION

Fibre glass wool insulation should be made of fine, long, inorganic glass fibres bonded by high temperature resin and should be energy conserving with sound insulating properties. It should be suitable for applications ranging from 195°C to 230°C.

Chemical Stability : It should be chemically inert. The application should not cause or accelerate corrosion. It should also be rot proof and odourless.

Fire Safety : It should be non-combustible in accordance with BS 476 Part 4, 1970. incombustible low fire propagation extremely low spread of flame (class 1 BS 476 Part 7) non emission of dense smoke and toxic gases (low toxicity index 0.86) non depletion of oxygen (high oxygen index 70%)

The Glasswool should possess high insulation values by virtue of its low fibre diameter, consistent fibre distribution and homogeneous density. This should be reflected in glasswool's low thermal conductivity, which meets the requirement of IS:8183 and BS:3958:Part 5.

Thermal Conductivity Values in W/m.K

Mean Temperature	Density in kg/m ³			
	16	24	32	48
10°C	0.035	0.031	0.03	0.027
25°C	0.038	0.033	0.032	0.03
50°C	0.043	0.039	0.035	0.033
100°C	0.057	0.047	0.043	0.04

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Acoustical Insulation Values

Specification	Average N. R. C.
	Frequency Range
(Density x Thickness)	100Hz - 6200 Hz
16 kg/m ³ x 50mm	0.93
24 kg/m ³ x 50mm	0.96
32 kg/m ³ x 50mm	0.96

1.75. FLEXIBLE PLYWOOD

Wherever flexi-ply is used the thickness should be in multiples of 6 mm or 8 mm. It can mould and bend into any shape without chipping, cracking, peeling or staining. It should have a bend radius as low as 25 mm.

CHARACTERISTICS	ISI SPECIFICATIONS
Moisture Content	5%-15%
Flammability	> 30 minutes
Flamed penetration	15 minutes per 6mm
Rate of burning	Weight loss approx. 30-70%- 20 minutes
Retention of preservative	6 kg per cum

1.76. GYPBOARD PLAIN

A Gypsum panel is composed of a non-combustible gypsum core encased in a strong, smooth-finish paper on the face side and a natural-finish paper on the back side. The face paper is folded around the long edges to reinforce and protect the core, and the ends are square-cut and finished smooth. The long edges of the panels are available in a choice of designs (including tapered), allowing joints to be reinforced and concealed with approved joint treatment system

Application:- Suitable for most applications where normal fire, structural performance and acoustic levels are specified

Board colour:- Grey face paper, Brown reverse side paper

Standards and certification:- IS 2095 - Part I, 1996

Thermal Conductivity: 0.16 (W/m²K)

Moisture Content : Should be less than 2% in accordance with BS 2972.

Water Absorption : Should be less than 2% in accordance with BS 2972.

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1.77. LAMINATES

PROPERTY	TEST METHOD PART2	PROPERTY OR ATTRIBUTES	UNITS	TEST REQUIREMENTS	TEST
Thickness	4	Maximum variation	mm	0.1	0.04
Warping	5	Maximum warp	mm	120	0.15
Resistance to surface wear	6	Wear resistance	Revs(min)	>150	200
			IP FP	>350	600
Resistance to immersion in boiling water	7	Mass increase thickness appearance	%[max]	10	5.46
			%[max]	12	4.11
			Rating	4	5
Resistance to dry heat	8	Appearance other finish	Rating	4	4
Dimensional stability at elevated temperatures	9	Dimensional change	%CM	1.05	0.7
			%M	-0.55	0.3
Resistance to impact by small diameter ball	11	Spring face	M(min)	>20	>20
Resistance to cracking	13	Susceptibility	Rating(not less than)	4	5
Resistance to scratching	14	Load	n(min)	>2.0	7
Resistance to staining	15	Appearance Group 1 and 2	Rating(not less than)	5	5.5
		Group 3 and 4		3	5,5,4,5
Resistance to colour change in xenon arc light	16	Wool standard	min	6	>6
Resistance to cigarette burns	18	Appearance	Rating(not less than)	Brand A 3	3
				Brand B 3	4
				Brand C 3	4
Resistance to steam	24	Appearance	Rating((not less than)	3	5

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Product conformity

British European standard - BS EN 438, American NEMA LD- 3, FIRA England, BS EN-476 part 7, Warrington Research UK, IS -2046 BIS (Bureau of Indian Standards)

Care and maintenance

Cleaning should be carried out with a soft moist cloth and warm soap solution. Do not use detergents containing abrasive particles or excess soda. Care and maintenance instructions do not apply to the range of metallic patterns series as they are very sensitive.

Note

Samples presented are indicative of colour, pattern and surface finish but not the actual thickness. All metallic patterns series are recommended for vertical applications only. Information and samples for special cabinet liners, phenolic boards, special purpose compact laminates and post forming laminates are available on request. Phone/ fax /email for larger samples of your choice.

POST CONSTRUCTION ANTI-TERMITE TREATMENT

A) STAGE1

Treatment to wall and floor junction : Holes of 12mm diameter 18-20 inches apart will be drilled along the inner junction of wall and floor at depth of 6" on the entire ground and 4" on the first floor premises. Termiticide solution will be injected under pressure into these holes to create barrier against termites. If heavy infestation is noticed on 2nd and above floors the same treatment will be carried out on that particular floor. Mode of measurement will be Carpet area on Ground and 1st floor only

B) STAGE2

Treatment to wooden fixtures : Holes of 12mm diameter will be drilled at the base of wooden-fixtures such as window frames and doorframes adjoining the flooring and termiticide solution will be injected. This treatment will be carried out on all floors (except basements/Terrace). An oil-based termiticide will be sprayed on all the woodwork infested by the termites within the premises. Special care will be taken in case furniture attached to the wall as the termites can easily attack them. Drilling will be carried out at the base of all such fixture and termiticide solution will be injected. The rate for this treatment to be included in Stage 1, no separate measurements for the same will be done

Holes drilled in the floors, walls or wood work sides will be sealed with white cement mixed with matching pigment by the contractor with the above tender items without any extra payment. Damaged parts of the wood work, plaster, masonry will be made good by the Contractor.

Work carried out should be guaranteed for a period for 5 years on the requisite stamp paper.

Contractor has to use approved brand conforming IS-8944 latest version.

The treatment will be carried out as per latest version of IS- 6313 (Part III)

Chemical used for anti-termite treatment are insecticides with a persistent action and are highly poisonous. This chemical can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mists or swallowed.

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The containers having emulsifiable concentrates shall be clearly labelled and kept securely closed in stores so that children or pet cannot get at them. Storage and mixing of concentrates shall not be done near any fire source or flame. Persons using these chemical shall be warned that absorption through skin is the most likely source of accidental poisoning. Particular care shall be taken to prevent skin contact with concentrates and prolonged exposure to dilute emulsion shall also be avoided. After handling the concentrates or dilute emulsion. Workers shall wash themselves with soap and water and wear clean clothing, especially before eating. In the event of severe contamination, clothing shall be removed at once and the skin washed with soap and water. If chemical has splashed into the eyes, they shall be flushed with plenty of soap and water and immediate medical attention shall be sought.

Care should be taken in the application of chemicals to see that they are not allowed to contaminate wells or springs which serve as source of drinking water.

C) TREATMENT FOR EXISTING BUILDING: POST CONSTRUCTION TREATMENT

Chemicals: Any one of the following chemicals conforming to relevant Indian Standards in water emulsion may be used for soil treatment in order to protect a building from termite attack

Chemical with Percent	Relevant Indian Standards	Concentration by weight (Active ingredient)
Chlorpyrifos 20EC	IS 8944	1.0
Lindane 20EC	IS 632	1.0

These chemicals are available in concentrated form in the market and concentration is indicated on the sealed containers. To achieve the specified percentage of concentration, chemicals should be diluted with water in required quantity before it is used. Graduated containers shall be used for dilution of chemicals with water in the required proportion to achieve the desired percentage of concentration. For example, to dilute chemical of 20% concentration, 19 parts of water shall be added to one part of chemical for achieving 1% concentration. Oil or kerosene based solution of chlorpyrifos 20 EC or Lindane 20 EC, 1.0 percent (by weight) concentration is useful for treatment of wood. Engineer-in-charge shall procure the chemical of required concentration in sealed original containers directly from the reputed and authorized representative. Chemical shall be kept in the custody of the Engineer-in-charge or his authorized representatives and issued for use to meet the day's requirements. Empty containers after washing and concentrated chemical left unused at the end of the day's work shall be returned to the Engineer-in-charge or his authorized representative.

D) SAFETY PRECAUTIONS

Chemical used for antitermite treatment are insecticides with a persistent action and are highly poisonous. This chemical can have an adverse effect upon health when absorbed through the skin, inhaled as vapours or spray mists or swallowed. The containers having emulsifiable concentrates shall be clearly labeled and kept securely closed in stores so that children or pet cannot get at them. Storage and mixing of concentrates shall not be done near any fire source or flame. Persons carrying out chemical soil treatments should familiarize themselves and exercise due care when handling the chemicals whether in concentrated or in diluted form.

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After handling the concentrates or dilute emulsion, worker shall wash themselves with soap and water and wear clean clothing especially before eating and smoking. In the event of severe contamination, clothing shall be removed at once and the skin washed with soap and water. If chemical has splashed into the eyes, they shall be flushed with plenty of soap and water and immediate medical attention shall be sought. The use of chemical shall be avoided where there is any risk of wells or other water supplies becoming contaminated.

Once the termites have an Ingress into the building, they keep on multiplying and destroy the wooden and cellulosic materials, and as such it becomes essential to take measures for protection against termites.

Measures described below are necessary for the eradication and control of termites in existing building. To facilitate proper penetrations of chemical in to the surface to be treated, hand operated pressure pump shall be used. To have proper check for uniform penetration of chemical, graduated containers shall be used. Proper check should be kept so that the specified quantity of chemical is used for the required area during the operation. Chemical treatment for the eradication and control of sub-terranean termites in existing building shall be done as per IS 6313 (Part III). Treatment shall be got done only from the approved specialized agencies using the chemical procured directly by the Engineer-in-Charge from reputed and authorized dealers.

E) TREATMENT ALONG OUTSIDE OF FOUNDATIONS

The Soil in contact with the external wall of the building shall be treated with chemical emulsion at the rate of 7.5 litres per square metre of vertical surface of the sub-structure to a depth of 300 mm. To facilitate this treatment, a shallow channel shall be excavated along and close to the wall face. The chemical emulsion shall be directed towards the wall at 1.75 litres per running metre of the channel. Rodding with 12 mm diameter mild steel rods at 150 mm apart shall be done in the channel. If necessary, for uniform dispersal of the chemical to 300 mm depth from the ground level. The balance chemical of 0.5 litre per running metre shall then be used to treat the backfill earth as it is returned to the channel directing the spray towards the wall surface. If there is a concrete or masonry apron around the building, approximately 12 mm diameter holes shall be drilled as close as possible to the plinth wall about 300 mm apart, deep enough to reach the soil below and the chemical emulsion pumped into these holes to soak the soil below at the rate of 2.25 litres per linear metre. In soils which do not allow percolation of chemicals to desired depth, the uniform disposal of the chemical to a depth of 300 mm shall be obtained by suitably modifying the mode of treatment depending on site condition. In case of RCC foundations the soil (backfill) in contact with the column sides and plinth beams along with external perimeter of the building shall be treated with chemical emulsion at the rate of 7.5 litres/sqm of the vertical surface of the structure. To facilitate this treatment, trenches shall be excavated equal to the width of the shovel exposing the sides of the column and plinth beams upto a depth of 300 mm or upto the bottom of the plinth beams, if this level is less than 300 mm. The chemical emulsion shall be sprayed on the backfill earth as it is returned into the trench directing the spray against the concrete surface of the beam or column as the case may be.

F) TREATMENT OF SOIL UNDER FLOORS

The points where the termites are likely to seek entry through the floor are the cracks at the following locations:

- (a) At the junction of the floor and walls as result of shrinkage of the concrete;
- (b) On the floor surface owing to construction defects;
- (c) At construction joints in a concrete floor, cracks in sections; and
- (d) Expansion joints in the floor.

Chemical treatment shall be provided in the plinth area of ground floor of the structure, wherever such cracks are noticed by drilling 12 mm holes at the junction of floor and walls along the cracks on the floor and along the construction and expansion joints at the interval of 300 mm to reach the soil below. Chemical emulsion shall be squirted into these holes using a hand operated pressure pump to soak the soil below until refusal or upto a maximum of one litre per hole. The holes shall then be sealed properly with cement mortar 1:2 (1 cement: 2 coarse sand) finished to match the existing floors. The cement mortar applied shall be cured for at least 10 days as per instruction of Engineer-in-charge.

G) TREATMENT OF VOIDS IN MASONRY

The movement of termites through the masonry wall may be arrested by drilling holes in masonry wall at plinth level and squirting chemical emulsions into the holes to soak the masonry. The holes shall be drilled at an angle of 45 degree from both sides of the plinth wall at 300 mm intervals and emulsion squirted through these holes to soak the masonry using a hand operated pump. This treatment shall also be extended to internal walls having foundations in the soil. Holes shall also be drilled at wall corners and where door and window frames are embedded in the masonry or floor at ground. Emulsion shall be squirted through the holes till refusal or to a maximum of one litre per hole. Care shall be taken to seal the holes after the treatment.

H) TREATMENT AT POINTS OF CONTACT OF WOOD WORK

The wood work which has already been damaged beyond repairs by termites shall be replaced. The new timber shall be dipped or liberally brushed at least twice with chemical in oil or kerosene. All existing wood work in the building which is in contact with the floor or walls and which is infested by termites, shall be treated by spraying at the points of contacts with the adjoining masonry with the chemical emulsion by drilling 6 mm holes at a downward angle of about 45 degree at junction of wood work and masonry and squirting chemical emulsion into these holes till refusal or to a maximum of half a litre per hole. The treated holes shall then be sealed. Infested wood work in chaukhats, shelves, joints, purlins etc., in contact with the floor or the walls shall be provided with protective treatment by drilling holes of about 3 mm diameter with a downward slant to the core of the wood work on the inconspicuous surface of the frame. These holes should be at least 150 mm centre to centre and should cover in entire frame work. Chemicals shall be liberally infused in these holes. If the wood is not protected by paint or varnish two coats of the chemicals shall be given on all the surfaces and crevices adjoining the masonry.

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I) TREATMENT OF ELECTRICAL FIXTURES

If infestation in electrical fixture (like switch boxes in the wall) is noticed, covers of the switch boxes shall be removed and inside of such boxes shall be treated liberally with 5 per cent Malathion dusting powder. The covers of the switch boxes shall be refixed after dusting.

J) FREE SERVICE GUARANTEE

The Contractor shall note that termite-proofing work is subject to a free service guarantee from the date of completion of the treatment. The Contractor shall give an undertaking in writing that during the **5 (FIVE)** years guarantee period any infestation of subterranean termites will be eradicated and necessary treatment carried out to prevent re-infestation, free of cost to the Employer.

Contractors must ensure that the work is done through a professional pest control operator who is a member of the National Pest Control Association of USA, Indian Pest Control Association or other recognized professional body. A list of termite control jobs successfully undertaken for Government Departments, Statutory bodies or large private organizations are to be provided to prove that they are capable of handling anti-termite work.

K) MODE OF MEASUREMENT

The Mode of measurement for all the above steps will be Carpet area of the floor. The rate quoted by the Contractor The rate shall include the cost of labour and all other inputs (including concentrated chemical) involved in all the operations described above including drilling, refilling and making good the holes.

MORTARS

A) LIST OF BUREAU OF INDIAN STANDARD CODES

S. No.	I.S. No.	Subject
1	IS 269	Specification for 33 grade ordinary Portland cement
2	IS 383	Specification for coarse and fine aggregate from natural source for concrete.
3	15455	Specification for Portland slag cement.
4	IS 460 (Part I)	Specification for test sieves: wire cloth test sieves.
5	IS 650	Specification for standard sand for testing of cement
6	IS 1269	Specification for 53 grade ordinary Portland cement
7	IS 1344	Specification for calcined clay Pozzolana.
8	IS 1489	Specification for Portland pozzolana cement
9	IS 1542	Specification for sand for plaster
10	IS 1727	Methods of Test for Pozzolana materials

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11	IS 2116	Specification for sand for masonry mortar.
12	IS 2250	Code of practice for preparation and use of masonry Mortar.
13	IS 2386 (Pt-I)	Method of test for aggregate for concrete (Particle size and
14	IS 2386 (Pt-II)	-Do- Estimation of deleterious materials and organic
15	IS 2386 (Pt-III)	-Do- Specific gravity, density, voids, absorption and bulking.
16	IS 3025	Method of sampling and test for water
17	IS 3406	Specification for masonry cement.
18	IS 3812 (Part I)	Specification for fly ash for use as pozzolana in cement
19	IS 3812 (Part II)	Specification for fly ash for use as admixture in cement
20	IS 4031 (Part I) to (Part XIII)	Method of Physical test for hydraulic cement
21	IS 4032	Method of chemical analysis of Hydraulic cement.
22	IS 8041	Rapid hardening Portland cement.
23	IS 8042	Specification for white cement
24	IS 8043	Hydrophobic Portland cement
25	IS 8112	Specification for 43 grade ordinary Portland cement
26	IS 11652	Woven HDPE sacks for packing cement
27	IS 11653	Woven polypropylene sacks for packing cement
28	IS 12174	Jute synthetic union bags for packing cement

B) GENERAL

Desirable properties of mortars for use in masonry are:

- (a) **Workability**
- (b) **Water retentivity**
- (c) **Rate of stiffing**
- (d) **Strength**
- (e) **Resistance to rain penetration**
- (f) **Durability**

C) MATERIALS

i. Water

Water used for mixing and curing shall be clean and free from injurious quantities of alkalis, acids, oils, salts, sugar, organic materials, vegetable growth or other substance that may be deleterious to bricks, stone, concrete or steel. Potable water is generally considered satisfactory for mixing. The Ph value of water shall be not less than 6. The following concentrations represent the maximum permissible values: (of deleterious materials in water).

(a) Limits of Acidity: To neutralize 100ml sample of water, using phenolphthalein as an indicator, it should not require more than 5ml of 0.02 normal NaOH. The details of test shall be as given in IS 3025 (part 22).

(b) Limits of Alkalinity: To neutralise 100ml sample of water, using mixed indicator, it should not require more than 25ml of 0.02 normal H₂SO₄. The details of tests shall be as given in IS 3025 (part 23).

(c) Percentage of Solids: Maximum permissible limits of solids when tested in accordance with IS 3025 shall be as under:

Organic 200mg/ litre

Inorganic 3000 mg/ litre

Sulphates 400 mg/ litre

Chlorides 2000 mg/ litre. For concrete not containing embedded steel and 500 mg. /litre. For reinforced concrete work.

Suspended matter 2000 mg/ litre

The physical and chemical properties of ground water shall be tested along with soil investigation and if the water is not found conforming to the requirements of IS 456-2000; the tender documents shall clearly specify that the contractor has to arrange good quality water for construction indicating the source.

Water found satisfactory for mixing is also suitable for curing. However, water used for curing shall not produce any objectionable stain or unsightly deposit on the surface.

Sea water shall not be used for mixing or curing

Water from each source shall be tested before the commencement of the work and thereafter once in every three months till the completion of the work. In case of ground water, testing shall also be done for different points of drawdown. Water from each source shall be got tested during the dry season before monsoon and again after monsoon.

ii. Cement

The cement used shall be any of the following grades and the type selected should be appropriate for the intended use.

(a) 33 grade ordinary Portland cement conforming to IS 269.

(b) 43 grade ordinary Portland cement conforming to IS 8112.

(c) 53 grade ordinary Portland cement conforming to IS 12269. (Only for RCC and specialized applications)

(d) Rapid hardening Portland cements conforming to IS 8041.

(e) Portland slag cement conforming to IS 455.

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- (f) Portland Pozzolana cement (fly ash based) conforming to IS 1489 (Part 1).
- (g) Portland Pozzolana cement (calcined clay based) conforming to IS 1489 (part 2).
- (h) Hydrophobic cement conforming to IS 8043
- (i) Low heat Portland cement conforming to IS 12600.
- (j) Sulphate resisting Portland cement conforming to IS 12330
- (k) White cement conforming to IS 8042

Different types of cement shall not be mixed together. In case more than one type of cement is used in any work, a record shall be kept showing the location and the types of cement used.

Compressive Strength:

Compressive strength requirement of each type of cement for various grades when tested in accordance with IS 4031(part 6) shall be as under:

Sample	Strength in N/mm ² not less than for		
	Gr. 33	Gr.43	Gr.53
72 + 1 hr	16	23	27
168 + 2 hrs	22	33	37
672 + 4 hrs	33	43	53

Setting Time:

Setting time of cement of any type of any grade when tested by Vicat apparatus method described in IS 4031 shall conform to the following requirement:

- (a) Initial setting time: Not less than 30 minutes
- (b) Final setting time: Not more than 600 minutes

Supply:

The cement shall be packed in jute sacking bags conforming to IS 2580, double Hessian bituminized (CRI type) or woven HOPE conforming to IS 11652. Woven polypropylene conforming to IS 11653, jute synthetic union conforming to IS: 12174, or any other approved composite bags, bearing the manufacturer's name or his registered trade mark if any, with grade batch no. and type of cement, with date of manufacturing of batch of cement. Every delivery of cement shall be accompanied by a producer's certificate conforming that the supplied cement conforms to relevant specifications. These certificates shall be endorsed to the Engineer-in-Charge for his record.

Every consignment of cement must have identification marks on packages indicating date of manufacturing grade and type of cement batch no. etc. Cement brought to works shall not be more than 6 weeks old from the date of manufacture.

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Effective precautionary measures shall be taken to eliminate dust-nuisance during loading or transferring cement.

Stacking and Storage: For stacking and storage please refer the relevant conditions as mentioned under the heading of Stacking and storage.

iii. Fine Aggregate

Aggregate most of which passes through 4.75 mm IS sieve is known as fine aggregate. Fine aggregate shall consist of natural sand, crushed stone sand, crushed gravel sand stone dust or marble dust, fly ash and broken brick (Burnt clay). It shall be hard, durable, chemically inert, clean and free from adherent coatings, organic matter etc. and shall not contain any appreciable amount of clay balls or pellets and harmful impurities e.g. iron pyrites, alkalis, salts, coal, mica, shale or similar laminated materials in such form or in such quantities as to cause corrosion of metal or affect adversely the hardening, the strength, the durability or the appearance of mortar, plaster or concrete. The sum of the percentages of all deleterious material shall not exceed 5%. Fine aggregate must be checked for organic impurities such as decayed vegetation humps, coal dust etc. in accordance with the procedure prescribed in Appendix 'A' as given under

APPENDIX A DETERMINATION OF PARTICLE SIZE

In order that the sieves shall not be overloaded, care must be taken to ensure that the maximum sieve loads shown in Table A-4.1 (below) are not exceeded at the completion of sieving.

TABLE A-4.1

<i>I.S. Sieve Designation</i>	<i>Maximum weight for</i>	
	<i>45 cm dia sieve kg</i>	<i>30 cm dia sieve kg</i>
45mm	10	4.5
40mm	8	3.5
31.5 mm or 22.1 mm	6	2.5
20mm	4	2.0
16 mm or 12.5 mm	3	1.5
10mm	2	1.0
5.6mm	1.5	0.75
4.75 mm	1.0	0.50
3.35 mm		0.30

The sample weight taken will thus normally require several operations on each sieve. Each sieve should be taken separately over a clean tray or receiver until no more than a trace passes, but in any case for not less than two minutes. Materials should not be forced through the apertures but hand placing is permitted. A light brush should be used with fine sieves. The cumulative weight passing each sieve should be calculated as percentage of the total sample weight to the nearest whole number.

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Silt Content: The maximum quantity of silt in sand as determined by the method prescribed shall not exceed 8%. Fine aggregate containing more than allowable percentage of silt shall be washed as many times as directed by Engineer-in-charge so as to bring the silt content within allowable limits for which nothing extra shall be paid.

Grading: On the basis of particle size, fine aggregate is graded in to four zones. The grading when determined shall be within the limits given in Table 3.1 below. Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron IS sieve, by a total amount not exceeding 5 per cent, it shall be regarded as falling within that grading zone.

TABLE 3.1

Fine Aggregates (Clause 3.1.3)

IS Sieve	Percentage passing for			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10mm	100	100	100	100
4.75 mm	90-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 microns	15-34	35-59	60-79	80-100
300 microns	5-20	8-30	12-40	15-50
150 microns	0-10	0-10	0-10	0-15

Note 1: For crushed stone sands, the permissible limit on 150 micron sieve is increased to 20 per cent.

Note 2: Allowance of 5% permitted can be split up, for example it could be 1% on each of three sieves and 2% on another or 4% on one sieve and 1% on another.

Note 3: Fine aggregate conforming to Grading Zone IV shall not be used in reinforced cement concrete unless tests have been made to ascertain the suitability of proposed mix proportions.

Note 4: Sand requiring use for mortar for plaster work shall conform to IS 1542 and for masonry work shall conform to IS 2116.

Type and grading of fine aggregate to be used shall be specified. It shall be coarse sand, fine sand, stone dust or marble dust, fly ash and surkhi. Use of sea sand shall not be allowed, unless otherwise specified.

- a) Coarse and fine sand shall be river sand. Its grading shall fall within the limits of grading
- b) Zone I, II, III, IV of Table 3.1. Grading of sand shall conform to IS 2116 for use in Masonry work.

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- c) Stone dust shall be obtained by crushing hard stones or gravel. Its grading shall fall within the limits of grading Zone, I, II, or III of Table 3.1.
- d) Marble dust shall be obtained by crushing marble. Its grading shall fall within the limits of Grading Zone IV of Table 3.1. Grading of Marble dust for use in Mortar shall be as per following table.

Grading of Marble Dust

Grading of Marble Dust

<i>IS Sieve</i>	<i>Percentage Passing</i>
10mm	100
4.75 mm	95-100
2.36 mm	95-100
1.18 mm	90-100
600 micron	80-100
300 micron	15-50
150 micron	0-15

- e) Sand for Masonry Mortar and for Plaster- Sand shall consist of natural sand, crushed stone sand or crushed gravel sand or a combination of any of these. Sand shall be hard durable, clean and free from adherent coating and organic matter and shall not contain the amount of clay, silt and fine dust more than specified as under.

Deleterious Material: Sand shall not contain any harmful impurities such as iron, pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shale in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar.

The maximum quantities of clay, fine silt, fine dust and organic impurities in the sand / Marble dust shall not exceed the following limits:

- (1) Clay, fine silt and fine dust when determined in accordance within IS 2386 (Part II). In natural sand or crushed gravel sand and crushed stone sand - Not more than 5% by mass
- (2) Organic impurities when determined in accordance with IS 2386 (Part II) - Colour of the liquid shall be lighter than that indicated by the standard specified in IS 2386 (Part II).

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Grading of sand for use in masonry mortar shall be conforming to IS 216 (Table 3.2 below).

TABLE 3.2

Grading of Sand for use in Masonry Mortar and Plaster

<i>Grading of sand for use in masonry mortar</i>		<i>Grading of sand for use in plaster</i>	
<i>IS Sieve Designation</i>	<i>Percentage passing by mass</i>	<i>IS Sieve Designation</i>	<i>Percentage passing by mass</i>
10mm	100	10mm	100
4.75 mm	100	4.75 mm	95 to 100
2.36 mm	90 to 100	2.36 mm	95 to 100
1.18 mm	70 to 100	1.18 mm	90 to 100
600 micron	40 to 100	600 micron	80 to 100
300 micron	5 to 70	300 micron	20 to 65
150 micron	0 to 15	150 micron	0 to 50

Note: For crushed stone sands, the permissible limit on 150 micron IS Sieve is increased to 20%, this does not affect the 5% allowance as per IS 2386 (Part 1).

Bulking: Fine aggregate, when dry or saturated, has almost the same Volume but dampness causes increase in volume. In case fine aggregate is damp at the time of proportioning the ingredients for mortar or concrete, its quantity shall be increased suitably to allow for bulking, which shall be determined by the method at the end of the chapter. Table 3.3 gives the relation between moisture content and percentage of bulking for guidance only.

Stacking: Fine aggregate shall be so stacked as to prevent dust and foreign matter getting mixed up with it as far as practically possible. Marble dust in dry condition shall be collected in bags and properly staked so as not to form lumps, suitable arrangements shall be made to protect it from moisture similar to those adopted for stacking of cement bags.

Measurements: As the fine aggregate bulks to a substantial extent when partially wet, measurements shall be taken when the stacks are dry or appropriate allowance made for bulking.

iv. Broken Brick (Burnt Clay) Fine Aggregate

Broken Brick (Burnt Clay) Fine Aggregate, also known as Surkhi, shall be made by grinding well burnt (but not under or over burnt) broken bricks as specified in IS 3068-1986.

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It shall not contain any harmful impurities, such as iron pyrites, salts, coal, mica, shale or similar laminated or other materials in such form of quantity as to adversely affect hardening, strength, durability or appearance of the mortar.

The maximum quantities of clay, fine silt, fine dust and organic impurities in surkhi (all taken together) shall not exceed five per cent by weight. The particle size grading of surkhi for use in lime mortars shall be within the limits specified in Table 3.4.

TABLE 3.4

<i>IS Sieve Designation</i>	<i>Percentage passing (by wt)</i>
4.75 mm	100
2.36 mm	90-100
1.18 mm	70-100
600 microns	40-100
300 microns	5-70
150 microns	0-15

Stacking: Surkhi shall be stacked on a hard surface or platform so as to prevent the admixture of clay, dust, vegetation and other foreign matter. It shall be also protected from rain and dampness and kept under adequate coverings.

Measurements: Surkhi shall be measured in regular stacks in cubic metres. Alternatively it may be measured by weight when supplied in bags.

v. Fly Ash

Fly ash is finely divided residue resulting from the combustion of pulverized coal in boilers. Fly ash is the pulverized fuel ash extracted from the flue gases by any suitable process such as cyclone separation or electrostatic precipitation. The ash collected from the bottom of boilers is termed as bottom ash. Fly ash is finer than bottom ash. Siliceous fly ash (ASTM Class F) containing calcium oxide less than 10% by mass is normally produced from burning anthracite or bituminous coal and possesses pozzolana properties. Calcareous fly ash (ASTM Class C) is produced by burning lignite or sub-bituminous coal and contains calcium oxide more than 10% by mass; the content could be as high as 25%. This fly ash has both hydraulic and pozzolana properties. It shall be clean and free from any contamination of bottom ash, grit or small pieces of pebbles. It is obligatory on the part of supplier/manufacturer that the fly ash conforms to the requirements if mutually agreed upon and shall furnish a certificate to this effect to the purchaser or his representative.

Characteristics:

The physical requirements of fly-ash shall be as specified in Annexure 'E' as given below. The chemical properties of fly ash shall be as per IS 3812 (part 1 and 2) depending on the usage.

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APPENDIX 'E'

PHYSICAL REQUIREMENTS OF FLY ASH

(Clause 3.1.5 and 3.1.5.1)

Sr. No	Characteristics Requirement of Fly Ash	For use as Pozzolana	For use as admixture in Cement Mortar and concrete
1	2	3	4
(i)	Fineness- Specific surface in m ² /kg by Blaine's permeability method, min	320	200
(ii)	Lime reactivity- average compressive strength in <u>N/mm² Min</u>	4.5	
(iii)	Compressive strength at 28 days in N/mm ²	Not less than 80 per cent of the strength of corresponding mortar cubes.	
(iv)	Soundness of autoclave test expansion of specimens, per cent, max	0.8	0.8
(v)	Particles retained on 45 micron IS sieve (wet sieving) in percent maximum	34	50

Stacking: Fly ash shall be protected from dirt collecting on it, for details on stacking, please refer the detailed specifications as mentioned in the stacking of material section in this Tender document.

Measurements: Fly ash shall be measured in regular stacks in cubic metres. Alternatively it may be measured by weight when supplied in bags.

D) PREPARATION OF MORTARS AND ITS GRADE

Grade of Masonry Mortar

The grade of masonry mortar will be defined by its compressive strength in N/mm² at the age of 28 days as determined by the standard procedure detailed in IS 2250.

For proportioning the ingredients by volume, the conversion of weight into volume shall be made on the following basis:

- (a) Burnt Clay Pozzolana 860 Kg/cum
- (b) Coarse Sand (dry) 1280 kg/cum
- (c) Fine sand (dry) 1600 kg/ cum
- (d) Fly Ash 590 kg/ cum

For details of grades and criteria for selection of Masonry mortars see Appendix 'F'.

APPENDIX F - CRITERIA FOR SELECTION OF MASONRY MORTARS (Clauses 3.2.0, 3.2.0.1, 3.2.1.1)

The selection of masonry mortars from durability consideration will have to cover both the loading and exposure condition of the masonry. The masonry mortar shall generally be as specified below in (a) to (g).

- a) In case of masonry exposed frequent to rain and where there is further protection by way of plastering or rendering or other finishes, the grade of mortar shall not be less than 0.7 MM but shall preferably be of grade MM2. Where no protection is provided, the grade of mortar for external wall shall not be less than MM2.
- b) In case of load bearing internal walls, the grade of mortar shall preferably be MM 0.702 or more for high durability but in no case less than MM 0.5.
- c) In the case of masonry work in foundations laid below damp proof course, the grade of mortar for use in masonry shall be as specified below.
 - a) Where soil has little moisture, masonry mortar of grade not less than MM 0.7 shall be used. (ii) Where soil is very damp, masonry mortar of grade preferably MM 2 or more shall be used. But in
 - d) In no case shall the grade of mortar be less than MM 2.
 - e) For masonry in building subject to vibration of machinery, the grade of mortar shall not be less than MM 3.
 - f) For parapets, where the height is greater than thrice the thickness, the grade of masonry mortar shall not be less than MM3. In case of low parapets the grade of mortar shall be the same as used in the wall masonry.
 - i. The grade of mortar for bedding joints in masonry with large concrete blocks shall not be less than **MM 3**.
 - ii. The compressive strength shall be determined in accordance with the procedure given in IS **2250**.
- g) While mixing the pozzolana material like fly ash in mortars Ordinary Portland cement only shall be used.

h)

Grade of Masonry Mortar (IS 2250) (Clause 3.2.0)

Sl. No.	Grade	Compressive strength at <u>28 days in</u>	Cement	Pozzolana (Fly Ash)	Sand
1	MM0.7	0.7 to 1.5	1.00		8.00
2			1.00	0.4*	10.00
3	MM 1.5	1.5 to 2.0	1.00		7.80
4			1.00	0.4*	7.50
5	MM3	3.0 to 5.0	1.00		6.00

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6			1.00	0.21	4.20
7			1.00	0.40	7.50
8	MM5	5.0 to 7.5	1.00		5.00
9			1.00	0.40	6.25
10			1.00	0.40	5.00
11	MM7.5	7.5 and above	1.00	0.20	4.00
12			1.00**	0.40	2.10
13			1.00		3.30
14			1.00		3.75

Note:

* **Pozzolana of minimum lime reactivity of 4 N/MM²**

** **This ratio by volume correspondence approximately to cement pozzolana ratio of 0.8:0.2 by weight.** In this case, only ordinary Portland cement is to be used (see IS 269). Specifications for ordinary rapid hardening and low heat Portland Cement (Third revision). Note: Compressive strength shall be determined in accordance with the Appendix -A-IS 2550.

Cement Mortar

This shall be prepared by mixing cement and sand with or without the addition of pozzolana in specified proportions

Proportioning: Proportioning on weight basis shall be preferred taking into account specific gravity of sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic metres. Other ingredients in specified proportion shall be measured using boxes of size 40 x 35 x 25 cm. Sand shall be measured on the basis of its dry volume in the case of volumetric proportioning.

Mixing

The mixing of mortar shall be done in mechanical mixers operated manually or by power as decided by Engineer-in-Charge. Hand mixing will not be allowed under all circumstances.

- (a) **Mechanical Mixing:** Cement and sand in the specified proportions shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least three minutes. Only the required quantity of water shall be added which will produce mortar of workable consistency but not stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing, shall be prepared at a time. Mixer shall be cleaned with water each time before suspending the work.

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- (b) Hand Mixing: Hand mixing will not be allowed.

Precautions: mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.

Cement Fly ash Sand Mortar

This shall be prepared by mixing cement, fly ash and sand in specified proportions. Mixing shall be done in a mechanical mixer (operated manually or by power). Hand mixing will not be allowed under all circumstances.

Proportioning:

Proportioning on weight basis shall be preferred taking into account specific gravity of Fly Ash, sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic metres. Other ingredients in the specified proportions shall be measured using boxes of suitable sizes. Sand and fly ash shall be measured on the basis of their dry volume in the case of volumetric proportioning.

Mixing

- (a) Mechanical Mixing: Sand and fly ash in the specified proportions shall be mixed dry in a mixer and then the specified quantity of cement shall be added and mixed dry thoroughly. Water shall then be added gradually and wet mixing continued for at least one minute. Water shall be just sufficient to bring the mortar to the consistency of a workable paste. Only the quantity of mortar which can be used within 30 minutes of its mixing shall be prepared at a time.

- (b) Hand Mixing: Hand mixing will not be allowed

Precautions: mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.

E) TESTS ON MORTAR

12.5.1. TEST FOR SILT CONTENT

The sand shall not contain more than 8% of silt as determined by field test with measuring cylinder.

The method of determining silt contents by field test is given below:

A sample of sand to be tested shall be placed without drying in a 200 ml measuring cylinder. The volume of the sample shall be such that it fills the cylinder up to 100 ml mark. Clean water shall be added up to 150 ml mark. Dissolve a little salt in the water in the proportion one tea spoon to half a litre. The mixture shall be shaken vigorously, the last few shakes being sidewise direction to level off the sand and the contents allowed to settle for three hours.

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The height of the silt visible as settled layer above the sand shall be expressed as a percentage of the height of sand below. The sand containing more than the above allowable percentage of silt, shall be washed so as to bring the silt contents within allowable limits.

12.5.2. BULKING OF FINE AGGREGATES/SAND (FIELD METHODS)

Two methods are suggested for determining the bulking of sand/fine aggregate. The procedure may be suitably varied, if necessary. Both depend on the fact that the volume of inundated sand/fine aggregate is the same if the sand/fine aggregate were dry.

Method -1: Put sufficient quantity of sand loosely into a container until it is about two-third full. Level off the top of the sand and push a steel rule vertically down through the sand at the middle to bottom, measure the height. Suppose this is 'X' cm.

Empty the sand out of the container into another container where none of it is lost. Half fill the first container with water. Put back about half the sand and rod it with a steel rod, about 6 mm in diameter, so that its volume is reduced to a minimum. Then add the remainder and level the top surface of the inundated sand. Measure its depth at the middle with the steel rule. Suppose this is 'Y' cm.

The percentage of bulking of the sand due to moisture shall be calculated from the formula:

$$\text{Percentage bulking} = (X/Y - 1) \times 100$$

Method-2: In a 250 ml measuring cylinder, pour the damp sand, consolidate it by staking until it reached the 200 ml mark.

Then fill the cylinder with the water and stir the sand well (the water shall be sufficient to submerge the sand completely). It will be seen that the sand surface is now below its original level. Suppose the surface is at the mark of Yml, the percentage of bulking of sand due to moisture shall be calculated from the formula.

$$\text{Percentage bulking} = (200/Y - 1) \times 100$$

TABLE 3.3

<i>Moisture content % age</i>	<i>Bulking % age (by volume)</i>
2	15
3	20
4	25
5	30

CONCRETE BLOCK MASONRY

A) SCOPE

These specifications cover the use of Concrete Block Masonry for the structural/ non structural purposes.

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B) GENERAL

The provision of the latest Indian Standards listed below form part of these specifications:

All relevant Standards as specified elsewhere in this Volume are also applicable.

IS 269	Specification for ordinary and low heat Portland cement
IS 383	Specification for coarse and fine aggregates from natural sources for concrete.
15455	Specification for Portland slag cement
15456	Code of Practice for plain and reinforced concrete.
IS 2185 (Part I)	Solid cement concrete blocks.
IS 2572	Code of practice for construction of hollow concrete block masonry.
IS 2645	Specification for integral waterproofing compound.
IS 9103	Specification for admixtures for concrete.

C) MATERIALS

i. Cement

Ordinary Portland cement complying with IS 269 shall be used unless specified. Cement complying with any of the following Indian Standards may be used at the discretion of the Engineer-in Charge: IS 269-1989, 455-1989, 1489-1999, 6909-1990, 8041-1990, 8043-1991. When cement conforming to IS: 269-1989 is used, replacement of cement by fly ash conforming to 15:3812-1981 may be permitted up to a limit of 20%. However, it shall be ensured that blending of fly ash with cement is as intimate as possible, to achieve maximum uniformity.

ii. Aggregates

Aggregates shall conform to IS 383. Grading shall be as indicated in IS 383. Fineness modulus of the combined aggregates shall be between 3.6 and 4. The aggregates used in the manufacture of block shall be clean and free from all deleterious matter, and shall conform to the requirements of IS:383-1970. Maximum size of the coarse aggregate shall be 10 mm. Sand used in the manufacture of blocks shall be well graded, clean and free from deleterious matter, and shall conform to the requirements of IS: 383-1970. Besides it shall have fine particles 15 to 20% passing 300 micron IS Sieve and 5 to 15% passing 150 micron IS Sieve.

iii. Water

Water conforming to IS 456 and as approved by the EiC shall be used.

iv. Admixtures

Additives or admixtures may be added to the cement or concrete mix conforming to the IS specifications. Admixtures shall be chloride free and melamine polymer based. Other additives or admixtures not being governed by Indian Standards shall be tested and checked that the same are not detrimental to durability.

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However any addition shall only be after approval of the EiC.

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v. FLY ASH

Fly ash conforming to IS: 3812 (Part 111)-1966* may be used for part replacement of fine aggregate up to a limit of 20 percent for the construction of blocks. This will only be applicable on the written recommendations of the structural consultant and his decision will be final on this matter

D) MANUFACTURE

- i. Concrete blocks may be hollow (open or closed cavity) or solid and shall be referred to by its nominal dimension. The term nominal dimension includes the thickness of the mortar joint. All specifications of solid concrete blocks including specifications for actual dimensions, tolerances, sizes, shapes and webs, grades of blocks etc. shall conform to IS : 2185. Blocks may be manufactured either at construction site or in factory on a central casting platform using steel moulds with or without surface vibration for compaction of cement concrete.
- ii. Mould: - Moulds shall be fabricated using mild steel plates and mild steel angles for stiffening the plates. The mould shall be either fixed type (box with four side walls fixed at corners, and top and bottom open) or split type. Split type may be either individual or gang mould. Where the compaction of the concrete is done manually, the mould may be either fixed type or split type. When the compaction of the blocks is done with surface vibrator, the mould shall be only split type (individual or gang mould).
- iii. Concreting
Concrete mix used for blocks shall be pre-designed to give a minimum crushing strength as specified in table 2 given below. Concrete shall be mixed in the mechanical mixer. Blocks shall be moulded, laid and compacted with automatic machines table vibrator. Care shall be taken to see that the mix mould is properly filled up. Block shall be protected until they are sufficiently hardened to permit handling without damage. The cement concrete mix for concrete masonry blocks shall not be richer than one part by volume of cement to 9 parts by volume of combined fine and coarse aggregates, and shall not be leaner than one part by volume of cement to 13 parts by volume of combined fine and coarse aggregates.
- iv. In case of blocks where compaction is done manually, concrete mix of medium Consistency (10-12 mm slump) shall be used in order to enable proper compaction and de-moulding. The consistency of the mix should be such that it may cohere when compressed in the hand without free water being visible.
- v. In case of blocks where compaction is done by external vibrator, concrete mix of very low consistency (zero slump) shall be used in order to vibrate and compact the concrete under pressure.
- vi. Mixing:-
Concrete shall normally be mixed in a mechanical mixer unless otherwise permitted by Engineer-in-charge. In case of hand mixing 10% extra cement shall be used without any extra

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payment. Mixing shall be continued until there is a uniform distribution of the materials, and the mass is uniform in colour and consistency.

- vii. De-moulding shall be done 5 to 10 minutes after compaction. In case of fixed type mould it shall be pulled up with side handles while pressing down the block with the plate at top with thumb., In case of split type mould, the sides shall be removed first and the partition plates (gang mould) shall be pulled up subsequently.

After de-moulding, the blocks shall be protected until they are sufficiently hardened to permit handling without damage.

- viii. Curing and Drying

Blocks shall be cured in the curing yard by keeping them continuously moist for at least 14 days. Steam-cured blocks shall be preferred. Cured blocks shall be allowed to dry for a period of 4 weeks before being used. The blocks shall be allowed to complete their initial shrinkage before they are laid in the wall.

- ix. Physical requirements

All blocks shall be sound and free of cracks or other defects. For exposed construction face or faces shall be free of chips, or other imperfections, and the overall dimensions of the blocks shall be in accordance to tolerance as specified. Minimum compressive strength shall be as per table 2 below, maximum permissible water absorption shall not exceed the limit specified in I.S. : 2185, dimensional variations shall conform to I.S. 2185.

The minimum compressive strength at 28 day being the average of eight blocks, and the minimum compressive strength at 28 days of individual blocks, when tested in the manner described in Appendix B, of IS:12440-1988, shall be as prescribed in Table 2.

TABLE 2 COMPRESSIVE STRENGTH OF CONCRETE STONE MASONRY BLOCKS

Class Designation Compressive Strength (N/mm²)	Minimum average blocks N/mm²	Minimum strength of individual of blocks (N/mm²)
5	5	3.5
6	6	4.2
7	7	5
9	9	6.3
10	10	7.5

For 100 mm wide blocks (for 100 mm thick walls), the minimum strength may be 3.5 N/mm²

- x. Testing

Tests as indicated in Appendices A to F of IS 2185 shall be conducted on samples of units selected according to the sampling procedure given here under to ensure conformity with the physical requirements as specified.

xi. Sampling

A sample of 20 blocks shall be taken from every consignment of 5000 blocks or part thereof of the same size and same batch of manufacture. From these samples, the blocks shall be taken at random for conducting the test.

The blocks shall be taken at regular intervals during the course of work, preferably while being loaded or unloaded. In case samples are to be taken from the stacks, blocks shall be taken at random from across the top of the stacks, the sides accessible and from the interior of the stacks.

The blocks shall be kept under cover and protected from extreme conditions of temperature, relative humidity and wind until they are required for test. The test shall be conducted as soon as the sample has been taken.

xii. Number of Tests

All the 20 blocks shall be checked for dimensions and inspected for visual defects. Out of the 20 blocks, 3 blocks shall be subjected to the test for block density, 8 blocks to the test for compressive strength, 3 blocks to the test for water absorption and 3 blocks to the test for drying shrinkage and later to the test for moisture movement. The remaining 3 blocks shall be reserved for retest for drying shrinkage and moisture movement if a need arises.

Blocks shall be approved if requirements of conditions mentioned in 11.2 to 11.5 (of IS 2185 (Part I) are satisfied.

The number of blocks with dimensions outside the tolerance limit and/ or with visual defects, among those inspected shall not be more than two.

For Block density and compressive strength, the mean value determined shall be greater than or equal to the minimum limit specified in Table 2 of IS 2185 (Part I) and reproduced as Table 27 of Annexure.

For drying shrinkage and moisture movement, all the test specimens shall satisfy the requirements of the test. If one of more specimens fails to satisfy the requirements, the remaining 3 blocks shall be subjected to these tests. All blocks shall satisfy the requirements.

Drying shrinkage shall not exceed 0.1 percent.

For water absorption, the mean value determined shall not be more than 10 percent by mass.

E) HOLLOW AND SOLID CONCRETE BLOCK MASONRY

Hollow and solid concrete blocks- Shall conform to the requirements of IS: 2185--1979.

Specification for hollow and solid concrete blocks except with regard to the mix of cement concrete and sizes of aggregates shall be as indicated. Hollow blocks shall be sound, free from cracks, broken edges, honey combing and other defects that would interfere with the proper placing of block or impair the strength or performance of construction.

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Concrete Block-hollow (open or closed cavity) or solid shall be referred to by its nominal dimensions.

The nominal dimensions of concrete block shall be, as follows:

Length 400mm, 500mm or 600mm

Height 200mm or 100 mm

Width 50mm, 75mm, 100mm, 150mm, 200mm, 250mm or 300mm

In addition, block shall be manufactured in half lengths of 200mm, 250mm or 300mm to correspond to the full lengths. The maximum variation in the length of the units shall be not more than ± 5 mm and maximum variation in height and width of unit, not more than ± 3 mm.

i. WORKMANSHIP

1. In total dry climate top and sides may be slightly moistened to avoid absorption of water from mortar.
2. Joints shall not be bigger than 10mm and will be perfectly horizontal and vertical. Joints shall be raked 10mm deep while mortar is wet.
3. Cut blocks shall not be used. Special solid pre-cast blocks at site shall be cast well in advance to be used as spacers and to adjust breaking of vertical joints.
4. Cracks in block masonry are due to shrinkage or expansion of blocks or due to settlement, thermal expansion or changes in moisture content in the structural members enclosing the block walls. The following measures are recommended to prevent formation of cracks.
 - a. While curing, the block masonry should be lightly sprinkled with water and not made excessively wet.
 - b. Expansion joints shall be provided in walls exceeding 30 m in length.
 - c. Reinforcement should be provided in the bed joints in block work, one course above and course below windows and above doors in order to distribute the shrinkage/ temperature stresses occurring at the corners of openings, more uniformly throughout the walls.
 - d. R.C.C. band (Patlis) 100 mm thick and width equal to block masonry and having 8 mm dia. two bars with 8 mm dia links @ 300 mm c/c shall be provided at every 1000mm interval in the block masonry. The gap between the topmost layer of block and the soffit of the beam shall be packed by lightly hammering flat pieces of Shahabad/ Kota tiles and then the gaps will be covered by weld mesh before closing them by cement plaster. The weld mesh will be extended at least 150 mm on the R.C.C. beam and 150 mm on block masonry and nailed to them with strong nails.
 - e. Provisions for door and window frames: - A course of solid concrete block masonry shall be provided under door and window openings (or a 10em thick pre-cast concrete sill block under windows). The solid course shall extend for at least 20cm beyond the opening on either side. For jambs of very large doors and windows either solid unit are used, or the hollows shall be filled in with concrete of mix 1:3:6 using 12.5 mm nominal size aggregates.
 - f. Provisions for Roof/ceiling: - The course immediately below the roof slab shall be built with solid blocks: The top of the roof course shall be finished smooth with a layer of cement and coarse sand mortar 1:3, 10mm thick and covered with a thick coat of white wash or crude oil, to ensure free movement of slab.

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g. Intersecting walls: - When two walls meet or intersect and the courses are to be laid up at the same time, a true masonry bond between at least 50% of the units at the intersection is necessary. When such intersecting walls are laid up separately, pockets with 20mm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets. Fixtures, fittings, etc. shall be built into the masonry in cement and coarse sand mortar 1:3 while laying the blocks where possible. Hold fasts shall be built into the joints of the masonry during laying. Holes, chases, sleeves, openings, etc of the required size and shape shall be formed in the masonry with special blocks while laying, for fixing pipes, service lines, passage of water etc. After service lines, pipes etc are fixed, voids left, if any, shall be filled up with cement concrete 1:3:6 (1 cement 3 coarse sand: 6 stone aggregate 20mm nominal size) and neatly finished.

ii. SCAFFOLDING

Scaffolding shall be **double** and shall be erected with steel sections or pipes of adequate strength so as to be safe for construction operations. The contractor shall take all measures to ensure the safety of the work and working people. Any instructions of the Engineer in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach to every part of the work. Overhead work shall not be allowed. Block work shall be carried out with double scaffolding only. Making holes of any kind for the purpose of supporting the scaffolding shall not be permitted.

iii. MEASUREMENT

Hollow or solid cement concrete block work shall be measured in Sqm for the specified widths up to 200mm. For widths 200mm and greater than 200mm, the mode of measurement will be in cubic meters

iv. RATES

Rates for concrete block masonry item shall include the following:

- 13.5.4.1.1. Material and labour, for the completion of items as specified including any centring, shuttering, curing etc.
- 13.5.4.1.2. Raking out of joints.
- 13.5.4.1.3. Preparation of the tops and sides.
- 13.5.4.1.4. Forming and preparing expansion, contraction or construction joints as detailed above or specified in the BOQ or drawings.
- 13.5.4.1.5. Making holes, openings, etc. for outlets, embedding down take pipes, etc. wherever necessary during construction and finishing exposed surfaces as per instruction of the EiC.
- 13.5.4.1.6. Curing and protection as specified.
- 13.5.4.1.7. Making holes, openings, outlets, etc. embedding pipes, ends of beams, joints, slabs, trusses, sills, etc. whatever required during construction and neatly finishing the exposed surfaces and opening as per instructions of the EiC.

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F) AUTOCLAVED AERATED BLOCKS/ LIGHT WEIGHT BLOCK MASONRY

Autoclaved Aerated Concrete Blocks or AAC Blocks are concrete products which possess a unique combination of thermal properties like low thermal conductivity and high thermal inertia. AAC Blocks provide thermal insulation through walls. Autoclaved aerated concrete mixture consisting of quartz sand, lime, cement, proprietary additives, water, and reinforcement.

Technical Data:

Face Size (L X H in mm)	600 x 200		
Wall Thickness (in mm)	100	150	200
Dry Weight (in Kg)	7.8	11.7	15.6
Normal Dry Density (kg/m ³)	650	650	650
Thermal Conductivity	0.16	0.16	0.16
Sound Reduction (in decibels)	38-50 db depending on thickness		
Fire Resistance (in hours) for			
NLB (Non load bearing)	4	6	6
LB (load bearing)	2	4	4

Compressive Strength: The light weight concrete block shall have a minimum compressive strength of 35 kg/ sq.cm.

Bending Compression: 15 kg/ sq.cm.

The mortar used for light weight concrete block shall be as specified in the Schedule of Items; Cement and water used in mortar shall conform to the quality as described in Mortar, whereas sand used for mortar shall be fine screened only. The light weight concrete block masonry should not be used below ground or in plinth. The block masonry work shall be built in stretcher course only. Use of strong mortar with light weight concrete blocks is not advisable, use of compatible mortar is advisable. Lean mortars distribute and accommodate more readily the strains arising from thermal, moisture and chemical changes. According to IS 6041:1985 blocks shall be embedded with a mortar, the strength of which is relatively lower than that of mix used in making of blocks. Cement sand mortar 1:6 or 1:1: 5 (1 cement: 1 fly ash : 5 sand) shall be used. The mortar shall not be spread so much ahead of the actual laying of the units that it tends to stiffen and lose its plasticity there by resulting in poor bond. Consistency as per requirement of site must be maintained at the point of laying over bed. Mortar joint shall be struck off flush with wall surface and when the mortar starts stiffening, it shall be compressed tightly to have a key for plastering.

i. WORKMANSHIP

1. In total dry climate top and sides may be slightly moistened to avoid absorption of water from mortar. These blocks should never be soaked prior to laying in the wall. Only slight wetting is required

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2. Joints shall not be bigger than 10mm and will be perfectly horizontal and vertical. Joints shall be raked 10mm deep while mortar is wet.
3. Cracks in AAC block masonry are due to shrinkage or expansion of blocks or due to settlement, thermal expansion or changes in moisture content in the structural members enclosing the block walls. The following measures are recommended to prevent formation of cracks.
4. While curing, the block masonry should be lightly sprinkled with water and not made excessively wet.
5. Expansion joints shall be provided in walls exceeding 30 m in length.
6. Reinforcement should be provided in the bed joints in block work, one course above and one course below windows and above doors in order to distribute the shrinkage/ temperature stresses occurring at the corners of openings, more uniformly throughout the walls.
7. R.C.C. band (Patlis) 100 mm thick and width equal to block masonry and having 8 mm dia. two bars with 8 mm dia links @ 300 mm c/c shall be provided at every 1000mm interval in the block masonry. The gap between the topmost layer of block and the soffit of the beam shall be packed by lightly hammering flat pieces of Shahabad/ Kota tiles and then the gaps will be covered by weld mesh before closing them by cement plaster. The weld mesh will be extended at least 150 mm on the R.C.C. beam and 150 mm on block masonry and nailed to them with strong nails.
8. Provisions for Roof/ceiling: - The course immediately below the roof slab shall be built with solid blocks: The top of the roof course shall be finished smooth with a layer of cement and coarse sand mortar 1:3, 10mm thick and covered with a thick coat of white wash or crude oil, to ensure free movement of slab.

9. Intersecting walls: - When two walls meet or intersect and the courses are to be laid up at the same time, a true masonry bond between at least 50% of the units at the intersection is necessary. When such intersecting walls are laid up separately, pockets with 20mm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets. Fixtures, fittings, etc. shall be built into the masonry in cement and coarse sand mortar 1:3 while laying the blocks where possible. Hold fasts shall be built into the joints of the masonry during laying. Holes, chases, sleeves, openings, etc of the required size and shape shall be formed in the masonry with special blocks while laying, for fixing pipes, service lines, passage of water etc. After service lines, pipes etc are fixed, voids left, if any, shall be filled up with cement concrete 1:3:6 (1 cement 3 coarse sand: 6 stone aggregate 20mm nominal size) and neatly finished.

ii. SCAFFOLDING

Scaffolding shall be **double** and shall be erected with steel sections or pipes of adequate strength so as to be safe for construction operations. The contractor shall take all measures to ensure the safety of the work and working people. Any instructions of the Engineer in this respect shall also be complied with.

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The contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach to every part of the work. Overhead work shall not be allowed. Block work shall be carried out with double scaffolding only. Making holes of any kind for the purpose of supporting the scaffolding shall not be permitted.

iii. MEASUREMENT

AAC /Lightweight block work shall be measured in Sqm for the specified widths up to 200mm. For widths 200mm and greater than 200mm, the mode of measurement will be in cubic meters

iv. RATES

Rates for AAC/Light weight block masonry item shall include the following:

1. Material and labour, for the completion of items as specified including any centring, shuttering, curing etc.
2. Raking out of joints.
3. Preparation of the tops and sides.
4. Forming and preparing expansion, contraction or construction joints as detailed above or specified in the BOQ or drawings.
5. Making holes, openings, etc. for outlets, embedding down take pipes, etc. wherever necessary during construction and finishing exposed surfaces as per instruction of the EiC. Curing and protection as specified.
6. Making holes, openings, outlets, etc. embedding pipes, ends of beams, joints, slabs, trusses, sills, etc. whatever required during construction and neatly finishing the exposed surfaces and opening as per instructions of the EiC.

The light weight concrete block wall of required thickness as described in Schedule of Items shall be constructed with R.C.C. vertical and horizontal stiffeners, of required size at suitable intervals, as directed by the Engineer-in-Charge, or as per drawing. R.C.C. and steel reinforcement shall be included in the rate and will not be measured and paid for separately. The masonry work shall be raised truly in plumb. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. The vertical joints should be not more than 12mm thick and shall be fully filled from the top with cement mortar without any void in masonry. All face joints shall be raked out to a minimum depth of 15 mm. by raking tool, during the progress of the work, when the mortar is still green, so as to provide proper key for the plaster or pointing. All fixtures, pipes, outlets of water, holdfasts, of doors, windows, which are required to be built into the block masonry, shall be embedded in mortar or cement concrete, as specified, in correct position, as the work proceeds and as directed by the Engineer-in-Charge. After masonry work is over, the masonry shall be marked with date of construction visible for inspection and curing.

G) CAVITY WALL

It is a wall comprising of two leaves, each leaf being built of masonry units and separated by a cavity so as to provide an air space within the wall and tied together with metal ties or bonding units to ensure that two leaves act as one structural unit. The width of the cavity shall not be less than 50 mm and not more than 150 mm. Each leaf of the cavity wall shall not be less than 75 mm.

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The space between the leaves shall be either left as cavity or filled with non-load bearing insulating and water proofing material. The method of construction of the cavity is the same as mentioned under the head of respective block items

Metal Ties

These may be of galvanised iron, wrought iron, gun metal, brass, copper, stainless steel or any such corrosion resistant metal, made of flats 20 x 5 mm cranked or twisted at their mid point with ends split and fish tailed. The ties shall be built into horizontal bed joints during erection, placed sloping towards the exterior side to prevent water from flowing along it from outer to inner leaf side

Mode of Measurement:-

Both the masonries made for the cavity will be measured as one single wall in Sqm

H) GUIDELINES FOR CUTTING CHASES IN THE MASONRY

Guide lines for chases in masonry walls as per Indian Standard BIS:1905 need to be followed. The cutting of chases, recesses etc. should be done without damage to the surrounding masonry. It is desirable to use such tools for cutting which depend upon rotary motion not on heavy impact for cutting action.

- 1) As far as possible, services should be planned with the help of vertical chases and use of horizontal chases should be avoided
- 2) Vertical chases shall not be closer than 2 m in any stretch of wall and shall not be located within 34.5 cm of an opening or within 23 cm of a cross wall that serves as a stiffening wall for stability. Width of a vertical chase shall not exceed thickness of wall in which it occurs

BRICK WORK

A) TERMINOLOGY

These specifications cover the use of Brick Masonry for the structural purposes.

Bond

The arrangement of the bricks in successive courses to tie the brick work together both longitudinally and transversely is known as Bond. The arrangement is usually designed to ensure that no vertical joint of one course is exactly over the one in the next course above or below it, and there is greatest possible amount of lap.

Bed Joint

Horizontal joint in brick work or masonry is called as Bed Joint.

Closer

Any portion of a brick used in constructing a wall, to close up the bond next to the end brick of a course.

Coping or Weathering

The cover applied over or the geometrical form given to a part of structure to enable it to shed rain water.

Corbel

A cantilever projecting from the face of a wall to form a bearing is known as Corbel.

Cornice

Horizontal or ornamental feature projecting from the face of a wall is known as Cornice

Course

A layer of bricks including bed mortar is known as a course.

Cross joint

A joint other than a bed joint normal to the wall face is called as cross joint.

Efflorescence

A powdery incrustment of salts left by evaporation is known as Efflorescence. This may be visible on the surface or may be below surface. In the latter case, this is termed as crypto Efflorescence.

Header

A brick laid with its length across the wall is a Header.

Indenting

The leaving of recesses into which future work can be bonded is called as Indenting.

Jamb

The part of the wall at the side of an opening is known as a Jamb.

Joint

A junction of bricks is a joint.

Jointing

The operation of finishing joints as the masonry work proceeds is known as jointing.

Pier

A thickened section forming integral part of the wall placed at intervals along the wall primarily to

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increase the stiffness of the wall or to carry a vertical concentrated load is a pier. The thickness of a pier is the overall thickness including the thickness of the wall, or when bonded into one leaf of a cavity wall the thickness obtained by treating this leaf as an independent wall

Pillar

Pillar means a detached masonry support. This can be rectangular, circular, elliptical etc. In case of rectangular pillar, the breadth shall not exceed three times the thickness and thickness itself shall not exceed more than thrice the length of brick.

Quoin

An external corner in brick work, the term may also denote the brick used to form the quoin.

Scaffolding

A temporary erection of timber or steel work used in the construction, alteration, demolition or repairs of a building to support or to attend of the hoisting or lowering of workmen, their tools and materials. Scaffoldings are of two types, namely single and double scaffoldings. Single scaffolding consists of a row of verticals connected to wall by horizontal supported on and tied to the structure. Double scaffolding consists of two rows of verticals secured or leashed together with horizontal and diagonal bracings forming essentially a structure independent of the building. It may also connect to the structure at convenient points for the sake of better stability.

Sill

A brick work forming the lower boundary of door or window opening

Spandrel

The space between the haunches and the road decking of an arch is known as a Spandrel.

Stretcher

A brick laid with its length in the direction of the wall is a Stretcher.

String course

A horizontal course projecting from a wall usually introduced at every floor level or windows or below parapet for imparting Architectural appearance to the structure and also keeping off the rain water is a String Course.

Template

A pattern of sheet metal used as a guide for setting out specific section and shape is a Template.

Toothing

Bricks that are left projecting in alternate courses to bond with future work is known as toothing.

Wal/joint

A joint parallel to the wall face is a Wall joint.

B) GENERAL

The provision of the latest Indian Standards listed below form part of these specifications:

IS: 1077	Specifications for common burnt clay building bricks
IS: 1200	Measurement for Building works
IS: 1725	Specifications for solid cement blocks used in general building construction.
IS: 1905	Code of practice for structural safety of buildings Masonry walls.
15:2116	Sand for masonry mortars.
15:2180	Specification for heavy duty burnt clay building bricks
15:2185	Specification for concrete masonry units: Hollow and solid concrete blocks.
15:2212	Code of practice for brick work.
15:2222	Specification for burnt clay perforated building bricks.
15:2250	Code of practice for preparation and use of masonry mortar.
15:2691	Specification for burnt clay facing bricks.
15:3115	Specification for lime based blocks.
15:3414	Code of practice for design and installation of joints in buildings.
15:3466	Specification for masonry cement.
15:3861	Method of measurement of plinth, carpet and rent able areas of buildings.
15:3952	Specification for burnt clay hollow blocks for walls and partitions.
15:4098	Specification for lime-pozzolana mixture
15:4139	Specification for sand lime bricks
15:4441	Code of practice for use of silicate type chemical resistant mortars.
15:4442	Code of practice for use of sulphur type chemical resistant mortars.
IS: 5495	Size and shape for fire bricks

Other 1.5. Codes not specifically mentioned here but pertaining to the use of bricks for structural purposes forms part of these specifications.

C) MATERIALS

i. Bricks

Bricks shall be of regular and uniform size, shape and colour, uniformly well burnt throughout but not over burnt. They shall have plane rectangular faces with parallel sides and sharp straight and right angled edges. They shall be free from cracks or other flaws. They shall have a frog of 10 mm. depth on one of their flat faces.

They shall give a clear metallic ringing sound when struck. They shall show a fine grained, uniform homogeneous and dense texture on fracture and be free from lumps of lime, laminations, cracks, air holes, soluble salts causing efflorescence or other defects which may in any way impair their strength, durability, appearance or usefulness for the purpose intended. They shall not have any parts under-burnt. They shall not break when thrown on the ground on their flat face in a saturated condition from a height of 60 cm.

Bricks used in the masonry may be of the following type.

1. The Common Burnt Clay Bricks shall conform to IS 1077 and shall be hand moulded or machine moulded. They shall be free from nodules of free lime, visible cracks, flaws warp age and organic matter, have a frog 100 mm in length 40 mm in width and 10 mm to 20 mm deep on one of its flat sides. Bricks made by extrusion process and brick tiles may not be provided with frogs. Each brick shall be marked (in the frog where provided) with the manufacturer's identification mark or initials.
2. Fly Ash Lime Bricks (FALG Bricks) : The Fly Ash Lime Bricks (FALG Bricks) shall conform to IS 12894. Visually the bricks shall be sound, compact and uniform in shape free from visible cracks, warp age, flaws and organic matter. The bricks shall be solid and with or without frog on one of its flat side. Fly ash shall conform to IS 3812. Note: This item will be operated only for load bearing structure up to 2 storeys and for non-load bearing walls 23 centimetres thick for multi-storeyed buildings. Bottom ash used as replacement of sand shall not have more than 12% loss on ignition when tested. Sand: Deleterious materials, such as clay and silt in the sand shall preferably be less than 5%. Lime: Lime shall conform to class 'C' hydrated lime of IS 712. Additives: Any suitable additive considered not detrimental to the durability of bricks may be used.
3. Clay Fly Ash Bricks: The clay fly ash bricks shall conform to IS 13757. The bricks shall be sound, compact and uniform in shape and colour. Bricks shall have smooth rectangular faces with sharp and square corners. The bricks shall be free from visible cracks, flaws, warp age, nodules of free lime and organic matter, the bricks shall be hand or machine moulded. The bricks shall have frog of 100 mm in length 40 mm width and 10 to 20 mm deep on one of its flat sides. If made by extrusion process may not be provided with frogs. Fly Ash shall conform to grade I or grade II of IS 3812.

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4. **Calcium Silicate Bricks:** The bricks shall conform to IS 4139. The Calcium silicate bricks shall be sound, compact and uniform in shape. Bricks shall be free from visible cracks, warp age, organic matter, large pebbles and nodules of free lime. Bricks shall be solid and with or without frog. The bricks shall be made of finely grounded sand siliceous rock and lime. In addition limited quantity of fly ash conforming to IS 3812 may be used in the mix. These bricks are also known as Fly Ash Sand Lime bricks in the construction industry.
5. **Tile Brick:** The bricks of 4 cm height shall be moulded without frogs. Where modular tiles are not freely available in the market, the tile bricks of F.P.S. thickness 44 mm (1-3/4") shall be used unless otherwise specified.
6. **Brick Bats:** Brick bats shall be obtained from well burnt bricks.
7. **Mechanized Autoclave Fly Ash Lime Brick:** These bricks shall be machine moulded and prepared in plant by appropriate proportion of fly ash and lime. The autoclave fly ash bricks shall conform to IS 12894. Visually, the bricks shall be sound, compact and uniform shape, free from visible cracks, warp age and organic matters. The brick shall be solid with or without frog, and of 100/80 mm in length, 40 mm width and 10 to 20 mm deep one of its flat side as per IS 12894. The brick shall have smooth rectangular faces with sharp corners and shall be uniform in shape and colour. Fly ash shall conform to IS 3812 and lime shall conform to class 'C' hydrated lime of IS 712.

ii. Size of bricks

1. The brick may be modular or non-modular. Sizes for both types of bricks/tiles shall be as per Table 6.1. While use of modular bricks/tiles is recommended, non-modular (FPS) bricks/tiles can also be used where so specified. Non-modular bricks/tiles of sizes other than the sizes mentioned in Table 6.1 may also be used where specified.

TABLE 6.1

<i>Type of Bricks/ Tiles</i>	<i>Nominal Size mm</i>	<i>Actual Size mm</i>
Modular Bricks	200 x 100 x 100 mm	190x90 x90 mm
Modular tile bricks	200 x 100 x40 mm	190x90 x40 mm
Non-modular tile bricks	229 x 114x44 mm	225 x 111 x 44 mm
Non-modular bricks	229 x 114x70 mm	225 x 111 x 70 mm

2. When metric bricks are used they shall comply with I. S: 1077 - 1976.

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Classification

Bricks/Brick tiles shall be classified on the basis of their minimum compressive strength as given below

TABLE 6.2

Class Designation	Average compressive strength			
	Not less than		Less than	
	N/mm ²	Kgf/cm ²	N/mm ²	Kgf/cm ²
12.5 (125)	12.5	125	15	150
10 (100)	10	100	12.5	125
7.5 (75)	7.5	75	10	100
5 (50)	5	50	7.5	75
3.5 (35)	3.5	35	5	50

iii. Absorption

After immersion in water, absorption by weight shall not exceed 20% of the dry weight of the brick when tested according to IS: 1077-1976.

iv. Mortars

Cement and sand shall be mixed in specified proportions given on the drawings. Cement shall be proportioned only by weight, by taking its unit weight as 1440 kg per cubic metre and the sand shall be proportioned by volume after making due allowance for bulking. The required quantity of water shall then be added and the mortar mixed to produce workable consistency.

The mixing shall be done intimately in a mechanical mixer unless hand-mixing is specifically permitted by the Engineer-in-charge. If hand mixing is done, the operation shall be carried out on a clean watertight platform and cement and sand shall be first mixed dry in the required proportion to obtain a uniform colour and then the mortar shall be mixed for at least two minutes after addition of water. The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes. The mortar remaining unused after that period or mortar, which has partially hardened or is otherwise damaged shall not be re-tempered or remixed. It shall be destroyed or thrown away. In case of cement mortar that has stiffened because of evaporation of water the same shall be re-tempered by adding water as frequently as needed to restore the requisite consistency, but this re-tempering shall be permitted only within thirty minutes from the time of addition of water at the time of initial mixing.

Necessary tests to determine compressive strength of the mortar, for consistency of the mortar and its water retentively shall be carried out in accordance with 15-2250. The frequency of testing shall be one cube for every 2 cubic metre of mortar prepared subject to a minimum of 3 cubes for a day's work.

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D) CONSTRUCTION

v. Soaking of Bricks

Bricks shall be soaked in water for a minimum period of one hour before use and ideally be soaked 24 hours prior to use in masonry, so that they will be saturated and will not absorb water from the mortar. When bricks are soaked they shall be removed from the tank sufficiently in advance so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not spoiled by dirt, earth, etc,

vi. Laying of Bricks

Bricks shall be laid in English Bond unless otherwise specified. For brick work in half brick wall, bricks shall be laid in stretcher bond. Half or cut bricks shall not be used except as closers where necessary to complete the bond. Closers in such cases, shall be cut to the required size and used near the ends of the wall. Header bond shall be used preferably in all courses in curved plan for ensuring better alignment.

Note: Header bond shall also be used in foundation footings unless thickness of walls (width of footing) makes the use of headers impracticable. Where thickness of footing is uniform for a number of courses, the top course of footing shall be headers.

All loose materials, dirt and set lumps of mortar which may be lying over the surface on which Brick work is to be freshly started, shall be removed with a wire brush and surface wetted. Bricks shall be laid on a full bed of mortar, when laying, each brick shall, be properly bedded and set in position by gently pressing with the handle of a trowel. Its inside face shall be buttered with mortar before the next brick is laid and pressed against it. Joints shall be fully filled and packed with mortar such that no hollow space is left inside the joints.

The walls shall be taken up truly in plumb or true to the required batter where specified. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in the alternate course shall come directly one over the other. Quoin, Jamb and other angles shall be properly plumbed as the work proceeds. Care shall be taken to keep the perpend properly aligned within following maximum permissible tolerances:

- (a) Deviation from vertical within a storey shall not exceed 6 mm per 3 m height.
- (b) Deviation in verticality in total height of any wall of building more than one storey in height shall not exceed 12.5 mm.
- (c) Deviation from position shown on plan of any brick work shall not exceed 12.5 mm.
- (d) Relative displacement between loads bearing wall in adjacent storeys intended to be vertical

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alignments shall not exceed 6 mm.

(e) A set of tools comprising of wooden straight edge, Masonic spirit levels, square, 1 meter rule line and plumb shall be kept on the site of work for every 3 masons for proper check during the progress of work.

All quoins shall be accurately constructed and the height of brick courses shall be kept uniform. This will be checked using graduated wooden straight edge or storey rod indicating height of each course including thickness of joints. The position of damp proof course, window sills, bottom of lintels, top of the wall etc. along the height of the wall shall be marked on the graduated straight edge or storey rod. Acute and obtuse quoins shall be bonded, where practicable in the same way as square quoins. Obtuse quoins shall be formed with squint showing three quarters brick on one face and quarter brick on the other.

The brick work shall be built in uniform layers. No part of the wall during its construction shall rise more than one meter above the general construction level. Parts of wall left at different levels shall be raked back at an angle of 45 degrees or less with the horizontal. Tothing shall not be permitted as an alternative to raking back. For half brick partition to be keyed into main walls, indents shall be left in the main walls. All pipe fittings and specials, spouts, hold fasts and other fixtures which are required to be built into the walls shall be embedded, as specified, in their correct position as the work proceeds unless otherwise directed by the Engineer-in-Charge.

Top courses of all plinths, parapets, steps and top of walls below floor and roof slabs shall be laid with brick on edge, unless specified otherwise. Brick on edge laid in the top courses at corner of walls shall be properly radiated and keyed into position to form cut corners as directed by the Engineer in Charge. Where bricks cannot be cut to the required shape to form cut corners, cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) equal to thickness of course shall be provided in lieu of cut bricks.

Bricks shall be laid with frog (where provided) up. However, when top course is exposed, bricks shall be laid with frog down. For the bricks to be laid with frog down, the frog shall be filled with mortar before placing the brick in position.

In case of walls one brick thick and under, one face shall be kept even and in proper plane, while the other face may be slightly rough. In case of walls more than one brick thick, both the faces shall be kept even and in proper plane.

To facilitate taking service lines later without excessive cutting of completed work, sleeves (to be paid separately) shall be provided, where specified, while raising the brick work. Such sleeves in external walls shall be sloped down outward so as to avoid passage of water inside.

Top of the brickwork in coping and sills in external walls shall be slightly tilted. Where brick coping and sills are projecting beyond the face of the wall, drip course/throating (to be paid separately) shall be provided where indicated.

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Care shall be taken during construction that edges of jambs, sills and projections are not damaged in case of rain. New built work shall be covered with gunny bags or tarpaulin so as to prevent the mortar from being washed away. Damage, if any, shall be made good to the satisfaction of the Engineer-in-Charge.

Vertical reinforcement in the form of bars (MS or high strength deformed bars or thermo mechanically treated bars as per direction of Engineer-in-Charge)), considered necessary at the corners and junction of walls and jamb opening doors, windows etc. shall be encased with cement mortar not leaner than 1:4 (1 cement: 4 coarse sand), or cement concrete mix as specified. The reinforcement shall be suitably tied, properly embedded in the foundation and at roof level. The dia. of bars shall not be less than 8 mm and concrete grade shall be minimum 1:3:6 (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size).

In retaining walls and the like, where water is likely to accumulate, weep holes, 50 to 75 mm

Square shall be provided at 2 m vertically and horizontally unless otherwise specified. The lowest weep hole shall be at about 30 cm above the ground level. All weep holes shall be surrounded by loose stones and shall have sufficient fall to drain out the water quickly.

Note: Work of providing loose stone will be payable extra.

Work of cutting chases, wherever required to be made in the walls for housing G.I. pipe, CI pipe or any other fixtures shall be carried out in various locations as per guidelines given below:

(a) Cutting of chases in one brick thick and above load bearing walls.

(i) As far as possible services should be planned with the help of vertical chases. Horizontal chases should be avoided.

(ii) The depths of vertical chases and horizontal chases shall not exceed one-third and one-sixth of the thickness of the masonry respectively.

(iii) When narrow stretches of masonry (or short length of walls) such as between doors and windows, cannot be avoided they should not be pierced with openings for soil pipes or waste pipes or timber joints, etc. Where there is a possibility of load concentration such narrow lengths of walls shall be checked for stresses and high strength bricks in mortar or concrete walls provided, if required.

(iv) Horizontal chases when unavoidable should be located in the upper or lower one-third of height of storey and not more than three chases should be permitted in any stretch of a wall. No continuous horizontal chase shall exceed one meter in length. Where unavoidable, stresses in the affected area should be checked and kept within the permissible limits.

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(v) Vertical chases should not be closer than 2 min any stretch of a wall. These shall be kept away from bearings of beams and lintels. If unavoidable, stresses in the affected area should be checked and kept within permissible limits.

(vi) Masonry directly above a recess, if wider than 30 cm horizontal dimension) should be supported on lintel. Holes in masonry may be provided up to 30 cm width and 30 cm height without any lintel. In the case of circular holes in the masonry, no lintel need be provided for holes up to 40 cm in diameter.

(b) Cutting of chases in half brick load bearing walls.

No chase shall be permitted in half brick load bearing walls and as such no recessed conduits and concealed pipes shall be provided with half brick thick load bearing walls.

(c) Cutting of chases in half brick non-load bearing wall:

Services should be planned with the help of vertical chases. Horizontal chase should be provided only when unavoidable.

vii. Joints

The thickness of joints shall not exceed 10mm and this thickness shall be uniform throughout.

viii. Joining with existing structure

When fresh masonry is to be placed against existing surfaces of structures, these shall be cleaned of all loose material, roughened and wetted as directed by the Engineer-in-charge so as to affect a good bond with the new work.

ix. Curing

Green work shall be protected from rain by suitable covering. Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. The top of the masonry work shall be left flooded with water at the close of the day. During hot weather all finished or partly completed work shall be covered or wetted in such manner as will prevent rapid drying of the brick work.

x. Scaffolding

The scaffolding shall be sound and strong to withstand all loads likely to come upon it and will be double or single as is warranted for the particular work. The holes, which provide resting space for horizontal members, shall not be left in masonry under one metre in width or immediately near the skew backs of arches. The holes left in the masonry work for supporting the scaffolding shall be filled and made good with 1:4:8 cement concrete.

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xi. Condition of Equipment

All equipment used for mixing or transporting mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

xii. Finishing of Surfaces

For a surface which is to be subsequently plastered or pointed the joints shall be squarely raked out to a depth of 15mm while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

E) MEASUREMENT FOR PAYMENT

- xiii. Brick work shall be measured in cubic metres unless otherwise specified-. Any extra work over the specified dimensions shall be ignored. Dimensions shall be measured correct to the nearest 0.01m i.e. 1 cm. Areas shall be calculated to the nearest 0.01 Sqm and the cubic contents shall be worked out to the nearest 0.01 cubic metres
- xiv. No deductions or additions shall be done and no extra payment made for the following-
Note: Where minimum area is defined for deduction of an opening, void or both, such areas shall refer only to opening or void within the space measured.
- xv. Ends of dis-similar materials{that is, joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps, etc.; up to 0.1m² in section;
- xvi. Opening up to 0.1 m² in area
- xvii. Wall plates, bed plates, and bearing of slabs, Chajja and the like, where thickness Does not exceed. 10cm and bearing does not extend over the full thickness of wall;

F) RATE

The contract unit rate for brick work shall include the cost of all labour, materials, tools and plant, scaffolding and other expenses incidental to the satisfactory completion of the work as described herein above and as shown on the drawings. The rate for work shall also include:

- (i) Dewatering required for completing this item and till the mortar of masonry pointing and plastering is properly set
- (ii) watering the masonry and
- (iii) cleaning the site round the brick-work so as to restore the area to its original condition.

The rate for work shall also include full compensation for using specially moulded bricks on the face of walls with batter and provision of weep holes.

All other specifications under Brick Work for Construction and Measurements will be applicable.

xviii. **G) TESTS FOR BRICK WORK**
TEST FOR DIMENSIONAL TOLERANCE

Procedure

All the blisters, loose particles of clay and small projections shall be removed from the surface of bricks. Each specimen of 20 bricks shall then be arranged upon a level surface successively as indicated in Fig. A, Band C of Para A-4 below in contact with each other and in straight line. The overall length of the assembled bricks (20 Nos) shall be measured with a steel tape sufficiently long to measure the whole row at one stretch.

Tolerance

The actual dimensions of bricks when tested as described in A-2 shall be within the following limits per 20 bricks.

Modular Bricks

Length 3720 to 3880 mm (3800 ± 80 mm) Width 1760 to 1840 mm (1800 ± 40 mm) Height
1760 to 1840 mm (1800 ± 40 mm) for 90 mm high brick 760 to 840 mm (800 ± 40 mm) for 40 mm
high brick

Non-Modular Bricks

For class 10

Length (4520 to 4680) mm (4600 ± 80 mm) Width (2240 to 2160) mm (2200 ± 40 mm) Height
(1440 to 1360) mm (1400 ± 40 mm) for 70 mm high bricks (640 to 560) mm (600 ± 40 mm) for 30
mm high bricks

For other classes Length (4320 to 4680) mm Width (2130 to 2310) mm Height (1340 to 1460)
mm for 70 mm high bricks (840 to 920) mm for 44 mm high bricks

Criteria for Conformity

A lot shall be considered conforming to the requirements of dimensions and tolerances if all the groups of bricks are tested to meet the specified requirements.

xix. TEST FOR COMPRESSIVE STRENGTH

Specimen

Five whole bricks shall be taken from the samples as specimens for this test. Length and width of each specimen shall be measured correct to 1 mm.

Apparatus

The apparatus consists of compression testing machine, the compression plate of which shall have a ball seating in the form of portion of a sphere the centre of which shall coincide with the centre of the plate.

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Procedure

Pre-conditioning: The specimen shall be immersed in the water for 24 hours at 25 to 29 C. Any surplus moisture shall be allowed to drain at room temperature. The frog of the bricks should be filled flush with mortar 1:3 (1 cement: 3 clean coarse sand of grade 3 mm and down) and shall be kept under damp jute bags for 24 hours, after that these shall be immersed in clean water for three days.

After removal from water, the bricks shall be wiped out of any traces of moisture.

Actual Testing: Specimen shall be placed with flat faces horizontal and mortar filled face upward between three 3 ply plywood sheets each of thickness 3 mm and carefully centred between plates of the testing machine. Plaster of Paris can also be used in place of plywood sheets to ensure a uniform surface.

Load shall be applied carefully axially at uniform rate of 14 N/mm² per minute till the failure of the specimen occurs.

Reporting the Test Results

The compressive strength of each specimen shall be calculated in N/mm² as under:

$$\text{Compressive Strength} = \frac{\text{Maximum load at failure (in N)}}{\text{Area of Specimen (in sq mm)}}$$

In case the compressive strength of any individual brick tested exceeds the upper limit of the average compressive strength specified for the corresponding class of brick, the same shall be limited to the upper limit of the class specified in 6.1.2 for the purpose of calculating the average compressive strength. Compressive strength of all the individual bricks comprising the sample shall be averaged and reported.

Criteria for Conformity

A lot shall be considered having satisfied the requirements of average compressive strength if the average compressive strength specified in 6.1.2 for the corresponding class of brick tested is not below the minimum average compressive strength specified for the corresponding class of bricks by more than 20 per cent.

xx. TEST FOR WATER ABSORPTION

No. of Specimen

Five whole bricks shall be taken from samples as specimen for this test.

Apparatus

A balance required for this test shall be sensitive to weigh 0.1 percent of the weight of the specimen.

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Procedure

Pre-conditioning: The specimen shall be allowed to dry in a ventilated oven at a 110°C to 115°C till it attains a substantially constant weight. If the specimen is known to be relatively dry, this would be accomplished in 48 hours, if the specimen is wet, several additional hours may be required to attain a constant weight. It shall be allowed to cool at room temperature. In a ventilated room, properly separated bricks will require four hours for cooling, unless electric fan passes air over them continuously in which case two hours may suffice.

The cooled specimen shall be weighed (W_1) a warm specimen shall not be used for this purpose.

Actual Testing: Specimen shall be completely dried before immersion in the water. It shall be kept in clean water at a temperature of 27°C ± 2°C for 24 hours. Specimen shall be wiped out of the traces of water with a damp cloth after removing from the water and then shall be weighed within three minutes after removing from water (W_2).

Reporting the Test Results

The water absorption of each specimen shall be calculated as follows and the average of five tests shall be reported.

Water Absorption $(\frac{W_2 - W_1}{W_1} \times 100)$

Criteria for Conformity

A lot shall be considered having satisfied the requirements of water absorption if the average water absorption is not more than 20% by weight.

xxi. APPENDIX D TEST FOR EFFLORESCENCE

No. of Specimen

Five whole bricks shall be taken as specimen for this test.

Apparatus

Apparatus required for this test shall be a shallow flat bottom dish containing distilled water.

Procedure (actual testing)

The brick shall be placed vertically in the dish with 2.5 cm immersed in the water. The room shall be warm (18QC to 30QC) and well ventilated. The bricks should not be removed until it absorbs whole water. When the whole water is absorbed and the brick appears to be dry, place a similar quantity of water in that dish and allow it to evaporate as before. The brick shall be examined after the second evaporation.

Reporting the Test Results

The rating to efflorescence in ascending order shall be reported as 'NIL', 'SLIGHT', 'MODERATE', 'HEAVY' or 'SERIOUS' in accordance with the following :

- (a) *NIL:* When there is no perceptible deposit of efflorescence.

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- (b) *SLIGHT*: When not more than 10 per cent of the area of the brick is covered with a thin deposit of salts.
- (c) *MODERATE*: When there is heavier deposit and covering up to 50% of the area of the brick surface but unaccompanied by powdering or flaking of the surface.
- (d) *HEAVY*: When there is a heavy deposit of salts covering 50% or more of the brick surface but unaccompanied by powdering or flaking of the surface.
- (e) *SERIOUS*: When there is heavy deposit of salts, accompanied powdering and/or flaking of the surface and tending to increase in the repeated wetting of the specimen.

Criteria for Conformity

A lot be considered having satisfied the requirements of efflorescence if for 4 out of the specimen of 5 bricks, the rating of efflorescence is not beyond "Moderate".

WATERPROOFING

A) SCOPE

These specifications cover the requirements of various waterproofing treatments for waterproofing various components of structures. The specifications cover the detailed procedure adopted.

B) CODES TO BE FOLLOWED

- IS 6494 Code of Practice for waterproofing of Underground Water Reservoir
- IS 2645 Indian Standard Specifications for integral cement waterproofing

C) WATERPROOFING COATINGS

SUMMARY

Section Includes: Furnishing of all labour, materials, services and equipment necessary for the supply and installation of waterproofing systems (as described in the BOQ) to concrete substrates, above-grade, on either dry or wet side of substrates, as indicated on drawing and as specified herein.

REFERENCES

- A. Applicable Standards: The following standards are referenced herein.
 1. American Society for Testing Materials (ASTM)
 2. Army Corps of Engineers (CRD)
 3. NSF International (NSF)
 4. Bureau of Indian Standard (IS) - 2720

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SYSTEM DESCRIPTION

Acrylic Polymer-Modified Flexible Cementitious Membrane/ Coating: having UV resistance, underground ground-chemical resistance, and high melting points, flexible and elastic with high adhesive strength. The membrane shall be reinforced with a layer of non-woven polyester fabric of minimum 30 g/Sqm. The Acrylic Polymer-Modified Flexible Cementitious Membrane/ Coating shall be protected with a subsequent protective cementitious layer of concrete screed/ plaster in thickness as specified in the BOQ. The total coating thickness shall be as specified by the manufacturer's technical literature but not less than 1.5 mm and shall be applied in 2 - 3 coats.

D) QUALITY ASSURANCE

Manufacturer: Provide products of manufacturer with no less than 20 years experience in manufacturing the waterproofing materials offered by them for the required work. Manufacturers that cannot provide the performance test data specified herein will not be considered for the project.

Specialized Executing Waterproofing Agency: Specialized Executing Waterproofing Agency shall be experienced in the installation of the offered waterproofing materials as demonstrated by previous successful installation, and shall be approved by the manufacturer in writing.

Pre-Installation Conference: Prior to installation of waterproofing, conduct meeting with waterproofing agency, Architect/Engineer, owner's representative, and waterproofing manufacturer's representative to verify and review the following:

- 1 Project requirements for waterproofing as set out in Contract Documents.
- 2 Manufacturer's product data including application instruction.
- 3 Substrate conditions, and procedures for substrate preparation and waterproofing installation.

Technical Consultation: The waterproofing manufacturer's representative shall provide technical consultation on waterproofing application.

E) DELIVERY, STORAGE

Delivery: Deliver packaged waterproofing materials to project site in original undamaged/ unopened containers/ pallets, with manufacturer's labels and seals intact. Shall be approved by the PM. Material delivered shall be accompanied by manufacturer's certificate for quality parameters and date of manufacture/ expiry.

Storage: Material shall be stored in dry, well ventilated and covered storage.

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PROJECT CONDITIONS

A. Compliance: Comply with manufacturer's product data regarding condition of substrate to receive waterproofing, weather conditions before and during installation, and protection of the installed waterproofing system.

F) GUARANTEE

Manufacturer's Guarantee: Manufacturer shall provide standard product guarantee executed by authorized company official. Term of guarantee shall be 10 years from Date of Substantial Completion.

Guarantee of the Specialised Executing Waterproofing Agency: The specialized Executing Waterproofing Agency shall guarantee the waterproofing installation against defects caused by faulty workmanship or materials for a period of 10 years from Date of Substantial Completion. The guarantee will cover the surfaces treated and will bind the agency to repair, at his expense, any and all leaks through the treated surfaces which are not due to structural weaknesses or other causes beyond applicator's control such as fire, earthquake, tornado and hurricane. The guarantee shall read as follows.

Guarantee: The agency guarantees that, upon completion of the work, surfaces treated with offered waterproofing material will be and will remain free from water leakage resulting from defective workmanship or materials for a period of 10 years from Date of Substantial Completion. In the event that water leakage occurs within the guarantee period from such causes, the agency shall, at his sole expense, repair, replace or otherwise correct such defective workmanship or materials. Agency shall not be liable for consequential damages and the agency's liability shall be limited to repair, replacement or correcting of defective workmanship or materials. Agency shall have no responsibility with respect to water leakage or other defects caused by structural failure or movement of the structure, or any other causes beyond the Agency's control. The contractor to submit the guarantee for the entire terrace along with the expansion joints on requisite stamp paper

E. Source Quality: Obtain proprietary waterproofing products directly from the manufacturer.

F. Other Civil Materials related with waterproofing: Cement, screened river sand, brick-bats, aggregates, integral waterproofing compounds, etc. required for screeds, protective toppings and plasters shall conform to the pertaining IS standards (IS 269, IS 8112, IS 13286, IS 383, IS 2645, IS 12118 and IS 3495). The Consultants/ PM shall demand the conformance of these materials from the Specialised Executing Waterproofing Agencies/ civil contractor from time to time and they shall have to produce test reports / documents to prove the conformance of these materials with their applicable standards, without any argument.

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G) EXECUTION EXAMINATION

- xxii. Site Visit: Prior to waterproofing installation, arrange visit to project site with waterproofing manufacturer's representative. Representative shall inspect and certify that concrete surfaces are in acceptable condition to receive waterproofing treatment.
- xxiii. Verification of Substrates: Verify that concrete surfaces are sound and clean, and that form release agents and materials used to cure the concrete are compatible with waterproofing treatment.
- xxiv. Examination for Defects: Examine surfaces to be waterproofed for form tie holes and structural defects such as honeycombing, rock pockets, faulty construction joints and cracks. Such defects to be repaired in accordance to manufacturer's product data and 3.02 below.

PREPARATION

- xxv. Concrete Finish: Concrete surfaces to receive waterproofing treatment shall be free from scale, excess form oil, laitance, curing compounds and foreign matter. Horizontal surfaces shall have a rough wood float, smooth or broom finish, as required by the waterproofing material manufacturer.
- xxvi. Surface Preparation: Smooth surfaces (e.g. where steel forms are used) or surfaces covered with excess form oil or other contaminants shall be washed, lightly sandblasted, water blasted, or acid etched with muriatic acid (as necessary) to provide a clean absorbent surface. Surfaces to be acid-etched shall be saturated with water prior to application of acid.
- xxvii. Repair of Defects: Surface defects shall be repaired in accordance with manufacturer's instructions as follows:
 - 1. Form Tie Holes, Construction Joints, cracks: Chip out defective areas in a 'U' shaped slot 25 mm wide and a minimum of 25 mm deep. Clean slot of debris and dust. Soak area with water and remove excess surface water. Apply a polymer modified cementitious bonding coat of approved material to the slot. Then fill cavity with a non-shrink, waterproof, cementitious grout / mortar, while the bonding coat is tacky. Compress tightly into cavity using pneumatic packer or block and hammer. Where the concrete is defective, do injection grouting with high pressure (140 psi) grouting machine using cement admixed with non-shrink grouting admixture.
 - 2. Rock Pockets, Honeycombing or Other Defective Concrete: Rout out defective areas to sound concrete. Remove loose materials and saturate with water. Remove excess surface water and apply a polymer modified cementitious bonding coat of approved material to

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the area. While the bonding coat is still tacky, fill cavity to surface level with non-shrink grout. Where the concrete is defective, do injection grouting with high pressure (140 psi) grouting machine using cement admixed with non-shrink grouting admixture.

H) APPLICATION

A. Construction Joints: Apply cementitious bonding material in slurry form to joint surfaces between concrete pours, just prior to pouring fresh concrete. Moisten surfaces prior to the bonding coat application. Where joint surfaces are not accessible prior to pouring new concrete, consult manufacturer for application procedure.

B. Coves (vata): Make a minimum 4 inch (diagonal) cove / vata at all 90° interfaces in concrete surfaces where waterproofing is carried out, without fail.

C. Surface Application: After repairs, surface preparation, treatment of construction joints, cracks, honeycombs, tie-holes, etc., have been completed in accordance with manufacturer's product data and as specified herein, apply / provide the waterproofing material as specified in the manufacturer's technical and application data sheet to concrete surfaces. Application rates, thicknesses and locations shall be as indicated in the drawing. When brushing, work slurry well into surface of the concrete, filling surface pores and hairline cracks. When spraying, hold nozzle close enough to ensure that slurry is forced into pores and hairline cracks. When torching, uniformly burn the surface when overlapping, to ensure that the membrane adheres uniformly.

Sandwich (Topping) Application: When treated structural slabs are to receive a concrete or other topping, place the topping only after the initial curing period of the material being used, is completed. Lightly pre-water when rapid drying conditions exist.

I) CURING

A. General:

For cementations materials: Begin curing as soon as the applied waterproofing material has hardened sufficiently so as not to be damaged by a fine spray. Cure the treatment with water as per the manufacturer's instructions. In warm climates, more-than-normal curing duration may be necessary to prevent excessive drying of coating.

For liquid applied membranes/ Pre-fabricated membranes: natural air curing for duration as described in the manufacturer's technical data sheet.

B. Air Circulation: Do not lay plastic sheeting directly on the waterproofing coating as air contact is required for proper curing. If poor circulation exists in treated areas, it may be necessary to provide fans or blown air to aid in curing of waterproofing treatment.

C. Water-holding Structures: For concrete water-holding structures such as swimming pools, reservoirs, water treatment tanks and wet wells, cure the waterproofing system for a minimum of three days and then allow the waterproofing system to set for 7 days before filling structure with liquid.

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For structures holding hot or corrosive liquids, cure waterproofing treatment for three days and allow to set for 15 days before filling.

D. Protection: During the curing period, protect the treated surfaces from damage by wind, sun, rain and temperatures below 2° C. If plastic sheeting is used for protection, it must be raised off the waterproofing coating to allow sufficient air circulation.

J) BRICK BAT COBA

Brick bat of size 25 mm to 115 mm out of well burnt bricks shall be used for the purpose of brick bat coba. The brick bats shall be properly dampened for six hours before laying. Brick bats shall be laid to required slope/gradient over the base coat of mortar leaving 15-25 mm gap between two bats. Cement mortar 1:5 (1 blended cement: 5 coarse sand) shall be poured over the brick bats and joints filled properly. Under no circumstances dry brick bats should be laid over the base coat. The haunches/gola at the junction of parapet wall and the roof shall be formed only with brick bat coba as directed by the Engineer in Charge

In case the brick bat coba is laid on the base coat immediately on initial set there will be no necessity of applying cement slurry over the base coat before laying the brick bat coba. However, if the brick bat coba is to be laid on the subsequent day, cement slurry prepared as described under shall be applied over the top surface of the base coat, then only the brick bat coba shall be laid.

Cement Slurry

The quantity of water required to prepare the slurry with 2.75 kg. of blended cement to be painted over an area of 1 sqm. Depending upon the area of surface that has to be covered, the required quantity of slurry should be prepared using 2.75 kg. blended cement+ water per sqm. area to be covered, taking particular care to see that only that much quantity of slurry shall be prepared which can be used within half an hour of preparation i.e. before the initial setting time of cement. The prepared slurry shall be applied over the dampened surface with brushes very carefully, including the joints between the floor slab and the parapet wall, holes on the surfaces, joints of pipes, masonry/concrete etc. The application of the slurry should continue upto a height of 300 mm on the parapet wall and also the groove as directed. The slurry should also be applied upto a height of 150 mm over pipe projections etc.

Application of Slurry over Brick Bat Coba

After two days of curing of brick bat coba cement slurry prepared as mentioned earlier shall be applied on the surface of brick bat coba The application of slurry shall be the same as described earlier which should cover the haunches/gola, and the remaining small portion of parapet wall and also inside the groove as shown in the figure.

Laying Finishing Layer (Protective Coat)

Immediately on applying the cement slurry over the surface of the brick bat coba and when the slurry applied is still green, a protective coat of 20 mm thick layer of cement plaster, without leaving any joints shall be applied with cement mortar 1:4 (1 blended cement: 4 coarse sand) over the entire fibre glass cloth including the haunches/gola and the small portion on the parapet wall. The groove in the parapet

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wall over the haunches shall also be filled neatly packing the mortar firmly in the groove.

The surface of the finishing layer (protective coat) shall be neatly finished with cement slurry. The finished surface shall be allowed to dry for a while and then to be kept ready to take on finishes.

Curing and Testing the Treatment

The entire surface thus treated shall be flooded with water by making kiaries with weak cement mortar, for a minimum period of two weeks.

K) WATERPROOFING METHODOLOGY

Floor area and walls: -

Cleaning the surface thoroughly.

Chasing open the cracks, honey combs if any, same shall be grouted with waterproof cement slurry admixed with cebex-100@225gm /bag of cement up to full saturation using gravitational pressure wherever required

Providing and applying flexible polymer modified Cementitious water proof coating consist of Ni-o-pol acrylic polymer admixed with cement in equal proportions(1:1) in 2 coats Or Sika Top seal 107 1.5 to 2.00kg/Sqm in 2 coats to the floor and on the wall up 1m hts Or as specified at site above FFL(interval between each coat shall be 4 hours) .

Allow to Sprinkle curing for 24 hours.

Providing and laying 25mm thick water proof screed in Cement Mortar 1:3 admixed with proofsol @ 1 kg/bag of cement coving at the junction, troweled and compacted.

Curing and pond checking for 7days.before starting plumbing work.

Brick Bat coba as mentioned above on floors

Tiling work

PLASTERING

A) SCOPE

These specifications cover the use of plastering for masonry and RCC work, pointing for brick and stone masonry work.

B) IS CODES

The provision of the latest revisions of the following IS codes shall form a part of this specification to the extent they are relevant.

IS: 269	Specification for ordinary rapid hardening and low heat Portland cement
IS: 712	Building Lines
IS: 1200 (Part XII)	Method of measurement of building and Civil Engg. Works - Plastering and Pointing
IS: 1542	Specification for sand for plaster
IS: 1630	Mason's Tools for Plaster work and pointing work.

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IS: 1661	Code of practice for application of cement lime plaster finishes
IS: 10067	Material Constants for Building Works

Other I. S. Codes, not specifically mentioned here, but pertaining to plastering work, form part of these specifications.

C) GENERAL

i. Cement Mortar

Cement mortar shall have the proportion of cement to sand as specified and shall comply with relevant clauses of Cement Mortar specifications.

ii. Cement:

Cement shall conform to IS: 269 Ordinary Portland cement shall be used. The weight of ordinary Portland cement shall be taken as 50 kg per bag. The Contractor shall ensure that the cement is of sound and requiring quality before using it. Any cement which has deteriorated caked or which has been damaged shall not be used. The specifications covered under the section Concrete' shall be applicable in addition.

iii. Water:

Water for mixing cement mortar or concrete shall not be salty or brackish and shall be clean, reasonably clear and free from objectionable quantities of silt and traces of oil, acid and injurious alkali, salts, organic matter and other deleterious material which will either weaken the mortar or concrete or cause efflorescence. Sea water shall not be used. Water fit for drinking shall generally be found suitable for mixing cement mortar. Water fit curing mortar or concrete shall not be too acidic or alkaline. It shall have pH value above 6. Sea water shall not be used for curing purpose.

iv. Fine Aggregate

All fine aggregate shall conform to IS: 383 - 1963 and relevant portion of IS: 515-1959. Sand shall be clean, well graded, hard, strong, durable and gritty particles free from injurious amounts of dust, clay, kankar nodules, soffit or flaky particles, shale, alkali, salts, organic matter loam mica or other deleterious substances and shall be approved by the Engineer-in-charge. The maximum size of particles shall be limited to 5 mm (about 3/16"). If the fine aggregate contains more than 4 per cent of clay, dust or silt, it shall be washed.

The fine aggregate for cement mortar for masonry and first coat of plaster should generally satisfy the following grading:

The fineness modulus shall not exceed 3.00.

The fine aggregate for cement mortar for fine joints of ashlar masonry, pointing and second coat of plaster may have the following grading:

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IS Sieve	Percentage by wt. passing sieve
4.75 mm	100
2.36 mm	80- 95
1.18 mm 7	0- 90
600 microns	40-85
300 microns	5-50
150 microns	0-10

The fineness modulus shall not exceed 1.6 IS: 2116 - 1980 shall generally apply for sand for plaster. The fine aggregate should be stacked carefully on a clean, hard surface so that it will not get mixed up with deleterious foreign materials.

v. Scaffolding,

Scaffolding shall be erected with steel sections or pipes of adequate strength so as to be safe for construction operations. The contractor shall take all measures to ensure the safety of the work and working people. Any instructions of the Engineer-in-charge in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach to every part of the work. Overhead work shall not be allowed.

vi. Tools and Accessories

Tools and accessories used in plaster work shall conform to IS: 1630. All tools shall be cleaned by scrapping and washing at the end of each day's work or after use. Metal tools shall be cleaned after each operation. All tools shall be examined to see that they are thoroughly cleaned before plastering is begun.

vii. Programme of work in relation to plastering

The programme of other building operations before, during and after plastering shall be according to the instructions contained in clause 9 of IS: 1661.

viii. General Precaution in plastering

All general precautions as specified in IS. 1661, Clause 9, shall be taken and preparation of the background shall be done as laid down in IS: 1661, Clause 13. Care shall be taken to see that other parts of the work or adjacent works are not damaged while plastering.

ix. Preparatory work

All joints in the face work that is to be plastered shall be raked out to depth equal to not less than the width of the joints or as directed by the Engineer. The raking shall be done taking care not to allow by chipping of masonry. In new work the raking out shall be done when the mortar in the joints is still green. Smooth surfaces of concrete, old plaster, etc. must be suitably roughened to provide necessary bond for the plaster. All dirt, soot, oil paint or any other material that might interfere with satisfactory

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bond shall be removed. In the case of stone masonry, scrubbing on the walls to receive the plaster shall not be more than 12 mm (1 ½"). The surface to be plastered shall be cleaned and scrubbed with fresh water and kept wet for 6 hours prior to plastering. It shall be kept damp during the progress of the work. The plastering shall not be commenced unless the preparatory work is passed in writing by the Engineer-in-charge.

In hand mixed mortar, cement and sand in the special proportions shall be thoroughly mixed dry on a clean impervious platform. Fresh and clean water as specified above shall be added gradually and thoroughly mixed to form a stiff plastic mass of uniform colour so that, each particle of sand shall be completely covered with a film of wet cement. The water cement ratio may be as under or as directed by the Engineer-in-charge.

Cement Ratio per 50 kg of cement	Sand	Water-Cement	Qty of Water (Litres)
1	1	0.25	12.5
1	1-1/2	0.28	19
1	2	0.3	15
1	2-1/2	0.35	17.5
1	3	0.4	20
1	4	0.53	26.5
1	5	0.6	30
1	6	0.7	35
1	8	0.9	45

Machine mixed mortar shall be prepared in an approved mixer. Water cement ratio shall be as per hand mixed mortar. The mortar so prepared shall be within 30 minutes of adding water should be used in the work. The mortar remaining unused after that period mortar which has partially hardened or is otherwise damaged shall not be re-tempered or remixed. It shall be destroyed or thrown away.

x. Gauges

Patches of plaster 15cm x 15cm shall be put on about 3 m apart as gauges to ensure even plastering in one plane.

xi. Workmanship

Plastering:

In all plaster work the mortar shall be firmly applied with somewhat more than the required thickness and well pressed into the joints and on the surface and rubbed and levelled with a flat wooden rule to give required thickness. Long straight edges shall be freely used to give perfectly plane and even surface. All corners must be finished to their true angles or rounded as directed by the Engineer-in-charge. The surface shall be finished to plane or curved surface as shown on the plan or directed by the Engineer-in-

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charge, and shall present a neat appearance. The mortar shall adhere to the masonry surface intimately when set and there should be no hollow sound when struck. Cement plastering should be done in squares or strips as directed. Plastering shall be done from top downward.

First or Backing Coat

The first coat of the specified thickness shall be applied as described above. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days depending upon weather conditions. The surface shall not be allowed to dry during this period.

D) PLASTERING TO CEILING

Projecting burrs of mortar formed due to the gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brushes. In addition concrete surface shall be poke marked with a pointed tool at spacing of not more than 50 mm centres, the pokes being made not less than 3 mm deep, to ensure a proper key for the plaster. The mortar shall be washed off and surface cleaned of all oil, grease etc., and well wetted before the plaster is applied.

Cement plaster to ceiling shall be 6 mm thick finished/ not finished with a floating coat of neat cement and thick coat of lime wash on top of walls for bearing of slabs.

The plaster shall be applied over the cleaned and wetted surface of the wall. When the plaster has been brought to a true surface with the wooden straight edge it shall be uniformly treated over its entire area with a paste of neat cement and rubbed smooth, so that the whole surface is covered with neat cement coating. The quantity of cement applied for floating coat shall be 1 kg per Sqm. Smooth finishing shall be completed with trowel immediately and in no case later than half an hour of adding water to the plaster mix. The rest of the specifications described above shall apply.

E) ROUGH COAT CEMENT PLASTER WITH CEMENT MORTAR

i. Base Coat

The first coat of plaster shall be of cement mortar of 1:4 mix and applied according to the relevant provisions of IS: 1661 Clause 14. 1. The finished thickness of the first coat shall be 12 mm for brick masonry or concrete surface and 15 mm for rubble stone masonry. The plaster shall be laid by throwing the mortar (by using a strong whipping motion) on the prepared surface with a trowel in a uniform layer, and pressed to form a good bond. The surface shall be roughened.

ii. SCAFFOLDING

Scaffolding shall be erected with steel sections or pipes of adequate strength so as to be safe for construction operations. The contractor shall take all measures to ensure the safety of the work and

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working people. Any instructions of the Engineer-in-charge in this respect shall also be complied with. The contractor shall be entirely responsible for any damage to property or injury to persons resulting from ill erected scaffolding, defective ladders and materials or otherwise arising out of his default in this respect. Proper scaffolding shall be provided to allow easy approach to every part of the work. Overhead work shall not be allowed.

F) MESH TO WALLS

i. GI Chicken Mesh

GI Chicken mesh of 20 gauge as approved shall be used over junctions of concrete and masonry or two dissimilar materials about 150mm wide fixed with GI wire nails etc. as directed by the in charge/Architect. GI Plaster Mesh should be made out of galvanized iron coils of nominal thickness 0.35m with hot dip zinc coating of 120gms/square meters. The GI plaster mesh should be manufactured out of coils of varying widths, which depends upon the width of the required finished product. G.I Plaster Mesh is used for avoiding cracks between wall column joints, wall beam joints, plastering of electrical conduits etc. Chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be not be made separately.

ii. PVC Plaster Mesh:

PVC Plaster mesh should be made from Polypropylene products and should possess good chemical and heat resistance. They should be semi rigid with good impact strength, appearance and are easily welded. The thickness of mesh to be 0.9mm

G) MEASUREMENTS

Length and breadth shall be measured correct to a cm and its area shall be calculated in square metres correct to two places of decimal.

Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves, or open joints in brick work.

The measurement of wall plaster shall be taken between the walls or partitions (the dimensions before the plaster shall be taken) for the length and from the top of the floor or skirting to the ceiling for the height. Depth of coves or cornices if any shall be deducted.

The following shall be measured separately from wall plaster.

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- (a) Plaster bands 30 cm wide and under
- (b) Cornice beadings and architraves or architraves moulded wholly in plaster.
- (c) Circular work not exceeding 6 min radius.

Plaster over masonry pilasters will be measured and paid for as plaster only.

Exterior plastering at all heights shall be measured together. Patch plastering (in repairs) shall be measured as plastering new work, where the patch exceed 2.5 Sqm. extra payment being made for preparing old wall, such as dismantling old plaster, raking out the joints and cleaning the surface. Where the patch does not exceed 2.5 Sqm in area it shall be measured under the appropriate item under sub head 'Repairs to Buildings.'

Deductions in measurements, for opening etc. will be regulated as follows:

No deduction will be made for openings or ends of joists, beams, posts, girders, steps etc. up to 0.5 Sqm in area and no additions shall be made either, for the jambs, soffits and sills of such openings. The above procedure will apply to both faces of wall.

Deduction for opening exceeding 0.5 Sqm but not exceeding 3 Sqm each shall be made for reveals, jambs, soffits sills, sills, etc. of these openings.

- (i) When both faces of walls are plastered with same plaster, deductions shall be made for one face only.
- (ii) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is unplastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side. Where width of reveals on both faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of plaster and/or pointing as the case may be.
- (iii) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each plastered face of wall.

For opening exceeding 3 Sqm in area, deduction will be made in the measurements for the full opening of the wall treatment on both faces, while at the same time, jambs, sills and soffits will be measured for payment.

In measuring jambs, sills and soffits, deduction shall not be made for the area in contact with the frame of doors, windows etc.

H) RATE

The rate shall include the cost of all labour and materials involved in all the operations described above.

- i. Providing GI Chicken mesh 20 gauge or PVC mesh (whichever is mentioned in the BOQ), over lapping to a width of 150 mm at the junctions of masonry and concrete works on either side and including tying in position by using suitable nails/ clamps/ screws and as

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- directed etc. complete at all levels
- ii. Forming of drip mould/ bands, grooves of sizes as required etc., wherever grooves are to be provided horizontally/ vertically for in accordance with the drawings.
- iii. Cost of All material and labour
- iv. Hacking concrete surfaces to be plastered or rendered
- v. Preparation of surfaces by raking out joints, wetting the surface etc.,
- vi. Work at all heights, levels and situations.
- vii. Washing floors, cleaning glass and leaving premises clean and tidy after the plastering is done. Disposing off the debris outside the site
- viii. Curing the same.
- ix. Providing necessary scaffolding, ladder, platform for any height and depth and removing the same after the work is completed
- x. Neat finishing of junctions of plaster and skirting
- xi. Screening and washing approved fine aggregates

POP PUNNING/ GYPSUM PLASTER

A) GYPSUM PLASTER TO WALLS

GYPSUM UNIVERSAL PLASTER (Base coat), a gypsum based material in a handy application can be applied over any normal background in not more than one coat, depending on evenness or the background. Smooth finish and good impact strength are its virtue.

Gyplaster base coat plaster is a calcium sulphate hemihydrate plaster with additives including light weight aggregate to improve plasters handling workability and application. It attains early strength and is free from shrinkage cracks. The thickness of the plaster should be a maximum of 13 mm on uneven background but should not exceed 10 mm or less than 5 mm on a level and even background.

The setting time of plaster is approximately 30 minutes after the application, depending upon suction of background. The setting progresses evenly and gradually until the surface is hard enough to receive a final stroke of a trowel, at approximately 45 to 60 minutes.

The coverage is approximately 65 to 75 sq.m. per 1000 kg at 13 mm thickness.

For application of gyplaster, the wall is first marked vertically at 1220 mm centres, then checked with straight edge, or line (preferably aluminium square tube) centres to find the high spots which are used as guide for level to be set.

The background should be suitably wetted with a brush 5-10 minutes before plastering to displace the trapped air and for a good plaster contact with the surface. Four points (by putting plaster with flat surface) are fixed in level and plumb to each corner of the wall to determine the thickness of the plaster required to be done.

40 mm wide strips of plaster are fixed. Then the points are applied vertically, in level and plumb of both ends of the wall.

These vertical strips are then made with plaster at even 1220 (or 1550 mm) centres on the entire area of the wall, to ensure level and plumb of the strips, to be in line.

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The plaster is applied to surface of the wall with a trowel to required thickness and finish the surface by setting straight edge (sq. tube) horizontally by them placing on the vertical strips already fixed above, with firm pressure.

A tight coat is applied then turned back with the same batch material to fill out to required thickness.

A featheredge should be used to straighten the plaster to a reasonable plane, whilst at the same time filling in any slacks or hollows when the plaster has stiffened sufficiently, further ruling out the feather edge is necessary to achieve a flat surface.

As the plaster stiffens progressively, further flattening and paring should be carried out with a spatula. When the plaster is sufficiently formed, the surface should be soaked lightly with a sponge float and light application of water if necessary to raise the flat and bring the surface to a suitable condition for finishing.

Closing in with the trowel should commence as soon as plaster starts to set, followed by a final trowel at the appropriate time.

Overpolishing should not be done at any cost.

Decoration and final finish should be delayed until the plaster work has dried out thoroughly.

Precautions:

- a. Tools and water used in mixing must be clean and free from set plaster and other impurities.
- b. Set plaster shorten the setting time and thus reduces the strength of plaster which sets.
- c. Surfaces should be protected from weather and should be reasonably wetted 5-10 minutes before plastering so that the plaster holds on the background satisfactorily.
- d. Fittings and plugging of all kinds should be done before proceeding to plaster.
- e. Openings, chases or other apertures for cable conduits and other's should be cut before plastering.
- f. Background to be plastered should be thoroughly brushed with broom to remove dust and loose mortar.
- g. Once a mix has started to set, it should not be retempered neither should be a fresh gauging be mixed with an old one.

Background surface should be reasonably dry and protected from the weather. The suitability of a particular background for plastering should be considered in relation to its length, suction, bonding properties, shrinkage or thermal movement characteristics, water and soluble salt content. The high suction of certain backgrounds (like concrete block masonry) should be adjusted by sprinkling water. Plaster is not supposed to isolate dampness and this is not suitable for use in continuously damp or humid conditions. During application of Gyplaster in hot or dry conditions, care should be taken to ensure that rapid loss of water is avoided. The reason is that Gyplaster requires a proportion of the mixing water in order to set and achieve full strength. If the water is dried off too rapidly then the strength of the plaster will be impaired. Once set and fully dry, it is suitable for use in situation where the inside temperature is 50 de. C maximum.

Universal plaster attains early strength during the drying process and the plaster work does not suffer from inherent shrinkage cracks. Whilst the finished surface can be intended by impact, the natural resilience of set plaster prevents more serious damage.

Tubular service conduits should be chased into the background wherever possible. The following

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precautions should be taken in order to minimise any risk of subsequent plaster cracking or rust staining over service runs.

1. Conduit of minimum permissible dimensions should be used.
2. High spots in the background should be chiselled if possible.
3. The undercoat plaster thickness specified should be sufficient to cover the extreme protrusions of the conduit by at least 5 mm.
4. Service routes should avoid door frames, ground, etc.
5. Service piping, conduits, fixing clips and other metallic objects should be adequately protected by galvanizing, painting or applying a thicker layer of lacquer in order to protect it from rusting.
6. At junctions of different materials (like concrete blocks and RCC columns/ beams) a fibre mesh shall be applied prior to the application of the plaster to avoid cracks at a later date.

Gyplaster universal shall be mixed in a clean mixing bucket using clean water. Plastic buckets can be used to avoid rust staining from metal containers

B) POP PUNNING TO WALLS

The plaster of Paris shall be of the calcium-sulphate semi-hydrate variety. Its fineness shall be such that when sieved through a sieve of IS sieve designation 3.35 mm for 5 minutes the residue left on it after drying shall be not more than 1% by weight. It shall not be too quick setting. Initial setting time shall not be less than 13 minutes. The average compressive strength of material determined by testing 5 cm cubes after removal from moulds, after 24 hours and drying in an oven at 40 degree C till weight of the cubes is constant, shall not be less than 84 kg per square metre.

The material will be mixed with water to a workable consistency. Plaster of Paris shall be applied to the underside of the laths over the rabbit wire mesh in suitable sized panels and finished to a smooth surface by steel trowels. The plaster shall be applied in such a manner that it fully fills the gaps between the laths and the thickness over the laths is as specified in the description of the item. The joints shall be finished flush to make the ceiling in one piece. The finished surface shall be smooth and true to plane, slopes or curves as required.

All other details to be same as the application of gypsum plaster mentioned above

FLOOR FINISHES

A) SCOPE

These Specifications covers flooring, skirting, dado or cladding works using different types of stone/ slabs/ tiles as detailed hereunder:

B) GENERAL

The provision of the latest revisions of the following IS Codes shall form a part of this specification to the extent they are relevant:

IS: 269	Specification for ordinary, rapid hardening and low heat Portland cement.
IS: 383	Specification for coarse and fine aggregate from natural sources for concrete
IS: 777	Specification for glazed earthenware tiles.
IS: 1200 Part XI	Method of measurements for Building and Civil Engg. Works, paving, floor finishes, dado and skirting.
IS: 1237	Specification for cement concrete flooring tiles.
IS: 1443	Code of practice for laying and finishing of cement concrete flooring tiles.
IS-. 2541	Code of practice for use of lime concrete' in buildings.
IS: 2571	Code of practice for laying in situ cement concrete flooring
IS: 10067	Material Constants in Building Work

Other 1.5 Codes not specifically mentioned here, but pertaining to Floor Finishes form part of these specifications.

C) INDIAN PATENT STONE FLOORING

i. Materials

1. Cement concrete:

The cement concrete shall generally conform to specifications for ordinary concrete. The coarse aggregates shall be carefully selected, sufficiently tough and hard stone pieces broken in a manner that will provide particles of approximately cubical shape affording good interlocking. The maximum size of coarse aggregate shall be 12 mm. The fine aggregate shall consist of properly graded particles. The proportion of mix shall be M15 or as mentioned in the BOQ. The least amount of mixing water that will produce a workable mix and will allow finishing without excessive travelling shall be used. Generally a water cement ratio of 0.5 should suffice.

ii. Workmanship

The sub-grade in all cases shall be formed to proper levels and slopes, well compacted and cured. The top surface shall be kept slightly rough.

The surface of the sub-grade shall be cleaned off all loose materials and moistened immediately before laying the concrete floor. The concrete flooring shall be laid in alternate bays not exceeding 6.25 Sqm (about 64 sf.ft) each. The edge of each panel into which the floor is divided should be supported by flat bars of steel or wood duly oiled to prevent sticking. Their depth shall be the same as that proposed for

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the finished floor as mentioned in the item. The bars should be removed before filling in the adjoining panels. At least 48 hours shall elapse before the concreting in the adjacent bays is commenced. The concrete shall be laid immediately after mixing. While being placed the concrete shall be vigorously sliced and spaded with suitable tools to prevent formation of voids or honey comb pockets. The concrete shall be brought to the specified levels by means of a heavy straight edge resting on the side forms and drawn ahead with a sawing motion in combination with a series of lifts and drops alternating with small lateral shifts. While concreting the adjacent bays care shall be taken to ensure that the edges of previously laid bays are not broken by careless or hard tamping.

Immediately after laying the concrete, the surface shall be inspected for high or low spots and any needed correction made up by adding or removing the concrete. After striking off the surfaces to the required grade concrete shall be compacted with a wooden float. The blows shall be fairly heavy in the beginning but as consolidation takes place, light rapid strokes shall be given to complete the ramming. The floating shall be followed by steel trowelling after the concrete has hardened sufficiently to prevent excess of fine material from working to the surface, The finish shall be brought to a smooth and even surface free from defects and blemishes and tested with straight edges. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface of the concrete to absorb moisture or to stiffen the mix. After the concrete has been thoroughly rammed and has dried sufficiently to allow rendering to be worked up, surface shall be rendered with a thin coat of 1:1 cement mortar with fine sand and uniformly floated. If so directed by the Engineer-in-Charge, approved mineral colour pigment conforming to appendix-B of IS 657 shall be added to the cement mortar to give the required colour and shade to the flooring. When the cement mortar rendering is sufficiently stiff, lines shall be marked on it with strings or by any other device to give the appearance of tiles 30 x 30 cm or of any other size laid diagonally or square as directed by the Engineer-in-Charge. The junctions of floor and walls shall be rounded off if so directed, without any extra payment.

After the concrete in the bays has set, the joints of the panels shall be filled with cement cream or with suitable bitumastic compound as shown on the drawings or directed by the Engineer-in-Charge. Vertical edge of the bays shall be neatly marked on the surface of the concrete with a pointed trowel after filling the joints.

iii. Finishing:

When the rendering is somewhat stiff, neat cement may be sprinkled on sparingly through a paper pot on the surface and rubbed lightly to give smooth polished ordinary cement coloured surface. If coloured flooring is required by the Engineer-in-Charge the approved coloured cement shall be used. Surface shall be protected from direct sun when it is green.

iv. Curing:

Curing shall start on the next day after finishing and shall be continued for 14 days.

D) CEMENT CONCRETE FLOOR WITH METALLIC HARDENER TOPPING

Cement concrete flooring of specified thickness and mix as per 'Itemised Schedule of Quantities' shall be laid as specified under the specification of cement concrete flooring. The top surface shall be roughened with brushes while the concrete is still green and the forms shall be kept projecting up 12mm. Over the concrete surface to receive the metallic hardening compound topping. Metallic concrete hardener

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topping shall consist of 12mm thick layer of cement hardener of mix 1:2 (1 cement hardener: 2 stone aggregate 6mm nominal size by volume). The metallic concrete hardening compound of approved quality is mixed in the ratio of 1:4 (1 metallic concrete hardener: 4 cement by weight). Concrete hardener shall be fry mixed with cement and then with stone aggregate. The mixture by adding water so obtained shall be laid in 12mm thickness after putting cement slurry on cement concrete under-layer but within 2 to 4 hours of laying the under-layer. The surface shall be finished smooth and true to slope with steel floats. 3. RCC Floor Slab this shall be of RCC 1:2:4 nominal mix (MIS grade) of thickness 130mm or as indicated otherwise. The slab shall be reinforced with 8 mm MS bars at 200mm. Spacing both ways. The water cement ratio shall be adjusted suitably to provide a Slump of not more than 35mm. The flooring shall be laid in continuous panels of about 3 metre width dummy joints at every 6 metre length and full depth transverse expansion joints at every 30 to 40 metres. The expansion joints shall be filled with compressible pre-moulded joint filler such as Choksi or other approved make. The floor slab shall be laid in a workmanlike manner by workers skilled in this trade. Proper slopes and levels as indicated shall be maintained. Shuttering to sides of panels shall be of steel channels only. Concrete shall be vibrated after pouring with needle type vibrators. The work shall be measured and paid for as per IS 1200 inclusive of form work. Reinforcement shall be measured and paid for separately.

E) MARBLE STONE SLAB/ GRANITE STONE SLAB/LIMESTONE FLOORING

v. Material

Machine cut marble stone/ granite stone slabs shall be of thickness as specified in the item description. Colour shall be uniform and the slabs free from all defects. Tiles used at site shall be machine-cut. The slabs shall be made from selected stock, which are hard, sound, homogeneous and dense in texture and free from flaws, angles and edges shall be true, square, and free from chipping and surface shall be plane. The slabs shall preferably to machine cut the required dimensions. Tolerance of +/- 5mm in dimensions and +/- 2mm in thickness will be allowed.

In machine-cut tiles, edges shall be protected from any damage in transit. No breakage shall be permitted. All edges shall be sharp, perfectly rectangular. Edges shall be pencil-rounded and polished for exposed corners and faces.

Uniformity of size shall generally be maintained for the flags used in any one room. The stone flags shall be without any soft veins cracks or flows and shall have a uniform colour. They shall have even natural surfaces free from broken flakes on top and shall be true and square to ensure uniform width of joint. Samples of stone slabs to be used shall be got approved by the Engineer-in-charge and the slabs to be used shall conform to the approved sample.

The slabs would be cut by Gang saw and the lubricant for cutting will be water only.

Multiple Blade cutters should be used for cutting large sizes/blocks.

Polishing /Honing should be done by '21 Head polisher'

Packing of stones - Packaging should be done with following steps:

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- a) Base will be wooden planks.
- b) Over it, there would be Thermocol sheet.
- c) Vertically, perimeter will be a wooden box
- d) First sheet of Thermocol sheet would be put.
- e) Stone slab will be placed vertically
- f) Thermocol sheet would be put on the other side of slab
- g) Another stone slab would be placed.

Quantities/lots have to be blocked based on the following parameters:

- a) Colour Consistency
- b) Tonal Range
- c) Cutting direction (it should be along the length)

vi. Tolerances

The following tolerances shall be allowed in the dimension of blocks, slabs and tiles:

Length	Tolerance
<i>Blocks</i>	
Width	+ 2 per cent
Thickness	+ 2 per cent
Length	+ 2 per cent
<i>Slabs</i>	
Width	+ 2 per cent
Thickness	+ 2 per cent
Length	+ 3 per cent
<i>Tiles</i>	
Linear dimension	+ 3 per cent
Thickness	+ 2 per cent

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The sizes other than those mentioned above may be provided as directed by the Engineer and nothing extra shall be payable on this account.

vii. PHYSICAL PROPERTIES

The physical properties of marble for blocks, slabs and tiles and method of tests are mentioned below

Characteristic	Marble		Granite	
	Marble Requirements	Method of test	Granite Requirement	Method of test
(1) Moisture absorption after 24 hrs	Max. 0.4%	IS 1124	Max. 0.50% by weight	IS 1124
(2) Hardness	Min. 3	Mhos scale		-
(3) Specific Gravity	Min. 2.5	IS 1122	Min. 2.6	IS 1122

viii. Bedding

Bedding shall be of cement-sand-mortar mix in a ratio of 1:4 unless specified otherwise in the BOO/drawings. The base of cement or lime concrete shall be laid and compacted to a reasonably true plain surface and to the required slopes and level. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Before spreading mortar, the sub-floor or base shall be cleaned off all dirt, scum or laitance and of loose material and then well wetted without forming any pools of water on the surface. In case of R.C.C floors, the top shall be left a little rough. The mortar shall then be evenly and smoothly spread over so much area as will be covered with slabs within half an hour. The thickness of the mortar bedding shall not be less than 12 mm and not more than 35 mm.

ix. Laying

Laying of marble /granite stone slab flooring shall be as follows:-

Before laying, the stone slab shall be thoroughly wetted with clean water. Neat cement grout (pigmented to match the shade of the stone slab) of honey like consistency shall be spread on the mortar bed over as much areas as could be covered with the slabs within 15 to 20 minutes. Each stone slab shall be gently tapped with a wooden mallet till it is firmly and properly bedded. If there is a hollow sound on gentle tapping of the slabs such slabs shall be removed and reset properly. The joints shall be as thin as possible and limited to 2mm at the maximum. The stone slab shall be laid so as to give continuous parallel long joints with cross joints at right angles to them. The edges of the adjoining slabs shall be in one plane. Where the slabs cover open edges of floor or window sills the edges shall be neatly rounded off.

Laying shall start after due consideration is given to following points and approved by the Engineer-in-charge.

Base concrete or the RCC slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as given in the description of the item.

The average thickness of the bedding mortar under the slab shall be 25 mm and the thickness at any

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place under the slab shall be not less than 12 mm.

The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible.

Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The flooring shall be cured for a minimum period of seven days.

The surface of the flooring as laid shall be true to levels, and, slopes as instructed by the Engineer-in-Charge. Joint thickness shall not be more than 1 mm.

x. Polishing and Finishing

The day after the tiles are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shape of the topping of the wearing layer of the tiles. The same cement slurry shall be applied to the entire surface of the tiles in a thin coat with a view to protect the surface from abrasive damage and fill the pin holes that may exist on the surface.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be grounded evenly with machine fitted with coarse grade grit block (No. 60). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, mixed with or without pigment to match the colour of the topping of the wearing surface in order to fill any pin hole that appear. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit block (No. 120).

The final grinding with machine fitted with the finest grade grit blocks (No. 320) shall be carried out the day after the second grinding described in the preceding Para or before handing over the floor, as ordered by the Engineer-in-Charge.

For small areas or where circumstances so require, hand grinding/polishing with hand grinder may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundum stones, shall be used:

1st grinding coarse grade stone (No. 60)

Second grinding - medium grade (No. 80)

Final grinding fine grade (No. 120)

In all other respects, the process shall be similar as for machine polishing.

After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square metre sprinkled with water and rubbed hard with a 'namdah' block (pad of woollen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

xi. Measurement

Measurement shall be done in square metres. Steps and risers for specified width and height shall be measured in running metres or as detailed in BOQ. Rates shall include costs for all labour, material, cutting, dressing, polishing of exposed faces and edges, wastage etc. including dry laying in pattern, providing dividing strips, special cut pieces of various sizes to create the pattern as shown in the drawing

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and polishing to required standard etc. No extras shall be permitted on any account.

xii. Coating :

Before laying all limestone/Marbles/Italian Marble and only those Granite exposed to external agencies to be treated with UV resistant, water resistant coat, fungus resistant coats having low VOE and all laying and applying specifications as per manufacturer's specifications

The coating should be high performance natural look solvent based penetrating sealer with a unique formulation designed for the protection of all porous to dense tile, stone and grout surfaces. The product should be formulated for resistance against oil, water, alkalis, acids, staining and freeze-thaw damages. The coating should function on the surface of the substrate, it penetrates and forms a invisible barrier so that it prevents moisture and stains from entering the substrate, but it remains permeable to vapours letting the substrate to breath

and keeping their characteristics unchanged. It is effective for interior and exterior applications. It is UV transparent, resists acid rain and will not alter the natural colour of the substrate.

APPLICATION:

- a. Read entire label, Datasheet and MSDS before using.
- b. The surface to be sealed must be clean, dry and free from dust. Ensure area is well-ventilated during application and until the surface is dry.
- c. Mask the neighbouring areas not intended to seal.
- d. Test on a small hidden area before coating entire surface to determine the desired results.
- e. Apply an even coat using sponge, brush, and paint pad or cotton towel. Not to be diluted. Do not spray or aerosol.
- f. Allow the sealer to penetrate 10 -20 minutes.
- g. Excess sealer remaining on the surface must be wiped (buffed) using absorbent paper or cotton towels or with buffing machine. Use White buffing pad only.
- h. A second coat to be applied after 30-45 minutes after first coat application. For very porous surfaces a third coat may be required.
- i. 3-5 minutes after the final application, wipe the entire surface with dry cotton towels or start buffing to remove excess sealer.
- j. If any excess sealer dried on the surface and formed residue, apply a thin coat of the sealer and wipe with cotton towel immediately.
- k. A full cure is achieved after 48-72 hours. Foot traffic may begin in 24 hours.
- l. Clean the tools using soap water immediately after each use.

xiii. MARBLE STONE/ OTHER STONE SLAB FLOORING FOR TREADS:

The method of laying, bedding etc. for marble/ other stone flooring in treads shall be similar to that for marble stone slab/ granite stone slab flooring as specified in 4.0 above. Chamfering/Bull nosing of the treads shall be done as mentioned in the BOQ. All edges after rounding/chamfering will be machine mirror polished as directed.

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xiv. SKIRTING/ DADO OR CLADDING OF POLISHED STONE SLAB:

The backing for skirting/ dado or cladding shall be cement plastered mentioned in the item, 12 mm to 20 mm thick and this plastering shall be done in a single coat. Thickness of joints shall not exceed 1.5 mm. Final polishing may be done by rubbing. The top of skirting or dado shall be jointed neatly with the plaster above as directed. The joints between the two slabs shall be filled with neat white cement and matching coloured pigment grout of appropriate consistency. All cutting joints to be in 45° machine cut, only for the staircase

xv. MEASUREMENT

Flooring shall be measured in Square Metres correct to two places of decimal while the individual dimensions shall be measured correct to one centimetre before laying skirting, dado or wall plaster. No deduction shall be made nor extra paid for any opening in the floor area up to 0.1 Sqm. Nothing extra shall be paid for use of outlines nor for laying the floor at different levels in the same room. Treads of stairs and steps without nosing shall also be measured under flooring.

Unless otherwise mentioned in the BOQ, Risers of steps, skirting, cladding and dado shall be measured in square metres correct to two places of decimal. Length shall be measured in centimetre along finished face of the riser, skirting, cladding or dado correct to a centimetre. Height shall be measured from the finished level of tread or floor to the top.

F) JOINTS IN FLOORING

xvi. Joints:

Joints shall be provided in flooring to take care of expansion and contraction due to variations in temperature. In addition, construction joints shall also be provided in case of compulsory break in continuity of slabs due to the close of day's work and the commencement of the same the next day. The location and type of joints provided shall be as shown in the drawing or as directed by Engineer-in-charge. The edge of the slab at all joints shall be rounded with an edging tool having radius not greater than 6mm. It should be carefully ensured by proper vibration, that concrete at joints is free from honeycomb.

xvii. Transverse Joints.

Transverse joints shall be expansion, contraction or construction joints and shall be provided as shown in the drawing or as directed by Engineer-in-charge. They shall be at right angles to longitudinal joint surface of the floor. Contraction and expansion joints shall be continuous from edge to edge.

xviii. Transverse Expansion Joints :

These joints shall be provided at an interval or spacing of 30 m. They shall be pre moulded type and shall extend the entire width of the pavement and form sub-base to 25mm below the surface of the pavement. The gap width for this type of Joint shall be approximately 20 to 25mm. The filler shall be held accurately in place during the placing of the concrete by a metal bulkhead, a metal channel cap or other approved method, Load transfer is effected through a system of reinforcement called dowel bar. Dowel bars are embedded and kept fixed in concrete at one end and is kept free to expand or contract

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by providing a thin coating of bitumen over it. Metal cap is provided at this end to offer a space of about 25mm for movement during expansion.

xix. Transverse Contraction Joints

These joints shall be provided at an interval on spacing of 10m, depending upon the type of aggregates. They shall be placed as shown in the drawing or as directed by the Engineer-in-charge. They shall be constructed by forming in the surface of the slab, a slot not less than 6mm wide and having a depth equal to one fourth depth of the concrete slab. This slot may be formed such as by pushing into concrete a flat bar or the web of a 'T' bar and keeping the slot open or any manner approved by the Engineer-in-charge. It shall be filled flush with top surface by using approved sealant.

xx. Longitudinal Joints

Longitudinal joints, parallel to longer side of floor slab shall be of plain type and shall be formed by placing the concrete against the faces of the slabs concreted earlier. The faces of the old concrete shall be painted with bitumen before placing fresh concrete.

The bar shall be used at longitudinal joints and they shall be of the dimensions and at spacing as shown in drawing or as directed by the Engineer-in-Charge. Tie bars shall be fairly well supported so as not to be displaced during construction operations.

G) GLAZED TILE FLOORING AND DADO

xxi. Glazed tiles shall, unless otherwise indicated, be 150mm x 150mm x 6mm thick in size and of best quality, Indian make obtained from approved sources. Glazed tiles shall be pure white or of colour as indicated. The tiles shall be sound hard, well and evenly glazed, free from twist, with fine and sharp edges. Different makes of tiles shall be brought for approval and samples of tiles shall be first got approved by the Engineer-in-charge and all the tiles which shall be used in the work shall strictly conform to the approved sample otherwise all the tiles will be rejected. The surface to be laid for flooring or dado shall be thoroughly hacked; joints of masonry raked cleaned of all mortar scales, concrete lumps, loose materials, etc., and washed to remove mud, dirt, etc., from the surface. Unless and until the surface is approved by the Engineer-in-charge, the flooring or dado shall not be started. The prepared surface shall be thoroughly drenched with water. The glazed tiles and all specials shall be soaked in water for a minimum period of 6 hours before use.

xxii. Flooring:

A bedding of 20 mm thick (unless otherwise specified) cement mortar 1:3 shall be laid evenly to levels or slope as directed. The tiles shall then be laid on the bedding with a backing of thin cement paste. All tiles shall truly and evenly set and pressed in position to obtain a uniform plane surface. The tiles shall be close jointed and all joints shall be uniform and run in perfect straight lines. The joints shall be staggered or continuous as directed. The other specials like, corner angles, elephant feet, bull eyes etc. shall be used at the proper places whenever required and as directed. The entire finished surface shall be thoroughly cleaned to remove all cement stains etc. The joints shall be kept wet for 7 days.

xxiii. Dado:

The prepared surface shall be plastered with cement mortar 1:3 to get bedding of 12mm thick. The plastered surface shall be even uniform and true to plumb. The tiles shall be fixed in position with a backing of cement paste. All tiles shall be evenly set and pressed in position to a true plane surface. The specifications for workmanship regarding joints, specials, cleaning, pointing, curing etc. shall be exactly similar to tile flooring. The flooring and dado shall be finally cleaned with diluted hydrochloric acid and water to produce a clean white and shining surface.

Measurement shall be for the actual area. The dimensions shall be taken on the glazed tiled surface. The rate shall include for all specials such as comer angles, elephant foots, bulls eyes etc. The unit of measurement shall be 1 Sqm. If the tile manufacturer specifies the use of adhesives for dado, the Contractor to use the same at no extra cost to the Client

H) CERAMIC TILES /VITRIFIED TILES FLOOR AND DADO

xxiv. Ceramic tiles shall be 300mm x 300mm x 7mm thick in size or as mentioned in the BOQ, Vitrified tiles to be 600x600x10mm thick/900 x 900 x 12mm / 1000 x 1000 x 12mm or as specified in the Item and of best quality, Indian make obtained from approved manufacturer. The tiles shall be sound, hard, well and evenly treated, free from twist, with fine and sharp edges. Sample of the tiles shall be first got approved by the Engineer-in-charge in case of the Contractor's supply and all the tiles which shall be used in the work shall strictly conform to the approved sample otherwise all the tiles will be rejected. The surface to be laid for the flooring or dado shall be thoroughly hacked, joints of masonry racked, cleaned of all mortar scales, concrete" lumps, loose materials, etc. and washed to remove mud, dirt, etc. from the surface. Unless and until the surface is approved by the Engineer-in-charge, the flooring and dado shall not be started. The prepared surface shall be thoroughly drenched with water.

xxv. Flooring

A bedding 20 mm thick (unless otherwise specified) of cement mortar 1:3 shall be laid evenly to levels or slope as directed, The tiles shall then be laid on the bedding with a backing of thin cement paste. All tiles shall be truly and evenly set and pressed in position to obtain a uniform plane surface. The tiles shall be closed jointed and ail joints shall be uniform and run in perfect straight lines. Joints shall be filled with matching cement paste. Entire finished surface shall be thoroughly cleaned to remove all cement stains, etc. The joints shall be kept wet for 7 days. Epoxy joints can also be used as a substitute for cement paste.

When tile flooring is to be laid over the existing flooring without dismantling old flooring it can be laid with adhesive. The old flooring shall be thoroughly cleaned and checked for undulations, if any shall be rectified with cement mortar 1:3 (1 cement: 3 coarse sand). Old cement concrete surface shall be hacked and cleaned off to have proper bond with the old surface. High polymer modified quick set tile adhesive (conforming to IS 15477) shall be thoroughly mixed with water

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and a paste of zero slump shall be prepared so that it can be used within 1.5 to 2 hours. It shall be spread over an area not more than one Sqm at one time. Average thickness of adhesive shall be 3 mm. The adhesive so spread shall be combed using suitable trowel. Tiles shall be pressed firmly in to the position with slight twisting action checking it simultaneously to ensure good contact gently being tapped with wooden mallet till it is properly backed with adjoining tiles. The tiles shall be fixed within 20 minutes of application of adhesive. The surplus adhesive from the joints, surface of the tiles shall be immediately cleaned. The surface of the flooring shall be frequently checked during laying with straight edge of above 2m long so as to attain a true surface with required slope. Where spacer lugs tiles are provided these shall be filled with grout with lugs remaining exposed. Where full size tile cannot be fixed these shall be cut (sawn) to the required size and edges rubbed smooth to ensure straight and true joints. Tiles which are fixed in floor adjoining to wall shall enter not less than 10 mm under plaster, skirting or dado.

xxvi. Dado:-

The prepared surface shall be plastered with cement mortar 1:3 to get a bedding of 12mm thick. The plastered surface shall be even, uniform and true to plumb. The tiles shall be fixed in position with a backing of cement paste or water proof adhesive of approved manufacturer as specified in the item. All tiles shall be evenly set and pressed in position to a true plane surface. The specifications for workmanship shall be exactly similar to tile flooring. The joints shall be filled with matching cement paste or with joint filler material of approved manufacturer as specified in the item. If the tile manufacturer specifies the use of adhesives for dado, the Contractor to use the same at no extra cost to the Client

I) TWIN GRANITE/MARBLE STONE FRAMES

xxvii. Bedding shall be of grey cement-paste with minimum cement consumption of 0.21 bags per Sqm. Of applied area, unless specified otherwise in the BOO/drawings. The base of cement shall be compacted to a reasonably true plain surface and to the required level. The amount of water added shall be the minimum necessary to give just sufficient plasticity for laying and satisfactory bedding. Before spreading paste, the sub- base shall be cleaned off all dirt, scum or laitance and of loose material and then well wetted without forming any pools of water on the surface. The paste shall then be evenly and smoothly spread over so much area as will be covered with slabs within half an hour. The thickness of the paste shall not be less than 6 mm and not more than 12 mm.

The joints shall be cleaned and properly grouted with a neat paste of white cement with minimum cement consumption of 0.55 kg per Sqm

The proportion of mortar bedding shall be 1:4, unless and otherwise prescribed any other proportion and shall be as per IS 2116-1965, as applicable to non-reinforced masonry work.

The adhesion of two slab frames overlay shall be ensured with araldite or approved Ardex endure/ Latecrete adhesive.

xxviii. Laying

Laying of marble /granite stone slab frame shall be as follows :-

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Before laying, the stone slab shall be thoroughly wetted with clean water. 20mm thick marble slab/ tiles shall be fixed with polymer modified cement adhesive or cement paste (as per BOQ) Each stone slab then shall be gently tapped with a wooden mallet till it is firmly and properly bedded. If there is a hollow sound on gentle tapping of the slabs such slabs shall be removed and reset properly. The joints shall be as thin as possible and limited to 2mm at the maximum. Unless and until detailed in the BOQ or Drg, exposed edges of window sills/door frames, the edges shall be neatly rounded off.

Laying shall start after due consideration is given to following points and approved by the Engineer-in-charge.

The vertical surface for frame cladding work should be rough, fairly in plumb and in right angles with each other, Concealed plumbing and electric conducting shall be complete before the execution of frame cladding work.

Check all the right angles of the corners of bath/W.C. /toilet or pantry area. Please ensure that the plaster is in plumb.

Check the level of the wooden Patti with spirit level before commencing the cladding work. After the frames are laid, surplus cement slurry from the joints shall be cleaned. The following day the joints shall again be cleaned, washed and wire brushed.

In case not specified in the Drawing or BOQ, and if the projection is not recommended, 6mm groove to be provided at the junction of the wall and stone frame.

Polishing and grinding shall be completed on the surfaces and edges before the laying of the stone frames. At first the grinding shall be with rough stone of grade 48 to 60. All chips shall be visible and grinding shall be uniform. It shall be cleaned with water. All pin-holes and opened out joints shall be grouted with matching coloured cement grouts supplied by the tile manufacturer. It shall be cured for a period of 7 days by keeping it moist.

Second coat cutting/grinding shall be done with carborandum stone of grade 120. The same procedure as for the first coat shall be repeated till curing is completed.

The final cutting/grinding shall be with a fine stone of 220-320 grade and shall be done with ample water.

Oxalic acid powder shall be spread 33 gm/Sqm. and polished by machine fitted with Hessian bobs. The floor shall then be washed, cleaned and dried with a soft cloth or linen. They should be hand polished by using rubbing stone.

In case of wax polishing, wax polish shall be applied to the surface. It shall be rubbed with machine. Then clean saw-dust shall be spread over the slab and rubbed with polishing machine. This will remove wax, leaving a glossy surface underneath.

xxix. Rates:

Apart from other factors mentioned elsewhere in this contract, the rate shall include for the following:

1. All labour, materials(except for Client supplied ones), equipments, cleaning of the sub-base, laying mortar bed and adhesives, grout, fixing marble slabs as specified above and making up the joints.
2. Transportation of material/ equipment
3. Any cutting and wasting if required

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4. Mouldings and edge polishing
5. All adhesives, grouts and mastic sealants etc.
6. Curing
7. Cleaning the floor and surrounding areas all stains, etc.

J) CAR PARK SYSTEMS

xxx. PROPOSED SPECIFICATION

The following details the requirements for a Polyurethane seamless lightweight multi-layered system comprising of primers and protective coatings incorporating a full blinded wearing course.

xxxi. TURNING CIRCLES, DRIVEWAYS and PARKING BAYS

- Mechanically prepare the surface
- Prime the surface with water based epoxy as per manufacturer's specifications
- Fully blind the surface with Silica Aggregate 25/30 at the rate of 2.00 kg/m².

xxxii. SUBSTRATE REQUIREMENTS AND SURFACE PREPARATION

All new concrete surfaces, a minimum twenty - eight days old, shall be shot Blasted or mechanically grinded to remove any laitance, dust and open up the pores of concrete for primer penetration.

The moisture content in the floor should not exceed 5%. This will be checked by the contractor prior to laying the CAR PARK system

Deep hollows, indents or other unacceptable defects in concrete surfaces to be made good, prior to the application of the CAR PARK System as directed by the Engineer-in-charge

Brickwork, dense concrete blocks, etc, shall be flush pointed with defects made good by the client

xxxiii. EXPANSION JOINTS

Expansion joints specified by the Architect/ Engineer-in-charge shall be installed by others in accordance with manufacturer's instructions.

xxxiv. TURNING CIRCLES, DRIVEWAYS and PARKING BAYS

xxxv. PRIMING

All dust and debris to be removed prior to primer application.

Apply a coat of approved primer to prepared concrete surfaces at a coverage rate of 0.30kg/m². Allow to become tack free 6- 8 hours or overnight.

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xxxvi. BASE COAT

Apply a high build coat of approved make to the primed at a coverage rate of 0.50kg/m² or as per manufacturer's specifications

xxxvii. ANTI-SLIP WEARING SURFACE

Apply a full blinding of SILICA AGGREGATE 25-30 immediately cast into wet film. (Approx 2.00kg/m²).

Allow to cure for 6- 8 hours or overnight.

Vacuum or sweep blinding surface to remove all non - bonded aggregates.

Apply two coats CAR PARK SYSTEM at a coverage rate of 0.60kg/m² at an inter coat interval of 4-6 hours.

Allow to cure overnight.

Applying Isle marking coat on the surface as per the client's drawing and requirements.

TRAFFICKING

24 hours shall be allowed for opening completed areas to foot traffic and 72 hours for vehicular traffic.

K) IPS WITH NON METAL HARDNERS

Cement concrete flooring of specified thickness and mix as per 'Itemized Schedule of Quantities' shall be laid as specified under the specification of cement concrete flooring. The top surface shall be roughened with brushes while the concrete is still green and the forms shall be kept projecting up 12mm. Over the concrete surface to receive the metallic hardening compound topping.

The non metal hardeners shall be as per the manufacturer's specifications. All installation procedure, mixing, laying procedure shall be as per manufacturer's specifications

L) KOTA FLOORING

xxxviii. Kota Stone Slabs

The slabs shall be of selected quality, hard, sound, dense and homogeneous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut to the requisite thickness. They shall be of the colour indicated in the drawings or as instructed by the Engineer-in-Charge.

The slabs shall have the top (exposed) face polished before being brought to site, unless otherwise specified. The slabs shall conform to the size required. Before starting the work the contractor shall get the samples of slabs approved by the Engineer-in-Charge.

xxxix. Dressing

Every slab shall be cut to the required size and shape and fine chisel dressed on the sides to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surface shall be true and plane.

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The thickness of the slab after it is dressed shall be 20, 25, 30 or 40 mm as specified in the description of the item. Tolerance of ± 2 mm shall be allowed for the thickness. In respect of length and breadth of slabs Tolerance of ± 5 mm for hand cut slabs and ± 2 mm for machine cut slabs shall be allowed.

xi. Preparation of Surface and Laying

Base concrete or the RCC slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:4 (1 cement : 4 coarse sand) or as given in the description of the item.

The average thickness of the bedding mortar under the slab shall be 25 mm and the thickness at any place under the slab shall be not less than 12 mm.

The slabs shall be laid in the following manner:

Mortar of the specified mix shall be spread under the area of each slab, roughly to the average thickness specified in the item. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped with wooden mallet and brought to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows. The mortar is allowed to harden a bit and cement slurry of honey like consistency shall be spread over the same at the rate of 4.4 kg of cement per Sqm. The edges of the slab already paved shall be buttered with grey cement with or without admixture of pigment to match the shade of the Kota slabs as given in the description of the item.

The slab to be paved shall then be lowered gently back in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slabs with as fine a joint as possible.

Subsequent slabs shall be laid in the same manner. After each slab has been laid, surplus cement on the surface of the slabs shall be cleaned off. The flooring shall be cured for a minimum period of seven days.

The surface of the flooring as laid shall be true to levels, and, slopes as instructed by the Engineer-in-Charge. Joint thickness shall not be more than 1 mm.

xli. Polishing and Finishing

The day after the tiles are laid all joints shall be cleaned of the grey cement grout with a wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed and cleaned. Joints shall then be grouted with grey or white cement mixed with or without pigment to match the shape of the topping of the wearing layer of the tiles. The same cement slurry shall be applied to the entire surface of the tiles in a thin coat with a view to protect the surface from abrasive damage and fill the pin holes that may exist on the surface.

The floor shall then be kept wet for a minimum period of 7 days. The surface shall thereafter be grounded evenly with machine fitted with coarse grade grit block (No. 60). Water shall be used profusely during grinding. After grinding the surface shall be thoroughly washed to remove all grinding mud, cleaned and mopped. It shall then be covered with a thin coat of grey or white cement, mixed with or without pigment to match the colour of the topping of the wearing surface in order to fill any pin hole that appear. The surface shall be again cured. The second grinding shall then be carried out with machine fitted with fine grade grit block (No. 120).

The final grinding with machine fitted with the finest grade grit blocks (No. 320) shall be carried out the day after the second grinding described in the preceding Para or before handing over the floor, as ordered by the Engineer-in-Charge.

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For small areas or where circumstances so require, hand grinding/polishing with hand grinder may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundum stones, shall be used:

1st grinding coarse grade stone (No. 60)

Second grinding - medium grade (No. 80)

Final grinding fine grade (No. 120)

In all other respects, the process shall be similar as for machine polishing.

After the final polish, oxalic acid shall be dusted over the surface at the rate of 33 gm per square metre sprinkled with water and rubbed hard with a 'namdah' block (pad of woollen rags). The following day the floor shall be wiped with a moist rag and dried with a soft cloth and finished clean.

If any tile is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with a wooden mallet.

M) THRESHOLD

Thresholds will be of two types

- 1) In 19mm thick pre-polished Granite
- 2) In 20mm thick polished Kota

The method of laying the thresholds is the same as that of flooring.

Granite and Kota threshold should have 6mm chamfer on one side/ full round nosing which will be mirror polished as per the instructions of the Engineer-in-charge.

N) PANTRY/ HAND WASH COUNTER

- xlii. Necessary chases to be made in the wall for supporting the backing materials
- xliii. Machine cut Cudappa stone slabs used shall be of 25 mm thickness, colour shall be uniform and the slabs free from all defects. Or 19mm marine ply wood to be used instead of Cudappa (as specified in the BOQ)
- xliv. Slabs shall be either machine cut at factory in required sizes or cut by machine at site. In all cases no damaged stone shall be used in the work.
- xlv. Vertical stones and stones of shelf shall be machine polished on both sides while the top slab shall be polished on one side i.e. underside, while top surface shall be kept rough for better adhesion with granite top.
- xlvi. All edges shall be sharp, perfectly rectangular and the exposed edges shall be pencil rounded and machine polished.
- xlvii. Assembly of toilet counter shall be done as per detail given by Architect or Engineer complete to all details and dimensions.
- xlviii. Vertical pieces shall be in perfect plumb on all sides while horizontal slab shall be in perfect level.
- xlix. All joints and in fill layer shall be filled with cement sand mortar of mix 1:4 (1 cement : 4 sand) and properly cured.

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- I. Granite top used shall be of approved quality and shade. Thickness shall be about 20 mm and all slabs shall be machine cut.
- li. All slabs preferable shall be from same mines and granite blocks/ rocks to ensure uniformity of colour and quality.
- lii. Cutting and polishing shall be by machine only at factory. No damaged piece shall be used.
- liiii. All edges shall be sharp, perfectly rectangular and the exposed edges shall be pencil rounded and polished.
- liv. Granite top shall be laid over cement mortar bed of about 20 mm thickness of mix cement mortar 1:4 (1 cement : 4 sand). Prior to laying of mortar bed the top of Cudappa stone base shall be scrapped clean and washed thoroughly. In case Granite is to be laid on ply backing, the same to be done by means of approved Adhesive from Roff or Ardex Endura or Latecrete as per the manufacturer's specifications
- lv. Mortar bed shall be laid and neat cement slurry with cement paste shall be spread over the mortar bed and clear granite slab shall be laid and fixed to perfect level over it.
- lvi. Joints shall be as thin as possible and limited to 1-2 mm maximum. The joints shall be wiped off for excess cement slurry and cleaned prior to grouting with matching coloured cement grout.
- lvii. Granite facia Patti shall be fixed by using anchor fasteners and epoxy based adhesives of approved type by the Engineer.
- lviii. Work shall be protected and cured for at least 7 days. The timber props on braces shall be left in place as per instruction/ recommendations of adhesive manufacturer.
- lix. The sink/ wash basin of specified size and make shall be fixed by cutting of Cudappa stone base and the joints on top with granite shall be filled with silicon sealant of approved make and colour.
- lx. Measurements shall be in running meters or as mentioned in BOQ.
- lxi. Rate shall include all materials, wastage, labour, grout, sealant, adhesives, anchors, protection, curing etc. complete. Sink/ wash basin shall be paid separately
- lxii. The cost to include storage below the counter if mentioned in the BOQ

O) CORIAN / ACRYLIC SOLID SURFACE COUNTER

Corian is a solid, non-porous surfacing material homogeneously composed of $\pm 1/3$ acrylic resin (also known as PolyMethyl MethAcrylate or PMMA), and $\pm 2/3$ natural minerals. These minerals are composed of Aluminium TriHydrate(ATH) derived from bauxite, an ore from which aluminium is extracted.

INSTALLATION

Joints :

To minimise material and facilitate installation, corner joints should be made square (butt) rather than mitred. All Corian joints should be reinforced. The edges to be joined should be straight, smooth and clean. Joints should only be made with "Joint Adhesive for DuPont Corian". Make cutouts with a router equipped with a sharp 9.5 mm diameter (minimum) carbide bit. Corners of a cutout must be rounded to 5 mm radius and edges smoothed, top and bottom, all around a cutout. L- and U- shaped corners need

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smooth, 13 mm radius inside corners

Sealants and Adhesives:

Corian is compatible with many commercially available caulks and sealants. However, a specially developed FDA-listed silicone sealant sold by DuPont or its distributors should be used to achieve the best performance and colour match. The base for the counter should be in 19mm marine ply backing or as mentioned in the BOQ. Vertical panels of Corian should be installed over suitable substrates, most probably marine-grade plywood. Use "Silicone Sealant" for DuPont Corian® whenever low flamespread is required. In other cases, light coloured elastic polyurethane adhesive or Type I (ANSI A 136.1-1967) elastic solventbased spread mastic adhesives may also be used. DO NOT USE WATERBASED ADHESIVES. Install worktops on perimeter framing support (without added substrate) using small amounts of silicone sealant. For making joints in worktops, repairs and custom edges, "Joint Adhesive for DuPont Corian®" is required. When used in accordance with manufacturer's instructions, it provides a smooth and inconspicuous joint. Repairs, while sound and fully functional, can be expected to be slightly visible. Joint Adhesive is available wherever Corian® is sold. Joint Adhesive can also be used to add decorative inlay designs into horizontal and vertical

FALSE CEILING

A) GYPSUM FALSE CEILING

20.1.1. Scope of work:

The work envisaged under these specifications refer to supplying and fixing in position Gypsum (Plaster board) false ceiling at any floor, any location and at any height.

20.1.2. Materials

20.1.2.1. Gypsum Boards:-

Plain plaster board should be of thickness as specified in the BOQ. It should be suitable for Interior applications and should follow the standards and specifications as mentioned in IS 2095, Part 1. The Thermal Conductivity of the plaster board should be $0.16 \text{ (W/m}^{\circ}\text{K)}$. The longitudinal edge of the Gyp board shall be of tapered/ square edges, so as to have flush joints while fixing. Handling and transporting of Gyp board shall be done carefully and as recommended by the manufacturers. The board should always be kept in a dry and covered place sheltered from rain and to avoid dampness from flow, they should be supported on wooden battens which should not be more than 45cm apart on a flat surface. The material shall be stacked in piles of smaller heights and should not be stacked on edges. Gyp board which have deformed due to poor stacking should not be used. Cutting of board should be made in faced side of the board by means of retractable knife or by using a normal saw and the edges of the boards shall be planned using proper files.

20.1.2.2. MR grade Gypsum Boards:-

MR grade plaster board should be of thickness as specified in the BOQ. This is the moisture resistant gypsum plasterboard with water repellent additives in the core and paper liners. It

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should be suitable for Interior applications and should follow the standards and specifications as mentioned in IS 2095, Part 1. The Thermal Conductivity of the plaster board should be 0.16 (W/m²K). The longitudinal edge of the Gyp board shall be of tapered/ square edges, so as to have flush joints while fixing. Handling and transporting of Gyp board shall be done carefully and as recommended by the manufacturers. The board should always be kept in a dry and covered place sheltered from rain and to avoid dampness from flow, they should be supported on wooden battens which should not be more than 45cm apart on a flat surface. The material shall be stacked in piles of smaller heights and should not be stacked on edges. Gyp board which have deformed due to poor stacking should not be used. Cutting of board should be made in faced side of the board by means of retractable knife or by using a normal saw and the edges of the boards shall be planned using proper files.

20.1.2.3. GI frame works:- The system consists of G.I. frame work suspended from the soffit of the RCC ceiling. The following G.I. components shall be used for grid work.

20.1.2.3.1. Ceiling section which is the main supporting section to fix plasterboard 80 x 26 x 51 x 3660mm having ribbed surfaces

20.1.2.3.2. Perimeter Channel used to Fix around walls/ partitions having Dimensions in (mm) as 20 x 28 x 30 x 3660mm

20.1.2.3.3. Intermediate Channel which is used to Primary section to support the ceiling section having Dimensions in (mm) as 15 x 45 x 15 x 3660

20.1.2.3.4. Ceiling Angle used to provide suspensions from the structural soffit having Dimensions in (mm) as 25 x 10 x 3660mm

20.1.2.3.5. Connecting clips of 2.64 mm dia.

20.1.2.3.6. Soffit cleat 22X37mm

20.1.2.3.7. Anchor fasteners 6 mm

All the G.I. components shall be of approved make. The G.I. grid work system shall be suspended from the soffit of RCC ceiling using anchor fasteners of 6mm of approved type and make and connected to soffit cleats and ceiling angle by means of necessary nuts, bolts and washers etc.

20.1.2.4. Methodology

20.1.2.4.1. Providing and fixing suspended G.I. frame work

20.1.2.4.2. Providing and fixing one layer of 12.5 mm Gypboard over this frame work.

20.1.2.4.3. Jointing the board flush, applying two coats of primer suitable for Gypboard

20.1.2.4.4. Making necessary cut out for light fitting, A.C. grills diffusers and other necessities. The work shall include horizontal, vertical and inclined surfaces depending upon the various requirements.

20.1.2.4.5. Gypsum Board of plain or MR series 12.5 mm manufactured by Saint Gobain India Gyproc or equivalent from the approved makes list shall be used. The Gyp board shall conform to IS 2095. Gypsum boards shall be of specified thickness and of specified finish shall be screw fixed to the under side of false ceiling grid system with 12.5 mm dia dry wall screw @ 230 mm C/C by drilling machine. Joints in the board shall be finished flush with fillers, finisher and primer as per manufactures recommendation to give a seamless finish.

20.1.2.4.6. Perimeter channels are levelled at the required position of the finished ceiling line and fixed

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to the wall at 610 mm centre with the screws and nylon plugs. The remaining G.I. grid component are installed to form a regular grid suspended from the soffit of RCC slab using soffit cleats ceiling angle and anchor fasteners as specified. Extra frame for various cut-outs of different shapes, light fittings, AC grills, diffusers, smoke detectors and other necessities have to be provided frame work has to be made with perimeter channel of specified size and shall be suitably supported. The line and level of the grid work has to be checked for perfection and prior clearance of the grid work has to be checked for perfection and prior clearance of the grid work has to be obtained from the Engineer-in-charge before the placement of Gyp board.

20.1.2.4.7. The Gyp board are fixed with bound edges at right angles to ceiling section with all joints staggered. All joints of Gyp board have to be fixed on ceiling section. The Gyp boards are screwed to the ceiling section and perimeter channels with Gyp board dry wall screws with joints staggered. Spotting of screws and jointing are then carried out according to recommendations of Saint Gobain India Gypsroc or equivalent make to give a flush and smooth joint.

20.1.2.4.8. Necessary door openings of hinged type of suitable sizes has to be provided with a suitable frame work for control valves and for access above false ceiling/ AC duct boxing at not extra cost. Joints at horizontal, vertical and inclined surfaces shall be suitably strengthened with additional G.I. frame work as required. Finally the boards are jointed and finished so as to have a flush look which includes fling and finish gin the tapered and square edges of the board with a jointing compound, paper tape and two coats of primer suitable for gyp board (all as per recommended practices of Saint Gobain Indian Gyproc or equivalent). The rate shall includes providing all materials, erecting, suspending, G.I. grid work, jointing the boards, providing required cut-outs and open able doors and painting including providing necessary fittings and fixtures etc. complete as per the specifications and all other activities related to the completion of the above job.

20.1.2.4.9. Details of A.C. grills, diffusers, and recessed type electrical fittings to be erected in false ceiling will be as per specifications and as shown in drawings. The quantities indicated are approximate and is likely to vary depending upon the site conditions.

20.1.2.5. Workmanship:-

Finishing ceiling shall be at the correct plans and present a pleasing and uniform appearance free from sags, wraps, figures or damaged joint exposed grid etc. shall be in true lines and symmetrically placed in manner shown on drawings or as recommended by manufacturers. All the cut out for light fixtures, diffusers etc. shall be exact dimensions and in exact locations as shown in respective drawings. All works in this section shall be performed in an efficient manner by installers approved by the manufacturers.

20.1.2.6. Mode of Measurement

Measurements will be made on flat plan area basis in Sq.m calculated to 3 places of decimal. Length and breadth shall be measured corrected to a cm. No deduction shall be made for cut-outs made for A.C. grills, diffusers, electrical fittings, smoke detectors etc.

20.1.2.7. Rates:

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Rate to be inclusive of providing and fixing of angle beads at external angles to achieve straight line finish and protection from normal impacts. Rate to be also inclusive of providing and fixing of edge bead essential for the exposed edge of the Gypboard at the cut-outs for tube lights or any other such unprotected core. Rate to be inclusive of making of Cut- outs for Light fittings, grills, diffusers etc. All the rates shall be inclusive of all level differences/ coves, etc. as per design and supply - installation of full system with necessary fixtures and fasteners when made to merge with different type of ceiling. Scaffolding is to be included in the rate and will not be paid separately

B) CALCIUM SILICATE FALSE CEILING

20.2.1.1. Scope of work:

The work envisaged under these specifications refer to supplying and fixing in position Calcium silicate false ceiling at any floor, any location and at any height.

20.2.1.2. Materials

Calcium silicate Board

Properties / Sizes	Units	Values
Thickness	mm	6.8, 10 and 12
Length	mm	1220, 1830 and 2440
Width	mm	1220
Density	Kg/m ³	900
Compressive strength	Kg/Cm ²	225
Tensile strength	Kg/Cm ²	60
Bending strength	Kg/Cm ²	100
Impact strength	J/m ²	1700
Young's modulus	Kg/Cm ²	265
Flexural streng	Kg/mm ²	10- Longitudinal, 5.5- Transverse
Fire Protection		
a) Non combustibility		Non-combustible according to BS 476: part 4-1970
b) Surface spread of flame		Class 1 to BS 476: part 4-1970 Part -7-1971
c) Ignitibility		P' NOT EASILY IGNITABLE as per BS476:Part 5-1968
d) Fire Propagation		Fire propagation index I = 4.0 as per BS 476:Part 6-1981

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Fire Resistance		60 - 240 minutes
Sound Insulation	dB	39 - 52 decibles
Thermal Conductivity-K	W/mK	0.15
Thermal resistance-R		0.04/0.05/0.006/0.08 for 6 /8/ 10/12mm thick boards respectively
Moisture Content		Under 15%
Shrinkage Dimension (dry-saturated)	%	0.10%
Length change in water	%	0.15%
Biological		No fungus growth
Alkalinity	pH	10

Metal framed suspended ceiling comprises of G.I perimeter channel having 0.55 mm thickness, two unequal flanges of 20 and 30 mm and web of 27 mm is fixed to surrounding walls /Partition using nylon sleeves and screws at 450 mm centres. Then intermediate channel (0.91mm thick) having two equal flanges of 15 mm each and a web of 45 mm is suspended from the soffit at 1220 mm centre with ceiling angle of width 25 mm x 10 mm x 0.55 mm thick, fixed to soffit with G.I cleat and steel expansion fasteners. Ceiling section of 0.55 mm thickness having knurled web of 50.5 mm and flanges of 26 mm each with lips of 10.5 mm are then fixed to the intermediate channel with connecting clips across to the Intermediate channel, at 457 mm centers. 8 mm thick square/tapered edge Hilux Calcium Silicate Boards are then screw fixed across the ceiling sections with 25 mm long self drilling and tapping screws having Phillips head with under head cutter, at 200 mm centres through the Hilux Calcium Silicate Board fillets.

20.2.1.3. Jointing and Finishing

The joints of the face boards are finished with specially formulated jointing compound and 48 mm wide fibre tape to provide seamless finish. Cement primer (Oil based) to be provided on entire surface before putty/ painting.

Note:

G.I. perimeter channel and supporting materials are to be provided to make any opening for light fittings, diffusers etc. and should be supported properly to maintain the integrity of the ceiling, and should not be charged extra.

20.2.1.4. Methodology

20.2.1.4.1. Providing and fixing suspended G.I. frame work

20.2.1.4.2. Providing and fixing one layer of 12mm / 8mm Calcium silicate over this frame work.
The thickness should be as per the BOQ

20.2.1.4.3. Jointing the board flush, applying two coats of primer suitable for Calcium silicate board

20.2.1.4.4. Making necessary cut out for light fitting, A.C. grills diffusers and other necessities. The work shall include horizontal, vertical and inclined surfaces depending upon the various requirements.

20.2.1.4.5. Calcium silicate of thickness as indicated in the BOQ should be manufactured by Hilux

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or equivalent from the approved makes list shall be used.

- 20.2.1.4.6. Perimeter channels are levelled at the required position of the finished ceiling line and fixed to the wall at 610 mm centre with the screws and nylon plugs. The remaining G.I. grid component are installed to form a regular grid suspended from the soffit of RCC slab using soffit cleats ceiling angle and anchor fasteners as specified. Extra frame for various cut-outs of different shapes, light fittings, AC grills, diffusers, smoke detectors and other necessities have to be provided frame work has to be made with perimeter channel of specified size and shall be suitably supported. The line and level of the grid work has to be checked for perfection and prior clearance of the grid work has to be checked for perfection and prior clearance of the grid work has to be obtained from the Engineer-in-charge before the placement of Gyp board.
- 20.2.1.4.7. The Calcium silicate board are fixed with bound edges at right angles to ceiling section with all joints staggered. All joints of Calcium silicate board have to be fixed on ceiling section. The boards are screwed to the ceiling section and perimeter channels with dry wall screws with joints staggered. Spotting of screws and jointing are then carried out according to recommendations of Ramco Hilux or equivalent make to give a flush and smooth joint.
- 20.2.1.4.8. Necessary door openings of hinged type of suitable sizes has to be provided with a suitable frame work for control valves and for access above false ceiling/ AC duct boxing at not extra cost. Joints at horizontal, vertical and inclined surfaces shall be suitably strengthened with additional G.I. frame work as required. Finally the boards are jointed and finished so as to have a flush look which includes fling and finish gin the tapered and square edges of the board with a jointing compound, paper tape and two coats of primer suitable for calcium silicate board (all as per recommended practices of Ramco Hilux or equivalent). The rate shall includes providing all materials, erecting, suspending, G.I. grid work, jointing the boards, providing required cut-outs and open able doors and painting including providing necessary fittings and fixtures etc. complete as per the specifications and all other activities related to the completion of the above job.
- 20.2.1.4.9. Details of A.C. grills, diffusers, and recessed type electrical fittings to be erected in false ceiling will be as per specifications and as shown in drawings. The quantities indicated are approximate and is likely to vary depending upon the site conditions.
- 20.2.1.5. Workmanship:-
Finishing ceiling shall be at the correct plans and present a pleasing and uniform appearance free from sags, wraps, figures or damaged joint exposed grid etc. shall be in true lines and symmetrically placed in manner shown on drawings or as recommended by manufacturers. All the cut out for light fixtures, diffusers etc. shall be exact dimensions and in exact locations as shown in respective drawings. All works in this section shall be performed in an efficient manner by installers approved by the manufacturers.
- 20.2.1.6. Mode of Measurement
Measurements will be made on flat plan area basis in Sq.m calculated to 3 places of decimal. Length and breadth shall be measured corrected to a cm. No deduction shall be

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made for cut-outs made for A.C. grills, diffusers, electrical fittings, smoke detectors etc.

20.2.1.7. Rates:

Rate to be inclusive of providing and fixing of angle beads at external angles to achieve straight line finish and protection from normal impacts. Rate to be also inclusive of providing and fixing of edge bead essential for the exposed edge of the Gypboard at the cut-outs for tube lights or any other such unprotected core. Rate to be inclusive of making of Cut- outs for Light fittings, grills, diffusers etc. All the rates shall be inclusive of all level differences/ coves, etc. as per design and supply - installation of full system with necessary fixtures and fasteners when made to merge with different type of ceiling. Scaffolding is to be included in the rate and will not be paid separately

C) MINERAL FIBRE BOARD CEILING

GENERAL SPECIFICATION

Providing and Fixing Mineral Fibre Acoustical Suspended Ceiling System with approved edge tiles with 15 mm Exposed Grid/ 24mm Grid/ Silhouette grid (as per BOQ)

The tiles should have Humidity Resistance (RH) of 99%, NRC as per BOQ, Light Reflectance >85%, Thermal Conductivity $k = 0.052- 0.057$ w/m K, Colour White, Fire Performance Class 0/Class I (BS 476 Part 6 and 7) in module size of 600 X 600 mm or as per BOQ with Bio Block coating on the face of the tile, suitable for Green Building application, with Recycled content of 63%.

The grid should be of approved make with 15mm/24mm wide T - section flanges colour white having rotary stitching on all T sections i.e. the Main Runner, 1200 mm and 600 mm Cross Tees . The T Sections have a Galvanizing of 120 grams per M2 and passed through 500 hrs of Salt test.

The Tile and Grid system used together should carry a 15 year warranty.

INSTALLATION: To comprise main runner spaced at 1200mm centres securely fixed to the structural soffit using approved suspension system (specifications below) at 1200mm maximum centre. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall.

Flush fitting 1200mm long cross tees to be interlocked between main runners at 600mm centre to form 1200 x 600 mm module. Cut cross tees longer than 600mm require independent support. 600 x 600mm module to be formed by fitting 600mm long flush fitting cross tees centrally between the 1200 mm cross tees.

Perimeter trim to be approved make wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centres.

SUSPENSION SYSTEM accessories manufactured and supplied by approved make and consisting of Anchor Fasteners with Vertical Hangers made of Galvanised steel of size 26 x 26 x 25 x 1.2mm with a Galvanised Thickness of 80g/m², A pre Straightened Hanger wire of dia - 2.68 mm of 1.83 m length., thickness of 80 g/m² and a tensile strength of 344-413 MPa, along with Adjustable hook clips

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of 0.8mm thick, galvanised spring steel for 2.68 mm with a minimum pull strength of 110 kg. The adjustable clip also consists of a 3.5 mm aquiline wire to be used with the main runner.

At least 15 years limited warranty on the assembled system when installed to manufacturer's specifications and maintained under an AMC programme

The cost should include the cost of making mock-ups of the ceiling if directed by the Architect/ Engineer in charge. The rate to also include the cost of demolishing/ removing the mock up if not approved. Shop drawings shall be prepared for all suspended ceiling work by the Contractor. The shop drawings shall show the entire installation system, including framing around light fixtures, ducts, grilles, access panels, etc. Shop drawings shall be submitted to the Engineer for approval. It will be the responsibility of the Contractor to co-ordinate with all the service Contractor's doing work in ceilings, to incorporate appropriate suspension systems free of ducts, pipes, cable trays etc.

D) MINERAL FIBRE BOARD CEILING WITH PERIMETER TRIMS 150mm

The tiles should have Humidity Resistance (RH) of 95%, NRC 0.90, Light Reflectance >88%, Thermal Conductivity $k = 0.032$ w/m K, Colour White, Fire Performance Class 0/Class 1 (BS - 476) in module size of 600mm x 600mm x 15mm with facing of white scrim tissue of 320 gsm and 45 gsm formaldehyde free fibre tissue backing, suitable for Green Building application, with Recycled content of 65%.

20.2.1. GI Planks of micro look (150x1200mm):

The tiles should have Humidity Resistance (RH) of 100%, Light Reflectance >70%, Colour Global White, Fire Performance Class 0/Class 1 (BS - 476) in module size of 150mm x 1200mm x 0.5mm thick hot-dipped galvanised post-coated steel. The grid should be of approved make with 15mm wide T - section flanges colour white having rotary stitching on all T sections i.e. the Main Runner (with 150mm slots) and 1200 mm cross tees. The T Sections have a Galvanizing of 120 grams per M² and passed through 500 hrs of Salt test.

The Tile and Grid system used together should carry a 15 year warrantee.

PERIMETER TRIMS ALONG EDGES AS SHOWN IN THE DRAWINGS SHOULD BE INCLUDED IN THE RATE

20.2.2. INSTALLATION:

To comprise main runner spaced at 1200mm centres securely fixed to the structural soffit using approved suspension system (specifications below) at 1200mm maximum centre perpendicular to the direction of 'Zone'. The First/Last suspension system at the end of each main runner should not be greater than 450mm from the adjacent wall. Flush fitting 1200mm long cross tees to be interlocked between main runners at alternating intervals of 1200 and 150mm centre to form a 'Zone' (to carry the services) module of 150mm width across the main runners. The 'Zone' shall be accessed through the 1200x1200mm void the separates two adjacent 'Zones'. Perimeter trim to be approved make wall angles of size 3000x19x19mm, secured to walls at 450 mm maximum centres. Large panels tiles and

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'Zone' planks shall be placed in the respective positions

20.2.3. SUSPENSION SYSTEM

Accessories should be manufactured and supplied by a vendor in the approved makes list and consisting of M6 Anchor Fasteners with Vertical Hangers made of Galvanised steel of size 26 x 26 x 25 x 1.2mm with a Galvanised Thickness of 80gm/ sq.m, A pre Straightened Hanger wire of dia - 2.68 mm of 1.83 m length., thickness of 80 g/sq.m and a tensile strength of 344-413 MPa, along with Adjustable hook clips of 0.8mm thick, galvanised spring steel for 2.68 mm with a minimum pull strength of 110 kg. The adjustable clip also consists of a 3.5 mm aquiline wire to be used with the main runner. The grid should be of "approved" make with 15mm wide T - section flanges colour white having rotary stitching on all T sections i.e. the Main Runner (with 150mm slots) and 1200 mm cross tees. The T Sections have a Galvanizing of 120 grams per M2 and passed through 500 hrs of Salt test. The Tile and Grid system used together should carry a 15 year warrantee. Services including light fixtures, AC diffusers shall be of approved vendors with global white colour finish and edge detail match with the rest of the ceiling

Measurements will be made on flat plan area basis in Sqm calculated to 3 places of decimal. Length and breadth shall be measured corrected to a cm. No deduction shall be made for cut-outs made for A.C. grills, diffusers, electrical fittings, smoke detectors etc.

At least 10 years limited warranty on the assembled system when installed to manufacturer's specifications and maintained under an AMC programme

E) ALUMINIUM BAFFLE CEILING SUBMITTALS

Product Data: Manufacturer's published literature, including specifications.

B. Shop Drawings, showing:

1. Reflected Ceiling Plan(s): Indicating screen metal ceiling layout, ceiling mounted items and penetration locations.
2. Suspension System, Carrier and Component Layout.
3. Details of system assembly and connections to building components.

C. Samples; submit:

1. Screen ceiling panels: Minimum 8 inch (200 mm) piece of each type and finish.
2. Colour samples: Manufacturer's standard colours (finishes) for Architect's selection.
3. Suspension system components and mouldings/trim.

D. Quality Assurance/Control Submittals:

1. Test Reports: Certified reports from independent agency substantiating structural compliance to wind loads and other governing requirements.
2. Certificates:

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- a. Data substantiating manufacturer and installer qualifications.
- b. Certified data attesting fire rated materials comply with specifications.
3. Manufacturer's Instructions: Detailed installation instructions and maintenance data.

QUALITY ASSURANCE

A. Manufacturer/Installer Qualifications:

1. Provide screen metal ceiling system components produced by a single manufacturer with a minimum 3 years experience in actual production of specified products and with resources to provide consistent quality in appearance and physical properties, without delaying the work.
2. Provide suspension system and associated components produced by a single manufacturer, as recommended by the screen ceiling system manufacturer, to provide compatible components for a complete screen metal ceiling system installation.
3. Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.

B. Regulatory Requirements:

1. Fire Rating Performance Characteristics: Install system to provide a flame spread of O - 25, and smoke developed 50 or less, complying with certified testing to ASTM E 84.
2. Structural Criteria: Install and certify system to comply with structural and wind uplift requirements of governing codes.
3. Installation Standard for Suspension System: Comply with ASTM C 636.

C. Mock-Up: Prior to beginning installation erect a mock-up section, minimum 10 feet x 10 feet, where directed, using all system components.

D. Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs.

FABRICATION

A. Suspension System: Form and fabricate into a {one directional pattern with fixed V/U-shaped carriers spaced at {60 inch on centre at interior installations) and suspend from the building structure.} {two directional framing pattern with pivot T-shaped carriers spaced 48 inch on centre and cross tee runners at 48 inch on centre suspended from the building structure.}

B. Panels: Form edges to snap into carriers with a positive action. {Overlap continuous runs of panels 4 inches in (fixed carrier) (pivot carrier) applications.}

C. Fixing Clips: Use fixing clips at all exterior, moveable carrier and pivot carrier applications.

EXECUTION

EXAMINATION

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- A. Examine areas receiving screen metal ceiling system for conditions that might adversely affect the installation.
- B. Verify that all work above ceiling system has been satisfactorily completed prior to start of ceiling installations.
- C. Do not start ceiling installations until all unsatisfactory conditions affecting ceiling systems have been corrected.

PREPARATION

- A. Provide layouts for inserts, clips and other support items required to be installed by other trades. Furnish inserts, clips and related items to other trades in a timely manner to preclude construction delays.
- B. Coordinate with other trades for proper installation of inserts and related items.
- C. Verify ceiling layouts by actual field measurements.
 - 1. Establish ceiling layout to balance borders and minimize out-of-square conditions.

INSTALLATION

- A. Install screen metal ceiling system in accordance with manufacturer's printed installation instructions, submittals, applicable industry standards, and governing regulatory requirements for the work.
- B. Suspension System Installation:
 - 1. Install suspension system to comply with requirements of ASTM C636.
 - 2. Support hangers securely from building structure using wires directly attached to structure, or to inserts or other devices with eye-screws, by looping and wire-tying.
 - 3. At exterior locations, install wind uplift (compression) struts and expansion joints at spacing to comply with structural calculations of an approved registered engineer.
- C. Install ceiling panels perpendicular to carriers.
- D. Install ceiling panels and trim pieces with neat, tight joints and to comply with approved details.
 - 1. Scribe and cut panels as necessary to fit at borders and other penetrations to comply with manufacturer's instructions.
- E. Install air distribution devices and lighting fixtures at indicated locations.
 - 1. Support devices and fixtures from building structure above, independent from ceiling suspension system.

ADJUST AND CLEAN

- A. Adjust components to provide uniform tolerances.
- B. Replace all ceiling panels that are scratched, dented or otherwise damaged.
- C. Clean exposed surfaces with non-solvent, non-abrasive commercial type cleaner

F) METAL MODULAR CEILING TILES:-

Size: 600 x 600 mm

Thickness: 0.5 mm

Light reflectance(%): 85

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Humidity resistance(% RH): Not affected by humidity

Fire reaction: Class O/Class 1 BS 476

Fire resistance(hour): 1

Perforation: Micro Perforation

GRID:

False Ceiling Grid should be in galvanized steel sections with white pre-coated exposed surface. 3600mm long Main Tee of size 34mm x 24mm x 0.35mm shall be suspended with G.I. wire or rod at 1200mm cc. 1200mm long pre punched Cross Tee of size 25mm x 24mm x 0.33mm shall be locked in the Main Tee at every 600mm c/c. 600mm long Sub Cross Tee of size 25mm x 24mm x 0.33mm shall be locked to the Cross Tee of 1200mm. The periphery of wall shall have Wall Angles of size 19mm x 19mm x 0.45 mm. The Cross Tee shall have an over-ride at both ends to avoid swivel moments of Cross Tee.

INSTALLATION GUIDE:

Modular ceilings are among the last equipments to be installed at the site because it is a pre-finished product. Therefore, the building is expected to be in suitable condition, with regard to humidity, cleanliness etc., before installation of modular ceiling begins.

The installation site is expected to be fully enclosed and all wet work should be completed beforehand and dried. All installations (ducting, insulation etc.) must be installed before laying the T-Grid system and ceiling tiles.

Levelling: Sufficient information shall be clearly indicated on the drawings to enable the ceiling module and setting out points in each ceiling area applicable to all relevant trades to be established early. The ceiling height in each area shall be marked in relation to the elevation bench marks and then transferred by means of water level.

Top fixings: The suitability of the site will be verified before installing the suspension system.

The top fixings are best installed with the T-grid system as this will maintain the dimensional integrity.

Hangers: When the hangers cannot be installed at the recommended dimensions, an appropriate suitable sub grid will be installed based on the site dimensions. Hangers to be installed will be vertical or nearly vertical and shall not press against insulation covering ducts or pipes. If hangers have to be fixed diagonally to avoid obstructions the horizontal force shall be offset by bracing.

Main Runners: Levelling of the main runners shall be done with the supporting hangers. This will prevent downward movement when tiles are loaded. To ensure proper levelling, any bending of the material will never be undertaken. The main runners shall be suspended by means of a GI wire of 2/2. Smm diameter or 4mm rod at every 1.2m and not more than 150mm from the spliced joints. The last hanger at the end of each main runner should not be more than 450mm from the adjacent wall.

Hanger Wires: The loops shall be sharply bent and tightly wrapped to prevent vertical movement of the runner within the loop, wherever it passes through the main runner. The wire shall be wrapped around itself a minimum of the full turns within a 3 inches length.

Cross Tees: Cross tees are installed on the main runners in a right angle. The 1200mm long Techno Cross Tee is attached to two main T section. Then the 600mm long Techno Cross Tis filled between 2 sections of 1200 cross T's.

Wall Angle: The wall angles are neatly joined around the corners. The straight line wall angles shall be

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completely in line. The wall angles shall be firmly screwed to the wall at every 300mm.

Installation: To comprise of 3000 mm long 'carrier bars' manufactured and supplied by the manufacturer to be spaced at 1200mm maximum centres securely anchored to the structural soffits by 6mm/8mm threaded rods. The last hanger at the end of each carrier bar should not be greater than 600mm from the adjacent wall. Tiles should be clipped on to the special locking arrangement provided in the carrier bar from below.

Perimeter trims to be of approved make wall angles of white colour secured to walls at 450mm maximum centres.

G) WOODEN FINISHED MODULAR CEILING

Providing and Fixing of Approved make Wooden finish Suspended Ceiling System with 24 mm EXPOSED GRID.

The tiles Wenge/ US Maple/ Beech/ Maple finish should have Humidity Resistance (RH) of 70%, Fire Performance Class 2(BS - 476) in module size of 600mm x 600mm x 12mm. The grid should be of "Approved make" make with 24mm wide T - section flanges colour white having rotary stitching on all T sections i.e. the Main Runner and stabilizer bars with a web height of 43mm and a load carrying capacity of 23.78 Kgs/M2. The T Sections have a Galvanizing of 120 grams per M2 and passed through 500 hrs of Salt test.

INSTALLATION: To comprise main runner spaced at 600mm centres securely fixed to the structural soffit using Approved make suspension system (specifications below) at 600mm maximum centre and not more than 150mm from spliced joints. Main runners should be fixed in the direction depending on desired direction of grains.

Stabilizer bars (600mm wide) with notches to be placed over the main runners in a direction perpendicular to it spaced at not more than 1500mm. The tiles to be inserted matching the SL2 edges into the flange of the main runner.

Perimeter trim to be Approved make wall angles, secured to walls at 450 mm maximum centres.

APPROVED MAKE SUSPENSION SYSTEM accessories manufactured and supplied by Approved make World Industries consisting of M6 Anchor Fasteners with Vertical Hangers made of Galvanised steel of size 26 x 26 x 25 x 1.2mm with a Galvanised Thickness of 80gsm/ sq.m, A pre Straightened Hanger wire of dia - 2.68 mm of 1.83 m length., thickness of 80 g/sq.m and a tensile strength of 344-413 MPa, along with Adjustable hook clips of 0.8mm thick, galvanised spring steel for 2.68 mm with a minimum pull strength of 110 kg. The adjustable clip also consists of a 3.5 mm aquiline wire to be used with the main runner.

PANELLING AND BOXING

A) ACOUSTICAL PANELLING

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The acoustic boards to be used for panelling should be of approved make. They shall be cladded with fabric. The installation work of this Section shall be performed by an authorized applicator, licensed by the manufacturer. Install materials in accordance with manufacturer's instructions, and comply with governing regulations, fire resistance rating requirements, as indicated, and industry standards applicable to the work. The technical details for the board to be as per the following

Tech Primer		
No	Description	Materials Specifications
1	Thickness (mm)	As per BOQ
2	Size (mm)	Width 600 / Length up to 2400
3	Core	Sound Smooth/ SoundSynth
4	Nominal Density (Kg/m3)	400 to 500
5	Weight (Kg/m2)	up to 25
6	Edge	Square with long edges Kerfed
7	NRC / STC	Up to 0.9
8	Fire	Class I
9	Moisture Resistance (%)	RH 90
10	Light Reflectance (%)	As per manufacturer's specifications
11	Warranty	10 years
12	Installation	As per manufacturer's specifications
13	Colour	As per Architect's sample
14	Maintenance	As per manufacturer's specifications

FABRIC

Fabric should be non-woven, needle-punched, chemically-free, thermally-bonded, multi-purpose acoustical fabric which is highly durable with exceptional performance and has been specially developed for the Acoustic panels.

The following are the specifications for the fabric

- 100% polyester
- Safe, non-toxic
- Recyclable, environmentally-friendly
- UV stable - resistant to fading
- Moisture-resistant - rot-resistant, stain resistant
- Durable - infinite product life
- Does not fray or zipper when cut
- Density 400 gsm

B) PLY PANELLING AND BOXING

- i. Frame work: -

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Timber panels shall be preferably made of timber of larger width. The minimum width and thickness of a panel shall be 150 mm and 15 mm respectively. When made from more than one piece, the pieces shall be joined with a continuous tongue and groove joint, glued together and reinforced with metal dowels. The grains of timber panels shall run along the longer dimensions of the panels. The panels shall be designed such that no single panel exceeds 0.5 square metre in area. The timber shall be planed smooth and accurate to the full dimensions, rebates, rounding, mouldings, as shown in drawings, before assembly. Grounds shall be provided where so specified. Timber shall consist of second class T.W. or any other wood as mentioned in the BOQ, with dimensions as per BOQ, fixed over the wall, with 50mm long wood screws. The rate should include a coating of anti-termite solution on all unexposed surfaces of wooden frame work.

ii. Plywood /Plywood Boards

Plywood boards are formed by gluing and pressing three or more layers of veneers with the grains of adjacent veneers running at right angles to each other. The veneers shall be either rotary cut or sliced and shall be sufficiently smooth to permit an even spread of glue. Face veneers may be either decorative on both sides or one side commercial and the other decorative. Plywood shall be of BWP grade or BWR grade as per IS 303.

Adhesive: Adhesive used for bonding BWP grade of plywood boards shall be BWP type synthetic resins conforming to IS 848 .

The thickness of all veneers shall be uniform, within a tolerance of ± 5 per cent. Corresponding veneers on either side of the centre one shall be of the same thickness and species. The requirements of thickness and core veneers shall be as follows:

- a) In 3 ply boards upto 5 mm thick. The combined thickness of the face veneers shall not exceed twice the thickness of centre ply.
- b) In multiply boards, the thickness of any veneer shall not be more than thrice the thickness of any other veneer.
- c) The sum of the thickness of the veneers in one direction shall approximate to the sum of the thickness of the veneers at right angle to them and shall not be greater than 1.5 times this sum except for 3 ply as specified in (a).

Thickness :Plywood boards are available in thickness ranging from 3 to 25 mm. Tolerance in thickness shall be $\pm 10\%$ for boards upto and including 5 mm; $\pm 7\%$ for boards from 6 to 9 mm and $\pm 5\%$ for boards above 9 mm thickness. The boards shall be of uniform thickness and the surfaces of the boards shall be sanded to a smooth finish.

Moisture content of the plywood boards when tested in accordance with IS 1734 (Part 1) shall not be less than 5 per cent and not more than 15 per cent.

Testing: One sample for every 100 sqm or part thereof shall be taken and testing done as per IS 303. However, testing may not be done if the total requirement of plywood boards is less than 30 sqm. All the samples tested shall meet the requirements of physical and mechanical properties of plywood boards specified in IS codes

iii. Particle Boards

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Particle boards shall be of medium density and manufactured from particles of agro waste, wood or lignocellulose i.e. material blended with adhesive and formed into solid panels under the influence of heat, moisture, pressure etc. The particle boards shall be flat pressed three layered or graded and of Grade-I as per Table 1 of IS 3087. Both surfaces of the boards shall be sanded to obtain a smooth finish and shall conform to IS 3087.

Adhesives : Adhesives used for bonding shall be BWP type synthetic resin conforming to IS 848.

Thickness and Tolerance : Thickness of particle boards shall be as specified. Tolerance in thickness shall be $\pm 5\%$ for boards upto and including 25 mm thick and ± 2.5 per cent for boards above 25 mm thickness. Each board shall be of uniform thickness.

Testing : One sample for every 100 sqm or part thereof shall be taken and testing done as per IS 3087. However, testing may not be done if the total requirement of particle boards in a work is less than 30 sqm. All the samples tested shall meet the requirement of physical and mechanical properties of particle boards specified in relevant IS code

iv. Veneered Particle Boards

Veneered Particle Boards with core of FPT-1 or graded board Grade-I particle board (IS 3087) with commercial or general purpose veneer (Type-1) or decorative veneers on both faces or with decorative veneer on one face and commercial /general purpose veneers on the other Type-2. Face veneers are bonded using adhesives under the influence of heat and pressure.

Adhesives : The adhesive used for bonding veneers shall be BWP or BWR type conforming to IS 848 for grade I veneered particle board.

Thickness & Tolerance : Veneered particle boards are available in various thickness 6, 10, 12, 20, 25, 30, 35, 40, 45 & 50 mm.

Tolerance in thickness shall be $\pm 5\%$.

Testing : One sample for every 100 sqm or part thereof shall be taken and testing done as per IS 3097. However, testing may not be done if the total requirement of veneered particle boards in a work is less than 30 sqm. All the samples tested shall meet the requirements of physical and mechanical properties of veneered particle boards as under:

Type of face veneers, thickness of veneered particle boards and adhesive used for bonding shall be as specified. Unless otherwise stated, exterior grade veneered particle boards with BWP type synthetic resin adhesive shall be used.

v. Veneered Decorative Plywood

Decorative plywood shall be of two grades namely BWR and MR Decorative Plywood shall be of two types. Type I and type 2 and shall conform to IS 1328.

Requirement of Type-I Veneered decorative plywood shall be as under:

Open slits checks or open joints not more than 150 mm in length and 0.5 mm in width shall be permissible provided the same are rectified with a veneer insert bounded with synthetic resin adhesive,

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as the case may be and further provided that the insert matches with the surrounding veneer in colour as well as figure.

- a) The decorative veneered surface shall be free from torn grain, dead knots discolourisation and sapwood.
- b) The decorative veneered surface shall be selected for figure, texture, colour and grain etc. It shall be free from all manufacturing and wood defects except to the Engineer-in-charge All veneers shall be matched or mismatched to achieve a decorative effect in colour figure and grain.

Adhesive: The adhesive for bonding veneers shall be MR and BWR type synthetic resin adhesive conforming to IS 848 for MR and BWR grade veneered decorative plywood respectively.

Dimensions and Tolerances:

The dimensions of plywood boards shall be as follows:

- 2400 mm x 1200 mm
- 2100 mm x 900 mm
- 100 mm x 1200 mm
- 1800 mm x 900 mm
- 1800mm x 1200mm

Thickness: The thickness of veneer shall be 3 mm, 4 mm,

Note: Any other dimensions (length, width and thickness) as agreed to between the manufacturer and the purchaser may also be used.

Finish : The decorative plywood shall be uniform in thickness within the tolerances limits specified.

Sampling and Criteria for Conformity: The method for drawing representative samples and criteria for conformity shall be as per IS 7638.

Tests: Boards shall be subjected to following tests

- i. **Moisture content:** Decorative veneered plywood of either type when tested in accordance with IS 1734 (Pt. I) shall have a moisture content not less than 5 per cent and not more than 15 per cent.
- ii. **Water Resistance Test :** Three test specimen of size 250 mm x 100 mm shall be prepared for each of the boards selected and submerged in water at $62 \pm 2^\circ \text{C}$ for a period of 3 hours and dried for 8 hours at a temperature of $65 \pm 2^\circ \text{C}$ and then followed by two more cycles of soaking and drying under same conditions described above. Decorative Veneered plywood of either type shall not show delamination or blister formation.

Marking : Each plywood board shall be legibly and indelibly marked or stamped with the following on the face of board near one corner.

Indication of the source of manufacture

Year of manufacture

Batch no.

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Type of plywood

Criteria for which the plywood has been labelled as ECO mark

The decorative veneered plywood may also be marked with standard BIS certification mark.

vi. Marine Plywood

Marine plywood shall be generally conforming to IS 710. Selection of timber species for manufacture of plywood shall be as prescribed in IS 710 and as far as possible a single species of timber shall be used.

Adhesive : The adhesive used for bonding the veneer shall be of the hot press synthetic resin, phenol formaldehyde type (BWP) and shall conform to IS 848. Extender shall not be added to the adhesive by the plywood manufactures. Fillers, if used, shall not exceed 10 percent by mass of solid content of the glue.

The thickness of any board shall not exceed the number of pieces multiplied by 2.5 mm. The two face veneers in finished board shall be of the same nominal thickness.

Tolerances: The following tolerances in the nominal size of finished boards shall be permitted.

Dimension	Nominal Size	Tolerance
Length	Upto 120 cm.	+3mm
	Above 120 cm.	+6mm
Width	Upto 90 cm.	+3mm
	Above 90 cm	+6mm
Thickness	Upto 4 mm	+ 10 oer cent
	Above 4 mm	+ 5 oer cent

Sampling : The method of drawing representative samples and criteria for conformity shall be as prescribed in IS 7638.

Tests : Test pieces cut from each of board as specified shall be subjected to following tests.

Moisture content

Glue adhesive in dry state

Water resistance test.

Tensile strength

Mycological test

Retention of preservative.

These tests shall be carried out as specified in IS 710.

Marking : Each plywood board shall be legibly and indelibly marked or stamped with following particulars along with such other marks as the purchaser may stipulate at the time of placing order.

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- Manufacturer's name, initials or recognized trade mark, if any.
- Year of manufacturing.
- Abbreviation indicating the species of timber used in each ply as indicated in col. 3 of Table - 1 and 2 of IS 710.
- Batch number

BIS Certification Marking: The plywood board may also be marked with the standard mark, governed by the BIS Act, 1986.

Tender Sample, Inspection and Acceptance: Where samples are required to be tendered, three samples each not less than 90 x 60 mm in size shall be submitted by the supplier, and these samples, if the tender is accepted shall constitute the standard as regards the type of timber, quality and finish.

vii. Fire Retardant Plywood

Fire retardant plywood shall generally conform to IS 5509. The plywood to be given fire retardant treatment shall conform to BWR grade of IS 303 to be able to stand pressure impregnation. Plywood for treatment shall be clean, free from oil or dirt patches on the surface and at a moisture content not exceeding 15 percent. In case of veneered decorative plywood care shall be taken that colour of the solution does not spoil to decorative surface.

For Eco-mark the plywood shall conform to the requirements of Eco-mark specified in IS 303.

Fire Retardant Treatment : This shall be either pressure impregnation or soaking treatment as per IS 5509.

Choice of Treatment : The choice of treatment may be left to the manufacturer of plywood as per fire resistant requirements prescribed in IS 5509. The purchaser should however, specify whether plywood is to be treated with fire retardants only or with fire retardants and preservatives.

The recommended retention of fire retardant chemicals for different hazards like interior or exterior use not subject to leaching by rain and water is of the order of 50 kg/m³.

Conditioning after Treatment : The plywood after treatment shall be conditioned to suitable equilibrium moisture content of not more than 20 per cent.

Dimension and Tolerances shall conform to IS 2049. The tolerance of thickness shall conform to IS 303.

Sampling : The method of drawing representative sample and the criteria of conformity shall be as prescribed in IS 7638.

Test Specimen and Number of Tests: From each of fire retardant plywood selected as above the following test specimens shall be cut from portions 150 mm away from the edges for tests specified as under:

- For Flammability : Six test specimens 125 mm x 125 mm in full thickness of material from each sample.
- For Flame Penetration : Three test specimens 125 mm x 125 mm in full thickness of material from each sample.
- For Rate of Burning : Three test specimen 100 mm x 12.5 mm in full thickness of material from each sample.

Test Requirements and Other Tests

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- i. Moisture Content : Shall not exceed 20%.
- ii. Flammability: When tested as per IS 1734, time taken for second ignition shall not be less than 30 minutes.
- iii. Flame Penetration : When tested as per IS 1734, time taken for flame penetration shall not be less than 15 minutes for every 6 mm thickness.
- iv. Rate of Burning: When tested as per IS 1734, the time taken to lose weight from 30 per cent to 70 per cent shall not be less than 20 minutes.

Marking : Each board shall be legibly and indelibly marked near the edge with the following:

- Manufacturer's name, his initials or his recognized trade mark, if any.
- Year of manufacture
- Type of treatment
- Criteria for which the plywood has been labeled as ECO mark.

BIS Marking : Each board may also be marked with standard mark governed by the BIS Act, 1986.

viii. Decorative Thermosetting Synthetic Resin Bonded Laminated Sheets

Scope : Decorative thermosetting synthetic resin bonded laminated sheets shall generally conform to IS 2046. This material is intended for interior use and is not intended for load bearing applications.

Terminology: For the purpose of this standard, the definition given under para 2 of IS 1998 shall apply.

Types : The material shall be of two types namely:-

- (a) Type 1- Having only one side bearing decorative surface the other side being roughened or given an appropriate treatment to promote adhesion to the base. This type shall generally be used, unless specified otherwise.
- (b) Type 2- Having both sides bearing the decorative surface, the two sides may be different in colour or pattern or both.

Requirements

(i) Appearance : The types of surface finish of decorative and reverse side, edge finish, colour and pattern shall be as agreed to between the purchaser and the supplier. The sheets shall be reasonably free from local deformation.

Note : Since sheets may vary slightly in colour and appearance, it is recommended that sheets for any one scheme may be matched.

(ii) Flatness: For nominal thickness 1.5 mm -when a sheet is tested for flatness in accordance with the method given in Appendix -C of IS 2046, the height above the flat surface at the edge of full manufactured and trimmed width shall nowhere exceed 150 mm.

(iii) Tolerance to nominal thickness : The departure from nominal thickness of sheet at any point, shall not exceed the value given below:

Nominal Thickness

Upto 1.5 mm

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Tolerance +0.25 mm

(iv) Straightness of edges of rectangular finished panels, resistance to dry heat, resistance to boiling water, resistance to staining, gross breaking strength, packing and marking, sampling and criteria for conformity etc. shall be as per IS 2046.

ix. WALL LINING

Specified timber shall be used, and it shall be sawn in the direction of the grains. Sawing shall be truly straight and square. The timber shall be planed smooth and accurate to the full dimensions, rebates,

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roundings, and mouldings as shown in the drawings made, before assembly. Patchings or plugging of, any kind shall not be permitted except as provided.

Grounds

Grounds shall be provided where so specified. These shall consist of first class hard wood plugs or the class of wood used for fabricating the frames, of trapezoidal shape having base of 50 x 50 mm and top 35 x 35 mm with depth of 5.0 cm and embedded in the wall with cement mortar 1:3 (1 cement : 3 fine sand) and batten of first class hard wood or as specified of size 50 x 25 mm or as specified, fixed over the plugs with 50 mm long wood screws. The plugs shall be spaced at 45 to 60 centimetres centre to centre, depending upon the nature of work. The battens shall be painted with priming coat, of approved wood primer before fixing.

x. Panelling

Material : This panelling shall be decorative or non-decorative (Paintable) type as per design and thickness specified by the Engineer-in-Charge, of 2nd class teak wood, FPT-1 or graded wood prelaminated particle board or as specified in item.

Ornamental Work : The ornamental wood work shall be painted on the back with priming coat of approved wood primer before fixing the same to the grounds with screws, which shall be sunk into the wood work and their tops covered with putty. The ornamental work shall be made true and accurate to the dimensions shown in the working drawings. The fixing shall be done true to lines and levels. The planks for wall lining shall be tongued and grooved, unless otherwise specified.

Measurements : Length and breadth shall be measured correct to a cm. Wall panelling such as teakwood panelling and block panelling, plain lining, and plain skirting each shall be measured separately in square metre nearest to two places of decimal. The moulded work shall be measured in cm running metre i.e. in running metres stating the girth in cm. The sectional periphery (girth) of moulding excluding the portion in contact with wall shall be measured in cm correct to 5 mm and length in metre correct to a cm.

Rate: The rate includes the cost of materials and labour required for all the operation described above. Length and breadth shall be measured correct to cm. Wall panelling such as T.W. panelling, block board, plain lining, plain skirting each shall be measured separately in square metre nearest to two places of decimal. The moulded work shall be measured in running length. ONLY SEEN AREA IS TO BE PAID. ANY PART WHICH IS HIDDEN IN THE BOXING WILL NOT BE MEASURED AND PAID. The rate shall include the cost of materials and labour required for all the operations described above.

C) MIRROR PANELLING AND TOILET MIRROR

The item includes providing bevelled or plain edges glass mirror with or without frame of size as mentioned in the schedule including fixing.

MATERIAL: Glass mirror shall be 6mm thick plate glass unless specified with silvered polish and protective coat of copper sulphate. Backing shall be provided with marine plywood of thickness as specified in the BOQ. Edges to be bevelled or machine polished as per BOQ

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FIXING: Glass mirror shall be fixing to proper line and level as indicated in drawing with Mirror studs or mirror head screws as per BOQ, and making good the wall to the original condition after fixing the glass mirror etc.

THE RATE INCLUDES FOR:

1. Glass mirror with plywood backing, all studs, screws, bolts etc.
2. All necessary labour, material and the use of tools.

MODE OF MEASUREMENT: The measurement shall be for unit square meter of each, unit of glass mirror as specified in the schedule.

SHUTTERS AND DOORS

A) SCOPE

The specifications refer to wood work in general including carpentry and joinery work in the building.

B) GENERAL

The provision of the latest revisions of the following I.S. codes shall form a part of these specifications.

IS 205	Specifications for non-ferrous metal butt hinges
IS 287	Recommendation for maximum permissible moisture content of timber used for different purposes.
IS 303	Specification for plywood for general purpose.
IS 362	Specification for parliamentary hinges
IS 419	Specification for putty for the use on window frames
IS 883	Code of practice for design of structural timber in building.
IS 1003	Specification for Timber panelled and glazed shutters Part II - Window and ventilator shutters.
IS1200	Method of measurement of building and Civil Part XXI Engineering Works - Wood Work and Joinery.
IS:1341	Specification for steel butt hinges
IS:1658	Specification for Fibre Hard Boards
IS: 1761	Specification for transparent sheet glass for glazing and framing purposes.
IS: 3087	Specification for wood particle boards (medium density for structural timber in building)

Other I.S. codes not specifically mentioned here, but pertaining to wood work and joinery form part of

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these specifications.

C) MATERIALS

i. Sawn Timber

Timber is classified as under :

- (i) Teak wood
- (ii) Deodar wood
- (iii) Non-coniferous timbers other than teak
- (iv) Coniferous timber other than deodar.

The timber shall be free from decay, fungal growth, boxed heart, pitch pockets or streaks on the exposed edges, splits and cracks. The timber shall be graded as first grade and second grade on the basis of the permissible defects in the timber. For both the grades, knots should be avoided over a specified limit.

Teak Wood (Tectona Grandis)

It is of outstanding merit in retention of shape and durability. The heart wood is one of the most naturally durable woods of the world. It usually remains immune to white ant attack and insect attack for very long periods. It is, however, not always immune from fungus attack (rot). Taken as a whole, good quality teak is very durable, it is relatively easy to saw and work. It can be furnished to a fare surface and takes polish well. It is generally used for making furniture and all important timber construction.

Superior Class Teak Wood such as Balarsha, Malabar and Dandeli: Individual hard and sound knot shall not be more than 12 mm in diameter and the aggregate area of all the knots shall not exceed one half per cent of the area of the piece. It shall be close grained.

Deodar Wood (Cedrus Deodars)

It is the strongest of the Indian conifers. Its weight and strength is 20% per cent less than teak. It is easy to saw and works to a smooth finish. It is not, however, a suitable wood for polish or paint work as the oil in the wood and especially near knots, always seeps through such finishes and discolours them. It is used for house building, furniture and other construction work. It is also suitable for beams, floors, boards, posts, window frames and light furniture etc.

Sal Wood (Shoera Robusta)

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Sal is about 30 per cent heavier than teak, 50 per cent harder, and about 20 to 30 per cent stronger. In shock resistance it is about 45 per cent above teak. Its heart wood is a naturally durable wood, and usually remains immune to attack by white ants and fungi for a long period, while its sapwood is very perishable and should not be used. Well dried sal is not a really easy wood to saw and work. It is a rough constructional wood than a carpentry timber. No individual hard and sound knot shall exceed 25 mm in diameter and the aggregate area of all the knots shall not exceed 1% of the area of the piece. It can be used for a variety of purposes, such as for beams, rafters, flooring, piles, bridging, tool handles, picker arms and tent pegs, etc.

Kail Wood (Pinus Roxburghie)

Kail Wood is not a very durable wood. But it is easy to saw and work and usually very popular in workshops. It can be brought to a fine smooth surface, but is more suitable for paint and enamel finishes than for polish work. It is useful for joinery works, constructional work, light furniture and house fittings

All wood to be FSC (Forest Stewardship Council) certified Forests certified to be in compliance with the standards endorsed by the Forest Stewardship Council (FSC).

Products milled or otherwise altered by manufacturers certified to be in compliance with the standards endorsed by the Forest Stewardship Council (FSC).

ii. Glazing materials

Glass Panels:

Unless otherwise specified, glass panes used in glazed or panelled and glazed shutters, shall be of good quality glass of thickness not less than 2 mm for panes up to 0.1 Sqm in area not less than 3 mm for glass panes of area larger than 0.1 Sqm with a tolerance of 0.2 mm in both cases. The glass shall be free from flaws such as specks, bubbles, smoke waves, air holes, etc. and shall conform to the relevant IS: 1761.

Unless otherwise specified, glass panes used in shutters of bath room and lavatories shall be frosted and of thickness as mentioned above and shall be free from any flaws.

Where so specified, special quality glass such as plate glass, pin heads glass, wired glass, float glass etc. shall be used. They shall conform to relevant IS standards as regards quality.

Putty for glazing in wooden frames of doors and windows

Putty shall be prepared by mixing one part of white lead with three parts of finely powdered chalk and then adding boiled linseed oil and mixing the whole thing into a homogeneous stiff paste. It shall be free from impurities like dust, grit, etc. and shall conform to IS : 419.

iii. Fittings

The item of wood work of joinery generally includes fittings such as hinges and screws for fixing of door shutters and is explicitly so mentioned in the item.

Hinges - Hinges shall be of iron, brass, aluminium or any other material as specified. They shall present a neat appearance and shall operate smoothly. All hinges shall be of steel and their riveted heads shall be well formed and smooth. Hinges shall be of the type specified and shall conform to the relevant Indian Standard Specifications.

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iv. Framing

Framed woodwork includes all sawing, cutting, planing, jointing framing, supply and use of straps, bolts holdfasts, nails treenails, spikes, screws etc. necessary for framing and fixing. Framing and trussing are to be done in the best possible manner. Holes of correct size shall be drilled before inserting screws.

Driving in or starting the screws with hammer is prohibited. All screws shall be dipped in oil before being inserted in the wood. The kind of nails and screws shall be subject to the approval of the Engineer-in-charge.

v. Scaffolding

The Contractor shall provide all labour, scaffolding ladders and tackle necessary for hoisting and fixing woodwork in position and afford facilities for its inspection during construction. The Contractor shall be responsible for the safety of the work, workmen and for any action or compensation that may arise in this connection.

vi. Iron Work

All iron work connected with woodwork which is going to be embedded in masonry shall before erection, receive two coats of hot coal tar. If it is to be painted, it shall be given the first two coats on the ground before being fixed in position and the third coat after erection in position.

vii. Precautions against Fire

During the progress of work all shavings, cutting and other rubbish shall be cleared away as the work progresses and all precautions shall be taken against fire.

viii. Inspection

All woodwork shall be inspected and passed by Engineer-in-charge before being put into actual position. In no case the woodwork shall be painted or otherwise treated before it is inspected and approved by the Engineer-in-charge. After approval it shall have the primary coat of paint put on or otherwise treated before being fitted in position. The subsequent coats of paint or other finish shall be applied after the woodwork is fixed in position.

ix. Defective Work

If within three months after the work is completed any undue shrinkage or bad workmanship is discovered the Contractor shall forthwith replace or refix the same to the satisfaction of the Engineer-in-charge, without extra charge.

x. Moisture Content

Control on moisture content of timber is necessary to ensure its proper utility in various climatic conditions. For specifying the permissible limit of moisture content in the timber the country has been divided into four climatic zones. In each of the zones, maximum permissible limit of moisture content of timber for different uses, when determined in accordance with the shall be as per Table 9.2.

TABLE 9.2 Maximum Permissible Moisture Content of Timber

Sl.No.	Use	Max Moisture Content Percent			
		Zone	Zone	Zone	Zone
			II	III	IV
1.	Beams, Rafters and Posts	12	14	17	20
2.	Doors and windows				
	(a) 50 mm and above thickness	10	12	14	16
	(b) Thinner than 50 mm	8	10	12	14
3.	Flooring strips	8	10	10	12
4.	Furniture and Cabinet making	10	12	14	15

Tolerance on Moisture Content: Average Moisture content of all the samples from a lot shall be within + 3 per cent and moisture content of individual samples within + 5 per cent of maximum permissible moisture content specified in Table 9.2. These tolerance are the absolute values over the percentage moisture content for Sl. No. 1 and 2 of Table 9.2. No tolerance on moisture content is permitted for Sl. No. 3 and 4 of Table 9.2.

Seasoning of Timber

The process of drying timber under controlled conditions is called seasoning of timber. Timber shall be either air seasoned or kiln seasoned and in both cases moisture content of the seasoned timber shall be as specified in Table 9. 2 above unless otherwise specified, air seasoned timber shall be used. Kiln seasoning of timber, where specified, shall be done as per IS 1141 in a plant approved by Engineer-in-charge.

Preservation of Timber

Preservative treatment does not improve basic properties of timber but gives varying degree of protection against deterioration due to attacks by fungi, termites, borers and marine organisms. Preservative treatment, where specified, shall be done using Oil type, Organic solvent type or Water-soluble type preservative. Oil type preservatives shall be used if the timber is not required to be polished or painted. Before preservative treatment, the timber shall be sawn and seasoned. All surfaces exposed after treatment, except due to planing, shall be thoroughly brushed with the preservation before jointing. Preservative treatment of timber shall be done as per IS 401 in a plant approved by the Engineer-in-Charge.

D) WORKMANSHIPWood Work, Wrought, Framed and FixedGeneral:

The work shall be carried out as per detailed drawings and/or as directed by the Engineer-in-charge. The wooden members of the frame shall be planed smooth and accurate to the full dimensions. Rebates, rounding, mouldings, etc. as shown in the drawing shall be done before the members are joined into frames. Where wood work is not exposed to view as in the case of frames for false ceiling, however, no planning is required to be done unless specified expressly as rough timber work.

Note: The work wrought shall mean 'planed'.

Jointing in timber frames must be made carefully and accurately. They shall be strong, neat and shall fit without edging or filling. The joints shall be pinned with hard wood or bamboo pins of 10 to 15 - dia after the members of the frame are pressed together in a suitable vice-mechanism

The door and window frame shall have rebate to house the shutters and the depth of such rebate shall be 1.25 cm. Timber for door, window and ventilators frames shall be as specified. Timber shall be sawn in the direction of the grains. All members of a frame shall be of the same species of timber and shall be straight without any warp or bow. Frames shall have smooth, well-planed (wrought) surfaces except the surfaces touching the walls, lintels, sill etc., which may be left clean sawn. Rebates, rounding or moulding shall be done before the members are jointed into frames. The depth of the rebate for housing the shutters shall be 15 mm, and the width of the rebates shall be equal to the thickness of the shutters. A tolerance of ± 2 mm shall be permitted in the specified finished dimensions of timber sections in frames.

Wood work shall be painted, oiled, polished or otherwise treated as specified. All portions of timber abutting against masonry or concrete portion of building shall be coated with boiling coal tar or other type of approved wood preservatives primer, before placing them in final position.

Before any surface treatment is applied in the wood work shall be got approved by the Engineer-in-Charge. The Jamb posts shall be through tenoned in to the mortise of the transoms to the full thickness of the transoms and the thickness of the tenon shall be not less than 2.5 cm. The tenons shall closely fit into the mortise without any wedging or filling. The contact surface of tenon and mortise before putting together shall be glued with polyvinyl acetate dispersion based adhesive conforming to IS 4835 or adhesive conforming IS 851 and pinned with 10 mm dia hard wood dowels, or bamboo pins or star shaped metal pins. The joints shall be at right angles when checked from the inside surfaces of the respective members. The joints shall be pressed in position. Each assembled door frame shall be fitted with a temporary stretcher and a temporary diagonal brace on the rebated faces.

Fixing in Position:

The frames shall be fixed only after acceptance by the Engineer-in-Charge. In case of door frames without sills, the vertical members shall be buried in floor for the full thickness of the floor and the door frame shall be temporarily braced at the sill level so as to prevent warping or distortion of frame during construction. The frames shall be got approved by the Engineer-in-Charge before being painted, oiled or otherwise treated and before fixing in position. The surface of the frames abutting masonry or concrete and the portions of the frames embedded in floors shall be given a coating of coal tar. Frames shall be fixed to the abutting masonry or concrete with holdfasts or metallic fasteners as specified Hilti or equivalent make. After fixing, the jamb posts of the frames shall be plugged suitably and finished neat.

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Vertical members of the door frames shall be embedded in the floor for the full thickness of the floor finish and shall be suitably strutted and wedged in order to prevent warping during construction. A minimum of three hold fasts shall be fixed on each side of door and window frames one at centre point and other two at 30 cm from the top and bottom of the frames. In case of window and ventilator frames of less than 1 m in height two hold fasts shall be fixed on each side at quarter point of the frames. Hold fasts and metallic fasteners shall be not be measured and paid for separately.

Panelled, Glazed or Panelled and Glazed Shutters:

General

The work shall be carried out as per detailed drawing. The wooden members shall be planed smooth and accurate. They shall be cut to the exact shape and sizes without patching or plugging of any kind. Mouldings, rebates, rounding, etc. shall be done, as shown in the drawing, before the pieces are assembled into the shutter.

Joinery work:

The thickness of the styles and rails shall be as specified in the item of work. The minimum thickness of panels shall normally be 15 mm where the clear width of panel is not more than 300 mm and 20 mm where the clear width of the panel is more than 300 mm. However, where the Engineer-in-Charge so considers lesser thickness up to 12 mm and 15 mm respectively may be allowed by him instead of 15 mm and 20 mm specified above. Solid wood panel for door and window shutters shall be made out of one or more strips of timber planks of not less than 125 mm width. It is preferable to use strips of not more than 200 mm width to reduce chances of warping, splitting or other defects. The timber strips shall be joined together with continuous tongued and grooved joints, glued together and reinforced with metal dowels. The grooving of the solid panel shall normally run along the longer dimensions of the panel unless otherwise directed. The corners and edges of panels shall be finished as shown in the drawing and these shall be feather tongued into styles and rails. Sash bars shall have mitres joints with the styles.

Styles and rails of shutters shall be made out of single piece. Lock and intermediate rails exceeding 200 mm in width if permitted by the Engineer-in-charge may be made out of one or more pieces of timber but the width of each pieces shall not be less than 125 mm. Where more than one piece of timber is used, they shall be joined with a continuous tongued and grooved joint glued together and reinforced with metal dowels (rust proof) at regular intervals of 20 cm or pinned with not less than three 40 mm rust proof pins of the lost head type.

The tendons shall pass clear through styles. The styles and rails shall have a 12 mm groove to receive the panel.

In case the double shutters the rebate at the closing junction of the two shutters shall be of depth not less than 2 cm.

Shutters shall not be painted or otherwise treated before these are passed by the Engineer-in-Charge and fixed in position.

Glazing:

The glazing work shall be done in accordance with the specification given separately elsewhere.

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Hold Fast

Hold fasts used for fixing doors and window frames shall be made of 40 x 3 mm flat iron and 40 cm long. It shall have two holes on one end for fixing to frame with long screws, and at the other end, the flat iron shall be split and bent at right angles in the opposite direction. The hold fast shall be tightly fixed to the frame by means of bolts, the bolt hole in frame being plugged suitably and finished neat. The hold fast shall be embedded into masonry by concrete block of 200 x 250 x 400 mm size.

E) MEASUREMENTS

Unless otherwise specified in the BOQ, Woodwork and joinery work shall be measured in cubic meters.

Length and width of unfinished opening shall be measured to the nearest 0.01 m.

Volume shall be worked out correct up to 3rd place of decimal of a Cum. All work shall be measured net as fixed, that is, no extra allowance in measurement shall be made for shape, joints, etc. However, where the dimensions as fixed exceeds the specified dimension (as per drawing, etc.) only the specified dimensions(s) shall be measured and where one or more dimension of the piece as fixed is less than the fixed dimension the actual dimension shall be measured, without prejudice to the right of the Engineer-in-Charge to reject the piece and order replacement of such pieces.

It shall include:

- i) Supply of specified species of timber sawn to requisite sizes without any defect, wrought, framed and fixed in position with the required standard of workmanship including supply-and-fixing of fixtures, straps, bolts, hold-fasts, spikes, nails, screws, etc. applying contractors glue or other jointing materials, coal tarring embedded parts, glazing and supplying and fixing of all specified fittings.
- ii) All material, labour, scaffolding, use of equipment etc. for framing, fixing and completing the item as specified.

F) FLUSH DOOR SHUTTER

General

The door shall be of flush type solid core with single or double shutter as the case may be.

Shutters

Flush door shutters shall have a solid core and may be of the decorative or non-decorative (Paintable type as per IS 2202 (Part I)). Nominal thickness of shutters may be 25, 30 or 35 mm. Thickness and type of shutters shall be as specified.

Width and height of the shutters shall be as shown in the drawings or as indicated by the Engineer-in-Charge. All four edges of the shutters shall be square. The shutter shall be free from twist or warp in its plane. The moisture content in timbers used in the manufacture of flush door shutters shall be not more than 12 per cent when tested according to IS 1708.

Core: - The core of the flush door shutters shall be a block board having wooden strips held in a frame constructed of stiles and rails. Each stile and rail shall be a single piece without any joint. The width of the stiles and rails including lipping, where provided shall not be less than 45 mm and not more than 75 mm. The width of each wooden strip shall not exceed 30 mm. Stiles, rails and wooden strips forming the core of a shutter shall be of equal and uniform thickness. Wooden strips shall be parallel to the stiles. End joints of the pieces of wooden strips of small lengths shall be staggered. In a shutter, stiles and rails

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shall be of one species of timber. Wooden strips shall also be of one species only but it may or may not be of the same species as that of the stiles and rails. Any species of timber may be used for core of flush door. However, any non-coniferous (Hard wood) timber shall be used for stiles, rails and lipping.

Face Panel:- The face panel shall be formed by gluing, by the hot-press process on both faces of the core, either plywood or cross-bands and face veneers. The thickness of the cross bands as such or in the plywood shall be between 1.0 mm and 3.0 mm. The thickness of the face veneers as such or in the

plywood shall be between 0.5 mm and 1.5 mm for commercial veneers and between 0.4 mm and 1.0 mm for decorative veneers, provided that the combined thickness of both is not less than 2.2 mm. The direction of the veneers adjacent to the core shall be at right angles to the direction of the wooden strips. Finished faces shall be sanded to smooth even texture. Commercial face veneers shall conform to marine grade plywood and decorative face veneers shall conform to type I decorative plywood in IS 1328.

Lipping:- Lipping, where specified, shall be provided internally on all edges of the shutters. Lipping shall be done with battens of first class hardwood or as specified of depth not less than 25 mm. For double leaved shutters, depth of the lipping at meeting of stiles shall be not less than 35 mm. Joints shall not be permitted in the lipping.

Rebating:- In the case of double leaves shutters the meeting of stiles shall be rebated by 8 mm to 10 mm. The rebating shall be either splayed or square type as shown in drawing where lipping is provided. The depth of lipping at the meeting of stiles shall not be less than 30 mm.

Opening for Glazing:- When required by the purchaser opening for glazing shall be provided and unless otherwise specified the opening for glazing shall be as per drawings. The bottom of the opening shall be at a height as shown in the drawings. Opening for glazing shall be lipped internally with wooden batten of width not less than 25 mm. Opening for glazing shall be provided where specified or shown in the drawing.

Tolerance:- Tolerance on width and height shall be + 3 mm and tolerance on nominal thickness shall be ± 1.2 mm. The thickness of the door shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any two points.

Adhesive:- Adhesive used for bonding various components of flush door shutters namely, core, core frame, lipping, cross-bands, face veneers, plywood etc. and for bonding plywood shall conform to BWP type, phenol formaldehyde synthetic resin adhesive conforming to IS 848.

Tests

Samples of flush door shutters shall be subjected to the following tests:

End Immersion Test

Knife Test

Glue Adhesion Test

Fixing:- For side hung shutters of height up to 1.2 m, each leaf shall be hung on two hinges at quarter points and for shutter of height more than 1.2 m, each leaf shall be hung on three hinges one at the centre and

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the other two at 200 mm from the top and bottom of the shutters. Top hung and bottom hung shutters shall be hung on two hinges fixed at quarter points of top rail or bottom rail. Centre hung shutter shall be suspended on a suitable pivot in the centre of the frame. Size and type of hinges and pivots shall be as specified. Flap of hinges shall be neatly counter sunk into the recesses cut to the exact dimensions of flap. Screws for fixing the hinges shall be screwed in with screw driver and not hammered in. Unless otherwise specified, shutters of height more than 1.2 m shall be hung on butt hinges of size 100 mm and for all other shutters of lesser height butt hinges of size 75 mm shall be used. For shutter of more than 40 mm thickness butt hinges of size 125 x 90 x 4 mm shall be used. Continuous (piano) hinges shall be used for fixing cup-board shutters where specified. Fittings shall be provided as per schedule of fittings decided by Architect. Cost of providing and fixing shutter shall include cost of hinges, door closer, handle, lock and necessary screws for fixing the same. The fittings shall conform to specifications laid down under the hardware list which is coming up in the document later. Where the fittings are stipulated to be supplied by the Client free of cost, screws for fixing these fittings shall be provided by contractor and nothing extra shall be paid for the same.

Measurements:- Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Overlap of two shutters shall not be measured. The overall openings to be measured in case the doors are paid in Nos

G) FIRE RATED/ GENERAL PURPOSE STEEL DOOR

A. SCOPE

This specification covers the design, supply of materials, manufacture and installation of factory made type fire rated steel doors with 1 (one) Hour or 2 (two) Hours fire rating/ General purpose Steel Door of approved make with different rating as per the requirements with all accessories, hardware, ironmongery, fastening materials and including installation of door with hardware in position.

B. GENERAL REQUIREMENTS

The Nominated sub Contractor shall furnish all materials, labour, operations, equipment, tools and plant, scaffolding and incidentals necessary and required for the completion of metal work in connection with steel doors, as called for in the drawings, specifications and bill of quantities which cover the major requirements only. Anything called for in the tender documents shall be considered as applicable to the items of work concerned. The supply and installation of additional fastenings (Metal expansion Shields), accessory features and other items not specifically mentioned, but which are necessary to make a complete functioning installation shall form a part of this contract.

All metal work shall be free from defects, impairing strength, durability and appearance and shall be of the best quality for purposes specified made with structural properties to withstand safety strains, stresses to which they shall normally be subjected to. All Hardware fittings and Accessories shall be of high quality and as specified and as approved by the Employer/ OE and PMC.

The Nominated sub Contractor shall strictly follow, at all stages of work, the stipulations contained in the Indian Standard Safety Code and the provisions of the safety code and the provision of the safety rules as specified in the General Conditions of the Contract for ensuring safety of men and materials. Any approval, instructions, permission, checking, review, etc. whatsoever by the Employer/ OE and PMC, shall not Relieve the Nominated sub Contractor of his responsibility and obligation regarding adequacy, correctness, completeness, Safety, strength, quality, workmanship, etc.

The Nominated sub Contractor shall submit the Shop drawing for all works including all details, and after check by his own Engineer. The Nominated sub Contractor shall not commence the work before obtaining prior and final approval for shop drawings incorporating the changes, if any, instructed by the Employer/ OE and PMC. Such prior approval shall not relieve the Nominated sub Contractor from his responsibility of correctness of design, workmanship and material errors and omissions, if any.

C. CODES AND STANDARDS

All standards, specifications, acts, and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.

List of certain important Indian Standards, Acts and Codes applicable to this work is given below. However, the applicable standards and codes shall be as per this but not limited to the list given below:

IS: 277	Galvanized steel sheet (plain and corrugated) of GPL Grade Z 120 coating.
IS: 3614 Part 1 and 2/ BS 476 Part 20 and 22	Metallic and non-metallic fire check doors - Resistance test and Performance criteria.
BS 7352 /BS EN 1935	Specification of Hinges

D. HOLLOW METAL FIRE DOOR / GENERAL PURPOSE DOOR WITH IN FILL MATERIAL AS PER MANUFACTURER'S SPECIFICATION.

- a) Fire door shall be 1 Hour/ 2 hour fire rated and door quality shall be approved by CBRI and the door should be tested to conform the Performance Criteria as per IS: 3614 and should meet the requirements of CBRI. General purpose Door shall be as per Manufacturer's specification. Unless otherwise specified, the door shall be provided to the height of 2100 mm. If the height specified as above 2100 mm and up to 3000 mm height, the options would be:
 - i. A man operation door up to 2100 mm high shall be provided with a removable/ fixed panel on top as below: (i.e. above 2100 mm level as below).

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- ii. Fire Door: Fully flush double skin steel panel construction to a total thickness of 46 mm.

- iii. General purpose Door: Fully flush double skin steel panel construction to a total thickness of 46 mm or fixed Glazing Panel on the top with Single/ Double glass panel.

- b) The construction and finish of panel above 2100 mm level shall be designed similar to that of a shutter in case of flush panel in order to match the exterior finish.

c) DOOR FRAME:

i. Material:

Frame shall be manufactured by using Galvanized steel sheets complying with latest IS 277. Galvanized coating shall be GPL grade Z 120 coating.

ii. Profile:

Fire Door and General Purpose door frame profile shall be as given below:

- I. Fire Door - 2 Hour rating: Double rebate profile of size 143 x 57 mm(+/- 0.3) with bending radius of 1.4 mm.
- II. Fire Door - 1 Hour rating: Single rebate profile of size 100 x 57 mm(+/- 0.3) with bending radius of 1.4 mm.
- III. General Purpose Door: Single rebate profile of size 100 x 57 mm (+/- 0.3) with bending radius of 1.4 mm.

iii. Manufacture :

Frame shall be fabricated from galvanized steel sheet to the thickness specified below and to the specified profile and dimensions:

- I. Fire Door - 2 Hour rating : 16 Gauge or 1.6 mm thick.
- II. Fire Door -1 Hour rating : 18 Gauge or 1.25 mm thick.
- III. General Purpose Door : 18 Gauge or 1.25 mm thick.

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Frames fabricated at factory shall be in knock down form with butt joints for bolted assembly at site or as per manufacturer's Specification.

iv. Preparation:

Frames shall be provided with 3 mm thick back plates on all jambs with provision for anchor bolt fixing to wall openings.

Frames shall be provided with hinge plates 3 mm thick pre-drilled to receive approved type and make of hinges for screw mounted fixing.

Frames shall have factory finish-pre-punched cut outs to receive specified type and make of hardware and iron Mongery. All cut outs including hinge plates, strike plates to have mortar guard covers from inside to prevent cement, dust ingress into cut outs at the time of grouting of the frame.

Frames shall have reinforcement pads for fixing of door closer, locks and handles at appropriate location as per manufacturer's details.

Frames shall have plug-in type rubber silencer not less than 2 mm dia on the strike jambs for single shutter frames and on the head jambs for double shutter frames.

d) DOOR SHUTTER:

i. Material:

Shutter shall be manufactured with double skins press formed by using Galvanized steel sheets complying with latest IS 277. Galvanized coating shall be GPL grade Z 120 coating.

ii. Profile:

Shutters should be press formed with double skins in such a way to get 46 mm thick double skin hollow door with lock seam joints at stile edges.

Fire Door and General Purpose door frame profile shall be as given below:

- | | | |
|------|---------------------------|------------------------------|
| I. | Fire Door - 2 Hour rating | : 18 Gauge or 1.25 mm thick. |
| II. | Fire Door - 1 Hour rating | : 20 Gauge or 0.80 mm thick. |
| III. | General Purpose Door | : 20 Gauge or 0.80 mm thick. |

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Shutters shall have no visible screws or fasteners on both face and internal reinforcement shall be provided at top, bottom and stile edges for desired fire rating.

iii. In Fill Material:

Shutters shall be provided with honeycomb paper core as infill material and to be bounded to the inner faces of the shutter or as per Manufacturer's specification. Door should have been tested with Infill material proposed by the manufacturer and the same should have been approved by CBRI.

iv. Preparation:

Shutters shall be provided with factory prepared and with pre-punched cut-outs and reinforcement pads to receive the approved type and make of Hardware and Iron Mongery. The shutter should have an interlocking arrangement at this stile edges for flat surface on either side.

Shutters shall have pre-drilled hinge plates with hinge guard covers.

Shutters with locks to have concealed lock box with lock fixing brackets with pre-tapped holes and screws.

Shutter shall have reinforcement pad at appropriate location to receive the locks, Door closer, Panic Bar, etc as per the approved type and make of Hardware and all as per manufacturer's design and conforming to Standards.

Necessary provision/ fixing arrangements shall be provided in the shutter as well as in the frame to receive/ fix the Electromagnetic latch, Electromagnetic contact for hooters with reinforcement pads and in such a way to connect the same to the card access control system/ IBMS. Fixing Details of the above latches shall be provided in coordination with IBMS agency.

Vision panel shall be provided as given below:

a) Fire rated Door (1 Hour/ 2 Hour) - Provide Borosilicate single clear toughened glass of approved equivalent make to the thickness of 6 mm to with stand two hours fire rating.

b) General purpose Door - Provide Single/ Double clear toughened glass of approved equivalent make to the thickness of 5 mm to the specified size and as per Manufacturer specification. Glass to be fixed with clip on frames for square and rectangular vision panels and with spin turned rings for circular vision panels. One side adhesive Glazing tape shall be provided in the frame to fix the vision panel glass in position and ensuring the stability of the fixing.

e) Finish - Frame and Shutter:

i) Surface of the frame and shutter shall be cleaned suitably and thoroughly with solvents and as per manufacturer's specification.

ii) Apply Zinc etch primer coating as shop coat to receive additional coat of primer and top coats.

iii) Apply stove zinc phosphate primer (35 microns DFT) as additional coat.

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iv) Apply as finish coat and finish the surface neatly with thermo setting polyurethane paint (35 microns DFT) of approved colour and make.

f) PACKING

i) Individual frames members and individual shutters to be wrapped and protected with self adhesive Peel-off Polythene sheets or Co extruded PE film to a minimum thickness of 60 Microns, with low tack adhesive and with abrasion resistant for a minimum period of 6 months and UV resistant capability.

ii) Individual frames members and individual shutters to be packed in an individual card board boxes and to be sealed with Identification numbers.

iii) All frames and shutters shall be marked with identification number in such a way install the door according to the door schedule.

g) STORAGE

Frames shall be stacked flat and shutters shall be stacked vertically on wooden runners and suitably covered as per the manufacturer's instructions to prevent rust and damage.

h) INSTALLATION

FRAME:

i) Door frames should be assembled adjacent to the place of installation as per the Manufacturer's specification. Frames are not allowed for transporting in an assembled condition. If the manufacturer is desired to transport the frames in an assembled condition, the frames should be designed suitably and adequate packing to be given prior to transport in order to avoid any damage, bending etc during transport. If any defects found during the installation, such frames will be summarily rejected and will not be allowed to use.

ii) After assembly it is to be ensured that all threaded preparations/ joints are covered by using 15 x 10 self adhesive sponge strips at the back of the frame to prevent penetration of grouting mortar into screw threads. The head member of assembled frame shall be positioned against jambs ensuring correct alignment and secured using M 8 x 20 mm long plated Stainless steel bolts together with nuts spring and flat washers. Frames to be assembled at site with aid of roofing bolts and the protective film shall not be removed during installation.

iii) Assembled frame shall be kept in position within the opening by means of bracing. In order to correctly position the frame against finished floor level or equalize on adjustable floor anchors where specified, suitable strength PVC nylon shim shall be used under jambs. The frame shall be checked for square ness, alignment, twist etc. with carpenters bevel and plumb.

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- iv) A tie rod shall be fixed to the frame during installation to ensure the correct dimensions between the frame rebates and the same may be removed after installation.
- v) Where fixing the frame is necessitated, the required gap between frame and jambs shall be created to accommodate the PVC nylon shims in such a way to maintain the uniform frame level.
- vi) Methodology to be followed during the installation of the frames:
 - i) Site survey shall be conducted to ensure the opening size and reveal the correct opening size prior to installation of the frames.
 - ii) Place the frame in position, brace, level etc.
 - iii) Mark all positions of fixings anchors on the wall/ lintel.
 - iv) Remove frame and drill wall to appropriate fastener or anchor bolts size.
 - v) Place and fit rod anchor shells metal expansion bolts into the wall.
 - vi) Place and fit jamb spacer bracket into back of frame profile.
 - vii) Reposition the frame back into opening and realign.
 - viii) Lightly tighten the CSK HD machine screws into shells.
 - ix) Check the position of the nylon shims placed behind frame to ensure the uniform gap between the frame and jamb.
 - x) Slowly fasten the screws continually by checking the plumb, square ness etc. and finally ensure that the frames are not deformed while tightened.
 - xi) After fixing the frame in position, the frame shall be pressure grouted with cement slurry 1:3 ratio or filling the pre- cast solid block core to the frame profile as approved. The surface after grouting shall be neatly cleaned and to be ensured that there is no scratch in the door frames after grouting.
 - xii) Back fill the frame through holes provided and insert plug in type nylon plugs after cleaning the surface. Nylon plugs shall be provided to suit the frame finish and colour.
 - xiii) Gap between the frame and masonry surface shall be grouted with cement slurry and sealed with Intumscent sealant of approved make, if called for in the Bills of quantities.

SHUTTER:

- i) Fix all the hardware to the door shutter like hinges, flush bolts, bolts, Mortise locks, Dead lock, handle, Push plate, Door closer, Door stoppers, etc. with the appropriate SS screws and bolts supplied.
- ii) The shutter is to be then fixed in to the installed frame and align the shutter to match the hardware to the cut-outs in the frame. Tighten the hinge screws.
- iii) Clean the door jamb rebate surfaces of all dust, oil etc.

iv) Affix self-adhesive 'FLAT' seal on the door frame rebates, on hinge jambs, strike jambs, head member, sill etc and affix 'FLAT' seal in the shutter by using self adhesive EPDM smoke seal 'FLAT' type (Polyethylene cross linked foam of size 2 mm thick and 12.5 mm width) of Monarch Make and as indicated by the manufacturer and if specifically called for in the bills of quantities.

HARDWARE SCHEDULE:

Refer the Hardware Schedule enclosed along with BOQ.

i) **TESTING/ INSPECTION and GURANTEE:**

During the process of manufacturing the Door by the agency, successful vendor shall arrange an inspection of the factory by the representative of Employer/OE and PMC/LA within the quoted rate. After installing the door, the Nominated sub Contractor shall test the performance of the Door Frame and Shutter in the presence of the Employer/ OE and PMC. The doors shall be smoothly operable under all ambient conditions. All control, hardwares and locking devices shall give fault free performance. A successful bidder shall arrange a test for one door with the specified hardware and place the door for testing in exactly the same way as fixed at site. The Employer/ OE and PMC at random basis will select the door during the process or end of the manufacture and conduct the test at an approved laboratory in the presence of the representative of Employer/ OE and PMC within the quoted rate and ensure that the door shall comply with the set out criteria.

Provide a Guarantee certificate and Test certificate for the tested door in an acceptable format in a stamped paper.

H) 2 HOUR NON METAL FIRE RATED DOOR

2 Hours fire Non Metal fire rated doors system duly tested for integrity and Insulation as per the IS:3614 part 2 and BS:476 part 20 at FRL CBRI Roorkee with standard heating conditions as specified in IS:3809 - 1979 and BS:476 part 20 and 22 1987 to achieve the required integrity and insulation (I.e. to restrict the heat radiation, temperature rise on the non fire side to the maximum of 140 degree Celsius above the ambient temperature on the

unexposed surface of the shutter), Framework to be in Seasoned hardwood (Moisture contain limited to 18%) frame of section 150mm X 75mm with 1 nos. of approved make Intumescant strip to take care of Hot smoke size of 20mm X 2mm cancelled in the groove of the frame with fixing arrangements of 3 nos. of G.I. hold fast 225mmX20mmX4mm with split end on either side and wall grouted with cement concrete mix 1:3:6 adjustable lugs with split end tail to each jamb alternatively approved make Anchor Fastener, including 4 nos. of stainless steel ball bearing hinges of SS 304 quality of size 102mmX102mmX3mm thick to capable of taking load up to 120 Kg of the shutter with SS pin, lock strike plate, shock absorbers as specified and 56mm thick single leaf shutter made out of perimeter railing of Seasoned Red Marenti hard wood (Moisture contain limited to 18%) of size 100mmX30mm and 2 nos. of 9mm thick Promina - 60 board duly HOT PRESSED with 4mm Commercial/ Marine Ply to get the require surface for Laminate/ Veneer/ Paints with 30mm thick Non-combustible Fire Retardant compound and Fire Intumescant Seal of size 20mm x 2mm mounted in the grooves in the shutter on all sides except

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bottom with 10mm thick teak wood beading on all side and Intumescant sealant is used to seal the gaps between Promina-60 Board and shutter beading. The fire Doors with frame will be as per 15:3614 part 4 and BS:476 part 20 at FRL CBRI Roorkee with standard heating conditions as specified in 15:3809 - 1979 and BS:476 part 20 and 22 1987 all complete to the entire specification with the certified copy of the valid Test Certificates

I) TRAP DOOR

The trap Door should be of size as mentioned in the drawings. It should be made from 19mm marine grade plywood and finished in 1mm thick approved shade laminate on the exposed side and balancing laminate, 0.8mm thick on the underside. The edges to be in finished in 6mm thick teakwood lipping and finished in approved melamine polish. The framework should be as mentioned in the drawings. The cost should include hardware like a hatch using self-adjusting clasping springs, with a lock and hinge mechanism that is integrated in the frame corners and concealed. The system should be equipped with round cylinder lock/ square bolt/ lock, designed for profile cylinders Product/ system. Item should include all accessories, fitments, man and material, correct installation procedure, necessary cutting in False ceiling strictly with unit template and finishing, cleaning complete.

Method and workmanship

The location of the trap door to be neatly located, surrounding surface cleaned of all dust and grime. The location and outline of the trap door should be neatly marked. This should strictly be the cut-line, any opening larger or smaller than this is not technically appropriate and may lead to malfunctioning of the Trap door. The self tapping screws provided for in the unit packing and the corresponding raul-plugs to be strictly used. Only the indicated number of screw holes and their indicated positions should be followed. The trap door is a system designed to rest on false ceiling Gypsum board. Any installation damages to false ceiling can be touched up with gypsum plaster. Post installation finishing involves neat painting touch-up to the vicinity, with masking tapes on the Trap door rim.

Working Platform and Safety

A local portable ladder of sufficient stoutness and stability should be used for reaching out to the false ceiling.

Making good

Post installation inspection should follow sufficient drying of paint and removal of masking tapes & fine touch-up if need be.

Mode of Measurement and payment

Mode of measurement should be in Sqm. Architect/Consultant certified completed units to be eligible for measurement for payment.

J) DOOR HARDWARE

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Mortise Latch

- 1) Shall carry manufacturer's warranty of 1 year
- 2) Euro Mortise Passage Latch - Inside and Outside shall be opened by handle at all times
- 3) Shall comply with EN12209-1 and BS 5872 Standards
- 4) Shall be Tested for 5,00,000 cycles
- 5) Shall be suitable for wooden, metal and fire doors (latch functions) with 60mm standard back set
- 6) Shall be suitable for doors of thickness range 30mm to 50mm
- 7) Latch bolt, Deadbolt, Faceplate shall be made of Stainless Steel
- 8) Shall have Satin Stainless Steel finish
- 9) As an option locks may be Fire tested to GB7633 standards, CNAFL certified, AS 130.4-2005 Standard
- 10) Euro Mortise Lock - Outside - Shall be opened by handle when unlocked. Lever shall withdraw latch bolt. Key shall lock or unlock bolt, key shall withdraw latch bolt. Inside - Shall be opened by handle when unlocked. Lever shall withdraw latch bolt. Key shall lock or unlock bolt, key shall withdraw latch bolt.
- 11) Euro Mortise Deadbolt - Outside - Bolt shall be locked or unlocked by key or turn. Inside - Bolt shall be locked or unlocked by key or turn
- 12) Euro Mortise Night latch - Outside - Latch bolt shall be withdrawn by key or turn. Inside - Latch bolt shall be withdrawn by key or turn.
- 13) Euro Mortise Privacy Lock - Outside - Shall be opened by handle except when bolt is thrown by turn knob from inside. Bolt may be unlocked from outside by coin or screwdriver by operating the slotted emergency button. Inside - Shall be opened by handle except when bolt is thrown by inside turn knob.

Euro Cylinder -

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Shall be of 5 pin Euro Double Cylinder
- 3) Shall be suitable to be used with Euro Profile Mortise Locks
- 4) Shall have C4 Key Profile, 70mm length and have 3 keys
- 5) Shall have Satin Chrome Finish

Euro Single Cylinder with Thumb turn -

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Shall be of 5 pin Euro Single Cylinder with Turn
- 3) Shall be suitable to be used with Euro Profile Mortise Locks
- 4) Shall have C4 Key Profile
- 5) Shall be of 65mm length

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- 6) Shall have 3 keys
- 7) Shall have Satin Chrome Finish

Tubular Lever Handle -

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Tubular Lever on Rose shall be with Euro Profile Escutcheon
- 3) Shall be made of Stainless Steel Grade 304
- 4) Shall have Satin Stainless Steel Finish
- 5) Shall be tested for corrosion resistance in accordance with AS 2331.3.1 Neutral Salt Spray Test
- 6) Spray Test

Euro Profile Escutcheon or Rose -

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Euro Profile Rose material
- 3) Stainless Steel Grade 304
- 4) Satin Stainless Steel Finish
- 5) Tested for corrosion resistance in accordance with AS 2331.3.1 Neutral Salt Spray Test

Entrance Handle -

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Shall be tubular Back to Back Pull Handle
- 3) Shall have spigots to suit 10 - 12mm thick glass doors as well as spigots to suit aluminium and timber doors up to 50mm thick
- 4) Shall be made of 304 grade stainless steel construction suitable for use in external environments
- 5) Shall have Satin Stainless Steel Finis

Cylindrical lever -

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Shall be suitable for semi commercial applications such as apartments and offices

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- 3) Back set shall be 60mm standard. Extension tubes shall be available for 127mm back set
- 4) Latch bolt shall be of Stainless Steel
- 5) Shall suit door thickness of 35-46mm
- 6) Shall have standard T Strike
- 7) Shall have Satin Stainless Steel finish
- 8) Shall have field changeable handing
- 9) Shall be successfully tested up to 4 hours on fire door assemblies in accordance with Australian Standards AS-1905 Part 1, fire resistant door sets

Patches-

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Shall be suitable for doors with maximum weight 80Kgs and maximum width 1100mm
- 3) Shall have Satin Stainless Steel Finish

Door stop/ Security door chain/ door guard/ other door accessories-

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Shall be made of 304 Grade Stainless Steel
- 3) Shall have Satin Stainless Steel finish

Hinges-

- 1) Shall carry manufacturer's warranty of 1 yr
- 2) Stainless Steel Ball Bearing Button Tip Hinge
- 3) Shall be suitable for interior/ exterior doors
- 4) Shall be with two ball bearings
- 5) Shall be manufactured of 304 Stainless Steel
- 6) Shall be with Fixed Pins of Standard Imperial Hole pattern
- 7) Shall be of size as per manufacturer's specifications
- 8) Finish shall be Satin Stainless Steel

Kick Plates-

This shall be of brass (finished bright or chromium plated or oxidised) bronze, stainless steel, aluminium or as specified. Aluminium kicking plates shall be anodised and the anodic coating shall not be less than grade AC-10 of IS 1868. It shall be made from a plate of minimum thickness 3.0 mm & 1.5mm in case of stainless steel. Shape of the plate shall be as specified. This shall have bevelled or straight edges and shall be fixed by means of counter sunk or rounded screws of the same material and finish as that of the plate. The shape and pattern shall be according to the drawings and as approved by the Engineer-in-Charge.

PAINTING

A) SCOPE

These specifications cover the use of paints for the plastered and concrete surfaces. It also includes the painting of wood and metal surfaces. The paint to be low VOC. Conventional paints contain Volatile Organic Compounds (VOC), which are petroleum-based solvents that evaporate from paint films while the paint is drying. These compounds are the unpleasant solvent fumes that may trigger respiratory reactions including asthma and breathing discomfort, when using conventional paints. They also contribute to greenhouse gas emissions.

Traditional oil based paints (also known as alkyd enamels) have a solvent level of approximately 50% or more. This means that for every four-litre can of enamel, two litres go straight into the atmosphere, compounding the "Greenhouse Effect". Conventional water-borne paints have a solvent level of around 7%, so obviously using water-borne paints is a far more environmentally responsible option.

Additives classified as VOC's are included to achieve some of the positive attributes of paint, such as good coverage, easy application and wash ability. The challenge for manufacturers, is delivering the quality of paint finish customers have come to expect, whilst reducing the overall environmental impact of each tin.

Low VOC paints, stains and varnishes use water as a carrier instead of petroleum-based solvents. As such, the levels of harmful emissions are lower than solvent-borne surface coatings. These certified coatings also contain no, or very low levels, of heavy metals and formaldehyde. The amount of VOC's varies among different "low-VOC" products, and is listed on the paint can or MSDS. Paints and stains, to meet EPA standards, must not contain VOC's in excess of 200 grams per litre. Varnishes must not contain VOC's in excess of 300 grams per litre.

As a general rule, low VOC paints marketed by reputable paint manufacturers usually meet the 50 g/L VOC threshold. Paints with the Green Seal Standard (GS-11) mark are certified lower than 50 g/L.

Low VOC paints will still emit an odour until dry. If you are particularly sensitive, make sure the paint you buy contains fewer than 25 grams/litre of VOC's

B) GENERAL

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

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IS: 63	Whiting for Paints 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, and colour as required.
IS: 710	Marine Plywood
IS: 1200 (Part XIII)	Method of Measurement of Building and Civil Engg Works - White Washing, colour washing, distempering and other finishes.
IS: 1477 (Part 1)	Code of practice for painting of ferrous metals in buildings Pre-treatment
IS: 1477 (Part 11)	Code of practice for finishing of ferrous metals in buildings. Painting
IS: 2338 (Part 1)	Code of practice for finishing of wood and wood based materials Operations and workmanship for finishing.
IS: 2338 (Part 11) :	Code of practice for finishing of wood and wood based materials, Schedule
IS: 2395 (Part 1) :	Code of practice for painting concrete masonry and plaster surfaces. Operation and workmanship
IS: 2395 (Part 11)	Code of practice for painting concrete, masonry and plaster surfaces. Schedule.
IS: 159	Specification for ready mixed paint, brushing, acid resistant.
IS: 2524 (Part 1)	Code of practice for painting of non-ferrous metal in buildings Pre-treatment
IS: 2524 (Part II)	Code of practice for painting of non-ferrous metal in buildings Painting
IS: 3140	Code of practice for painting asbestos cement buildings:
IS: 5410	Specification for cement paints, colour as required.

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

C) MATERIALS

Materials shall strictly conform to the relevant IS: Specifications.

D) OIL-BOUND DISTEMPERING

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xi. Preparation of Surfaces:

Any unevenness shall be made good by applying putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry.

xii. Primer Coat:

The primer where used as on undercoated surfaces shall be alkali resistance primer or distemper primer as specified in the item. These shall be of the same manufacture as of oil bound distemper. If the wall surface plaster has not dried completely alkali resistance primer shall be applied before distemping the walls. But if the distemping is done after the wall surface is dried completely, distemper primer shall be applied.

xiii. Application:

Primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours, before oil bound distemper or paint is applied.

xiv. Preparation of oil bound distemper:

The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for days work shall be prepared.

xv. Application of distemper coat:

After the primer coat has dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out the printing coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed to immediately by vertical which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit the proper drying of the preceding coat.

The finished surface shall be even and uniform without patches, brush marks, distemper, drops, etc. Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room, which cannot be completed the same day.

15 cm. double bristled distemper brushes shall be used. After each day's work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

E) WATER PROOF CEMENT PAINT

xvi. Preparation of Surfaces:

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

xvii. 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 brush able 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 becomes air set due to its hygroscopic qualities.

xviii. 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 undecorated 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.

xix. Curing

Painted surfaces shall be sprinkled with water two or three times a day. This shall done 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.

F) PLASTIC EMULSION PAINTING ON WALL AND CEILING

xx. General

Plastic emulsion paints are not suitable for application on external wood and iron surfaces and surfaces which are liable to heavy condensation and are to be used generally on masonry or plastered surfaces. Suitable primer as per manufacturer shall be provided.

xxi. Paint

Plastic emulsion paint of approved brand and manufacture and of the required shade shall be used.

xxii. 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 putty, made of plaster of Paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry.

xxiii. 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 emulsion 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.

xxiv. Precautions

Old brushes if they are to be used with emulsion 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.

1. In the preparation of walls for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.

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

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

xxv. Other Details :

These shall be as per specification for "Painting" as far as they are applicable.

G) RESIN BASED THERMO PLASTIC PAINT (DECORATIVE AND PROTECTIVE FINISH)

Materials: resin based thermo plastic paint such as sandtex matt or other equivalent approved manufacture, colour and shade shall only be used.

Preparation of surface and general: the specifications for painting (general) described herein before shall hold good as far as they are applicable.

Protective coatings: on surfaces such as ferrous metals, brass, copper and phosper bronze, a protective coating of suitable bituminous compound or chromate red oxide should be given. New wood should be treated with a leafing grade aluminium primer or water based acrylic emulsion primer. The surfaces with algae growth thoroughly cleaned down to remove as much growth as possible and effective solution of stabilized house hold bleach (calcium hypochlorite) of approved quality with approximate 35% chlorine content @ 2 Kgs. Per 50 litres (or as per manufacturers recommendations) should be used to treat the surfaces. On chalky or friable surfaces after removing the loose materials by stiff brushing or scraping the surface should be treated with one coat of advanced solvent based materials such as snow sol stabilizing solution or other approved equivalent with white spirit.

Application: the ready mix sandtex matt or other equivalent approved resin based there plastic paint shall be applied on clean and wetted surfaces by means of brushes or roller. The solution shall be kept well stirred during the period of application. To avoid direct heat of the sun, the paint shall be applied on the side in shade. On rough and textured, one under coat of cement based paint such as snocem or other equivalent shall be applied before application of undiluted sandtex matt finish coat. In case of application of two coats of sandtex matt at normal temperatures, the first one shall be diluted by addition of 25% water and the second coat direct. In extremely hot environs, the second coat shall be diluted @ 2.5 litres of water to 20 litres of paint or as directed. Painting with resin based thermo plastic shall be carried out generally as per manufacturer's specifications.

Other details:

The specification for painting (general) mentioned herein before shall hold good as far as they are applicable. Snow sol stabilized solution shall not be applied over bitumen. Snow sol stabilized solution treated surfaces shall be left unpainted for more than 2 (two) days. Gypsum based materials shall not be used for filling of exterior cracks while preparation of surfaces.

H) BEES WAXING OF POLISHING WITH READYMADE WAX POLISH (NEW WORK)

Materials: The polishing shall be done with bees waxing prepared locally or with readymade wax polish of approved brand and manufacture, as stipulated in the description of item. Where bees waxing are to be prepared locally, the following specifications for the same shall apply:

Pure bees wax free from paraffin or steering adulterants shall be sued. Its specific gravity shall be 0.965 to 0.969 and melting point shall be 630 C. The polish shall be prepared from a mixture of bees wax, linseed oil, turpentine and varnish in the ratio of 2:1.5:1:05 by weight. The bees wax and boiled linseed oil shall be heated over a slow fir. When the wax is completely dissolved, the mixture shall be cooled till it is just warm and turpentine and varnish added to it in the required proportions and the entire mixture shall be well stirred.

Preparation of Surface: Preparation of surface will be as mentioned herein under painting with the exception that knotting, holes and cracks shall be stepped with a mixture of fine saw dust formed of wood being treated, beaten, beaten up with sufficient bees wax to enhance cohesion.

Application: The polish shall be applied evenly with a clean soft pad of cotton cloth in such way that the surface is completely and fully covered. The surface is then rubbed continuously for half an hour. When the surface is quite dry, a second coat shall be applied in the same manner and rubbed continuously for one hour or until the surface is dry. The final coat shall then be applied and rubbed for two hours (more if necessary) until the surface has assumed a uniform gloss and is dry showing no sign stickiness. The final polish depends largely on the amount of rubbing which should be continuous and with uniform pressure with frequent changes in the direction.

Other details: The specifications for painting (general) as mentioned herein before shall hold good as far as they are applicable.

I) FRENCH SPIRIT POLISHING (ON NEW WORK WITH A COAT OF WOOD FILLER)

Polish: Pure shellac varying from pale orange to lemon yellow colour, free from resin or dirt shall be dissolved in methylated spirit at the rate of 140 gm. Of shellac to 1 litre of spirit. Suitable pigment shall be added to get the required shade.

Preparation of surface: The surface shall be cleaned. All unevenness shall be rubbed down smooth with sand paper and well dusted off. Knots if visible shall be covered with a preparation to red lead and glue size laid on while hot. Holes and indentations on the surface shall be stopped with glazier's putty. The surface shall then be given a coat of wood

Filler made by mixing whiting (ground chalk) in methylated spirit the surface shall again be rubbed down perfectly smooth with glass paper and wiped clean.

Application: The number of coats of polish to be applied shall be as described in the item.

A pad of wooden cloth covered by fine cloth shall be used to apply the polish. The pad shall be moistened with the polish and rubbed hard on the wood, in a series of overlapping circles applying the mixture sparingly but uniformly over the entire area to give an even level surface. A trace of linseed oil on the face of the pad facilitates this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh piece of clean fine cotton cloth, slightly damped with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall have a uniform texture and high gloss.

Measurement, Rate and other details: These shall be as for painting (general) mentioned herein before as far as they are applicable.

J) COLOURLESS LACQUER POLISH

Polish

Nitro cellulose lacquer polish of approved brand manufacture and finish shall be used.

Preparation of Surface

The surface shall be cleaned and all unevenness shall be rubbed down smooth with suitable grade sand paper and well dusted. Knots if visible shall be made good as per the direction of the OWNER'S ENGINEER/ Architects. Holes and indentation on the surface shall be stopped with glaziers putty. The surface then shall be given a coat of ready made ragging wood filler and allowed to dry for maximum 4 hours. The surface again shall be rubbed down perfectly smooth with suitable emery paper and wiped clean. There after a finishing touch up with ragging wood filler is to be given and allowed to dry. To receive the polishing the surface is again rubbed down smooth.

Application

Nitro cellulose sealer coat of approved manufacturer shall be applied strictly as per the manufacturers specification. The polish shall be applied with a sprayer at suitable pressure and viscosity as recommended by the manufacturer, and allowed to dry for 4 to 6 hours and rubbed down with suitable grade emery. The surface shall be again sprayed with 3 of NC lacquer (3 wet on wet coat). Finally the surface shall be given wax polishing by using rubbing compound.

K) MELAMINE POLISH

Glossy/ Matt

Apcolite Natural Wood finish clear glossy/ matt is a premium quality melaminised coating specially formulated as a protective and decorative finishing clear coating for wood.

Flash point : Above 14 degree C (57° F)

TECHNICAL DATA

Method of application	Brushing at 25-30 seconds by Ford Cup B4 at 30 degree C.
	Spraying at 20-25 seconds by Ford Cup at 30 degree C.
Thinner recommended	Brushing - Thinner 106
	Spraying - Thinner 124
Thinner intake	20-25% by volume
Mixing ratio	Base to hardener in 10:1 by volume
	8 hours
	Surface dry - less than 30 minutes

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Drying Time	Hard dry 16-20 hours
Recoating period	Overnight
Finish	25 microns film thickness smooth and glossy/ matt

Sand the surface along the grains with Emery Paper No.180 or with a suitable grade sand paper. Brush the surface free of loose dust. Fill the wood using Apcolite Wood Filler. Remove excess filler immediately after applications. Allow 2-3 hours of drying, before sanding with Emery Paper No.240 or 280. If desired, apply Apcolite Natural Wood Finish upto 20% by volume and apply by spraying after Sealer Coat. In application by ragging allow a drying time of 5-10 minutes in between coats and 30-60 minutes before over coating with finish coats. Apply a coat of Apcolite Natural Wood Finish Clear Sealer. After overnight drying, smooth sand with Emery Paper No.320 and wipe the surface free of loose dust. Apply Apcolite Natural Wood Finish Clear Glossy/ Matt as follows. Ensure that the surface to be coated is free from loose matter. Apcolite Natural Wood Finish Clear Glossy/ Matt is a two component system consisting of base and hardener. These should be mixed in the recommended ratio. The two components should be mixed in a glass, plastic or enamelled container. Allow the mixture to stand for 30 minutes and then apply by brushing or spraying using the recommended thinner for consistency adjustment. The mixture of base and hardener should be used within 8 hours.

L) CONSUMPTION OF PAINT FOR DIFFERENT PAINTING ITEMS

Sl no.	Brief description of painting work	Consumption per 10 Sqm. Of net
A	Oil bound distemper on plastered surfaces:	
1	Cement primer (one coat)	0.91 litres
2	Two finishing coats	1.60 kg
3	Three finishing coats	2.4 kg
B	Flat oil paint to plastered surfaces:	
1	Cement primer (one coat)	0.91 litres
2	Cement primer (two coats)	1.82 litres
3	Two finish coats	1.72 litres
C	Acrylic emulsion paint:	
1	Cement primer (one coat)	0.91 litres
2	Two finishing coats (two coats)	0.87 litres
3	Three finish coats	1.30 litres

D	Cement paint (old surface):	
1	Two coats on sand faced plastered surface	4.10 kg
2	Two coats on rough cast plastered surface	7.70 kg
E	Cement paint (old surface):	
1	Two coats on sand faced plastered surface	4.50 kg
2	Two coats on rough cast plastered surface	8.50 kg
F	Enamel paint to wood / steel:	
1	Wood primer (one coat)	0.90 litres
2	Steel primer (one coat)	0.75 litres
3	Two finishing coats on wood	1.40 litres
4	Two finishing coats on steel	1.35 litres
G	Flat oil paint to wood /steel work:	
1	Wood primer (one coat)	0.90 litres
2	Steel primer (one coat)	0.75 litres
3	Two finishing coats on wood	1.70 litres
4	Two finishing coats on steel	1.70 litres
H	External painting with flat oil paint:	
1	Cement primer (one coat)	1.00 litres
2	Two finishing coats	1.74 litres
	Re-painting old painted surfaces:	
1	Two coats of emulsion paint	0.86 litres
2	Two coats of flat oil paint	1.59 litres
3	Two coats of enamel paint	1.35 litres

(The consumption give is indicative only. Please check the respective vendors for more details and accurate figure. No escalation will be paid on account of increase in the consumption of paint)

M) MEASUREMENT

Painting on plastered or concrete surface shall be measured as for plastering. Painting on wooden or metal surfaces shall not be measured separately and is deemed to be included in the respective item for wood and MS respectively.

IS 1200 shall be followed for measuring all painting

PLUMBING AND SANITARY

A) GENERAL

Providing and fixing GI pipes and GI specials of approved ISI make cut to required lengths as per site conditions. The lines shall be concealed and protected using 1 coat of anti corrosive paint. The chasing of walls should be done as per the layout and should be filled with cement mortar. The pipes of various diameter should be used as specified in drawings, BOQ etc. The open lines shall be finished with 1 coat of primer and 2 coats of enamel paint. Both the lines shall be anchored to the wall using proper GI clamps. The lines shall be pressure tested to a maximum of 11 Kgs /sq.cm.for any leakage.

All sanitary ware shall generally conform to IS: 2556 Part I to XV unless stated otherwise.

All sanitary ware and CP fittings shall be new and of approved make, type and colour. All samples of materials with catalogues shall be submitted and got prior approved before use. Approved samples along with other approved materials shall be neatly displayed on a board and such a display board of samples shall always be in exhibition in the site office.

In cases where the materials are supplied by the clients, all such materials shall be inspected and received in good condition and thereafter, it will be totally under the safe custody of the tenderer/contractor till they are handed over satisfactorily after installation, testing and commissioning.

Wherever multiple choices of fixtures are mentioned, the final choice will be as per the joint decision taken by the client and the architect.

Indianw.c

Indian W.Cpan shall be Madurai/ Orissa pattern in white vitreous chinaware size as specified in the schedule of work. Each W.C shall be provided with a 100 mm dia vitreous chinaware P or Strap with or without vent horn, as required.

The water closet shall be provided with an exposed or concealed type C.P brass flush valve or flushing cistern as specified in the schedule of work. Flush valves shall have a suitable flow regulating facility. Discharge connection to the W.C shall be by means of approved type of flush bend.

Foot rests

Indian W.Cshall be provided wherever specified, with a pair of vitreous china foot rests at proper

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distance (where specified) on either side of the W.C.

Foot rests shall be set in cement mortar 1:2 mix. Edges shall be finished neatly with white cement.

Orissa W.C

Orissa W.C shall be in white glazed vitreous chinaware of size specified. The W.C shall be provided with a 100 mm white vitreous chinaware P or Strap with or without vents as required.

Each W.C shall be provided with an exposed or concealed type brass flush valve or flushing cistern generally as for Indian W.C.

European W.C

European W.C shall be wash down or siphonic, floor or wall mounted in white glazed vitreous chinaware with integral P or Strap as required. Wall hung W.C shall be supported by C.I or G.I floor mounted chair. The W.C shall be provided with an exposed or concealed type brass flush valve or flushing cistern as specified in the schedule of work.

Each W.C shall be provided with a solid plastic seat. The seat shall be fixed to the W.C with CP brass or S S pillar bar hinges. Rubber buffers shall be provided for the cover.

Urinals

Urinals shall be as specified in the BOQ / drawings in white glazed vitreous chinaware of size as per the approved product number of approved make/ brand.

Urinals shall be provided with:

- i) spreader
- ii) CP dome waste
- iii) CP P-trap with unions.
- iv) CP wall flange and pipe.

All exposed pipes and fittings shall be of C.P brass. The urinals shall be fixed with C.P brass screws.

Urinal flushing shall be through one of the following methods as specified in the schedule of work:

- i) Small urinal flush valve with push button.
- ii) Auto flush valve with DC long life battery or AC supply.

Auto flush shall be concealed in wall and flush pipe shall be of copper or G.I except the exposed parts which shall be C.P brass.

Waste pipe for urinals shall be any one of the following :-

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- a) G.I pipes, heavy quality as per 1.5 1239
- b) Lead pipes
- c) Copper pipes
- d) HDPE pipes as per IS 4984

as specified in the schedule of work or shown on drawings.

Urinal partitions shall be white glazed vitreous chinaware complete with CP brass screws, anchor fasteners etc. as required.

Lavatory Basin

Lavatory basins shall be ivory glazed vitreous china or poly marble or any other material and of size, shape and type specified in the schedule of work.

Each basin shall be complete with:

- i) C.I or galvanized steel supporting brackets and clips as required.
- ii) CP waste and overflow.
- iii) Pop-up waste or rubber plug with CP chain as specified.
- iv) CP P-trap with cleanout, unions, CP pipe to wall and wall flange
- v) CP control angle valve/s with CP connections.
- vi) Mixing or CP fittings as specified.

Sinks

The sink shall be of size specified in with glazed vitreous chinaware or stainless steel AISC 304 as specified., Each sink shall be complete with:

- i) C.I or galvanized steel brackets and clips as required.
- ii) Waste fitting with brass/ rubber plug and chain.
- iii) P-trap with clean out, unions, CP pipe to wall and wall flange.
- iv) CP control valve/s with CP connections.
- v) Mixing or CP fittings with spout as specified.

Mirrors

Mirrors shall be of approved make and sample and should be plate glass electro coated copper 6 mm thick and should be clear, distortion-less (at all angles) non-wavy. The size shall be as specified in the schedule of work.

Mirrors shall be provided with backing of 12 mm thick marine plywood fixed with CP brass semi round

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headed screws and cup washers or CP brass clamps as specific or instructed by Architect.

Semi Circular Channels

The channels shall be in white glazed vitreous chinaware with or without dead ends. They shall be laid to proper lines and levels and shall be set in a bed of 12mm thick cement sand mortar 1:2. The joints shall be finished with white cement paste and finished neat.

Towel rods and racks

They shall be of approved make and size as specified in schedule. The towel rod shall be provided with a pair of CP brass brackets fixed to the wall with CP brass screws with round head, using cup washers, screwed on to fill-plugs embedded in wall. The brackets shall be of concealed type.

Soap trays

The soap trays shall be of white glazed vitreous chinaware or stainless steel and of size specified in schedule.

Soap trays shall be fixed flush with the finished wall surface (tile surface) by cutting recess in wall and set in cement mortar 1:2. The wall surface shall be reinstated to original condition.

Soap Solution dispensers

They shall be chromium plated brass with CP brass brackets and CP brass cap. They shall be of approved make. They shall be fixed to the wall with CP brass screws, screwed on to fill-plugs embedded in wall.

Toilet paper roll holder

Toilet paper roll holder shall be of white glazed vitreous chinaware or stainless steel of size specified in schedule. It shall be of recessed type with wooden rod with spring at one end for holding the paper roll. The rate shall include cutting recess in the wall, fixing the holder with cement mortar 1:2 and rectifying the wall surface to original conditions.

Installation of Sanitary ware

All sanitary ware and CP fittings shall be installed in accordance with the interior requirements. Neat workmanship and maintaining exact position and level of each fixture shall be the sole objective of the installation. Care shall be taken to fix inlet and outlet pipes at correct positions. Faulty positioning shall be made good without any damage to the finished floor or wall tiling and any damage to the finished surfaces shall be made good at the tenderer / contractor's cost.

In order to ensure quality of workmanship and compliance with interior requirements, one or two mock-up installations shall be done and got approved. Fixtures used in the mock-up may be reused with the approval of the Architect.

All fixing accessories like bolts, nuts, brackets etc. may be supplied along with the ware as defined in the mode of measurement and schedule of work. All such accessories shall be CP brass or galvanized or stainless steel as approved by the Architect. All exposed pipes and bends shall be of CP brass.

The Indian W.C shall be fixed in level in a neat manner. The W.C and trap shall be set in brick bat 1:2:4 concrete mix. Joints between W.C and flush pipe shall be made with a putty or white lead and linseed oil and caulked well or with approved rubber joints. The joint between W.C and trap shall be made with 1:1 cement mortar and shall be rendered leak proof.

The Orissa W.C shall be fixed in level in a neat manner. The W.C and trap shall be set in brick bat concrete 1:2:4. Joint between W.C and flush pipe shall be made with putty of white lead in linseed oil and caulked well or with approved rubber joint. Joint between W.C and trap shall be made with 1:1 cement sand mortar and shall be rendered leak proof.

Wall-hung European W.C shall be mounted on C.I chairs which are fixed to the wall and floor using Anchor fasteners. The bolts and nuts used for fixing the chairs shall be stainless steel and the fixing bolts for the W.C and chairs could be CP brass or stainless steel. Floor-mounted W.C shall be fixed with Anchor fasteners using stainless steel bolts and nuts. The gap between the WC and floor or wall shall be neatly sealed with water proof non-hardening sealant of approved colour. The sealant should not extrude beyond the foot print or WC outline.

All W.C's shall be aligned and levelled with the floor and wall tiles so as to present an integrated look. Utmost care and skill shall be exercised to achieve a good installation in keeping with the interior designs.

Urinals shall be fixed to the wall using Anchor fasteners and stainless steel bolts and nuts. The urinals shall be held in line and level according to the interior designs and tile modules. Partitions, wherever required shall be provided, shall also maintain line and level as shown on drawings. Supply spreader and drain piping and P-trap shall be of CP brass and installed in a neat manner. No unseemly bends or wooden support pieces shall be permitted.

Wall-mounted lavatory basins and sinks shall maintain line and level as specified by the interior drawings and also with the tile modules. The supply connections shall be of CP brass from the angle stop valves to the pillar taps or single level fixture and shall display good workmanship. Drain connections shall have a CP P-trap with unions and exposed CP drain pipe and a wall flange. In the case of counter mounted basins and sinks, extreme care shall be taken to provide independent and adequate support for the basin and aligning it with the opening in the counter slab. Supply and drain connections shall be same as that for the wall mounted basins. The crevices between basin and wall or counter shall be neatly sealed with a non-hardening sealant of approved colour.

All accessories like the mirror, soap trays etc shall be neatly fixed as per interior designs. Good workmanship is the essence of all sanitary installation for achieving the interior design objectives.

Cast Iron Pipes and Fittings

Cast iron pipes shall be of 'LA' class conforming to IS 1536 suitable for lead jointing with spigot and socket joints and if flanged, they shall be of 'A' class conforming to IS 1537. Pipes shall be in maximum

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lengths available.

Fittings shall conform to IS 1538. Spigot-sockets shall be suitable for lead jointing.

Pipe Installation

Shop drawings for the routing of pipes shall be prepared generally on the basis of layout drawings issued. The shop drawings shall reflect the site conditions, structural beams and columns, obstructions by way of any construction elements or any other service pipes, ducts etc. The drawings should clearly indicate openings required in brick or concrete walls, drain valves at low points, air valves at high points, isolating valves, if any, and invert levels at every 15m intervals. The drawings should also indicate typical details of hangers, supports, brackets etc. After approval of the drawings, pipe routes shall be marked with a distinct colour of paint on the site and got it approved by the Architect.

All openings and chases in brick walls shall be made neatly and refilled to a reasonable finish. However, final finishing will be done by the civil contractor. Openings in concrete walls shall, however, be made only with the approval of the Architect. Pipe penetrations, through wall or floor, shall be sealed with an approved fire resistant sealant.

Good workmanship and neat pipe layout are the pre requisites of these specifications. Horizontal pipes shall be truly horizontal with necessary slopes and hangers or supports as specified and shown on drawings. Vertical pipes shall be truly vertical and shall be laid away from the walls at least by 10mm or as required by the Architect. All pipe runs shall be parallel to the ceiling or walls for presenting a neat appearance. Pipes buried in wall shall be laid in machine-made cases with galvanized steel anchors.

All pipes before and after testing shall be protected with wooden or brass plugs to prevent ingress of dust, sand or any extraneous matter.

Pipe supports; hangers and clamps

Pipe supports, clamps, suspenders shall be pre-fabricated and galvanized (after fabrication). Application of support systems shall follow the guidelines in the above specifications. Any other types of support, suspension or clamping to meet the site conditions shall be got approved before use.

All fittings shall be screwed type unless specified otherwise. However, flanged joints shall be provided at the following positions:

- i) Pairs of flanges for isolation and removal of equipment.
- ii) Mating flanges for equipment flange connections.
- iii) Mating flanges for valves, strainers, as the case may be.

EXTERNAL DRAINAGE: Trenches for drainage shall be carried out to the required level only. No refilling will be allowed for the purpose of making up bed of the trenches. Any excess excavation shall not be

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paid for, and shall be made good with well rammed and consolidated cement concrete M75 at the cost of the contractor, and for which no extra cost will be paid. The trenches shall be filled in and the earth shall be well rammed and properly consolidated. The surplus earth shall be placed or spread elsewhere, or near the site, or carted away free of charge as may be directed by the Architect. The Contractor shall at his own expense and without extra charge make provision for all shoring, pumping, dredging soil or sub soil and bailing out or draining out water or rain water and the trenches shall be kept free of water. When trenches are opened for laying the drainage, water pipes, or any other work and if the depth is over 1.2 M (or even less in low bearing soil) then the sides shall be closely and securely supported by suitable shoring.

B) MISCELLANEOUS

MANHOLES :- Manholes shall be circular and of conical shape with internal 600 MM dia opening at the top and internal 1 M to 1.2 M dia depending on the depth at the bottom. The required depth shall be provided at all junctions and change of directions. (Manholes can be rectangular only when the depth is less than 1.5 M. The size shall be 0.9 M x 0.45 M internal measurement) They shall be built in 230 MM brick wall in cement mortar 1:6 with cement plaster 1:4 smooth finish 20 MM thick from inside and rough finished from outside on a base of 230 MM cement concrete M100 projecting 150 MM beyond the brick work on all sides. Proper cement concrete channel shall be provided at the bottom and the branches from various pipes discharged in the channel with easy slope. The top of all the manholes shall be provided with cast iron circular air and water tight frame. In the case of any damage to the covers due to traffic or any other reason during construction or in the maintenance period, they shall be replaced immediately by the contractor at his own cost and if the damage is repeated, the Architects may demand heavier types than what are supplied and the contractor has to comply with the same without asking for extra charges. The frame and covers shall be painted with Black Bitumen Anti-Corrosive paint and space between cover and frame to be filled with bitumen. In deeper manholes, i.e. where depths are more than 1 M necessary cast iron manholes steps shall be provided, cost of which is to be included in the cost of manholes and nothing extra shall be paid.

Portland cement shall be thoroughly mixed dry with sand in the proportion of 1 to 3 with approved water-proofing compound added as per manufacturer's specifications. Water shall be then added gradually to make the mixture homogenous. Cement mortar shall be mixed which can be used within half an hour. The joints between the stones or bricks will be raked out to a depth of 12 MM and the surface shall be thoroughly watered and the mixture of sand and cement applied evenly on all surfaces that needs to be plastered. The surface shall be finished off with a thin layer of cement floating. The plaster work shall be kept thoroughly wet for a period of seven days. Thickness of plaster shall be 20 MM thick.

Stoneware Pipes and Fittings : All the stoneware pipes, bends, gully traps and sewer traps, etc., shall be of the best salt glazed variety, of a uniform thickness, free from air holes, blisters, cracks, hard sound and free from other imperfection and external and internal surfaces shall be smooth and perfectly glazed and perfectly straight. They shall be of best approved Indian make and of approved quality. The diameter mentioned shall be their internal diameter and the thickness. A piece of stoneware pipe after 48 hours immersion in water shall absorb not more than 4 % of its own dry weight. If the Architect for

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his own satisfaction takes test to determine the yielding point of any or every pipe by any known method in Engineering Practice, the contractor has to pay for the same without demanding extra. The internal diameter of the socket shall be sufficiently large to allow a joint of 6 MM thickness all-round. Joints in stoneware pipe shall be made perfectly air sealed and neatly finished, the spigot and socket should be thoroughly cleaned specially at the inner side of the pipes. Cracked pipes whether at the socket or on the body, shall be rejected. The socket ends of pipes shall always face upstream of effluent flow. The drains shall run in perfectly straight lines between manholes as shown on plans. No trenches shall be filled in until the foundations have been tested and alignment of the drain and connections into and from the manholes and their positions are examined and certified by the local authority and the Architects. The pipes shall be laid in perfect straight line to a desired slope.

While laying drain pipes, the centre of each manhole or water gully must be marked by peg or otherwise as may be determined by the Architects.

The pipes are to be laid beginning at the lower end. No pipe is to be laid until the trenches have been excavated to its required depth as directed by the Architect. All pipes are to be laid perfectly true, both in line and in gradient. The pipes in a trench shall be laid dry and all joints of the pipes must be made thoroughly sound and water tight, and any one of them which may be proved to be leaking, shall be immediately made tight by filling it with water to a height as the Architect may determine. Any additional precautionary measures or appliances that may be found necessary to ensure tightness of the manholes or water gullies and the joints of pipes shall be adopted by the contractor without any extra charge, the responsibility of making them completely water-tight rests upon the contractor. The Architect may inspect the joints after the pipe joints in underground work have thoroughly set, and if he has any doubt, he may require the contractor to cut open and clean away the cement of any joint that he may select and to make good the same at contractor's cost without asking for extra.

Whenever a pipe enters or exits a manhole, brick on edge must be cut to a proper form and laid around the upper half of the pipe so as to form an arch. There shall be a joint of cement mortar 12 MM thick all-round the pipe between the pipe and the bricks. The ends of all pipes shall be properly built in and neatly finished off with cement mortar. The Gully Traps shall be 150 MM x 100 MM and of best quality. They shall be encased in bricks and cement masonry (1:6) with cement plaster (1:4) forming an inspection chamber with cast iron full size frame and cover 230 MM x 300 MM. The sewer trap of required size shall be installed in the last manhole.

Spigot and socked 150 MM C.I. pipes shall be heavy pattern (weighing not less than 46 Kgs per meter run) for the portion going below the floor and embedded in the walls. These shall be embedded and laid over 150 MM thick cement concrete and laid to a slope and connected to the drain. On no account lime or lime concrete is to come in direct contact with cast iron pipe or fittings.

The pipes shall be carefully laid to the level and gradient shown on the plans and sections and great care shall be taken to prevent any material entering the pipes. The pipe between manholes shall be laid truly in straight line without vertical or horizontal undulations.

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Cement shall be slightly moistened and on no account it should be soft or sloppy and it shall be carefully inserted by hand into the joint. When the current has been inserted it shall be punched and caulked in to the joints and more cement added until the space of the joint has been filled completely with tightly caulked cement. The joint shall be finished off neatly outside the socket at an angle of 45 degrees. Any surplus cement projecting inside the joints is to be removed and to guard against any projections sack or gunny bag shall be drawn past each joint after completion. The contractor shall be responsible that each section of pipe is properly cleaned out on completion of the work.

Cast Iron Pipe Work: All cast iron pipes, fittings shall be of approved make and shall conform to IS codes and should be free from flaws, air bubbles, cracks, sand holes and other defects, truly cylindrical and in uniform thickness. They shall not be brittle, but shall allow of ready cutting, chipping and drilling and shall be 10 MM thick, and of the diameter (diameter mentioned shall be the internal diameter) mentioned in the Schedule of Quantities and shall be of the longest length available and shall be fixed against the wall on special iron nails and bobbins fixed to the wall by means of round headed nails painted with two coats of approved paint. All the joints shall be caulked with tarred gasket of hemp or spun yarn and cement mixed with linseed oil to render perfectly air and water tight joint.

150 MMC. I. socket and spigot pipe shall be of the heavy duty (weighing not less than 46 Kg/ M run) for the portion going below the floor or embedded in the wall. This shall be laid to slope and shall be encased in cone 300 MM x 300 MM and connected to the Municipal or other drain line.

The C. I. Nahni traps of approved make shall be 115 MM in height and 350 MM long and shall be embedded in the concrete floors with c. c. M-100 all-round. They shall be connected by means of 75 MM lead pipes of specified weight and thickness with thimbles, tail pieces and inspection caps fixed to the lead pipes by lead wiped joints or by 75 MMC. I. Nahni plug bend to suit the thickness of wall. The Nahni trap shall be provided with C. P. brass grating.

The lead used caulking joints of cast iron pipes shall be pure soft pig or bar lead free from all impurities and the rates of pipe shall be inclusive of all that is mentioned above. All vertical soil waste vent pipes shall be arranged straight in manner. The joints in the rainwater pipes shall be filled in with gasket of hemp or spun yarn and cement mixed with linseed oil, For underground usage the thickness and weight of cast iron pipe shall not be less than those shown above. All cast iron pipes and fittings shall be treated with two coats of approved compounds to prevent oxidation and two coats of anti-corrosive paint should be applied afterwards.

All cast iron pipes, fittings etc. shall be best E. L. C. and of approved make of the diameter mentioned which shall be their internal diameters. The thickness of the pipes shall be as follows: -

Diameter	150MM
50MM	
65MM	
75MM	
100MM	

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Thickness

3MM

3MM

5MM

5MM

6MM

Cast Iron soil pieces shall be 100 MM diameter, 5 MM thick, and coated (internally) with Dr. Angus Smith's solution. The fittings for soil pipes shall also be treated similarly. The 100 MM soil pipes shall be in the longest available lengths and shall be fixed to the walls on tapered hard timber 50 MM x 50 MM x 50 MM gutties plugged to the stone or brick-walls or C.I. taper bobbins so as to keep the pipes 20 MM clear of the bricks walls. They shall be with socket and spigot ends, fixed in perfectly vertical and horizontal lines with all necessary fittings. The joints between C. I. pipes shall be filled in with cement mixed with linseed oil, gasket and caulked nicely.

Asbestos Cement Pipe Work: All A.C. pipes, fittings shall be of approved make and conforming to I. S. S. and free from flaws, air bubbles, cracks, sand holes and other defects, truly cylindrical and in uniform thickness. They shall not be brittle, but shall allow of ready cutting, chipping and drilling, and shall be 5 MM thick, and of the diameter (diameter mentioned shall be their internal diameter) mentioned in the Schedule of Quantities and shall be of the longest length available shall be fixed against the wall on special iron nails and bobbins fixed to the wall by means of round headed nails painted with three coats of approved paint. All the joints shall be caulked with tarred gasket of hemp or spun yarn and red lead putty to render perfectly air and water-tight joints.

Lead Pipes: (for soil waste and vent pipes) shall be used only for short branch soil waste or vent connections.

Joints of lead pipes shall solder wiped joints. All joints of fittings shall be made perfectly air and water - tight.

Joints between lead and brass shall be wiped joints. Joints between lead pipe and wrought iron pipes fittings shall be made with heavy soldering ferrules, screwed to the iron pipe fittings.

Joints between lead and cast iron pipes shall be made with soldering or flanged thimbles soldered and caulked with lead in the usual manner.

Cast brass clearing eyes shall be provided at all points, intersection and changes of direction and these shall be secured by means of wiped solder joints.

Rainwater Pipes: Rainwater pipes shall be of Cast Iron conforming in every respect Indian Standards as may be revised up-to-date. They will be maintained perfectly straight from the tip to bottom of the building. The inlet shall be provided with lead connector with C. I. grating of approved design. Rainwater pipes will terminate at 150 MM above ground level by means of a shoe. All the above fixtures shall be included in the rate of rainwater pipes.

Water Supply Pipes and Fittings: All water supply pipes shall be of 'C' class quality and as required by the Bye Laws of Local Corporation or I. S. S.

Water pipes shall be of Galvanized iron specified internal ICs etc. in perfect straight lines, both vertical and horizontal. The pipes in the interior of the building shall be fitted with M. S. seamless fittings and covered with asbestos twine and asbestos magnesia powder and shall be embedded in chases filled in

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with cement concrete. The pipes laid under the floor shall be painted with bitumen and embedded in concrete. The pipes, where exposed on the surface, shall be coated with aluminium paint as specified. The pipes running underground shall be laid after excavating trenches to a minimum depth of 0.6 M and the trenches shall be refilled after the pipes are laid to position.

These shall be measured in Running Metre and the rate shall be inclusive of all fittings, paint and coverings and cost of crust and chase and filling them with concrete, if inside the building and cost of excavating trenches and refilling, if laid underground.

Inspection chamber to be provided in Brick Masonry of 230 mm thick intercepting trap chamber 90 x 45 centimetre including 1:4:8 cement concrete foundation, 1:2:4 cement concrete channels/ half round glazed stoneware pipe channel, salt glazed stoneware intercepting trap with rodding pipe set in 1:4:8 cement concrete block, plastering inside and outside Cast iron lid with frame to be fixed in cement concrete.

MISCELLANEOUS

A) STAINLESS STEEL RAILINGS

The work shall be carried out as described and as per the drawing.

All rails and other tubular components shall be constructed using the following:

Stainless steel grade AISI, type 316; surface to be 320 grain/grit finish; tubes 1-1/2" {38mm} outside diameter by 5/64" (2 mm) wall thickness.

All posts and other components shall be constructed using the following:

- a) Stainless steel grade AISI type 316, surface to be 320 grain/grit finish; posts to be 2" (50 mm) by 1/2" flat bar, finish and final design to be strictly in accordance with d line design guidelines.
- b) Stainless steel grade AISI type 316, surface to be bead blasted for: component fittings including handrail attachment support and post attachment components strictly in accordance with d line design guidelines.
- c) Fastening bolts to be stainless steel or other high strength material as determined by engineering requirements

Fasteners for railings

- a) Anchors shall be fabricated from stainless steel or other materials as determined by engineering requirements with capability to sustain, without failure, load imposed within a safety factor of 4, as determined by testing per ASTM E488.

Fabrication

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- a. Fabricate railing system for compliance with structural requirements of applicable code.
- b. Pre-assemble railings prior to shipping to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and for coordination with shop drawings.
- c. Stainless steel tubing cuts shall be square, without burrs and where exposed, rounded to produce smooth rigid and hairline joints

Installation

Installation shall be by **done** a qualified, authorized representative of the manufacturer.

Installation must be in accordance with standard or non-standard, yet applicable details (instructions) included on installation/shop drawings provided by **the manufacturer**.

Install components plumb and in-line, accurately fitted, free from distortion or defects and securely anchored to structure.

Provide anchors, plates, angles, etc., necessary for connecting railings to structure.

Any and all field welding shall be by a certified welder.

Access for anchors that require through bolting either vertically or horizontally to be made available through General Contractor.

Erection tolerances

Maximum variation from plumb shall be 1/4".

Maximum offset from true alignment for every 50-foot of railing shall be 1/4", non-accumulative.

Protection after installation

General contractor to provide protective covering on handrails and guardrails if construction is not yet finished in the area where the railings are installed.

Correction of deficiencies

All deficiencies in work and/or items not meeting specified requirements shall be corrected in order to meet specification requirements at no additional cost to owner.

B) M.S. GRILLS/RAILING

Materials:

All structural steel shall conform to IS 226-1963 sections for grills and shall be free from loose mill scales, rusts, pitting or any other defects affecting its strength and durability.

Fabrication :

The grill/railing shall be fabricated to the design and pattern shown in the drawings. All joints shall be made in best workman like manner with slotting and welding as required to the specified size and shape. The edge of the M.S. flats shall be suitably mitred before welding to get the desired shape. The

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joints shall be filled to remove excess stay after welding screws, nuts, washers, bolts, rivets and any other miscellaneous fastenings devices shall be of steel and shall be provided by the contractor. Manufactured Rails then be fixed in between the posts, balusters, M.S. frame work etc. to correct alignment. Any undulations, bends etc. found shall be rectified by the contractor at his own cost. The complete assembly of railing so fixed shall be firm and there shall not be any lateral movements.

Samples:

Samples of grill and railings shall be submitted for approval of the Engineer-in-charge and to be got approved before taking up for mass fabrication.

Installation:

The approved grills shall be fixed in position where specified and shown in drawings including in masonry walls, teakwood frames, hand railings etc. Any damages to walls, frames etc. caused during fixing the grills shall be made good by grouting with cement mortar/packing /repairing properly at the contractors cost.

Painting:

Painting shall be done as per the specification specified under painting.

Mode of measurement:

The railing shall be measured correct to two decimal places. Only the running length of the railing shall be considered for payment. Individual rails not to be measured separately.

The rate is to include the cost of all materials, labour, transporting, fabricating, installing, scaffolding if necessary, painting, grouting etc. complete.

C) TOILET CUBICLES

Toilet cubicles shall be of size as per drawings and BOQ. They should be of approved make and series as approved by the Architect. The following are the additional specifications for the toilet cubicles

Cubicle Size	As per the drawings Received
Quantity	As per BOQ
Thickness of Merino Compact Laminate Board	18 mm
Door Size	As per drawing
Colour of Merino Compact Board	As per Architect's approval

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Standard Accessories Details (Per Cubicle Unit)	<p>Accessories:</p> <ol style="list-style-type: none"> 1. SS Top Rail (Stainless Steel Grade 304 with Satin Finish) 2. SS Coat Hook with Door Stopper Option (Stainless Steel Grade 304 with Satin Finish) 3. SS Gravity Hinges (Stainless Steel Grade 304 with Satin Finish) 4. SS Latch cum Occupancy Indicator (Stainless Steel Grade 304 with Satin Finish) 5. SS "U" Channel (Stainless Steel Grade 304 with Satin Finish) 6. SS "F" Channel (Stainless Steel Grade 304 with Satin Finish) 7. SS Palm Design Adjustable Foot (Stainless Steel Grade 304 with Satin Finish) 8. SS Screws and Inserts (Stainless Steel Grade 304 with Satin Finish) <p>Rubber Lining for Door Stopper</p>
<p>Special Note: All accessories will be Stainless Steel as per manufacturer's specifications</p>	

D) FIRE SEALS **PREAMBLE TO FIRE SEALS**

- 1) A specialised agency is to be appointed to cover all the items under this head

- 2) Necessary test certificates to be submitted by the vendor and manufacturer to provide fully tested and internationally approved systems for a vast variety of fire stop applications

Fire Barrier mortar

Fire Barrier mortar should have a minimum 2 hours fire rating when tested in accordance with BS 476 part 20 and UL 1479 for horizontal openings in fire rated floors or slabs and vertical openings in walls for passing service shafts. The product shall be age tested for 30 years as per DAFSTB and DIBT standards. The product shall be tested and approved by third party agencies such as UL, FM and LPCB.

This is used for Fire stopping for sealing of Refrigerant Service Shaft, Fire Fighting Shaft and Plumbing Shaft and openings in the Wall and Floor penetration.

Fire resistant board system

Fire resistant board system should have a minimum 2 hours fire rating when tested in accordance with

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BS 476 part 20 for horizontal openings in fire rated floors or slabs and vertical openings in walls for passing service shafts. The fire resistant board system shall comprise of a mineral wool board having a minimum density of 160Kg/m³ coated with an ablative coating at 1mm dft.. The product shall be age tested for 30 years as per DAFSTB and DIBT standards. The product shall be tested and approved by third party agencies such as FM and LPCB.

This is to be used sealing for Electrical Shaft Openings/ HVAC Duct Openings.

Fire expanding foam

Fire expanding foam should have a minimum 2 hours fire rating when tested in accordance with BS 476 part 20 and UL 1479 for horizontal openings in fire rated floors or slabs and vertical openings in walls made of concrete/ masonry or Gypsum for passing service shafts. The expanding foam should expand *seven* times its volume to fill the cavity at the time of dispensing the material. The product shall be age tested for 30 years as per DAFSTB and DIBT standards. The product shall be tested and approved by third party agencies such as UL, FM and LPCB.

For small/ medium size Cable Tray Openings

Sprayable Fire-rated Mastic

Sprayable Fire-rated Mastic should be used in curtain wall joints, edge of slab joints, top of wall joints and expansion joints in Concrete, Masonry and Gypsum to give 2 hours of fire rating when tested as per UL standards. The product is to have up to 50% Movement Capability and Sound Insulation of SSdb as per ASTM E90.

This product should be suitable for sealing joints in curtain walls

Fire Stop for core cuts

The fire stop System for Slab and Wall Core Cuts shall be as per manufacturer's specification,

The diameter should be as per the site conditions

It should have a minimum 2 hours fire rating when tested in accordance with BS 476 part 20 and UL 1479

Acrylic Intumescent sealants

Acrylic sealants are acrylic intumescent based materials of putty consistency with excellent adhesive and fire resistance properties. Sealants are used to prevent the spread of fire and smoke through joints and gaps in fire rated walls and floors and around service penetrations. When exposed to the heat Acrylic Sealant expands forming an insulating char thus preventing the passage of fire and smoke. The choice joint sealant shall be determined by the configuration and the requirement for the degree of

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movement in substrates. Supply and Installation of System will done by authorized Dealer and Installer
The system will be supported by a valid International Test report of the complete system as per BS 476 part 20

MODE OF MEASUREMENT

Note: Measurements shall be recorded only up to two digits after decimal point

ITEM	UNITS OF MEASUREMENT
Pest Control	Sqm of Carpet Area and not area of application
Demolition of walls up to 175mm thick (with plaster)	Sqm
Demolition of walls greater than 175mm thick (with plaster)	Cum
Breaking of IPS	Sqm in required thickness
Removal of existing Plaster, tiles, flooring	Sqm
Core cuts	Nos
Making openings in wall	Sqm mentioning the thickness.
POP Punning/Gypsum Punning	Sqm
Gypsum False ceiling	Sqm. Verticals of all heights to be paid separately in Sqm
Modular false ceiling	Sqm as per laid area. No deductions for light fittings
Modular ceiling 1200x1200mm	Sqm. Rate to include band rasters
Trims, Axioms and band rasters	Rmt. Different widths to be paid separately
Double skinned Gypsum Partition	
GI Frame work	Sqm, up to true ceiling
Glass wool insulation	Sqm, up to true ceiling
First Skin of Gypsum	Sqm, up to true ceiling. Running length of the Partition multiplied by the height
Second Skin of Gypsum, ply	Sqm. Mode of measurement to be actual area on both sides
Modular Partition	Sqm. Mode of measurement, up to false ceiling. Rate to include single skin Gypsum above the false ceiling as described in the BOQ

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Modular Glass Partition	Sqm. Mode of measurement, up to false ceiling. Rate to include single skin Gypsum above the false ceiling as described in the BOQ.
Panelling and Boxing	Sqm. All portions hidden behind the boxing will not be measured. Height of boxing will be not be greater than false ceiling height
Doors	Nos. The rate to include shutter, finishes on shutter, frame, finishes on frames, all hardware like hinges, door closer, vision panel (if applicable), floor spring, locks, handles etc as specified in the Drawings/BOQ
Loose furniture	As per BOQ
Storages	Sqm. ELEVATIONAL area for a specified thickness
Paint	Sqm.
Cavity floor	Sqm for a thickness as specified in the BOQ
Vinyl floor	Sqm. The rate to include skirting
Wooden floor	Sqm
Skirting	Rmt.
Frosted Film	Sqm
Railing	Rmt of the Railing. Individual Pipes not to be paid separately
Wall Paper	Sqm

CALIBRATION OF EQUIPMENTS

Contractor must keep the measuring devices to check the products for adherence to the specifications and quality mentioned in the tender documents.

Measuring devices as mentioned below must be kept at site along with the calibration report of the device used:

1. Metal Tape
2. Vernier Calliper
3. Screw Gauge
4. Pressure Gauge

It is the responsibility of the contractor to provide calibration report of each device mentioned above. In case the validity of the certificate expires, then the contractor has to either bring a new device with valid certification or get the old device re-certified through the accreditation agency.

All the measuring devices used at the time of execution for testing and checking of products should be calibrated from **National Accreditation Board for Testing and Calibration, Laboratories Assessed and Accredited Agency.**

MODE OF MEASUREMENT

Note: Measurements shall be recorded only up to two digits after decimal point

ITEM	UNITS OF MEASUREMENT
Pest Control	Sqm of Carpet Area and not area of application
Core cuts	Nos
Making openings in wall	Sqm mentioning the thickness.
POP Punning/Gypsum Punning	Sqm
Gypsum False ceiling	Sqm. Verticals of all heights to be paid separately in Sqm
Modular false ceiling	Sqm as per laid area. No deductions for light fittings
Modular ceiling 1200x1200mm	Sqm. Rate to include band rasters
Trims, Axioms and band rasters	Rmt. Different widths to be paid separately
Double skinned Gypsum Partition	
GI Frame work	Sqm, up to true ceiling
Glass wool insulation	Sqm, up to true ceiling
First Skin of Gypsum	Sqm, up to true ceiling. Running length of the Partition multiplied by the height
Second Skin of Gypsum, ply	Sqm. Mode of measurement to be actual area on both sides
Modular Partition	Sqm. Mode of measurement, up to false ceiling. Rate to include single skin Gypsum above the false ceiling as described in the BOQ
Modular Glass Partition	Sqm. Mode of measurement, up to false ceiling. Rate to include single skin Gypsum above the false ceiling as described in the BOQ.

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Panelling and Boxing	Sqm. All portions hidden behind the boxing will not be measured. Height of boxing will be not be greater than false ceiling height
Doors	Nos. The rate to include shutter, finishes on shutter, frame, finishes on frames, all hardware like hinges, door closer, vision panel (if applicable), floor spring, locks, handles etc as specified in the Drawings/BOQ
Paint	Sqm.
Skirting	Rmt.
Frosted Film	Sqm
Railing	Rmt of the Railing. Individual Pipes not to be paid separately
Wall Paper	Sqm

APPROVED MAKE LIST

LIST OF APPROVED MAKES / MATERIALS TO BE USED FOR CIVIL WORKS SI No	ITEM/ MATERIAL	MAKES
1	Cement 43/53 - OPC	'Cement shall be procured from the reputed firms as per Indian Standard Codes/BIS as amended upto date only shall be used duly taking the approval from the Engineer- in - charge of the work (Not below the rank of Executive Engineer) prior to execution Ultratech, Ambuja, Grasim, JK, Binani, Dalmia Cement, Kalburgi Cement
2	Steel	Steel shall be procured from the reputed firms as per Indian Standard Codes/BIS as amended upto date only shall be used duly taking the approval from the Engineer - in - charge of the work (Not below the rank of Executive Engineer) prior to execution .

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3	Ready Mix Concrete (RMC)	The contractor has to arrange/establish concrete batching plant for RMC with all testing equipments etc., at site only. No Ready mix concrete shall be used on the work, purchased from the manufacturers or suppliers away from the vicinity of work spot beyond one Km.
4	Flush Door Shutters	Kit ply, Duraboard, Merino Ply Kutti /Anand/ Raveela / Subhdwar
5	UPVC Sections	Fenesta/ Rehau /NCL/Aparna
6	UPVC Fixtures for wood and iron works	Fenesta/ Rehau /NCL/Aparna
7	Ceramic Tiles Dadoing Tiles	Johnson/ Somani/ Kajaria
8	Flooring Tiles	Johnson/ Somany / Kajaria
9	ACP Cladding	Alcopanel/ Alcomat/ Alstrong/ Durabuild
10	Structural glazing & Glass	St.Gobain/ Glaverbel
11	MS Tubes	TATA/ Khandelwal / Zenith
12	GI Sheets	Jindal/ TATA
13	Paints (a) Synthetic enamel paint, Oilbound distemper	ASIAN/ NEROLAC/ ICI / BERGER
	b) White primer coat external walls	JK/ BIRLA/ ICI /BERGER/ASIAN
	c) Texture Paint	Spectrum
14	Water Proof Compound	FOSROC / MC Bauchemie / Pidilite /MYK
16	Mortice Locks	Godrej /Dorma / Link/ Dorset/ Sobeet

ELECTRIFICATION WORKS

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SNo	Materials	Preferred Make
1.	EDO / MDO 3P/4P ACBs	SIEMENS/ SCHINDLER/ L&T
2.	MCCBs / MCBs / ELCBs (3P / 4p / DP/ SP)	SIEMENS/ SCHINDLER L&T Hagar
3.	Analog/ Digital Meters	CONZERV
4.	CTs	IMP
5.	Indicating Lamps	TEKNIC
6.	Connectors	Connectwell
7.	650V Grade FR wires	Finolex / Polycab
8.	1.1 KV Power and Control CU/ Al Conductor Cables	Polycab
9.	GI Ladder Tray	Approved local make
10.	Earth Pit Material	Approved local make

PLUMBING AND SANITARY WORKS

PLUMBING AND SANITARY WORKS**LIST OF APPROVED MAKES FOR EQUIPMENT & MATERIALS****DIESEL GENERATING SET INSTALLATION**

S. No.	Details of Materials / Equipment	Manufacturer's Name
1.	Diesel Generating Engine	Cummins India MTU Friedrichshafen Caterpillar Mitsubishi
2.	Acoustic Enclosure	Jakson S & W TIL Mitsubishi
3.	Alternator	Stamford Leroy Somer Caterpillar Mitsubishi
4.	DG Synchronizing Panel	Electro Allied Products Sterling Generators
5.	Air Circuit Breaker (3/4 Pole)	ABB (E-Max) Larsen & Toubro (U-Power) Schneider Electric (Master Pact NW) Siemens (3WL)
6.	Moulded Case Circuit Breaker (MCCB)	ABB (T – Max) Larsen & Toubro (Dsine) Schneider Electric (Compact NSX/ NS) Siemens (3VL)
7.	Miniature Circuit Breakers (MCB)	ABB Hager (L&T) MDS Legrand Schneider Electric–(Multi 9) Siemens
8.	Power/Aux. Contactor	Schneider Electric Larsen & Toubro ABB Siemens

S. No.	Details of Materials / Equipment	Manufacturer's Name
9.	Protection Relay	
	a. Numeric Type	ABB Areva Larsen & Toubro Siemens
	b. Electromagnetic Type	ABB Areva Larsen & Toubro
10.	Indicating Lamps LED type and Push Button	Larsen & Toubro (ESBEE) Schneider Electric Siemens Vaishno
11.	Overload relays with built in Single Phase preventer	Schneider Electric Larsen & Toubro ABB Siemens
12.	Electronic Digital Meters (A/V/PF/Hz/KW/ KWH) with LED Display	Conzerv (Schneider Electric) Automatic Electric EI Measure Secure
13.	Static Power Meter & Logger (SPML) With RS 485 port	Conzerv (Schneider Electric) Larsen & Toubro EI Measure
14.	PLC	Allen Bradley Siemens Modicon (Schneider Electric)
15.	PVC insulated XLPE aluminium/copper conductor armoured MV Cables upto 1100 V grade	Finolex Gloster KEI Polycab Ravin Cables Grandlay
16.	LT Jointing Kit / Termination	Raychem REPL Safe Kit

S. No.	Details of Materials / Equipment	Manufacturer's Name
17.	Cable Glands Double Compression with earthing links	Baliga Lighting Comet Cosmos
18.	Vibration Isolators	Cori Dunlop Kanwal Industries Corporation Flexionics
19.	Noise Control Silencer / Muffler (Residential Type Silencer)	Intertec Sound Control India
20.	Fiberglass	Owens Corning UP Twiga
21.	Thermometer	Emerald H Guru Taylor
22.	Alarm Annunciator	Advani Oralikon Larsen & Toubro Minilec
23.	Motors (Energy Efficient Class – I)	Kirloskar Bharat Bijlee Siemens ABB
24.	Plug Valve	Audco SKS
25.	GM / Forged brass Ball Valve	RB Italy Zoloto
26.	Check Valve Wafer Type / Dual Plate	Advance Valve Jayhiwa Kirloskar
27.	Flexible Pipe Connections	Flexionics Resistoflex
28.	Pypcoat (AW4) for fuel tank & Burried oil	IWL

29.	piping Oil Flow Meter	Crown Kent Schlumberger
30.	Level Indicator (Oil)	Forbes Marshall
31.	Anchor Fastner	Fisher Hilti Shakti
32.	GI Pipe Fittings	Unik Zoloto M
33.	Welding Rod	ADOR Advani

**LIST OF APPROVED MAKE
ELECTRICAL WORK (HT)**

SL. NO.	DETAILS OF MATERIAL	NAME OF MANUFACTURERS
1.	Indoor/ Outdoor Oil Filled Transformer :	Areva Intra Vidyut Kirloskar RPG – Raychem Voltamp Schnider ABB
2.	Cast resin dry (EPOXY) type transformer :	Intra Vidyut Kirloskar RPG – Raychem SGB, Germany (DTPL, India) Voltamp Schnider ABB
3.	Vacuum impregnated resin dry type transformer	Voltamp
4.	VCB	ABB (up to 11 KV) AREVA Siemens

		Schneider Electric (Evolis) (Up to 11 kV)
5.	Compact substation: 6.6KV/11 KV	ABB AREVA Schneider Electric Siemens Voltamp (with dry type Transformer only)
6.	Compact HT Switchgear / RMU:	ABB AREVA C&S L&T (TAMCO) Siemens Schneider Electric.
7.	Numeric Type Protection Relay	ABB AREVA L & T Schneider Electric Siemens
8.	Potential Transformer	AE Kappa Matrix Pragati
9.	Current Transformer (Cast Resin Epoxy Coated)	AE Kappa Matrix Pragati
10.	Static Power Meter & Logger (Trivector Meters)	AE El Measure Larsen & Toubro Rishabh Secure Schneider Electric(Conzerv) Socomec

11.	Electronic Digital Meter (A/ V/ PF/ HZ/ KWH) with LED Display.	AE El Measure Larsen & Toubro Rishabh Secure Schneider Electric(Conzerv) Socomec
12.	HRC Fuse and Fuse Fitting	GE L & T Siemens
13.	Battery Charger & Batteries	HBL Life AMCO Exide Amar Raja Global (Rocket) Hitachi Max Power Shinkobe
14.	Insulating Mats	Commercial Enterprises DL Miller & Co. Ltd. Premier Polyfilm Ltd. RMG Polyvinyl India Ltd.

**LIST OF APPROVED MAKE
(HVAC work)**

S.No.	Details of Materials / Equipment	Manufacturer's Name	
		Imported	Indigenous
1	Magnetic Bearing oli free centrifugal turbo core Chiller	Carrier	
		Trane	
		Climaveneta (Mitsubisi Eletric)	
		York (Johnson Control)	
2	Heat pumps	Bluebox	
		Climaveneta	
		Trane	
		York (JCI)	
3	Variable Refrigerant Flow System	Daikin	

		Hitachi	
		Mitsubishi	
		Toshiba	
4	Primary Pump (Split casing/Monobloc) & Condenser Water Pump.	Armstrong	
		TACO	
		Bell & Gosset	
5	Secondary CHW/HW pump with Variable Speed Pumping System including following :		
	Adjustable Frequency Drive	Armstrong	
	Automatic AFD Bypass	TACO	
	Pump Controller / Tertiary loop controller	Bell & Gosset	
	Differential Pressure Sensor /Transmitter		
6	Pressurized Expansion Tank and Air Separator		Armstrong
			Grundfoss
			ITT
7	Air Handling Unit	Carrier	
		Edgetech	
		ETA	
		VTS-TF Class I	
	Air Handling Unit accessories such as Corners, Profiles, Hinges, Handles etc		HiraArosio
			VTS-TF Class I
	Cooling Coil for AHU	To be manufactured by individual supplier as indicated above	Carrier
			Hi-Tech
			International Coil company
			Nutech
8	Precision AC unit	Blue Box	

		Climaveneta (Mitsubisi Eletric)	
		GEA	
		Stulz	
9	Active under Floor System for Data Centre	Titus Uniflair(Schneider Electric) Trox	
10	Split Unit (5 Star as per BEE) / Package Unit		Blue Star Carrier ETA
11	Split Unit (with Refrigerant R-410A/R-407c)	Toshiba Trane York	
12	Fan Coil Unit	Midea Sinko York	Carrier Edgetech VTS
13	Chilled Water Cassette Unit	Carrier Climaveneta Midea Mitsubishi	Carrier DAIKIN VTS
14	Variable Air Volume Box (Unit)	Honeywell Titus Trox	Systemaire Honeywell
15	Cooling Tower	Baltimore GEA Polacel Marley	Bell Marley GEA Polacel
16	Centrifugal Fan	KRUGER NICOTRA Flaktwoods ELTA	Nadi Nicotra Humidin
17	Mixed flow fan	Flakt Kruger	
18	Plug fans	NICOTRA/KRUGER	

19	Axial Flow Fan	KRUGER	Kruger
		NICOTRA	Nadi
		Flaktwoods	
		ELTA	Nicotra
20	Inline / Propeller Fan / Roof extractor Fan	Chaysol	Air flow
		Nuaire	Alstom
		Ostberg	Nadi
		ELTA	Lau
		Systemair	
21	JET Ventilation fan for basement carparking	Aerovent	
		Flaktwoods	
		Systemair	
		ELTA	
22	Thermal Heat Recovery Wheel	Flakt Woods	
		Ostberg(Enventus)	
		DRI	
23	Inline UV sterilizer	Arklite	
		Ruks Engineering Ltd.	
		Sterile	
		UV-Lux	
24	Dessicant wheels	Ostberg (Enventus)	
		DRI	
25	PIPES & FITTINGS		
26	M.S. Pipe upto 200 MM Dia.		AST
			Jindal
			Tata Steel
27	MS PIPES above 200 mm dia factory rolled		Jindal
			SAIL
			Welspun
28	Butterfly valve (32 mm and upwards)	KITZ	
		Audco	
		CRI	
		C & R	
29	Butterfly Valve with Actuator	Honeywell	
		Kitz	

		Sauter	
		Siemens	
30	Balancing valve (Manual)		Advance Valve Navtech
31	Balancing Valve cum flow control (Pressure independent dynamic) valve with modulating actuator for AHUs and FCUs	Siemens Flowcon Honeywell Overtrop (AZV) TA Auto Flow	
32	PICV & Ball valve (upto 32 mm)	Siemens Honeywell KITZ RB Zoloto Rapid Control	
33	Check valve	Kitz Honeywell Advance Valve	
34	Pot / Y Strainer		Emerald Sant
35	Pressure Gauge		Fiebig H Guru
36	Thermometer		H Guru Emerald Grundfoss
	Combined pressure/temperature gauge with digital display with BAS compatibility		Grundfoss
37	Ball valve (Fan Coil Unit)	Overtrop	Emerald
			Rapid Control
			Zoloto
38	Ball valve with Y-Strainer (Fan Coil Unit)	Tiemme	Emerald
		Overtrop	Rapid Control
39	Auto Air Vent Valve	RB	Rapid Control
			Anergy

40	GI Sheet		ESSAR
			Jindal
			Lloyd
			SAIL
			TATA
41	Terminal HEPA filter plenums		Airtech
			AAF synder general
			Fabtech
			Sankalp Enterprise
42	Factory Made Duct		Nuair Engineers
			Rolastar
			Seven star
			Zeco
43	Factory Made Spiral Duct		Atco
			Karthila Industries
			Seven Star
			Spiral Tubes Pvt. Ltd.
			Western Air Duct
44	Flexible duct		Atco
			Caryaire
			Seven star
			UP Twiga
45	Pre-insulated duct		ALP
			Nutech
			Pai Pal
46	Pipe / duct supports		Diamond
			Hitech
			Seven star
47	Passivation system for hydraulic systems (CHW/CDW/Hot water)		Biocide
			Chemtex
48	Grille/diffuser/dampers		Airflow
			Air Master
			Caryaire
			Dynacraft
			Ravistar
49	Smoke / Fire Damper		Greenheck
	(Actuator shall be UL listed)		Ruskin

		Airmaster	
		Caryaire	
		George Rao	
		Ravistar(Systemair)	
		ELTA	
		Caryaire	
		George Rao	
		Ravistar (Systemair)	
51	Anchor Fastener	Fischer	
		Hilti	
	Insulation		
	Closed Cell Elastomeric nitrile rubber/EPDM along with adhesive	TWIGA	
		Eurobatex – Union Foam	
		A flex	
		K flex	
52	Microban Closed Cell Elastomeric nitrile rubber along with adhesive	K flex	
		A flex	
	Cross link polyethylene foam with adhesive	Trocellen	
	Fibreglass (Al. Foil Faced)		Lloyd insulation
			UP Twiga
	Acoustic insulation		
	a. Fibre glass		Lloyd insulation
			UP Twiga
	b. Nitrile rubber with Antimicrobial property	K flex	
		A flex	
54	Expanded Polystyrene (TF Quality)		Beardsell
			Coolite
			DEBS Products
	Extruded Polystyrene for Overdeck Insulation	Isoboard	
		Owens Corning	
		Polybond	
		Thermosheid	
56	Premoulded PUF section for pipe support		Lloyd
			Malanpur
57	Protective Coating over Closed Cell		K flex

	Elastomeric – Fibreglass Woven Cloth		Fosters Paramount
58	UV Protective coating		K flex Paramount Polybond
59	Fire Sealant	Birla 3 M OBO Bitterman	
60	Fire Wrap/Board/Paint	Birla 3 M Flamebar Hilti Promat	
	Controls		
61	Three way Modulating / Two way valve / PIBCV for AHU	Honeywell Sauter Siemens	
62	Three way / Two way modulating control Valve for FCU	Danfoss (Model: VRG) Honeywell (Model: VC7936) Johnson Control (VG 5400 MC) Schneider (VB-7215-0-4-07/8) Siemens (Model: VVP/VXP 469)	
63	Proportionate Room Thermostat with Digital Temperature Indication for FCU	Honeywell (Model: T 6865) Johnson Control Schneider (TA-168-2) Siemens (Model: RDF 340)	
64	Humidistat	Honeywell Invensys Johnson Control Siemens	
65	Safety thermostat for heater		Anergy Controls
66	Dial Thermometer Capillary Type.	Penn Tadington	

67	Flow Switch		Rapid Control	
68	Airstat		Rapid Control	
	Miscellaneous			
69	Vibration Isolator, Flexible Pipe Connection, Flexible duct connector, Heavy duty pipe support clamp		Cori	
			Dunlop	
			Easyflex	
			Flexionics	
			Kanwal Industrial Corporation	
			Resistoflex	
70	Grooved Pipe Connector		Grinnel Tyco	
			Sharjoint	
			Victaulic	
71	ELECTRICAL ACCESSORIES			
A.	MEDIUM VOLTAGE EQUIPMENT			
		North side	Westside	
		Projects	Projects	
1	Power Distribution Panel and Motor Control Centre & Air Insulated Bus ducts	Adlec Control System	Accusonic (Pune)	
		Advance Panels & Switchgear	Antia Electricals	
		KMG Atoz	Arrow Engineers	
		SPC Electrotech	Manshu (Pune)	
		Sudhir Engineering	Popular Switchgear	
		Tricolite	Scoot Engineering	
			Smash Electricals	
			Sterling & Wilson	
			Zenith Engineering	
			Southside Projects	
			Bangalore	
			Dynam	
			Load Controls	Chennai
			Lotus Powergear	Electro Alagen
			Elins	Formaplastic Controls
			Power Control Equipments	Ohm Energy
			Pragati Controls	Shanti Electricals
	Kolkata			
	Electro Allied Products			

2	Sandwiched Construction Busduct	Control & Switchgear	
		EAE (IIGM)	
		GE Power Control	
		Henikwon	
		Intraco BKS (Marketed by Larsen & Toubro)	
		Power Plug Malaysia (Marketed By Tricolite)	
		Schneider Electric	
3	Motor	ABB	
		Bharat Bijlee	
		HAVELL	
		Kirloskar	
		Marathon	
		Siemens	
4	Starter	ABB	
		Allen Bradley	
		Kirloskar	
		L & T	
		Schneider	
		Siemens	
5	Variable Frequency Drive (VFD)	ABB	
		Alan Bradley	
		Fuji Electric	
		L&T	
		Siemens	
		Schneider Electric	
		VACON	
6	Air Circuit Breaker (3/4 Pole)	ABB(E-Max)	
		GE Power Controls (M-Pro)	
		Larsen & Toubro (U-Power)	
		Schneider Electric (Master Pact NW)	
		Siemens (3WL)	
7	Moulded Case Circuit Breaker (MCCB)	ABB (T – Max)	
		GE Power Controls (Recod plus)	
		Larsen & Toubro (Dsine)	
		Schneider Electric (Compact NSX/ NS)	

		Siemens (3VL)	
8	Motor Protection Circuit Breaker(MPCB)	ABB GE Power Control Hager (Marketed by Larsen & Toubro) Schneider Electric Siemens	
9	Automatic Transfer Switch (ATS)	ASCO Cummins GE Power Control	
10	Miniature Circuit Breakers (MCB)	ABB Hager (L&T) MDS Legrand Mitsubishi Electrical (DIN rail mounted) Schneider Electric-(Multi 9) Siemens	
11	Residual Current Circuit Breaker (RCCB)	ABB Hager (L&T) MDS Legrand Mitsubishi Electrical (DIN rail mounted) Schneider Electric-(Multi 9) Siemens	
12	Power/Aux. Contactor	ABB Larsen & Toubro Mitsubishi Electrical Schneider Electric Siemens	
13	Change Over Switch	C & S Havells Elcon HPL – Socomec Larsen & Toubro	
14	Control Transformer/Potential Transformers	Automatic Electric Gilbert & Maxwell Matrix Reco	

15	Current Transformer (Epoxy Cast Resin)	Automatic Electric	
		Gilbert & Maxwell	
		Matrix	
		Reco	
16	Protection Relay		
	a. Numeric Type	ABB	
		Areva	
		Larsen & Toubro	
		Siemens	
	b. Electromagnetic Type	ABB	
		Areva	
		Larsen & Toubro	
17	Indicating Lamps LED type and Push Button	Altos	
		GE Power Controls	
		Larsen&Toubro (ESBEE)	
		Schneider Electric (MG)	
18	Overload relays with built in Single Phase preventer	ABB	
		Larsen & Toubro	
		Mitsubishi Electrical	
		Schneider Electric(Telemechanique)	
		Siemens	
19	a. Electronic Digital Meters (A/V/PF/Hz/KW/KWH) with LED Display	ABB	
		Conzerv	
		L & T	
	b. Dual Energy Meter with centralized metering & billing system	ActarisConserve	
		El Measure	
		Secure	
	c. Prepaid Meters & accessories	Actaris	
		Conzerve	
		Secure	
	d. Electromagnetic Meters	Automatic Electric	
		Rishabh (L&T)	
	20	Static Power Meter & Logger (SPML) with RS 485 port	Conzerv
El measure			
Larsen & Toubro			

21	Power Capacitor	ABB
		Matrix
		Meher (Larsen & Toubro)
		Siemens (Epcos)
22	Autoamtic Power Factor Correction Relay (Numeric Type)	Areva
		BELUK (Germany)
		Conzerv
		Siemens
23	Thyristerised APFC Control Panel	ABB
		Meher(Larsen & Toubro)
		Siemens
24	PVC insulated XLPE aluminium/copper conductor armoured MV Cables upto 1100 V grade	Finolex
		Polycab
		RPG
25	LT Jointing Kit / Termination	Raychem
		REPL
		Safe Kit
26	Cable Glands Double Compression with earthing links	Baliga Lighting
		Comet
		Cosmos
27	Bimettalic Cable Lug	Comet
		Cosmos
		Dowell's (Biller India)
		Hax Brass (Copper Alloy India)
28	PVC insulated copper conductor stranded flexible wires (FRLS) -	Anchor
		Finolex
		Havells
		KEI
		R Rkabel
29	Mettalic Conduit (ISI approved)	AKG
		BEC
		NIC
		Vimco
30	PVC Conduit (ISI approved)	AKG
		BEC

		Polypack	
		Precision	
31	Industrial Socket		
	Splash Proof	Clipsal	
		MDS Legrand	
		Neptune Balls	
32	Industrial Socket Metal Clad	BCH	
		MDS	
33	Selector Switch, Toggle switch	Kaycee	
		Salzer (Larsen & Toubro)	
34	Timer	ABB	
		Larsen & Toubro	
		MDS Legrand	
		Schneider Electric	
		Siemens	
35	LT Servo Automatic Voltage Stabilizer & Isolation Transformers	Abhishek Electrical	
		Aplab	
		Automatic Electric	
		Recon	
36	Inverter	Luminous	
		Megatech	
		Neel Industrial Corporation	
37	Cable Trays (Factory Fabricated) / Raceways	Asian Ancillary Corporation	
		Elcon	
		Profab Engineer	
		Rico Steel	
		Slottco	
38	Fire Sealant & Fire Retardant Paint	BTHM Engineering	
		Birla 3 M	
		HILTI	
		Promat	
39	230/12 V Step Down Transformer with Built in Isolation Transformer	Talema	
		Volstat	

Tender Notice (NIT) No: - SMPK/KDS/CIV/T/2830/12

dated 08/03/2024

Name of Work - Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, and Kolkata – adjacent to Indenture Memorial area.

कार्य का नाम - इंडेंट्योर मेमोरियल क्षेत्र से सटे केडीएस, एसएमपी, कोलकाता में रिवरफ्रंट सौंदर्यीकरण कार्यों के साथ-साथ रिवर क्रूज़ टर्मिनल और नदी पर्यटन सुविधा का विकास।

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ELECTRICAL SYSTEM

TECHNICAL SPECIFICATION

Client	SYAMA PRASAD MOOKERJEE PORT TRUST
Project Name	RIVERFRONT CRUISE TOURISM CENTRE AT KIDDERPORE
Project Location	KOLKATA, WEST BENGAL
Date	01/02/2023
Revision	R0

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1. GENERAL

1.1. Design Philosophy

This specification is intended to cover design, residual, engineering, manufacture, test and inspection at works, delivery to site properly packed for transportation, erection, testing, commissioning, performance demonstration at site and handing over to purchaser as indicated in the schedule of requirement as per the codes/standards and scope of work.

1.1.1. Codes and Standards

The installation shall also be in conformity with the bylaws and requirements of the local authority in so far as these become applicable to the installation. Wherever this specification calls for, a higher standard of materials and /or workmanship than those required by any of the above regulations and standards, then this specification shall take precedence over the said regulations and standards.

Wherever drawings and specifications require something that may conflict with the regulations, the regulations shall govern. This shall be referred to the Superintendent for arbitration.

The design shall be done on the guide lines of NBC 2016 and the applicable local & International codes and standards, illustratively listed below as per the project requirements and site conditions.

Sr. no	Standards	Code Description
A	Ring Main Unit (RMU) / High voltage Switchgear (HVS)	
1	IS: 13118, IEC: 56	Circuit Breakers
2	IS: 3427, IEC: 298, IEC: 694	Metal enclosed Switchgear
3	IS: 2705 IEC: 44	Current Transformers
4	IS: 3156 IEC: 186	Potential Transformers
5	IS: 5578, IS: 11353	Guide for Marking Busbars, Main Connection and auxiliary wiring
6	IS: 2544, IEC: 273	Busbar support insulators
7	IS: 13947, IS: 3427, IEC: 947	Degree of Protection
8	IS: 3231, IEC: 255	Electrical relays for Power System Protection
9	IS: 1248, IEC: 51	Electrical Indicating Instruments
10	IS: 9385, IEC: 282	High Voltage Fuses
11	IS: 722	AC Electricity Meters
12	IS: 4171, IEC: 694	Copper Busbars
13	IEC: 129	Offload isolators
14	IS: 6005	IS: 4171, IEC: 694
15	IS: 9224	HRC Fuses
B	Transformer	
1	IS 2026 Part I IV	Power transformer
2	IS 3639	Fittings & accessories
3	IS 2147	Degree of protection
4	IS 2026	Tests
5	IS 2026	Tolerance on guaranteed particulars
6	IS 1271	Electrical insulation classified by Thermal stability
7	IS 335	Insulating oil
8	IS 8468	OLTC
9	IS 10028 Part II	Installation and maintenance

Sr. no	Standards	Code Description
		of transformer
10	IS 6600	Guide for loading of oil immersed Transformer
C	Low Voltage Switchgear (LVS)	
1	IS 4237, IEC 947	Switchgear General Requirements
2	IS 13118, IEC 56	AC Circuit Breakers
3	IS 8623, IEC 439	Factory built assemblies of switchgear and control gear for voltages upto and including 1000V AC and 1200V DC
4	IS 13947(Part 3), IEC 947-3	Air break switches
5	IS 8828, IEC 898	Miniature circuit breakers
6	IS 9224 ,IEC-269	HRC cartridge fuses
7	IS 8187	D Type fuses
8	IS 13947(Part 4), IEC 947	Contactors
9	IS 13947(Part 4),IEC 947	Starters
10	IS 6875	Control switches / push buttons
11	IS 2705, IEC 44-1	Current transformers
12	IS 3156 , IEC 186	Voltage transformers
13	IS 3231, IEC 255	Relays
14	IS 1248 ,IEC 51	Indicating instruments
15	IS 11353 / IS 5578	Arrangement for busbars main connections and accessories
16	IS 722	AC electricity meters
17	IS 13947(Part 1), IEC 947-1	Degree of protection
18	IS 10118	Code of practice for installation and maintenance of switchgear
19	IS 6005	Code of practice for phosphating iron and steel
20	IS 5082 , IEC 114	Wrought aluminium & aluminium alloys for electrical purposes
21	IS 12021 , IEC947	Control transformer for switchgear and control gear for voltage not exceeding 1000V AC
D	Lighting	
1	IS 1913 (Pt 1): 1978	General and safety requirements for luminaries: Part-1 Tubular fluorescent Lamps (Second revision).
2	IS 2206 (Pt.1): 1984	Flameproof electric lighting fittings: Part-1 Well-glass and bulkhead types (first revision).
3	IS 3528: 1966	Waterproof electric lighting fittings
4	IS 5077: 1969	Decorative lighting outfits
5	IS 9583: 1981	Emergency lighting units.
6	IS 10322 (Pt.4): 1984	Luminaries: Part-4 Methods of tests

Sr. no	Standards	Code Description
7	IS 10322 (Pt.5/Sec2): 1985	Luminaries: Part-5 Particular requirements, Section-2 Recessed luminaries.
8	IS 2418	Tubular fluorescent lamps
9	IS 1777: 1978	Industrial Luminaire with metal reflectors and its Amendments
10	IS 4012: 1967	Dust-proof electric lighting fittings.
11	IS 4347: 1967	Code of practice for hospital lighting
E	Cables	
1	IS: 7098-Part-1 1998, IEC:502 1983	11KV Cables
2	IS:1554 - Part - I (1988)	433 V Cables
F	UPS	
1	IS 589	Basic climatic & mechanical durability tests for Components for electronic and electrical equipment
2	IS 9000	Environmental tests for electronic & Electrical equipment
3	IS 5921	Metal clad base material for printed circuits for use in Electronic and telecommunication equipment.
4	IS 6297	Transformer and inductors (power, audio, pulse & Switching) for electronic equipment
5	IS 7405	Printed wiring boards
6	IS 6553	Environmental requirements for semiconductor Devices and integrated circuits
7	IS 4007	Terminals for electronic equipment
8	IS 8623	Factory built assemblies of switchgear and control gear for voltages upto and including 1000V AC and 1200V DC
9	IS 13947-3	Air break switches
10	IS 9224	HRC Cartridge fuses
11	IS13947-4	Contactors
12	IS 6875	Control switches / push buttons
13	IS1248	Indicating instruments
14	IS 2147	Degree of protection
15	IEC 146	Semiconductor converters
16	IS 6619	Semiconductor rectifier equipment code
17	IS 3700	Thyristors converters
18	IEEE 446	Emergency std by power systems
19	IEEE 472	Surge withstand capability test

1.1.1 Building Information

This report communicates the proposed Electrical engineering designs system requirements for the Proposed Amusement Park at Kidderpore Port in Kolkata.

1.1.2 Systems Proposed

1.1.3.1 Ring Main Unit (RMU) & HT Metering Cubicle:

6KV Power supply will be tapped from the nearby substation. The power will be received by installing 6KV HT RMU (Ring Main Unit) Panel located in the HT RMU Room in electrical substation area (RMU to be provided as per local state electricity requirements). The metering arrangement will be provided with the HT RMU and to be provided as per local electricity board norms.

1.1.3.2 HT VCB Panel:

6KV HT VCB Panel will receive power from RMU located in substation area for protection.

1.1.3.3 Transformers

6KV / 433V, 3 PHASE, 1 x 630KVA Distribution Transformer of outdoor type (ONAN) with On-Load tap changer is considered for the entire facility.

1.1.3.4 Emergency Power Supply

1 x 400kVA & 1 x 320kVA radiators cooled, 415V, 3ph, 1500RPM coupled with Alternator and Acoustic enclosure DG Sets are considered for 100% power back up of entire facility.

1.1.3.5 Low Voltage Switchgear

433V, 50Hz, 3-phase, 4-wire indoor (Main LT Panel, APFC Panel, Utility Panel) / outdoor (all feeder pillars) switchboard & shall have cable entry/exit from bottom.

1.1.3.6 Distribution Boards

Distribution boards shall be TP+N type for 415 volts, 3 phases, A.C. supply or 230V single-phase A.C. supply as required & shall be of Vertical or Horizontal type on mounting with single or double door. Distribution boards shall generally conform to IS 8878 - 1978.

1.1.3.7 Power and Control cables

Power & control cables considering of Aluminium/Copper conductor, XLPE Insulation, Armoured/Un armoured buried in ground or laid in cable tray or through conduits.

1.1.3.8 Cable Installation

Electrical installation work shall comply with all currently applicable statutes, regulation and safety codes in the locality / country where the installation is to be carried out.

1.1.3.9 Lighting System

All luminaries shall be considered as LED fittings.

1.1.3.10 Earthing System

A complete earthing system comprising earthing conductors, earth electrodes and earth connections necessary for effective and permanent bonding to earth, all non-current carrying metal work and for termination of the earthing conductors of all electrical 6kV and 415V/230Vswitchboards, sub boards, distribution boards etc., installed for the Electricity Distribution System for this project shall be connected under this section of the specification and the associated drawings.

1.1.3.11 Lightning Protection

The Lightning Protection System shall be strictly in accordance with BIS: /IEC 62305. The lightning protection installation can consist of Mesh, down conductors, earthing and bonding.

The materials of lightning conductor, down conductors, earth termination etc., are aluminium and conform to BIS/IEC 62305.

Each down conductor has an independent earth termination. All the earth termination interconnected and shall be capable of isolation for testing using test links.

Earth pits will be installed in accordance with BIS: 3043. The resistance of earthing system shall not exceed 1 ohm.

1.1.3.12 CCTV System

IP based Closed Circuit Supervision System is considered to monitor the personnel movement in the entire external area under the scope. Camera point locations will be considered for Entry and Exits, Perimeter areas, external road & utility building as per site condition for security purpose. NVR and Monitor will be Located in Main Security Room of the facility.

1.1.3.13 UPS

1no. 1kVA single phase in – single phase out UPS is only provided for CCTV power supply units.

1.2. Scope of Work

The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labor, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete electrical system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The electrical System shall comprise of following:

- a) Electrical System
- b) Other related miscellaneous items as per the tender drawing & Bill of quantities.
- c) Approval from Local Authorities
- d) Wiring & Earthing from MCC panels to electrical, control wiring & interlocking.
- e) Cutting holes, chases & like through all types of walls /floors and finishing for all services crossings, including sealing, frame works, fire proofing, providing sleeve, cover plates, making good structure and finishes to an approved standard.
- f) Balancing, testing & commissioning of the electrical works.
- g) Test reports, list of recommended spares, as-installed drawings, operation & maintenance manual for the entire electrical works.
- h) Training of Owner's staff.

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 Architect 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 system and for the Pipes / valves /Wiring/Cable installed in his scope of work. The balancing shall be to the satisfaction of Client /Architect/Consultant / Project Manager.

Six copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

1.2.1. Inspection and Approval

The contractor shall obtain approval to the installation from the Local Authority. Successful Bidder shall be responsible for preparation of documents / applications / drawings / necessary calculations and flow up action at all stages, (Drawing / completion) arranging inspections, revisions / modifications for obtaining approval from Local Authority within the overall completion period stipulated in the Tender. The Contractor shall also make payment of all statutory payments like payment Local Authority etc. The quoted rates shall take care of any contingencies.

The contractor shall guarantee both the material and workmanship of first-class quality corresponding to standard engineering practice. Any defective materials/workmanship shall be rejected, the contractor has to rectify/ replace at his own cost. Guarantee certificate of the materials supplied shall be handed over to the clients.

1.2.2. Quality Assurance

Comply with the current applicable codes as specified in the Tender documents and local rules, regulations and requirements of the local authorities.

Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the more stringent shall apply.

Executive work in strict accordance with the best practices of the trades in a thorough substantial, workmanlike manner by competent workmen.

All equipment, materials and installation method shall comply with the General Specification and the current standards and regulations as described in the Tender Documents.

The Owner's Site representative reserves the right to inspect and reject any part of the Works not complying. The Contractor shall replace such rejected works without cost variation and delay to the Contract.

Approval or acceptance by the Owner's Site representative shall not relieve the Contractor of his responsibilities under the Contract for the quality of materials and the standard of workmanship in the Works.

No work shall be covered up or put out of view without the agreement of the Owner's Site representative. The Contractor shall provide/allow the Owner's Site representative full opportunity for the examination and measurement of any work which is about to be covered or put out of view. Upon request by the Owner's Site representative, the Contractor shall expose

their Works and allow/provide access to the Owner's Site representative to inspect any part of the Works during the course of the manufacturing or site installation/erection.

When requested by the Owner's Site representative, the Contractor shall submit evidence including written certificates and full testing reports from approved/recognized testing organization certifying that his proposed equipment or material have been tested and conform with the specified standard.

1.2.3. Bye-Laws and Regulations

The installation shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities concerned, in so far as these become applicable to the installation. But if these Specifications and Drawings call for a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then these Specifications and Drawings shall take precedence over the said regulations and standards. However, if the Drawings and specifications require something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

1.2.4. Fees and Permits

The contractor shall obtain all permits/ licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation.

1.2.5. Drawings

The electrical Drawings listed under respective section, which may be issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of equipment/accessories /fixtures etc.

The contractor shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.

Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the Architect/Consultant/Owner's site representative before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and contractor shall rectify the same at his own cost.

The contractor shall examine all architectural, structural, plumbing, electrical and other services drawings and check the as-built works before starting the work, report to the Owner's site representative any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/Owner's site representative without additional cost to the Owner. The data given in the Drawings and Specifications is as exact as could be procured, but its accuracy is not guaranteed.

1.2.6. Shop Drawings

All the shop drawings shall be prepared on computer through AutoCAD System based on Architectural Drawings, site measurements drawings. After award of the contract, within agreed time line contractor shall furnish, for the approval of the Architect/Consultant, two sets of detailed shop drawings of all equipment and materials including all layouts/sections/elevation details /typical details as per the consultants drawing showing exact details. Electrical panels inside/outside views, power and control wiring schematics, cable trays, supports and terminations. These shop drawings shall contain all information required to complete the Project as per specifications and as required by the Architect/Consultant/Owner's site representative. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment/materials/works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings. Minimum Six sets of drawings shall be submitted after final approval along with CD/DVD.

Each item of equipment/material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers listed in respective sections and quoted by the tendered in technical data part of respective sections

When the Architect/Consultant makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated along with check prints, for approval. The contractor shall submit further six sets of shop drawings to the Owner's site representative for the exclusive use by the Owner's site representative and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment/installation.

Shop drawings shall be submitted for approval four weeks in advance of planned delivery and installation of any material to allow Architect/Consultant ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved program.

Manufacturer's drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

Samples of all materials shall be submitted to the Owner's site representative prior to procurement. These will be submitted in two sets for approval and retention by Owner's site representative and shall be kept in their site office for reference and verification till the completion of the Project. Wherever directed a mock up or sample installation shall be carried out for approval before proceeding for further installation.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the

drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.

Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, piping, wiring or any other part of the mechanical, electrical or architectural layouts; all such redesign, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the Architect/Consultant/ Owner's site representative. Any delay on such account shall be at the cost of and consequence of the Contractor.

Electrical Contractor shall prepare coordinated services shop drawings based on the drawings prepared by other services Contractors to ensure adequate clearances are available for installation of services for each trade.

Where the work of the contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so, directed by the Owner's site representative, the contractor shall prepare composite working drawings and sections at a suitable scale, not less than as per the consultant's base drawing, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Owner.

Within four weeks of approval of all the relevant shop drawings, the contractor shall submit four copies of a comprehensive variation in quantity statement, and itemized price list of recommended (by manufacturers) imported and local spare parts and tools, covering all equipment and materials in this contract. The Project Manager shall make recommendation to Owner for acceptance of anticipated variation in contract amounts and also advise Owner to initiate action for procurement of spare parts and tools at the completion of project.

1.2.7. Progress Drawings

Contractor has to provide and keep on the job at all times, one complete and separate set of prints of the respective work on which shall be clearly, neatly and accurately noted, promptly as the work progresses, all architectural and other changes, revisions and additions to the work. Whatever work is installed other than as shown on the Tender Drawings, such changes shall be noted.

Indicate daily progress on these prints by coloring the various conduits, ducts, piping, cable trays, fixtures, apparatus and associated installation works erected.

1.2.8. As Built Drawings

The contractor shall provide as built drawings, as approved by the Owner's Site representative AutoCAD DWG format in CD/DVD, as per the Project Documentation requirement. The drawings shall be submitted as directed by the Owner's site representative, or putting into operation, whichever is earlier. In addition, six sets of hard copies of all relevant drawings, which will be

required for operation and maintenance, shall be supplied in bound book forms immediately after the commissioning of the Project.

The contractor shall supply, 6 sets of all operation and maintenance manuals in original, from the manufacturer in bound book forms, at least 2 weeks prior to commissioning of the equipment. These shall also be supplied, in computer diskettes, based on popular Microsoft window-based publishing software programmers, along with the as built drawings as mentioned above, as specified in the Project Documentation.

1.2.9. Fire and Safety Precautions

Establish from Architectural Drawings where fire and smoke barriers exist, and make adequate provision of fire and smoke barriers in and around trunking, conduits, cables, etc., where they pass through floors and fire rated walls, and where protection systems are installed pack space between wiring and sleeve full with Fire Retardant Material and seal with caulking.

The Contractor shall ensure that this work is carried out such that the integrity of any such fire barrier is properly maintained where pierced by electromechanical services.

1.2.10. Samples

The term 'samples' includes natural materials, fabricated items, equipment, devices, appliances, or parts thereof as specified and other samples as may be required to determine whether kind, quality, construction, workmanship, finish, colour and other characteristics of materials conform to requirements of the Tender Documents.

Samples shall establish kind, quality and other required characteristics of various parts of the work. Indicate details of construction, dimensions, capacities, weights and electrical performance characteristic of equipment or material.

Samples and sample board shall be prepared and identified by the manufacturer and stamped/engraved with make, type, Cat No. and size marking shall be indelible and legible.

1.2.11. Quality of Materials

Manufacturers shall provide their standard guarantees for products furnished under this Tender. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturers and the Contractor may have by law or by other provisions of the Tender Documents.

All materials, items of equipment and workmanship furnished under this Tender shall carry standard warranty against all defects in materials and workmanship. Any faults due to defective or improper material, equipment, workmanship which develop shall be made good, forthwith, by and at the expense of the Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

Guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

Upon receipt of notice from the Owner's Site representative, of failure of any part of system or equipment during the defect liability period the affected parts shall be replaced.

1.2.12. Equipment and Materials Approval

Approval of materials and equipment shall be based on latest manufacturer's published data. Complete and detailed information of all materials and equipment to be incorporated in the work shall be submitted. Submit detailed description and specifications, catalogues cuts, installation data, diagrams, dimensions, controls and any other data required to demonstrate compliance with the Tender Documents. Each item submitted shall be referenced to the applicable paragraph in the Specification.

At the request of the Owner's Site representative, submit a sample of any equipment or material for further study before approval. Where samples are required by the Owner's Site representative, the period required to obtain the sample will be taken into account when scheduling approvals.

Only approved materials shall be employed at the site. All materials installed which are not approved shall be removed and reinstated by approved ones.

Time periods for equipment and materials approvals shall be as submitted for the approval of the Owner's Site representative.

1.2.13. Technical Data

Each Tenderer shall submit along with his tender, the technical data for all items listed in respective section in the indicated format. Failure to furnish complete technical data with tenders may result in summary rejection of the tender.

1.2.14. Workmanship

The entire work provided in this specification shall be constructed and finished in every aspect in a workmanlike and substantial manner. The Contractor shall provide the system in accordance with the best trade practice and to the satisfaction of the Owner's Site representative.

Keep others fully informed as to the shape, size and position of all openings required for apparatus and give full information sufficiently in advance of the work so that all openings may be built in advance. Provide and install all sleeves, supports, etc., hereinafter specified or required.

Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting the same. Obtain all information from others which may be necessary to facilitate work and the completion of the whole Project.

Provide the services of an experienced foreman, who shall be continuously in charge of the erection of the electrical work, together with all necessary skilled workmen, helpers and labours, required to properly unload, transfer, erect and connect up, adjust, start, operate and test the system.

Before installing any work, verify that it does not interfere with clearance required for other work. Notice of adverse conditions shall be forwarded in writing to the Owner's Site representative before any work in question is installed. If notification is not made, and work installed causes interference with the contemplated design, make such changes in his work as directed by the Owner's Site representative to permit the installation of all work of the Project, at no additional cost to the Client.

Raceways shall be run as straight and direct as possible in general forming right angles with or parallel with walls or piping and neatly spaced, with risers erected plumb and true, maintain a clearance of at least 25 mm between finished coverings and adjoining work. Approved ceiling height shall be obtained from Architectural Drawings.

All equipment and accessories shall operate without objectionable noise or vibration. Should operation of any of the equipment or systems produce noise or vibration which is, in the opinion of the Owner's Site representative objectionable, make change in equipment and do all work necessary to eliminate the objectionable noise or vibration at no additional cost to the Client.

Wherever possible services shall not cross expansion joints. Where this is unavoidable the services shall accommodate the design movement without damage, by use of approved expansion couplings/flexible conduit arrangement.

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the relevant Codes.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

1.2.15. Method Of Measurement

The works shall be measured in accordance with relevant IS codes. Notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract

1.2.16. Balancing, Testing and Commissioning

Balancing of electrical works and all tests as called for the Specifications shall be carried out by the contractor through a specialist group, in accordance with the Specifications and Indian Standards. Performance test shall consist of three days of 10 hour each operation of system for each season.

The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Owner's site representative. All tests shall be carried out in the presence of the representatives of the Architect/Consultant and Owner's site representative.

1.2.17. On Site Training

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labor and helpers for operating the entire installation for a period of fifteen (15) working days of ten (10) hours each, to enable the Owner's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Owner's personnel in the operation, adjustment and maintenance of all equipment installed.

1.2.18. Completion Certificate

On completion of the electrical and related works, a certificate shall be furnished by the contractor, counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority.

The contractor shall be responsible for getting the entire electrical installation for electrical works duly approved by the local authorities concerned, and shall bear expenses if any, in connection with the same.

1.3. Special Conditions

1.3.1. General

These special conditions are intended to amplify the General Conditions of Contract, and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply.

1.3.2. Introduction

The general character and the scope of work to be carried out under this contract is illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every aspect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labour, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete Electrical system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The Electrical System shall comprise of following:

- i) Electrical System
- j) Other related miscellaneous items as per the tender drawing & Bill of quantities.
- k) Approval from Local Authorities
- l) Wiring & Earthing from MCC panels to Electrical, control wiring & interlocking.
- m) Cutting holes, chases & like through all types of walls /floors and finishing for all services crossings, including sealing, frame works, fire proofing, providing sleeve, cover plates, making good structure and finishes to an approved standard.
- n) Balancing, testing & commissioning of the Electrical system.
- o) Test reports, list of recommended spares, as-installed drawings, operation & maintenance manual for the entire Electrical.
- p) Training of Owner's staff.

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 Architect 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.

Contractor shall ensure proper balancing of the system and for the Cables/Wires installed in his scope of work. The balancing shall be to the satisfaction of Client /Architect/Consultant / Project Manager.

Six copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

1.3.3. Segregation of Services

Electrical services shall be segregated as specified throughout the installation to obviate the following;

- a. Electrical interference from one circuit to another
- b. A fault on one circuit affecting another
- c. Unnecessary fire damage
- d. Difficulties in circuit identification
- e. Voltage limits for general safety
- f. Difficulties in removal and/or maintenance.

Unless specifically indicated otherwise, normal, emergency, low voltage cables and wiring shall be segregated throughout the installation generally in the following manner:

Armoured and sheathed cables: Where more than one tray has been specified or is necessary to accommodate the number of cables on a run, where practical, segregation shall be achieved by dedicating each tray to either normal or emergency services. Where normal and emergency cables have to run together in trays, ducts or trenches, they shall be formed in two groups, one normal and one emergency.

1.3.4. Safety Interlocks

A complete system of interlocks and safety devices shall be provided as indicated and necessary for the safe and continuous operation of the plant in order to provide for the following:

- a. Safety of personnel engaged on operation and maintenance of the plant
- b. Correct sequence of operation of the plant during start up and shut down
- c. Safety of the plant when operating under normal or emergency conditions.
- d. Interlocks shall be preventive and not corrective
- e. The Contractor shall be responsible for the preparation of interlocking schemes for the approval of the Owner's Site representative on the basis of Consultant's scheme.
- f. Locks for interlocking purposes shall be electrical or mechanical interlock wherever asked. No spare or master key shall be provided, unless specified. Device items are to be arranged to ensure that there is no danger of interchange with existing locks on other units in case of mechanical interlocks.

1.3.5. Quiet Operation and Vibration Isolation

All equipment shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Owner's site representative. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense. The contractor shall guarantee that the equipment installed shall maintain the desired (noise criterion) NC levels.

1.3.6. Accessibility

The Contractor shall verify the sufficiency of the size of the shaft openings, clearances in cavity walls and suspended ceilings for proper installation of his piping/cabling/ducting/ other ancillaries. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed, valve or other devices requiring attendance, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense. Access panel shall be standardized for each piece of equipment / device / accessory and shall be clearly nomenclature / marked.

1.3.7. Manufacturer's Instructions

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

1.3.8. Electrical Installation

Work related to the electrical services, shall be carried out in full knowledge of, and with the complete coordination of the contractor. The electrical installation shall be in total conformity with the control wiring drawings prepared by the contractor and approved by the Architect/Consultant. All equipment shall be connected and tested in the presence of an authorized representative of the contractor.

The Electrical system shall be commissioned only after the contractor has certified in writing that the electrical installation work has been thoroughly checked, tested and found to be totally satisfactory and in full conformity with the contract Drawings, Specifications and manufacturer's instructions. It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the contract requirements, of the electrical installation work for respective services, lies solely with the contractor.

1.3.9. Maintenance during Defects Liability Period

1.3.9.1 Complaints

The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 10 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

1.3.9.2 Repairs

All equipment that requires repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defect's liability period, all replacement parts and labour shall be supplied promptly free-of-charge to the Owner.

1.3.9.3 Uptime Guarantee

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defect's liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defect's liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all pressures, power consumption. Starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Owner's site representatives/Consultant's review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.

1.3.9.4 Operation and maintenance

Contractor may be required to carry out the operation of the Electrical installation for the defect's liability period.

Further, he may also be required to carry out operation and all-inclusive maintenance of the entire system for a period of three years beyond the defects liability period if required by the owner.

1.3.9.5 Operation Contract

- a) 24 hours a day, year-round.
- b) All stand-by equipment to be operated as per mutually agreed programmed.
- c) Proper entry and upkeep of relevant log books.
- d) Maintain complaints register. Submit weekly report.
- e) Proper housekeeping of all areas under the contract.
- f) Prepare daily consumption report and summary of operation.

1.3.9.6 Maintenance Contract

Routine Preventive Maintenance Schedule to be submitted

- a) Schedule to cover manufacturer's recommendation and/or common engineering practice (for all plant and machinery under contract).
- b) Plant and machinery history card giving full details of equipment and frequency of checks and overhaul.

- c) Monthly status report.
- d) There shall be no reimbursement for the extended period.
- e) Break-downs shall be attended to within ten hours of reporting.
- f) Spares are to be made available within seven calendar days in case of total breakdown/burnout.

1.3.9.7 Manpower

- a) Adequate number of persons to the satisfaction of the Owner's site representative shall be provided including relievers.
- b) Statutory requirements of EPF, ESIC and other applicable labour legislations to be complied with; and monthly certification to that effect to be submitted.
- c) Duty allocation and Roaster control shall be contractor's responsibility.
- d) No overtime shall be payable by Owner for any reason whatsoever.

1.3.9.8 Shut downs

- a) Routine shut downs shall be permitted only as allowed by the Chief Engineer.
- b) Contractor shall be at liberty to carry out routine maintenance as and when required but with prior permission of the Owner.

1.3.9.9 Operating instruction & maintenance manual

Upon completion and commissioning of part Electrical system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Owner's site representative and two for Owners Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4-year period of maintenance of each equipment.

1.3.9.10 Method Of Measurement

The works shall be measured in accordance with relevant IS codes. Notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract.

1.3.9.11 Demonstration To Owner

At completion, devices subject to manual operation shall be operated at least five times in presence of Owner's site representative to demonstrate satisfactory operation.

1.3.9.12 Tools And Tackles

The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, and tackles, all transport for labor and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Owner's site representative.

1.3.9.13 Partial Ordering

Owner through the Architect/Consultant/ Owner's site representative reserves the right to order equipment and material from any and all alternates, and /or to order high side and /or low side equipment and materials or parts thereof from one or more tenderers. Certificates of approval

from statutory and / or local authorities for the operation and maintenance of the installation and equipment, wherever such approval or certification is required.

2. PRODUCT SPECIFICATION AND INSTALLATION

2.1 High Voltage Switchgear

2.1.1 Description

- a) The switchgear shall be in accordance with NEMA SG-4, IEEE C37.20.2, applicable UL and CSA standards and listings and the National Electrical Code as minimum requirements, and shall be as shown on the drawings and as specified.
- b) Indicating instruments shall be in accordance with ANSI C39.1
- c) Relays and relay systems shall be in accordance with IEEE C37.90.
- d) Instrument transformers shall be in accordance with IEEE C57.13.
- e) The switchgear line-up shall be a complete, grounded, continuous-duty, metal clad, dead-front, dead-rear, self-supporting, front connected switchgear assembly. Incorporate devices shown on the drawings and everything required to fulfil the operational and other requirements shown on the drawings.
- f) Switchgear shall conform to the arrangements and details of the drawings and space designed for installation.
- g) Interlocking shall be provided as shown on the drawings and as required for the safety of personnel and safe operation of the equipment.

2.1.2 Seismic Requirements

- a) The switchgear shall meet the following seismic standards. The equipment shall be tested on a shake table to comply with these standards.
 - a) International Building Code, IBC-2006 Sections 1613 and 1708, ASCE/SEI 7-05, Minimum Design Loads for Buildings and Other Structure
 - b) International Code Council, ICC-ES-AC156 Acceptance Criteria for Seismic, Qualification by Shake Table Testing of Non-structural Components and Systems
 - c) IEEE-344-2004, Recommended Practice for Seismic Qualification of Class 1E, Equipment for Nuclear Power Generating Station
 - d) IEEE-693-2005, Recommended Practices for Seismic Design of Substations

2.1.3 Housing

The equipment and structure shall have the following features:

2.1.4 Frames and enclosures

- a) The assembly shall be braced with reinforcing gussets as required to assure rectangular rigidity.
- b) The enclosure shall be steel with all exposed parts painted and fabricated from not less than the gauge required by NEMA and ANSI Standards.
- c) Provide adequately spaced holes for connecting adjacent structures to ensure proper alignment and to allow for future additions.

- d) The equipment sections shall be configured to provide an arc resistance enclosure with the ability to have all cable terminations located near the front of the equipment with suitable clearances and bending radius for the cable type and terminations types specified. The cable compartment and CTs shall be front accessible.
- e) Provide doors, covers, and infrared windows as shown to allow for UL and cUL / CSA listed rating as arc resistance equipment as supplied. Provide an extension from the arc plenum to allow for connection to ducting (by others) for the exit of gases resulting from an internal arc.
- f) Properly isolate circuit breakers, buses, and cable terminations in separate compartments with steel partitions or barriers of approved and tested materials. Meet all UL, ANSI, CSA and NEMA standards regarding individual section isolation for bus compartments.

2.1.5 Switchgear sections:

- a) The individual switchgear sections shall be comprised of three individual compartments: a lower cable or PT compartment; a middle circuit breaker, PT or CPT compartment; and an upper LV control compartment.
- b) A circuit breaker or CPT compartment shall be supplied for each circuit breaker, CPT or future circuit breaker indicated.
- c) Each compartment furnished with a circuit breaker (active or spare) shall be fully equipped as noted on drawings and specified below.
- d) Each compartment noted as space for future circuit breaker shall be fully equipped for positioning and connecting the breakers. Provide all equipment required to implement the future breaker installation, except for any the relays and meters in the associated LV control compartment.

2.1.6 Compartment doors:

- a) The doors shall permit convenient removal and interchanging of the circuit breakers between cubicles. The doors shall be capable of a swing approaching 180 degrees and shall be equipped with infrared windows or tested blast proof Lexan windows as shown on the drawings.
- b) Each door shall include suitable handles. Suitable heavy-duty hinges for the arc resistant rating shall be provided to attach the doors.
- c) The following equipment shall be mounted on the door of the low voltage compartment:
 - i. Draw out or other protective relays as specified herein or shown on the drawings.
 - ii. A breaker control switch.
 - iii. Relays and/or metering as indicated on the drawings or other sections of the specifications.
 - iv. Any additional items indicated on the drawings for example, transfer switch controller, Generator controller, HMI, etc.

2.1.7 Finish:

- a) All metal surfaces shall be thoroughly cleaned, phosphatized and finished using a power coat system tested to at least 3000 hours for salt spray resistance.
- b) Provide a light grey or other suitable standard factory finish for the switchgear.
- c) The cut-outs in the low voltage compartment shall be fully painted after punching the low voltage compartment door.

2.1.8 Bus bar

2.1.8.1 Bus bars and interconnections:

- a) Provide silver plated aluminium/copper buses, fully rated and tested for the amperage shown on the drawings.
- b) Fully insulate and totally enclose the buses within the bus compartment of the switchgear.
- c) Mount the buses on appropriately spaced insulators and brace to withstand the available short circuit currents.
- d) The bus and bus compartment shall be designed and tested so that the acceptable NEMA, ANSI, UL and CSA standard temperature rises are not exceeded.
- e) Install a ground bus the full length of the switchgear assembly.

2.1.8.2 Insulation:

The insulation shall be a 15 kV rated, high flame-retardant, self-extinguishing, high track resistant epoxy material that complies with the NEMA Standard 65 degree C temperature rise.

2.1.9 Circuit breakers

A) Breakers that have the same ratings shall be interchangeable with other breakers in that line-up

B) The circuit breakers shall be in accordance with IEEE C37.04, NEMA C37.06.1 and NEMA SG-4. Breakers shall have the following features:

C) Draw out, vacuum interrupter type, UL and cUL / CSA listed.

Vacuum:

- i. Three independent sealed high vacuum interrupters contained within epoxy encapsulated poles for high reliability.
- ii. Breaker total interrupting time of 3 cycles.
- iii. Suitable contacts to allow for a minimum of 50,000 no load or light load operations without intermediate maintenance.
- iv. Contact surfaces to be made of special chrome-copper alloys or equivalent to reduce effect of chopping.
- v. Vacuum interrupters shall meet the safety requirements of ANSI C37.85.

2.1.9.1 Operating mechanism:

- a) The mechanism shall operate in a quick-make, quick-break manner and shall be operated by a linear magnetic operator. Breaker tripping, closing, and indicating lamps shall be AC or DC operated.
- b) The speed of the contacts during the operation shall be independent of the control voltage and the operator's movements.
- c) Equip the mechanism for manual opening of the contacts during loss of normal control power.

2.1.10 Relays

Comply with IEEE C37.90, integrated digital type; with test blocks and plugs.

2.1.11 Multifunction digital-metering monitor:

Microprocessor-based unit suitable for three- or four-wire systems, with the following features:

- a) Inputs from sensors or 5-A current-transformer secondaries, and potential terminals rated to 600 V.
- b) Switch-selectable digital display with the following features:

Phase Currents, Each Phase: ± 1 percent.

Phase-to-Phase Voltages, Three Phase: ± 1 percent.

Phase-to-Neutral Voltages, Three Phase: ± 1 percent.

Three-Phase Real Power: ± 2 percent.

Three-Phase Reactive Power: ± 2 percent.

Power Factor: ± 2 percent.

2.1.12 Draw-out rails:

- a) Design the rails to guide the breakers to their disconnected, and connected positions. Provide an indication in the cubicle of each of the positions.
- b) The breaker shall maintain contact with ground in all positions through a ground connection that has been fully tested and approved by UL.

2.1.13 Power line and load disconnecting contact fingers and springs:

- a) The contact fingers shall be silver-plated, full-floating, self-aligning, self-coupling, and designed for smooth action during engaging and disengaging movements.
- b) Provide adequate flexibility between stationary and movable components to assure proper meeting of the contact fingers, while also providing adequate pressure on the contact surfaces.
- c) Mount the contacts on the breaker so that they can be conveniently inspected.

The stationary contacts for the line and load breaker contact fingers shall be isolated from the breaker compartment by metal shutters when the breaker is removed from the connected position.

The control and auxiliary contacts of the breaker shall be multi-contact plug on an umbilical cord with a positive locking mechanism to insure connection. The mechanism on the umbilical cord shall also provide leverage to allow for easy disconnection when the breaker is in the withdrawn position. Interlocks to prevent disconnection of the umbilical cord when the breaker is in the connected position shall be provided.

2.1.14 Mechanical interlocks

- a) Shall prevent the breaker from movement, except when the breaker contacts are in the open position.
- b) Shall prevent the breaker from closing the contacts while in the connected position, except when the power line and load disconnecting contacts are completely connected.
- c) The interrupting ratings of the breakers shall be not less than 270 MVA for 5kV systems and 800 MVA for 15 kV systems, but higher ratings if shown on the drawings shall apply.

2.1.15 Current transformers

- a) Provide ring type current transformers or approved equal. The transformers shall have a mechanical and one-second thermal rating in RMS amperes of not less than the momentary and interrupting rating of the breaker at rated voltage.

- b) Provide transformer ratios as shown on the drawings. Accuracies shall be coordinated with the associated relays and meters by the switchgear manufacturer to assure proper operation at the selected pick up and operating current ratings.
- c) Current transformers shall be mounted over the circuit breaker connections to the main (line) bus or load bus and shall be able to be replaced from the front of the equipment without major disassembly of the circuit breaker cubicle.

2.1.16 Potential transformers

- a) The potential transformers shall be encapsulated, draw out, disconnecting type and shall be properly protected by primary current-limiting fuses.
- b) When the transformers are withdrawn from the compartment the primary terminals shall be grounded.
- c) The transformer ratios and accuracies shall be coordinated with the associated relays and meters by the switchgear manufacturer.
- d) All potential transformers shall be UL and cUL / CSA listed for use in the equipment.

2.1.17 Control power transformers

- a) The control power transformers shall be encapsulated, draw out, disconnecting type and shall be properly protected by primary current-limiting fuses.
- b) The ratings of the transformer shall be as indicated on the drawings.

2.1.18 Metering

- a) Provide ring-type current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.
- b) Provide voltage transformers including primary fuses and secondary protective devices for metering as shown on the drawings.

2.1.19 Other Equipment

2.1.19.1 Cable Terminations:

- a) Cable terminations shall conform to the requirements in Section 16 05 13, MEDIUM-VOLTAGE CABLES.
- b) Coordinate cable terminations with the switch gear being furnished.

2.1.19.2 Medium voltage surge arresters:

- a) Distribution class, metal-oxide-varistor type. Comply with NEMA LA 1.
- b) Provide each ungrounded conductor of each incoming circuit with an arrester.

2.1.20 Auxiliaries

Install all additional components required for proper operation of the switchgear.

2.1.20.1 Control wires

- a) Switchgear control wires shall not be less than No. 14 AWG copper 600-volt, Stranded SIS. Install wiring complete at the factory, adequately bundled and protected. All conductors across hinges, and all conductors for interconnection between shipping units shall be stranded.
- b) Conductors shall be sized in accordance with the NEC. Provide separate control circuit fuses in each breaker compartment and locate for ease of access and maintenance.

2.2 Transformer

2.2.1 Oil Filled Transformers with ON Load Tap Changing Links on HV Side

A. Codes and Standard: (As per latest BIS:1180)

Transformer shall conform to Indian Standard IS: 2026-Part I to Part IV, ECBC-2007 (as per revised latest standards).

B. Rating:

Selected transformer shall be of specified rating suitable for continuous operation.

C. Connections and Vector Group:

Delta on High Voltage side and star on low voltage side with neutral terminal brought out for solid earthing corresponding to the Vector Symbol Dyn - 11.

D. System of Supply:

3 phase, 50 Hz 6 KV earthed system.

E. Tapping's:

'ON' load tap changing links on HV side. The tapping's to be provided for variation on HV side from + 5% to - 15% in steps of 1.25% each.

F. Temperature rise:

Continuously rated for full load, temperature rise not exceeding 40 deg C by thermometer in oil or 45 Deg C by resistance.

G. Type:

Outdoor type.

H. Terminals:

The cable box with glands on HT side shall be suitable for 3core XLPE cable of specified capacity. Flanges with cable box on LT side shall be suitable for aluminium conductor armoured cables of size mentioned in BOQ. All cable glands shall be earthed.

I. Cooling:

Natural cooling by means of pressed/round tubes around transformer tank.

J. Insulation:

The transformer shall be oil insulated type.

K. Earthing:

Two separate earthing terminals to be provided at the bottom on both sides.

L. Fittings and Accessories:

The following accessories and fittings shall be provided.

- Lifting Lugs: The arrangement for lifting the active part out of the transformer tank along with the cover by means of lifting lugs without disturbing the connections.
- Swivel Type Rollers: the transformer to be provided with 4 Nos Bi-Directional rollers fitted on cross channels to facilitate the movement of the transformer in both directions.
- Oil Conservator: The transformer to be provided with an oil conservator with welded end plates. It is to be bolted to the cover and can be dismantled for purpose of transport. It

has to be provided with magnetic oil level gauge and an oil filling hole 1 1/4" BSF size with a cap, which can be used for filtering oil. For draining purpose, a plug shall be provided. A connection pipe between the conservator and the main tank is to be provided which projects inside the conservator and the main tank

- Air release Valve: An air release valve is to be provided on the top of the tank cover facilitate the release of the entrapped air and filling of oil.
- Breather: The transformer to be provided with an indicating dehydrating silica gel breather of sufficient capacity.
- Drain-cum-oil Filter Valves: The transformer to be provided with a drain-cum-oil filter valve of 1 1/4" BSF size at the bottom of the tank.
- Diagram and rating plate: Diagram and rating plate shall be provided indicating the details of transformer, connection diagram, vector group, tap changing diagram etc.
- Dial type thermometer for Oil (150 mm dia) with maximum set pointer at 75 deg C and electrical contacts for electrical alarm at high temperature.
- Winding temperature indication and electrical contacts for trip /alarm.
- Buchholz relay of double float type with high gas pressure alarm & trip suitable for 24 volts DC supply.
- Filter valve of 1 1/4" BSF at top.
- Explosion vent.
- Disconnecting chamber shall be provided for cable termination.
- Outdoor type Marshalling box with interconnecting cables
- HT Cable box suitable for 3C x 240 sq.mm 6.6KV HT XLPE (UE) cable
- LV Cable box suitable for L.V cable arrangement as per SLD

M. Winding:

The transformer shall be copper conductor wound.

N. Core:

The magnetic core shall be made up of cold rolled grain oriented low loss steel stampings.

O. Maximum Allowable Power Transformer Losses:

Maximum allowable losses for oil filled distribution transformers with highest voltage for equipment 6 KV, at 50% and 100% of the load.

P. Testing:

The transformer shall be subject to the following tests at the factory before dispatching the same and test certificates shall be furnished:

- Measurement of winding resistance.
- Ratio polarity and phase relationship.
- Impedance voltage.
- Load losses.
- No-load losses and no-load current.
- Insulation resistance.
- Induced over voltage withstand.
- Separate - source voltage withstand.
- Temperature rise.
- Di-electric strength of oil.

2.3 LT switchboards

2.3.1 General

The switchboard shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on medium voltage power, 3 phase 4 wire 50 cycles system.

The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs for use in installations where continuity of operation is of prime importance.

2.3.2 Codes and standard:

Some of the important applicable codes/ standards issued by the Bureau of Indian Standards are listed below for the guidance of the Tenderers. Latest issues of the standards/codes shall be applicable:

IS: 13947	:	L.V. switchgear and control gear Part-I – 1993 General rules
IS: 5578	:	Guide for marking of insulated conductors
IS: 11353	:	Guide for uniform system of marking and identification of conductors and apparatus terminals
IS: 2147	:	Degree of protection provided by enclosures for low voltage switchgear and control gears
IS: 2675	:	Enclosed distribution fuse boards and cutouts for Voltages not exceeding 1000 V
IS: 255	:	Danger notice plates
IEC60947	:	Circuit Breakers (Part- II)
IEC60947	:	Circuit breakers (Part-II)
IS: 13947	:	Switches, Disconnectors, switch disconnector (Part - III) and fuse combination units.
IS: 1818	:	Alternating current isolators (disconnectors) and earthing switches.
IS: 8623	:	Factory built assemblies of switchgear and control gear for voltages up to and including 1000 V AC & 1200 V DC.
IS: 8828	:	Miniature air brake circuit breakers for voltages not exceeding 1000 V
IS: 9926	:	Fuse wires used in rewirable type Electric fuses up to 1100 Volts
IS: 2208	:	HRC fuse links
IS: 2705	:	Current Transformers (Part- I, II & III)
IS: 3156	:	Voltage Transformers (Part- I, II & III)
IS: 1248	:	Indicating Instruments
IS: 722	:	Integrating Instruments
IEC 60947 /IS: 13947	:	Control devices and switching elements (Part - 5) Section-1
IEC60947/ IS: 13947	:	Contactors and motor starter section 1 (Part - 4) Electromechanical. Section – 1
IS: 3231	:	Relays
IS: 375	:	Marking and arrangement of bus bars Indian Electricity Act and Rules

2.3.3 Type and construction

The switchboard shall be of:

- a. Indoor type floor mounted panel: IP 54.
- b. Outdoor feeder pillar: IP 66.
- c. Made up of the requisite vertical sections modular type which when coupled together shall form continuous dead front switchboards.
- d. Sheet steel enclosed, dust, vermin and damp proof and enclosure.
- e. Each feeder/instrument compartment shall be provided with a hinged door interlocked with MCCB inside the compartment such that door can only be opened when MCCB in off position.
- f. Readily extendable as required by the addition of vertical sections after removal of the end covers.
- g. Switchboards shall have access to the feeders, bus bars, cable termination, cable alley, etc. as required.
- h. Main Breakers need to be lockable.

Each vertical section shall comprise:

- a. A front framed structure of rolled/folded CRCA sheet steel angle section of minimum 3 mm thickness rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment such as circuit breaker cassettes, main horizontal bus bars, vertical risers and other front mounted accessories.
- b. The structure shall be mounted on a rigid base frame of folded CRCA sheet steel of minimum 6 mm thickness and 75 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.
- c. A cable chamber housing the cable end connections and power or control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling and adequate safety for working in one vertical or horizontal section without coming into accidental contact with live parts of the adjacent section.
- d. A cover plate at the top of the vertical section, provided with a ventilating hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1mm diameter perforations to prevent entry of vermin.
- e. Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors generous overlap shall be ensured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust

The height of the panel shall not be more than 2200 mm unless otherwise specified and maximum height of switch operating handle shall not be more than 1800mm from FFL. The total depth of the panel shall be adequate to cater for proper cabling space.

Doors shall be of minimum 14-gauge sheet steel and covers and partitions of 160 sheet steel. All sheet steel work forming the exterior of switchboards shall be smoothly finished, levelled and free from flaws. The corners shall be rounded.

The Components in the switchboards shall be so arranged as to facilitate ease of operation and maintenance and at the same time to ensure necessary degree of safety.

Components forming part of the switchboards shall have the following minimum clearances:

- a. Between phases 25 mm
- b. Between phases and neutral 25 mm
- c. Between phases and earth 25 mm
- d. Between neutral and earth 19 mm

When, for any reason, the above clearances are not available, suitable insulation barrier/shielding shall be provided. Clearances shall be maintained during normal service conditions.

Creep-age distances shall comply with those specified in relevant standards. All insulating material used in the construction of the equipment shall be of non-hygroscopic material treated to withstand the effects of high humidity, high temperature and tropical ambient service conditions.

Functional units such as circuit breakers, MCCBs, etc. shall be arranged in multi-tier formation except that not more than two air circuit breakers shall be housed in a single vertical section.

Metallic and/or insulated shrouding shall be provided within vertical sections and between adjacent sections to ensure prevention of accidental contact with:

- a. Main bus-bars and vertical risers during operation, inspection or maintenance of functional units and front mounted accessories.
- b. Cable terminations of one functional unit, when working on those of adjacent units.

All covers providing access to live power equipment or circuits shall be provided with tool operated fasteners to prevent unauthorized access. Provision shall be made for permanently earthing the frames and other metal parts of the switch gear by two independent distinct connections. Only CRCA steel sheets shall be used for fabricating the cubicle. Thickness tolerance for sheets shall be as applicable in relevant IS.

Metal Treatment and Finish Generally the treatment and finish of the metal surface shall be as per detailed specifications in Clause 8.4 Metal Treatment and Finish.

2.3.4 Bus bars

The bus bars shall be made of high conductivity high strength E91E aluminium alloy suitable for 440 volts 3phase 4 wires 50 Hz 50kA/35kA/25KA as specified in electrical SLD.

The bus bars shall be suitably supported with non-hygroscopic supports to provide a fault withstand capacity as specified.

High tensile bolts and spring washers shall be provided at all bus bar joints.

Fish plates of equal type and size shall be used at all joints.

The bus bars shall have uniform cross section throughout and shall be capable of carrying the rated current at 433V continuously. The bus bars shall be designed to withstand a temperature rise of 45 Deg C above the ambient. A current density of 1.00 Amp/Sq. mm & 0.8Amp/Sq. mm. shall not be exceeded for copper and aluminium bus bars respectively.

The neutral bus bars shall have a continuous rating of at least 100% of the phase bus bars, unless mentioned otherwise.

Bus bars shall be fully sleeved using heat shrunk PVC sleeves appropriately colour coded to identify different phases and neutral bar.

An earth bus of size not less than 40 x 6 mm aluminium shall run throughout the length of switchboard at top or bottom as required.

2.3.5 Air circuit breakers

2.3.5.1 General

The ACBs shall conform to IS 13947-172/IEC60947-1&2; conforming to test sequence 1. The ACBs shall be suitable for 3 phase 415 Volts. 4 pole ACBs shall have settable neutral at site (0,50, 100% In). All the breakers shall have topicalization as a standard feature.

2.3.5.2 Construction

The Breaker shall be suitable for rear and vertical mounting and line load reversibility without duration. The operating mechanism shall be designed such that the handle can only be in 'OFF' position if the Main contacts are actually separated and vice versa. It shall conform to Isolation as per standard.

2.3.5.3 Control Units

The Control Units shall be housed in a separate enclosure and there shall be total insulation of the control unit with respect to the power unit. The Control Unit shall be suitable to provide short circuit, overload and earth fault protection (wherever specified). The Control Unit shall not be a peak sensing device and shall measure the true RMS values to make the measurement free from the influence of harmonics. It shall have thermal memory.

2.3.5.4 Protections

The overload settings shall be adjustable from 0.4 to 1.0 times the nominal rating (In) and shall have time delay. Short circuit protection shall be from 3 to 9 times the rated current (Ir) with time delay. Instantaneous protection shall be settable up to 15 times nominal rating. Earth fault Protection (wherever specified) from 0.2 to 0.7 times nominal current (In) with time delay.

All breakers shall have segregated Led fault Indications & microprocessor failure indication.

2.3.5.5 Accessories

- All ACB feeders shall have metering and local display features viz. Ammeter, Voltmeter, frequency, KVA, KW, KWAh, p.f, maximum demand. It shall be possible via COM (485 port) to transmit the protection & metering settings to PC.
- ACB shall be provided with following accessories, in addition to the item specified in Bill of Quantities. Further these devices shall be fit-table at site accessible from the top and front and shall be common for all ratings.
- The connection for the auxiliary shall be accessible from the front.
- All ACBs shall have Under Voltage trip, shunt trip, auxiliary switches with NO. + NC. In EDO type, closing coil shall be provided.

2.3.5.6 Interlocking

- ACBs shall be provided with the following interlocking devices for interlocking the door of a switchboard:
 - Handle interlock to prevent unnecessary manipulations of the breaker.
 - Door interlock to prevent door being opened when breaker is ON position.
 - Defeat interlocking device to open the door even if the breaker is in ON position.

2.3.6 MCCB - Moulded Case Circuit Breaker

2.3.6.1 General

MCCB shall conform to IS 13947-1&2/IEC60947-1&2; confirming to test sequence 1 and Isolation as per standard. It should be suitable for Horizontal and Vertical mounting and line load reversibility without any duration.

The Moulded Case Circuit Breaker incorporated in the switchboard shall be of the current limiting type, cat A, up to 630A. 800A and above shall be cat B i.e with Short time withstand capacity $I_{cw}/0.5$ sec of minimum 20kA. MCCB shall be suitable either for Single Phase AC 230V On Three Phase 415V. The MCCB shall be available in fully rated four pole versions for neutral isolation. It shall have topicalization as standard feature.

The MCCB cover and case shall be made of high strength heat-resistant and flame-retardant thermosetting insulating material. The operating handle shall be quick make, quick break, and trip - free type. The operating handle shall have suitable 'ON' 'OFF' 'TRIPPED' indicators and in order to ensure suitability for isolation complying with IS 13947-2/IEC60947-2, the operating mechanism shall be designed such that the toggle or the handle can only be in 'OFF' position: if the main contacts are actually separated.

All Breakers shall have adjustable overload and short circuit settings.

Overload – adjustable 0.4 to 1 times nominal rating (In)

Short-circuit – adjustable from 2 – 9 times rated current (Ir)

Earth fault (wherever specified) – adjustable setting with time delay.

All MCCB feeders shall have monitoring & display feature viz. Ammeter, Voltmeter, frequency, KVA, KW, KWAh, p.f.

2.3.6.2 Accessories

MCCB shall be designed to have following accessories and it shall be able to fit at site.

- a. Under voltage trip
- b. Shunt trip
- c. Alarm switch
- d. Auxiliary switch

2.3.6.3 Interlocking

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

- a. Handle interlock to prevent unnecessary manipulations of the breaker.
- b. Door interlock to prevent door being opened when breaker is in ON position.

2.3.7 Other Equipment

2.3.7.1 Contactors

Contactors shall comply with IS 13947-1 for general rules and IS 13947 - 4.1 for Standards pertaining to Contactor and Motor Starter.

The Contactors shall be capable of withstanding breaking and making capacities per following:

AC3 Category	AC4 category
Making Current 10 x Rated Current	12 x Rated Current
Breaking Current 08 x Rated Current	10 x Rated Current

Contactors shall be capable of withstanding an impulse voltage of 8kV and have an insulation voltage of 1000V.

- Contactors shall be suitable for copper termination with a maximum permissible temperature rise of 65 Deg; C at the terminals with an ambient temperature of 50 Deg; C.
- The coils shall have three terminals and the insulation shall be of class H type.

- The auxiliary contact block shall have a switching capacity of 240V at 2A. Contactors shall have one auxiliary in built and it shall be possible to have additional normally opened, normally closed contacts in steps of two.

2.3.8 Miniature circuit breakers [MCB]

MCB shall be in 1,2,3 or 4, pole versions. MCB casing shall be made of self-extinguishing, tropicalized material.

MCB shall comply with IS 8828-1996/IEC 898-1995. It shall be suitable for use in frequency range 40Hz to 60Hz and shall accommodate AC/DC supply according to requirements. It shall have a trip-free mechanism and toggle shall give a positive contact indication. It shall be suitable for mounting on 35mm DIN rail/surface mounting.

Line supply may be connected to either top or bottom terminals i.e. there shall be no line-load restriction. Degree of protection, when the MCB is flush mounted, shall be IP40. MCB shall be supplied with clamping terminals fully open. Contact closing shall be independent of the speed of the operator. The breaking capacity of the MCB shall be 10kA. The MCB shall be capable of being used as Incomer Circuit Breaker and shall be suitable for use as an isolator. In case of multiple MCBs in a single location (DB), it shall be possible to remove any MCB without having to disturb other MCB's in the vicinity.

2.3.9 RCCB - (Residual Current Circuit Breaker)

RCCB shall be available in 2 pole and 4 pole versions and threshold sensitivities of 30mA, 100mA, 300mA and current ratings from 25 to 80A. Rating and sensitivities shall be as specified.

RCCB shall comply with IS 12640-1988/IEC 1008. The short circuit withstand of the RCCB without the associated short circuit/overhead protection shall not be less than 3 kA. It shall be operationally independent of line voltage. The sensitivity thresholds (30mA, 100mA, 300mA) shall be of non-user adjustable type by construction.

2.3.10 Current Transformers

Current transformers shall comply with the requirements of IS 2705. They shall have ratios, outputs and accuracy as specified/required. All CT's shall be of resin cast type unless otherwise specifically called for.

- All CTs shall be of bar type primary or suitable for the cable given type and size.
- For all the CTs suitable type and size clamps are to be supplied for mounting in the switchboards.
- Polarities and terminal markings of primary and secondary shall be clearly marked on all CTs

2.3.10.1 Specifications For CTs

a) Current Ratios:

1. Primary: As per feeder ratings
2. Secondary: 5A

b) Type: Resin Cast

c) Class: PS-Differential Protection

5P10-O/C, E/F, RPR

Class 1 for metering

d) System Voltage

LT: 415V, 3Ph, 50Hz

2.3.11 Potential Transformers

- All the Potential Transformers shall comply with the requirements of IS 3156 latest editions. All PT's shall be resin cast type and shall have Voltage ratios, output and accuracy class as specified in Data Sheet.
- All PT's shall be single phase, dry type suitable for mounting inside the panel or cubicles. Clamps, brackets and supports required for the mounting shall be supplied along with PT. Polarities and Terminal markings shall be clearly marked in all PT's. Name plate indicating, voltage ratio, burden, accuracy class, type, serial number, make and model plus other related data, shall be provided.
- A common earth terminal for earthing of core, bolts, clamps (noncurrent carrying metal parts) etc., shall be provided.

For 415V system, Specification of the PT's shall be as follows:

- a) Voltage ratio : 415V/110V
- b) Type : Resin cast
- c) Burden : 100VA
- d) Class (Metering/Protection): 0.5/3P

2.3.12 Instruments And Meters

All instruments and meters shall be enclosed in dust proof, moisture resistant black finished cases and shall be suitable for tropical use. They shall be calibrated to read directly the primary quantities. They shall be accurately adjusted and calibrated at Works and shall have means of calibration, check and adjustment at site. Definition of various meters as follows: -

2.3.12.1 Dual Energy Meter

Dual Energy meter (Used as shown in SLD)

- A. Must Indicate kw and KWH of EB and Dg selectable through Separate Display Switch
- B. Tariff Change to be imitated through Volt Free Contacts (NO Aux or DG power will be available)
- C. Inputs: Voltage: 250V from 20 to 800 Hz
- D. Current: 5 A from 20 to 800 Hz with Field programmable Ct ratios
- E. Input overload: Voltage: max.264 Vrms phase to neutral Current: max 20 Arms,

F. Automatic Scale Change on V and I for linearity of reading min scales: 2 current scales 1 voltage scale and Auto offsetting of Errors for Consistent reading

G. Accuracy: Class 1 according to IEC1036 standards

H. IP rating: Instrument = IP20 Front panel = IP40

I. Temperature range: from -10°C to +40°C Relative humidity: R.H. max 90% Condensation: not permitted

J. Isolation: in accordance with group B VDE 0110 standards for 250 VACrms operating voltages.

2.3.12.2 Multi-Function Meter

Multifunction meter used on Panels as shown in SLD.

1. To display all electrical parameter V, I, Hz, kw, kVA, kVA_r, Energy (kwh kVAh, kVA_rh), Max Demand, and Neutral Current.
2. To Display Individual harmonics from 0 to 31 on V, I and KW with Indication of Direction of Harmonic from load to Source or Vice versa
3. Accuracy Class 1 on energy complying with IEC EN 61036. Quadrants. 2 and 4 quadrant measurement (programmable) with Auto Automatic Scale Change on V and I for linearity of reading min scales: 2 current scales 1 voltage scale and Auto offsetting of Errors for Consistent reading
4. Standards - Safety: IEC EN 61010 class 2 - E.M.C IEC EN 61326-1A
5. Protection degree IP51 on front panel.
6. OUTPUT through RS 485 confirming to J MODBUS MODICON communication Protocol or Output thru RS 4*20mA
7. 2 Set Points as 2 digital outputs rated 27Vdc-27mA (DIN43864) with programmable functionality (pulse output or alarm)
8. Galvanic Isolation on all inputs and outputs to Attenuate RFI Disturbance

2.3.13 SPD

A surge protective device (SPD) is a protective device for limiting transient voltages by diverting or limiting surge current and is capable of repeating these functions as specified. SPDs were previously known as Transient Voltage Surge Suppressors (TVSS) or secondary surge arresters (SSA). Secondary surge arrester is a legacy term (often used by utilities) and is used most commonly for a device that has not been certified to ANSI/UL 1449. In 2009, after the adoption of ANSI/UL 1449 (3rd Edition), the term Transient Voltage Surge Suppressor was replaced by Surge Protective Device.

Surge protection is a cost-effective solution to prevent downtime, improve system and data reliability, and eliminate equipment damage due to transients and surges for both power and signal lines. It is suitable for any facility or load (1000 volts and below). Typical SPD applications

within industrial, commercial and residential include: Power distribution, control cabinets, programmable logic controllers, electronic motor controllers, equipment monitoring, lighting circuits, metering, medical equipment, critical loads, back-up power, UPS, HVAC equipment. Communication circuits, telephone or facsimile lines, cable TV feeds, security systems, alarm signaling circuits, entertainment center or stereo equipment, kitchen or household appliances.

In Main LT Panel, Type-1 SPD is used.

2.4 Distribution Board

2.4.1 General

Distribution boards shall be TP & N type for 415 volts, 3 phases, A.C. supply or 230V single-phase A.C. supply as required. Distribution boards shall generally conform to IS 8878 - 1978. However, the specifications hereinafter described shall take precedence over the above wherever these specifications call for a higher standard of material or workmanship.

2.4.2 Cabinet design

Distribution boards shall be of totally enclosed dead front safety type and with dust and vermin proof construction. The enclosure shall be made of the sheet steel of 14G corresponding to the size. The sheet steel shall be treated with a rigorous rust inhibition process before fabrication. The distribution boards shall comprise of miniature circuit breaker, Earth leakage Circuit Breaker as incoming and required number of miniature circuit breakers as outgoings. The mains and outgoings shall rating as specified on the drawings and schedule. The cabinet shall spray enameled to required colour shade finish. The interior surface shall be finished to an off-white shade. The interior components shall be mounted on a separate sheet steel which is mounted on locked on to the studs provided inside the cabinet. The cabinet shall be equipped with a 14 G inside hinged front door having a spring latch and a vault lock or over flanged door. Cabinets shall have detachable suitable size top and bottom, cable/conduit entry boxes with gland plates made out of 14 gauge. The hinged type door shall be with compressed rubber gasket lining and for over flanged type door the same gasket shall be provided inside the box.

2.4.3 Bus Bars

Suitable size bus bars made of high conductivity copper and mounted on non-hygroscopic insulating supports shall be provided. Neutral and earth bus bar shall be with taped holes and brass screws spring washers, etc., complete. For UPS distribution boards separate bus bars shall be provided for system neutral and body earthing.

2.4.4 Circuit Breakers:

Miniature circuit breakers shall be of approved design and make. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front face of all the breakers shall be flush with each other. The incoming MCBs shall be provided with insulator shoes.

2.4.5 Safety and Interlocks:

All the liver parts be properly shrouded such that accidental contact with live parts are totally avoided. Distribution boards interior assembly shall be dead front with the front cover removed. Incoming MCB terminal shall be shrouded with insulating shoes. Suitable insulating barrier made

of arc resistant material shall be provided for phase separation. Ends of the bus structures shall also be shrouded.

2.4.6 Terminals:

Distribution boards shall be provided with a terminal block of adequate size to receive mains and outgoing circuits. The location of the terminal block shall be so located that, crowding of wires in the proximity of live parts is avoided.

2.4.7 Directory:

Distribution boards shall be provided with a directory indicating the areas of loads served by each circuit breaker, the rating of breakers, size of conductors, etc.. The directory shall be mounted on metal holder with a clear plastic sheet on inside surface of the front door. The Din Plate with a clear Perspex sheet shall be provided on the front door for over flanged door type DBs.

2.4.8 Installation:

Distribution boards shall be surface or recess mounted as required and at the locations shown on the drawings. The surface mounted boards shall be fixed on 40 x 40 x 6 mm angle iron frame work and bolts. All the cables/conduits shall be properly terminated using glands/grips/check nuts, etc.. Wiring shall be terminated properly using crimping lugs/sockets and PVC identification ferrules while carrying out the termination. No bare conductors shall be provided inside the board.

Distribution boards shall be bonded to the earthing system at least at two points using brass bolts and lugs. Suitable name plate/danger plate indicating the voltage, number of ways shall be fixed to the front cover. Minor civil works for mounting the DB shall be in the scope of the Contractor.

2.5 Power and Control Cables

2.5.1 Scope

This specification covers the design, manufacture, testing, inspection at Manufacturer's works and supply of power and control cables as detailed in Data Sheet conforming to specific requirements mentioned in this specification. The estimated quantities are given in the price schedule. However, the Contractor shall recheck the quantities and supply according to the requirements.

2.5.2 Codes and standards

The design manufacture and performance of cables shall comply with the requirements of the latest editions of the codes and standards.

2.5.3 Specific Requirements-Power Cables

2.5.3.1 415V Power Cables

The cables shall be 1100V grade, single / multicore, stranded aluminium conductor, unarmoured, PVC insulated, with PVC inner sheath and outer sheath of PVC. The cables for emergency services shall be with additional FRLS properties. The cables shall conform to IS-1554 - Part - I (1988).

For multicore cables, fillers used to fill in the space between the phases shall be non-hygroscopic, chemically inert and non-putrescent.

Cables laid outside the building, either buried or in trench shall be of armoured type.

2.5.4 Specific requirements-control cables

1100V grade multicore, 1.5 sq.mm stranded copper conductor, PVC insulated and extruded PVC inner sheathed and extruded PVC outer sheathed of PVC. FRLS cables, which have outer sheath of specially formulated FRLS PVC cable, shall be used for cables connected to Emergency services. The cables shall conform to IS 1554 Part- I (1985) / IEC 502 (1983) in all other respects. Cables laid outside the building, either buried or in trench shall be of armoured type.

2.5.5 Power cables shall be selected on the following basis:

Power cable shall carry the full load current of the circuit continuously under site conditions considering the various de-rating factors like ambient air temperature (40 deg C), grouping, laying methods etc.

Power cables shall be sized to restrict the voltage drop to 5% and a voltage dip of 10% for motors.

Power cable shall withstand the fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault.

2.5.5.1 Instruction manuals

Four copies of instruction manuals, descriptive bulletins etc. as indicated in the distribution schedule shall be furnished prior to dispatch of cables. The manual shall include amongst others, the following particulars.

Description of insulation, sheathing and screening. This should include data on resistance to attack by chemicals, fungus, termites, rodents, water and ultra-violet radiation.

2.5.5.2 Test certificates

Type/Routine test certificates for all types of cables included in the order and special tests on FRLS/FS cables.

Specified number of copies of the approved test certificates shall be furnished to the Employer before dispatch of cables.

2.5.6 Cable and Installation

These notes in general apply to installation of cables up to and including 33KV grade.

Electrical installation work shall comply with all currently applicable statutes, regulation and safety codes in the locality / country where the installation is to be carried out.

Installation of cables shall be carried out generally as per IS: 1255 or relevant applicable standards of any other country specified in the specification and as per the instructions contained in specification, enclosed standard drawings and relevant project drawings.

Installation of cables includes storing, laying, fixing, jointing, termination, and all other work necessary for completing the job. Supply of glands and lugs, together with other necessary materials for joining and termination shall also be included in the Contractor's scope.

Construction of cable trenches, provision of embedment and similar work involving civil items shall be coordinated with Civil Contractor by Electrical Contractor. However when such work is required to be done by the Electrical Contractor, it shall be carried out as per the instruction / notes on the relevant project drawings and installation specification of the project.

Cables shall be installed in trenches, trays, racks, tunnels, conduits, and ducts or directly buried. The actual cable layouts shall be shown on the relevant project drawings. Changes if necessary, after obtaining prior approval of the Employer shall be carried out at site by the Contractor and shall be clearly indicated in "As Built Drawings" by him and forwarded to the Employer

Cables to each circuit to be laid in one continuous length. Cable joining if necessary shall be done only after obtaining prior permission from Employer.

2.5.7 Outdoor cable Installation

Directly buried cables shall be laid as per drawings and cable markers shall be provided. At least one cable marker shall be provided if the length of the buried cable is less than 15 meters. Buried single core cable laid in trefoil formation shall be tied by plastic tapes or 3mm dia. Nylon cord every 750mm.

Joints in directly buried cable shall be identified by joint markers at each joint location. For details of joint markers refer drawings.

In each outdoor cable run greater than 60 meters, some extra length of cable shall be kept at a suitable point to enable a straight through joint to be made, should the cable develop fault at a later date.

Where cable cross roads and water / oil / gas / sewage pipes, the cable shall be laid in hume or pipes. For road crossing the pipe for the cable shall be buried at not less than 600mm depth unless otherwise noted in the drawings. Hume pipe shall be preferred to steel pipe from the point of view of corrosion.

Control cables and small power cables in trenches, tunnels and racks shall be run in ladder type cable trays (Maximum tray width 600mm) supported on trench/ tunnel/ rack carrier arms. The cables shall be tied to tray rungs by means of 3mm dia. Nylon cord at an interval not exceeding 3000mm and also at bends.

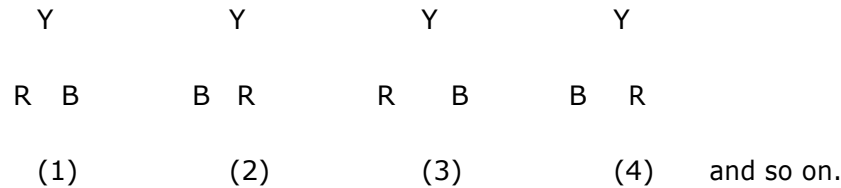
For good sealing arrangements at entry points, suitable pipe sleeves, adequate in number and adequate in sizes shall be provided in building walls / slabs for passage of cables into building from cable trays/ racks/ cable trenches located outside the buildings. Details of sleeves and exact location of such entry points will be available on relevant project drawings.

2.5.8 Cables in Trays/On Racks

Different voltage grade cables shall be laid in separate trays when trays are arranged in tiers. HV cables shall be laid in top trays and cables of subsequent voltage grade in lower tier of trays.

The power cables of 1.1KV and above shall be laid in trays / on racks as follows

- a) In single Layer only without exception.
- b) 3 core cables shall be laid in touching formation
- c) Single core cables shall be laid in trefoil groups with a spacing equal to the diameter of the cable between the edges of the trefoils
- d) Cables in trefoils groups of the same circuit shall be laid as indicated below so as to ensure balanced current distribution



1100V grade power cables of 120 sq mm size and above shall normally be laid in single layer in trays or on racks. In exceptional cases, these may be laid in double layer, if shown on the drawings or with the permission of the Employer

Control and instrumentation cables can be laid upto maximum of three layers in each tray / Rack.

Single core power cable of 3 phase AC circuits laid in trays/ racks/ trenches in trefoil group shall be held in trefoil clamps placed at an interval not exceeding 3 meters. The trefoil group of cable additionally be tied by means of 3mm dia. Nylon cord as follows.

- a) At an interval not exceeding 1 meter when laid in cable tray / Racks.
- b) At an interval not exceeding 750mm when laid in trenches without cable trays.

Cables in vertical raceways shall be clamped by saddle type cleats / cable binders to the horizontal slotted angles. Cleats shall be fabricated from 3mm aluminium strip at site by Electrical Contractor to suit the cable groups. Single core cables shall be clamped with trefoil clamps.

2.5.9 Bending Radius for Cables

The bending radius for various types of cables shall not be less than those specified below, unless specifically approved by the manufacturer.

Type and voltage grade of the cable.	Minimum Bending Radius	
	Single core	Multicore
a) Paper insulated upto 1.1KV	20 D	15 D
b) Paper insulated above 1.1KV and upto 11KV	20 D	15 D
c) Paper insulated above 11KV	25 D	20 D
d) PVC & XLPE insulated upto 1.1KV	15 D	12 D
e) PVC & XLPE insulated above 1.1KV and upto 11KV	15 D	15 D

Type and voltage grade of the cable.	Minimum Bending Radius	
	Single core	Multicore
f) PVC & XLPE insulated above 1.1KV	20 D	15 D

Where "D" is the overall diameter of the cable.

(For other types of cables, recommendation of manufacturers shall be followed.)

The values may be reduced to the extent of 70% when making only one bend such as in case of installing the termination.

2.5.10 Termination, Clamping and Miscellaneous Details

Cable entry to the motors, Push button stations and other electrical devices shall be from the bottom as far as possible or from the sides. Top entry shall be avoided particularly for outdoor equipment.

Identification tags made from aluminium sheet shall be attached to each end of each cable by means of GI binding wire. Tags shall be additionally put at an interval of 30 meters on long runs of cable and in pull boxes.

All cable terminations shall be soldering less crimping type. Whenever lugs are to be supplied, adequate size crimping lugs for approved make shall be used by the contractor. The crimping tools shall be adequate for the size of the lug

Saddle type clamps to suit number of cables to be clamped at a particular location shall be used for clamping cables running along the walls, ceilings, structures etc. The interval between adjacent clamps shall be shown on the relevant enclosed drawings

Wooden cleats when required for supporting vertical runs of one or more single core cables per phase, such as near transformer cable boxes, shall be made of well-seasoned wood and shall be painted with two coats of fire-retardant paint of approved quality

2.5.11 Testing and commissioning of cables

Cables shall be checked for insulation resistance before Laying and after laying and termination/jointing of the cable. The voltage rating of the megger for cables of different voltage grade as indicated below.

Voltage Grade of cable	Megger Rating
1.1 KV	500V
3.3 KV, 6.6 KV and 11 KV	1000V
11/33 KV	2.5KV motorized megger

2.5.12 High voltage Testing

All cables of 33KV grade 400sqmm HV cables shall be subjected to DC or AC high voltage test after jointing and terminating but before commissioning as per relevant standards. Testing with DC voltages should be preferred as test equipment required is compact, easily portable and requires low power. The DC test voltages applicable in India in accordance with IS:1255. The cable cores must be discharged on completion of DC high voltage test and cable shall be kept earthed until it is put into services.

DC test voltages for the old cables shall be 1.5 times rated voltage or less depending upon the age of the cable, repair work or nature of jointing work carried out.

In each test, Metallic sheath/ screen/ armour shall be connected to earth.

Continuity of all the cores, correctness of all connections as per wiring diagrams, correctness of polarity and phasing of power cables and proper earth connection of cable glands, cable boxes, armour and metallic sheath shall be checked.

2.5.13 Earthing

Metallic sheaths, screens and armour of all multicore cables shall be earthed at both equipment and switchgear end.

Sheath and armour of single core power cables shall be earthed at switchgear end only. If specially indicated in the project specification / drawings, for long lengths of cables, multiple earthing may have to be adopted to safeguard against the presence of standing voltages under normal as well as under faulty conditions.

Earthing of power cable with core balance CT shall be in accordance with latest IS standards.

Earthing of CT and PT neutral lead shall be done at one end only.

2.5.14 Painting

Whenever M.S. items are supplied by the contractor as indicated in the installation specification, these shall be painted as follows.

- a) For indoor installation : One shop coat of red oxide zinc chromate primer (site coat for exposed surfaces of embedded steel) and two site coats of aluminium alkyd paint or paint as specified.
- b) For outdoor and corrosive Atmosphere indoor : Painting with two pack epoxy coating.

Where any cuts or holes are made on the finished steel work or welding is done, the effected portion of steel work shall be painted as stated above. Galvanised structures if damaged, during welding, cutting etc., shall be touched up with two coats of zinc-rich paints.

2.6 Lighting

2.6.1 Scope

This specification covers the design, material specification, manufacture, testing, inspection and delivery to site of lighting system equipment such as lighting fixtures, lighting poles and other similar items necessary for lighting system.

2.6.2 Standards

The items of supply comply with the latest applicable standards as specified in specification. Where no standards are available, the supply items shall be backed by test results shall be of good quality and workmanship.

2.6.3 Lighting fixtures and Accessories

Lighting Fixtures / Luminaires – General Requirements

Luminaires shall be designed for continuous trouble-free operation under atmospheric conditions without reduction in lamp life or without deterioration of materials and internal wiring. Outdoor fittings shall be weatherproof and waterproof type.

All luminaires shall be supplied complete with lamps suitable for operation on a normal supply voltage and the variation in supply voltage and frequency indicated in data sheet.

LED type luminaires shall be complete with accessories like LED's, drivers etc. These shall be mounted as far as possible in the luminaire housing only. If these cannot be accommodated integral with the luminaire then a separate metal enclosed control gear box shall be included to accommodate the control accessories together with a terminal block suitable for loop-in, loop-out connections. Outdoor type fixtures shall be provided with outdoor type weatherproof box with IP 65 or better.

Each luminaire shall have a terminal block suitable for loop-in, loop-out and T-off connection by 1100 V grade suitable size of cable as per SLD. The internal wiring should be completed by the MANUFACTURER by means of stranded copper wire of minimum 1.5 sq.mm size and terminated on the terminal block. Terminal blocks shall be mounted with minimum two fixing screws. Mounting facility and conduit knockouts for the luminaires shall be provided.

All hardware used in the luminaire shall be suitably plated or anodized and passivized for use in chemical, industrial and power plants.

Earthing:

- a) Each luminaire and control gearbox shall be provided with an earthing terminal suitable for connection earthing conductor as indicated.
- b) Painting / Finish
- c) All surfaces of the luminaire / control gearbox housing accessories shall be thoroughly cleaned and degreased. It shall be free from scale, rust, sharp edges and burrs.
- d) The finish of the luminaire shall be such that no bright spots are produced either by direct light source or by reflection.
- e) External control gearbox provided for housing accessories shall be galvanised.

2.7 Diesel Generator

2.7.1 Scope

The dealer shall furnish standby power units, including all equipment, materials, and labour to insure complete, functional, and reliable standby power. Only manufacturer's authorized dealers who have a minimum of twenty-five years' experience in the field of power generation with the same manufacturer whose products are being offered and can certify to this requirement, are allowed to supply equipment for this project. The dealer must be authorized by the manufacturer to administrate warranty for the engine generator set and must employ factory-trained mechanics.

2.7.2 Standards

The items of supply comply with the latest applicable standards as specified in specification. Where no standards are available, the supply items shall be backed by test results shall be of good quality and workmanship.

2.7.3 Quality assurance

- A. Design, manufacture, testing and method of installation of all apparatus and materials furnished under requirements of these specifications shall conform to latest publications or standard rules.
- B. All equipment and materials shall be listed by Underwriters Laboratories, Inc. (UL) for their intended use and shall bear the UL label or shall be manufactured according to that agency's standards where such standards have been established
- C. All materials shall be new and free of defects and shall be installed using the manufacturer's latest standard design.

2.7.4 Submittals

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, required clearances, method of field assembly, components and location and size of each field connection.
- C. Compliance: At the time of bid, supplier must submit a certificate indicating compliance with the specifications. A copy of the manufacturer's printed and published service manual, parts book, installation guide, operation guide, service directory, and warranty shall be available to the Engineer during bid evaluation.
- D. Field quality-control test reports.

2.7.5 General

2.8.5.1 Manufactures

The standby generator set as specified is based on an acceptable unit. The Vendor shall be responsible foray engineering changes and costs that may be incurred with substitution. Only engine manufacturer's standard rating shall be acceptable, no dealer special ratings will be approved.

2.8.5.2 Generator set characteristics

- A. Rating at 1500 RPM: 415 volts

1. Standby kVA with fan: selection as per requirement
 2. Power factor: 0.8
 3. Frequency: 50 Hz
- B. The specified or selected standby kW shall be for continuous electrical service, interruption of the normal utility source, per NEMA standards.

2.8.5.3 Components

- A. Engine: The engine shall be water-cooled, compression-ignited, rated for continuous standby application. It shall produce sufficient horsepower to achieve ratings as shown on the drawing while driving all accessories and parasitic loads such as fuel, lube oil, and jacket water pumps. The engine cylinders shall be equipped with replaceable cylinder liners and shall be fully water-cooled. Pistons shall be one piece, three ring design with cast in iron banks for the top two minimal restrictions and long life. Connecting rods shall be forged, hardened, and peened for increased strength. Main and rod bearings shall be of aluminum construction with copper bonding to the lead tin overlay, super finished for uniform film. A fuel priming pump shall be standard equipment. The engine shall incorporate one-piece high strength cylinder heads. The cylinder block shall be of single piece construction and constructed in such a way that liner shall rest on top of the block with a spacer plate installed between the block and cylinder head. Each cylinder shall have a continuously pressurized oil cooling jet directed at bottom of the pistons.
- B. Governor: The engine shall be equipped with a speed control with 0 (isochronous) speed drop rom no load to full rated load and steady state speed regulation shall be $\pm 0.25\%$ over a range of -40° to 75° C. The governor shall be Woodward electronic type with speed control.
- C. Safety Device: The generator set shall have installed and be warranted by the engine manufacturer the following alarms and shutdowns.
1. Oil pressure shutdown with step protection at high and low idle
 2. High water temperature shutdown
 3. Over speed shutdown
 4. Over crank shutdown
 5. Emergency stop push-button
- D. Cooling System:
1. Construction: The engine jacket water shall be cooled through an integral tube and fin type radiator sized to provide full cooling of engine heat rejected to the coolant at 105 % of maximum load operation and a maximum external air flow restriction of 0.5" water. A blower type fan and all rotating members and drive belts shall be guarded and meet OSHA standards.
 2. Coolant and Conditioner: The unit shall be provided with factory installed and tested 50% ethylene glycol Nalcool treatment shall also be added to the system in proper proportion.
 3. Jacket Water Pump: Provide an integrally mounted jacket water pump of sufficient capacity to circulate jacket water through engine coolant system at a rate as required to provide full cooling of engine heat rejection to coolant at full load rated speed.
- E. Provide dual connection compression type lugs.

- F. Provide two (2) battery charges and two (2) battery racks.
- G. Exhaust System:
 - Muffler
 - a. Provide a critical grade exhaust silencer, Maxim M41, as manufactured by Beard Industries, Inc. or approved equal, properly sized by the manufacturer. The exhaust outlets on the engine shall be joined so there is only one common exhaust connection, one common flexible connection and one companion flange. Gaskets shall be furnished as required. Muffler shall be of double-walled, all welded construction protected by two single coats of shop primer.
 - b. Provide performance data for sound attenuation in dB in each of the eight octave band frequencies and 'A' scale attenuated exhaust noise with silencer at ten feet.
- H. Main Circuit Breaker shall be moulded case, enclosure mounted on the generator, and be sized as per requirement, 480 volts, and a 24 volt DC shunt trip. The circuit breaker enclosure shall be built to accept a flexible conduit, bottom entrance.
- I. Voltage Regulator: The voltage regulator shall be solid state, three phase sensing, volts per hertz type, to be supplied by the engine generator set manufacturer. Voltage drift shall be no more than $\pm 0.5\%$ of rated value at constant temperature. Adjustable controls for voltage drop, level and gain shall be easily accessible. Voltage level adjustment shall be a minimum $\pm 10\%$. Current limiting circuits shall be used to restrain exciter field current in the event of a sustained low power factor load. It shall provide rapid response during transient conditions. Overvoltage and under voltage protection shall be provided along with a solid state circuit to remove excitation when generator overload for more than 10 seconds occurs. Telephone Influence Factor shall not exceed 50. At full throttle engine starting, output voltage shall not overshoot more than 5% of its rated value, with respect to the volts/Hz curve and response time shall be less than 20 milliseconds.
- J. Control Panel: A generator mounted solid state control panel with digital readout meters and self diagnostic capability shall be provided, shock mounted and vibration isolated on the generator. Control panel shall include 1% true RMS reading meters for amps, and volts, a phase selector switch (four position), frequency meter, and voltage adjust rheostat, oil pressure gauge, water temperature gauge, battery DC voltmeter, tachometer, auto start-stop control module, over crank, four position engine control switch for: Stop-Off/Reset-Manual-Auto, Cycle Cranking, Cool down Timer, and Emergency Stop Push-button.
 - 1. Alarm module with flashing LEDs and horn to annunciate the following:
 - a) High coolant temperature alarm
 - b) Low coolant temperature alarm
 - c) Low oil pressure alarm
 - d) Battery Charger Malfunction
 - e) Generator on load
 - f) Low oil level
 - 2. Engine run contact
 - 3. All necessary control wiring, fuses, fuse blocks, terminal blocks, name- plates, fault contacts, auxiliary contacts, metering control transformers.

- K. Remote Annunciation Panel: A remote annunciator panel shall be provided with alarm indicating lights and alarm horn with test switch and silence button for the following alarm conditions:
1. Low oil pressure
 2. Over speed Shutdown I
 3. Battery charger malfunction
 4. Low coolant temperature
 5. Over crank Shutdown
 6. Generator On load
 7. Low Oil level
- L. Foundation: The engine and generator shall be factory mounted on a torsionally stiff base, prime painted, fabricated from channel or I-beam to insure adequate mounting surface contact and minimal deflection.
- M. Vibration Isolator: Provide spring-type vibration isolators between engine structure and foundation pad. Quantity of isolators shall be furnished as required to provide the whole system (base, engine, and generator) with proven compatibility and shall be certified as such by the manufacturer of the unit. Spring isolators shall be capable of 96% of transmitted vibration isolation, rated for a static deflection of 1" maximum, and suitable for seismic design appropriate for an importance factor of III (essential facility) and a ground motion acceleration as indicated in the International Building Code Sections 1614 and 1615. Seismic protection and vibration efficiency calculations shall be submitted for approval. Vibration Isolators shall be by Ace Mounting Co., Inc., Series 632, or approved equal.
- N. Power Generator: The power generator shall be of the single bearing type, KW rating as per selection, 1500 rpm, 0.8 pf, 50 Hz, 3 Phase, 4 wire, 415 V, Brushless type. Sub transient reactance shall be a minimum of .20 per unit on the direct access. The power generator shall be manufactured and packaged by the engine manufacturer to insure proper performance and affect a single source of responsibility. The generator shall be rated and conform to NEMA standards for temperature rise and construction. The unit shall be synchronous, tropicalized and built per NEMA MG I-22 and IEEE standards. Class H insulation shall be used on stator and rotor and both shall be protected with an asphalt modified epoxy on all end coils. The generator shall derive excitation current from the generator output. The AC power shall be converted and controlled by silicon-controlled rectifiers. The rotor assembly shall demonstrate 130% overspeed capability at 170° C for 2 hours. The generator rotor two plane dynamic balance shall be within 0.002" peak-to-peak amplitude displacement while at operating speed. The generator shall have a waveform deviation of not more than 5% and shall meet NEMA limits for telephone influence factors. Generator pitch shall be .6666. Power supply to the voltage regulator shall be by a Self-Excited Self-regulated Brushless type excitation system.
- O. Automatic Starting System
- A 24 volt DC electric starting system with positive engagement drive shall be furnished.
 - Provide 24 volt Lead-Acid storage batteries of the heavy duty diesel starting type. The battery set shall be complete with steel rack, necessary cable and connectors,

all in conformance with the engine manufacturer's requirements. Battery set shall be rated 244 amp hour capacity minimum.

- For maintenance of the batteries at 90% - 100% of full charge, a 20 amp minimum, automatic dual rate battery charger, as manufactured by La Marche or approved equal, shall be provided. The charger shall recycle automatically to "on" or high rate at sufficient frequency to maintain high state of charge and long battery life. The charger shall be complete with DC ammeter, voltmeter, on-off switch, DC fuse, and charging indicator light. The 120 volt input to the charger shall be automatically disconnected during engine cranking cycle.
- P. Jacket Water Heater: Thermostatically controlled, jacket water heater, 480 V, single phase, 50 Hz, as per manufacturer's recommendations, with an oil pressure switch to shut down the water heater when the engine starts and flow of oil has been proven. It shall maintain engine coolant temperature at a minimum of 100° F in an ambient of 40° F. A contact shall close when jacket water temperature drops below 70° for remote alarm.
- Q. A VAR/Power Factor controller shall be provided.

2.8.5.4 Day Tank

- A. Provide a packaged design fuel oil day tank for each emergency generator. Day tank shall be complete in all respects in order to provide the generator with a reliable, local source of fuel. Tank assembly shall be complete in all respects in order to provide the generator with a reliable, local source of fuel. Tank assembly shall be in compliance with NFPA 30, 31, and 37 and in conformance with UL-142.
- B. Capacity: 300 gallons or as per standards.
- C. Power requirements: 240 VAC, single phase, 50-Hertz, 15 A dedicated branch circuit.
- D. Day tank construction:
 - All welded steel atmospheric tank of rectangular construction, built in accordance with codes and standards noted above for indoor use with fuel oil.
 - Pipe thread connections shall be provided for fuel oil supply from main tank, supply to prime mover, return from prime mover, over flow to main tank, vent, and drain with ball valve. The drain will penetrate the containment described below. A weather-proof, screened vent cap shall be provided as a loose item for field installation at the outdoor vent termination.
 - An inspection port in the top shall be provided.
 - The tank shall be equipped with a welded steel channel base suitable for bolt attachment to a concrete pad.
 - The tank shall have interior corrosion protection consisting of an epoxy coating.
 - The exterior of the day tank and the interior and exterior of the containment described below shall receive a heavy duty industrial anti-corrosion coating and be finish painting.
 - All day tank system components shall be protected by a removable steel equipment cover.
 - Day tank shall be factory leak tested at 5 psi.
 - The tank shall be installed and anchored with a steel containment basin having a minimum capacity of 110% that of the day tank. The containment shall be protected

against intrusion of debris and falling water. The containment shall be equipped with a leak detector that shall activate the "rupture" alarm. A drain with ball valve shall be supplied.

- The day tank shall be equipped with a solenoid valve 1.0 inch NPT, 100 psi, normally closed, under control of level controller. An inlet shut off valve shall be provided.
- Day tank level controller: Provide an electronic liquid level controller/indicator with functions to include: adjustable differential valve level control, tank level indication, system alarms, and manual operating controls. Level controller shall be self-contained as a unit and within a NEMA 1box mounted on top of the day tank.

The level controller shall provide the following:

a) Control Functions:

- "Auto-off-Manual" fill control mode switch
- "Press to Test" fill control pushbutton
- Adjustable differential valve level control with output contacts for control of on board solenoid valve and remote delivery.
- Overflow cut out.

b) Indication functions:

- Electric level gauge and condition indicator scaled in percent level, color coded and placard to indicate system condition vs. level.
- LED lamp indicators for:
 - Power available
 - Fill control not in auto
 - Tank filling
 - Low level alarm
 - High level alarm
 - Tank rupture

c) Outputs:

- Fill control start-stop
- Low level alarm
- High level alarm
- Not-in-auto
- Tank rupture

d) The level controller shall have an intrinsic overflow cut out back-up control which, upon sensing an overflow, will open the fill control contacts, close the fill control solenoid valve, and stop the remote fuel delivery system, activate an alarm and cause the controller to revert to an emergency back-up level control mode, which allows the tank to continue operating automatically, which inhibits overflow.

e) The level controller shall have a tank rupture cut out circuit which, upon sensing the presence of liquid in the tank containment, will open the fill control contacts, close the fill control solenoid valve, and stop the remote fuel deliver system and activate an alarm.

E. System testing:

- The fuel supply system shall be supplied with manufacturer's test certificates as follows:

- Tank test: Pressure test, leak-proof test, and structural integrity/appearance test.
- Level controller: Operational test and calibration of level sensors, level indicator, level control, alarms, back-up devices.

2.8 UPS

UPS will be IGBT rectifier based on-line type with sealed maintenance free batteries for 30minutes battery backup along with built in isolation transformer, interconnectors, rack and accessories.

Input & Output Voltage: 240V ± 5%

Frequency: 50Hz

Harmonics: < 5%

Out Put P.F: > 90%

Rectifier: IGBT based

IGBT Rectifier with built-in Isolation transformer (External Transformer is not acceptable)

Back-Up Time: 30 Munities at 100% load

Ambient Temperature: 0°C - 35°C

Protection Class: IP 20

Noise Level: < 60 dB

3 BILL OF MATERIAL

3.1 Preamble

- All items of work mentioned in the Schedule of Quantities shall be read and executed strictly in accordance with the description of the item in the Schedule of Quantities & read in conjunction with the appropriate IS and conditions of Contract.
- The rate for each item of work included in the bill of quantities shall unless expressly stated otherwise included cost of: -
 - a. All materials, fixing materials, accessories, hardware, operations, tools, equipment, consumables, civil works wherever involved and incidentals required in preparation for in the full and entire execution and completion of the work called for in the item as per specification and drawings completely.
 - b. Wastage on materials and labour.
 - c. All taxes, duties, Octroi, including works contract tax, sales tax, transit insurance, packing and forwarding charges, loading, transportation, unloading, handling, hoisting, to all levels, setting and fixing in position, disposal of debris and all other labour necessary in accordance with contract documents, good practice and recognized principles.
 - d. Liabilities, obligations and risks arising out of conditions of contract.
 - e. Liaison service charges.
- All requirements of system whether such of them are mentioned in the item or not the specifications and drawings are to be read as complimentary to and part of the schedule of quantities and any work called for in one shall be taken as required for all.

- In the event of conflict between the bill of quantities and other documents, the most stringent shall apply and interpretation of the Architect shall be final and binding.
- The installation price of switchboards, metering panels, DB's or any other items shall include supply and fixing of supporting steel structures/MS channels grouting of the same civil works etc., as required.
- No change in unit rate shall be allowed for any change in quantity or for any other reason whatsoever.
- Supply of materials shall mean supply of materials at site. The rate for supply shall include all taxes, Octroi, insurance, packing and forwarding charges, transportation, unloading at site. However, the quote should indicate the tax structure separately with necessary details.
- The successful contractors shall submit the Schematic diagrams, fabrication drawings with details of all equipment wirings diagrams etc., to Client/ Architect for approval prior to supply/commencement of such works. The approval of these drawings will be general and will not absolve to contractor of the responsibility of the correctness of these drawings. At least four copies of the approved drawings shall be supplied to Architects for their distribution to various agencies at site at no cost of Owner.
- The tenderers must see the site conditions such as type of soil, locations etc., and take all factors into consideration while quoting the rates as no extra cost will be allowed on any ground arising out of or relating to the site conditions.
- Any error in description or in quantity or omission of items from the contract shall not vitiate this contract but shall be corrected and deemed to be a variation required by the Architect/Owners.
- The Liaison Service Charges shall include the following:
 - a. Follow up expenses with the Local Statutory authorities from the drawing approval up to servicing the installation and getting the safety certificate.
 - b. Preparation of detailed drawings required by the Local Statutory Authorities.
 - c. Obtaining approval of drawings and installation from Local statutory Authorities as applicable.
 - d. Obtaining route drawings from Local Statutory Authorities as applicable.
 - e. All incidental charge/expenses associated with the above work as applicable.
 - f. Official deposits paid to the above agencies will be reimbursed separately at actual by the Owners.
- The tenderer shall take into account the expenses of pre-commissioning tests to be conducted as per specification of the complete installation by licensed agencies.

3.2 Bill of quantity

Refer the separate sheet of bill of quantity.

3.3 List of Approved Makes

ELECTRICAL MAKES OF MATERIALS		
1	HT PANELS	: SCHNEIDER / L & T / SIEMENS
2	LT PANEL BOARDS	: CPRI Tested vendors and should have minimum 10 Years' experience
3	TRANSFORMERS	: MAKPOWER / VOLTAMP / RPG
4	PVC CONDUIT	: PRECISION / ANCHOR / POLYCAB
5	MS CONDUIT	: AKG / BEC
6	PVC/ MS CONDUIT ACCESSORIES	: AKG / BEC / PRECISION
7	PVC FRLS COPPER WIRES	: ANCHOR / RR CABLE / FINOLEX
8	MODULAR SWITCH / SOCKET	: LEGRAND / ANCHOR-ROMA / HAVELLS
9	MCB / MCB DB	: L & T / PANASONIC / ABB
10	ELCB/RCBO	: L & T / PANASONIC / ABB
11	HV / MV XLPE INSULATED CABLE	: KEI / RR CABLE / HAVELLS
12	HT CABLE TERMINATION KIT	RAYCHEM / 3-M
13	INDUSTRIAL TYPE PLUG AND SOCKET	: L & T / PANASONIC / ABB
14	GI CABLE TRAYS & RACEWAYS	: PROFAB / ABO / PATNY
15	EXHAUST FAN	: ANCHOR / HAVELLS / CROMPTON
16	LED LIGHT FITTINGS	: AS PER ARCHITECT
17	ACB	: L & T / ABB / SCHNEIDER
18	MCCBs	: L & T / ABB / SCHNEIDER
19	CONTACTOR AND OVER LOAD RELAY	: L & T / ABB / SCHNEIDER

20	DIGITAL METERS	:	CONSERV (SCHNEIDER) / ELMEASURE / HPL / NEPTUNE
21	CAPACITOR ALL PP / HEAVY DUTY MPP	:	SCHNEIDER / NEPTUNE / L&T / HAVELLS
22	CTs & PTs	:	KAPPA / KALPA / AE
23	CONTROL SWITCHES	:	KAYCEE/GEC/ALSTOM /SALZER
24	ELR / EARTH FALUT RELAY	:	ALSTOM / PROK DIVS / ER
25	PROTECTVE RELAY	:	ALSTOM / AVKC / ER / L&T
26	PUSH BUTTONS	:	TECHNIC / VASIHNO /SCHNEIDER / L&T
27	INDICATING LAMPS (LED)	:	TECHNIC / VASIHNO /SCHNEIDER / L&T
28	LUGS / GLANDS	:	DOWELLS / SMI / COMET / POLYCAB
29	TERMINALS	:	ELMEX /ESSEN-FINGER TOUCH PROOF
30	LIGHTNING PROTECTION	:	CAPE ELECTRIC/ ALLIED POWER SOLUTIONS
31	UPS / INVETERS	:	BPE / EMERSON / APC / NUMERIC
32	BATTERY	:	AMARRAJ/EXIDE/AMCO
33	STABILIZER	:	DUBAS / EMERSON / POWERTRONIX/SERVO
34	Load Monitors / Controller	:	Ducati / Electrex / Enercon
35	Control Cables	:	KEI / RR CABLE / HAVELLS
39	DG sets - Engines	:	Perkins / Cummins / KOEL
40	DG sets - Alternator	:	Sterling / Kirloskar / Crompton Greaves / Mahindra
41	Battery charger	:	AMERON/ EXIDE/AMCO

4 TESTING OF ELECTRICAL SYSTEMS

4.1 General (Part-1)

A. Conform to General Requirements for Electrical Services of Division 26.

I. Description of Work

A. Prior to acceptance, inspect, operate and test all electrical equipment, materials and components, whether such tests are detailed in this specification or not. Tests will be witnessed by the Owner, to ensure that the operation of the systems and components satisfies the requirements of the Contract Documents.

B. Include any specific testing required by the Authorities, or any other body having jurisdiction over the installation, and as directed by the Owner.

C. Provide all tools, equipment, labor and materials required to perform the electrical testing. Provide three copies of the test reports to the Owner.

The Owner reserves the right to witness factory testing of all equipment. Coordinate with the equipment manufacturers and notify the Owner 21 days before any factory testing, to confirm the presence of the Owner.

II. Report any deficiencies in test results immediately to the Owner.

Test in accordance with the applicable standards issued by the local authorities having jurisdiction (e.g. IEC, IS, NBC 2016 NFPA, IEE), and with the recommendations of the manufacturers.

E. Include the cost of all testing in the bid price, whether performed in the field or at the factory. Inform the manufacturers of the factory and site testing requirements.

F. Make test records in a neat and legible manner, fully identifying the equipment or system being tested, type of test equipment, calculation, and expiry date for the same, the test results and the date of the test. Submit 3 copies to the Owner at the end of each test.

G. Do not energize distribution or control equipment until the test results have been reviewed, passed and approved by the Owner.

Ensure that phasing and phase rotation is the same throughout the system. Ensure that all devices are wired for the same polarity.

III. Test all electrical systems and installation in accordance to the related standards and in accordance to the equipment manufacturers testing procedure.

IV. Carryout all tests in accordance to an approved procedure by the Owner and all necessary data and results which may be requested by the Owner.

V. Provide all testing to demonstrate proper operation as required by these Specifications and the authorities having jurisdiction of the electric system, equipment and components as indicated on the Drawings and as specified herein. Tests shall include, but not be limited to the items specified in this section.

4.2 Submittal Data

- A. The following submittal data shall be furnished according to the General Conditions and shall include, but not be limited to:
1. Test Procedures for all tests proposed.
 2. Recording Forms.
 3. Test Data and Results including the following:
 - a. Test performed.
 - b. Test procedure.
 - c. System and area tested.
 - d. Date(s) and time(s) of test.
 - e. Weather conditions.
 - f. Test criteria.
 - g. Test results.
 - h. Additional pertinent data.
 4. Instruments including documentation that such instruments were properly calibrated at the time of the testing.
 5. Personnel and Qualifications

VI. Testing Materials

- A. Provide all materials, including fuels where required, supplies, services, temporary equipment and test equipment required for testing of specified electrical system components as well as integrated system tests, including any retests required to obtain acceptable results.
- B. Testing materials that fail to provide acceptable test results shall be repaired or replaced with suitable materials as required to obtain acceptable test results.

4.3 General for Execution (Part-2)

- A. Testing shall be carried out in accordance with contract requirements, by personnel specializing in this work.
- B. The contractor shall submit to the Owner for approval his schedule of program for the works, the program shall address the following:
1. Planned date of commencement of testing.
 2. Expected date of completion of testing.
 3. Power ON date.
 4. Fire alarm ON date.
 5. Telephone/Data system 'ON' date.
 6. Actual testing date and duration for each system.

- C. The contractor shall submit for approval, a detailed method statement for each testing activity.
- D. The contractor shall maintain written records of all tests.
- E. Successful test records shall be counter signed by the Owner's Representative and bound into the Operation and Maintenance Manual. Upon completion of the testing the Contractor shall demonstrate to the Owner the following:
 - 1. Voltage within correct tolerances in accordance with the contract Documents.
 - 2. Power factor and harmonics in accordance with the Contract Documents.
 - 3. Earthing in accordance with the contract Documents.
 - 4. Illumination levels in accordance with the Contract Documents.
 - 5. Correct control of all MEP plant equipment and decrease devices.
 - 6. Fire alarm system.
 - 7. Correct functioning of the following specialist systems and their integration:
 - a. PA System
 - b. Central Battery System
 - 8. An audit inspection at factory before dispatch and at site after receipt of the switchgear for any manufacturing / transit defects.
- F. Pre functional check sheets for all equipment in accordance with the Commissioning Plan.
- G. Manufacturing Defects:
 - 1. Inspect the doors of cubicles for proper opening/closing including door inter locks.
 - 2. Ensure the bus bar supports and insulation are free from cracks and damages.
 - 3. Ensure that the correct rating of the components such as fuses, contactors and over load relays are as per the approved drawings.
 - 4. Ensure that the physical condition of all meters, protection relays are good and ranges are as per approved layouts.
 - 5. Ensure all components are properly installed including CTs.
 - 6. Ensure the overall dimension and color of the cubicle is as per approved layout.
- H. Transit Damages
 - 1. Inspect the external surface of the cubicle for any transit damages and paint scratches.
 - 2. Inspect that batteries and chargers are not damaged during transit.
- I. The following pre-requisites have to be ensured before testing of the respective panels:
 - 1. Color coding / ferruling
 - 2. Tightening all bus bar joints with torque wrench
 - 3. Tightening of all connections
 - 4. Termination of cables on the panels

5. Interlocks as per approved drawings
 6. Inter panel wiring between various cubicles
 7. Operation of space heaters
 8. Control & power diagram of respective switchgear is readily available on the panel board for reference
 9. No loose tools left inside the panel
 10. Availability of first aid / firefighting equipment
- J. Field Testing of Electrical Systems
- K. The entire electrical installation shall be inspected by the manufacturer and tested by the Electrical Contractor to ensure safety to building occupants and operating personnel, conformity to Code authorities and Contract Documents, including the General Conditions for design services and construction procedures. The Contractor shall obtain the following approvals,
1. Electrical Inspectorate Approvals for drawings and installation
 2. Load sanction approval
- L. Recognized safety procedures and techniques shall be used during energizing and de-energizing of all equipment to ensure employee safety and protect the work.
- M. During the progress of the Work and upon completion, tests shall be made as specified herein and as required by authorities having jurisdiction including inspectors, Owner, Owner's insurance agency, Architect or Engineer. Tests shall be conducted by the Electrical Contractor as part of the Work of this Division and shall include the services of qualified personnel as well as all equipment, apparatus, and services required. Each wiring system with devices connected must test free from short circuits and from grounds and must have an insulation resistance between conductors and ground, based on maximum load, but not less than local code requirements and the requirements of the latest edition of the India National Electrical Code and relevant industry standards such as NETA, IEEE, ANSI, IS, NBC etc., whichever is more stringent
- N. The Electrical Contractor shall submit in writing proposed test procedures, recording forms, list of personnel and qualifications and test equipment for the Engineer's, Owner's, and Commissioning Authority's (CxA) review.
1. Procedures shall include operation of entire electrical power system including:
 - a. Voltage and current readings for each feeder and motor circuit under maximum operating conditions. Readings shall be submitted to the Engineer for review. Readings questioned shall be repeated for confirmation.
 - b. Operation of lighting and receptacle circuits with associated switching and controls.
 - c. Running of motors with demonstration of controls and interlocks.
 - d. Operation of transformers with voltage check while loaded to assure proper transformer tap settings.
 - e. Operation of electrical equipment and appliances whether provided

under this Division or not.

- f. Earth leakage protection system testing and calibration after construction is completed and prior to final acceptance.
- g. Demonstration and operating test of the entire Fire Detection, Alarm and Communication System as required by the Owner and the local authorities.

O. Factory and Site Testing

- 2. Each of the following (separate) factory tests and/or inspections shall be scheduled, organized and attended by the Electrical Contractor. The factory testing will familiarize the Contractor with the equipment and testing procedures that will be required at the site and allow the Contractor to inspect the equipment to be installed prior to shipment. The CxA shall identify the relevant test that should be attended by themselves, owners, consultants, and construction managers.
 - a. EPS system generator factory tests.
 - b. UPS system module and I/O switchgear tests.
 - c. UPS system static transfer switch tests.
- 3. The site tests included in paragraph 3.3 shall be performed by the Electrical Contractor as part of this Contract scope.
 - a. As part of these tests, where heat runs or "burn-ins" are included, infrared scanning shall be performed on all associated equipment during the full duration of the test.
 - b. Temporary load banks, cables and connections for all heat runs shall be provided for all of the following tests, as part of this Contract.

4.4 Equipment Testing

4.4.1 LT Distribution Switchboards

- 1. LT Distribution switchboards shall be megger tested.
- 2. LT Distribution switches shall be operated to confirm proper mechanical operation.
- 3. Test the accuracy of all meters with hand-held True RMS reading multi-meters.
- 4. Earth leakage/sensing systems shall be tested to verify their settings and proper activation. Polarity verification of the interconnection of the ground sensor circuits shall be performed.
- 5. Contact resistance test for busbar by means of equipment with minimum 10A

4.4.2 Cable

- A. Cables shall be megger tested. Individual cables shall be megger tested on an individual basis.
- B. Grouping of phase conductors for a group measurement shall not be permitted.
- C. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps, and connections are made and prior to final

connection to source or load.

- D. Insulation resistance of conductors which are to operate at 600 volts or less shall be tested by using Biddle (or approved equal) Megger with an output of not less than 1,100 volts d.c. Conductors shall be tested between phase conductors, between each phase conductor and neutral and ground, and between neutral and ground. Reading shall be observed after 15 seconds of operation of the Megger. Insulation resistance of conductors rated at 600 volts shall be not less than one (1) mega-ohm. (1,000,000 ohms), or the latest IS Standard requirement for the conductor type or governing Code, whichever is more stringent.
- E. Conductors that do not exceed insulation resistance values listed above shall be completely removed (source to load) and replaced and test repeated. The Contractor shall furnish all instruments and personnel required for tests.
- F. The above testing and report requirements shall apply to all No. 95mm² and larger conductors. Conductors No. 70mm² and smaller, branch circuits, control circuits, and signal circuits shall be checked in accordance with the NEC (National Electrical Code) Articles 110-7 and 250. If values are less than the minimum values noted in the Code, the feeder conductors shall be removed and replaced with conductors of identical size.
- G. All feeders which can be paralleled shall be tested for proper phasing using hot phasing or other approved techniques.

4.4.3 Panel Boards

Following the installation of branch circuitry, phase currents shall be verified to ensure the balance of loads. Branch circuitry shall be reconnected to achieve a maximum imbalance of 10%.

4.4.4 Receptacles

Receptacles shall be tested for polarity.

4.4.5 Lighting Fixtures

- Contractor shall perform final field aiming of all light fixtures.
- Document lighting lux levels to confirm meeting provided design criteria and specifications.

4.4.6 Lighting Inverters

- Inverters shall have an operational test performed following installation.
- Provide 80% load battery discharge test and document discharge time.

4.4.7 LT Distribution Switchboard / Motor Controllers

1. Testing including the following:
 - a. Detailed Check List
 - 1) Effectiveness of mechanical actuating elements
 - 2) Door interlocks
 - 3) Interconnection conductor sizes, laying and clamping/screwing

- 4) Visual inspection of degree of protection, creep-age and clearance distances
 - 5) Labels for feeders and circuit indications
 - 6) Supply of operational instructions, wiring diagrams, technical data of equipment used.
 - 7) Inspection and operational testing of the factory built assembly
 - 8) Electrical controls and sequence of operation
 - 9) Physical verification of drawings, including front and internal layouts
 - 10) Single line diagrams & Control schemes
 - 11) Check for cracks on components and housings
 - 12) Correctness of sizes and terminations. Properly Torque as per equivalent manufacturers recommendations.
 - 13) Cable entry/tray provisions, top and bottom
 - 14) Ventilation, anti-condensation heaters, and fans
 - 15) Sealing/pad locking for meter cabinet
 - 16) Phase barriers for incoming and outgoing breakers
 - 17) Size of bus bars - neutral/earth
 - 18) Gland plates
 - 19) Colour codes for cables
 - 20) Ferrules, labels etc.
 - 21) Termination cable with lugs
 - 22) Wiring connections of load side of incomer
 - 23) Mounting height of Meter, max 2M min 0.8M
- f. Physical Check
- 1) Check general arrangements of the components, internal wiring and complete cleanliness.
 - 2) Check the panel against approved shop drawing to ensure that right components (ACB, MCCB) of correct ratings are installed.
 - 3) Check the tray riser, cable drops cable overlapping and dressing of cable to LT Main Distribution Boards (MDB).
 - 4) Check all the bolts / nuts and bus bar connection to ensure that all are in good and tight condition.
 - 5) Check earthing/grounding of components and other related connection.
 - 6) Check all meters and selector switches to ensure the correct selection & rating.
 - 7) Check the phase barriers are properly fixed for separation of circuits.

- 8) Check all cables and panels are properly labeled and identified.
- g. Insulation Resistance Check
 - 1) Check and measure insulation resistance between phases, neutral and earth with 500 volts megger (the values to be verified with the permissible limits).
 - 2) Check the terminal insulation. Cable gland termination and shrouding.
- h. Functional Test (Panel to be temporarily energized)
 - 1) Check the control circuit of each system for its correct operation.
 - 2) Switch ON and OFF of all MCCBs, contactors, relays to verify for the desired operation.
 - 3) Check draw out mechanism of main incomer ACB.
 - 4) Check operation of the indication lamps & meters to ensure proper functioning.
 - 5) Check functions of motor operated ACB/MCCBs
 - 6) Check for any abnormal rise in temperature on bus bars, jumper cables, terminals and various devices by using an infrared scanner.
- i. Earth Leakage Test
 - 1) Check earth leakage circuit breakers by means of Residual Current Circuit Breaker (RCCB) tester, selecting 50% 100%, 150% of the rated sensitivity currents and the respective trip time to be recorded.
 - 2) Check the rating of core balance CTS and EL relays for earth leakage protection.
 - 3) Tabulate the readings taken.
- j. Earth Fault Loop Impedance Test
 - 1) Measure the earth loop impedance across phase and protective conductor with earth loop impedance tester.
 - 2) Tabulate the reading taken and check with permissible values.
- k. Polarity Test
 - A. Check the polarity of incomer supply by polarity tester before energizing panels.
 - B. Check all fuses/circuit breakers and single pole control devices are connected to phase conductors only.
- l. Test on Capacitor Panels
 - 1) Check the operation and indications of contactors in manual mode
 - 2) Check the operation and indications of contactors in auto mode by setting various power factor in the regulators.
- m. Overall Performance Test - Check and ensure the satisfactory operation of the boards at full load.
- n. Any other tests as requested by the Owner.
Infrared scanning shall be performed on the following equipment

4.4.8 Final LT distribution switchboard and panel board light & power points

- a. Physical Check
 - 1) Check the electrical components such as conduits, wires, trunking, light fixtures, socket outlets are connected to the final circuit of the distribution board.
 - 2) Check the installation of LT distribution switchboard and panel board and internal wiring.
 - 3) Check the identification and labeling of each final circuits.
 - 4) Check that all metallic components are earthed/bonded.
 - 5) Check the terminal insulation, cable gland termination and shrouding.
- b. Polarity Check
 - 1) Check the polarity of power / light points to ensure the light switches (single pole) are installed in the line conductor.
 - 2) Check for screw type lamp holders. The outer or screwed conductor is connected to the neutral conductor.
- c. Continuity Check
 - 1) Check the continuity of the protective conductor from the farthest point to main earth terminal of the DB for each final circuit by means of a DC ohm meter verify the values are within permissible limit).
 - 2) Check the continuity between the open ends of each of the three rings of circuit (i.e., phase, neutral and earth) for all ring final circuits conductors with a multi meter and the value to be within the permissible limit.
- d. Insulation Resistance Test - Check and measure the insulation resistance between phase, neutral and earth through a 500 V megger
- e. Residual Current Circuit Breaker (RCCB) and Polarity Test
 - 1) Switch on and off all MCB's and Contactor relay to verify for the desired operation.
 - 2) Check earth leakage circuit breakers by means of Residual Current Circuit Breaker tester.
 - 3) Check the circuit performance by switching on the Main Circuit Breaker (MCB) in the LT Distribution Switchboard.
 - 4) Check the light and power points by operating all the switches connected in the circuits.
 - 5) Check all the sockets outlets of ring/radial circuits with 3 pin socket tester (13A)/test lamp.
 - 6) Tabulate the readings taken.
- f. Earth Fault Loop Impedance Test
 - 1) Measure the earth loop impedance across phase and protective conductor with earth loop impedance tester.
 - 2) Tabulate the readings taken and compare with permissible values.

4.4.9 LT Power And Control Cables

1. Physical Check
 - a. Check the cable installation and ensure the following:
 - b. Proper laying and dressing cable cleating /tying cable.
 - c. Tray supports are adequate.
 - d. Cable identification and labeling.
 - e. Glanding and gland earthing termination is correct.
 - f. No physical damage.
2. Insulation Resistance Test
 - a. Conduct insulation resistance test as per cables manufacturer recommendations, and test requirements.
 - b. Measure insulation resistance between cores of all LT cable with a 500 V Megger and tabulate readings, the readings to be verified with permissible limits (min. 10 Mega ohms)
 - c. Measure insulation resistance between cores and cable and earth terminal with a 500 V Megger and tabulate readings. The readings to be verified with permissible limit.
3. Phase Rotation Test- Phase rotation at all points should be some other wise rectify.
4. Performance Test (to be energized temporarily)
 - a. Switch on all isolators and run all equipment, for 2 hours and verify complete performance.
 - b. Check for any unusual temperature rise in cables, terminals and switches and protective devices.

4.4.10 Emergency Lighting System

1. Visual Checks
 - a. Check the cable entries with regards to their tightness.
 - b. Check the general arrangements of components and wiring.
 - c. Rating and details of components.
 - d. Labels and identifications.
 - e. Earthing of components and related connections.
 - f. Check the polarity.
2. Insulation Resistance Test
 - a. Disconnect and bridge the mains connecting lead.
 - b. Disconnect and bridge the cable to the emergency lights.
 - c. Carry out insulation measurement to PE.
 - d. Remove the bridges after the insulation resistance measurement.
 - e. Reconnect the mains connecting lead and cable the emergency lights.

4.4.11 Lighting

1. Verify the correct lamps, position, ballast and operation of all fixtures.
2. With all lighting in operation, measure the average illuminance on the floor/working plane by establishing the maximum and minimum levels in the following locations:
 - a. Entry & Exits, electrical equipment rooms, pump rooms and stairways.
 - b. Every place of assembly rooms and areas as directed by the Owner.
3. With only the emergency lighting in operation, measure the average illumination at entry & exits & other areas of the facility where the public may congregate and other rooms and areas as directed by the Owner.
4. Take readings at night, with no outside light contribution.
5. Take readings with a cosine corrected portable digital illuminance meter, or with a video camcorder with suitable software for illuminance measurements. Measuring instruments shall be tested, calibrated and certified accurate to within 2%.
6. Submit technical, testing and calibration data as well as certification on the photometer.
7. All readings results should match the required illuminance levels as specified in relevant sections.

4.5 Systems Testing

A. General

1. Following the short circuit and coordination study of the complete electrical installation, all breaker-adjustable settings shall be calibrated accordingly. Primary and secondary injection testing shall not be performed until final breaker settings are calibrated. Lastly, all final site tests shall not be performed until breaker settings are adjusted and primary and secondary injection testing is complete.
2. Whenever full load tests or "burn-ins" are being performed as part of this testing scope, thermo-scanning of all equipment involved in the test shall be performed continuously during these periods.
3. The formal test procedures for all of the above-mentioned tests and their associated commissioning forms will be provided at a future date. No test will be considered complete until these forms have been submitted to the Owner and Engineer and have been found to meet the design criteria.
4. Check torque values of all lugs in the presence of the Owner or his authorized representative, and provide lamacoid plates indicating proper torque in each termination compartment.
5. Submit six (6) copies of each complete test report specified herein to the Engineer for review and send two (2) copies of each report to the Owner. The Contractor shall submit individual test reports for each individual system within two (2) weeks after completion of testing. .6 The foregoing shall in no way relieve the Contractor of any warranty requirements.

6. After the electrical distribution system, including all new switchgear, distribution panels, busways, transformers, control panels, motor controllers, lighting panels, etc. and equipment conductor terminations, has been checked, adjusted, finally calibrated and under load just prior to substantial completion as determined by the Project's construction schedule, it shall be subjected to a thermograph test using an infrared temperature scanning unit. Two (2) copies of the test report shall be furnished to the Engineer upon completion of test. Connections indicated having higher temperatures than acceptable will be tightened or corrected as required. After corrections have been made the connections shall be subjected to an additional thermograph by the Electrical Subcontractor and rechecked to confirm that the problem has been corrected.

5 COMMISSIONING

5.1 General

5.1.1 Description

- A. The purpose of this section is to specify Electrical Contractor responsibilities in the commissioning process. The Commissioning Authority (CxA) is part of the project reporting directly to the Owner and is authorized to act on behalf of the Owner as called out herein. Commissioning (Cx) requires the participation of the CxA/Stakeholders and Electrical Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The specific commissioning requirements will be presented in a Commissioning Plan developed by the project's Commissioning Authority (CxA). The Electrical Contractor shall become familiar with all parts of the Commissioning Plan issued by the CxA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.
- B. Testing shall be carried out in accordance with contract requirements, by personnel specializing in this work
- C. Contractor shall provide required manpower, Instruments for commissioning activities as per the project requirements specified in the commissioning plan or as instructed by the CxA/stakeholders.
- D. Separate commissioning team shall be appointed by contractor. for commissioning & Quality assurance (Different from the execution team) during the project phase & assign a commissioning manager who shall co-ordinate with the CxA / stake holder from time to time during project execution

While this Specification Section provides a general overview of the process and of roles and responsibilities, the Commissioning Plan is specific to the project.

- E. The testing and commissioning shall be carried out in accordance with contract requirements, by a firm specializing in this work, under no circumstances or without prior approval by the Owner shall the Contractor be allowed to use his own staff or affiliated companies for the Capital plant such as switchboards, power factor correction equipment, fire alarm system, lighting control and dimming system, central emergency

lighting system, lifts, and specialized ELV systems including CCTV and security systems etc.

- F. The contractor shall submit to the Owner for approval his schedule of program for the works, the program shall address the following:
- i. Planned date of commencement of testing and commissioning.
 - ii. Expected date of completion of testing and commissioning.
 - iii. Power ON date.
 - iv. Fire alarm ON date.
 - v. Telephone/Data system 'ON' date.
 - vi. Actual testing and commissioning date and duration for each system.
1. This Commissioning Plan deconstructs the commissioning procedure into a series of progressive tasks that must be competed in succession to properly commission the system under review. The five stages are defined as the FACTORY TESTING, VENDOR START-UP PREFUNCTIONAL VERIFICATION, FUNCTIONAL VERIFICATION and SYSTEM PERFORMANCE STAGES and can be described as follows:
 2. The first stage is the FACTORY TESTING stage and it defines all the items required for the functional testing of the equipment in a factory setting. The Owner / Stake holder reserves the right to witness factory testing of all equipment. Contractors shall co-ordinate with the equipment manufacturers and notify the Owner / stake holder 21 days before any factory testing, to confirm the presence of the Owner / stake holder. The tests to be included/incorporated in the Factory testing must be approved by all the stake holder the items completed during this period will lay the foundation for the vendor start-up and functional testing of the system and the equipment within. This stage will require the manufacturer to test all equipment functions and prepare a certified factory test report prior to shipping the equipment.
 3. The second stage is the VENDOR START-UP stage and it defines all the items required to be inspected, tested and checked for the initial start-up of the equipment. The items completed during this period will lay the foundation for the functional and acceptance testing of the system and the equipment within. This stage is an integral part of the EQUIPMENT PREFUNCTIONAL stage. This stage will require the cooperation of the equipment manufacturer, electrical contractor.
 4. The third stage is the EQUIPMENT PREFUNCTIONAL stage and it defines all the items required for the installation and includes as one item, the initial start-up of the equipment. The items completed during this period will lay the foundation for the start-up and later acceptance of the system and the equipment within. This stage will require the cooperation of the commissioning agent, site personnel, and design engineer. During this stage the installing contractor and manufacturer will be required to complete the items of work on the pre-functional check list and related test forms. Through meetings with the CxA, it will be determined which items on the check list are required prior to start-up and which items can follow for completion of the check list. This stage begins with visual inspections to ensure system is complete, and has been installed as designed/specified before testing begins. Systems are to be checked to assure that the commissioning process will not have to be stopped once it has started (sufficient testing points in the design/ installation,

sufficient power for tests etc). This stage includes air megger test, cable continuity, milivolt drop test, torque test, primary and secondary injection on breakers, earth loop impedance. The process for testing, of systems must be submitted to Engineer and Owner approval. This is important before the first start to avoid damage to the equipment. This procedure should include calibrated testing equipment. The contractor shall be responsible for coordination of sufficient temporary power for all operations at this stage. Upon completion of this stage, including factory testing, field start-up, all tests and visual inspections, the installing contractor and manufacturer shall submit the pre-functional check list and test forms to the CxA for approval. Upon receipt of approval, the functional testing can be scheduled.

5. The fourth stage consists of the EQUIPMENT FUNCTIONAL TEST items. The series of tests performed during this stage determines the suitability of the installed components to be placed into service and for compliance with the design and operational intent of the equipment. This stage will require the collaboration of the installing contractor with the manufacturer's representative to help assure an operational system is ready for final acceptance. Also the contractor should ensure the critical snags related to each equipment documented during Para functional are completed prior to commencing to functional test. During the functional testing the equipment will be subjected to all possible operating modes. The unit will then be tested to confirm that all alarm and BMS functions operate as designed. Upon completion of the alarm testing the manufacturer will prove all settings to the CxA by either showing alarm set points on the control panel or simulating alarm conditions and failure modes.
6. The final stage is the SYSTEM PERFORMANCE VERIFICATION TEST phase, which will integrate the equipment with the other system components for final evaluation by the CxA. This stage will require the installing contractor and manufacturer's representative to operate the installed equipment for the owner's representative, CxA and engineer of record's final approval. Included in this section is the "black building test" or "pull-the-plug test" in which the systems operation will be tested under the conditions of main power failure. NOTE: the procedure for these tests shall be documented, eg. standard plant operation and loss of power to ensure essential services cut in and load shedding takes place as planned; loss of power and then fire alarm mode operation; fire alarm mode and then loss of power. (For electrical services this includes elevator/lift control, access control, etc.)

5.1.2 Responsibilities

- A. Electrical Contractors. The commissioning responsibilities applicable to each of the electrical contractors of Division 26 are as follows:
 1. Provide start-up for all electrical equipment and coordination of the start-up of Electrical and Fire Protection equipment by other trades.
 2. Assist and cooperate with the CxA by:
 - a. Putting all equipment and systems into operation and continuing the operation during each working day of commissioning, as required.
 - b. Including cost of fuses and consumable devices that may be required by CxA.
 - c. Include any specific testing required by the Authorities, or any other body having jurisdiction over the installation, and as directed by the Owner / stake holder.

- d. Provide all tools, equipment, labour and instrument required to perform the electrical testing. Provide three copies of the test reports to the Owner.
 - e. Test in accordance with the applicable standards issued by the local authorities having jurisdiction and with the recommendations of the manufacturers.
 - f. Include the cost of all testing in the bid price, whether performed in the field or at the factory. Inform the manufacturers of the factory and site testing requirements.
 - g. Make test records in a neat and legible manner, fully identifying the equipment or system being tested, type of test equipment, calculation, and expiry date for the same, the test results and the date of the test. Submit 3 copies to the Owner at the end of each test. All the test results & records to be maintained as prescribed in the Commissioning plan & the same to be approved from the owners representative / commissioning Authority prior to final submission to the owner.
 - h. Do not energize any equipment until the test results have been reviewed critical snags passed and approved by the Owner / Stakeholder.
 - i. Carryout all tests in accordance to an approved procedure by the Owner / stake holder and all necessary data and results which may be requested by the Owner / Stake holder.
 - j. Prior to acceptance, inspect, operate and test all electrical equipment, materials and components, whether such tests are detailed in this specification or not. Tests will be witnessed by all the stake holder (Commissioning Authority, MEP consultant, Owners representative, etc), as prescribed in the commissioning plan; to ensure that the operation of the systems and components satisfies the requirements of the Contract Documents. Provide training to the O&M staff
 - k. If any test fails the test shall be repeated after taking necessary corrective measures
3. List and clearly identify on the as-built drawings the locations of all electrical components and devices including measurement and verification devices.
 4. Prepare a preliminary schedule for Division 26 testing, cleaning, and equipment start-up and completion for use by the CxA. Update the schedule as appropriate.
 5. Notify the CM or CxA depending on protocol, when testing, cleaning, and equipment start-up and completion for use of each piece of equipment will occur. Be responsible to notify the CM, ahead of time, when commissioning activities not yet performed or not yet scheduled will delay construction. Be proactive in seeing that commissioning processes are executed and that the CxA and CM both have the scheduling information needed to efficiently execute the commissioning process.
 6. Provide the following:

Construction and Acceptance Phases

- a. Include and itemize the cost of testing (FAT & SAT) & commissioning in the contract price and requisition break down. Also Inform the manufacturers of the factory and site testing requirements
- b. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data and training.
- c. Attend commissioning scoping meetings and other meetings necessary to facilitate the Cx process.
- d. Contractors shall provide the CxA with normal cut sheets and shop drawing submittals of commissioned equipment.
- e. Provide additional requested documentation, prior to normal O&M manual submittals, to the CxA for development of start-up, pre-functional and functional testing procedures.
 - i. Typically this will include detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, full details of any owner-contracted tests, performances curves, full factory testing reports, if any, and full warranty information, including all responsibilities of the Owner to keep the warranty in force clearly identified. In addition, the installation, start-up and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning Authority.
 - ii. The Commissioning Authority may request further documentation necessary for the commissioning process.
 - iii. This data request may be made prior to normal submittals.
- f. Provide a copy of the O&M manuals and submittals of commissioned equipment, through normal channels, to the CxA for review and approval.
- g. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
- h. Provide assistance to the CxA in preparing the specific pre-functional and functional performance test procedures as outlined in the Commissioning Plan. Contractor shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
- i. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the CxA for all commissioned equipment. Submit to CxA for review and approval prior to start-up.
- j. During the start-up and initial checkout process, execute the Electrical-related portions of the pre-functional checklists for all commissioned equipment.
- k. Perform and clearly document all completed start-up and system operational

checkout procedures, providing a copy to the CxA.

- l. Test in accordance with the applicable standards issued by the governing organisations (e.g. IEC, NFPA, IEEE), and with the recommendations of the manufacturers.
- m. Address critical snags identified by CxA/Stakeholder in punch list for each equipment before functional testing.
- n. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests under direction of CxA for specified equipment outlined in the commissioning plan and as per the requirement of contractual document. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- o. Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA, CM and retest the equipment.
- p. Prepare O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
- q. During construction, maintain as-built red-line drawings for all drawings and final CAD as-built for contractor-generated coordination drawings. Update after completion of commissioning (excluding deferred testing).
- r. Provide training of the Owner's operating staff using expert qualified personnel, as specified.
- s. Provide training plan submittal and obtain approval prior to training.
- t. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
- u. Provide standby and assistance for specific testing requiring the coordination of multiple trades and where this contractor's equipment and systems are a part of the test or must be functioning to allow for complete performance and testing verification. This shall include but not be limited to the "Pull the Plug" test, emergency generator testing, etc.
- v. Attend Commissioning coordination meetings and provided assistance and cooperate in the preparation of a commissioning schedule with the CM and CxA.
- w. Commissioning Tasks shall be performed by the same personnel who were involved in the installation and are familiar with the equipment.

Warranty Period

- a. Execute seasonal or deferred functional performance testing, witnessed by the CxA, according to the specifications.
- b. In compliance with the requirements of the project must perform near end of warranty re-testing and commissioning. This shall be performed by Owner personnel. Contractors shall return to the site with personnel originally involved with the commissioning of the project to assist the Owner personnel by providing any information needed to correct problems and instruct in the proper operation of the equipment and systems.

5.1.3 Commissioning documentation

A. Provide the following information to the CxA for inclusion in the commissioning plan:

- (i) Plan for delivery and review of submittals, systems manuals, and other documents and reports.
- (ii) Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
- (iii) Process and schedule for completing construction checklists and manufacturer's prestart and start-up checklists for Electrical systems, assemblies, equipment, and components to be verified and tested.
- (iv) Certificate of completion certifying that installation, prestart checks, and start-up procedures have been completed.
- (v) Certificate of readiness certifying that Electrical systems, subsystems, equipment, and associated controls are ready for testing.
- (vi) Test and inspection reports and certificates.
- (vii) Corrective action documents.
- (viii) Verification of testing reports.
- (ix) To cover tests at Manufacturer's works

5.1.4 Related Work

- H. Refer to the Commissioning Plan for a listing of all commissioning requirements.
- I. Refer to the Commissioning Plan for systems to be commissioned and pre-functional and functional testing requirements.
- C. The Subcontractor and Vendors will be required to assist in the testing and verification of certain systems to assure the proper performance of their equipment. The equipment will be functional during the Emergency Systems, UPS and "Pull the Plug" tests to simulate complete power failure. The Subcontractor and Vendor must perform the test in advance and provide verification of the equipment performance. Refer to the Draft Commissioning Plan for additional information and requirements.
- D. The project will undergo a commissioning and measurement and verification process. The Subcontractor and Vendors shall be required to sign-off on that all components and devices have been installed as per the manufacturer's recommendations and been properly calibrated prior to the CxA commencing this process. Refer to the Draft Commissioning Plan for additional information and requirements.

5.1.5 Products

5.1.5.1 Test Equipment

- A. All standard testing equipment required to perform start-up and initial checkout and required functional performance testing shall be provided by the division contractor for the equipment being tested. For example, the electrical contractor of division 26 shall ultimately be responsible for all standard testing equipment for the electrical system, except for equipment specific to and used by tab in their commissioning responsibilities. The contractor shall review all test requirements and have on hand any devices needed so as not delay the process in the field. An example would be amperage readings shall require the contractor to have an amp probe immediately on hand.

- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these contract documents shall be included in the base bid price of the contractor and left on site, except for stand-alone data logging equipment that may be used by the ca.
- C. Data logging equipment and software required to test equipment will be provided by the BMS contractor, and shall become the property of the owner.
- D. The instruments shall be calibrated not more than 6 months before the start of any commissioning activity. The calibration of the instruments shall be kept in force full time until the time of commissioning gets completed to the satisfaction and acceptance of cxa and owner. The instruments should be approved by the commissioning authority & MEP consultants at least 1 week prior carrying out any commissioning task.
- E. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the specifications. If not otherwise noted, the following minimum requirements apply: all electrical measuring instruments such as multimeter power analyser, etc. Should have calibration within the accuracy of 0.5%. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.
- F. Refer to the commissioning plan for details regarding equipment that may be required to simulate required test conditions.

5.1.6 Execution

5.1.6.1 General Requirements:

The general process of the Execution of the Commissioning Process will require the completion of the following steps / functions / procedures:

- A. The Vendor / Manufacturer will be required to perform factory testing as described in the specific equipment documentation / specifications and provide certified factory test reports on certain pieces of equipment. Not every section of the specification will require a factory test. Where factory testing is called for, each piece of equipment must be tested unless noted otherwise.
- B. The contractor with the assistance of the Vendor / Manufacturer will be required to perform a field start-up test (manufacturer's start-up) of specific pieces of equipment as described in the specific equipment documentation / specifications.
- C. Upon completion of factory testing, submittal of factory test report(s) that is approved by the Engineer and completion of the manufacturer's field start up test, the vendor can complete the pre-functional checks as identified in the Commissioning Plan.
- D. The CxA will meet with the Contractor to develop proper test procedures and observe each Contractor performing the initial test of one Pre-functional Check of a specific piece of equipment or testing process. Once one check is administered, the contractor / vendor will be responsible for completing the remainder of the similar checks under the supervision of the CM. The Contractor shall be responsible for completing the forms electronically and submitting them to the CxA for review and approval.
- E. Upon submission of pre-functional testing and approval of pre-functional testing forms by the CxA, the vendor can then schedule the functional testing of the equipment

that will be witnessed at a minimum by the CxA and CM.

- F. The CxA will observe and administer each Functional Test of each piece of equipment and will document the results of the test.
- G. Upon successful completion of the functional system test and sign-off from all parties involved the vendor can schedule any training sessions with site personnel that may be required.
- H. If a Systems Integration test is required for a particular piece of equipment, the additional tests will be scheduled by the CxA & CM.
- I. Contractor shall support CxA and make necessary arrangements for scheduling system integration tests or pull the plug tests. Contractor shall provide all the necessary manpower and instruments required to perform the test as directed by CxA. .
- J. Contractor needs to follow the entire documentation standard as prescribed in the commissioning plan.
- K. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- L. The CxA may direct that set points be altered when simulating conditions is not practical.
- M. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
See the Commissioning Plan for additional information.
- N. Successful test records shall be counter signed by the Owner and bound into the Operation and Maintenance Manual. Upon completion of the testing and commissioning the Contractor shall demonstrate to the Owner the following:
 - Voltage within correct tolerances in accordance with the contract Documents.
 - Power factor and harmonics in accordance with the Contract Documents.
 - Earthing in accordance with the contract Documents.
 - An audit inspection at factory before dispatch and at site after receipt of the switchgear for any manufacturing / transit defects.
- O. Pre commissioning/Commissioning check sheets for the following shall be submitted for the Owner review:
 - i. MDB/SMDBs
 - ii. DB / Final Light & Power Points
 - iii. Specified Lighting Controls
 - iv. Power And Control Cables
 - v. Uninterrupted power system
 - vi. Emergency Lighting System

vii. Telephone and Data Communication System

Once the procedures are agreed up on, the Inspection and testing reports for the above systems shall be submitted for Owner review/approval.

- P. The following inspections have to be carried out for any manufacturing defects/transit damages and inform the supplier immediately if found any defects Ensure the bus bar supports and insulation are free from cracks and damages.

Ensure that the correct rating of the components such as fuses, contactors and over load relays are as per the approved drawings.

Ensure that the physical condition of all meters, protection relays are good and ranges are as per approved layouts.

Ensure all components are properly installed including CTs.

Ensure the overall dimension and colour of the cubicle is as per approved layout.

5.1.6.2 Transit damages

Inspect the external surface of the cubicle for any transit damages and paint scratches.

Inspect that batteries and chargers are not damaged during transit.

The following pre-requisites have to be ensured before pre-commissioning / commissioning of the respective panels:

- Colour coding / ferruling
- Tightening all bus bar joints with torque wrench Tightening of all connections
- Termination of cables on the panels Interlocks as per approved drawings
Inter panel wiring between various cubicles Operation of space heaters
- Control & power diagram of respective switchgear is readily available on the panel board for reference

5.1.6.3 PANELS / Motor Control Centre

Testing and commissioning shall be in accordance with specification section 16440 part 3.2 and including the following:

The contractor shall arrange for the witnessing of the following tests on the fully equipped switchboard including primary bus bars and connections at the factory, in accordance with IEC 439-1:circuits

Dielectric/insulation resistance tests

Electrical operation of circuit breakers control circuits at the appropriate voltage

limits Mechanical operations tests and tests to certify correct functioning of interlocks. Primary injection tests

Secondary injection tests

Millivolt drop tests

The following tests shall be carried out after the equipment has been completely erected and connected up on site:

Power frequency voltage tests on the completed switchgear
Insulation resistance tests on all main and secondary circuits
Secondary injection tests

Calibration checks on ammeters, voltmeters and any other instruments

Testing at normal voltage to prove that closing and tripping from local and remote control points, tripping from relays and protective gear, interlocks, alarm and indications, etc are satisfactory.

Any other test required to prove compliance with the specification

At the end of tests, the protective relays and breaker tripping times shall be set in accordance with the Owner approved discrimination coordination.

Contact resistance test for busbar by means of equipment with minimum 10A

Detailed Check List

Effectiveness of mechanical actuating elements
Door interlocks
Interconnection conductor sizes, laying and clamping/screwing

Visual inspection of degree of protection, creepage and clearance distances
Labels for feeders and circuit indications

Supply of operational instructions, wiring diagrams, technical data of equipment used. Inspection and operational testing of the factory built assembly

Electrical controls and sequence of operation

Physical verification of drawings, including front and internal layouts
Single line diagrams & Control schemes

5.1.6.4 Physical Check

- Check the tray riser, cable drops cable overlapping and dressing of cable to MDB.
- Check all the bolts / nuts and bus bar connection to ensure that all are in good and tight condition.
- Check earthing/grounding of components and other related connection.
- Check all meters and selector switches to ensure the correct selection & rating. Check the phase barriers are properly fixed for separation of circuits.
- Check all cables and panels are properly labelled and identified.

5.1.6.5 Final DB light & power points

5.1.6.5.1 Physical check

- Check the electrical components such as conduits, wires, trunking, light fixtures, socket outlets are connected to the final circuit of the distribution board.
- Check the installation of distribution boards and internal wiring.
- Check the identification and labelling of each final circuits.
- Check that all metallic components are earthed/bonded.
- Check the terminal insulation, cable gland termination and shrouding.

5.1.6.5.2 Polarity Check

Check the polarity of power / light points to ensure the light switches (single pole) are installed in the line conductor.

Check for screw type lamp holders. The outer or screwed conductor is connected to the neutral conductor.

5.1.6.5.3 Continuity Check

Check the continuity of the protective conductor from the farthest point to main earth terminal of the DB for each final circuit by means of a DC ohm meter verify the values are within permissible limit).

Check the continuity between the open ends of each of the three rings of circuit (i.e. phase, neutral and earth) for all ring final circuits conductors with a multi meter and the value to be within the permissible limit.

Insulation Resistance Test - Check and measure the insulation resistance between phase, neutral and earth through a 500 Volts, Megger.

5.1.6.5.4 RCCB and polarity test

Switch on and off all MCB's and Contactor relay to verify for the desired operation.

Check earth leakage circuit breakers by means of RCCB tester.

Check the circuit performance by switching on the MCB in the DB.

Check the light and power points by operating all the switches connected in the circuits.

Check all the sockets outlets of ring/radial circuits with 3 pin socket tester (13A)/test lamp.

Tabulate the readings taken.

5.1.6.5.5 Earth fault loop impedance test

Measure the earth loop impedance across phase and protective conductor with earth loop impedance tester.

Tabulate the readings taken and compare with permissible values.

5.1.6.6 Lv power and control cables

5.1.6.6.1 Physical check

Check the cable installation and ensure the following:
Proper laying and dressing cable cleating /tying cable.
Tray supports are adequate.
Cable identification and labelling.
Glanding and gland earthing termination is correct.
No physical damage.

5.1.6.6.2 Insulation resistance test

Conduct insulation resistance test as per cables manufacturer recommendations, and test requirements.

Measure insulation resistance between cores of all LV cable with a 500 V Megger and tabulate readings, the readings to be verified with permissible limits (min. 10 Mega ohms)

Measure insulation resistance between cores and ECC and earth terminal with a 500 V Megger and tabulate readings. The readings to be verified with permissible limit.

Phase Rotation Test- Phase rotation at all points should be same otherwise rectify.

Performance Test (to be energised temporarily)

Switch on all isolators and run all equipment, for 2 hours and verify complete performance.

Check for any unusual temperature rise in cables, terminals and switches and protective devices.

5.1.6.7 UPS

5.1.6.7.1 Physical check

Check the cable installation and ensure the following:
Proper laying and dressing cable cleating /tying cable. Cable identification and labelling.
Glanding and gland earthing termination is correct. No physical damage.

5.1.6.7.2 Alarm check

Verify the alarms on the display under various operations

- Mains failure
- Bypass open
- Rectifier open
- Battery breaker open
- Output switch open

- Manual bypass closed
- Emergency stop
- Ventilation fan operation
- Hooter operation

Phase Rotation Test- Phase rotation at all points should be same otherwise rectify.
Performance Test (to be energised temporarily with external load bank) for

- Block load test
- Step load test
- Harmonics test
- Efficiency verification
- Transfer/ Retransfer verification
- Battery impedance measurement
- Autonomy test

5.1.6.8 Lighting

- Verify the correct lamps, position, ballast and operation of all fixtures.
- With all lighting in operation, measure the average illuminance on the floor/working plane by establishing the maximum and minimum levels in the following locations:
 - Entry, Exits, electrical equipment rooms, pump rooms and stairways.
 - Every place of assembly rooms and areas as directed by the Owner.
- Take readings at night, with no outside light contribution.
- Take readings with a cosine corrected portable digital illuminance meter, or with a video camcorder with suitable software for illuminance measurements. Measuring instruments shall be tested, calibrated and certified accurate to within 2%.
- Submit technical, testing and calibration data as well as certification on the photometer.
- All readings results should match the required illuminance levels as specified in relevant sections.

5.1.6.9 Submittals

- A. The Electrical and controls contractors shall follow the start-up and initial checkout procedures listed in the Responsibilities list in this section and in the Commissioning Plan. Division 26 has start-up responsibility and is required to complete systems and sub-systems so they are fully functional, meeting the design objectives of the Contract Documents. The commissioning procedures and pre-functional and functional testing do not relieve or lessen this responsibility or shift that responsibility partially to the Commissioning Authority, CM or Owner.

- B. Functional testing is intended to begin upon completion of a system. Functional testing may proceed prior to the completion of systems or sub-systems at the discretion of the CxA and Owner. Beginning system testing before full completion, does not relieve the Contractor from fully completing the system, including all pre-functional checklists as soon as possible.

5.1.6.10 Testing documentation, non-conformance and approvals

- A. Documentation. The CxA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the contractor for implementation. The contractor will include the filled out forms in the O&M manuals.
- B. Non-Conformance.
1. All deficiencies or non-conformance issues shall be noted and reported to the CxA / stake holder on a standard non-compliance form.
 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
 4. As tests progress and a deficiency is identified, the CxA discusses the issue with the executing contractor.
 - a. When there is no dispute on the deficiency and the contractor accepts responsibility to correct it:
 - (i) The CxA documents the deficiency and the contractor's response and intentions and they go on to another test or sequence. After the day's work, the CxA submits the non-compliance reports to the CM for signature, if required. A copy is provided to the contractor and CxA. The contractor corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CxA.
 - (ii) The CxA reschedules the test and the test is repeated.
 - b. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
 - (i) The deficiency shall be documented on the non-compliance form with the contractor's response and a copy given to the CM and to the contractor representative assumed to be responsible.
 - (ii) Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the CxA / stake holder. Final acceptance authority is with the Owner.
 - (iii) The CxA documents the resolution process.

- (iv) Once the interpretation and resolution have been decided, the contractor corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.
5. Cost of Retesting.
- a. The cost for the contractor to retest a pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the CM.
 - b. For a deficiency identified, not related to any pre-functional checklist or start-up fault, the following shall apply: The CxA and CM will direct the retesting of the equipment once at no "charge" to the contractor for their time. However, the CxA's and CM's time for a second retest will be charged to the contractor.
 - c. The time for the CxA and CM to direct any retesting required because a specific pre-functional checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be faulty, will be back charged to the contractor for executing the faulty pre-functional test.
 - d. Refer to the Commissioning Plan for requirements for testing and retesting identical equipment.
6. The Contractor shall respond in writing to the CxA and CM at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
7. The CxA retains the original non-conformance forms until the end of the project.
- Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.
- C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CxA / stake holder . In such case, the Contractor shall provide them with the following:
1. Within one week of notification from the CxA / stake holder, the Contractor or manufacturer's representative shall begin examining all other identical units until a representative number of units, as determined by the Engineer, are examined sufficient to determine the extent and cause of the failure. The findings shall be recorded and provided to the CxA / stake holder within two weeks of the original notice.
 2. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

3. The CxA / stake holder will determine whether a replacement of all identical units or a repair is acceptable.
 4. Two examples of the proposed solution will be installed by the Contractor and the CxA / stake holder will be allowed to test the installations for up to one week, upon which the CxA / stake holder will decide whether to accept the solution.
 5. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
- D. Approval. The CxA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CxA / stake holder, if necessary. The CxA recommends acceptance of each test to the CM using a standard form. The CxA gives final approval on each test using the same form, providing a signed copy to the Contractor.

5.1.7 Operation and maintenance (O&M) manuals

- A. Contractors shall comply with the requirements of specification Section "Basic Electrical Requirements" regarding O&M Manuals.

5.1.8 Training of owner personnel

- A. Construction Manager (CM) shall be responsible for training coordination and scheduling and ultimately to ensure that training is completed. .
- B. B. Commissioning Authority (CxA) shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.
- C. Electrical Contractor shall perform training utilizing both classroom instruction and field demonstrations.

5.1.9 Deferred testing

- C. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the CM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.
- D. Seasonal Testing. During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) specified in Commissioning Plan shall be completed as part of this contract. The CxA and CM shall coordinate this activity. Tests will be executed, documented by the appropriate contractors with facilities staff and the CxA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made. Seasonal tests shall be carried out through the first year of building operation and shall be scheduled based on building occupancy and under proper load conditions.

5.1.10 Written work products

- E. The commissioning process generates a number of written work products described in various parts of the Specifications. The Commissioning Plan shall list all the formal written work products, describes briefly their contents, who is responsible to create them, their due dates, who receives and approves them and the location of the specification to create them. In summary, the written products are:

<u>Product</u>	<u>Developed By</u>
i. Final commissioning plan	CxA
ii. Commissioning Meeting minutes	CxA
iii. Commissioning schedules	CM/CxA with Contractors
iv. Pre-functional Test Procedures (provided in specifications)	CxA/ Contractors
v. Sequence clarifications	CxA and Contractors
vi. Pre-functional checklist verification	CM/CxA with Contractors
vii. Startup and initial checkout plan (documents)	Contractors and CM/CxA (compilation of existing)
viii. Startup and initial checkout forms filled out	Contractors verified by CM/CxA/ Stakeholders
ix. Punchlist	CM/CxA/ Stakeholders
x. Commissioning Progress Record	CxA
xi. Deficiency reports (not punchlist)	CxA and CM/GC

5.2 Final inspection & approvals

5.2.1 Statutory Authorities' Tests and Inspections (If any)

As and when notified in writing or instructed by the Architect/Consultant, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Electricity Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect 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/Consultant 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 Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect 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 Architect without delay.

5.2.2 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 Architect/Consultant.

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.

5.2.3 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 Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect 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/Architect/Consultant.

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 Consultant/Architect/Employer.

5.2.4 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.

5.2.5 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.

5.3 Guarantee

The contractor shall guarantee both the material and workmanship of first-class quality corresponding to standard engineering practice.

For a period of One Year from the date of acceptance of the total installation, contractor has to repair or replace to the satisfaction of the Owner, any or all such work that may prove defective in workmanship, equipment or materials within that period, ordinary wear and tear and unusual abuse or neglect excluded, together with any other work, which may be damaged or displaced in so doing. Any defective materials / workmanship shall be rejected, the contractor has to rectify / replace at his own cost.

Also, contractor has to test the entire installation upon completion and ensure that all units are functioning satisfactorily. Guarantee certificate of the materials supplied shall be handed over to the owner.



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PUBLIC HEALTH ENGINEERING

TECHNICAL SPECIFICATION

Client	SYAMA PRASAD MOOKERJEE PORT TRUST
Project Name	RIVERFRONT CRUISE TOURISM CENTRE AT KIDDERPORE
Project Location	KOLKATA, WEST BENGAL
Date	01/04/23
Revision	R0

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1. GENERAL

1.1. Design Philosophy

This specification is intended to cover design, residual, engineering, manufacture, test and inspection at works, delivery to site properly packed for transportation, erection, testing, commissioning, performance demonstration at site and handing over to purchaser as indicated in the schedule of requirement as per the codes/standards and scope of work .

1.1.1. Codes and Standards

The installation shall also be in conformity with the bylaws and requirements of the local authority in so far as these become applicable to the installation. Wherever this specification calls for, a higher standard of materials and /or workmanship than those required by any of the above regulations and standards, then this specification shall take precedence over the said regulations and standards.

Wherever drawings and specifications require something that may conflict with the regulations, the regulations shall govern. This shall be referred to the Superintendent for arbitration.

Sr .No.	Code	Description
1	NBC	National building Code for Water Supply, drainage and Sanitation. Part IX Plumbing services section 1 and 2
2	IS 651 – 1992	Specification for Salt Glazed stoneware pipes and fittings (fifth revision).
3	IS 7558 – 1974	Code of practice for domestic hot water installation
4	IS 5329 – 1983	Code of practice for sanitary pipe work above ground for buildings.
5	IS 12251 – 1987	Code of practice for drainage of building basements
6	IS 2064 – 1973	Code of practice for selection, installation and maintenance of sanitary appliances
7	IS 6924 – 1973	Code of practice for construction of refuse chutes in multistoried buildings
8	IS 1200 (Part 1)	Method of measurement of building earthwork
9	IS 1200 (Part 16)	Method of measurement of laying of water and sewer lines including appurtenant
10	IS 1200 (Part 19)	Method of measurement of Water supply, plumbing and drains.
12	IS 783 – 1959	Code of practice for laying of concrete pipes
13	IS 13592 – 1992	Specification for unPlasticized PVC pipes for soil and waste discharge system inside building including ventilation and rainwater.
14	IS 2527 – 1984	Code of practice for fixing rainwater gutters and down pipes for roof drainage.
15	IS 2685 – 1971	Code of practice for selection, installation and maintenance of sluice valves.

Sr.No.	Code	Description
16	IS 6784 – 1984	Method of performance testing of water meters (Domestic type).
17	IS 12235 (Parts 1 to 11)	Methods of test for unPlasticized PVC pipes for portable water supplies.
18	IS 458 – 1988	Specification for precast concrete pipes (with or without reinforcement)
19	IS 2692 – 1989	Specification of ferrules for water services
20	IS 12701 – 1989	Specification for rotational moulded polyethylene water storage tanks
21	IS 771 – (Part 3to 6)	Specific requirements for urinals
22	IS 2548 (Part 1&2)	Specification for plastic seats and covers for water closets.
23	IS 3004 – 1979	Specification for plug cocks for water supply purposes.
24	IS 1711 – 1984	Specification for self closing taps for water supply
25	IS 1703 – 1977	Specification for ball valves (Horizontal plunger type) including floats for water supply purposes.
26	IS 4038 – 1979	Specification for foot valves for water works purposes.
27	IS 782 – 1978	Specification for Caulking Lead.(Third revision)
28	IS 1172 – 1983	Code of basic requirements for water supply, drainage & sanitation (revised).
29	IS 1239 – 1990 (Part I)	Specifications for mild steel tube, tubular and other steel pipe fittings.
30	IS 1239 – 1992 (Part II)	Specifications for mild steel tube, tubular and other steel pipe fittings.
31	IS 1726 – 1991	Code for cast iron manhole frame and cover (third revision).
32	IS 1742 – 1983	Code of practice for building drainage.(Second revision)
33	IS 2064 – 1973	Code of practice for selection, installation and maintenance of sanitary appliances.
34	IS 2065 – 1983	Code of practice for water supply to buildings.
35	IS 3114 – 1985	Code of practice for Laying of CI pipes
36	IS 1538 (Part-1 to 23) – 1976	Specification for cast iron fittings for pressure pipes for water, gas and sewage.
37	IS 1729 – 1979	Specification for sand cast iron socket and spigot soil, waste and ventilating pipes, fittings and accessories.
38	IS 780 – 1984	Specification for sluice valves for water works purposes

Sr.No.	Code	Description
39	IS 1537 – 1976	Specification for vertically cast iron pressure pipes for water, gas and sewage.
40	IS 1536 – 1976	Specification for centrifugally cast (spun) iron pressure pipes for water, gas and sewage.
41	IS 732 & IS 2274 – 1963	Indian Standard code of practice for electrical wiring & installation.
42	IS 4111 – 1986	Code of practice for Ancillary structures in sewerage system
43	IS 4127 – 1983	Code of Practice for laying glazed stone ware pipe.
44	BS 4515	Specification for unPlasticized PVC pipe fittings.
45	IS 4985 – 1988	Specification for unPlasticized PVC pipes for portable water supplies (second revision)

1.1.2. Building Information

This report communicates the proposed Electrical engineering designs system requirements for the Proposed Amusement Park at Kidderpore Port in Kolkata.

1.1.3. Systems Proposed

1.1.3.1. Pumps & Electrical Equipments

The Pumps associated with electrical control equipments are provided based on the water demand calculations and should test for Sequential Auto start in case of using respective systems. Also pump shall deliver minimum required flow & pressure at top design point.

1.1.3.2. Sanitary installation and fixtures

Sanitary fixtures shall be best quality white colored chinaware with CP fittings as approved by the Architects/clients. Each toilet shall be provided with European water closets with health faucets / ablution tap, washbasins with pillar cock, and urinals with sensor system as per the detailed bill of quantities.

1.1.3.3. Water supply system

Water Supply System is available near the proposed complex. Water is potable. Bore well water is also anticipated for shortfall of municipal water since the supply is intermittent. In assessing the water requirements, due consideration shall be given to the local needs of people, habits and climatic conditions. Plumbing fixtures, devices and appurtenances shall be supplied with water in sufficient volume and at adequate pressures.

1.1.3.4. Soil, Waste and Vent Pipes and Rain Water Pipes

The system shall be designed as two pipe system based on IS specifications. Vent pipe shall be provided for soil stack.

The rain water system is separated from sewage system. Separate down takes and collectors provided for rainwater disposal from terrace. The down takes are designed for maximum intensity

of rainfall. Horizontal pipes running in basement/ground floor shall be designed to take discharge from these down take pipes.

Rain water from the building and all landscaped areas would be collected by suitable underground drain and disposed off to the storm water drain.

Suitable rain water harvesting / recharging system shall be worked out as per the norms of the state. Soak wells / pits shall be provided all along the periphery of the building. The soak pits shall be covered with pebbles & broken brickbats for percolation. (As per site condition)

1.1.3.5. External Sewerage System

It is mandatory to have a domestic sewage treatment plant as per Norms. It is proposed to set up Domestic Sewage Treatment Plant (STP) for proposed building and the treated water shall be used for flushing and irrigation purpose and the excess water shall be disposed off to existing sewerage system. The location of STP is marked on the floor plan.

1.1.3.6. Storm Water Drainage

Storm Water Drainage System shall be designed to dispose off the rainwater from building terraces and external catchments area within the site premises. Terrace rain water may be harvested and reused for irrigation, building washing, and road washing. Rainwater recharging channels and soak pits shall be proposed all along the compound wall through closed storm water drain system. Excess overflow storm water shall be disposed off to the existing storm water drain. The system shall be designed for rainfall.

1.2. Scope of Work

The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labor, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete PHE system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The water supply & drainage System shall comprise of following :

- a) water supply & drainage System
- b) Other related miscellaneous items as per the tender drawing & Bill of quantities.
- c) Approval from Local Authorities
- d) Wiring & Earthing from MCC panels to water supply & drainage , control wiring & interlocking.
- e) Cutting holes, chases & like through all types of walls /floors and finishing for all services crossings, including sealing, frame works, fire proofing, providing sleeve, cover plates, making good structure and finishes to an approved standard.
- f) Balancing, testing & commissioning of the water supply & drainage system.

- g) Test reports, list of recommended spares, as-installed drawings, operation & maintenance manual for the entire water supply & drainage system
- h) Training of Owner's staff.

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 Architect 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 system and for the Pipes / valves /Wiring/Cable installed in his scope of work. The balancing shall be to the satisfaction of Client /Architect/Consultant / Project Manager.

Six copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

1.2.1. Inspection and Approval

The contractor shall obtain approval to the installation from the Local Authority. Successful Bidder shall be responsible for preparation of documents / applications / drawings / Necessary calculations and flow up action at all stages, (Drawing / completion) arranging inspections, revisions / modifications for obtaining approval from Local Authority within the overall completion period stipulated in the Tender. The Contractor shall also make payment of all statutory payments like payment Local Authority etc. The quoted rates shall take care of any contingencies.

The contractor shall guarantee both the material and workmanship of first class quality corresponding to standard engineering practice. Any defective materials/workmanship shall be rejected, the contractor has to rectify/ replace at his own cost. Guarantee certificate of the materials supplied shall be handed over to the clients.

1.2.2. Quality Assurance

Comply with the current applicable codes as specified in the Tender documents and local rules, regulations and requirements of the Chief Fire Officer.

Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the more stringent shall apply.

Executive work in strict accordance with the best practices of the trades in a thorough substantial, workmanlike manner by competent workmen.

All equipment, materials and installation method shall comply with the General Specification and the current standards and regulations as described in the Tender Documents.

The Owner's Site representative reserves the right to inspect and reject any part of the Works not complying. The Contractor shall replace such rejected works without cost variation and delay to the Contract.

Approval or acceptance by the Owner's Site representative shall not relieve the Contractor of his responsibilities under the Contract for the quality of materials and the standard of workmanship in the Works.

No work shall be covered up or put out of view without the agreement of the Owner's Site representative. The Contractor shall provide/allow the Owner's Site representative full opportunity for the examination and measurement of any work which is about to be covered or put out of view. Upon request by the Owner's Site representative, the Contractor shall expose their Works and allow/provide access to the Owner's Site representative to inspect any part of the Works during the course of the manufacturing or site installation/erection.

When requested by the Owner's Site representative, the Contractor shall submit evidence including written certificates and full testing reports from approved/recognized testing organization certifying that his proposed equipment or material have been tested and conform with the specified standard.

1.2.3. Bye-Laws and Regulations

The installation shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities concerned, in so far as these become applicable to the installation. But if these Specifications and Drawings call for a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then these Specifications and Drawings shall take precedence over the said regulations and standards. However, if the Drawings and specifications require something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

1.2.4. Fees and Permits

The contractor shall obtain all permits/ licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation.

1.2.5. Drawings

The water supply & drainage system Drawings listed under Respective section, which may be issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of equipments/accessories /fixtures etc.

The contractor shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.

Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the Architect/Consultant/Owner's site representative before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and contractor shall rectify the same at his own cost.

The contractor shall examine all architectural, structural, plumbing, electrical and other services drawings and check the as-built works before starting the work, report to the Owner's site representative any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/Owner's site representative without additional cost to the Owner. The data given in the Drawings and Specifications is as exact as could be procured, but its accuracy is not guaranteed.

1.2.6. Shop Drawings

All the shop drawings shall be prepared on computer through AutoCAD System based on Architectural Drawings, site measurements and Interior Designer's Drawings. After award of the contract, within agreed time line contractor shall furnish, for the approval of the Architect/Consultant, Two sets of detailed shop drawings of all equipment and materials including all layouts/sections/elevation details /typical details as per the consultants drawing showing exact details. Electrical panels inside/outside views, power and control wiring schematics, cable trays, supports and terminations. These shop drawings shall contain all information required to complete the Project as per specifications and as required by the Architect/Consultant/Owner's site representative. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment/materials/works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings. Minimum Six sets of drawings shall be submitted after final approval along with CD/DVD.

Each item of equipment/material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers listed in respective sections and quoted by the tendered in technical data part of respective sections

When the Architect/Consultant makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated along with check prints, for approval. The contractor shall submit further six sets of shop drawings to the Owner's site representative for the exclusive use by the Owner's site representative and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment/installation.

Shop drawings shall be submitted for approval four weeks in advance of planned delivery and installation of any material to allow Architect/Consultant ample time for scrutiny. No claims for

extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved programme.

Manufacturer's drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

Samples of all materials shall be submitted to the Owner's site representative prior to procurement. These will be submitted in two sets for approval and retention by Owner's site representative and shall be kept in their site office for reference and verification till the completion of the Project. Wherever directed a mockup or sample installation shall be carried out for approval before proceeding for further installation.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.

Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, piping, wiring or any other part of the mechanical, electrical or architectural layouts; all such re-design, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the Architect/Consultant/ Owner's site representative. Any delay on such account shall be at the cost of and consequence of the Contractor.

Water supply & drainage Contractor shall prepare coordinated services shop drawings based on the drawings prepared by other services Contractors to ensure adequate clearances are available for installation of services for each trade.

Where the work of the contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Owner's site representative, the contractor shall prepare composite working drawings and sections at a suitable scale, not less than as per the consultants base drawing, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Owner.

Within four weeks of approval of all the relevant shop drawings, the contractor shall submit four copies of a comprehensive variation in quantity statement, and itemized price list of recommended (by manufacturers) imported and local spare parts and tools, covering all equipment and materials in this contract. The Project Manager shall make recommendation to Owner for acceptance of anticipated variation in contract amounts and also advise Owner to initiate action for procurement of spare parts and tools at the completion of project.

1.2.7. Progress Drawings

Provide and keep on the job at all times, one complete and separate set of prints of the respective work on which shall be clearly, neatly and accurately noted, promptly as the work progresses, all architectural and other changes, revisions and additions to the work. Whatever work is installed otherwise than as shown on the Tender Drawings, such changes shall be noted.

Indicate daily progress on these prints by coloring the various conduits, ducts, piping, cable trays, fixtures, apparatus and associated installation works erected.

1.2.8. As Built Drawings

The contractor shall provide as built drawings, as approved by the Owner's Site representative AutoCAD DWG format in CD/DVD, as per the Project Documentation requirement. The drawings shall be submitted as directed by the Owner's site representative, or putting into operation, whichever is earlier. In addition, Six sets of hard copy of all relevant drawings, which will be required for operation and maintenance, shall be supplied in bound book forms immediately after the commissioning of the Project.

The contractor shall supply, 6 sets of all operation and maintenance manuals in original, from the manufacturer in bound book forms, at least 2 weeks prior to commissioning of the equipment. These shall also be supplied, in computer diskettes, based on popular Microsoft window based publishing software programme, along with the as built drawings as mentioned above, as specified in the Project Documentation.

1.2.9. Samples

The term 'samples' includes natural materials, fabricated items, equipment, devices, appliances, or parts thereof as specified and other samples as may be required to determine whether kind, quality, construction, workmanship, finish, color and other characteristics of materials conform to requirements of the Tender Documents.

Samples shall establish kind, quality and other required characteristics of various parts of the work. Indicate details of construction, dimensions, capacities, weights and electrical performance characteristic of equipment or material.

Samples and sample board shall be prepared and identified by the manufacturer and stamped/engraved with make, type, Cat No. and size marking shall be indelible and legible.

1.2.10. Quality of Materials

Manufacturers shall provide their standard guarantees for products furnished under this Tender. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturers and the Contractor may have by law or by other provisions of the Tender Documents.

All materials, items of equipment and workmanship furnished under this Tender shall carry standard warranty against all defects in materials and workmanship. Any faults due to defective or improper material, equipment, workmanship which develop shall be made good, forthwith, by and at the expense of the Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

Guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

Upon receipt of notice from the Owner's Site representative, of failure of any part of system or equipment during the defect liability period the affected parts shall be replaced.

1.2.11. Equipment and Materials Approval

Approval of materials and equipment shall be based on latest manufacturer's published data. Complete and detailed information of all materials and equipment to be incorporated in the work shall be submitted. Submit detailed description and specifications, catalogues cuts, installation data, diagrams, dimensions, controls and any other data required to demonstrate compliance with the Tender Documents. Each item submitted shall be referenced to the applicable paragraph in the Specification.

At the request of the Owner's Site representative, submit a sample of any equipment or material for further study before approval. Where samples are required by the Owner's Site representative, the period required to obtain the sample will be taken into account when scheduling approvals.

Only approved materials shall be employed at the site. All materials installed which are not approved shall be removed and reinstated by approved ones.

Time periods for equipment and materials approvals shall be as submitted for the approval of the Owner's Site representative.

1.2.12. Technical Data

Each tenderer shall submit along with his tender, the technical data for all items listed in respective section in the indicated format. Failure to furnish complete technical data with tenders may result in summary rejection of the tender.

1.2.13. Workmanship

The entire work provided in this specification shall be constructed and finished in every respect in a workmanlike and substantial manner. The Contractor shall provide the system in accordance with the best trade practice and to the satisfaction of the Owner's Site representative.

Keep others fully informed as to the shape, size and position of all openings required for apparatus and give full information sufficiently in advance of the work so that all openings may be built in advance. Provide and install all sleeves, supports, etc., hereinafter specified or required.

Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting the same. Obtain all information from others which may be necessary to facilitate work and the completion of the whole Project.

Provide the services of an experienced foreman, who shall be continuously in charge of the erection of the electrical work, together with all necessary skilled workmen, helpers and labourers, required to properly unload, transfer, erect and connect up, adjust, start, operate and test the system.

Before installing any work, verify that it does not interfere with clearance required for other work. Notice of adverse conditions shall be forwarded in writing to the Owner's Site representative before any work in question is installed. If notification is not made, and work installed causes interference with the contemplated design, make such changes in his work as directed by the Owner's Site representative to permit the installation of all work of the Project, at no additional cost to the Client.

Raceways shall be run as straight and direct as possible in general forming right angles with or parallel with walls or piping and neatly spaced, with risers erected plumb and true, maintain a clearance of at least 25 mm between finished coverings and adjoining work. Approved ceiling height shall be obtained from Architectural Drawings.

All equipment and accessories shall operate without objectionable noise or vibration. Should operation of any of the equipment or systems produce noise or vibration which is, in the opinion of the Owner's Site representative objectionable, make change in equipment and do all work necessary to eliminate the objectionable noise or vibration at no additional cost to the Client.

Wherever possible services shall not cross expansion joints. Where this is unavoidable the services shall accommodate the design movement without damage, by use of approved expansion couplings/flexible conduit arrangement.

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the relevant Codes.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

1.2.13.1. Method of Measurement

The works shall be measured in accordance with relevant IS codes. Notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract

1.2.14. Balancing, Testing and Commissioning

Balancing of water supply & drainage systems and all tests as called for the Specifications shall be carried out by the contractor through a specialist group, in accordance with the Specifications and Indian Standards. Performance test shall consist of three days of 10 hour each operation of system for each season.

The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Owner's site representative. All tests shall be carried out in the presence of the representatives of the Architect/Consultant and Owner's site representative.

1.2.15. On Site Training

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labor and helpers for operating the entire installation for a period of **fifteen (15) working days of ten (10) hours** each, to enable the Owner's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Owner's personnel in the operation, adjustment and maintenance of all equipment installed.

1.2.16. Completion Certificate

On completion of the water supply & drainage system, a certificate shall be furnished by the contractor, counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority.

The contractor shall be responsible for getting the entire electrical installation for Fire system duly approved by the local authorities concerned, and shall bear expenses if any, in connection with the same.

1.3. Special Conditions

1.3.1.General

These special conditions are intended to amplify the General Conditions of Contract, and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply.

1.3.2.Existing Services

The contractor is deemed to have visited and inspected the site to familiarize himself with the existing site conditions and services at tender stage.

Co-ordination between shop drawings, work on site and existing services shall be carried out by the Contractor.

The Contractor shall be fully responsible for any damages to the existing services including repairs, and penalties imposed by the concerned parties etc and for removing any site obstacles such as underground cables, pipes, civil works etc. which is obstructing his work on site.

1.3.3.Associated Civil Works

Following civil works associated with water supply & drainage installation are excluded from the scope of this contract. These shall be executed by other agencies in accordance with approved shop drawings, and under direct supervision of the water supply & drainage contractor.

- a) RCC work for Panels /DG /Transformers
- b) Water proofing of floors.

1.3.4. Associated Services Works

All associated electromechanical works listed below are excluded from the scope of this contract. These shall be installed by other agencies in accordance with approved shop drawings of, and under direct supervision of the water supply & drainage contractor.

1.3.5. Builders Work

Lay electrical works in advance of pouring concrete slabs and construction of walls. Obtain Owner's Site representative approval before commencing builder's work in connection with electrical installation. Related co-coordinated shop-drawings shall be submitted for approval. Materials approval shall be obtained as per procedure of the Owner's Site representatives. The contractor shall make it certain that drawings properly co-coordinated with other works are submitted immediately after signing of the contract and approval of drawings and the materials are obtained at least one month prior to the commencement date of the construction.

Check with other trades to ensure equipment and material can be installed in space provided.

Provide other trades with information necessary for them to execute their work.

Details on drawings which are specific regarding dimensions and locations, are for information purposes. Co-ordinate with other trades to ensure work can be installed as indicated.

1.3.6. Fire and Safety Precautions

Establish from Architectural Drawings where fire and smoke barriers exist, and make adequate provision of fire and smoke barriers in and around trunking, conduits, cables, etc., where they pass through floors and fire rated walls, and where protection systems are installed pack space between wiring and sleeve full with Fire Retardant Material and seal with caulking.

The Contractor shall ensure that this work is carried out such that the integrity of any such fire barrier is properly maintained where pierced by electromechanical services.

1.3.7. Segregation of Services

Electrical services shall be segregated as specified throughout the installation to obviate the following;

- a. Electrical interference from one circuit to another
- b. A fault on one circuit affecting another
- c. Unnecessary fire damage
- d. Difficulties in circuit identification
- e. Voltage limits for general safety
- f. Difficulties in removal and/or maintenance.

All raceways shall be kept clear of other services except where intentionally earthed or bonded. Generally, raceways shall be kept 150 mm away from and above hot water and 75 mm away from other services.

Unless specifically indicated otherwise, normal, emergency, low voltage cables and wiring shall be segregated throughout the installation generally in the following manner:

Armoured and sheathed cables: Where more than one tray has been specified or is necessary to accommodate the number of cables on a run, where practical, segregation shall be achieved by dedicating each tray to either normal or emergency services. Where normal and emergency cables have to run together in trays, ducts or trenches, they shall be formed in two groups, one normal and one emergency

1.3.8. Safety Interlocks

A complete system of interlocks and safety devices shall be provided as indicated and necessary for the safe and continuous operation of the plant in order to provide for the following:

- a. Safety of personnel engaged on operation and maintenance of the plant
- b. Correct sequence of operation of the plant during start up and shut down
- c. Safety of the plant when operating under normal or emergency conditions.
- d. Interlocks shall be preventive and not corrective
- e. The Contractor shall be responsible for the preparation of interlocking schemes for the approval of the Owner's Site representative on the basis of Consultant's scheme.
- f. Locks for interlocking purposes shall be electrical or mechanical interlock wherever asked for.

No spare or master key shall be provided, unless specified. Device items are to be arranged to ensure that there is no danger of interchange with existing locks on other units in case of mechanical interlocks.

1.3.9. Quiet Operation and Vibration Isolation

All equipment shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Owner's site representative. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense. The contractor shall guarantee that the equipment installed shall maintain the desired NC levels.

1.3.10. Accessibility

The Contractor shall verify the sufficiency of the size of the shaft openings, clearances in cavity walls and suspended ceilings for proper installation of his piping/cabbling/ducting/ other ancillaries. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed, valve or other devices requiring attendance, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense. Access panel shall be standardized for each piece of equipment / device / accessory and shall be clearly nomenclature / marked.

1.3.11. Manufacturer's Instructions

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

1.3.12. Electrical Installation

Work related to the electrical services, shall be carried out in full knowledge of, and with the complete coordination of the contractor. The electrical installation shall be in total conformity with the control wiring drawings prepared by the contractor and approved by the Architect/Consultant. All equipment shall be connected and tested in the presence of an authorized representative of the contractor.

The water supply & drainage system shall be commissioned only after the contractor has certified in writing that the electrical installation work has been thoroughly checked, tested and found to be totally satisfactory and in full conformity with the contract Drawings, Specifications and manufacturers instructions. It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the contract requirements, of the electrical installation work for respective services, lies solely with the contractor.

1.3.13. Maintenance during Defects Liability Period

1.3.13.1. Complaints

The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these **within 10 hours** of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

1.3.13.2. Repairs

All equipment that requires repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defects liability period, all replacement parts and labor shall be supplied promptly free-of-charge to the Owner.

1.3.13.3. Uptime Guarantee

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all pressures, power consumption. Starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Owner's site representatives/Consultant's review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.

1.3.13.4. Operation and Maintenance

Contractor may be required to carry out the operation of the water supply & drainage installation for the defects liability period.

Further, he may also be required to carry out operation and all inclusive maintenance of the entire system for a period of three years beyond the defects liability period if required by the owner.

1.3.13.5. Operation Contract

- a) 24 hours a day, year round.
- b) All stand-by equipment to be operated as per mutually agreed programme.
- c) Proper entry and upkeep of relevant log books.
- d) Maintain complaints register. Submit weekly report.
- e) Proper housekeeping of all areas under the contract.
- f) Prepare daily consumption report and summary of operation.

1.3.13.6. Maintenance Contract

Routine Preventive Maintenance Schedule to be submitted

- a) Schedule to cover manufacturer's recommendation and/or common engineering practice (for all plant and machinery under contract).
- b) Plant and machinery history card giving full details of equipment and frequency of checks and overhaul.
- c) Monthly status report.
- d) There shall be no reimbursement for the extended period.
- e) Break-downs shall be attended to within ten hours of reporting.
- f) Spare are to be made available within seven calendar days in case of total breakdown/burnout.

1.3.13.7. Manpower

- a) Adequate number of persons to the satisfaction of the Owner's site representative shall be provided including relievers.
- b) Statutory requirements of EPF, ESIC and other applicable labour legislations to be complied with; and monthly certification to that effect to be submitted.
- c) Duty allocation and Roaster control shall be contractor's responsibility.
- d) No overtime shall be payable by Owner for any reason whatsoever.

1.3.13.8. Shut Downs

- a) Routine shut downs shall be permitted only as allowed by the Chief Engineer.
- b) Contractor shall be at liberty to carry out routine maintenance as and when required but with prior permission of the Owner.

1.3.13.9. Operating Instruction & Maintenance Manual

Upon completion and commissioning of part water supply & drainage system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Owner's site representative and two for

Owners Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

1.3.13.10. Tools and Tackles

The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, all transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Owner's site representative.

1.3.13.11. Partial Ordering

Owner through the Architect/Consultant/ Owner's site representative reserves the right to order equipment and material from any and all alternates, and /or to order high side and /or low side equipment and materials or parts thereof from one or more tenderers. Certificates of approval from statutory and / or local authorities for the operating and maintenance of the installation and equipment, wherever such approval or certification is required.

2. PRODUCT SPECIFICATION AND INSTALLATION

2.1. Sanitary Installation and Fixtures

2.1.1.General

All fixtures shall be fixed in a neat workman like manner true to line and as recommended by the manufacturer or shown in the drawings. Care shall be taken to fix all fixtures, brackets and accessories by proper wooden cleats, crawl plugs, bolts and nuts.

Care shall be taken in fixing all approved chromium plated (CP) fixtures and accessories so as not to leave any tool marks or damages on the finish. All such fixtures shall be tightened with fixed spanners. Use of 'Stilton' type pipe wrenches with toothed jaws shall not be allowed.

All fixtures shall be thoroughly tested after connecting the drainage and water supply system. All fixtures shall be thoroughly finished and any leakage in piping valves and waste fittings corrected to the complete satisfaction of the Consultant/Engineer.

Upon completion of the work, all labels, stickers, plasters, etc. shall be removed from the fixtures and all fixtures shall be cleaned with soap and water so as to present a neat and clean toilet.

Detail of Sanitary fixture are for the information of the Contractor, however model / makes of all sanitary fixture shall be selected by Architect / Interior designer / client and the same shall be binding for execution

The sanitary fixtures & CP fittings in the standard manufacturer's packing shall be delivered to site. The contractors rate shall include Supply the same, handling, transporting to work place, providing all materials, fitments, consumables, nut bolts, screw, bush, washers, o rings etc. as required for completing the installation and labor to fix the sanitary fixture for the intended use.

No additional fixing cost shall be paid for change in type of sanitary fixtures or fittings.

Provision of extension piece for final connection of CP fitting shall be supplied and installed by the contractor accordingly (as required)

All necessary brackets, clamps etc required for supporting pipes, fixtures shall form part of below said rates.

2.1.2.Indian Water Closet

Indian Water Closet white colour Orissa pan type with porcelain `P` or `S` trap shall be provided with cistern with necessary accessories etc., as per BOQ. Indian Water Closet and trap shall be set in plain cement concrete 1:4 and flush with the floor.

2.1.2.1. Measurement

Indian Water Closets shall be measured per number and the quoted rate shall include:

- a) The cost of W.C.pan with `P` or `S` trap and cistern.
- b) Setting the closets in Plain cement concrete including the cost of cement concrete.

2.1.3.European Type Water Closet

The closet shall be white or colored as per BOQ and made of vitreous China and shall be of the best quality manufactured by an approved firm, and fixed by approved means. It shall have 100 mm dia `P` or `S` trap depending on the location of water closets and soil stacks with effective seal. Each closet shall be provided with the following accessories:

- a) Double flapped heavy urea formaldehyde seat cover of approved make quality and color with rubber buffers and C.P. brass screws fixed to the pan.
- b) 10 ltrs. Capacity flushing cistern complete with internal accessories. With 15mm dia angular stop cock.
- c) 15mm C.P health faucet with angle valve.
- d) Cast-iron chair or cantilever bracket for wall hung type with C.P bolt & nut.

2.1.3.1. Mode of Measurement

These items shall be measured in numbers and the rate quoted shall be per number only. The quoted rate shall include.

- a) The cost of W.C. pan and flushing cistern.
- b) Plastic seat cover.
- c) Jointing and fixing material.
- d) C.I chair / cantilever bracket.
- e) Fixing the WC as per the drawing

Testing as specified, if any.

2.1.4. Health Faucet

These shall be of brass CP. The make and model shall be as specified in the BOQ. These shall be fixed by means of stainless steel counter sunk screws to wooden/ plastic cleats firmly embedded in the wall.

- 15 mm CP health faucet with 1.0m long flexible tube with end nuts & Hook.
- 1 No 15mm CP brass angular stop cock with wall flange
- Hook with CP brass counter sunk screws.

2.1.5. Angular Stop Cock

These shall be of brass, CP. The make and model shall be as specified in the BOQ. These shall be fixed by means of Teflon tape, extension nipple of suitable length shall be provided, if required. The stopcock shall be provided with CP wall flange.

2.1.6. Bib Cock & Stop Cock

A bibcock is a draw off tap with a horizontal inlet and free outlet and stopcock (stop tap) valve with a suitable means of connections for insertion in a pipeline for controlling or stopping the flow. They shall be of specified size and shall be screw down type. The closing device should work by means of a disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of the threaded spindle which operates. The handle shall be either crutch or butterfly type securely seated pattern. The cocks (taps) shall open in anticlockwise direction. The bib cock and stop cock shall be polished bright (Chrome plated).

2.1.7. Wash Basins

They shall be white or colored as per BOQ and of vitreous China/ cultured marble with best quality manufactured by an approved firm and size as specified. Oval/circular wash basins shall be supported on a RC counter/ MS brackets with necessary steel reinforcement and rectangular wash basins with or without pedestals shall be supported by a pair of CI brackets of approved design.. The washbasin shall be circular or oval shape below or above counter or rectangular with or without pedestal type as specified in Schedule of Quantities.

2.1.8. Shower Unit

The shower unit shall be brass chromium plated concealed single lever mixer with 4 way diverter unit with CP spout. The shower unit shall be fitted with an overhead shower set comprising of shower arm, rose etc., complete with wall flange.

2.1.8.1. Mode of Measurement

All the items above shall be measured in numbers only and the quoted rate shall be per number, which shall include:

- a) The cost of respective materials.
- b) Necessary fixtures.
- c) Fixing in position and
- d) Testing where necessary/specified.

2.1.9.Sinks

They shall be Stainless steel of best quality and shall be supported on necessary brackets. Each sink shall be provided with 40 mm CP waste coupling, CP bottle trap, spout as per BOQ.

2.1.9.1.1. Measurement

Sinks shall be measured in numbers including all items stated above and shall include the cost of all fixing materials and fixing in position.

2.1.10. Urinal

Urinal shall white or colored as per Schedule of Quantities. The urinal shall be large flat back type fixed with hanger and brackets. The partition shall be supplied by others. Each urinal shall be provided with the following units.

- a. 40 mm dia. C.P waste coupling with dome grating.
- b. 40 mm dia. C.P bottle trap.
- c. C.P urinal spreader & C.P flush pipe.
- d. Auto flush system with sensor, solenoid valve, gate valve, conduit and wiring complete.(If this system is specified in BOQ)

2.1.10.1. Measurement

Urinal shall be measured in numbers including all items stated above and shall include the cost of all fixing materials and fixing in position. In case of Auto Flush systems including wiring, fixing of solenoids, conduiting and other electrical related works etc., shall be measured in numbers.

2.1.11. Toilet Accessories**2.1.11.1. Towel Rail**

Towel rail shall be of C.P. with reinforced bends and circular flanges. The size of the rail shall be as specified. The bracket shall be fixed by means of stainless steel screws to wooden/plastic cleats firmly embedded in the wall.

2.1.11.2. Toilet Paper Holder

Toilet paper holder shall be of chromium plated as specified in the B.O.Q.

2.1.11.3. Towel Ring, Soap Tray, Etc.

These shall be of CP specified in the Schedule of quantities. These shall be fixed by means of stainless steel screws to wooden / plastic cleats firmly embedded in the wall.

2.1.11.4. Electric Hand Drier

The electric hand drier shall be twin blower type interpreted with timer range 0 to 3 minutes. The drier shall be fully automatic. The power requirement shall be 230V, 1PH, 50Hz 1700 watts. The drier shall be wall-mounted type.

2.1.11.5. Soap Dispenser

The Soap dispenser shall be wall mounted type tough ABS plastic with soap pouch and pump system as per list of recommended makes. The capacity of dispenser shall be 500 ml

2.1.11.6. Mode of Measurement

All the items above shall be measured in numbers only and the quoted rate shall be per number which shall include:

- a) The cost of respective materials.
- b) Necessary fixtures.
- c) Fixing in position, wiring, conduiting and Testing where necessary/specified.

2.1.12. Electric Water Heater

Hot water heaters where specified shall be pressure type controlled outlet, wall mounted horizontal/vertical type of suitable capacity given in the Schedule of Quantities. Hot water heaters shall have copper container duly tinned and 75mm thick fibreglass insulation. The Jacket shall be M.S. Steel white stove enameled finish. The heater shall conform to I.S. 2082-1965. Each heater shall be thermostatically controlled with a pilot neon lamp.

Hot water heaters shall be installed true to level in a neat workmanlike manner. Wall hung heaters shall be fixed with nuts and bolts of ample size neatly grouted in the wall and finished with cement concrete packing.

Each heater inlet and outlet shall be connected by means of 20mm dia C.P copper tubing with necessary nuts and washers. One 20mm dia C.P brass stop cock and C.P. horizontal or vertical non-return valve shall be provided on the inlet. If the inlet and outlet connections to the hot water heater are 15mm or less, the connection to C.P pipes described above shall be made by a C.P. reducer. Bushes shall not be used.

2.2. Water Supply System

2.2.1. Pumps

On completion of installation works at site the complete system shall be tested for satisfactory performance in line with specifications as per Tender / requirements of Employer / Consultants. Pumps should test for Sequential Auto start in case of using respective systems. Also pump shall deliver minimum required flow & pressure at top design point. All instruments for testing should be arranged by the Contractor.

2.2.2. Different Type of pumps

The pump set offered shall be generally horizontal centrifugal pump, single stage or multistage or mono-block pump to satisfy the duty conditions stipulated in the bill of quantities. The pump set shall conform to IS 8034-1972, IS 5120-1968 for handling water, IS 8034-1976 for submersible pump sets and IS 5600-1970 for pumping storm water and sewage.

The pumps shall be selected having their maximum efficiency at average operating conditions. The maximum speed at which a pump shall run is determined by the net positive head available at the pump, the quantity of liquid being pumped and the total head.

2.2.2.1. Hydro pneumatic System

Supply of booster set consisting up to a maximum of six identical vertical multistage in - line pumps in cast iron GG20 pump head & base c/w cataphoresis coating, cartridge type mechanical seal, all internals in AISI 304 stainless steel, mounted on common galvanized steel base frame and controlled by variable frequency drives & a PFU (Pump Functional Unit) logic controller, which have features like application optimized software, regular optimization of operating conditions and read-out of operating data, Bus Communication possibility, Digital remote-control functions, pump & system monitoring functions, Display, Alarm & signal functions and clock programs. Panel to have 2x24 character LCD display, green & red LED's for operating & fault indication, potential free contacts for remote interfacing, an inbuilt lifetime battery backup for all clock functions.

Booster set should include non-return valves, isolating valves, pressure transmitter on discharge side, non-return valve, pressure gauge all mounted on a factory assembled SS manifolds.

Booster set should ensure constant pressure on discharge side through continuously variable adjustment of speed of one of the pumps, while the remaining pumps in operation are running on mains operating at full speed to bring about pump performance to meet consumption levels. Also provision should be made for alternate change over between pumps in operation once every 24 hours & frequency converter operation of pumps by rotation - all should be built in, cyclically, in the controls to ensure equal wear and tear of all pumps in the booster set. Means should be provided for friction loss compensation for increased consumption rate.

- Booster set should incorporate following "Power saving features" as standard.
 - Selection basis set points for pressure relative to time.
 - Pipe compensation i.e. Change of set point depending on water consumption.
 - Compulsory change of starting of sequence, i.e. Equal operating time for pump, both for frequency control and ON/OFF regulation.
 - Inputs and outputs for external communication.

A small sized pressure tank, (accumulator) to provide for reducing impact of water hammer and minimize short cycling of the pumps. The accumulators are piped to allow for in service maintenance. The functions of the Controller should incorporate the following features.

- Closed loop control .
- On / Off operation at low flow.
- Automatic cascade control of pumps
- Selection of switching sequences , automatic pump change and pump priority.
- Manual Operation.
- Analog set point influence
- Friction loss compensation
- Set point adjustment

The remote control functions should have the following features.,

- System On / Off
- Set point control
- Switching of individual pumps

The monitoring functions should have the following features.,

- Min / Max Levels
- Pre pressure
- Motor protection
- Water shortage monitoring
- Enclosure Class : Control Box IP 54.
- Motors IP 55.

2.2.2.2. Material of Construction for Centrifugal Pump Sets

Material of construction for different parts of pump set shall be as per IS 5120. Following are indicated for guidance for pumps handling clear, cold fresh water pumps

Sr. No	Item/Part Description	Material Description
1	Bronze fitted pump Casing	Cast iron – grade 20 of IS 210-1970
2	Impeller, casing ring, impeller ring, shaft sleeve	Bronze – grade V of IS 318-1962
3	Shaft	Steel
	All cast iron	Grade 20 of IS 210-1970
	All bronze	Grade V of IS 318-1962
	Standard fitted Casing	Cast iron – grade 20 of IS 210-1970
	Impeller, casing ring, impeller ring, shaft sleeve	

The material of construction for different classes of construction shall be generally as follows:

Sr. No	Parts	All Cast Iron	All Bronze	Bronze Fitted	STD. Fitted
1	Casing	Cast iron gr.20	Bronze	Bronze	Cast-iron
2	Rings & bush	Cast iron gr.20	Bronze	Bronze	Bronze
3	Shaft sleeve	Cast iron gr.20	Bronze	Bronze	Bronze
4	Shaft	Steel	Steel	Steel	Steel
5	Sleeve nuts	Mild steel	Bronze	Bronze	Bronze
6	Gland	Mild steel	Bronze	Bronze	Bronze

2.2.2.3. Material of Construction For Submersible Pump sets

Generally, confirm to IS:8034-1976

Sr. No	Item/Part Description	Material Description
1	Bearing sleeve	Grade 3,4 or 5 of IS:318-1962
2	Discharge casing	Grade FG 200 of IS:210-1978.
3	Impeller	Grade 2 of IS:318-1962 or grade FG 200 of IS:210-1978.
4	Pump bowl	Grade FG 200 of IS:210-1978.
5	Pump shaft	12 percent chromium steel (grade 04 or 13, 12 or 13 and 20 or 13) conforming to IS:1570 (Part-V)-1972 or grade C40 or C45 of IS:1570-1961 'Schedules for wrought steels for general engineering purposes
6	Suction casing	Grade FG 200 of IS:210-1978.
7	Casting wear ring	Grade 3,4 or 5 of IS:318-1962 or gr. FG 200 of IS:210-1978

2.2.2.4. General Requirements

Since the motor and the pump are directly coupled or close coupled, the manufacturer shall indicate the minimum size of the bore hole in which the submersible pump can be erected and suspended freely.

For smooth and efficient working of the submersible pump set, the manufacturer shall recommend the minimum submergence.

2.2.2.4.1. Submersible Motor

The submersible motor shall be squirrel case induction motor. The windings shall be wet or dry type.

The motors shall be suitable for operation on voltages and the frequency conforming to IS:585-1962 voltage and frequency for AC transmission and distribution systems (revised).

The earthing of the motor shall comply with IS:3043-1966 'code of practice for earthing'.

The thrust bearing shall be of adequate size to withstand the weight of all rotating parts as well as the imposed hydraulic thrust. These shall be lubricated suitably.

The motor shall be protected by means of cable glands, rubber seals, etc., from ingress of bore well water, sand and other foreign matter.

The rotor shaft shall be provided with shaft protecting sleeves having a surface finish conform to IS: 3073-1967. However, for short length of shaft made of stainless steel, protecting sleeves may not be provided.

The motor shall be made of corrosion resisting materials or suitably treated materials to resist corrosion under normal conditions.

The motor shall have a name plate giving the following information:

- a. Induction motor

- b. Name of manufacturer
- c. Manufacturer's number and frame reference
- d. Type of duty
- e. Frequency in Hz
- f. Number of phases
- g. Rated output in KW
- h. Rated voltage and winding connections
- i. Current, approximate, in amperes at rated output and
- j. Speed in revolution per minute at rated output.
- k. There shall also be an indication to identify a motor with its pump.
- l. The cable used for submersible motors shall conform to IS:694 (Part-I)-1964 – Specification for PVC insulated cables with copper conductors.

Material of construction for other parts of pumps shall be as per IS:5120 for pumps handling clean cold fresh water.

- a. Material of construction for handling sewage shall be as per IS:5600-1970.
- b. All cast iron fitted – grade 20 of IS:210-1962.
- c. All stainless steel - Schedule I of IS:1570-1961.

2.2.2.5. Gaskets, Seals and Packing

The gaskets, seals and packing's used in special purpose pumps shall be suitably chosen so as to withstand the effect of liquid being pumped.

Liquid pumped	:	Material for seals.
Clear cold fresh water	:	Mechanical seal or cotton yard (lubricated) seal.
Sewage	:	Mechanical seal or white metal foil seal crinkled, lubricated asbestos yarn.

2.2.2.6. Accessories

Essential for pump set used for pumping water.

- a. Oil lubricant with oil level indicator if the pump is lubricated.
- b. Grease cup for grease lubricated bearings.
- c. Flanged ball valve/Gate valve on suction side if there is positive suction.
- d. Flanged ball valve/Gate valve on delivery side.
- e. Flanged horizontal/vertical check valve on delivery side.
- f. Pressure relief valve.
- g. Pressure gauge (for delivery pipe) and vacuum gauge (for suction pipe) with copper tubing and vinch cock.

- h. Priming funnel with separate or integral air cock.
- i. Float switches or automatic level operated control switch.

Base plate.

- a. Foundation bolts and nuts.
- b. Essential for pump set used for pumping storm water/sewage.
- c. Vacuum pump if there is no positive suction.
- d. Flanged sluice valve on suction side if there is a positive suction.
- e. Flanged reflux valve on delivery side.
- f. Flanged sluice valve on delivery side.
- g. Pressure relief valve (for high head pumps)

Coupling.

- a. Pressure (for delivery pipe) and vacuum gauge (for suction pipe) with brass/copper tubing and vinch cock.

Base plate.

- a. Foundation bolts and nuts.

Ball type air relief valve.

- a. An automatic level operated control switch may be provided as an optional accessory.

2.2.2.7. Essential Design Features

The pumps shall have suitable features properly designed to ensure satisfactory performance. In particular design features, such as the following shall be incorporated.

2.2.2.8. Water Pump Sets

In case of more than one duty point, the performance range is to be indicated and the prime mover should be of sufficient power to take the entire load in this range. Head (restrictions) shall be indicated in the name plates to avoid overloading of the prime mover.

For working in parallel pumps should be with stable head capacity characteristics.

Arrangement for cooling of bearings where required.

Balancing water leakage connection should be provided in case of multistage pumps with balancing discs. Thrust bearing of adequate size.

2.2.2.9. Sewage pump sets

The size of solids should be at least up to 80% of the outlet width of the impeller.

Casing and impeller should be so designed to allow free passage of the specified max size of solid.

Hand holes should be provided in the casing one to allow early access to the impeller eye, and one close as possible to the casing throat.

On account of the abrasive nature of sewage, provision should be made on stuffing boxes to ensure clear water supply or grease lubrication to the glands shall be provided from external source according to the directions of the manufacturer.

Information to be furnished by the supplier along with tender for performance with clear cold fresh water.

- a. Pump type.
- b. Discharge in liters per second.
- c. Head in meters.
- d. Suction pipe size in mm dia.
- e. Delivery pipe size in mm dia.
- f. Power at shaft in KW.
- g. Speed in revolution per minute.
- h. Required NPS in meters.
- i. Performance curves.
- j. Materials of construction.
- k. Casing – cast iron Gr. 20 IS 210-1470
- l. Casing ring – GM Gr. 20 IS 210-1470
- m. Impellers – cast iron
- n. Impeller wearing rings and bush cast iron /GM
- o. Shaft – steel
- p. Shaft sleeves – mild steel.
- q. Gland – cast iron /GM
- r. Sleeve nuts – CI/GM
- s. Recommended :
- t. Suction pipe size in mm dia.
- u. Delivery pipe size in mm dia.
- v. Weight of the pump in Kg.

Any special instruction for installation, operation and maintenance use of special tools.

Sealing arrange :

Recommended spares for 2 years service and cost.

Prime mover – all information corresponding to the particular in the item for satisfactory performance of the pump.

2.2.3.Pump Test

Pump tests are made to determine the following:

The discharge against the specified head when running at the rated speed under specified suction lift or head.

The power absorbed by the pump at the pump shaft (BP) under the above specified conditions and Efficiency of the pump under the above specified conditions.

The pump has to be tested at manufacturers works and a test certificate furnished before supply and tested at site after installation as per procedure as per clause 13 of 5120 – 1968.

2.2.4.Pump Installation

Certain precautions must be observed in planning a pump installation and during the erection period. Some of these point will now be considered.

2.2.5. Piping

Both the suction and discharge lines should be independently supported so as no strains will be thrown on the casing such strains may cause distortions and rubbing.

The suction line should be as short and straight as possible. Any elbows should have large radii. For pumps operation with suction lifts no valves other than a foot –valve should be placed in it. Generally, the diameter is made one or two sizes larger than the pump flange size. All these precautions insure the maximum available suction head on the pump. When an oversize line is used an eccentric reducer which is horizontal at top is placed between it and the pump flange size.

It is very important to have the suction line airtight and to avoid high spots at which dissolved gases or air might separate out and destroy the vacuum. After piping is installed and the pump is running all joints should be inspected with a flame, as air leakage will draw the flame to the opening. The same method can be used to determine leakage through the packing box, the eccentric reducer is used at the suction flange to avoid high spot at which the air might collect. The inlet end of the suction line i.e., submergence should be 1 to 2 m below the minimum water level of the pump (not less than 1 m) to prevent air from being drawn into the pipe with the water.

It is desirable to have as long a length of straight piping between the elbow and suction flange as possible to even out the flow of the water as it enters the pump. The pump should be placed to secure the greatest possible suction head and yet to be available for inspection and repair work.

A check valve and gate valve are usually placed in the discharge line. The gate valve is used to regulate the flow and the check valve prevents backflow into the pump which might cause it to operate like a turbine and perhaps be damaged on account of over speed. The check valve is placed between the gate valve and the pump so that it may be inspected or rewired without emptying the discharge line.

2.2.6. Foundation

The foundation should be heavy to reduce vibrations and should be rigid to avoid any twisting or misalignment. A space of 2 to 4 cm is allowed between the base plate and top of the foundation which is filled with grouting to secure a uniform load distribution.

When the grouting had dried the base plate should be drawn down evenly to avoid springing it. After this has been done the shaft is finally aligned both radially and axially with the driver by means of shims or wedges so that it turns freely. If the shaft is not properly aligned there will be vibration and excessive wear on the bearings, packing and wearing rings.

2.2.7. Pump Operation

The operation of centrifugal pump is quite simple and safe. There are relatively few valves and the pump will not be damaged even if the discharge valve is closed for short periods of time.

2.2.8. Starting

The pump must be primed before it will deliver any fluid. Failure to prime the pump may cause the wearing, rings, rub and seize or the shaft may be scored at the packing boxes. During starting it is wise to have the vent cock in the casing open slightly to remove any dissolved air in the water.

It is best to have the discharge valve set so that the least load is thrown on the driver when the pump is started. The valve should be opened gradually to avoid throwing a large sudden load on the driver and to prevent a sudden surge in the discharge line. The discharge valve should be fully open when starting mixed flow or propeller pumps because the brake horse power will then be a minimum.

2.2.9. Running

When the unit is running it requires very little attention beyond occasionally checking to see that the journal and thrust bearings are running cool and have a sufficient supply of oil.

the packing is adjusted to permit a slight leakage to cool and lubricate it, and the water is flowing to the water seal of the suction gland to prevent air from leaking in.

2.2.10. Shutting Down

When shutting down, the discharge valve should be in the same position as when starting up by closing the discharge valve gradually so that less power is dropped from the line and any sudden pressure surges in the pipe system are avoided.

2.2.11. Inspection and Maintenance

Manufacturer supply instruction books which give directions for the operations for the operation and maintenance of each pump. The following information is general.

The wearing ring clearance should be checked as they will increase with time and thus cause a decrease in efficiency. The frequency of the inspection will depend upon the liquid handled. If the liquid contains gritty materials or is corrosive, inspection may be made monthly, but if clear water is pumped it may be sufficient to check them annually. A general rule is to replace the rings when the clearance has increased 100 percent above the original.

The packing should be replaced after it becomes hard and tends to score the shaft. When the packing is being replaced the finish of the shaft sleeves should be examined for smoothness. It is essential that the lantern ring be placed directly under the water inlet when putting in the new packing to insure a circulation of the water and a satisfactory seal. The packing should be gradually compressed with the pump running. It should not be compressed too much as local heating of the shaft and consequent misalignment will result. A slight leakage will insure proper lubrication and cooling.

If the base is not too rigid the shaft alignment should be checked occasionally when the pump is at a temperature corresponding to running conditions. This must be done with the packing removed. At the same time the clearance of the journal bearings should be checked for wear.

The oil should be changed as required and at that time inspected for the presence of water. If water appears in the oil the pump casing should be examined to find the leak.

2.2.12. Guarantee of Performance

The pumps shall be guaranteed by the manufacturer/supplier against defects in material and workmanship under normal use and service for a period of at least one year from the date of dispatch.

the supplier shall indicate the working range of the pump and the efficiency of the pump shall be guaranteed at a specified point of rating only and shall not be guaranteed to cover the performance of the pump under conditions varying there from nor for a sustained performance for any period of time. If the purchaser so desires, the manufacturer shall guarantee the non-overload of the prime mover for variations in the head in the working range. In the case of pumps where acceptance tests cannot be conducted on the liquid for which the pump is designed, the manufacture shall indicate the liquid performance of the pump based on the results of the tests conducted by him on the pump with water as indicated under 13 and interpolated as explained under 14 (IS 5120) . however, in these cases, the manufacture shall guarantee for the performance of the pump with water for the specified range.

2.2.13. Tolerance

A tolerance of ± 2.5 percent shall be permissible on discharge. However, for small discharge up to 9000 liters per minute, a tolerance of ± 2.5 percent or +24 liters per minute whichever is higher is allowed. While the negative tolerance 2.5 percent is maintained.

The pump efficiency shall be not less than the specified value by more than 2.5 percent. This tolerance may be raised to 5 percent in case the prime mover does not get overloaded.

2.2.14. General Requirements

The specified range shall lie on the stable portion of the head characteristic curve. This is applicable in case of parallel operations of pumps only.

Suction and delivery ends : The size of the suction end of a double suction pump should preferably be one size larger than that of the delivery. This is to offset the increased loss in the suction. Typical practices of piping used are :

85/65m, 100/75m, 125/100m, 150/125m, 200/150m and 250/200m etc.,

For a high pressure pump, a reflux valve shall be connected on the delivery side and a pressure relief valve installed in pumping main outside pump house. Need for surge control devices verified.

2.2.14.1. Fluid Passages

All the liquid passages in the casing and the impeller which are inaccessible to machining shall be finished to smooth surface as far as possible.

2.2.14.2. Drainage Plugs

Tapped drain holes with plugs shall be provided for draining the fluid that may drip from the sealing arrangement. The sealing arrangement shall be sufficiently deep to provide for sufficient quantity of packing to prevent leakage of air.

2.2.14.3. Lantern Ring

In case, where a lantern ring is used in a stuffing box, it shall be sandwiched between rows of pickings and shall be easily removable.

Casing : Casing shall be of robust construction and tested to withstand 15. times the shut-off pressure or twice the rated pressure whichever is higher.

2.2.14.4. Impeller

The impeller shall be properly balanced along with any other un-machined rotating parts on proper balancing equipment so as not to cause any vibrations.

2.2.14.5. Shaft

The shaft shall be finished to close tolerance at the impeller coupling, pulley and bearing diameters. The impeller, pulley and shaft sleeves shall be firmly secured to the shaft by keys or nuts on both.

2.2.14.6. Shaft Couplings

Shaft couplings, where provided, shall be properly aligned and firmly secured to the shaft by keys or nuts on both.

The size of the shaft shall be calculated on the basis of the maximum combined shear stress. This shall not exceed 30 % of the elastic limit in tension or 18% of the ultimate tensile strength.

The next higher standard size of shaft in accordance with the relevant standard shall be chosen.

The design of the shaft shall also be taken into consideration the critical speed of the shaft which shall differ from the actual working speed by at least ten percent on either side.

2.2.14.7. Bearings

The bearings should be designed for a minimum life of 20,000 hours or 40,000 hours as required. The bearing housings be designed in such a manner that no liquid being pumped should enter the housing.

The bearing may be ball, roller or sleeve bearings. In the latter case, some sort of thrust bearings are necessary. If sleeve bearings are used, they are to be machined for close running fit. The bearings shall be so designed as to take up the necessary radial load as well as the net hydraulic axial thrust. Bearings shall be lubricated properly.

Where there is a possibility of fluid entering the bearing the pump shall be provided with suitable preventive arrangements for example., deflectors.

2.2.14.8. Stuffing Boxes

The stuffing boxes shall be extra deep and provided with a cooling water jacket if so required. In addition, provision for tapping off the leakage liquid shall also be made. The packing materials employed shall be suitable for withstanding special conditions such as temperature, corrosion due to the fluid being handled etc. wherever possible, suitable mechanical seals may be used.

2.2.14.9. Base Plates

The base plates which accommodate the pump and the prime mover, when provided shall be rigid so that alignment is not affected under normal working conditions.

2.2.14.10. Prime Mover

The prime mover shall be of a such capacity as provide, under working site conditions a power which is more than maximum power required by the pump at any point in the specified range should be a specific margin be required by the customer in the power of the prime mover, he should go advise the manufacturer for obtaining the proper recommendations.

2.2.14.11. Name Plate

Every pump shall have a name plate indicating:

Name and address of the pump manufacturer.

Type, size and serial number of the pump and

Speed, total head, capacity and corresponding pump input for the duty point.

For corrosive liquids the material of the name plate shall be suitable to withstand the corrosive atmosphere.

2.3. Electrical Works

2.3.1. General Specification of Equipment

The switch board shall be metal clad, totally enclosed, rigid, compartmentalized design, floor mounting, air insulated, extensible cubicle type for use on medium voltage power, 3 phase 4 wire 50 cycles system. The degree of protection shall be of IP55 in case of indoor application as detailed in SOQ.

The equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions. Means shall be provided to facilitate ease of inspection, cleaning and repairs for use in installations where continuity of operation is of prime importance.

2.3.2. Standards

Following equipments shall conform to the requirements of:

Air Circuit Breaker (ACB) - IS 13947 - 1, 2 / IEC 947 - 1, 2

- a. Moulded Case Circuit Breaker (MCCB) - IS 13947 - 1,2/ IEC 947 - 1&2
- b. Contactors - IS 13947 - 1,4
- c. Miniature Circuit Breaker (MCB) - IS 8828 - 1996/ IEC 898 - 1995
- d. Residual Current Circuit Breaker (RCCB) - IS 12640 - 1988 / IEC 1008
- e. HRC fuse link - IS 9224 and BS 8 :8
- f. Current Transformer - IS 2705 and IEC 185
- g. Potential Transformer - IS 3156
- h. Relay - IS 3231 & IS 8686 (For Static Relays)
- i. Indicating Instrument - IS 1248

2.3.3. Construction

The switch board shall be:

Sheet steel enclosed, indoor floor mounted free standing cubicle type.

Made up of the requisite vertical sections modular type which when coupled together shall form continuous dead front switchboards.

Dust, vermin and damp proof and enclosure protection not less than IP 52.

Each feeder/instrument compartment shall be provided with a hinged door interlocked with MCCB/SFU inside the compartment such that door can only be opened when MCCB/SFU in off position.

Readily extendable as required by the addition of vertical sections after removal of the end covers.

Switch boards shall have access to the feeders, bus bars, cable termination, cable alley, etc. as required.

A front framed structure of rolled/folded CRCA sheet steel angle section of minimum 3 mm thickness rigidly bolted together. This structure shall house the components contributing to the major weight of the equipment such as circuit breaker cassettes, fuse switch units, main horizontal bus bars, vertical risers and other front mounted accessories.

The structure shall be mounted on a rigid base frame of folded CRCA sheet steel of minimum 6 mm thickness and 75 mm height. The design shall ensure that the weight of the components is adequately supported without deformation or loss of alignment during transit or during operation.

A cable chamber housing the cable end connections and power/control cable terminations. The design shall ensure generous availability of space for ease of installation and maintenance of cabling and adequate safety for working in one vertical/horizontal section without coming into accidental contact with live parts of the adjacent section.

A cover plate at the top of the vertical section, provided with a ventilating hood where necessary. Any aperture for ventilation shall be covered with a perforated sheet having less than 1mm diameter perforations to prevent entry of vermin.

Front and rear doors fitted with dust excluding neoprene gaskets with fasteners designed to ensure proper compression of the gaskets. When covers are provided in place of doors generous overlap shall be ensured between sheet steel surfaces with closely spaced fasteners to preclude the entry of dust.

The height of the panel shall not be more than 2200 mm unless otherwise specified and maximum height of operating handle shall not be more than 1800mm from FFL. The total depth of the panel shall be adequate to cater to proper cabling space.

Doors shall be of minimum 14 gauge sheet steel and covers/partitions of 16G sheet steel. All sheet steel work forming the exterior of switchboards shall be smoothly finished, leveled and free from flaws. The corners should be rounded.

The Components in the switch boards shall be so arranged as to facilitate ease of operation and maintenance and at the same time to ensure necessary degree of safety.

Components forming part of the switch boards shall have the following minimum clearances:

Between phases	-	25mm
Between phases and neutral	-	25mm
Between phases and earth	-	25mm
Between neutral and earth	-	19mm

When, for any reason, the above clearances are not available, suitable insulation barrier/shielding shall be provided. Clearances shall be maintained during normal service conditions.

Creepage distances shall comply with those specified in relevant standards.

All insulating material used in the construction of the equipment shall be of non-hygroscopic material treated to withstand the effects of high humidity, high temperature and tropical ambient service conditions.

Functional units such as circuit breakers, fuse switches, MCCBs, etc. shall be arranged in multitier formation except that not more than two air circuit breakers shall be housed in a single vertical section.

2.3.4.Metal Treatment and Finish

Generally the treatment and finish of the metal surface shall be as per detailed specifications enumerated elsewhere in this document.

2.3.5.Degreasing

Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.

2.3.6.Phosphating

A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again shall be followed by hot water rinsing to remove traces of phosphate solution.

Drying in dust free atmosphere.

Primer : Primer coating with a coat of corrosion resistant primer applied on wet surface.

Finish coat : Two finishing coats of stoving synthetic enamel paint to the specified shade of IS:5. Both the finish shall be only spray painted or powder coating.

For outdoor units the finishing coat shall be of weather resistant stoving epoxy paint of specified shade of IS5.

2.3.7.Bus Bars

The bus bars shall be made of high conductivity high strength E91E aluminum alloy suitable for 415 volts,3phase 4 wires 50 Hz 20KA unless otherwise specified.

The bus bars shall be suitably supported with non-hygroscopic supports to provide a fault withstand capacity as specified.

High tensile bolts and spring washers shall be provided at all bus bar joints.

Fish plates of equal type and size shall be used at all joints.

The bus bars shall have uniform cross section throughout and shall be capable of carrying the rated current at 415V continuously. The bus bars shall be designed to withstand a temperature rise of 45 Deg. C above the ambient. A current density of 1.00 Amp/Sq.mm shall not be exceeded for Aluminum bus bars.

The neutral bus bars shall have a continuous rating of at least 50% of the phase bus bars, unless mentioned otherwise.

Bus bars shall be fully sleeved using heat shrunk PVC sleeves appropriately color coded to identify different phases and neutral bar.

An earth bus of size not less than 40 x 6 mm aluminum/GI shall run throughout the length of switch board at top or bottom as required.

2.3.8. Air Circuit Breakers

2.3.8.1. General

The ACBs shall conform to IS 13947-1/IEC 947-1 for general rules and IS 13947-2/IEC 947-2 for Circuit Breakers. The ACBs shall be suitable for 3 phase 415 Volts. All the breakers shall have tropicalisation as a standard feature.

2.3.8.2. Construction

The Breaker shall be suitable for rear and vertical mounting and line load reversibility.

The operating mechanism shall be designed such that the handle can only be in 'OFF' position if the Main contacts are actually separated and vice versa.

2.3.8.3. Control Units

The Control Units shall be housed in a separate enclosure and there shall be total insulation of the control unit with respect to the power unit.

The Control Unit shall be suitable to provide short circuit, overload and earth fault protection. The Control Unit shall not be a peak sensing device and shall measure the true RMS values to make the measurement free from the influence of harmonics.

The setting range of the short circuit protection shall be from 3 to 9 times the rated current for 1250A and 5 to 15 times for 1600A - 3200A breaker.

The overload settings shall be adjustable from 0.5 to 1.0 times the rated current.

The breaker shall provide Earth fault protection from 0.2 to 0.7 times earth fault nominal current.

2.3.8.4. Accessories

ACB shall be provided with following accessories, in addition to the item specified in Schedule of Quantities. Further these devices shall be fittable at site from the front and common for all ratings.

The connection for the auxiliary shall be accessible from the front.

Under Voltage trip, shunt trip, closing coil, auxiliary switches with 3No+3NC.

2.3.8.5. Interlocking

ACBs shall be provided with the following interlocking devices for interlocking the door of a switch board :

- Handle interlock to prevent unnecessary manipulations of the breaker.
- Door interlock to prevent door being opened when breaker is ON position.
- Defeat interlocking device to open the door even if the breaker is in ON position.

2.3.8.6. Breaking Capacity

The ACB shall have minimum service breaking capacity, ICS as under. Preferably ICS shall be equal to ultimate breaking capacity ICU or it shall be rated for 50 KA. As specified in BOQ.

Sr. No	Rating	ICS
1	Up to 1250 A	50 KA
2	1600 - 2000 A	60 KA
3	2500 - 3200 A	80 KA

Original test certificate of the ACB as per the IS shall be provided on request.

2.3.9. MCCB - Moulded Case Circuit Breaker

The Moulded Case Circuit Breaker shall be incorporated in the switch board wherever specified and shall be of the current limiting type. MCCB shall conform to IS 2516, IS 13947-1/ IEC 947-1 (part I & II / section 1) 1977 for general rules. It should be suitable for Horizontal and Vertical mounting and line load reversibility. MCCB shall be suitable either for Single Phase AC 230V On Three Phase 415V. The MCCB shall be available in four pole versions for neutral isolation. It shall have tropicalization as standard feature.

The MCCB cover and case shall be made of high strength heat-resistant and flame-retardant thermosetting insulating material. The operating handle shall be quick make, quick break, trip - free type. The operating handle shall have suitable 'ON' 'OFF' 'TRIPPED' indicators and in order to ensure suitability for isolation complying with IS 13947-2/IEC947-2, the operating mechanism shall be designed such that the toggle or the handle can only be in 'OFF' position : if the main contacts are actually separated.

2.3.10. Accessories

MCCB shall be designed to have following accessories and it shall be fittable at site.

- a. Under voltage trip
- b. Shunt trip
- c. Alarm switch
- d. Auxiliary switch
- e. Remote operation using motor mechanism with facility of using the same in auto/manual mode.

2.3.11. Interlocking

MCCB shall be provided with following interlocking devices for interlocking the door of a switch board.

Handle interlock to prevent unnecessary manipulations of the breaker.

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

The interlocking device to open the door even if the breaker is in ON position.

In addition to the above, any other features indicated in the Schedule of Quantities shall also be provided.

2.3.12. Breaking Capacity

Short time with standing capacities different ratings of MCCB's shall be as follows :

Sr. No	Rating (Amps)	Breaking Capacity (KA)
1	Up to 200	20
2	250 to 400	35
3	630 to 800	50
4	1000 & Above	65

2.3.13. Contactors

Contactors shall comply with IS 13947-1 for general rules and IS 13947 - 4.1 for Standards pertaining to Contactors and Motor Starter.

The Contactors shall be capable of withstanding breaking and making capacities per following :

AC3 category	AC4 category
Making Current 10 x Rated Current	12 x Rated Current
Breaking Current 08 x Rated Current	10 x Rated Current

Contactors shall be capable of withstanding an impulse voltage of 8KV and have an insulation voltage of 1000V.

Contactors shall be suitable for aluminum termination with a maximum permissible temperature rise of 650 C at the terminals with an ambient temperature of 500 C.

The coils shall have three terminals and the insulation should be of class H type.

The auxiliary contact block shall have a switching capacity of 220V, 2A.

Contactors shall have one auxiliary in built and it should be possible to have additional NO/NC contacts in steps of two.

2.3.14. Miniature Circuit Breakers [MCB]

MCB shall be in 1,2,3,4, pole versions. MCB casing shall be made of self extinguishing, tropicalised material.

MCB shall comply with IS 8828-1996/IEC 898-1995. It shall be suitable for use in frequency range 40Hz to 60Hz and shall accommodate AC/DC supply according to requirements. It shall have a trip-free mechanism and toggle shall give a positive contact indication. It shall be suitable for mounting on 35mm DIN rail/surface mounting. It may be installed horizontally, vertically on the ceiling in any place without any change in electrical performance.

Line supply may be connected to either top or bottom terminals i.e. There should be no line-load restriction. Degree of protection when the MCB is flush mounted, shall be IP40. MCB shall be supplied with clamping terminals fully open. Contact closing shall be independent of the speed of operator. The breaking capacity of the MCB shall be 9KA/10KA. The MCB shall be capable of

being used as Incomer Circuit Breaker and shall be suitable for use as isolator. In case of multiple MCBs in a single location (DB), it should be possible to remove any MCB without having to disturb other MCB in the vicinity.

2.3.15. RCCB - Residual Current Circuit Breaker

RCCB shall be available in 2 pole and 4 pole versions and threshold sensitivities of 30mA, 100mA, 300mA and current ratings from 25 to 80A. Rating and sensitivities shall be as per Bill of Quantities.

RCCB shall comply with IS 12640-1988/IEC 1008. The short circuit withstand of the RCCB without the associated short circuit/overhead protection shall not be less than 3 KA. It shall be operationally independent of line voltage. The sensitivity thresholds (30mA, 100mA, 300mA) shall be of nonuser adjustable type by construction.

2.3.16. Fuse Switch Units / Switch Fuse Unit

The FSUs / SFUs shall be of the load break heavy duty cubicle type conforming to the requirements of IS 4064 1978 (AC23 duty) and IS : 13947-1993

The fuse switch units shall be double break and shall have quick make and quick break mechanisms designed to ensure positive operation.

The unit shall be provided with a front operating handle. The ON and OFF positions of the switch handle shall be clearly marked. The handle coupling arrangement shall conform to IS : 8623-1977.

Interlocks shall be provided so as to prevent opening of the unit door when the switch is in the ON position and also to prevent closing of the switch with the door not properly secured. It should, however, be possible for competent examiner to operate the switch with the door open by releasing the interlock.

The interior arrangement of the switch unit shall be such that all 'live' parts are shrouded.

2.3.17. Current Transformers

Current transformer shall comply with the requirements of IS 2705. They shall have ratios, outputs and accuracy as specified/required. All CT's shall be of resin cast type unless otherwise specifically called for.

All CT's shall be of bar type primary or suitable for the cable given type and size and the CT's shall be provided with shorting links irrespective of the CT's ratio's preferably with ELMEX / PHOENIX

For all the CT's suitable type and size clamps are to be supplied for mounting in the switch boards.

Polarities and terminal markings of primary and secondary shall be clearly marked on all CT's.

Specifications for CT's :

a. Current Ratios

i. Primary : As per feeder ratings

ii. Secondary	:	5A
b. Type	:	Resin Cast
c. Class	:	PS-Differential
d. Protection	:	5P10-O/C,E/F,RPR Class 1 for metering
e. System Voltage		
i. LT	:	415V 3Ph 50Hz

2.3.18. Potential Transformer

All the Potential Transformers shall comply with the requirements of IS 3156 latest edition. All PT's shall be resin cast type and shall have Voltage ratios, output and accuracy class as specified in Data Sheet.

All PT's shall be single phase, dry type suitable for mounting inside the panel/cubicles. Clamps / brackets / supports required for the mounting shall be supplied along with PT.

Polarities and Terminal markings shall be clearly marked in all PT's.

Name plate indicating, voltage ratio, burden, accuracy class, type, Sr.No. make and model etc., shall be provided.

A common earth terminal for earthing of core, bolts, clamps (non current carrying metal parts) etc., shall be provided.

a. Voltage ratio	:	As detailed in drawing or in spec.
b. Type	:	Resin cast
c. Burden	:	Refer drawing or spec.
d. Class (Metering/ Protection)	:	Clause 1

2.3.19. Instruments & Meters

All instruments and meters shall be enclosed in dust proof, moisture resistant, black finished cases and shall be suitable for tropical use. They shall be calibrated to read directly the primary quantities. They shall be accurately adjusted and calibrated at Works and shall have means of calibration, check and adjustment at site.

2.3.20. Indicating Instruments

Indicating instruments shall be flush mounted with anti-parallel white circular scales with black pointer and with black numbers and lettering. Knife edge pointers shall be preferred. Unless otherwise specified, the size of all instruments shall be 144mm x 144mm type.

The dials shall be free from warping, fading and discoloring. Spring controlled instruments shall be provided with front of board zero adjuster, capable of being safely handled while the instrument is in Service. Instrument covers shall also have red marks on the dial corresponding to rated values of the associated primary equipment. Synchronizing instruments shall also meet the requirements of this clause.

The indicating instruments shall conform to IS:1248 and shall have on an accuracy class of 1.

The Ammeter and Wattmeter current coils shall withstand 200% of rated current continuously and 10 times the rated current for 0.5 seconds without loss of accuracy. Voltmeter and Wattmeter potential coils shall withstand 120% of rated voltage continuously and twice the rated voltage for 0.5 sec. without loss of accuracy.

2.3.21. Voltmeter

Voltmeter shall be suitable for operating directly on LT supply voltage 415V, 50Hz or with a PT as per the requirements.

All the Voltmeters used for rated operating Voltage of 415/110V as required at 50Hz AC. With a scale as required at site.

All Voltmeters are 144 x 144mm, suitable for mounting on the panel.

Type Sr.No. accuracy class and borders of the Voltmeter shall be indicated on the dial.

2.3.22. Ammeter

All the Ammeters shall be CT operated (5A) with a dial marked for line currents.

Type, Sr.No., Accuracy class, Operating Current, Burden etc., shall be indicated on the dial.

All Ammeter shall be of panel mounting type and shall be provided with zero setting screw.

2.3.23. Energy Meters

Watt Hour shall be of the three phase two element type suitable for measurement of unbalanced loads in three phase four wire circuits. They shall be of draw out type and suitable for flush mounting with back connecting terminals. The meter shall have glass covers removable from the front of the panel, without dismantling the meter from the panel. All permanent magnets shall of the non-ageing type. The meter shall be fitted with a separate test block for testing of the reverse direction. They shall be provided with a separate test block for testing of the meters without disturbing the CT and PT secondary connections. They shall have cyclometer type of register. At least two sealing studs for sealing purposes shall be provided.

They Energy Meter shall be connected to the secondary's of potential transformers and current transformers rated for $110/\sqrt{3}$ and 5 Amp. respectively. These meters shall conform to IS : 13010 and have an accuracy of class 1.0 or better for KWH meter and 3.0 or better for KVARH meters. Meters shall be compensated for temperature errors and factory calibrated to directly read the primary quantities without the use of additional multiplying factor. Multiplying factor,

if unavoidable shall be a multiple of 10. Number of digits provided shall be adequate to cover at least 1000hrs. of operations.

The current coil of the meters shall have a continuous overload capacity of 200% for both accuracy and thermal limits. Also the current coils shall withstand at least 10 times the rated current for 0.5 seconds without loss of accuracy.

2.3.24. Digital Load Monitor

Digital Load Monitor shall be capable of displaying the following parameters:

Line and Phase Voltages, Current, Active and Reactive Power, Power Factor, Frequency, Active and Reactive Energies. Maximum Demand etc.

The Digital Monitor shall have four quadrant capability to measure both power and energy. It shall serve as data logger for all Electrical Parameter as and when scanned, displayed and stored. Built in memory shall have a storage capacity to store all Data up to a period of 30 days a more.

The Digital Monitor shall have RS 232/RS 485 Port for PC interface for remote data acquisition, telemetering capability, analysis and graph plotting.

It shall be capable of operating on Low Voltage networks with a input voltage 110V to 600V and on a CT either 1A or 5A.

Shall be mechanically robust, LED display, suitable for mounting on Electrical panels, capable of operating on 3Ph, 4Wire, balanced/unbalanced load, continuously on environmental condition such as temperature 0 to +50Deg.C, Relative humidity 100%

2.3.25. Push Buttons

Push buttons shall be of momentary contact type with rear terminal connection. These shall be suitably shrouded to prevent inadvertent operation. Integral inscription plates engraved with their functions shall be provided. All push buttons shall have two Normally Closed and two Normally Open contacts comprising rivets of pure silver. The contacts shall be able to make and carry 5 A and break up one amp inductive load at 250V DC.

2.3.26. Cable Terminations

Cable entries and terminals shall be provided in the switch board to suit the number, type and size of aluminum conductor power cables and copper conductor control cable specified in the detailed specifications.

Provision shall be made for top or bottom entry of cables as required. Generous size of cabling chambers shall be provided with the position of cable gland and terminals such that cables can be easily and safely terminated.

Barriers or shrouds shall be provided to permit safe working at the terminals of one circuit without accidentally touching that of another live circuit.

Cable risers shall be adequately supported to withstand the effects of rated short circuit currents without damage and without causing secondary faults.

Cable sockets shall be of tinned copper and of the crimping type.

2.3.27. Control Wiring

All control wiring shall be carried out with 1100/660 V grade single core PVC cable having stranded copper conductors with minimum cross section of 1.5 Sq.mm for potential circuits and 2.5 Sq.mm for current transformer circuits.

Wiring shall be neatly bunched, adequately supported and properly routed to allow for easy access and maintenance.

Wires shall be identified by numbered ferrules at each end. The ferrules shall be of ring type and of non-deteriorating material. They shall be firmly located on each termination so as to prevent free movement.

All control circuit fuses shall be mounted in front of the panel and shall be easily accessible.

2.3.28. Terminal Blocks

Terminal blocks shall be of 500 Volts grade and of stud/screw less type.

Terminal blocks shall have a minimum current rating of 10Amps and shall be shrouded. Provisions shall be made for label inscriptions. At least 20% spare terminals shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks.

Terminal blocks for current transformer and voltage transformer secondary leads shall be provided with test links and isolating facilities. Also current transformer secondary leads shall be provided with short circuiting and earthing facilities.

There shall be a minimum clearance of 250mm between the first row of terminal blocks and the associated cable gland plate. Also, the clearance between two rows of terminal blocks shall be a minimum of 150mm.

2.3.29. Relays

All Relays shall conform to the requirement of IS : 3231/IS 8686 or other applicable approved standards. Relays shall be suitable for flush and Semi-flush mounting on front with connections from the rear.

All Protective Relays shall be of draw out or plug in type/Modular cases with proper built in test facilities. Test blocks and switches shall be located immediately below each relay for testing. The auxiliary relays shall be self reset type.

All AC Relays shall be suitable for operation at 50Hz. AC Voltage operated relays shall be suitable for 110/v3 Volts PT secondary's and Current operated relays for 5Amp. CT. secondary's as specified in this specification. Voltage operated relays shall have adequate thermal capacity for continuous operation.

Auxiliary Relays and Timers shall have pairs of contacts as required to complete the scheme. Contacts shall be silver faced with spring action.

All Protective Relays, Auxiliary Relays and Timers except the lockout relays and interlocking relays specified shall be provided with self reset type contacts. All, Trip and Timers shall be provided with externally hand reset positive action provided with inscription subject to /Consultant approval. Timers shall be of the electromagnetic or solid state type.

Wherever solid state relays are used the following requirement shall be met with:

All Relays shall be designed for operating under or ambient temperature 55.C and 100% relative humidity. Electronic type timers shall be as far as possible avoided.

All accessories required for correct operation of each relay shall be supported by the Contractor without any extra cost.

The solid state relays shall be stable and suitably protected against transient/induced over voltages. The bidder shall state clearly in his list special requirements, if any, for DC input arrangement or cabling considered necessary for satisfactory operation of solid state relays quoted by him.

2.3.30. Name Plate

The panel as well as feeder compartments shall be provided with name plate of anodized aluminum with white engraving on black background. They shall be properly secured with fasteners/rivets. The panel/feeder descriptions shall be as indicated in the drawings/ by the contractor.

2.3.31. Tests

The routine tests shall be conducted as per IS standards on each Power Control Centre and shall comprise:

Inspection of the Switch Boards including inspection of wiring and electrical operational/functional tests where necessary.

2.3.32. Dielectric Tests

Insulation resistance of the power circuit between each pole and the earth and that between the poles shall be measured. Insulation resistance of all secondary wiring between phase and earth shall be measured. Insulation test shall be carried out both before and after high voltage test. Checking of protective measures and electrical continuity of the protective circuits.

2.3.33. High Voltage Test

A high voltage test with 2.5 KV for power circuit and 1.5KV for Control Circuit, Duration one minute shall be applied between each pole and earth and between poles. Test certificate shall be submitted along with panel.

2.3.34. Storing, Erection and Commissioning

2.3.34.1. Storing

The panels shall be stored in a well ventilated dry place. Suitable polythene covers shall be provided for necessary protection against moisture, dust and vermin.

2.3.34.2. Erection

Switch boards shall be installed over trench/floor as required. Suitable grouting holes shall be provided in the flooring. Suitable MS base channel shall be embedded in the flooring on which the panel can directly be installed. The switch boards shall be properly aligned and bolted to the flooring by at least four bolts. Cables shall be terminated on the bottom plate or top plate as the case may be, by using brass compression glands. The individual cables shall then be led through the panel to the required feeder compartments for necessary terminations. The cables shall be clamped to the supporting arrangement. Either side, the switch board earth bus shall be connected to the local earth grid.

The base channel used for erection of panels shall form part of the cost of the panel and shall not be measured or paid separately.

2.3.34.3. Pre commission Tests

The panels shall be commissioned only after successful completion of the following tests. The test shall be carried in the presence of Architect's representative.

- All main and auxiliary bus bar connections shall be checked and tightened.
- All wiring terminations and bus bar joints shall be checked and tightened.
- Wiring shall be checked to ensure that it is according to the approved drawing.
- All wiring shall be tested for insulation resistance by a 500 volt megger.
- Phase rotation tests shall be conducted.
- Suitable injection tests shall be applied to all the measuring instruments to establish the correctness and accuracy of calibration and working order if required by the Employer.
- All relays and protective devices shall be tested for correctness of settings and operation by introducing a current generator and an ammeter in the circuit or shall produce calibration/test certificate as required by the Employer / Inspectorate / consultant.
- Functional tests on all feeders.
- Makes, type and ratings of all components shall be checked/verified as per approved drawings.

2.3.34.4. Metal Treatment and Finish

All steel work used in this contract shall in general, undergo the following process of treatment and finish even though the same is not highlighted in the SOQ or in any other section of this document.

2.3.34.5. Degreasing

Effective cleaning by hot alkaline degreasing solution followed by cold water rinsing to remove traces of alkaline solution.

2.3.34.6. Phosphating

A recognized phosphating process to facilitate durable coating of the paint on the metal surfaces and also to prevent the spread of rusting in the event of the paint film being mechanically damaged. This again shall be followed by hot water rinsing to remove traces of phosphate solution.

Drying in dust-free atmosphere.

Primer : Primer coating with a coat of corrosion resistant primer applied on wet surface.

Finish coat: Two finishing coats of powder coating/stoving synthetic enamel paint to the specified shade of IS 5. Both the finish coats shall be only spray painted.

For outdoor units the finishing coat shall be of weather resistant stoving epoxy paint of specified shade of IS 5.

2.3.35. General Specifications for Medium Voltage Cables**2.3.35.1. Type**

Medium voltage cables shall be aluminum conductor, PVC insulated, PVC sheathed and steel wire armored or steel tape armored construction. The cables shall conform to IS 1554 Part 1 in all respects. Cables shall be laid in tray/Hume pipe/in readymade trenches etc., as required.

2.3.35.2. Rating

The cable shall be rated for a voltage of 1100 Volts.

2.3.35.3. Core Identifications

Cores shall be provided with the following color scheme of PVC insulation:

1 core	:	Red/Black/Yellow/Blue
2 core	:	Red and Black
3 core	:	Red, Yellow and Blue
3 1/2 / 4 core	:	Red, Yellow, Blue & Black

2.3.35.4. Storing, Laying, Jointing and Terminations

On Receipt Of Cables At Site The Cables Shall Be Inspected And Stored In A Safe Place. Cables Shall Be Laid as Per The Specifications Given Below:

2.3.35.5. Cables In Outdoor Trenches

Cables shall be laid in outdoor trenches wherever called for. The depth of the trenches shall not be less than 75 cm from the final ground level. The width of the trenches shall suit easy laying of cable. Where more than one cable has to be laid in the same trench, all attempts shall be made to keep the axial distance between successive cables to be at least 1d where 'd' is the diameter of the bigger cable. The trenches shall be cut square with vertical side walls and with

uniform depth. Wherever cables are bent, the minimum bending radius shall not be less than 12 times the diameter of the cable. After the cable is laid and straightened, it shall be covered with sand cushion. Over this a course of cable protection tiles or burnt brick shall be provided on either sides and above. Trench shall be back filled with earth and consolidated. Cables shall be laid in Hume pipes/stoneware pipes at all road crossings & wall entries. Approved cable markers made of CI indicating the voltage, no. of cables and the direction of run of the cables shall be installed at regular intervals.

2.3.35.6. Cable in Indoor Trenches

Cables shall be laid in indoor trenches wherever specified. Suitable angle iron brackets, clamps, hoods and saddles shall be used for securing the cable in position.

2.3.35.7. Cable On Trays/Racks

Cables shall be laid on cable trays/racks wherever specified. Cable racks/trays shall be of perforated steel section/slotted angles suitable for the purpose. The trays/racks shall be complete with plates, tees, elbows, risers and all necessary hardware. The steel trays shall be painted. Cable trays shall be erected properly to present a neat and clean appearance. Suitable cleats or saddles shall be used for securing the cables to the cable trays. The cable trays shall comply with the following requirements :

- The trays are ladder type and shall have suitable strength and rigidity to provide adequate support for all contained cables.
- It shall not present sharp edges, burrs or projections injurious to the insulation of the wiring/cables.
- If made of Sheet metal, it shall be adequately protected against corrosion or shall be made of corrosion resistant material.
- It shall have side rails or equivalent structural members.
- It shall include fittings such as horizontal, vertical bends, tie rods, hooks etc., or other suitable means for changes in direction and elevation of runs, fish plates and hardware.

2.3.36. Installation

Cable trays shall be installed as a complete system. Trays shall be supported properly from the building structure. The entire cable tray system shall be rigid.

Each run of the cable tray shall be completed before the installation of cables.

In-ports where additional protection is required, non-combustible covers/enclosure shall be used.

Cable trays shall be exposed and accessible.

Where cables of different system are installed on the same cable tray, non-combustible solid barriers shall be used for segregating the cables.

Cable trays shall be grounded by two nos. earth continuity wires. Cable trays shall not be used as equipment grounding conductors.

2.3.37. Jointing and Terminations

Cable jointing shall be done as per the recommendations of the cable manufacturer. Jointing shall be done by qualified cable jointers.

Each terminations shall be carried out using brass compression glands and cable sockets. Hydraulic crimping tool shall be used for making the end terminations. Cable gland shall be bonded to the earth by using suitable size G.I. wire/tape.

Suitable identification tags with the feeder designation inscribed on an aluminum/G.I. sheet shall be tied to either ends of each cable.

2.3.38. Testing

Cables shall be tested at factory as per the requirements of IS 1554 Part I. The tests shall incorporate routine tests, type tests and acceptance tests. Copy of such test certificates shall be furnished to the Employer prior to dispatch.

2.4. Color code for water supply pipes

Color code for water supply pipes shall be as per standard requirement. Details are as mentioned below.

2.4.1. Color Code for General Services

Sr. No	Description	Ground Colour	1 st Colour band	2 nd Colour Band
1	Water	Water	Water	Water
2	Cooling	Sea green	French blue	-
3	Boiler feed	Sea green	-	-
4	Condensate	Sea green	Light brown	-
5	Drinking	Sea green	French blue	Signal red
6	Treated	Sea green	Light orange	-
7	Cold water from storage tank.	Sea green	French blue	Canary yellow

2.5. Un-plasticized Polyvinyl Chloride (uPVC) Pipes

The pipes shall be UPVC (Un-plasticized Poly Vinyl Chloride) material for cold water supply piping system with Sch. 40 /80 and using solvent welded Sch. 40 /80 fittings i.e. Tees, Elbows, Couplers, Unions, Reducers, Brushing etc. including transition fittings (connection between PVC & Metal pipes / GI) i.e. Brass adapters both Male & Female threaded and all conforming to ASTM D-2466 with only PVC solvent cement conforming to ASTM F-493, with clamps / structural metal supports as required / directed at site, including painting of the exposed pipes with one coat of desired shade of enamel paint. All termination points for installation of faucets shall have brass termination fittings. Installation shall be to the satisfaction of manufacturer, client & consultant.

Dimensions of ASTM Heavy Pressure UPVC Pipes at 23°C as per ASTM D-1785				
Size		Schedule 40	Schedule 80	

	Outside Diameter	Wall Thickness	Working Pressure	Burst Pressure	Wall Thickness	Working Pressure	Burst Pressure	Threads per inch	Thread Length
(inch)	(mm)	(mm)	(MPa)	(MPa)	(mm)	(MPa)	(MPa)	(Nos.)	(±2mm)
½	21.34 ± 0.10	2.77 + 0.51	4.14	13.17	3.73 + 0.51	5.86	18.76	14	15.00
¾	26.67 ± 0.10	2.87 + 0.51	3.31	10.62	3.91 + 0.51	4.76	15.17	14	16.50
1	33.40 ± 0.13	3.38 + 0.51	3.10	9.93	4.55 + 0.53	4.34	13.93	11	19.00
1¼	42.16 ± 0.13	3.56 + 0.51	2.55	8.14	4.85 + 0.58	3.59	11.45	11	22.00
1½	48.26 ± 0.15	3.68 + 0.51	2.28	7.31	5.08 + 0.61	3.24	10.41	11	22.00
2	60.32 ± 0.15	3.91 + 0.51	1.93	6.14	5.54 + 0.66	2.76	8.89	11	24.50
Note : 1 Mpa = 10Kgf/cm2, 1 Kgf/cm2 = 14.20 psi									

2.5.1. Joining Pipes & Fittings

a. Cutting: Pipes shall be cut either with a wheel type plastic pipe cutting or hacksaw blade and care shall be taken to make a square cut which provides optimal bonding area within a joint.

b. Deburring / Bevelling: Burrs should be removed from the outside and inside of pipe with a deburring tool/ pocket knife or file otherwise burrs may prevent proper contact between pipe and fittings during assembly. Also the outer end of pipe should be slightly chamfered.

c. Fitting preparation: A clean dry rag/cloth should be used to wipe dirt and moisture from the fitting sockets and tubing end. Dry assemble the pipe and fitting to ensure proper fit and alignment.

d. Solvent Cement Application: An even coat of solvent cement should be applied on the pipe end and a thin coat inside the fitting socket, otherwise too much of cement solvent can cause clogged water ways.

e. Assembly: After applying the solvent cement on both pipe and fitting socket, pipe should be inserted into the fitting socket within 20 seconds, and rotating the pipe, to turn while inserting so

as to ensure even distribution of solvent cement within the joint. The assembled system should be held for 10 seconds (approximately) in order to allow the joint to set up.

An even bead of cement should be evident around the joint and if this bead is not continuous remake the joint to avoid potential leaks.

Set & Cure times: Solvent cement set and cure times shall be strictly adhered to as per the below mentioned table. Minimum Cure time prior to pressure testing upto 180 PSI

Testing: Once an installation is completed and cured as per above mentioned recommendations, the system should be hydrostatically pressure tested at 150 psi (10 Bar) for two hours. During pressure testing, the system should be fitted with water and if a leak is found, the joint should be cut out and replacing the same with new one by using couplers. No payment shall be made for reworking of already finished works.

ii. Transition of PVC to Metals: When making a transition connection to metal threads, special Brass transition fitting (Male and female adapters) should be used. Plastic threaded connections/ transition fittings should not be used in the project.

iii. Threaded Sealants: For fixing of bath fittings Teflon tape shall be used to make threaded connections leak proof. Hold tite shall be used for other threaded connections like valve etc.

iv. Solvent Cement: Only CPVC solvent cement conforming to ASTM F 493 should be used for joining pipe with fittings and valves. Flow guard CPVC cement solvents have a minimum shelf life of 1 year. Aged cement solvent will often change colour or being to thicken and become gelatinous or jelly like and when this happens, the cement should not be used. The cement solvent should be used within 30 days after opening of the companies seal and tightly close the seal after using in order to avoid its freezing. The freezed cement solvent should be discarded immediately and fresh one should be used. The solvent cement usage should be adhered to manufacture standard This standard covers requirements for plain and socket end un-plasticized polyvinyl chloride (uPVC) pipes with nominal outside diameters 15 mm to 150 mm for use for water supply system inside buildings.

2.6. Chlorinated PVC Pipes (CPVC)

2.6.1.Scope

This specification covers requirements, test methods, and methods of marking for chlorinated poly (vinyl chloride) plastic hot-and cold-water distribution system components made in one standard dimension ratio and intended for water service up to and including 1800F (820C). These components comprise pipe and tubing, socket-type fittings, street fittings, plastic-to-metal transition fittings, solvent cements, and adhesives. Requirements and methods of test are included for materials, workmanship, dimensions and tolerances, hydrostatic sustained pressure strength, and thermo-cycling resistance. The components covered by this specification are intended for use in residential and commercial, hot and cold, potable water distribution systems.

The values stated in either inch-pound or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system are not exact equivalents

therefore each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the specification.

2.6.2. Referenced Documents

2.6.2.1. ASTM Standards

D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D1399 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings.

D1784 Specification for Rigid Poly (Vinyl Chloride) (UPVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D 1898 Practice for Sampling of Plastics

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2444 Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Failing Weight)

D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials

F 402 Practices for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F 412 Terminologies Relating to Plastic Piping Systems

F 493 Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings

2.6.2.2. ANSI Standards

ANSI B2.1-1968 Pipe Threads

ANSI Z17.1-1958 Preferred Numbers 4

2.6.2.3. Federal Standard

Fed. Std. No. 123 Marking for Shipments (Civil Agencies) 5

2.6.2.4. Military Standard

MIL-STD-129 Marking for Shipment and Storage

2.6.2.5. NSF Standards

Standard No. 14 for Plastic Piping Components and Related Materials 6

Standard No. 61 for Drinking Water Systems Components—Health Effects

2.6.2.6. NSF Standards:

Standard No. 14 for Plastic Piping Components and Related Materials 6

Standard No. 61 for Drinking Water Systems Components—Health Effects

2.6.3. Definitions

General—Definitions used in this specification are in accordance with Terminology F412, unless otherwise specified. The abbreviation for chlorinated poly(vinyl chloride) is CPVC. Plastic tubing

denotes a particular diameter schedule of plastic pipe in which the outside diameter of the tubing is equal to the nominal size plus 1/3 in. (3.18 mm). Relation between standard dimension ratio, stress, and internal pressure—the following expression is used to relate standard dimension ratio, stress, and internal pressure for pipe and tubing:

$$S / P = R - 1$$

$$2S / P = (D_o/t) - 1$$

Where:

S = stress in circumferential or hoop direction, psi (MPa).

P = internal pressure, psi (MPa),

D_o = average outside diameter, in. (mm),

T = minimum wall thickness, in. (mm), and

R = standard dimension ratio, SDR.

Standard dimension ratio (SDR)—a. selected series of numbers in which the average outside diameter to minimum wall thickness dimension ratios are constant for all sizes of pipe and tubing in each standard dimension ratio, and which are the ANSI Z17.1 Preferred Number Series 10 modified by +1. SDR fittings shall by definition be equivalent in minimum socket wall thickness to the minimum wall thickness of the corresponding SDR and size of pipe or tubing, and the minimum body wall thickness shall be 125% of that value.

Standard material designation code—the chlorinated poly(vinyl chloride) material designation code shall consist of the abbreviation CPVC followed by two digits indicating the ASTM type and grade in Arabic numerals. Where necessary, a third and fourth digit shall be added to indicate the hydrostatic design stress for water at 730F [230C] in units of 100 psi [0.69 MPa].

2.6.4. Material

Basic Materials Description—Chlorinated poly(vinyl chloride) plastics used to make pipe, tubing, and fittings meeting the requirements of this specification are categorized by two criteria; namely, basic short-term properties, and long-term hydrostatic strength. Sections 4.14.1 and 4.14.2 respectively define these categories.

Basic Short-Term Properties—This specification covers CPVC 41 pipe, tubing, and fittings made from plastic materials meeting the mechanical strength, heat resistance, flammability, and chemical resistance requirements for CPVC 23447-B in Specification D 1784.

CPVC 23447-B was formerly designated as CPVC Type IV Grade 1, and is herein designated as CPVC 41. This is also used in marking pipe, tubing, or fittings.

Long-Term Hydrostatic Strength—This specification covers CPVC 41 pipe, tubing, and fittings which are further defined by hydrostatic design stress as CPVC 4120. Pipe and tubing are so defined on the basis of long-term hydrostatic strength tests and are made from compounds having an established 180°F [820C] hydrostatic design stress of 500 psi [3.45 MPa] or greater in accordance with Appendix XI and Test Method D 2837. Fittings are so defined by hydrostatic sustained pressure tests on fitting assemblies, required by this specification (see 6.2), based on the hydrostatic strength of the corresponding pipe or tubing.

No hydrostatic design stress, as such, exists for finings until such time as long-term hydrostatic strength test methods for fittings are developed.

Rework Material—Clean rework material generated from the manufacturer's own production may be used by the same manufacturer provided the pipe, tubing, or fittings meet all the requirements of this specification.

2.6.5. Classification

Pipe, Tubing, and Fittings—This specification classifies CPVC 4120 pipe, tubing, and fittings by a single standard dimension ratio which shall be SDR 11, by a maximum continuous use temperature which shall be 1800F [820C] and by nominal pipe or tubing diameters from 3/8 in. [9.5 mm] through 2 in. [50 mm].

Plastic-to-Metal Transition Finings—This specification classifies CPVC plastic-to-metal transition fittings intended for use up to and including 1800F [820C] as CPVC-1800F on the basis of resistance to failure by thermo-cycling.

Solvent Cements and Adhesives— This specification classifies solvent cements and adhesives meeting the requirements contained herein as CPVC Solvent Cement or CPVC Adhesive.

2.6.6. Requirements for Pipe, Tubing And Fittings

Wall Minimums—Table 1 and Table 2 show wall thickness minimums. Calculated SDR 11 tubing wall thicknesses that fall below 0.068 in. [1.73 mm] shall be arbitrarily increased to that value. Calculated SDR 11 fitting wall thicknesses that fall below 0.102 in. [2.59 mm] for the fitting socket bottom, or 0.128 in. [3.25 mm] for the fitting body, shall be arbitrarily increased to these values.

Interference Fit—The diameters and tolerances in Table 1 and Table 2 provide for socket-type joints having an interference fit based on the major diameter of pipe and tubing having a degree of out-of-roundness. This does not necessarily imply interference based on the minor diameter of the pipe or tubing.

Out-of Roundness—The maximum out-of-roundness requirements shown in Table 1 and Table 2 for pipe, tubing, and finings apply to the average measured diameter.

2.6.7. Pipes and Tubing

Outside Diameter and Wall Thickness—The outside diameters and wall thicknesses for pipe and tubing shall meet the requirements for dimension and tolerance given in Table 1 when measured in accordance with Test Method D2122.

Wall Thickness Range—The wall thickness range for pipe and tubing shall be within 12 % when measured in accordance with Test Method D 2122.

Flattening—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 9.2

Length— Pipe and tubing supplied in straight lengths shall have a tolerance on any specified length of +1/2 -0 in. [+12.5, -0 mm].

2.6.8. Socket type fittings

Dimensions—Fitting sockets, inside diameters (waterways), wall thicknesses, laying lengths, and reducing bushing minimums shall meet the requirements for dimension and tolerance given in Table 2, Table 3, and Table 4 when measured in accordance with Test Method D2122. The spigot ends of street fittings shall meet the outside diameter and minimum wall requirements of Table 1.

Alignment—the maximum angular variation of any socket opening shall not exceed 1/20 off the true centreline axis.

2.6.9. Plastic –To-Metal Transition Fittings

Back Dimensions—Plastic parts of plastic to metal transition fittings shall meet the dimensional requirements of Table 1 and Table 2 where applicable with the following exceptions. Such parts shall be exempted from the requirements for inside diameter (waterway) and wall thickness tolerance.

Thread Dimensions — Transition fittings that rely on interference fit and sealant shall be threaded with American National Standard Taper Pipe Threads meeting the dimensional requirements of ANSI B2.1

Thread Tolerance — The manufacturing tolerance on CPVC threads, measured with a ring gauge, shall be a maximum variation of 1½ turns large or small when measured in accordance with Test Method D 2122.

Starting Threads — the entering ends of external CPVC threads shall have a Blunt Start (see Fig. 1) produced by making the width of the thread at the start approximately 50 to 75% of the full thread. The Blunt Start provides for easy entrance and protection of the thread, and shall be included in the measurement of thread length.

2.6.10. Hydrostatic Sustained Pressure

General — Pipe, tubing, and fittings (tested as assemblies) shall meet the minimum hydrostatic sustained pressure requirements when tested in accordance with 7.3.6

Pipe and Tubing Quality—Test condition B shall be termed the primary sustained pressure test for pipe and tubing and shall be used for quality control. Test condition A shall be termed the secondary sustained pressure test for pipe and tubing and shall be used for periodic performance qualification. Failure to pass either test is cause for rejection.

Fitting Quality—Test condition A shall be termed the primary sustained pressure test for fittings and shall be used for quality control. Test condition B shall be termed the secondary sustained pressure test for fittings and shall be used for periodic performance qualification. Failure to pass either test is cause for rejection.

Thermo cycling — Plastic-to-metal transition fittings (other than metal socket-type transitions for use with adhesives assembled according to the manufacturer's instructions, shall not separate or leak when thermo cycled 1000 times between the temperatures of 600F and 1800F [160C and 820C] in accordance with respective section .

2.6.11. Requirements of Solvent Cement and Adhesive Joints

2.6.11.1. Solvent Cements

Note 6—CPVC solvent cements may exist which meet the requirements of the specification when used in accordance with the manufacturer's recommendations, without a primer or cleaner. It is recommended that those CPVC solvent cements which may be used without a primer or cleaner be clear or yellow in colour. Otherwise, it is recommended that CPVC solvent cement requiring the use of primer or cleaner be orange in colour. Colour identification is recommended to facilitate cement recognition to prevent the misuse of the cement and to minimize the unintentional use of other cements that may fail at elevated service temperatures.

General—CPVC solvent cements, for use in CPVC 41, plastic-to-plastic, socket-type joints shall meet the requirements set forth in Specification F 493.

Hydrostatic Burst Strength—2-in. [50-mm] CPVC solvent cement joints shall exceed the minimum hydrostatic burst strength requirements given in Table 6 after a maximum drying interval of 2 h when tested in accordance with 10.1.3. Failure to pass the burst requirement at either temperature is cause for rejection.

Hydrostatic Sustained Pressure Strength—½-in. [15-mm] CPVC solvent cement joints shall meet the requirements of 7.3.6 .Safe Handling of Solvent Cement—Refer to Practice F402.

2.6.11.2. CPVC Adhesives

General—CPVC adhesives (other than CPVC solvent cement), shall qualify for use in CPVC socket-type joints by a rigorous simulated use testing program as further defined in 7.2.2 and 7.2.3. CPVC adhesives shall be tested in the largest size joint and in the exact type of joint for which they are intended; that is, 2-in. [50-mm] plastic-to-metal or 2-in. [50-mm] plastic-to-plastic.

Hydrostatic Sustained Pressure Strength—Socket-type CPVC adhesive joints, made and cured according to the adhesive manufacturer's recommended procedure, shall not separate or leak when tested in accordance with 10.2 at the hydrostatic sustained pressure condition.

Thermo-cycling—Socket-type CPVC adhesive joints, made and cured according to the adhesive manufacturer's recommended procedure, shall not separate or leak when thermo-cycled 10000 times between the temperatures of 600F and 1800F [160C and 820C] in accordance with 10.2.

2.6.12. Workmanship, Finish and Appearance

The pipe shall be homogeneous throughout and essentially uniform in colour, opacity, density, and other properties. The inside and outside surfaces shall be semi-matte or glossy in appearance (depending on the type of plastic) and free of chalking, sticky or tacky material. The surfaces shall be free of excessive bloom, that is slight bloom is acceptable.

The pipe walls shall be free of cracks, holes, blisters, voids, foreign inclusion, or other defects which are visible to the naked eye and which may affect the wall integrity. Holes deliberately placed in perforated pipe are acceptable.

Bloom or chalking may develop in pipe exposed to direct rays of the sun (ultraviolet radiant energy) for extended periods and consequently these requirements do not apply to pipe after extended exposure to direct rays of the sun.

2.6.13. CPVC Schedule 40 Pressure Pipes and Fittings

PVC and CPVC Pipes - Schedule 40					
Nominal Pipe Size (inches)	Outside Diameter (inches)	Minimum Wall Thickness (inches)	Inside Diameter*) (inches)	Weight (lb/ft)	
				PVC	CPVC
1/2	0.840	0.109	0.622	0.16	0.17
3/4	1.050	0.113	0.824	0.21	0.23
1	1.315	0.133	1.049	0.32	0.34
1 1/4	1.660	0.140	1.380	0.43	0.46
1 1/2	1.900	0.145	1.610	0.51	0.55
2	2.375	0.154	2.067	0.68	0.74
2 1/2	2.875	0.203	2.469	1.07	1.18
3	3.500	0.216	3.068	1.41	1.54
4	4.500	0.237	4.026	2.01	2.20
5	5.563	0.258	5.047	2.73	
6	6.625	0.280	6.065	3.53	3.86
8	8.625	0.322	7.981	5.39	5.81
10	10.750	0.365	10.020	7.55	8.24
12	12.750	0.406	11.938	10.01	10.89
14	14.000	0.437	13.124	11.80	
16	16.000	0.500	15.000	15.43	

PVC and CPVC Pipes - Schedule 80					
Nominal Pipe Size (inches)	Outside Diameter (inches)	Minimum Wall Thickness (inches)	Inside Diameter*) (inches)	Weight (lb/ft)	
				PVC	CPVC
1/2	0.840	0.147	0.546	0.20	0.22
3/4	1.050	0.154	0.742	0.27	0.30
1	1.315	0.179	0.957	0.41	0.44
1 1/4	1.660	0.191	1.278	0.52	0.61
1 1/2	1.900	0.200	1.500	0.67	0.74
2	2.375	0.218	1.939	0.95	1.02
2 1/2	2.875	0.276	2.323	1.45	1.56
3	3.500	0.300	2.900	1.94	2.09
4	4.500	0.337	3.826	2.75	3.05

5	5.563	0.375	4.813	3.87	
6	6.625	0.432	5.761	5.42	5.82
8	8.625	0.500	7.625	8.05	8.83
10	10.750	0.593	9.564	12.00	13.09
12	12.750	0.687	11.376	16.50	18.0
14	14.000	0.750	12.500	19.30	
16	16.000	0.843	14.314	25.44	

2.6.14. Support Spacing for PVC Pipe

To ensure the satisfactory operation of a PVC piping system the location and type of hangers should be carefully considered. Hangers should not compress, distort, cut or abrade the piping.

All piping should be supported with an approved hanger at intervals sufficiently close to maintain correct pipe alignment and to prevent sagging or grade reversal. Pipe should also be supported at all branch ends and at all changes of direction. Support traps arms as close as possible to the trap. In keeping with good plumbing practices support and brace all closet bends and fasten closet flanges.

Sr. No	Recommended Horizontal or Vertical Support / pipe clamping	
1	Pipe Size in inches	Spacing in feet
2	½ " to 1" (Cold)	5.0 (1.52 m)
3	½ " to 1" (Hot)	2.5 (0.76 m)
4	1¼ " to 2" (Cold)	6.0 (1.82 m)
5	1¼ " to 2" (Hot)	(1.06 m)

The pipe should be handled with reasonable care. Because thermoplastic pipe is much lighter in weight, than the metal pipe. There is sometimes a tendency to throw it around. This should be avoided.

The pipe should never be dragged or pushed from a truck bed. Pallets for pipe should be removed with a fork lift. Loose pipe can be rolled down timbers, as long as the pieces do not fall on each other or on any hard or uneven surface.

In all cases, severe contact with any sharp objects {rocks, angle irons, forks on forklifts, etc.) should be avoided.

2.6.15. Storing

If possible, pipe should be stored inside. When this is not possible, the pipe should be stored on level ground, which is dry and free from sharp objects. If different schedules of pipe are stacked together, the pipe with the thickest walls should be at the bottom.

The pipe should be protected from the sun and be in an area with proper ventilation. This will lessen the effects of ultraviolet rays and help prevent heat build-up. If the pipe is stored in racks, it should be continuously supported along its length. If this is not possible, the spacing of the supports should not exceed three feet (3').

When storage temperatures are below 32°F, extra care should be taken when handling the pipe. This will help prevent any problems, which could be caused by the slightly lower impact strength of PVC and CPVC pipe at temperatures below freezing.

2.6.16. Laying, Joining, Curing

Systems should be installed in a good and workmanlike manner consistent with normal industry standards and in conformance with all local plumbing, fire and building code requirements. Failure to follow proper installation practices procedures or techniques can result in system failure, property damage or personal injury.

Pipe and fitting systems should be used for their intended purpose as defined by local plumbing and building codes and the applicable ASTM standard.

Follow manufacturers' instructions for all related products.

Cut pipe square. As joints are sealed at the base of the fitting socket. An angled cut may result in joint failure.

Acceptable tools include mitre saw, mechanical cut off saw or wheel cutter. Wheel type cutters must employ a blade designed for plastics.

Remove all burrs from inside and outside of pipe with a knife-edge, file, or de-burring tool. Chamfer (bevel) the end of the pipe 10° -15°

Remove surface dirt, grease, or moisture with a clean dry cloth.

With light pressure, pipe should go one half to one third of the way into the fitting socket. Pipe and fittings that are too tight or too loose should not be used.

Use an applicator that is one half the pipe diameters. Too large an applicator will force excessive cement into the inside of small diameter fittings. Too small applicator will not apply sufficient cement to large diameter systems.

Recommended initial set times Apply a full even layer of cement to the outside of a pipe and medium layer of cement to inside of a fitting. Assemble pipe and fitting socket until it contacts socket bottom. Give pipe a quarter turn. Hold pipe and fitting together until the pipe does not back out. See table for recommended cure times. Remove excessive cement from the exterior. A properly made joint will show a continuous bead of cement around the perimeter.

2.6.17. Testing Pressure System

Prior to testing, safety precautions should be instituted to protect personnel and property in case of test failure. Conduct pressure testing with water. DO NOT USE AIR OR OTHER GASES for pressure testing.

The piping system should be adequately anchored to limit movement. Water under pressure exerts thrust forces in piping systems. Thrust blocking should be provided at changes of direction change in size and at dead ends.

The piping systems should be slowly filled with water, taking care to prevent surge and air entrapment. The flow velocity should not exceed 1 foot per second.

All trapped air must be slowly released. Vents must be

N.B.: Primers are used in solvent cement joints of PVC plastic pipe and fittings as per ASTM F 656 provided at all high points of the piping system. All valves and air relief mechanisms should be opened so that the air can be vented while the system is extremely dangerous and it must be slowly and completely vented prior to testing.

The piping system can be pressurized to 125% of its designed working pressure. However care must be taken to ensure the pressure does not exceed the working pressure of the lowest rated component in the system (valves, unions, flanges, threaded parts etc.) The pressure test should not exceed one hour. Any leaking joints or pipe must be cut out and replaced and the line recharged and retested using the same procedure

2.6.18. Disinfection of the Pipe Network

The entire water distribution network is to be disinfected by using residual chlorine of 0.2 ppm for a period of 2 (two) hours. The entire chlorinated pipe network is to be flushed out with fresh water before the water supply system is put into operation for domestic usage.

2.7. Water Pipe Insulation

2.7.1. Use

Hot water flow and return pipes will be insulated with fiber glass wool. Cold water pipes embedded in walls shall be insulated with same material as embedded hot water pipe.

Cold water pipes underground shall be wrapped as detailed in this section.

2.7.2. Cleaning

Before proceeding with the insulation works for hot water supply and return pipes the pipe surface should be thoroughly cleaned and made free from oil, grease or any other foreign material.

2.7.3. Glass wool

Suitable thickness of glass wool shall be provided and wrapped with 20 gauge GI lacing at 150mm centre and covered with GI wire netting of 24 gauge all around the pipe insulation.

Pipes 50 mm and below shall have 25 mm thickness and 65 mm and above shall have 40 mm thickness of insulation.

The pipe shall be clad with 20 gauge aluminium sheet including all bends, unions, flanges, valves etc., to complete the insulation.

The fibre glass wool shall have density = 100 Kg/m³ and K value of not less than 0.045 Kcal/m. h0 C. at 1000 C.

The manufacturer of fibre glass shall be either Owens Corning or approved equivalent.

2.7.4. Elastomeric Insulation

Alternatively, high quality closed cell light weight elastomeric insulation material as manufactured by M/s Poly bond organics shall be used for both hot and cold water pipe insulation. The insulation shall be carried out as follows:

Pipe surfaces shall be thoroughly cleaned and dried before the vidoflex rubber insulation is applied and shall be free of dirt, grease and rust scale or other foreign matter. The pipe shall be cleaned mechanically.

Oil and grease, if present on the pipe surface should be removed by using a suitable solvent and clean rags. The use of dirty, oil rags should not be permitted. Field Application of Tape.

The vidoflex rubber insulation shall be wrapped in accordance with the manufacturers recommendations in a manner that shall meet the adhesion requirement. During application, care shall be taken to ensure that there are no air pockets or bubbles beneath the tape. The tape should be wrapped with an overlap of 50% of Tees. The first wrapping shall be done individually. The tape may be cut if required to suit the profile. There shall be two layers of tape wrappings. The first layer is to be wrapped on the pipe directly after cleaning the pipe surface. The second layer is to be applied over the first layer, wrapped with 50% lap.

2.7.5.Cold Water Pipes below Ground

The cold water pipes passing below ground shall be wrapped and coated with 2mm thick upto 67mm dia and 4mm thick for higher dia with 50% overlap.

2.8. Valves, Strainers and Pressure Gauges

2.8.1.General

This section deals with different type of valves like butterfly valves, gate valves, ball valves, check valves, balancing valves and Strainers and pressure gauges. The contractor shall refer to the approved make of materials specified in the document & relevant drawings.

Valves shall be provided on branch pipe connections to mains and at connection to equipment where indicated. All valves are to be located for easy access. All valves shall be supported wherever necessary with MS brackets. Valves shall comply with IS 780 (Class I) for C.I sluice valves and IS 778 for G.M valves and tested.

Pressure gauges shall have outer diameter not less than 115mm with 10mm BSP full thread, brass body siphon and gauge cock of size 10mm. Dial gauges shall have adequate response for the pressures encountered within the specified (Range 0-15Kg/sq.cm).

2.8.2.Location

Valves shall be provided on branch pipe connections to mains and at connection to equipment where indicated. All valves are to be located for easy access and are to be full bore of pipe connected together. All valves shall be supported wherever necessary.

2.8.3.Specification

Valves for copper pipes and fittings shall be 70/30 dezincification resistant brass. The valve shall be copper to copper and the internal part made out of material resistant to dezincification.

From 54 mm and above valves shall be provided with metric flange connection either with bimetal flange (steel outer with Gun metal inside) or with brazing metal slip-on flange.

The on-line valves shall be copper to copper ball valves with stainless steel or dezincification resistant brass internal parts.

All valves shall be compatible to use with copper pipes and fittings.

2.8.4. Gate Valve

The primary function of a gate valve is for starting and stopping of flow. It has a disc actuated by a stem screw and hand wheel, moves up and down at right angles to the path of flow of fluid and seats against two faces to shut of flow. As the disc of the gate valve presents a flat surface to the direction of flow, this valve is only for starting and shutting the flow in the pipe.

These valves are of GM make. Supplying, fixing and testing corresponds to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.

All globe and check valves shall have working parts suitable for hot and cold water, as required. Valves shall be tagged with permanent label under hand wheel indicating type or duty.

All valves should have manufacturer's test certificate indicating the date of shop test and other quality control tests with the material used for the same. Gate valves shall be of the size as specified in the BOQ.

2.8.5. Ball Valve

The ball valve shall be of high pressure type and shall be of sizes as specified in the BOQ. The normal size of a ball valve shall be that, corresponding to the size of the pipe to which it is fixed. Ball valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE. The valve shall be complete with socket weld ends and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for a float exceeding 115mm dia. The body of the high pressure ball valve when assembled in working condition with the float immersed to not more than half of its diameter shall remain closed against a test pressure of 3.5kg/sq.cm.

The ball valve shall generally conform to IS specification No.1703:1977. The weight of ball cock and the size of the ball cock shall be as per IS specification.

2.8.6. Foot Valves

Foot valves are provided with cast iron body with brass disc and strainer of approved quality as specified in BOQ. The foot valve shall be of spring loaded or flapper type depending on the requirement. The valves should be tested physically for free operation before being mounted or assembled to the pipeline.

2.8.7. Butterfly Valves

Butterfly valves shall be slim seal, short wafer type with standard finish. The valves shall be suitable for mounting between flanges drilled to ANSI 125. The valve body shall be cast iron. The disc shall consist of disc pivot and driving stem shall be in one piece centrally located. The disc shall move in bearings on both ends with 'O' ring to prevent leakage. The seat shall be moulded with black nitrile rubber or nylon and shall line the whole body. The spindle shall be AISI 41 steel. The valve shall be suitable for a working pressure of 16.5 kg/sq.cm and shall be complete with flow control

lever and notches, factory machined companion flanges and bolts and nuts. These valves conform to BS 5155 with electro steel nickel coated SG Iron (N) and seat material EPDM3.

Flanged valves to be used with Flanges drilled to BS10 table F, valves Shall be capable of being locked in open Position. Hand wheel shall be with Worm and worm wheel operated for Smooth opening and closing. Key rod with MS Coated extended spindle to be provided Wherever the valves are not approachable from the ground surface.

2.8.8. Check Valves

Check valves are designed to prevent reversal of flow. These are also called Non-return valves or reflux valves to avoid reversal of flow. Check valves shall be Dual Plate check valves with CI body, aluminum bronze plate SS 316 hinge pins and springs and Buna-N seals to ANSI series 125. They can also conform to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.

2.8.9. Strainers

"Y" strainers up to 50mm shall be of gunmetal and above 50mm shall be of cast iron body. Strainers shall incorporate a removable bronze screen with 3.175mm (1/8") perforations and a permanent magnet. Strainers shall be provided with flanges at both inlet and outlet. They shall be designed to enable blowing out of accumulated dirt and facilitate dirt and facilitate removal and replacement of the screen without disconnection of the main pipe.

All strainer shall be provided with equal size isolating "Slim Seal" butterfly valves of approved brands as shown in drawings so that the strainer may be cleaned without draining the system

2.8.10. Flanges and Unions

Sufficient number of flanges and unions shall be provided as required to facilitate maintenance work after the piping is installed. Mild steel flanges shall be used for pipes. The flanges shall be connected to the pipeline by screwing or welding depending on the requirement. The flanges shall conform to the relevant ASTM standard for the particular material used for its manufacture. The flanges shall also conform to IS 5211.

2.8.11. Pressure Reducing Valve

Pressure relief valves are provided to keep the pressure in the line below a given value within the reasonable limits in the downstream side of the pipeline when the pressure builds up beyond the design value. Pressure reducing valves shall be of high pressured type of specified sizes. The valves should be suitable for mounting between flanges and threading connections also. The valve body shall be of bronze / SS as specified. The valve shall be of spring loaded, direct operation, metallic diaphragm type, as required for the particular usage.

The pressure reducing valves should be manufactured in conformance with ASA-150,300,600,800,900 and 1500, or to BS10- table -D, E, F, H or DIN- ND-16 & ND-40.

2.8.12. Brass Bib Cock and Stop Cock

A bib cock is a draw off tap with a horizontal inlet and free outlet and stop cock (stop tap) is a valve with a suitable means of connections for insertion in a pipe line for controlling or stopping the flow. They shall be of specified size and shall be screw down type. The closing device should

work by means of a disc carrying a renewable non-metallic washer which shuts against water pressure on a seating at right angles to the axis of the threaded spindle which operates it. The handle shall be either crutch or butterfly type securely seated pattern. The cocks (taps) shall open in anticlockwise direction.

The bib cock and stop cock shall be polished bright (Chrome plated). The minimum finished weights of bib tap (cock) and stop tap (cock) as given in the IS specification.

2.8.13. Level Sensors

Level sensor shall consist of 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 aluminum weather proof suitable for black panel / wall mounting etc.,

The enclosure of probes shall be manufactured with SS316 material. The least count of the central unit with amplifier should be +/- 0.10mm for response value of 30 seconds.

2.8.14. 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.

2.8.15. Anti Flood Non-Return Valves For Sewerage Connection

These valves are used for eliminating flood risk from the sewerage system. These valves should conform to the Building Regulations (H1- A13) and British standard BS 8301-1985. The valve should suit every angle without restricting the internal cross-section of the pipe. The valves shall be suitable for maintenance in accordance with CDM regulations, 1994. The valve is to be installed in level. For valves installed for depths more than 1 meter requires brickwork or concrete construction in accordance with BS 5955- Part6 – 1980. The valve is to be suitable installed as per the manufacturer's instruction.

2.8.16. Relief Vents

Drainage systems, especially those in tall buildings, are frequently found to develop extremely high and objectionable pneumatic effects in several specific portions of such piping. Special air pressure relief vents are recommended to control, within tolerable limits.

The air pressure relief vent, at least one-half the diameter of the building drain, should be provided at the top of vertical offset so as to supply such additional air to the drain as may be required by the sudden increase in liquid velocity in the vertical offset. Where a building trap or other sharp change in flow direction is provided in the building drain downstream from the vertical offset, an air pressure relief vent should be provided at the base of, and within 3 ft (0.900m) of, the vertical offset. Lower relief vent should be branch –connected to the upper relief vent at a sufficient height..

The recommended provision for soil and waste stacks more than ten stories in height is to provide a yoke relief vent at each tenth story of the drainage stack, counting downward from the top

story. The lower end of the yoke relief vent should connect to the drainage stack by means of a Y located below the horizontal branch drain serving fixtures in that story, and the upper end should connect to the vent stack by means of a T or inverted Y located at least 3 ft (0.900m) above the floor level as shown in the drawing.

2.8.17. Installation of Valves

Valves should be installed in true tolerance of +/-5mm with respect to the centre line of the pipe. Where threaded joints are encountered the threads should be initially sealed with PVC tape to avoid leakage due to improper tightening and leakage from threading.

Proper care has to be taken in welded installation so that the centerline of valve should not deviate from the pipe causing uneven load on the pipe and further stress during its operation. The welding should be done only after proper inspection of the joint by the Engineer-in-charge in the tacked position of the joint.

Before putting the line in operative mode the valves should be checked for free and easy operation of the hand wheel. Any burrs or foreign materials should be removed by flushing before final operation so that no choking in the valves should occur which might damage the valve seating.

2.8.18. Mode of Measurements

Valves shall be measured in number only and the cost shall include:

- a) Cost of valves and jointing materials.
- b) Fixing and jointing with necessary bolts, nuts, rubber inserting, etc.

Testing and making good the defects if any.

2.9. Water Hammer Arrestors

The effective fluid hammer which result in breaking of pipeline caused due to series of hydraulic shock should be arrested by means of a water hammer arrestor. The arrestor shall be capable of withstanding pressures up to 500 P.S.I. and temperatures in the range of -400F to 2120F (-540 C to +1000C). It shall be maintenance free with a companion flange to suit in the pipeline. The following materials are used for its manufacture

Barrel	—	Type 'K' hard drawn copper
Cap	—	Standard wrought copper fittings attached to Barrel with 95-5 solder.
Piston & Thread Adaptor	—	machined of free turning brass.
Seals	—	"O" rings shall be of Parker spec. EP-5778-80
Seal Lubricant	—	Dow-corning silicone compound #111, FF & DA Listed for use in potable water system or

Nickel plated for sea water application.

2.10. Tank Fitments

2.10.1. Puddle Flanges for Reservoir (Inserts)

Inlets, outlets, interconnection sleeves and drain outlets for the reservoir shall be made through mild steel bath galvanized puddle flanges obtained from reputed manufacturers and to be inserted at suitable levels as indicated on the drawings. The Contractor shall be responsible for placing the inserts at required level well in advance and before making the final shuttering layout for casting the walls.

2.10.2. Manhole Covers

The manhole covers shall be of heavy duty type (cast iron) with double seal, locking arrangement and lifting hooks. (Weight 110kgs.) Manufactured as per IS-1726. The shape of the cover to be as per the drawings.

2.10.3. Aluminum Step Ladder

For effective maintenance of the reservoir portable aluminum step ladder to suit the depth of the tank shall be provided with necessary hooks.

2.10.4. Link Seals

Link seal is a seal which is used as a substitute for puddle flanges in underground sumps and overhead tanks and in places where positive hydrostatic sealing is mandatory. The link seals shall be suitable to withstand a pressure of 20 psig (40 feet of head). It should be capable of withstanding temperatures from as low as -600 F to as high as 4000F, it should provide three minimum three hours of protection against flames, smoke, gases and water even when exposed to temperatures up to 19000F. The seal should be of HDPE thermoplastic / heavy wall welded or seamless pipe to withstand angular and off-centre pipe misalignment and has to seal effectively.

The following table indicates the materials for accessories of different models of link seals.

Code	Type	Seal Element	Pressure Plates	Bolts & Nuts	Temperature Range (Of)
C	Standard	EPDM Black	Composite	Steel Zinc-Dichromate	-40 to +250
S	Stainless	EPDM Black	Composite	316 Stainless Steel	-40 to +250
O	Oil-resistant	NITRILE Green	Composite	Steel Zinc-Dichromate	-40 to +210
OS	Oil-resistant	NITRILE Green	Composite	316 Stainless Steel	-40 to +210
T	High/low temperature	SILICONE Grey	STEEL Zinc-Dichromate	STEEL Zinc-Dichromate	-67 to +400
FD/FS	Fire seals	SILICONE Grey	STEEL Zinc-Dichromate	STEEL Zinc-Dichromate	-67 to +400
M	Non-insulating	EPDM Black	Steel	Steel Zinc-Dichromate	-40 to +250

2.11. Soil, Waste and Vent Pipes and Rain Water Pipes

2.11.1. Scope of Work

Work under this section consists of furnishing all labor, materials, equipment and appliances necessary and required to completely install soil, waste, vent pipes as indicated on the drawings.

Without restricting to the generality of the foregoing, the soil, waste and vent pipe system shall include the following:-

- a) Vertical and Horizontal Soil Waste pipes and fittings, joints, clamps and connections to fixtures.
- b) Connection of all pipes to sewer lines as shown on the drawings.
- c) Floor and urinal traps, cleanout plugs and inlet fittings.
- d) Testing of all pipe lines and all accessories as per Bureau of Indian Standards.
- e) Connectivity to existing lines/chambers shall form cost of below said works and will not be paid separately.

2.11.2. General Requirements

Materials shall be of the approved make and quality specified. They shall conform to the respective Bureau of Indian Standards, British Standards Specifications, supported by Manufacturing Certificate and any other specification referred to herein.

Pipes and fittings shall be fixed truly vertical, horizontal or on slopes as required in neat manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, and in suspended ceilings.

Pipes shall be fixed securely to walls and ceilings by suitable pipe supports at intervals specified.

Access door for fittings and cleanouts shall be so located that they are easily accessible for repair and maintenance.

2.11.3. Polyvinyl Chloride (SWR) Pipes and Fittings

PVC (SWR) class pipes of dia 75mm, 110mm and 160mm, of Type A for use in rain water and ventilation and of Type B for soil and waste discharging system and conforming to IS 13592: 1992, shall be used. The pipes shall be supplied in nominal lengths of 2,3,4 or 6 meters, tolerance on specified lengths shall be +10mm and – 0mm. Any physical test requirements shall be as per IS13592-1992.

2.11.4. Handling

Because of their lightweight, there may be a tendency for the PVC pipes to be thrown much more. Reasonable care should be taken in handling and storage to prevent damage to the pipes.

Contractor should hold the fullest responsibility in this case. On no account the pipes should be dragged on the ground. Pipes should be given adequate supports at all times.

2.11.5. Laying

The PVC pipes shall be laid under the floors below slab or on walls either buried or exposed as the case may be, as shown in the drawings. The minimum thickness of fittings shall be of 3.2 mm. the fittings shall be of injection mould type with solvent cement joint or rubber ring joint. The pipes and fittings shall be capable of withstanding sun's rays. PVC pipes laid below slab or suspended in ceiling shall be supported by angle brackets / supports as detailed in the drawings.

2.11.6. Jointing

The jointing of pipes to fittings shall be done as per the manufacturer's instructions / recommendations.

The PVC pipes and fittings shall be joined with Solvent Cement and jointing shall be carried out as follows:

- a. Cut the spigot end of the pipe square.
- b. All burrs from the internal and external surfaces should be removed.
- c. The spigot should be marked with a pencil line and a distance equivalent to the socket depth. Clean the surface within the marked area.
- d. Apply uniform coat of solvent cement on the external surface to the pipe and a lighter coat on the internal surface of the fitting.
- e. Insert the pipe end into the socket of the fitting and push it in up to the mark.

Remove the excess solvent cement and hold the joint firmly in position for 30seconds to dry. Gluing should be avoided in a rainy or foggy weather.

The other method of jointing shall be by rubber rings. The material of rubber ring should conform to IS 5382-1969. The ring is housed in groove formed in a plastic or metallic housing. The rubber is compressed and makes a seal between the pipe and housing. Lubricating paste should be applied before compressing the rubber. Where natural rubber rings are used, mineral oil or petrol or grease should be used.

2.11.7. Testing

PVC pipes and fittings shall be tested in accordance with IS 13592 - 1992. The openings of the pipes shall be sealed for the section to be tested. The water pressure of 0.5Mpa (50.98 m of H₂O or 5.98 kg/cm²) shall be maintained for a maximum of one hour. The Engineer-in-Charge shall examine carefully all the joints for leakage.

2.11.8. PVC Pressure pipes

The PVC pressure pipes and fittings shall be used for conveying waste water from wash basins, kitchen sinks, floor drain connecting to washing machines, etc.

The pipes shall be class III, 6/ 10 Kg/cm². PVC pipes and fittings shall be jointed with solvent cement. The pipes shall conform to IS 4985. Fittings shall be of injection moulded PVC conforming to IS 7634 (Part1) - 2000.

uPVC pressure pipes and fittings. Pressure pipes are manufactured as per IS:4985- 2000 standards and are available in 20 to 450mm sizes in different pressure classes. Pipes with both types of joints, i.e., solvent cement type and rubber seal type are available. Varieties of moulded fittings and wide range of handmade fittings are also available. Moulded fittings are manufactured as per IS:7834 and fabricated fittings are manufactured as per IS:10124 and company standards. These pipes and fittings are used for a variety of applications like, irrigation, water supply, industrial process lines, swimming pools, firefighting mains, etc. These pipes are superior to CI, DI or RCC pipes in terms of being light in weight, easier and quicker installation, excellent corrosion and chemical resistance properties, high flow rates, long life and economy. These pipes have the approval of MJP.

Features and benefits Odorless and hygienic - These pipes are an excellent choice for carrying potable water as they do not allow contamination.

High corrosion resistance - Being immune to chemical, electrolytic and galvanic action, these pipes are free from corrosion which ensures a much longer and useful life.

High chemical resistance - Pipes offer excellent resistance to acids, oxidizing agents, alkalis, oils and domestic effluents.

Smooth bore - Pipes have a mirror smooth inside surface offering much better flow characteristics in comparison to AC, CI and GI pipes.

Self extinguishing quality – This feature eliminates the need for fire resistant coatings

2.11.8.1. Properties

- Hazen Williams constant : 150 (remains constant)
- Specific gravity : 1.41 -1.46 -5
- Coefficient of linear expansion : 5.4 x 10 mm/m/°C
- Combined flexural and 2 compressive strength : 600 - 650 kgf/cm²
- Impact strength at 20°C : 3 Kgf/cm⁴ 2
- Modulus of elasticity : 3 - 3.8 x 10 Kgf/cm
- Vicat softening point : 80°C 14
- Electrical resistance : 10 ohm-cm

2.11.9. Dimensions of uPVC Pressure Pipes as per IS:4985-2000

Nominal Outside Diameter (mm)	Tolerance on Outside Diameter	Wall Thickness (mm)						
		Class 1(PN)	Class 2(PN)	Class 3(PN)	Class 4(PN)	Class 5(PN)	Class 6(PN)	Plumbing

		2.5 kgf/cm ²		4 kgf/cm ²		6 kgf/cm ²		8 kgf/cm ²		10 kgf/cm ²		12.5 kgf/cm ²		Pipes	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
20	0.3	-	-	-	-	-	-	-	-	1.1	1.5	1.4	1.8	2.8	3.3
25	0.3	-	-	-	-	-	-	1.2	1.6	1.4	1.8	1.7	2.1	2.9	3.4
32	0.3	-	-	-	-	-	-	1.5	1.9	1.8	2.2	2.2	2.7	3.4	3.9
40	0.3	-	-	-	-	1.4	1.8	1.8	2.2	2.2	2.7	2.8	3.3	3.6	4.2
50	0.3	-	-	-	-	1.7	2.1	2.3	2.8	2.8	3.3	3.4	4	3.7	4.3
63	0.3	-	-	1.5	1.9	2.2	2.7	2.8	3.3	3.5	4.1	4.3	5		
75	0.3	-	-	1.8	2.2	2.6	3.1	3.4	4	4.2	4.9	5.1	5.9		
90	0.3	1.3	1.7	2.1	2.6	3.1	3.7	4	4.6	5	5.7	6.1	7.1		
110	0.4	1.6	2	2.5	3	3.7	4.3	4.9	5.6	6.1	7.1	7.5	8.7		
125	0.4	-	-	2.9	3.4	4.3	5	-	-	-	-	-	-		
140	0.5	2	2.4	3.2	3.8	4.8	5.5	6.3	7.3	7.7	8.9	9.5	11		
160	0.5	2.3	2.8	3.7	4.3	5.4	6.2	7.2	8.3	8.8	10.2	10.9	12.6		
180	0.6	2.6	3.1	4.2	4.9	6.1	7.1	8	9.2	9.9	11.4	12.2	14.1		
200	0.6	2.9	3.4	4.6	5.3	6.8	7.9	8.9	10.3	11	12.7	13.6	15.7		
225	0.7	3.3	3.9	5.2	6	7.6	8.8	10	11.5	12.4	14.3	15.3	17.6		
250	0.8	3.6	4.2	5.7	6.5	8.5	9.8	11.2	12.9	13.8	15.9	17	19.6		
280	0.9	4.1	4.8	6.4	7.4	9.5	11	12.5	14.4	15.4	17.8	-	-		
315	1	4.6	5.3	7.2	8.3	10.7	12.4	14	16.1	17.3	19.9	-	-		
355	1.1	5.1	5.9	8.1	9.4	12	13.8	15.8	18.2	-	-	-	-		
400	1.2	5.8	6.7	9.1	10.5	13.5	15.6	-	-	-	-	-	-		
450	1.4	6.5	7.5	10.3	11.9	15.2	17.5	-	-	-	-	-	-		

2.11.10. Handling Instructions:

Pipes should be kept on an even surface while storing. They should be properly supported and should not be stacked for more than 1.5 m height for a long duration. While laying big pipelines, provision should be made for expansion of joints, air venting and proper anchorage.

Pipes or fittings should not be cleaned with solvent cement. Quality of solvent cement plays an important role. It is, therefore, recommended that good quality solvent cement be used. 2 For large diameter and higher class pipes (6 Kgf/cm and above), always use heavy duty solvent cement. Very old, hard, semi-fluid solvent cement should not be used

2.11.11. Properties

Hazen Williams constant	150 (remains constant)
Specific gravity	1.41 -1.46
Coefficient of linear expansion	5.4 x 10 ⁻⁵ mm/m/°C
Combined flexural and compressive strength	600 - 650 kgf/cm ²
Impact strength at 20°C	3 Kgf/cm ²
Modulus of elasticity	3 - 3.8 x 10 ⁴ Kgf/cm ²
Vicat softening point	80°C
Electrical resistance	1014 ohm-cm

2.11.12. 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. Burrs if any shall be removed. Pipes and fittings shall be jointed using solvent cement or rubber ring joints. The pipes and fittings shall be jointed accurately without any stress to achieve leak proof joints.

2.11.13. 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. The test shall be done in accordance with IS 2065 – 1983 – code of practice for water supply in buildings. The test pressure shall be 5 kg/cm² or the maximum working pressure plus 50%, whichever is greater. The pressure shall be maintained for at least 4 hours.

2.11.14. Mode of Measurement

PVC Pipes shall be measured along the centerline of the pipeline including the specials in running meter (Rm.) between:

- a) Chambers: Shall be recorded from the inside of one chamber to inside of another chamber.
- b) Gully trap and Chamber: Shall be recorded between socket pipe near gully trap and inside of chamber.

The quoted rate shall include the following:

- i) The cost of pipes, specials and other jointing materials and pipe supports and related civil works complete
- ii) Laying, jointing and curing.
- iii) Testing and making good the defects, if any.

2.11.15. Partial Backfilling of Pipe Trench before Testing

Before testing, the trench shall be partially back-filled except at the joints in accordance with provision of refilling clause.

2.11.16. 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. The test shall be done in accordance with IS 2065 – 1983 – code of practice for water supply in buildings. The test pressure shall be 5 kg/cm² or the maximum working pressure plus 50%, whichever is greater. The pressure shall be maintained for at least 4 hours.

2.11.17. Mode of Measurement

The measurement of pipeline is done in running meters, (Rm.), and the specials and fittings are done in Nos. (Quantity of fittings in numbers only). The lead joints shall be measured separately. The mode of measurement shall be as per IS 1200 (Part 16). The quoted rates should be as per above measurements.

2.12. External Sewerage System**2.12.1. Manhole and Inspection Chambers**

Inspection chambers of Internal size 800 x 900mm up to a depth of 1.2M and manholes of varying sizes as per IS 4111 shall be constructed beyond 1.2M (depth of the sewer line from the Formation Ground level).

2.12.2. Location and Sizes

The size indicated in the drawings shall be the internal size of chamber. Unless otherwise specified, manholes and inspection chambers are provided at all changes of direction of drains and where branch drain meets the main drain. Chambers shall be of such size as to allow necessary examination and clearance of drains. The minimum internal sizes shall be taken as per detail drawings; standards specified and local byelaws if any. In the absence of local byelaws, the requirements stipulated in IS 4111 (Part I) Code of Practice for Ancillary Structures on Sewerage System shall be followed. The work shall be done strictly as per standard drawings and the following specifications:

2.12.3. Bed Concrete

Bed concrete shall be in 1:4:8 cement concrete 150 mm thick for inspection chambers, 230 mm for depths up to 2.1 m and 300 mm for greater depths in case of manholes.

2.12.4. Brick Masonry

Brick work shall be with best quality table moulded bricks in 1:6 cement mortar as per specification for brick masonry. The thickness of masonry shall be as per Bill of Quantities.

2.12.5. Plaster

Inside walls of chambers/manholes shall be plastered with 15mm thick cement plaster 1:3 mixed with waterproofing material and finished smooth with a floating coat of neat cement. External walls shall be plastered in CM 1:3 and sponge finished.

2.12.6. Benching

Channels and benching shall be done in cement concrete 1:3:6 rendered smooth with neat cement. The following sizes of channels for the bench shall be adopted:

Sr. No	Size of Drain	Depth of Centre	Depth at sides i.e, at walls
1	100 mm (4``)	150 mm (6``)	250 mm (10``)
2	150 mm (6``)	200 mm (8``)	300 mm (12``)

2.12.7. Chamber/Manhole Covers

Covers shall be of heavy duty cast iron or fibre reinforced cement concrete as per bill of quantities with lifting hooks as per IS 1726 - 1974 and as per the details given in the drawings and fixed on CI frame or cement concrete embedded in concrete. Covers placed on the frames shall be airtight. The weight of frame and cover shall be as per bill of quantities.

2.12.8. Steps

PVC steps shall be provided wherever the depth of the manhole/chamber is more than 1.2M. Steps shall be arranged in a staggered manner as per drawings.

2.12.9. Drop Connections

In case the difference in invert levels between the main drain and the branch line requires a drop more than 600 mm, a drop connection should be provided with a cast iron or stoneware four way junction, fixed at right angles to the drop pipe at the level where the branch pipe enters the manhole. Access for cleaning the bend should be provided at finished ground level.

2.12.10. Gully Trap Chambers

Stoneware gully traps of specified size shall be provided as per IS 651. It shall be fixed on 15 cm. thick and 70 cm square 1:4:8 cement concrete bedding and the gully outlet shall be jointed similarly to the jointing of stoneware pipes. A brick masonry chamber 450 x 450 mm (internally) shall be constructed in 1/2 brick masonry with 1:6 cement mortar and the spaces between the trap and the wall shall be filled up with 1:3:6 concrete and the upper portion of the chamber shall be finished with neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating and the bottom of the chamber shall not be less than 230 mm. In addition to 150mm x 150mm CI grating, the chamber shall have a CI frame cover (450mm x 450 mm). It shall then be placed on top of the brick masonry.

2.12.11. Floor Traps

The floor trap shall be of multi inlet and one single outlet type. The floor trap shall be deep seal type with an effective seal of minimum 75mm. The waste from sanitary fixtures shall be directly discharged to the floor trap. Jointing of the waste pipe to the floor trap shall be done as per manufacturer's instructions. The height riser fitting shall be made use of, wherever the floor drain is located in deep sunk floors or is suspended from the ceiling. The floor trap shall be of reputed make and preferably of the same make as of the pipes used.

The floor trap shall be provided with 150 x 150mm square cast CP or stainless steel grating with rim of approved design. Minimum thickness of the grating shall be 4 to 5mm.

2.12.12. Grease Trap Chambers

2.12.12.1. Design Considerations

Design considerations are broadly based from the spacing building line. The traps provided in drains are the grease and sand traps. The grease trap is a device by means of which the grease content of wastes is cooled and congealed so that it can be skimmed from the surface. This is necessary in the case of liquid wastes from the kitchen or food processing establishments.

The sand trap is a device, often a simple enlargement in cross-sectional area in a conduit, for arresting the sand or silt carried by the liquid wastes through deposition or sedimentation. In Indian houses, where fine silt or ash is also used for cleaning utensils, this separation of the inorganic material is essential to prevent damage to sewers caused by erosion or reduction in capacity.

2.12.12.2. Location and Sizes

The location and sizes are shown on the drawings. The work shall be done strictly as per standard drawings and the following specifications:

Sr. No	Max Hourly discharge	Minimum Internal Dimensions		Minimum Spacing of Baffles & Weir				
		Width	Length	Depth Below crest of Weir	Inlet to baffle no.1	Inlet to baffle no.2	Baffle no.2 To Weir	Weir outlet
1	500	600	1870	700	200	1200	150	200
2	750	600	1870	1000	200	1200	150	200
3	1000	700	2660	600	300	1640	300	300
4	1500	700	3020	600	300	2000	300	300
5	2000	1000	3020	780	300	2000	300	300
6	3000	1250	3820	1050	300	2500	300	600
7	4000	1350	4020	1150	300	2700	300	600
8	5000	1450	4020	1250	300	2900	300	600

2.12.12.3. Bed Concrete

Bed concrete shall be in 1:4:8 cement concrete 100 mm Brick Masonry

2.12.12.4. Brick Masonry

Brick work shall be with best quality table moulded bricks in 1:6 cement mortar as per specification for brick masonry.

2.12.12.5. Plaster

Inside walls of manholes shall be plastered with 15mm thick cement plaster 1:3 mixed with waterproofing compound and finished smooth with a floating coat of neat cement. External walls shall be plastered in CM 1:3 and sponge finished.

2.12.12.6. Grease Racking Arm

Grease collected at the upper portion of the chamber shall be removed using raking arm made of galvanised MS with length and breadth as shown on the drawing.

2.12.12.7. Covers

Covers and baffle slab should be as per the structural drawings

2.12.13. Ventilating Columns / Shafts

The decomposition and purification of sewage results in production of foul gases. In order to achieve proper ventilation the ventilating columns or shafts are generally placed at intervals of 150 to 300 metres long the sewer lines. The vertical shaft to be made by joining cast iron or cast steel pipe, the foundation block of RCC 1:2:4 is to be provided at the bottom end of the shaft in order to keep it upright in vertical position. The y connection between the column and sewer is provided by cast iron pipe. The shaft to be provided with a cowl at the top. The diameter of the ventilating column is kept equal to one third of the diameter of the sewer served by it. The columns should be carried higher than the height of the nearby building. The joints in the vertical portion of the shaft should be air-tight.

2.12.14. Mode of measurement

Manholes, inspection chambers, Grease trap chambers, ventilating columns shall be measured in numbers and the rate quoted shall also be per number only. The quoted rate shall include the cost of all the following items:

- a) Bed concrete.
- b) Brick work.
- c) Plastering.
- d) Grease racking arm.
- e) Concrete to embed the grease trap.
- f) RCC top slab and Chamber cover with baffle slab
- g) Providing holes and embedding pipes for all connections.
- h) Excavation, refilling, necessary dewatering and disposing off extra material to a place as directed by Engineer. The floor traps used inside the toilets are measured in numbers.

2.13. Storm Water Drainage**2.13.1. Scope of Work**

Work under this section consists of furnishing all labour, materials, equipment and appliances necessary and required to completely install drainage system as required by the drawings, specified herein after and given in the schedule of quantities.

Without restricting to the generality of the foregoing, the drainage system shall include the following: -

Vertical and Horizontal Cast Iron pipes and fittings, joints, clamps and connections to fixtures

- b) RCC Hume pipes (light duty pressure pipes)
- c) Connection of all pipes to Catch Basins as shown on the drawings.
- d) Floor traps cleanout plugs and inlet fittings.
- e) Testing of all pipes lines.

2.13.2. Reinforced Cement Concrete (RCC) Light

These pipes shall conform to IS 458-1988 and this shall be of class Non Pressure (NP) 2. The design and strength thickness and test requirements of pipes shall be as per table 2. of IS 458.

2.13.3. Laying and Jointing

The concrete pipe should be carefully loaded, transported and unloaded without impact, the laying of pipes shall be done by using tripod stand and chain pulley blocks.

Joints shall be of collar joint and the caulking space shall be filled with CM. 1:1 mixture of cement & sand. The caulking shall be employed on both the ends and finished neatly outside the socket at an angle of 45°. Wooden caulking tool shall be used for forcing the mortar home into the collar.

All the joints shall be kept moist by means of wet gunny cloth to protect them from quick drying. The joints shall be cured at least for seven days.

2.13.4. Testing

Testing of non pressure pipes shall be subject to a test for 2.5 meters head of water at the highest point of the section under test for 10 minutes. The leakage or quantity of water supplied during testing shall not exceed 0.2 Lt./mm dia of pipes per Km length per day.

2.13.5. Mode of Measurement

The measurement of the storm water drainage is done as given below the excavation of trenches for laying of light duty RCC pipe (Hume pipe) the excavation for drainage, refilling in proper way as per the standard are measured in terms of cubic meters. The laying and jointing of pipe is measured in terms of running meters (Rm.) from centre line of one collar to the centre line of next collar. Catch basins and gully traps are measured in terms of Nos. (Number of quantities)

3. Sewage Treatment plant

3.1. General

The scope of STP vendor regarding Civil Works is coordinating necessary hydraulic testing for water tightness/seepage as per relevant IS codes for all water retaining structures and hydraulic levels of the units done by civil contractor. The capacity of STPs are mentioned in the BOQ .

Scope of contract for piping includes construction of necessary masonry valve chambers min 900 x 900 wherever necessary, removable type MS painted covers and extension spindles for valves.

Make of all piping/Equipments/Motors/Cables and Pumps shall be clearly stated in the offer shall be got approved by Consultant before Supply & Installation. The decision of Consultant in this regard shall be final and binding on the successful Contractor.

All equipment GA drawings shall be submitted to Consultant for approval prior to fabrication/ ordering. The fabricated and brought-out equipments shall be inspected at Contractor Works by Consultant and shall be dispatched to site only after obtaining clear dispatch instructions in writing from Consultant.

It is obligatory on the part of the intending bidder to visit the site of work prior to submitting the offer and familiarized himself with local/site /soil conditions, availability of men, Materials and Machinery for successful and timely execution of the works. No extra shall be paid in case Contractor fails to ascertain correct site conditions before submitting the offer.

All MS hand railing/ladders shall be given two coats of corrosive resistant paint over a coat of red-oxide primer or approved make and shade, which shall be in the scope of STP contractor.

Any other item not specifically mentioned in this tender but is essential for proper and successful completion, commissioning and running of the DSTP for its commercial utilization is also to be included in the scope of contract.

Fresh water line shall be provided to STP area but should be coordinated with plumbing vendor.

STP vendor has to coordinate with Main contractor, Plumbing vendor, Electrical contractor, Project management/Builder/Client, Architect and Consultant to establish the plant and to run the plant successfully".

Battery Limits: (Included in the STP contractors scope)

1. Sewage Inlet up to STP screen chamber
2. Treated water up to final sump in the STP
3. Exhaust fan capacity and ducting up to 1.0 m from STP
4. Electrical feeder up to LT panel.
5. Fresh water line up to STP.
6. The vendor should also provide necessary civil foundations for equipments and pumps , flanges to be incorporated in the plant during civil works and railings , MS ladder as required, core cutting of concrete as needed, all tank covers etc.,

The main source of effluent is wastewater resulting from Toilets, pantries, and washrooms. The scope of work includes detail design, drawings, getting approvals from statutory bodies, coordinating during construction, erection, commissioning and obtaining best results for completely Basement domestic sewage treatment plant with electrical, mechanical and piping. The treated effluent should be fit to reuse for gardening & flushing purpose.

The work should be carried out on a turnkey basis covering a performance guarantee of plant as per the standards committed.

3.2. Basic Data on Raw Waste Water (Sewage)

- Quality of raw wastewater:

▪ pH	=	6 – 8
▪ TSS	=	400 Mg / Lit
▪ BOD5	=	300 Mg/Lit
▪ COD	=	450 Mg/Lit

3.3. Treated Waste Water Quality

As stipulated by State Pollution Control Board (PCB), the treated effluent quality shall be within the following values for various parameters, for both present and future.

- Quality of treated wastewater:
 - pH = 6.5 – 7.5
 - TSS = <20 Mg / Lit
 - BOD5 = <10 Mg/Lit
 - COD = <150 Mg/Lit
 - Turbidity, NTU = ≤2
 - E-Coli = None
 - Residual chlorine = ≥1

3.4. The treatment plants

Based on the Raw Waste Water characteristics following treatment scheme is suggested:

The raw effluent is led by gravity into a Bar Screen Chamber provided with MS Bar Screen for removal of floating and large suspended matters.

The screened effluent is collected in an equalization tank. This sump is provided to dampen the flow fluctuations and in order to keep the solids in suspension/pre-aeration is provided with coarse bubble tubular diffusers.

The raw Influent is pumped to Extended Aeration unit comprising of aeration tank with fine pore diffusers, clarifier, and sludge re-circulation to Aeration tank, filter press.

The secondary treated effluent is further treated in Pressure sand filter, Activated carbon filter and chlorinated before reuse

The waste activated sludge is pumped through screw pump to filter press and solid cakes formed are carted out.

In general the requirements for complete domestic sewage treatment plant shall include (but not limited) the following.

Bar screen

Raw effluent pumps

- Treated effluent pumps.
- Air blowers.
- Secondary clarifier mechanism
- Final sump pumps

- Pressure filter, AC filters and chlorinator
- Screw pump
- Plant lighting
- Filter press
- Piping and cabling
- Motor control centre for control of all pumps/blowers, dosing equipments etc.,
- Ventilation system.

All the above units are housed basement structure as shown in the drawing.

3.5. Design Criteria

The STP shall be designed on the basis of wastewater flow and quality parameters as in Para 3.2 & 3.3. Vendor to submit an offer for STP with complete design and detail drawing. These values shall form the design criteria for design

STP running time : 22 Hours

a) Equalization Tank (Mixing Tank)

Detention time : 8.0 hours is considered based on hourly flow of raw sewage.

b) Raw effluent pumps : As indicated in the Data sheets.

c) Aeration Tanks

F: M Ratio : 0.12

Influent BOD5 : 300 mg/lit

MLSS : 3500 mg/lit

Oxygen requirement : 2 kg / kg of BOD @ 20° C / m3. Day

d) Settling Tank

Detention time : 2 to 3 hours

3.6. Scope of Contract & Description of Work

The tender is invited on turnkey basis for Design, Engg, Supply, Coordinating with construction works, Erection and Commissioning of Sewage Treatment Plant (STP) for Extended aeration technology, to give treated effluent quality as specified.

The schematic drawings attached herewith are preliminary. However, the successful contractor will be required to submit the Detailed Process & Structural drawings (shop drawings) incorporating the thickness of various structural members.

These detailed drawings shall be submitted to Consultants for their comments & approval. Vendor has to submit all the technical details for equipments used for operation of plant to the consultant and should get approval. All the works shall be carried out as per final "valid for construction drawings" only.

- Testing of all equipments at his workshop shall be certified from Consultant.
- Inspection visit to certify all the equipments before supply shall be arranged for Consultant/PMC.
- Complete interconnecting piping between various units as per piping details including supply of all materials like GI pipes, fittings, all valves, gaskets, flanges, nuts and bolts including all materials required for necessary pipe supports, etc., complete.
- Supply, erection and commissioning of all the equipments required for the sewage treatment plant as per the individual equipment specification.
- All electrical works including all electrical motors for the various equipment, cabling, LT panel, starters, etc.,
- The scope of work includes coordinating all necessary civil works like construction of panel foundations, cable trenches, cable supports, lighting of entire plant as per drawing etc., complete.
- Commissioning of all the equipment after the electricity is supplied will be within the scope of contract.
- All temporary sheds, office, go downs, etc. required for storage of materials and for contractors supervisory personnel at site.
- Vendor to submit detail cost sheet for operation and maintenance, inclusive of all consumables, man power and ele power charges for 1 year with tender.
- Vendor to submit the pay back calculation sheet for above technology with Civil, M&E costs including O&M charges.

3.7. Details of Civil Works (Excluding from the STP Contractor)

Civil works (By civil contractor) carried out in the treatment plant are as below which should be coordinated by STP vendor and vendor should furnish required levels and details.

- a. Coarse Bar Screen Chamber - 1 no.
- b. Oil and Grease Separator – 1 no
- c. Equalization Tank - 2 no.
- d. Decant tank - 1 no.
- e. Sludge tank – 1 no
- f. Final tank - 1 no
- g. ETP – 1 no

3.8. Details of Piping Work

Following piping works including excavation, back filling, masonry / structural pipe supports, puddle flanges, concrete bedding, pipe specials and approved makes only are all included in the scope of contractor. The quantity and sizes of the pipes are indicative, the contractors to quote for the designed sizes of the pipes.

3.9. Details of Electrical Works

As per the above-mentioned specification the part of pumps

4. Water Treatment plant

Depending on the Municipal / bore well water analysis the vendors shall submit design, supply, erection and commissioning of complete water supply system. The flow diagram and BOQ are indicated. The vendor has quote-complete system to get the satisfactory domestic water as per relevant codes and acceptable standards. The capacity of the plant is indicated in the BOQ. The vendor should submit technical information and catalogue along with the design of the system.

4.1. Water Data

The characteristics of raw water is attached to the tender should be considered.

4.2. Filters

The filter shall be built with MS/FRP sheet 5mm thick. The filter shall be coated internally and externally with Epoxy paint. The filter shall be provided with necessary inlet distribution and outlet collecting system. Complete frontal piping valves etc.

The initial charge of under bed and multi grade filtering media shall be selected and graded to suit the requirements as said above (elsewhere in the tender).

The filter shall be provided with necessary frontal piping (including valves) orifice board for monitoring backwash flow and pressure gauges suitable to measure upto 3.5kg/Sq cm and also to evaluate pressure drop across the unit.

4.3. Softener

The softener shall be built with MS /FRPM sheet 5mm thick and shall be painted both internally with sand blasting, epoxy coating and externally with epoxy paint.

The softener shall be provided with all its internal fitting and frontal piping complete with valves and ejector.

One set of hardness testing kit and a salt saturator solution tank of corrosion resistant material shall be provided.

One charge of resin and an orifice board for indicating wash flow rates shall be provided.

4.4. Electronic Dosing Pump / Chemical Dosing Pump

The electronic chemical dosing pump shall consist of electronic diaphragm with positive displacement, plastic head and complete with provision for adjustment of stroke length and frequency. The chemicals used for dosing are viz. chlorine.

The electronic pump shall be mounted suitably.

One no. Chemical solution tank, molded in FRP construction with necessary lids, inserts (for mounting pumps) and other ancillary items shall be provided for the efficient performance of the system.

The pump shall be provided with suitable suction pipe, foot valve and automatic switch to trip the supply to the dosing pump in case the chemicals in the dosing tank falls below a preset level to avoid any damage to the pumps.

4.5. Details of Electrical Works

As per the above-mentioned specification the part of pumps

5. BILL OF MATERIAL

5.1. Preamble

- All items of work mentioned in the Schedule of Quantities shall be read and executed strictly in accordance with the description of the item in the Schedule of Quantities & read in conjunction with the appropriate IS and conditions of Contract.
- The rate for each item of work included in the bill of quantities shall unless expressly stated otherwise included cost of: -
 - a. All materials, fixing materials, accessories, hardware, operations, tools, equipment, consumables, civil works wherever involved and incidentals required in preparation for in the full and entire execution and completion of the work called for in the item as per specification and drawings completely.
 - b. Wastage on materials and labour.
 - c. All taxes, duties, Octroi, including works contract tax, sales tax, transit insurance, packing and forwarding charges, loading, transportation, unloading, handling, hoisting, to all levels, setting and fixing in position, disposal of debris and all other labour necessary in accordance with contract documents, good practice and recognized principles.
 - d. Liabilities, obligations and risks arising out of conditions of contract.
 - e. Liaison service charges.
- All requirements of system whether such of them are mentioned in the item or not the specifications and drawings are to be read as complimentary to and part of the schedule of quantities and any work called for in one shall be taken as required for all.
- In the event of conflict between the bill of quantities and other documents, the most stringent shall apply and interpretation of the Architect shall be final and binding.

- The installation price of switchboards, metering panels, DB's or any other items shall include supply and fixing of supporting steel structures/MS channels grouting of the same civil works etc., as required.
- No change in unit rate shall be allowed for any change in quantity or for any other reason whatsoever.
- Supply of materials shall mean supply of materials at site. The rate for supply shall include all taxes, Octroi, insurance, packing and forwarding charges, transportation, unloading at site. However the quote should indicate the tax structure separately with necessary details.
- The successful contractors shall submit the Schematic diagrams, fabrication drawings with details of all equipments wirings diagrams etc., to Client/ Architect for approval prior to supply/commencement of such works. The approval of these drawings will be general and will not absolve to contractor of the responsibility of the correctness of these drawings. At least four copies of the approved drawings shall be supplied to Architects for their distribution to various agencies at site at no cost of Owner.
- The tenderers must see the site conditions such as type of soil, locations etc., and take all factors into consideration while quoting the rates as no extra cost will be allowed on any ground arising out of or relating to the site conditions.
- Any error in description or in quantity or omission of items from the contract shall not vitiate this contract but shall be corrected and deemed to be a variation required by the Architect/Owners.
- The Liaison Service Charges shall include the following:
 - a. Follow up expenses with the Local Statutory authorities from the drawing approval upto servicing the installation and getting the safety certificate.
 - b. Preparation of detailed drawings required by the Local Statutory Authorities.
 - c. Obtaining approval of drawings and installation from Local statutory Authorities as applicable.
 - d. Obtaining route drawings from Local Statutory Authorities as applicable.
 - e. All incidental charge/expenses associated with the above work as applicable.
 - f. Official deposits paid to the above agencies will be reimbursed separately at actual by the Owners.
- The tenderer shall take into account the expenses of pre-commissioning tests to be conducted as per specification of the complete installation by licensed agencies.

5.2. Bill of quantity

Refer the separate sheet of bill of quantity .

5.3. List of Approved Makes

Sr .No.	Details of Materials / Equipment	Manufacturer's Name
1.	Vitreous China Sanitary ware	Kohler/or as per client specification
2.	Low level Flushing cisterns	Kohler/or as per client specification
3.	Bath Tub and Shower Tray	Kohler/or as per client specification
4.	Stainless Steel Sink	Cobra/Jayna/Nirali
6.	Cistern	Kohler/or as per client specification
7.	CP Brass Fittings	Kohler/or as per client specification
8	Flow Control Devices	Kohler/or as per client specification
9	Storage Type Geyser / Heat Pump	Aiwsun/Thermax/Emerson
10.	Floor Drain Fixture, Rain Water Outlets	ACO/GMGR/Neer
11.	Urinal Trap	Kohler/or as per client specification
12.	Ultra Low Flow Fixtures-(Flush valves, Faucets, Bib taps) Low Flow C.P Fittings	Kohler/or as per client specification
13.	Macerating systems	Grundfos/Sanitop/kirloskar
14.	Shower Channel / PP – car parking channel	ACO/Kessel/Viega
15.	C.P. Grating for Floor Trap	Chilly /GMGR/Neer/Viega / Supreme / Astral/ Ashirwad/Hinware
16.	GI / M.S Pipes (IS : 1239 and IS : 3589)	Tata/Sail /Surya/Zenith
17.	GI pipes fittings	Crescent Engg Corp. Jalandhar/ KS Engg/RM Engg works, /Zoloto
18.	GI/MS Pipe Protection Wrapping & Coating	IWL – Pypkote/Neotape Rustech – Coatek/STP Ltd.
19.	Pipe clamp & supports	Mupro/Hilti/3M
20.	Pipe Hangers	Mupro/Hilti/3M
21.	D. I. Pipes	Jindal/NECO
22.	UPVC Pipe	Supreme / Ashirwad/Hindware

Sr.No.	Details of Materials / Equipment	Manufacturer's Name
23.	CPVC pipes & fittings	Supreme / Ashirwad/Hindware
24.	Teflon Tape	Approved local
25.	Toilet Accessories	Kohler/or as per client specification
26.	P.P.R Pipes	Prince/ Reliance/ Supreme
27.	P.E.X pipes	Itap/Giacomini/Henco/Viega
28.	FRP/GRP Manhole covers	Everlast/Thermoset
29.	HDPE Pipe & fitting	Duraline/Kimplas/Reliance
30.	RCC Pipe	Dhere/K K /INDIAN HUME PIPE/Pranali
31.	Stoneware Pipes	Anand/Burn & Co./Perfect potteries/Rajura
32.	GM / Forged Brass Ball Valves	Lehry valves /Normex/Sant /Jainson/
33.	Sluice Valves	Lehry valves /Normex/Sant /Jainson/
4.	Butterfly Valve	Lehry valves /Normex/Sant /Jainson/
35.	Check Valve – WaferType	Lehry valves /Normex/Sant /Jainson/
36.	Check Valve – Dual Plate	Lehry valves /Normex/Sant /Jainson/
37.	Cast Iron Non Return valve	Lehry valves /Normex/Sant /Jainson/
38.	Check Valve Forged Screwed	Lehry valves /Normex/Sant /Jainson/
39.	Pressure Reducing Valve	Lehry valves /Normex/Sant /Jainson/
40.	Solenoid Valve	Avcon/Aira/Danfoss/Lehry valves
41.	Thermostatic mixing valve	Danfoss/Overtrop
42.	Air Release Valve	Marck/OR/RB/Studor/Zoloto/Lehry vales
43.	Ball Float Valve	Prayag/Zoloto/Lehry vales
44.	NRV – Ball type – Sewage application	Danfoss/Silverspark/Normex
45.	Backflow preventor	Normex
46.	Foot valve	Kirloskar/Normex/Sant//Lehry vales
47.	HDPE Tanks	Sintex/Ashish

Sr.No.	Details of Materials / Equipment	Manufacturer's Name
48.	Air Vent Inlet Valve	Studor
49.	Food Crusher for Sink	Enviro/Venus/Zach- Rajguru
50.	FRP/GRP- SMC water tank	Devi Polymers pvt. Ltd./Smartage/Binani
51.	FRP/GRP storage tanks	Sintex
52.	Y Strainer CI	Leader/Marck-Cair/Zoloto/Lehry valves
53.	Hydro pneumatic System	Grundfos/Kirloskar /Willo – Mather & Platt
54.	Storm Water Drainage & Sewage Sump Pumps (Submersible)	Grundfos/Kirloskar /Willo – Mather & Platt
55.	Transfer Pumps	Grundfos/Kirloskar /Willo – Mather & Platt
56.	Self-Priming Pumps	Grundfos/Kirloskar /Willo – Mather & Platt
57.	Bore well Pump	Grundfos/Kirloskar /Willo – Mather & Platt
58.	Anti Vibration Mounting & Flexible Connections	Cori/Dunlop/Flexionics/Easyflex/Resistoflex/V impa
59.	Pressure Gauge	Fiebig/H Guru
60.	Water Meter (Mechanical Type)	Dasmesh/Kranti/Kent
61.	Level Controller & Indicator (Water)	Pumptrol/RM Engg. Works, Ahmedabad
62.	Paints	Asian Paints/Berger/ICI/Shalimar Paints
63.	MH / Water Tank Plastic Steps	KGM/Patel/Pranali Industries
64.	Insulation for Hot Water Pipes	Armacell – Armaflex/K-Flex/Thermaflex
65.	Electric Hot Water Generator / Heat Pump	A.O. Smith/Spherehot/Venus/Riello
66.	Solar Heating	A.O Smith/Ecotherm/Megasor (Greece)/Overtrap Solinteks/Tata BF Solar/Vijay Solar
67.	Grease Trap/Separator	ACO/Wade
68.	Welding Rods	Ador/Cosmos/Prima/Super Bond (S)
69.	Fastener	Fisher/Hilti/Muproo/Powers
70.	Fire Sealant	Birla 3 M/Hilti /Powers/Promat/STI (USA)/ Fire master

Sr.No.	Details of Materials / Equipment	Manufacturer's Name
71.	Manhole (prefabricated)	OK Play/Supreme
72.	Temperature Sensor / Gauge	Forbes Marshall/Danfoss/Wika
73.	Vacuum Sewer System	Roediger Vacuum
74.	Syphonic Roof Drainage System	Geberit/George Fisher/Neuva Terrain/Saint Gobian

5.3.1.List of Approved Makes for Equipment & Materials Treatment Plants

Sr.No.	Details of Materials / Equipment	Manufacturer's Name
1.	Water Treatment Plant	Aquanomics/Renewa/Equalent to be approved by consultants .
2.	Water Treatment Vessel	Certikin/Pure and Cure Technologie Panda
3.	Ultra Violet Water Purifier (WTP / STP)	Alfa UV/Eureka Forbes/Pentair
4.	Dosing Pumps	Grundfos/LMI/Prominent/Pulser Feeder/Toschon

5.3.2.List of approved makes for equipment & materials electrical system

Sr.No.	Details of Materials / Equipment	Manufacturer's Name
1.	Power Distribution Panel and Motor Control Centre & Air Insulated Bus ducts	Adlec Control System/Advance Panels & Switchgear/KMG Atoz/SPC Electrotech/Sudhir Engineering/ Tricolite Dynam/Load Controls/Lotus Powergear/ Elins /Power Control Equipments/Pragati Controls/ Electro Allied Products
2.	Sandwiched Construction Bus duct	Control & Switchgear EAE (IIGM)/GE Power Control/Henikwon/Intraco BKS (Marketed by Larsen & Toubro)/Power Plug Malaysia (Marketed By Tricolite)/Schneider Electric
3.	Motor	ABB/Bharat Bijlee/HAVELL/Kirloskar/Marathon//Siemens
4.	Starter	ABB/Allen Bradley/Kirloskar/

Sr .No.	Details of Materials / Equipment	Manufacturer's Name
		L & T/Schneider/Siemens
5.	Variable Frequency Drive (VFD)	ABB/Alan Bradley/Danfoss/ Fuji Electric/L&T/Siemens Schneider Electric/VACON
6.	Air Circuit Breaker (3/4 Pole)	ABB(E-Max)/GE Power Controls (M-Pro)/Larsen & Toubro (U-Power)/Schneider Electric (Master Pact NW)/Siemens (3WL)
7.	Moulded Case Circuit Breaker (MCCB)	ABB (T – Max)/GE Power Controls (Recod plus)/Larsen & Toubro (Dsine)/Schneider Electric (Compact NSX/ NS)/Siemens (3VL)
8.	Motor Protection Circuit Breaker(MPCB)	ABB/GE Power Control /Hager (Marketed by Larsen & Toubro)/Schneider Electric/Siemens
9.	Automatic Transfer Switch (ATS)	ASCO/Cummins/GE Power Control
10.	Miniature Circuit Breakers (MCB)	ABB /GE Power Controls/Hager (L&T)/IndoAsian (Gold Plus)/MDS Legrand/Mitsubishi Electrical (DIN rail mounted)/Schneider Electric–(Multi 9)/Siemens
11.	Residual Current Circuit Breaker (RCCB)	ABB/GE Power Controls/Hager (L&T)/IndoAsian (Gold Plus)/MDS Legrand/Schneider Electric (Multi 9)Siemens/Siemens
12.	Power/Aux. Contactor	ABB/EPCOS/GE Power Control/Larsen & Toubro/Mitsubishi Electrical/Schneider Electric /Siemens
13.	Change Over Switch	C & S/Havells/Elcon/HPL – Socomec/Larsen & Toubro
14.	Control Transformer/Potential Transformers	Automatic Electric/Gilbert & Maxwell/ Indcoil/Matrix/Pragati/Precise/Reco
15.	Current Transformer (Epoxy Cast Resin)	Automatic Electric/Gilbert & Maxwell/ Indcoil/Matrix/Pragati/Precise/Reco
16.	Protection Relay	
	a. Numeric Type	ABB/Areva/Larsen & Toubro/Prok Devices Pvt. Ltd /Siemens

Sr .No.	Details of Materials / Equipment	Manufacturer's Name
	b. Electromagnetic Type	ABB/Areva/Larsen & Toubro
17.	Indicating Lamps LED type and Push Button	Altos /GE Power Controls/Larsen & Toubro (ESBEE)/Schneider Electric (MG)/Teknik/Vaishno Electricals
18.	Overload relays with built in Single Phase preventer	ABB /GE Power Controls/Larsen & Toubro/Mitsubishi Electrical/Schneider Electric(Telemechanique)/Siemens
19.	a. Electronic Digital Meters (A/V/PF/Hz/KW/KWH) with LED Display	ABB/Automatic Electric/Conzerv/EI Measure/IME/L & T/Nippen/Schneider Electric/Secure
	b. Dual Energy Meter with centralized metering & billing system	ActarisConserve/EI Measure/Secure
	c. Prepaid Meters & accessories	Actaris/Conzerve/Secure
	d. Electromagnetic Meters	Automatic Electric/Rishabh (L&T)
20.	Static Power Meter & Logger (SPML) with RS 485 port	Conzerv/EI measure/IME/Larsen & Toubro/Nippen/Schneider Electric
21.	Power Capacitor	ABB/Datar/Ducati/GE Power Controls/Matrix /Meher (Larsen & Toubro)/Siemens (Epcos)
22.	Autoamtic Power Factor Correction Relay (Numeric Type)	Areva/BELUK (Germany)/Conzerv/Datar/Ducati/Siemens
23.	Thyristerised APFC Control Panel	ABB/Datar/Ducati /Meher(Larsen & Toubro)/Power Matrix Solutions/Siemens
24.	PVC insulated XLPE aluminium/copper conductor armoured MV Cables upto 1100 V grade	Batra Hanley/CCI/Finolex/Gloster/KEI/Nicco Cables/Polycab/Rajanighandha/Rallison Cables /Ravin Cables/RPG/Skytone/Torrent/Universal
25.	LT Jointing Kit / Termination	Raychem/REPL/Safe Kit
26.	Cable Glands Double Compression with earthing links	Baliga Lighting/Comet/Cosmos
27.	Bimettalic Cable Lug	Comet/Cosmos/Dowell's (Billar India)/Hax Brass (Copper Alloy India)

Sr.No.	Details of Materials / Equipment	Manufacturer's Name
28.	PVC insulated copper conductor stranded flexible wires (FRLS) -	Anchor/Batra Hanley/Bonton/Finolex/Havells Indo Asian/KEI/Lapp Kabel/Rajanighandha R R kabel
29.	Mettalic Conduit (ISI approved)	AKG/BEC/NIC/Vimco
30.	PVC Conduit (ISI approved)	AKG/BEC/D Plast/Duraline /Polypack/Precision
31.	Industrial Socket Splash Proof	Clipsal / Gewiss/ MDS Legrand/ Neptune Balls RR – PCE/ Schneider Electric
32.	Industrial Socket Metal Clad	BCH/ MDS
33.	Selector Switch, Toggle switch	Kaycee/Salzer (Larsen & Toubro)
34.	Timer	ABB/BCH/GE Power Control/Larsen & Toubro/MDS Legrand/Schneider Electric /Siemens
35.	LT Servo Automatic Voltage Stabilizer & Isolation Transformers	Abhishek Electrical/Aplab/Automatic Electric/Recon
36.	Inverter	Autopro (Professional Lighting)/Luminous/ Megatech/Microtek/Neel Industrial Corporation/Vivtar Electronics
37.	Cable Trays (Factory Fabricated) / Raceways	Asian Ancillary Corporation/Elcon/ Globe/Indiana/Profab Engineer/Rico Steel/Slottco/West Coast Engineering
38.	Fire Sealant & Fire Retardant Paint	BTHM Engineering/Birla 3 M/HILTI/Promat
39.	230/12 V Step Down Transformer with Built in Isolation Transformer	Talema/Volstat

5.4. Technical data sheet

5.4.1. Hydro pneumatic pumps (VFD)

Sr.No.	Description	:	Data
1	Pumps	:	

Sr.No.	Description	:	Data
A	Make	:	
B	Type & Model	:	
C	Discharge in LPS / GPM	:	
D	Head (Meters of WC)	:	
E	Shut off Head (Meters of WC)	:	
F	Efficiency (%)	:	
G	No. of Stages	:	
H	Suction End I.D.	:	
I	Delivery End I.D.	:	
J	Details of N.P.S.H.	:	
K	Vibration Isolation Detail	:	
L	Skid Details	:	
M	Operating Weight	:	
N	Overall Dimension (MM)	:	
O	Mechanical Seal Detail	:	
		:	
1.1	Material		
A	Body	:	
B	Impeller	:	
C	Type of Impeller	:	
D	Shaft	:	
E	Is it suitable for direct coupling	:	
		:	
1.2	Motor		
A	Make	:	
B	Model	:	
C	Power Requirement (HP / KW)	:	
D	R.P.M.	:	
E	Rating	:	
F	Over Load Capacity	:	
G	Class of Insulation	:	
H	Details of Additional protection in winding	:	
I	Motor Efficiency	:	
J	It suitable for direct coupling to pump?	:	
K	Type of rotary movement	:	
L	Method of Starting	:	
M	Size and type of cable for connections.	:	
N	Number of variable frequency drive	:	
O	Detail of VFD	:	
1.3	Pressure Vessel		
A	Make	:	
B	Model Number	:	
C	Material of construction (Vessel/Bladder)	:	
D	Dimension	:	
E	Overall capacity	:	
F	Cut-in/Cut-out setting	:	
G	Capacity at specified cut-in/cut-out	:	
H	Overall dimension of skid mounted system	:	
I	Weight (Static/Dynamic)	:	

5.4.2.Variable speed Pumping System - Adjustable Frequency Drive

Sr .No.	Description	:	Data
1	Pumps	:	
a.	Make / Country of Origin	:	
b.	Model No.	:	
c.	Type	:	
d.	Motor Rating	:	
e.	Rated Current	:	
f.	Maximum Output	:	
g.	PID Controller	:	
h.	Interface with BAS.	:	
j.	Fault Indication.	:	
k.	Dimensions (mm)	:	
l.	No. of Steps	:	
m.	Operating Weight	:	
1.2	AUTOMATIC AFD BY PASS :	:	
a.	Make / Country of Origin	:	
b.	Model No.	:	
c.	Type	:	
d.	Motor Rating	:	
e.	Rated Current	:	
f.	Rating of Power disconnect switch.	:	
g.	Type of Enclosure	:	

5.4.3. Transfer Pumps

Sr .No.	Description	:	Data
1	Pump	:	
A	Make	:	
B	Type & Model	:	
C	Discharge in LPS / GPM	:	
D	Head (Meters of WC)	:	
R	Shut off Head (Meters of WC)	:	
F	Efficiency (%)	:	
G	No. of Stages	:	
H	Suction End I.D.	:	
I	Delivery End I.D.	:	
J	Details of N.P.S.H.	:	
K	Vibration Isolation Detail	:	
L	Skid Details	:	
M	Operating Weight	:	
N	Overall Dimension (MM)	:	
O	Mechanical Seal Detail	:	
1.1	Material	:	
A	Body	:	
B	Impeller	:	
C	Type of Impeller	:	
D	Shaft	:	
E	Is it suitable for direct coupling	:	
1.2	Motor	:	
A	Make	:	
B	Model	:	
C	Power Requirement (HP / KW)	:	
D	R.P.M.	:	
E	Rating	:	
F	Over Load Capacity	:	
G	Class of Insulation	:	
H	Details of Additional protection in winding	:	
I	Motor Efficiency	:	
J	It suitable for direct coupling to pump	:	
K	Type of rotary movement	:	
L	Method of Starting	:	
M	Size and type of cable for connections.	:	
N	Number of variable frequency drive	:	
O	Detail of VFD	:	
1.3	Water Flow Switches	:	
A	Manufacturer	:	
B	Country of Origin	:	
C	Local Agent	:	
D	Type	:	
E	Model	:	
F	Body Construction Material	:	
G	Stem Construction Material	:	
H	Flapper Construction Material	:	
I	No. of Contacts	:	
J	Type of Contacts	:	

Sr.No.	Description	:	Data
K	Connections	:	
L	Power Supply	:	
M	Switch Rating	:	
N	Degree of Protection (IP)	:	

5.4.4.Pressure Switches

Sr.No.	Description	:	Data
	Manufacturer	:	
	Country of Origin	:	
	Local Agent	:	
	Type	:	
	Model	:	
	Construction Material	:	
	Dimensions (mm)	:	
	Mounting	:	
	Switch Rating	:	
	Body Construction Material	:	
	Sensing Element Material	:	
	Fill Material	:	
	Sensing Range	:	
	Over Range Protection	:	
	Max. Static Pressure on one side	:	
	No. of Contacts	:	
	Type of Contacts	:	
	Power Supply	:	
	Degree of Protection (IP)	:	

5.4.5.Water Treatment Plant

Sr.No.	Description	:	Data
1	Pump	:	
a	Make	:	
B	Type & Model	:	
C	Discharge in LPS/ GPM	:	
D	Head (Meters of WC)	:	
E	Shut off head (Meters of WC)	:	
F	Efficiency (%)	:	
G	No. of stages	:	
H	Suction end I.D.	:	
I	Delivery end I.D.	:	

Sr.No.	Description	:	Data
J	Details of N.P.S.H.	:	
K	Vibration Isolation Detail	:	
L	Skid Details	:	
M	Operating Weight	:	
N	Overall Dimension	:	
O	Mechanical Seal Detail	:	
1.1	Material	:	
A	Body	:	
B	Impeller	:	
C	Shaft	:	
D	Type of Impeller	:	
E	Is it suitable for direct coupling	:	
1.2	Motor	:	
A	Make	:	
B	Model	:	
C	Power Requirement (HP/KW)	:	
D	R.P.M	:	
E	Rating	:	
F	Over Load Capacity	:	
G	Class of Insulation	:	
H	Details of additional protection in winding	:	
I	Motor efficiency	:	
J	Is it suitable for direct coupling to pump ?	:	
K	Type of rotary movement	:	
L	Method of starting	:	
M	Size and type of cable for connections	:	
		:	
1.3	Filter	:	
A	Material of Construction	:	
B	Diameter	:	
C	Height on straight	:	
D	Filtering media	:	
E	Shell thickness	:	
F	Dish end thickness	:	
G	Service flow rate	:	
H	Design pressure	:	
I	Back wash duration	:	
K	Back wash flow rate	:	
L	Pressure drop across the filter	:	
M	Maximum inlet turbidity (NTU)	:	
N	Turbidity in filtered water	:	
1.4	Dosing system	:	

Sr.No.	Description	:	Data
1.4.1	Pump:	:	
A	Pump model	:	
B	Pump Type	:	
C	Make	:	
D	Material of construction	:	
E	Flow rate	:	
1.4.2	Tank:	:	
A	Capacity	:	
B	Material of Construction	:	
1.5	Chlorination system	:	
1.5.1	Pump:	:	
A	Pump model	:	
B	Pump Type	:	
C	Make	:	
D	Material of construction	:	
E	Flow rate	:	
1.5.2	TANK:	:	
A	Capacity	:	
B	Material of Construction	:	
1.6	U.V. Sterilization	:	
A	System Make	:	
B	Model	:	
C	Type	:	
D	Capacity	:	
E	Qty. of U.V. Lamps	:	
1.7	RO System	:	
1.7.1	Ro Feed Water Pumps:	:	
A	Pump make	:	
B	Type	:	
C	Material of construction	:	
D	Casing	:	
E	Impeller	:	
F	Shaft	:	

Sr.No.	Description	:	Data
G	Service flow rate	:	
H	Head	:	
I	Motor	:	
J	Electrical Supply	:	
K	Motor make	:	
L	Starting current	:	
M	Full load current	:	
N	NPSH Details	:	
O	Details of VFD	:	
1.8	Reverse Osmosis Modules	:	
A	Membranes make	:	
B	Material	:	
C	Percentage recovery	:	
D	Feed flow rate	:	
E	Product flow rate	:	
F	Reject flow rate	:	
G	Feed Pressure for high pressure pump	:	
1.9	Micron Cartridge Filter Unit:	:	
A	Quantity offered	:	
B	Type	:	
C	Operating Flow rate	:	
D	Operating Pressure.	:	
E	Micron Rating.	:	
F	Type of cartridge.	:	
G	M O C.	:	
1.10	CIP System	:	
1.10.1	Chemical preparation tank	:	
A	Quantity offered	:	
B	Capacity of tank.	:	
C	M O C of tank.	:	
1.11	Chemical cleaning pump.	:	
A	Make.	:	
B	Capacity	:	

Sr.No.	Description	:	Data
C	Head	:	
D	Type	:	
E	Material Of Construction.	:	
F	Pump Motor.	:	
G	Electrical Supply.	:	
H	Motor Make.	:	
1.12	Micron cartridge filter	:	
A	Quantity offered	:	
B	Type	:	
C	Operating Flow rate.	:	
D	Operating pressure	:	
E	Micron Rating	:	
F	Type of cartridge	:	
G	Material of construction	:	
1.13	RO Feed Water Limiting Conditions	:	
A	Turbidity	:	
B	S D I	:	
C	Heavy Metal	:	
D	Organics and bacteria.	:	
E	Oil & Grease.	:	
F	Residual chlorine	:	
G	COD	:	
H	BOD	:	
I	Oxidizing Agents.	:	
J	Temperature	:	
K	Colour / Odour	:	
L	PH at the feed of RO	:	
1.14	RO Plant Operating Data	:	
A	No. of Streams offered	:	
B	Feed flow rate	:	
C	Average recovery	:	
D	Product flow rate	:	
E	Operating Pressure	:	

Sr.No.	Description	:	Data
F	Type of operation	:	
G	Operating Hours	:	
H	Treated Water Per Day	:	

6. COMMISSIONING

6.1. Testing and commissioning

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 Architect/Consultant 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 water supply and drainage 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 water supply lines for ease of installing pressure gauge, temperature gauge & rota meters. Contractor shall also supply all required pressure gauge, temperature gauge & rota meter 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.

6.1.1.Pre-Commissioning

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 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 pre-treatment. 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 Architect 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 as for above.
- 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.

6.1.2. Water Supply System

- a. Check all isolation 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 runs each pump set.
- f. All pump sets shall be run continuously for 8 hours (if required with temporary piping back to the tank).
- g. The hot water supply distribution system shall follow the Cold Water Supply Installation as stipulated in respective specification including the cleaning and disinfection of potable water supply installation and water storage tank as described

6.1.3. Drainage System

- a. Proper means of access shall be provided to the area of work and the sides of any trench or excavation in which work is to be tested adequately supported and free from hazards.
- b. Where a water test is to be applied, drain stoppers and bags have been properly secured in position and provision made for the final removal of the stopper or bag from surface level by means of a strong cord.
- c. Buried underground drainage pipe shall be embedded away from the slope area unless or otherwise approved by the Consultant/Architect.
- d. No buried underground drainage pipe shall be embedded in the structural elements unless or otherwise approved by the Consultant/Architect.
- e. All obstructions, debris and superfluous matter have been removed from sections of pipeline, inspection chambers, manholes, or similar underground chambers. Deposits of cement mortar from the surfaces of benching and channel inverts, protective clothing, including gloves and eye shields, shall be provided for operatives using or handling the chemicals. On completion of the work, all treated surfaces shall be thoroughly hosed down.
- f. Before any test is applied, a disc or ball type profile testing device shall be passed through all drains and private sewers between inspection chambers, manholes or other suitable points of access and through all accessible branch drains.

- g. All pipes under test are marked with nominal size, name of manufacturer, manufacturing standard with colour and intervals required.
- h. All pipes under test are under correct alignment, level and length.
- i. All pipes shall be tested without damage
- j. When concrete bed, haunch and surround are used for the pipes, concrete work shall be complied with specifications.
- k. Joints between pipes are completed methodology complying with manufacturer's recommendations or specifications of contract documents.
- l. Terminal manhole and invert levels shall be complied with requirements.
- m. Size of connection pipe shall be complied with requirements.
- n. Temporary covers for the provision of all drain points are checked and securely covered up to ensure free of ingress of cement in the pipeline, in particular where in-situ construction method is used

6.1.4.Manhole

The scope of the test is to verify effective performance of the manhole against leakage. During the test, manhole will be filled with water under an approved water level and time interval. The fall in water inside the manhole will be recorded and compared with the maximum permissible fall. The result will be used to reflect the performance of the manhole against leakage. The test shall be applicable for all types of manholes with all sizes.

The minimum water level to be maintained under the test shall be equal to invert level of the incoming drain pipe or otherwise approved Consultant/Architect/Project manager

Test interval shall be a minimum of 30 minutes with at least 20 hours for absorption period before the test. The sequence of test shall be as follows,

- a. Remove all obstructions, debris and superfluous matter from the manhole;
- b. Seal the end of all connection pipes of the manhole under test
- c. by expanding drain plugs or inflatable canvas or rubber test bags;
- d. Fill water to the manhole at least 20 hours before the test to allow for absorption period;
- e. Record the water level upon test start;
- f. Measure the fall of water level inside.

6.1.5.Commissioning and Testing

Pressurise the water supply system by running the hydro pneumatic/booster pumps and after it attains the shutoff pressure of the pump, then

Open sanitary fixtures and allow the pressure to drop in the system. Check that the hydro pneumatic/booster pump cuts-in and cuts-out at the preset pressure. If necessary adjust the pressure switch for the hydro pneumatic/booster pumps Close by-pass valve.

Open more number of sanitary fixtures and valve and allow the water thru the drainage pipes and check any leak in the drainage .

System Cleanliness Irrespective of the precautions taken during the construction stage to keep the internal surfaces of pipe work clean, the following procedures shall be used to clean the system.

(a) Divide the pipe work system into self-draining sections so that the maximum possible flushing rate is achieved.

(b) Isolate or bypass items which are particularly sensitive to dirt such as pumps, small bore coils and tubes. Washers, feed and other tanks which may have accumulated with deposits during manufacturing or installation shall also be isolated and flushed independently; and

(c) where make-up or feed tanks are used for flushing, ensure that the maximum possible pressure is sustained on the system during the flushing process. This may necessitate the provision of a temporary parallel feed of mains water into the tank where the ball valve has limited capacity.

The flushing water wherever appropriate, shall be recalculated with suitable filtration to reduce the water demand and wastewater discharge.

(d) The Contractor shall ensure that:-

(i) flushing is carried out from the upper to the lower sections of a multi-section system, flushing with the lowest point; initial flushing shall always be from small bore to large bore pipe;

(ii) the large bore outlet is not opened until the section being flushed is fully primed;

(iii) The maximum possible flow rates are used; and

(iv) Flushing continues until the outflow runs clear. Where facilities exist, cleaning of systems can be achieved by circulation of the medium in order to collect dirt at filters or other selected points in the system. Where circulation is achieved by the use of a pump, this action shall be deferred until the pump has been set to work in accordance with the relevant paragraph below. The circulating velocity shall be 1.5 times of normal water velocity in pipe.

6.2. Final Inspection & Approvals

6.2.1. Statutory Authorities' Tests and Inspections

As and when notified in writing or instructed by the Architect/Consultant, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect 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/Consultant 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 Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect 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 Architect without delay.

6.2.2.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 Architect/Consultant.

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.

6.2.3.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 Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect 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/Architect/Consultant.

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 Consultant/Architect/Employer.

6.2.4.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.

6.2.5.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.

6.3. Guarantee

The contractor shall guarantee both the material and workmanship of first class quality corresponding to standard engineering practice.

For a period of One Year from the date of acceptance of the total installation, contractor has to repair or replace to the satisfaction of the Owner, any or all such work that may prove defective in workmanship, equipment or materials within that period, ordinary wear and tear and unusual abuse or neglect excluded, together with any other work, which may be damaged or displaced in so doing. Any defective materials / workmanship shall be rejected, the contractor has to rectify / replace at his own cost.

Also contractor has to test the entire installation upon completion and ensure that all units are functioning satisfactorily. Guarantee certificate of the materials supplied shall be handed over to the owner.



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FIRE PROTECTION & FIRE DETECTION SYSTEM

TECHNICAL SPECIFICATION

Client	SYAMA PRASAD MOOKERJEE PORT TRUST
Project Name	RIVERFRONT CRUISE TOURISM CENTRE AT KIDDERPORE
Project Location	KOLKATA, WEST BENGAL
Date	01/04/23
Revision	R0

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1. GENERAL

1.1. Design Philosophy

This specification is intended to cover design, residual, engineering, manufacture, test and inspection at works, delivery to site properly packed for transportation, erection, testing, commissioning, performance demonstration at site and handing over to purchaser as indicated in the schedule of requirement as per the codes/standards and scope of work .

1.1.1. Codes and Standards

Fire protection system shall be designed and install as per National Building code (NBC) of India 2016, part IV Fire & Life safety, and as per Local Byelaws

The installation shall also be in conformity with the bylaws and requirements of the local authority in so far as these become applicable to the installation. Wherever this specification calls for, a higher standard of materials and /or workmanship than those required by any of the above regulations and standards, then this specification shall take precedence over the said regulations and standards.

Wherever drawings and specifications require something that may conflict with the regulations, the regulations shall govern. This shall be referred to the Superintendent for arbitration.

Sr .No.	Code	Description
1	NBC	National Building Code of India Part IV for Fire protection
2	NFPA 72	National Fire Alarm Code
3	Shade No.536 of IS-5	Paint Shade for main Equipments/accessories
4	IS 9972	Specification for automatic sprinkler heads.
5	IS 937	Specification for washers for water fittings for fire fighting
6	IS 2190	Code of practice for selection, installation and maintenance of portable first aid fire extinguishers.
7	IS 884	First aid hose reel for fire fighting
8	IS 2871	Branch pipe, universal for firefighting purposes.
9	IS 8423	Controlled percolating hose for fire fighting.
10	BS-1965 Part I	Specification for butt-welded Pipe Fittings.
11	IS 9137	Specification for horizontal end suction centrifugal pump
12	IS-5	Specification for painting
13	IS-2159	Hot dip galvanizing of iron and steel
14	IS-2198	Control Panels.
15	IS-636	Synthetic, jacketed hose pipes.
16	IS-4853	Recommended practice for radiographic inspection of fusion welded butt joints in steel pipes.
17	IS-5290	Specifications for hydrant landing valves.
18	IS-903	Specifications for Branch pipes Fire hose couplings and auxiliary equipments
19	IS-4927	Specifications for Canvas Hose Pipes.
20	BS-5155	Specifications for C.I. butterfly valve.
21	IS-814	Specifications for covered electrodes for metal re welding of structural steel.
22	IS-800	Specifications for Structural steel
23	IS 15683:2006	Specification for fire extinguishers

Sr .No.	Code	Description
24	API 600 / BS 5163	Specifications for Gun Metal gate, globe valves
25	IS778/780/2906	Check Valves for water supply.

1.1.2. Building Information

This report communicates the proposed Electrical engineering designs system requirements for the Proposed Amusement Park at Kidderpore Port in Kolkata.

1.1.3. Systems Proposed

1.1.3.1. Fire Water Storage Tanks

As per National Building Code (NBC) of India, Separate underground sump is proposed 200 cum and OHT of 5 cum is proposed at Terrace level is required .

1.1.3.2. Fire Water Pumps

The piping and valve connections shall be done so that the water from the discharge of the Hydrant Pump sets is able to supply water, automatically to the sprinkler system. .

1.1.3.3. Hydrant System

A ring main at underground level with isolation valves. All wet risers are interconnected with Terrace level water tank with to increase the pressure in case of emergency. Fire Brigade Inlet connection for filling the Firewater tank as well as wet riser system.

1.1.3.4. Portable Fire Extinguishers

ABC stored pressure type fire extinguisher of suitable capacity will be provided on the following areas

- On all fire exit staircase
- All utility areas

Co2 stored pressure type fire extinguishers will be provided on following areas

- Electrical rooms
- Lift machine rooms

In addition to the above fire buckets will be provided at all utility areas and car parking areas..

1.1.3.5. Fire Exit Signage

Signage's are provided as per Local fire force like exit signs & Floor indication (e.g. Ground floor, 1st floor.), size shall 200mm x 500mm & action chart (size shall be 600mm x 1000mm) in case of fire / emergency, Staircase location indication etc. The location shall be on each landing of every staircase on each floor.

Signs shall be made out of 3mm thick PVC foam board with PVC non – reflective self-adhesive vinyl foam board OR equivalent material with Mirror fasteners for fixing complete.

1.1.3.6. Addressable Fire Detection and Alarm System

Addressable analogue type fire detection and alarm system shall be provided on all the floors in the building as per National Building Code (NBC) of India 2016, Part 4, Fire and Life Safety and as per IS: 2189. – 2008.

- The Fire detection and alarm system shall be consisting with the following,
- Analogue Addressable Fire detection & alarm control panel at each tower
- Field devices like modules.
- Conduits / wiring
- Manual call points and Hooters are provided at fire exit staircase

1.1.3.7. Emergency talkback system

- Two-way P.A. systems comprises speakers located on all landing of every fire exit staircases on each floor and connected to floor selector-switching console and amplifiers.
- The each speaker is considering as zone for easy identification and announcement, the speakers are dual type i.e., work as speaker and microphone to for talk back to the control room.
- The console / amplifier and microphone are installed in suitable Rack close to the fire alarm control panel.
- In the event of actuation of any manual call point on a particular floor, the fire marshal / security shall made announcements / listen to the talk back from the speakers and shall be guide the occupants for evacuation.

1.1.3.8. Pumps & Electrical Equipments

The Pumps associated with electrical control equipments are provided based on the water demand calculations and should test for Sequential Auto start in case of using respective systems. Also pump shall deliver minimum required flow & pressure at top design point.

1.2. Scope of Work

The general character and the scope of work to be carried out under this contract are illustrated in Drawings, Specifications and Schedule of Quantities. The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the contract documents and with the direction of and to the satisfaction of the Owner's site representative. The contractor shall furnish all labor, materials and equipment (except those to be supplied by the owner) as listed under Schedule of Quantities and specified otherwise, transportation and incidental necessary for supply, installation, testing and commissioning of the complete Fire system as described in the Specifications and as shown on the drawings. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or noted on the Drawings/Documents as being furnished or installed, but which are necessary and customary to be performed under this contract. The Fire System shall comprise of following:

- a) Fire System
- b) Other related miscellaneous items as per the tender drawing & Bill of quantities.
- c) Approval from Local Authorities
- d) Wiring & Earthing from MCC panels to Fire, control wiring & interlocking.

- e) Cutting holes, chases & like through all types of walls /floors and finishing for all services crossings, including sealing, frame works, fire proofing, providing sleeve, cover plates, making good structure and finishes to an approved standard.
- f) Balancing, testing & commissioning of the Fire system.
- g) Test reports, list of recommended spares, as-installed drawings, operation & maintenance manual for the entire Fire
- h) Training of Owner's staff.

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 Architect 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 system and for the Pipes / valves /Wiring/Cable installed in his scope of work. The balancing shall be to the satisfaction of Client /Architect/Consultant / Project Manager.

Six copies of all test results shall be submitted to the Engineer in A4 size sheet paper within two weeks after completion of the tests.

1.2.1. Inspection and Approval

The contractor shall obtain approval to the installation from the Local fire Authority. Successful Bidder shall be responsible for preparation of documents / applications / drawings / Necessary calculations and flow up action at all stages, (Drawing / completion) arranging inspections, revisions / modifications for obtaining approval from Local Authority within the overall completion period stipulated in the Tender. The Contractor shall also make payment of all statutory payments like payment Local fire Authority etc. The quoted rates shall take care of any contingencies.

The contractor shall guarantee both the material and workmanship of first class quality corresponding to standard engineering practice. Any defective materials/workmanship shall be rejected, the contractor has to rectify/ replace at his own cost. Guarantee certificate of the materials supplied shall be handed over to the clients.

1.2.2. Quality Assurance

Comply with the current applicable codes as specified in the Tender documents and local rules, regulations and requirements of the Chief Fire Officer.

Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the more stringent shall apply.

Executive work in strict accordance with the best practices of the trades in a thorough substantial, workmanlike manner by competent workmen.

All equipment, materials and installation method shall comply with the General Specification and the current standards and regulations as described in the Tender Documents.

The Owner's Site representative reserves the right to inspect and reject any part of the Works not complying. The Contractor shall replace such rejected works without cost variation and delay to the Contract.

Approval or acceptance by the Owner's Site representative shall not relieve the Contractor of his responsibilities under the Contract for the quality of materials and the standard of workmanship in the Works.

No work shall be covered up or put out of view without the agreement of the Owner's Site representative. The Contractor shall provide/allow the Owner's Site representative full opportunity for the examination and measurement of any work which is about to be covered or put out of view. Upon request by the Owner's Site representative, the Contractor shall expose their Works and allow/provide access to the Owner's Site representative to inspect any part of the Works during the course of the manufacturing or site installation/erection.

When requested by the Owner's Site representative, the Contractor shall submit evidence including written certificates and full testing reports from approved/recognized testing organization certifying that his proposed equipment or material have been tested and conform with the specified standard.

1.2.3. Bye-Laws and Regulations

The installation shall be in conformity with the Bye-laws, Regulations and Standards of the local authorities concerned, in so far as these become applicable to the installation. But if these Specifications and Drawings call for a higher standard of materials and / or workmanship than those required by any of the above regulations and standards, then these Specifications and Drawings shall take precedence over the said regulations and standards. However, if the Drawings and specifications require something which violates the Bye-laws and Regulations, then the Bye-laws and Regulations shall govern the requirement of this installation.

1.2.4. Fees and Permits

The contractor shall obtain all permits/ licenses and pay for any and all fees required for the inspection, approval and commissioning of their installation.

1.2.5. Drawings

The Fire Drawings listed under Respective section, which may be issued with tenders, are diagrammatic only and indicate arrangement of various systems and the extent of work covered in the contract. These Drawings indicate the points of supply and of termination of services and broadly suggest the routes to be followed. Under no circumstances shall dimensions be scaled

from these Drawings. The architectural/interiors drawings and details shall be examined for exact location of equipments/accessories /fixtures etc.

The contractor shall follow the tender drawings in preparation of his shop drawings, and for subsequent installation work. He shall check the drawings of other trades to verify spaces in which his work will be installed.

Maximum headroom and space conditions shall be maintained at all points. Where headroom appears inadequate, the contractor shall notify the Architect/Consultant/Owner's site representative before proceeding with the installation. In case installation is carried out without notifying, the work shall be rejected and contractor shall rectify the same at his own cost.

The contractor shall examine all architectural, structural, plumbing, electrical and other services drawings and check the as-built works before starting the work, report to the Owner's site representative any discrepancies and obtain clarification. Any changes found essential to coordinate installation of his work with other services and trades, shall be made with prior approval of the Architect/Consultant/Owner's site representative without additional cost to the Owner. The data given in the Drawings and Specifications is as exact as could be procured, but its accuracy is not guaranteed.

1.2.6. Shop Drawings

All the shop drawings shall be prepared on computer through AutoCAD System based on Architectural Drawings, site measurements and Interior Designer's Drawings. After award of the contract, within agreed time line contractor shall furnish, for the approval of the Architect/Consultant, Two sets of detailed shop drawings of all equipment and materials including all layouts/sections/elevation details /typical details as per the consultants drawing showing exact details. Electrical panels inside/outside views, power and control wiring schematics, cable trays, supports and terminations. These shop drawings shall contain all information required to complete the Project as per specifications and as required by the Architect/Consultant/Owner's site representative. These Drawings shall contain details of construction, size, arrangement, operating clearances, performance characteristics and capacity of all items of equipment, also the details of all related items of work by other contractors. Each shop drawing shall contain tabulation of all measurable items of equipment/materials/works and progressive cumulative totals from other related drawings to arrive at a variation-in-quantity statement at the completion of all shop drawings. Minimum Six sets of drawings shall be submitted after final approval along with CD/DVD.

Each item of equipment/material proposed shall be a standard catalogue product of an established manufacturer strictly from the manufacturers listed in respective sections and quoted by the tendered in technical data part of respective sections

When the Architect/Consultant makes any amendments in the above drawings, the contractor shall supply two fresh sets of drawings with the amendments duly incorporated along with check prints, for approval. The contractor shall submit further six sets of shop drawings to the Owner's site representative for the exclusive use by the Owner's site representative and all other agencies. No material or equipment may be delivered or installed at the job site until the contractor has in his possession, the approved shop drawing for the particular material/equipment/installation.

Shop drawings shall be submitted for approval four weeks in advance of planned delivery and installation of any material to allow Architect/Consultant ample time for scrutiny. No claims for extension of time shall be entertained because of any delay in the work due to his failure to produce shop drawings at the right time, in accordance with the approved programme.

Manufacturer's drawings, catalogues, pamphlets and other documents submitted for approval shall be in four sets. Each item in each set shall be properly labeled, indicating the specific services for which material or equipment is to be used, giving reference to the governing section and clause number and clearly identifying in ink the items and the operating characteristics. Data of general nature shall not be accepted.

Samples of all materials shall be submitted to the Owner's site representative prior to procurement. These will be submitted in two sets for approval and retention by Owner's site representative and shall be kept in their site office for reference and verification till the completion of the Project. Wherever directed a mockup or sample installation shall be carried out for approval before proceeding for further installation.

Approval of shop drawings shall not be considered as a guarantee of measurements or of building dimensions. Where drawings are approved, said approval does not mean that the drawings supersede the contract requirements, nor does it in any way relieve the contractor of the responsibility or requirement to furnish material and perform work as required by the contract.

Where the contractor proposes to use an item of equipment, other than that specified or detailed on the drawings, which requires any redesign of the structure, partitions, foundation, piping, wiring or any other part of the mechanical, electrical or architectural layouts; all such redesign, and all new drawings and detailing required therefore, shall be prepared by the contractor at his own expense and gotten approved by the Architect/Consultant/ Owner's site representative. Any delay on such account shall be at the cost of and consequence of the Contractor.

Fire Contractor shall prepare coordinated services shop drawings based on the drawings prepared by other services Contractors to ensure adequate clearances are available for installation of services for each trade.

Where the work of the contractor has to be installed in close proximity to, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. If so directed by the Owner's site representative, the contractor shall prepare composite working drawings and sections at a suitable scale, not less than as per the consultants base drawing, clearly showing how his work is to be installed in relation to the work of other trades. If the Contractor installs his work before coordinating with other trades, or so as to cause any interference with work of other trades, he shall make all the necessary changes without extra cost to the Owner.

Within four weeks of approval of all the relevant shop drawings, the contractor shall submit four copies of a comprehensive variation in quantity statement, and itemized price list of recommended (by manufacturers) imported and local spare parts and tools, covering all equipment and materials in this contract. The Project Manager shall make recommendation to

Owner for acceptance of anticipated variation in contract amounts and also advise Owner to initiate action for procurement of spare parts and tools at the completion of project.

1.2.7. Progress Drawings

Provide and keep on the job at all times, one complete and separate set of prints of the respective work on which shall be clearly, neatly and accurately noted, promptly as the work progresses, all architectural and other changes, revisions and additions to the work. Whatever work is installed otherwise than as shown on the Tender Drawings, such changes shall be noted.

Indicate daily progress on these prints by coloring the various conduits, ducts, piping, cable trays, fixtures, apparatus and associated installation works erected.

1.2.8. As Built Drawings

The contractor shall provide as built drawings, as approved by the Owner's Site representative AutoCAD DWG format in CD/DVD, as per the Project Documentation requirement. The drawings shall be submitted as directed by the Owner's site representative, or putting into operation, whichever is earlier. In addition, Six sets of hard copy of all relevant drawings, which will be required for operation and maintenance, shall be supplied in bound book forms immediately after the commissioning of the Project.

The contractor shall supply, 6 sets of all operation and maintenance manuals in original, from the manufacturer in bound book forms, at least 2 weeks prior to commissioning of the equipment. These shall also be supplied, in computer diskettes, based on popular Microsoft window based publishing software programme, along with the as built drawings as mentioned above, as specified in the Project Documentation.

1.2.9. Samples

The term 'samples' includes natural materials, fabricated items, equipment, devices, appliances, or parts thereof as specified and other samples as may be required to determine whether kind, quality, construction, workmanship, finish, color and other characteristics of materials conform to requirements of the Tender Documents.

Samples shall establish kind, quality and other required characteristics of various parts of the work. Indicate details of construction, dimensions, capacities, weights and electrical performance characteristic of equipment or material.

Samples and sample board shall be prepared and identified by the manufacturer and stamped/engraved with make, type, Cat No. and size marking shall be indelible and legible.

1.2.10. Quality of Materials

Manufacturers shall provide their standard guarantees for products furnished under this Tender. However, such guarantees shall be in addition to and not in lieu of all other liabilities which manufacturers and the Contractor may have by law or by other provisions of the Tender Documents.

All materials, items of equipment and workmanship furnished under this Tender shall carry standard warranty against all defects in materials and workmanship. Any faults due to defective or improper material, equipment, workmanship which develop shall be made good, forthwith,

by and at the expense of the Contractor, including all other damage done to areas, materials and other systems resulting from this failure.

Guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

Upon receipt of notice from the Owner's Site representative, of failure of any part of system or equipment during the defect liability period the affected parts shall be replaced.

1.2.11. Equipment and Materials Approval

Approval of materials and equipment shall be based on latest manufacturer's published data. Complete and detailed information of all materials and equipment to be incorporated in the work shall be submitted. Submit detailed description and specifications, catalogues cuts, installation data, diagrams, dimensions, controls and any other data required to demonstrate compliance with the Tender Documents. Each item submitted shall be referenced to the applicable paragraph in the Specification.

At the request of the Owner's Site representative, submit a sample of any equipment or material for further study before approval. Where samples are required by the Owner's Site representative, the period required to obtain the sample will be taken into account when scheduling approvals.

Only approved materials shall be employed at the site. All materials installed which are not approved shall be removed and reinstated by approved ones.

Time periods for equipment and materials approvals shall be as submitted for the approval of the Owner's Site representative.

1.2.12. Technical Data

Each tenderer shall submit along with his tender, the technical data for all items listed in respective section in the indicated format. Failure to furnish complete technical data with tenders may result in summary rejection of the tender.

1.2.13. Workmanship

The entire work provided in this specification shall be constructed and finished in every respect in a workmanlike and substantial manner. The Contractor shall provide the system in accordance with the best trade practice and to the satisfaction of the Owner's Site representative.

Keep others fully informed as to the shape, size and position of all openings required for apparatus and give full information sufficiently in advance of the work so that all openings may be built in advance. Provide and install all sleeves, supports, etc., hereinafter specified or required.

Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting the same. Obtain all information from others which may be necessary to facilitate work and the completion of the whole Project.

Provide the services of an experienced foreman, who shall be continuously in charge of the erection of the electrical work, together with all necessary skilled workmen, helpers and labourers,

required to properly unload, transfer, erect and connect up, adjust, start, operate and test the system.

Before installing any work, verify that it does not interfere with clearance required for other work. Notice of adverse conditions shall be forwarded in writing to the Owner's Site representative before any work in question is installed. If notification is not made, and work installed causes interference with the contemplated design, make such changes in his work as directed by the Owner's Site representative to permit the installation of all work of the Project, at no additional cost to the Client.

Raceways shall be run as straight and direct as possible in general forming right angles with or parallel with walls or piping and neatly spaced, with risers erected plumb and true, maintain a clearance of at least 25 mm between finished coverings and adjoining work. Approved ceiling height shall be obtained from Architectural Drawings.

All equipment and accessories shall operate without objectionable noise or vibration. Should operation of any of the equipment or systems produce noise or vibration which is, in the opinion of the Owner's Site representative objectionable, make change in equipment and do all work necessary to eliminate the objectionable noise or vibration at no additional cost to the Client.

Wherever possible services shall not cross expansion joints. Where this is unavoidable the services shall accommodate the design movement without damage, by use of approved expansion couplings/flexible conduit arrangement.

All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protective signaling system, meeting the relevant Codes.

All equipment and components shall be installed in strict compliance with manufacturers' recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place. Fasteners and supports shall be adequate to support the required load.

1.2.14. Method of Measurement

The works shall be measured in accordance with relevant IS codes. Notwithstanding any general or local custom, except where otherwise specifically described or prescribed in the contract

1.2.15. Balancing, Testing and Commissioning

Balancing of Fire systems and all tests as called for the Specifications shall be carried out by the contractor through a specialist group, in accordance with the Specifications and Indian Standards. Performance test shall consist of three days of 10 hour each operation of system for each season.

The installation shall be tested again after removal of defects and shall be commissioned only after approval by the Owner's site representative. All tests shall be carried out in the presence of the representatives of the Architect/Consultant and Owner's site representative.

1.2.16. On Site Training

Upon completion of all work and all tests, the Contractor shall furnish necessary operators, labor and helpers for operating the entire installation for a period of fifteen (15) working days of ten (10) hours each, to enable the Owner's staff to get acquainted with the operation of the system. During this period, the contractor shall train the Owner's personnel in the operation, adjustment and maintenance of all equipment installed.

1.2.17. Completion Certificate

On completion of the Fire system, a certificate shall be furnished by the contractor, counter signed by the licensed supervisor, under whose direct supervision the installation was carried out. This certificate shall be in the prescribed form as required by the local authority.

The contractor shall be responsible for getting the entire electrical installation for Fire system duly approved by the local authorities concerned, and shall bear expenses if any, in connection with the same.

1.3. Special Conditions

1.3.1. General

These special conditions are intended to amplify the General Conditions of Contract, and shall be read in conjunction with the same. For any discrepancies between the General Conditions and these Special Conditions, the more stringent shall apply.

1.3.2. Existing Services

The contractor is deemed to have visited and inspected the site to familiarize himself with the existing site conditions and services at tender stage.

Co-ordination between shop drawings, work on site and existing services shall be carried out by the Contractor.

The Contractor shall be fully responsible for any damages to the existing services including repairs, and penalties imposed by the concerned parties etc and for removing any site obstacles such as underground cables, pipes, civil works etc. which is obstructing his work on site.

1.3.3. Associated Civil Works

Following civil works associated with Fire installation are excluded from the scope of this contract. These shall be executed by other agencies in accordance with approved shop drawings, and under direct supervision of the Fire contractor.

- a) RCC work for Panels
- b) Water proofing of floors.

However any wall/floor opening made by the fire contractor shall be inclusive of this scope of work

1.3.4. Associated Services Works

All associated electromechanical works listed below are excluded from the scope of this contract. These shall be installed by other agencies in accordance with approved shop drawings of, and under direct supervision of the Fire contractor.

- a) Paddle flanges

1.3.5. Builders Work

Lay electrical works in advance of pouring concrete slabs and construction of walls. Obtain Owner's Site representative approval before commencing builder's work in connection with electrical installation. Related co-coordinated shop-drawings shall be submitted for approval. Materials approval shall be obtained as per procedure of the Owner's Site representatives. The contractor shall make it certain that drawings properly co-coordinated with other works are submitted immediately after signing of the contract and approval of drawings and the materials are obtained at least one month prior to the commencement date of the construction.

Check with other trades to ensure equipment and material can be installed in space provided.

Provide other trades with information necessary for them to execute their work.

Details on drawings which are specific regarding dimensions and locations, are for information purposes. Co-ordinate with other trades to ensure work can be installed as indicated.

1.3.6. Fire and Safety Precautions

Establish from Architectural Drawings where fire and smoke barriers exist, and make adequate provision of fire and smoke barriers in and around trunking, conduits, cables, etc., where they pass through floors and fire rated walls, and where protection systems are installed pack space between wiring and sleeve full with Fire Retardant Material and seal with caulking.

The Contractor shall ensure that this work is carried out such that the integrity of any such fire barrier is properly maintained where pierced by electromechanical services.

1.3.7. Segregation of Services

Electrical services shall be segregated as specified throughout the installation to obviate the following;

- a. Electrical interference from one circuit to another
- b. A fault on one circuit affecting another
- c. Unnecessary fire damage
- d. Difficulties in circuit identification
- e. Voltage limits for general safety
- f. Difficulties in removal and/or maintenance.

All raceways shall be kept clear of other services except where intentionally earthed or bonded. Generally, raceways shall be kept 150 mm away from and above hot water and 75 mm away from other services.

Unless specifically indicated otherwise, normal, emergency, low voltage cables and wiring shall be segregated throughout the installation generally in the following manner:

Armored and sheathed cables: Where more than one tray has been specified or is necessary to accommodate the number of cables on a run, where practical, segregation shall be achieved by dedicating each tray to either normal or emergency services. Where normal and emergency cables have to run together in trays, ducts or trenches, they shall be formed in two groups, one normal and one emergency

1.3.8. Safety Interlocks

A complete system of interlocks and safety devices shall be provided as indicated and necessary for the safe and continuous operation of the plant in order to provide for the following:

- a. Safety of personnel engaged on operation and maintenance of the plant
- b. Correct sequence of operation of the plant during start up and shut down
- c. Safety of the plant when operating under normal or emergency conditions.
- d. Interlocks shall be preventive and not corrective
- e. The Contractor shall be responsible for the preparation of interlocking schemes for the approval of the Owner's Site representative on the basis of Consultant's scheme.
- f. Locks for interlocking purposes shall be electrical or mechanical interlock wherever asked for.

No spare or master key shall be provided, unless specified. Device items are to be arranged to ensure that there is no danger of interchange with existing locks on other units in case of mechanical interlocks.

1.3.9. Quiet Operation and Vibration Isolation

All equipment shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Owner's site representative. In case of rotating machinery sound or vibration noticeable outside the room in which it is installed, or annoyingly noticeable inside its own room, shall be considered objectionable. Such conditions shall be corrected by the Contractor at his own expense. The contractor shall guarantee that the equipment installed shall maintain the desired NC levels.

1.3.10. Accessibility

The Contractor shall verify the sufficiency of the size of the shaft openings, clearances in cavity walls and suspended ceilings for proper installation of his piping/cablings/ducting/ other ancillaries. His failure to communicate insufficiency of any of the above shall constitute his acceptance of sufficiency of the same. The Contractor shall locate all equipment which must be serviced, operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed, valve or other devices requiring attendance, shall be finalized and communicated in sufficient time, to be provided in the normal course of work. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense. Access panel shall be standardized for each piece of equipment / device / accessory and shall be clearly nomenclature / marked.

1.3.11. Manufacturer's Instructions

Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, covering points not specifically mentioned in these documents, such instructions shall be followed in all cases.

1.3.12. Electrical Installation

Work related to the electrical services, shall be carried out in full knowledge of, and with the complete coordination of the contractor. The electrical installation shall be in total conformity with the control wiring drawings prepared by the contractor and approved by the Architect/Consultant. All equipment shall be connected and tested in the presence of an authorized representative of the contractor.

The Fire system shall be commissioned only after the contractor has certified in writing that the electrical installation work has been thoroughly checked, tested and found to be totally satisfactory and in full conformity with the contract Drawings, Specifications and manufacturer's instructions. It is to be clearly understood that the final responsibility for the sufficiency, adequacy and conformity to the contract requirements, of the electrical installation work for respective services, lies solely with the contractor.

1.3.13. Maintenance during Defects Liability Period

1.3.13.1. Complaints

The Contractor shall receive calls for any and all problems experienced in the operation of the system under this contract, attend to these within 10 hours of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.

1.3.13.2. Repairs

All equipment that requires repairing shall be immediately serviced and repaired. Since the period of Mechanical Maintenance runs concurrently with the defects liability period, all replacement parts and labor shall be supplied promptly free-of-charge to the Owner.

1.3.13.3. Uptime Guarantee

The contractor shall guarantee for the installed system an uptime of 98%. In case of shortfall in any month during the defects liability period, the Defects Liability period shall get extended by a month for every month having shortfall. In case of shortfall beyond the defects liability period, the contract for Operation and Maintenance shall get extended by a month for every month having the shortfall and no reimbursement shall be made for the extended period.

The Contractor shall provide log in the form of diskettes and bound printed comprehensive log book containing tables for daily record of all pressures, power consumption. Starting and stopping times for various equipment, daily services rendered for the system alarms, maintenance and record of unusual observations etc. Contractor shall also submit preventive maintenance schedule.

Each tenderer shall submit along with the tender, a detailed operation assistance proposal for the Owner's site representatives/Consultant's review. This shall include the type of service planned to be offered during Defects Liability Period and beyond. The operation assistance proposal shall give the details of the proposed monthly reports to the Management.

The tenderer shall include a list of other projects where such an Operation Assistance has been provided.

1.3.13.4. Operation and Maintenance

Contractor may be required to carry out the operation of the Fire installation for the defects liability period.

Further, he may also be required to carry out operation and all inclusive maintenance of the entire system for a period of three years beyond the defects liability period if required by the owner.

1.3.13.5. Operation Contract

- a) 24 hours a day, year round.
- b) All stand-by equipment to be operated as per mutually agreed programme.
- c) Proper entry and upkeep of relevant log books.
- d) Maintain complaints register. Submit weekly report.
- e) Proper housekeeping of all areas under the contract.
- f) Prepare daily consumption report and summary of operation.

1.3.13.6. Maintenance Contract

Routine Preventive Maintenance Schedule to be submitted

- a) Schedule to cover manufacturer's recommendation and/or common engineering practice (for all plant and machinery under contract).
- b) Plant and machinery history card giving full details of equipment and frequency of checks and overhaul.
- c) Monthly status report.
- d) There shall be no reimbursement for the extended period.
- e) Break-downs shall be attended to within ten hours of reporting.
- f) Spare are to be made available within seven calendar days in case of total breakdown/burnout.

1.3.13.7. Manpower

- a) Adequate number of persons to the satisfaction of the Owner's site representative shall be provided including relievers.
- b) Statutory requirements of EPF, ESIC and other applicable labour legislations to be complied with; and monthly certification to that effect to be submitted.
- c) Duty allocation and Roaster control shall be contractor's responsibility.
- d) No overtime shall be payable by Owner for any reason whatsoever.

1.3.13.8. Shut Downs

- a) Routine shut downs shall be permitted only as allowed by the Chief Engineer.
- b) Contractor shall be at liberty to carry out routine maintenance as and when required but with prior permission of the Owner.

1.3.13.9. Operating Instruction & Maintenance Manual

Upon completion and commissioning of part Fire system the contractor shall submit a draft copy of comprehensive operating instructions, maintenance schedule and log sheets for all systems and equipment included in this contract. This shall be supplementary to manufacturer's operating and maintenance manuals. Upon approval of the draft, the contractor shall submit

four (4) complete bound sets of typewritten operating instructions and maintenance manuals; one each for retention by Consultant and Owner's site representative and two for Owners Operating Personnel. These manuals shall also include basis of design, detailed technical data for each piece of equipment as installed, spare parts manual and recommended spares for 4 year period of maintenance of each equipment.

1.3.13.10. Tools and Tackles

The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, all transport for labour and materials and plant necessary for the proper execution and completion of the work to the satisfaction of the Owner's site representative.

1.3.13.11. Partial Ordering

Owner through the Architect/Consultant/ Owner's site representative reserves the right to order equipment and material from any and all alternates, and /or to order high side and /or low side equipment and materials or parts thereof from one or more tenderers. Certificates of approval from statutory and / or local authorities for the operating and maintenance of the installation and equipment, wherever such approval or certification is required.

2. TECHNICAL SPECIFICATION AND INSTALLATION

2.1. Pumps General

On completion of installation works at site the complete system shall be tested for satisfactory performance in line with specifications as per Tender / requirements of Employer / Consultants. Pumps should test for Sequential Auto start in case of using the Hydrants / sprinklers system. Also pump shall deliver minimum required flow & pressure at top most hydrant point. All instruments for testing should be arranged by the Contractor.

The pumps shall be horizontal centrifugal End suction type; pump designed for continuous operation and shall have a continuously dropping head characteristic without any zone of instability. The power capacity characteristic shall be non-over loading type. The head vs.

capacity, input power vs. capacity characteristics, etc., shall match to ensure load sharing and trouble free operation throughout the range. In case of accidental reverse flow through the pump the driver shall be capable of bringing the pump to its rated speed in the normal direction from the point of maximum possible reverse speed. The contractor under this specification shall assume full responsibility in the operation of the pump and the drive as one unit. The pump shall be capable to discharge 150 percent of rated capacity at a total head of not less than 65 percent of the total rated head. The total shut off head shall not exceed 120 percent of total rated head on the pump. An automatic air release valve shall be provided to vent air from the pump discharge and also to admit to the pump to dissipate the vacuum there, upon stopping of the pump.

This valve shall be located at the highest point in the discharge line between the pump and the discharge check valve. Pump coupled with motor or engine on a common base plate shall perform smoothly without any excessive noise or vibration. Also pump shall be provided with re-circulation piping with valves.

Detailed hydraulic calculations shall be performed to determine the capacity of the pump required for the hydrant system.

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.

2.1.1. Commissioning Spares

The performance test includes commissioning spares like, diesel oil, engine oil, coolant, grease, gland packs, and spare refills for Fire extinguishers, spare Sprinkler bulbs, Glasses for Manual call points and Hoses, hydrant valves etc complete as required for satisfactory completion.

Also the instrumentation, Tools tackles and labor required for performance test is included in vendor's scope of work.

2.1.2. Pumps and Accessories

The pumps shall be exclusively used for firefighting purposes and its performance shall be as per BIS 9137 approved and capacity and head shall be as mentioned in the BOQ. One set main pump for each hydrant & sprinkler system with electrical motor driven direct couple centrifugal pump of adequate discharge & head and in addition common standby Diesel engine driven direct coupled centrifugal pump for each system, of adequate discharge and head shall be provided. Also there shall be a jockey pump for each system. The pumping capacity of main and stand by hydrant / Sprinkler system pumps shall be as mentioned in the specimen BOQ. The suction / delivery pipes, valves, instrumentation and control panel shall be consider accordingly.

2.1.3. Pump Casing

The casing shall be cast iron to IS 210 and capable of withstanding to the maximum pressure developed by the pump at the pumping temperature.

2.1.4. Impeller

The impeller shall be of standard bronze. The impeller shall be secured to the shaft with hydraulically balanced and shall be retained against circumferential movement by keying, pinning or lock rings. All screwed fasteners shall tighten in the direction of normal rotation.

2.1.5. Shaft

Shaft size shall be selected on the basis of maximum combined shear stress. The shaft shall be of stainless steel AISI-410 ground and polished to final dimensions and shall be adequately sized to withstand all stresses from motor weight, hydraulic loads, vibrations and torque's coming in during operation. Pump Shaft-Motor Shaft Coupling shall be connected with adequately sized flexible couplings with spacer of suitable approved design. Necessary guards shall be provided for couplings. Pump shall be consisting with Gland plate for gland packing.

2.1.6. Base Plate

A common base plate for mounting both the pump and drive shall be provided. The base plate shall be of rigid construction, shall be fabricated by M.S. channels. Base plate and pump supports shall be so constructed, the pumping unit shall be mounted so as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust etc.,

2.1.7. Vibration and Balancing

The rotating elements shall be so designed to ensure least vibration during start and throughout the operation of the equipment. All rotating components shall be statically and dynamically balanced at workshop. All the components of pumps of identical parameters supplied under these specifications shall be interchangeable. Vendor shall consider the Anti-vibration pad and suitable size of metal expansion bellows to be considered for all pumps.

2.1.8. 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 "Noise and Vibration" for further technical requirements.

2.1.9. 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 & sprinkler system.

2.1.10. Instruction Manual and Tools/Spares

A comprehensive instruction manual shall be provided by the sub-contractor indicating detailed requirements for operation, dismantling and periodic operation and maintenance procedures. Recommended tools/spares shall be provided along with the Pump set.

2.2. Electrical Works

2.2.1.Scope

The scope of this section comprises of fabrication, supply, erection, testing and commissioning of Motor Control Centre (MCC), wiring and earthing of all air-conditioning equipment, components and accessories.

2.2.2.General

Work shall be carried out in accordance with the accompanying specifications and shall comply with the latest relevant Indian Standards and Electricity Rules and Regulations.

All motor control centers shall be CPRI approved and shall be suitable for operation on 3 phase/single phase 415/230 volts, 50 cycles' power supply system.

2.2.3.Constructional Features

The Motor Control Centre (MCC) electrical panels shall be sheet steel cabinet for indoor installation, dead front, floor mounting/wall mounting type and shall be 3b construction. The control panel shall be totally enclosed, completely dust and vermin proof and shall be with hinged doors with Neoprene gasket. Control panel shall be suitable for the climatic conditions as specified in Specifications. Steel sheets used in the construction of Control panel shall be 2 mm thick and shall be folded and braced as necessary to provide a rigid support for all components. Joints of any kind in sheet metal shall be seam welded, all welding, slag shall be rounded off and welding pits wiped smooth with plumber metal. The general construction shall confirm to relevant BIS Codes.

All panels and covers shall be properly fitted and square with the frame, and holes in the panel correctly positioned. Fixing screws shall enter into holes tapped into an adequate thickness of metal or provided with wing nuts. Self threading screws shall not be used in the construction of Control panels. A base channel of 75 mm x 40 mm x 5 mm thick shall be provided at the bottom for floor mounted panels. Minimum clearance of 275 mm shall be provided between the floor of control panel and the lowest unit.

The control panel shall be of adequate size with a provision of 25% spare space to accommodate possible future breakers. Breakers shall be arranged in multi-tier. Knockout holes of appropriate size and number shall be provided in the Motor Control Centre in conformity with the location of cable/conduit connections. Removable sheet steel plates shall be provided at the top to make holes for additional cable entry at site if required.

Every cabinet shall be provided with Trifoliate or engraved metal name plates. All panels shall be provided with circuit diagram mounted on inside of door shutter protected with Hylam sheet. All live accessible connections shall be shrouded and shall be finger touch proof and minimum clearance between phase and earth shall be 20 mm and phase to phase shall be 25 mm.

2.2.4.Wiring System

All LT power cabling between MCC and motors shall be carried out with 1100 volts grade PVC insulated, overall PVC sheathed aluminium conductor armoured cables, and Cables shall be sized by applying proper derating factor. All control wiring shall be carried out by using PVC insulated copper conductor wires in conduits. Minimum size of control wiring shall be 1.5 sq

mm. Minimum size of conductor for power wiring shall be 4 sq. mm 1100 volts grade PVC insulated copper conductor wires in MS conduit.

2.2.5.Circuit Compartment

Each circuit breaker, contactor and relay shall be housed in a separate compartment and shall have steel sheets on top and bottom of compartment. Sheet steel hinged lockable door shall be duly interlocked with the breaker in the "ON" position. Safety interlocks shall be provided to prevent the breaker from being drawn-out when the breaker is in 'ON' position. The door shall not form an integral part of the draw-out portion of the panel. Sheet steel barriers shall be provided between the tiers in a vertical section.

2.2.6.Instrument Accommodation

Adequate space shall be provided for accommodating instruments, indicating lamps, control contactors and control MCBs. These shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker and bus bar 'ON' lamps shall be provided on all outgoing feeders.

2.2.7.Bus Bar Connections

Bus bar and interconnections shall be of high conductivity electrolytic aluminium complying with requirement of grade E91E of IS:5082-1981 and shall be of rectangular cross section suitable for carrying the rated full load current and short circuit current without overheating of phase and neutral bus bar and shall be extendable on either side. Bus bar and interconnections shall be insulated with heat shrinkable sleeve and shall be colour coded and shall be supported on glass fiber reinforced thermosetting plastic insulated supports at regular intervals to withstand the force arising from in case of short circuit in the system. All bus bar shall be provided in a separate chamber and all connections shall be done by bolting. Additional cross sectional area shall be added to the bus bar to compensate for the holes. All connections between bus bar and breaker shall be through solid aluminium strips of proper size to carry full rated current as per approved for construction shop drawing and insulated with insulating sleeves. Bus bar shall be rated for current density of 1.0 amps/mm² cross section area.

2.2.8.Temperature - Rise Limit

Unless otherwise specified, in the case of external surface of enclosures of bus bar trunking system which shall be accessible but do not need to be touched during normal operation, an increase in the temperature rise limits of 25° C above ambient temperature shall be permissible for metal surface and of 15° C above ambient temperature for insulating surfaces as per relevant IS Codes.

2.2.9.Cable Compartments

Cable compartment of adequate size shall be provided in the control panel for easy clamping of all incoming and outgoing cables entering from the top/bottom. Adequate supports shall be provided in cable compartment to support cables as per approved for construction shop drawing.

2.2.10. Moulded Case Circuit Breaker (MCCB)

All MCCB's shall be motor duty and Current Limiting type, and comprise of Quick Make - break switching mechanism, preferably Double Break Contact system, arc extinguishing device and the tripping unit shall be contained in a compact, high strength, heat resistant, flame retardant, insulating moulded case with high withstand capability against thermal and mechanical stresses. All MCCB's shall be capable of defined Variable overload adjustment. All MCCB's rated 200 Amps and above shall have adjustable Magnetic short circuit pick up.

The trip command shall override all other commands. MCCB shall employ maintenance free double break contact system to minimise the let thru' energies and capable of achieving discrimination upto full short circuit capacity of downstream MCCB. The manufacturer shall provide both discrimination tables and let thru energy curves.

The breaking capacity of MCCB's shall be asked for in the schedule of quantities. The breaking capacities specified will be ICU=ICS i.e type-2. Co-ordination as per relevant IS and IEC Codes.

The MCCB's shall be provided with rotary handle operating mechanism. The handle position shall give positive indication of 'ON', 'OFF' or 'Tripped' thus qualifying to Disconnection as per the IS/IEC indicating the true position of all the contacts. In case of 4 pole MCCB the neutral shall be defined and capable of offering protection.

2.2.11. Miniature Circuit Breaker (MCB)

Miniature Circuit Breaker shall comply with relevant IS Codes and shall be quick make and break type for 230/415 VAC 50 Hz application with magnetic thermal release for over current and short circuit protection. The breaking capacity shall not be less than 10 KA at 415 VAC. MCBs shall be DIN mounted. The MCB shall be Current Limiting type (Class-3). MCBs shall be classified (B,C,D ref IS standard) as per their Tripping Characteristic curves defined by the manufacturer. The MCB shall have the minimum power loss (Watts) per pole defined as per the IS/IEC and the manufacturer shall publish the values.

The housing shall be heat resistant and having a high impact strength. The terminals shall be protected against finger contact to IP20 Degree of protection. All DP, TP and TPN miniature circuit breakers shall have a common trip bar independent to the external operating handle.

2.2.12. Painting

All sheet steel work shall undergo a process of degreasing, pickling in acid, cold rinsing, phosphating, passivating (seven tank processing) and then painted with electrostatic paint (Powder coating). The shade of colour of panel inside/outside shall be as per relevant BIS code.

2.2.13. Labels

Engraved PVC labels shall be provided on all incoming and outgoing feeder. Circuit diagram showing the arrangements of the circuit inside the control panel shall be pasted on inside of the panel door and covered with transparent plastic sheet.

2.2.14. Meters

- i. All voltmeters and indicating lamps shall be through MCB's.
- ii. Meters and indicating instruments shall be plug type.

- iii. All CT's connection for meters shall be through Test Terminal Block (TTB).
- iv. CT ratio and burdens shall be as specified on the Single line diagram.

2.2.15. Current Transformers

Current transformers shall be provided for Control panels carrying current in excess of 60 amps. All phase shall be provided with current transformers of suitable VA burden with 5 amps secondary's for operation of associated metering.

The CTs shall conform to relevant Indian Standards. The design and construction shall be dry type, epoxy resin cast robust to withstand thermal and dynamic stresses during short circuits. Secondary terminals of CTs shall be brought out suitable to a terminal block which shall be easily accessible for testing and terminal connections. The protection CTs shall be of accuracy class 5P10 and measurement CTs shall be of accuracy class I.

2.2.16. Selector Switch

Where called for, selector switches of rated capacity shall be provided in control panels, to give the choice of operating equipment in selective mode.

2.2.17. Starters

Each motor shall be provided with a starter of suitable rating. Starters shall be in accordance with relevant IS Codes. All Star Delta and ATS Starters shall be fully automatic.

2.2.18. Contactor

Contactors shall be built into a high strength thermoplastic body and shall be provided with an arc shield for quick arc extinguishing. Silver alloy tips shall be provided to ensure a high degree of reliability and endurance under continuous operation. The magnet system shall consist of laminated yoke and armature to ensure clean operation without hum or chatter.

Starters contactors shall have 3 main and 2 Nos. NO / NC auxiliary contacts and shall be air break type suitable for making and breaking contact at minimum power factor of 0.35. For design consideration of contactors the starting current of connected motor shall be assumed to be 6 times the full load current of the motor in case of direct-on-line starters and 3 times the full load current of the motor in case of Star Delta and Reduced Voltage Starters. The insulation for contactor coils shall be of Class "E".

Coil shall be tape wound vacuum impregnated and shall be housed in a thermostatic bobbin, suitable for tropical conditions and shall withstand voltage fluctuations. Coil shall be suitable for 220/415±10% volts AC, 50 cycles AC supply.

2.2.19. Thermal Overload Relay

Thermal over load relay shall have built in phase failure sensitive tripping mechanism to prevent against single phasing as well as on overloading. The relay shall operate on the differential system of protection to safeguard against three phase overload, single phasing and unbalanced voltage conditions.

Auto-manual conversion facility shall be provided to convert from auto-reset mode to manual-reset mode and vice-versa at site. Ambient temperature compensation shall be provided for variation in ambient temperature from -5° C to +55°C.

All overload relays shall be of three element, positive acting ambient temperature compensated time lagged thermal over load relays with adjustable setting. Relays shall be directly connected for motors up to 35 HP capacity.

2.2.20. Time Delay Relays

Time delay relays shall be adjustable type with time delay adjustment from 0-180 seconds and shall have one set of auxiliary contacts for indicating lamp connection.

2.2.21. Indicating Lamp And Metering

All meters and indicating lamps shall be in accordance with IS:1248 and IS-1258. The meters shall be flush mounted type. The indicating lamp shall be of LED-Cluster type & of low wattage. Each MCC and control panel shall be provided with voltmeter 0-500 volts with three way and off selector switch, CT operated ammeter of suitable range with three nos. CTS of suitable ratio with three way and off selector switch, phase indicating lamps, and other indicating lamps as called for. Each phase indicating lamp shall be backed up with 5 MCB. Other indicating lamps shall be backed up with fuses as called for in Schedule of Quantities.

2.2.22. Toggle Switch

Toggle switches, where called for in Schedule of Quantities, shall be in conformity with relevant IS Codes and shall be of 5 amps rating.

2.2.23. Push Button Stations

Push button stations shall be provided for manual starting and stopping of motors / equipment Green and Red colour push buttons shall be provided for 'Starting' and 'Stopping' operations. 'Start' or 'Stop' indicating flaps shall be provided for push buttons. Push Buttons shall be suitable for panel mounting and accessible from front without opening door, Lock lever shall be provided for 'Stop' push buttons. The push button contacts shall be suitable for 6 amps current capacity.

2.2.24. Conduits

Conduits and Accessories shall conform to relevant Indian Standards. Wall thickness shall be 16 gauge up to 32 mm dia and 14 gauge above 32 mm dia conduit. Screwed M.S. conduits shall be used. Joints between conduits and accessories shall be securely made, to ensure earth continuity. All conduit accessories shall be threaded type only. All raw metal shall be painted with bitumastic paint.

Only approved make of conduits and accessories shall be used. Conduits shall be delivered to the site of construction in original bundles and each length of conduit shall bear the label of the manufacturer.

Maximum permissible number of 650/1100 volt grade PVC insulated wires that may be drawn into rigid non metallic or M.S Conduits are given below

Sr no	Size of wires nominal cross	Maximum number of wires within conduit size(mm)				
1	Section Area (Sq. mm.)	20	25	32	40	50
2	1.5	5	10	14	--	--
3	2.5	5	8	12	--	--
4	4	3	7	10	--	--
5	6	2	5	8	--	--
6	10	--	3	5	6	--
7	16	--	2	3	--	6
8	25	--	--	2	4	6
9	35	--	--	--	3	5

2.2.25. Cables

M.V. Cables shall be PVC insulated aluminium conductor and armoured cables conforming to IS Codes. Cables shall be armoured and suitable for laying in trenches, ducts, and on cable trays as required. M.V. Cables shall be termite resistant. Cable glands shall be double compression glands. Control cables and indicating panel cables shall be multi core PVC insulated copper conductor and armoured cables.

2.2.26. Cable Laying

Cable shall be laid in accordance with IS code of Practice. Cables shall be laid on 14 gage factory fabricated perforated galvanized sheet steel cable trays, and cable drops / risers shall be fixed to ladder type cable trays factory fabricated out of galvanized steel angle. Access to all cables shall be provided to allow cable withdrawal / replacement in the future. Where more than one cable is running on a cable tray, one dia spacing shall be provided between cables to minimize the loss in current carrying capacity.

Cables shall be suitably supported with Galvanized saddles when run on walls / trays. When buried, they shall be laid in 350 mm wide and 750 mm deep trench and shall be covered with 250 mm thick layer of soft sifted sand & protected with bricks/tiles. Special care shall be taken to ensure that the cables are not damaged at bends. The radius of bend of the cables when installed shall not be less than 12 times the diameter of cable.

2.2.27. Wire and Wire Sizes

1100 volts grade PVC insulated copper conductor wires in conduit shall be used. For all single phase/ 3 phase wiring, 1100 volts grade PVC insulated copper conductor wires shall be used. The equipment inside plant room shall be connected to the control panel by means of insulated copper conductor wires of adequate size in exposed conduits. Final connections to the equipment shall be through wiring enclosed in galvanized flexible conduits rigidly clamped at both ends and at regular intervals. An isolator shall be provided near each motor/equipment wherever the motor/equipment is separated from the supply panel through a partition barrier or through ceiling construction. PVC insulated copper conductor wires shall be used inside the control panel for connecting different components and all the wires inside the control panel shall be neatly dressed and plastic beads shall be provided at both the ends for easy identification of control wiring.

The minimum size of control wiring shall be 1.5 sq. mm PVC insulated stranded soft drawn copper conductor wires drawn through conduit to be provided for connecting equipment and control panels. Power wiring, cabling shall be of the following sizes:

Sr No	Capacity Rating	Size Of Wires/Cables
1	Up to 5 HP motors/ 5 KW	3 x 4 sq. mm copper conductor wires.
2	From 6 HP to 10 HP motors	3 x 6 sq. mm copper conductor wires
3	From 12.5 HP to 15 HP	2 Nos. 3 x 6 sq. mm copper conductor wires
4	From 20 HP to 25 HP	2 Nos. 3 x 10 sq. mm copper conductor wires
5	From 30 HP to 35 HP	2 nos.3x 16 sq.mm aluminum conductor armored cable.
6	From 40 HP to 50 HP	2 Nos. 3x25 sq.mm aluminum conductor armored cable.
7	From 60 HP to 75 HP	1 No. 3 x 70 sq. mm aluminum conductor armored cable
8	100 HP	1 No. 3 x 150 sq. mm. aluminum conductor armored cable
9	200 HP	2 No. 3 x 150 sq. mm. aluminum conductor armored cable

All the switches, contactors, push button stations, indicating lamps shall be distinctly marked with a small description of the service installed. The DOL starters to be used for all pumps.

2.2.28. Earthing

Earthing shall be provided in accordance with relevant BIS Codes and shall be copper strips /wires The main panel shall be connected to main earthing system of the power supply. All single phase metal clad switches and control panels be earthed with minimum 3 mm diameter copper conductor wire. All 3 phase motors and equipment shall be earthed with 2 numbers distinct and independent copper wires / tapes as follows:

Sr .No.	Capacity Rating	Size Of Wires/Cables
1	Motor up to and including 10 HP	2 Nos. 3 mm dia copper wires
2	Motor 12.5 HP to 40 HP	2 Nos. 4 mm dia copper wires
3	Motor 50 to 75 HP	2 Nos. 6 mm dia copper
4	Motor above 75 HP	2 Nos. 25 mm x 3 mm Copper tapes

All switches shall be earthed with two numbers distinct and independent copper wires' tapes as follows:

Sr .No.	Capacity Rating	Size of Wires/Cables
1	3 phase switches and control panels up to 60 amps rating	2 nos. 3 mm dia copper wires.

Sr .No.	Capacity Rating	Size of Wires/Cables
2	3 phase switches, and Control panels 63 amps to 100 amps rating.	2 Nos. 4 mm dia copper wires.
3	3 phase switches and control Panels 125 amps to 200 amps rating	2 Nos. 6 mm dia copper wires
4	3 phase switches, control panels, bus ducts, above 200 amps rating	2 Nos. 3 mm x 25 mm copper tapes.

The earthing connections shall be tapped off from the main earthing of electrical installation. The overlapping in earthing strips at joints where required shall be minimum 75 mm. These straight joints shall be rivetted with brass rivets & brazed in approved manner. Sweated lugs of adequate capacity and size shall be used for all termination of wires. Lugs shall be bolted to the equipment body to be earthed after the metal body is cleaned of paint and other oily substance, and properly tinned.

2.2.29. Drawings

Shop Drawings For Control Panels And For Wiring Of Equipment Showing The Route Of Conduit & Cable Shall Be Submitted By The Contractor For Approval Of Architect/Consultant Before Starting The Fabrication Of Panel And Starting The Work. On Completion, Four Sets Of Complete "As-Installed" Drawings Incorporating All Details Like, Conduits Routes, Number Of Wires In Conduit, Location Of Panels, Switches, Junction/Pull Boxes And Cables Route Etc. Shall Be Furnished By The Contractor.

2.2.30. Testing

Before commissioning of the equipment, the entire electrical installation shall be tested in accordance with relevant BIS codes and test report furnished by a qualified and authorised person. The entire electrical installation shall be gotten approved by Electrical Inspector and a certificate from Electrical Inspector shall be submitted. All tests shall be carried out in the presence of Project Manager. Testing of the panels shall be as per relevant BIS Codes :

2.2.31. Painting

All sheet steel work shall undergo a process of degreasing, thorough cleaning, and painting with a high corrosion resistant primer. All panels shall then be baked in an oven. The finishing treatment shall be by application of powder coating of approved shade.

2.2.32. Rubber Mat

Rubber mat shall be provided in front to cover the full length of all panels. Where back space is provided for working from the rear of the panel, rubber mat shall also be provided to cover the full length of panel.

2.3. Hydrant System

2.3.1. General

Without restricting to the generality of the foregoing, the fire hydrant system shall include the following:

- a. Pumps, suction / delivery pipes, Valves, control panel and Instrumentation and pump set shall be manual start / stop.
- b. Internal hydrants, external hydrant valves, hose reels, fire duct shutters. Hose cabinets, fire brigade connections and connections to pumps and appliances.
- c. All materials shall be of the best quality and brand new, conforming to these specifications / standards and subject to the approval of the Client / consultant.
- d. 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.,
- e. Pipes and fittings shall be fixed to walls and ceilings by suitable clamps at intervals specified. Only approved types of anchor fasteners shall be used for RCC ceilings and walls.

2.3.2. External Hydrants

External (yard) hydrant valves shall be single headed as per IS: 5290 (Type A). The valves should be complete with hand wheels, quick coupling connections, springs and blank caps. The hydrants shall be fixed to stand posts of 80mm dia for single headed hydrants at 1.0M from ground level. External hydrant valves shall be consisting with 2 nos. fire Hoses of 15m long 63 mm dia, One No. Gun metal Branch pipe with Nozzle housed in the M.S cabinet and cabinet shall be mounted (next to stand post) on free standing support fabricated by suitable structural steel / pipe of not less than 80 mm dia. Please refer the tender drawings for the details.

2.3.3. Internal Hydrant Valve

The landing valve (internal) shall be gunmetal Single headed type conforming to IS: 5290 (Type A). Complete with hand wheel, quick coupling, spring and blank cap. 2 Nos. of RRL type hose pipe of 63mm dia and 15 mts. length as per IS: 636 with 63mm dia instantaneous type Gun metal heavy duty couplings & 2 Nos of Gun metal Branch pipe and nozzle to be provided. Fire hoses and branch pipes shall be kept in the Hose cabinet. Internal hydrants shall locate along with columns / walls in co – ordination with machinery layout.

2.3.4. Hose Reel

hose reel shall as per IS 884:1985 Specification for first-aid hose reel for firefighting (*first revision*).Hose reel shall be swinging type for 180 deg with mounting base plate. Hose reel shall consist with 19mm dia high-pressure rubber braided hose of 36 mts length with gunmetal nozzles. Hose reel water shall be tapped off from the wet riser with Ball valve. The hose reel shall be installed in fire hose duct inside the building.

2.3.5. Fire Hose

Fire hoses shall be Reinforced Rubber Lined (RRL) type as per IS: 636 and IS 8423:1994 Specification for controlled percolating hose for firefighting of 63 mm dia and 15 mts long. Hoses shall be bounded by G.I wire to heavy-duty instantaneous gunmetal couplings as per IS 903.

2.3.6. Branch Pipe with Nozzle

Branch pipe shall be gunmetal, 63 mm dia with Nozzle of 19 mm dia made as per IS: 903 and suitable fitted with hoses as specified elsewhere in these specifications.

2.3.7. Hose Cabinet

Hose cabinet shall be fabricated by M.S. sheet of 16 swg and size shall be 750mm x 600mm x 250mm. Hose cabinet shall have glass fronted door fitted with 4mm thick clear glass & powder coated finish of red outside & inside. Cabinet shall be suitable for stand mounting and shall have built in breakable glass type feature to keep key.

2.3.8. Shutters for Fire Shaft

Fire shaft shall have shutter fabricated by M.S. sheet of 16 swg with glass-fronted door (glass shall be 4mm thick) and size of the shutter shall be 900mm x 1200mm minimum. The door shall be in two leaves with necessary stiffeners. Shutter shall be powder coated finish of red outside and inside and on the glass label of "FIRE" shall be stick; the letter size shall be min. 75 mm height. Also there shall be built in breakable glass type feature to keep key.

2.3.9. Fire Brigade Inlet Connection (FBIC)

The storage tank shall be provided with a 150 mm fire brigade pumping connection to discharge at least 2275 liters /minimum 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 event of the hydrant pumps being out of commission. The connection shall be fitted with a sluice valve and reflux valve. Location of this valve shall be as per the approval of the Project Manager.

2.4. Sprinkler System

2.4.1. General

The sprinkler system shall be provided in parking areas and system shall include the following:

Sprinkler main, branch and internal piping complete with valves, alarms and supporting arrangements. Sprinkler heads with spare sprinklers. Connections to risers etc., all material shall be of the best quality conforming to specifications and subject to the approval of the Engineer-in-Charge. Pipes and fittings shall be fixed truly vertical/horizontal or on slopes required in a neat

manner. Pipes shall be fixed in such a manner so 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 at intervals specified. Only approved types of anchor fasteners shall be used for RCC ceilings and walls. Valves and other equipment shall be so located that they are easily accessible for operation, repairs and maintenance.

2.4.2. Installation Control Valve (ICV)

The sprinkler system shall have Installation control valve (Alarm valve) along with assemblies comprising of: -

- a. Upstream gate valve
- b. In and out pressure gauge
- c. Test connection of adequate size with valve and orifice plate with pressure connections.
- d. Water motor gang with necessary piping, isolating valve, strainer and drain.
- e. Water valve through a retard chamber.
- f. Test connection.
- g. There shall be two pressure gauges, one for the main's side and another for the installation side.

Alarm valve shall be straight through type suitable for wet pipe sprinkler systems. Valves shall of cast iron with gunmetal internals and suitable for vertical or horizontal installation. The valve clapper shall be of cast gunmetal with neoprene.

A test connection of adequate size as shown or shall approved shall be provided with a shut-off gate valve, an orifice plate with pressure connections. The discharge from the test connection outlet shall be led to the nearest sump or drain as shown in drawings.

The Installation Control Valve shall be double-seated clapper type check valve. The body and cover shall be made from Cast Iron to IS: 210: 1993 Grade FG 200. The seat and seat clamp shall be made from bronze to IS: 318: 1981, LTB II grade. The sealing to the seat shall be neoprene gasket. The hinges pin and ball shall be from stainless steel.

It shall be vertically mounted and the direction of water travel shall be indicated on the surface. It shall be rated to 12 Kg/sqcm and tested to 25 Kg/sqcm pressure.

A By-pass check valve shall be fitted to adjust minor and slow variations in water pressure for balancing so as to avoid any false alarm.

The valve shall also be provided with a Test Control Box. The Box shall house a lever to test and operate the ICV. A brass strainer shall also be provided at the point of water supply to the Alarm gong. A Retarding Chamber shall also be provided. The Chamber shall be able to balance the water pressure in case of water line surges.

Each Installation Control Valve shall have two sets of Pressure Gauges with brass ball valve type shut off.

A Water Motor Alarm shall also be provided. This shall be mechanically operated by discharge of water through an impeller. The drive bearing shall be weather resistant. A strainer shall be provided on line before the nozzle. The Gong piece shall be constructed from bronze to IS: 318:

1981, 2 TB II Grade, and base of cast iron. The Motor Housing, Rotor and Housing Cover shall be pressure die cast aluminium.

2.4.3. Sprinkler Heads

Sprinkler heads spacing shall be in conformity with the drawings and properly coordinated with electrical fixtures, ventilation ducts and grills and other services along the ceiling.

Sprinkler heads shall be brass / gunmetal with Quartzoid bulb containing liquid having high vapour pressure held in position by a forged GM yoke and deflector with suitable temperature rating as per the below table. Sprinkler heads shall be of type and quality approved by the local fire brigade authority. The inlet shall be screwed. Sprinkler heads shall be pendant, sidewall type. All sprinklers shall conform to the specifications given by UL&FM.

Sprinkler heads shall be of Quartzoid bulb type with bulb, valve assembly, yoke and the deflector. The sprinkler shall be of approved make and type with 15mm nominal dia outlets.

Contractor shall supply spare sprinkler heads of all types, which has been used and one spanner neatly installed in a steel box with glass shutters at locations approved by the Engineer in charge.

The spacing shall however conform to the detailed drawing, in Co-ordination with electrical and other allied services at the ceiling level. Contractor shall supply spare sprinkler heads (as mentioned in the BOQ) and spanners neatly installed in a steel box with glass shutter at an appropriate position approved by the Engineer-in-Charge.

A water motor gong and an inspection test connection shall be provided on the downstream of the system.

Sprinklers for below false ceiling shall be fixed with recessed (two piece) type Rosette plate fabricated by M.S. sheet of 2mm thick with Powder coated finish of approved colour.

2.5. Pipes, Fittings, Valves & Accessories.

2.5.1. Piping

All pipes inside the building and where specified, outside the building shall be GI. tubes conforming to IS: 1239 - heavy duty. Fittings for pipes shall be as per IS: 1239, Part II (heavy grade) up to 150mm dia., Above 200 mm dia. shall be M.S. pipes as per IS: 3589 with minimum 6 mm wall thick & fittings shall be fabricated from pipes conforming to IS 3589.

Pipes shall be carefully laid to the alignment, levels and gradients shown on the plan and sections and great care shall be taken to prevent any sand, earth or other matter from entering the pipes during laying. Pipes shall be kept thoroughly clean during the course of laying. The ends of pipes shall be blocked with wooden plugs wedged home, at the end of each day's work to prevent dirt and rodents, insects etc., entering the pipe.

Pipes up to 50mm dia, GI/DI screwed / Socket welded type jointing shall be adopted, while for pipes above 50mm dia welded or flanged connections shall be used. Flanged joints shall be made with 3 mm thick insertion rubber washer / Gaskets. All bolt holes in flanges shall be drilled

& making hole by using gas cutting is not acceptable. The drilling of each flange shall be in accordance with relevant Bureau of Indian Standards.

Flanged joints shall be used for connections to vessel equipment, flanged valves and also on suitable straight lengths of pipeline at strategic points to facilitate erection and subsequent maintenance work.

2.5.2. 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.

Fittings of approved type with "V" groove for welded joints. Fittings shall be screwed /welded type and shall be used for pipes of 50 mm dia & below. Fabricated fittings shall not be permitted for pipes diameters 50mm and below.

When fabricated fittings are used, they shall be fabricated, welded in workshops. Project Manager shall inspect them before dispatch from the workshop. The welding procedures of the workshop should have been approved by the rules for sprinkler system and applicable to hydrant and sprinkler system. For "T" connection, pipes shall be drilled and reamed. Cutting by gas or electrical welding shall not be permitted.

2.5.3. Pipe Jointing

2.5.3.1. 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.

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.

2.5.3.2. Flanged Joints (65 Mm Dia and Above)

Flanged joints with flanges conforming to IS: 6392 shall be provided on flange specification for different sizes of pipe lines to clearly mention.

Straight runs at intervals not exceeding 25-30m on pipe lines of 50 mm dia and above and as directed by the Project Manager.

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.

Flanges shall be with GI bolts and nuts and 3mm insertion gasket of natural rubber conforming to IS: 11149.

2.5.3.3. Unions

Approved type of dismountable unions shall be provided on pipe lines of 40 mm dia and smaller dia, in locations similar to those specified for flanges.

2.5.4. Pipe Identification

Vendor shall Install identification on each system. Place flow directional arrows at each pipe identification location.

Identify all piping, not less than once every 25 ft, not less than once in each room, at each branch, adjacent to each access door or panel, at each valve and where exposed piping passes through walls and floors.

Identify piping with marker system. Markers shall be "snap-on" or strap -on" type depending on applicable pipe size.

All piping in the system shall be tested to hydrostatic pressure of 1.5 times of the working pressure without drop in pressure for at least 120 minutes. The test should be made in the presence of and to the satisfaction of the Employers / consultants representatives. Any defects / leakage should be repaired or if necessary defective works / equipment should be replaced with new work / equipment. Tests should be repeated until work is done to the satisfaction of concern representatives. After testing all pipes shall be flushed with portable water to remove foreign materials.

2.5.5. Pipe Supports

Supports for above ground pipes of 65 mm dia and above shall be fabricated by structural steel of suitable sections (50x50x 6 mm angle) with suitable fasteners. The spacing of supports shall be 3mts minimum and painted two coats of enamel paint of approved colour over a coat of primer.

Suitable type hangers shall support pipes below 50 mm dia with clamps, anchor fasteners and suspended rods etc.

Fasteners (Anchor bolt, suspended rod, U bolts etc) shall not be less than 10 mm for pipes up to 80mm and 16mm for pipes 100mm & above.

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 Galvanized steel clamps. To permit free movement of common piping support shall be from a common hanger bar fabricated from Galvanized steel sections.

Pipe hangers shall be provided at the following maximum spacing:

Sr .No.	Pipe Dia(mm)	Hanger Rod Dia(mm)	Spacing between Supports (m)
1	Up to 25	6	2
2	32 to 50	10	2.7
3	80 to 100	12	2.7
4	125 to 150	12	3.6
5	200 to 300	16	5.3

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.

The structural supports/Bolts /Nuts / Washers used in the system (wherever required) shall be Galvanized as per IS 1367 and suitable length & not more than 15mm beyond the Nut.

Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat manner. The pipes shall be supported by structural steel fabricated (like, channel / angle / flat / plate etc) supports with suitable anchor fasteners / suspended thread rods not less than M16 in size.

2.5.6. Pipe Testing

2.5.6.1. Holiday Test

On completion of the coating, it shall be tested using efficient high voltage holiday detectors, operating at a voltage high enough to jump an air gap the length of which is equal to the thickness of the coating. All holidays found shall be repaired and the repairs shall be retested with holiday detector to ensure that adequate repairs have been made. Holiday testing shall be carried out by flexible and detachable ring probe, which shall enable the entire 360 degree of the surface of the pipe to be scanned.

2.5.6.2. Radiography Test

Underground Pipes after lowered in to trenches shall be Holiday tested for damages of the anticorrosion treatment and damages should be rectified, bring it to the notice of the engineer – in –charge of site before closing the trenches.

Also the underground pipes joints done after lowering shall be tested for 100% Radiography. However 10 % of the total weld joints must be covered. The test results and films shall be submitted for approval and any defects found in the welding process shall be rectified the contractor without any extra cost to the clients.

2.5.7. Pipe Protection

2.5.7.1. Above Ground Pipes

All pipes above ground and in exposed locations shall be painted with two coats of Zincrich primer for M.S pipes and etching primer for G.I. pipes and two or more coats of synthetic enamel paint of approved shade with minimum thickness if 75 microns. The pipes should be initially brushed to remove all foreign matter before applying paint / primer.

2.5.7.2. Under Ground Pipes

The pipes (buried) should be initially brushed to remove all foreign matter and apply the primer over the pipe. Primer is allowed to dry until the solvent evaporates and surface becomes tacky. The tape 4mm thick and 150/250mm wide shall then be wound in a spiral fashion and bonded completely to pipe by thermo fusion process. The overlap is to be maintained at 15mm. The necessary flushing arrangements to be made on the piping loop with blank flanges, which shall open as and when required for flushing purposes.

2.5.8. Painting

All Hydrant and Sprinkler pipes shall be painted with post office red colour paint as per (IS : 5 ,Shade No 536). All 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.

2.5.9. Excavation of Trenches

Excavation for pipelines shall be in open trenches to line and grade or as required at site including disposal outside of site at approved dumping yard with the prior approval of concerned authorities. Pipelines shall be buried to a minimum depth of 1M (top of the pipe) from the finished ground level.

The contractor shall support all trenches or adjoining structures with adequate timber supports wherever required.

On completion of testing and painting of the pipelines, trenches shall be refilled with excavated fine earth in 20cms. Layers and consolidated by ramming and watering.

2.5.10. Thrust Blocks

Contractor shall provide suitable PCC blocks of suitable dimensions at Change – in – direction and at "T" junctions (in case of filled earth or loose soil supports shall be provided at regular intervals of 6 meters) to support the pipes. Minimum Size of Blocks shall be 600mmx600mmx450mm. If any specific requirement t as per site conditions, contractor shall bring to owner /consultant notice

2.5.11. Valve Chambers

Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement: 5 Coarse sand) on cement concrete foundations 150mm thick 1:5:10 mix (1 cement: 5 fine sand: 10 graded stone aggregate 20mm nominal size) 15mm thick cement plaster inside and outside finished with a floating coat of neat cement inside with cast iron surface box (OR top cover fabricated by M.S. chequered plate of 6 mm thick with frame / stiffeners etc) approved by local fire brigade including excavation, back filling and additional Iron rungs for entering in to valve chamber etc, complete. Valve chamber shall be raised at least 50mm above the finished ground level around it and cover shall be fixed in such a way when it opens / closes should not damage the wall. Valve chambers shall be 1200mm x 1200mm x 1500mm depth.

2.5.12. Valves

2.5.12.1. General

This section deals with different type of valves like butterfly valves, gate valves, ball valves, check valves, balancing valves and Strainers and pressure gauges. The contractor shall refer to the approved make of materials specified in the document & relevant drawings.

Valves shall be provided on branch pipe connections to mains and at connection to equipment where indicated. All valves are to be located for easy access.

2.5.12.1.1. Location

Valves shall be provided on branch pipe connections to mains and at connection to equipment where indicated. All valves are to be located for easy access and are to be full bore of pipe connected together. All valves shall be supported wherever necessary.

2.5.12.1.2. Installation of Valves

Valves should be installed in true tolerance of +/-5mm with respect to the centre line of the pipe. Where threaded joints are encountered the threads should be initially sealed with PVC tape to avoid leakage due to improper tightening and leakage from threading.

Proper care has to be taken in welded installation so that the centerline of valve should not deviate from the pipe causing uneven load on the pipe and further stress during its operation. The welding should be done only after proper inspection of the joint by the Engineer-in-charge in the tacked position of the joint.

Before putting the line in operative mode the valves should be checked for free and easy operation of the hand wheel. Any burrs or foreign materials should be removed by flushing before final operation.

2.5.12.1.3. Valve Identification

Provide 30 mm dia brass valve tag, with embossed letters and number for each valve and attach the tag to valve handle by "S" hook or by suitable means. Contractor shall provide valve tag schedule and valve chart for each piping system, consisting of schematic drawing of piping layout, along with a valve list, showing and identifying each valve by number, service and location and describing its function.

The contractor shall frame under glass in the Fire pump room as directed by Owner's site representative two copies of valve chart. Two additional unmounted copies shall be supplied to the Owner's site representative.

Tags shall correspond with the valve schedule and record drawings. In back of house areas, where ceilings are installed and the valve or valve tag is not visible, a self adhering tag with the valve number shall be installed on the wall or directly under the ceiling.

2.5.12.2. Butterfly Valves

Butterfly valves shall be as per BS 5155 & provided for pipes 50mm dia and above on downstream (delivery side) of the pumps. The valves shall be CI construction; seat shall be black nitrile rubber with insitu moulding. The valves shall be PN 16 rating.

2.5.12.3. Gate Valves

Gate valves shall be as per IS: 14846 / 780, with C.I. body and bronze / brass internal parts and can be used on suction side of the pumps. Valve shall be flanged end type, PN 10 with rising Spindle type with C.I hand wheel etc.

2.5.12.4. Check Valves

Non – return valves shall be reflux swinging disc type with C.I. body and bronze / brass internals as per IS: 5312. Check valves are designed to prevent reversal of flow.

2.5.12.5. Air Release Valves

Air release valve is 25/20mm screwed inlet GM/CI single acting type and shall be fixed on all high points in the system (wet riser) with Ball valves or as shown on drawings.

2.5.12.6. Ball Valves

The ball valve shall generally conform to IS specification No.1703:1977. The ball valve shall be of high pressure type and shall be of sizes as specified in the BOQ. The normal size of a ball valve shall be that, corresponding to the size of the pipe to which it is fixed. Ball valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE. The valve shall be complete with socket weld ends and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for a float exceeding 115mm dia. The body of the high pressure ball valve when assembled in working condition with the float immersed to not more than half of its diameter shall remain closed against a test pressure of 3.5kg/sq.cm.

2.5.13. 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. The air vessel shall be tested to pressure for 12 hours at 2 times the operating pressure or 1.5 times the shut-off.

2.5.14. Air Cushion Tank

Every wet riser shall be provided with an air cushion tank at its top most point. The air cushion shall be provided with an automatic air release cock, 20 mm dia drain pipe, drain valve and shut off valve.

2.5.15. 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.

2.5.16. Pressure Gauge

Pressure gauge shall be provided near all individual connections of the hydrant system with isolation valves and near each flow switch assembly of the sprinkler system. Pressure gauge shall be 150 mm dia gunmetal bourdon type with gun metal isolation ball valve, tapping and connecting pipe and nipple. The gauge shall be installed at appropriate height for easy

readability. All gauges in the main fire pump room and ICV stations shall be glycerine filled gauges.

2.6. Welding

2.6.1. Quality Control for Welding

Welding machines mobilized shall be in good working condition and shall have proper control for regulating current. Adequate spares shall be kept in stock at site during the execution of the work for routine maintenance. Location of welding machines and the distribution boards to be connected with them shall be decided in consultation with site electrical supervisor to avoid overloading of the distribution boards, cables and electrical power sources.

For executing site fabrication/ welding the electric cables, distribution boards and connections for machines shall be carefully checked once a week and maintained in good working condition. Welding cables used shall have proper insulation throughout the length. The cables shall be carefully examined and repaired as necessary every day.

All welding shall be performed strictly in accordance with the welding requirements detailed in approved WPSs and ASME Boiler and Pressure vessel code Section IX. Suitable WPSs to be adopted for welding are required to be qualified.

2.6.2. Welding Electrodes

Generally all welding shall be performed using Shielded metal arc welding (SMAW) process using cellulosed-coated electrode (E 6013 type) for root run and subsequent passes

2.6.3. Storing of Welding Electrodes

Welding electrodes shall be stored indoors free from moisture. The package of the welding electrodes shall not be opened until immediately before use.

2.6.4. Handling of Welding Electrodes

During welding work, welding electrodes shall be stored in heated quivers. The lid of the quiver shall be kept closed to ensure that the electrodes are not exposed to moisture in the atmosphere.

No welding shall be done if there is impingement of any rain, or high winds on the weld area except when suitable protection or shield against the rain or wind is provided.

Tack welds may be done either with full penetration or as bridge tacks. If full penetration tacks are made, the ends shall be ground to featheredge and inspected for presence of any defect.

If tacks are cracked, these shall be completely removed by grinding and the area shall be inspected by Dye Penetrate examination to ensure freedom from defects.

Before welding, the ends shall be cleaned by wire brushing, filing or grinding. Each weld-run shall be thoroughly cleaned to remove the slag, irregularities and any defects, before the next run is deposited.

Welding of any joint shall be completed uninterrupted. If this cannot be followed for some reason, at least first two passes shall be welded prior to interruption.

2.6.5. Qualification of Welders

Qualified and certified welders only shall do welding. All welders assigned to the work shall be qualified by test as per the WPSs in accordance with ASME code Sec. IX and approved by QA/QC Engineer. Welders deployed for welding piping joints shall have qualification in SMAW process in 6G positions in accordance with ASME code Sec. IX. Previously qualified welders, whose qualification is still valid, may be deployed subject to the engineer-in-charge approval. Welding qualification records shall be maintained at site for reference of client at any time.

2.6.6. Instruction to Welders

Welding procedure and other related requirements should be fully explained to each welder and fitter prior to welding work. Welding shall not be started if bevel preparation and fit up of the base materials to be welded is not correct.

2.6.7. Identification of Weld

An identification number shall be given to each welder. Each weld shall be identified by marking the welder's identification number given. This shall be marked on the welded seam or at an adjacent location with metal marker.

2.7. Fire Extinguishers

Fire extinguishers shall be worked out in such a way that the Occupants shall not travel more than 15m to reach a Fire extinguisher. Also there shall be a Fire extinguisher for every 300 sq.m of floor plate / rooms of suitable type / size. Extinguishers to be provided at Surface car parks, outdoor Transformers / electrical installations and on the landing of each Staircase of all floors.

All Fire extinguishers shall be stored pressure type portable and hand held, a operating instruction should be pasted on the extinguisher body.

Portable Fire extinguishers should be BIS approved and valid certificates to be furnished at the time of delivery to site.

The number and location of portable fire extinguishers are depends on the size and use of the building. There deferent types of Extinguishers for special fires, such as carbon-di-oxide, dry chemical powder, water and Foam type etc.

Different types of Fire extinguishers have different characters and therefore, an appropriate type of Fire Extinguisher is required to be used.

ABC stored pressure type fire extinguisher of suitable capacity will be provided on the following areas

- Every 8 car parking
- On all fire exit staircase
- All utility areas

Co2 stored pressure type fire extinguishers will be provided on following areas

- Electrical rooms
- Lift machine rooms

In addition to the above fire buckets will be provided at all utility areas and car parking areas.

2.8. Photo -luminescent safety signage

The descriptive photo luminescent safety signage in different sizes / graphics / colours / texts can be made according to the standard for the following fire equipment's / accessories / areas.

Fire hose reel, Lifts, Fire extinguishers, Emergency exits, Analogue addressable Main fire alarm panel & Sprinkler control valves etc.

Photo luminescent safety signage plays a vital safety role in risk-prone areas and panic causing situation. When the source of light suddenly goes off, photo luminescent materials glow settles to a near continuous intensity.

This type of signages is Positive life saver during evacuation of buildings, in case of fire or other sudden emergencies

The luminous components that make up the materials are crystals consisting mainly of zinc sulphide in protective glass like shell; these crystals are incorporated in rigid plastic. In the presence of light, these crystals are excited and they glow brightly when the light is not present.

The crystals are made luminescent (glow in the dark) by the action of light. The term phosphorence is sometimes used to describe luminescence, but these signage materials contain no phosphorus.

The intense glow is instantly visible in the dark, the glow intensity decreases continuously but can last for more than eight hours.

This photo luminescent safety signage shall be non-toxic, non-radioactive and containing no phosphorus or lead or any other hazardous element or chemical. These shall be highly versatile and considerably less expensive than other forms of emergency lighting. These are ready to use, easily applied, long - lasting, virtually maintenance free and indefinitely reusable. Fluorescent light shall excite more crystals than incandescent light.

2.9. Analogue addressable fire detection and alarm system

2.9.1. Scope

- A new addressable analogue reporting, microprocessor-controlled fire detection system shall be installed in accordance with the specifications and approved shop drawings.
- The system shall be designed such that each loop shall limited to only 85% of its total capacity at initial installation.
- The system shall be capable of modification to accommodate new panels in the future.
- The Fire control panel shall be capable of integrating with other fire alarm panels (UL Listed /EN 54) are located at different areas/blocks through the communication cable. The Necessary software/hardware and modules required to be considered in the panel cost itself.

2.9.2. Introduction

The Fire Detection & Alarm System Installation Contractor, herein referred to as the 'Contractor' within this part and all other Sections of this specification shall carry out all fire detection works complete in accordance with the requirements of the Project Documentation.

The scope of work shall include but not be limited to:

The supply and installation of all services, equipment, components, accessories and fittings required for the operation of the facility to the extent specified and detailed on the Drawings and Specifications.

Builder's work in connection with the Fire Detection Installations, including supply, necessary inserts and sleeves

Any work which can be reasonably inferred as necessary for the safe, satisfactory operation of the system, whether such work is specified or shown on drawings or not

The supply and installation of cables, conduits, boxes and termination points inter connected for the Heating, Ventilation & Air-conditioning, Plumbing, Elevators and other Services.

Interfacing works for remote control and monitoring with the Building Management System.

All works shown on the Drawings and described in the Tender documents

The Main control panel shall be located in the ground floor entrance.

The location shall be a room or area readily accessible to the Fire Brigade upon their arrival at the building. This shall generally be immediately off the main entrance lobby. The exact location shall be approved by the appropriate authorities.

2.9.3. Description

The Fire Alarm Control Panel And All Transponders Shall Meet The Modular Listing Requirements Of Underwriters Laboratories, Inc. Each Subassembly, Including All Printed Circuits, Shall Include The Appropriate UL Modular Label. This Includes All Printed Circuit Board Assemblies, Power Supplies, And Enclosure Parts. Systems That Do Not Include Modular Labels May Require Return To The Factory For System Upgrades, And Are Not Acceptable.

This section of the specification includes the Design, engineering, furnishing, installation, and connection of a microprocessor controlled, analogue addressable fire alarm equipment required to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as per tender drawings and specified herein.

The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate "UL" testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing/FM approved/EN 54 with all detectors and devices .

2.9.4. Basic Performance

- a. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on type – A loop.
- b. All Detectors shall be wired Class A, as part of an addressable device connected by the loop Circuit.
- c. Notification Appliances shall be wired Class A, as part of an addressable device connected by the loop Circuit.
- d. A single ground fault or open circuit on the system loop shall not cause system malfunction, loss of operating power or the ability to report an alarm.
- e. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
- f. Detection addressable loops shall be NFPA "Style 7". NFPA "Style 7" for Main fire control panels, Repeater panel (s) and therefore return to the control panel.

2.9.5. Basic System Functional Operation

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- a. The System (Detector) Alarm LED shall flash.
- b. A local piezo electric signal in the control panel shall sound.
- c. The LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
- d. Printing and history storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.

- e. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.
- f. The audio portion of the system shall sound the proper signal (tone or voice) to the appropriate zones.

2.9.6. Software Modifications

Provide the services of a factory trained and authorized technician to perform all system software modifications, upgrades or changes. Response time of the Engineer to the site shall not exceed 4 hours.

Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones / loops and changes to system operation and custom label changes for devices or zones / loops. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

2.9.7. Certifications & Guaranty

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification.

All work performed and all material and equipment supplied & installed under this contract shall be free from defects, Brand-new. The full cost of maintenance, labour and materials required to correct any defect during DLP / Warranty shall be included in the quoted prices.

2.9.8. Fire Alarm Control Panel (FACP)

The main FACP Central Console shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, panel modules including initiating circuits, control circuits, and notification appliance circuits, local and remote operator terminals, annunciators, and other system controlled devices.

The Bidder shall undertake the responsibility of the complete installation, commissioning, user trials, training and maintenance of the System as required. The Bidder shall take all responsibility for preparation and installation of System Software into the FACP. The Software shall be such so as to be easily operated by the Client's Personnel and secured against Software errors, ability to be upgraded so as to incorporate more features at a later date.

The panel shall also have automatic dialler with speech processor for transmit fire message to select telephone numbers in case of fire.

The fire alarm control panel shall meet the modular listing requirements of Underwriters Laboratories Inc. The control panel shall be capable of expansion via Loop cards. Each Loop shall support a minimum of 250 analog addressable detectors/devices. The System shall be fail safe and adequate safe guards should be under taken that in the event of a failure of a part of the System, say a loop card or CPU; it shall not handicap the complete System. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs in that loop) in the unlikely event of a failure in the main CPU.

The logic circuitry shall be based on high noise immunity solid state hardware.

All addressable units shall be connected to the FACP through the Loop Cards and shall be addressed through individual numbers. The FACP shall be able to obtain analogue value for all detectors in the circuit through a pulsed digitalized current data. The FACP shall be able to analyse all analogue inputs from all addressable units, and through its own software and ambient level screening the FACP shall be able to identify fire, possible fire or fault conditions. The unit supervision shall be dynamic and continuous.

The FACP shall also give adequate warning signal whenever there is dust accumulation in detectors, and up to the point of its replacement it should be possible to change the level of ambient alarm calibration condition either by the use of software program operable by the owner or by resetting the detector.

Short / Open circuit units shall also be reported at the FACP In such cases, the system through the use of fault isolators shall be able to isolate that segment between the two fault isolators. The missing Detectors/Devices shall also be reported at the FACP with identification of the location.

The Bidder shall also undertake to trip the AHUs from the Fire Alarm Panel through the use of Addressable Output Modules and necessary AC/DC relays, activated by the fire signal of specified detectors and Input Modules for monitoring contacts from Fire exit doors.

The FACP shall also be able to discriminate between false alarms and fire conditions, as well as priority selection of alarm in case alarm activates in two or more remotely located units simultaneously. In such cases, the Manual Call Points shall have the highest priority.

The FACP shall have its own Battery Backup of a minimum of 24 hours in normal run and then half an hour in alarm condition. The Battery shall be of sealed lead acid re chargeable maintenance free type. Necessary battery calculations for the system shall be provided along with the bid.

It shall be able to withstand temperature variations from 00 centigrade to 500 centigrade. Further, Relative Humidity (non-condensing type) up to 95% shall not hamper its performance. The voltage rating shall be from 17V DC to 31V DC, though the voltage may be change depending upon the working voltages of a proprietary FACP.

The FACP shall also capable of repeating all the events & messages to a Passive Repeater Panel.

The Fire Alarm Control Panel shall include a full featured operator interface control for the field programming and control of the fire alarm system. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel

2.9.8.1. Display & Indication

LCD touch screen display that indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises. It shall also that indicate the status of the following minimum system parameters: Power Status, Test Status, Fire Alarm, Fault, CPU Failure, Points Disabled Etc.,

2.9.8.2. Alarm Acknowledge

Activation of the control panel acknowledges function in response to new alarms and/or troubles shall silence the local panel piezo electric signal and the associated LCD on the panel shall be turned ON.

2.9.8.3. Signal Silence

Signal Silence function shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards.

2.9.8.4. System Reset

Depression of System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. And the system reset operation starts. The associated Yellow LED shall flash during this operation to inform the user of the progress status of the reset cycle. The LED shall flash fast during the smoke detector power down sequence, then it shall flash slowly during the restart phase, and shall illuminate steadily for the restoral phase. The LED shall go out completely when the system is back to normal mode.

2.9.8.5. Evacuation/ Fire drill

Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.

2.9.8.6. Lamp Test

The Lamp Test function shall activate all local system LEDs, light each segment of the liquid crystal display to check all the components are working OK.

2.9.8.7. Panel Functions

The FACP shall minimum perform the following functions

Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions. System response to any alarm condition must occur within 3 seconds, regardless of the size and the complexity of the installed system.

Supervise all initiating signalling and notification circuits throughout the facility by way of connection to monitor and control modules.

Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.

Upon alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler water flow, the following functions shall automatically occur:

- The internal audible device shall sound at the FACP.
- Display the alarm event on the Fire graphic workstation.
- The LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location and time/date.
- Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.

The following audio messages and actions shall occur simultaneously:

- A pre-evacuation message shall be sounded on all floors (zones), Stair cases, Lifts. It is the intent of this message to advise occupants hearing this message that they are near danger and await further instructions for leaving the building via the stairs (nearest exit).
- Activate visual strobes /Sounders based on programmed sequence. The visual strobe shall continue to flash or the sounders will hoot until the system has been reset.
- An alert message shall be transmitted thru a telephone line on a pre-programmed telephone numbers.
- Activate automatic smoke control sequences such as AHU tripping
- All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
- All Access Controlled doors shall unlock throughout the building.

2.9.8.8. Panel Features

The system shall be fully supervised for all fault conditions with distinctive alarm operated for fault and fire conditions. Test buttons and software features shall be provided to test the electronic circuits and detector health

2.9.8.9. System Programming

Advanced Windows based software shall be used to configure the system during system start-up or system commissioning. Time and Date Stamps of all modifications made to the program must be included to allow full retention of all previous program version data. All System operational software is to be stored in FLASH memory. Control Panel disassembly and replacement of electronic components of any kind shall not be required in order to upgrade the operations of the installed system to conform to future application code and operating system changes. It shall have the ability to download all system applications programs and "firmware" from a computer through a single point into the FACP.

The panel shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.

2.9.8.10. Event Buffer

The panel shall maintain a history file of at least the last 1000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries.

2.9.8.11. Early warning capability

To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting.

It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated and an alert displayed on the panel.

When the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on alarm level.

2.9.8.12. Alarm verification delay

The FACP shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm after start of alarm processing. If the alarm is not acknowledged within programmed delay, all local and remote outputs shall automatically activate immediately. The control panel shall ignore the alarm verification timer if another alarm is detected during the verification period.

2.9.8.13. Enable/ Disable points

The FACP shall allow the operator to restore a disabled point (device) in the system, allowing that point (device) to operate as originally intended by the application program of the system. Additionally, the system shall allow the operator to restore any group function, function, Panel, system module, "software - defined zone", operator control, or time control function.

The FACP shall allow the operator to disable any point (device) in the system, inhibiting that point (device) from operating as originally intended by the application program of the system. Additionally, the system shall allow the operator to disable any group function, function, Panel, system module, "software - defined zone", operator control, or time control function within the system.

2.9.8.14. Check/Alter parameters

The system shall allow the operator to manually turn on any system output point, or system function. Alter Smoke Detector sensitivity, message routing within the system shall be modifiable with this simple command from the control panel.

The system shall allow the operator to restore the primary (application program defined) operation to the Smoke Detector sensitivity and the message routing functions with this simple command from the control panel.

The system shall allow the operator to manually command and control relays. Relays shall be able to be commanded to "Latch", to energize as a "High Priority", or as a "Low Priority", to "Energize", or to "De-Energize".

2.9.8.15. AHU Shutdown

The panel shall be capable of shutting down the AHUs in the event of Fire Alarm. It shall be possible to program the shut on zone basis

2.9.8.16. Sensitivity Adjust

The system shall provide Automatic Detector Sensitivity Adjust based on Day/Night schedules.

2.9.8.17. Environment Drift Compensation

The system shall automatically compensate for the drift in the sensitivity that can occur due to dust & environment changes. Environmental compensation shall mean that the sensing element adapts to long-term changes caused by dirt, humidity, aging etc. It shall even compensate for small amounts of normal ambient smoke. The detector shall periodically adjust and updates the sensitivity (% obscuration) baseline for its photoelectric sensing element. Periodically this information shall be written to its permanent memory. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.

2.9.8.18. System Status Display

The system shall allow the operator to determine the status of individual system components, including active points, disabled points, and active points by panel.

The LCD shall show the system time, and the number of active points and disabled points in the system in this section of the LCD Display.

The LCD shall show the first active event of the highest priority. The text shall show the sequence number in which the displayed event was received, as well as its event type. It shall also display an identification message related to the displayed event.

The LCD shall show the total number of active events in the system, by event type. There shall be at least three different System Event Types that shall be displayed, "Alarm Events", "Supervisory Events" and "Active Trouble Events". The Main LCD shall include queues for each of the System Event Types. The Main LCD shall allow the operator to access to the System Status information contained within those queues by pressing an associated select switch. Whenever there is an unacknowledged event in any of the System Event queues, the associated Status LED shall flash. Viewing each event listed in a queue shall acknowledge all events in that queue, and shall cause the associated LED to illuminate steady.

2.9.8.19. Passwords and Users

The system shall support at least two password levels, master and user. Passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.

2.9.8.20. Report Generation capability

The system shall have the capability to connect to a printer to print at least the following

- It shall give a detailed description of the status of certain system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the Main LCD, and shall be capable of being printed on any of the connected system printers.
- The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining.
- The system shall provide a report that provides a sensitivity listing of any particular detector or all detectors
- The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

2.9.8.21. One-Man Walk Test

The system shall provide walk test for testing the entire fire alarm system. The walk test shall allow a single operator to run audible tests on the panel. When points are activated, each initiating event shall latch the input. The test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.

2.9.8.22. Response based on event

The panel software functions shall provide means to program a variety of output responses based on various initiating events.

The system shall support at least 500 general purpose software zones for linking inputs to outputs. When an input device activates, any zone programmed into that device's zone map will be active and any output device.

2.9.8.23. Maintenance Menu

The Main LCD in the FACP shall also allow the System Operator to access system maintenance functions through a multi level password system.

2.9.8.24. Enclosures

The control panel shall be housed in cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.

The back box and door shall be constructed of steel with provisions for electrical conduit connections into the sides and top.

The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be site configured for either right or left hand hinging.

2.9.8.25. Power Supply

The Addressable Main / auxiliary Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP and the notification appliances.

The Addressable Main Power Supply shall also incorporate a battery charger for 24 hours of standby power for normal working & another ½ hour in alarm condition using dual-rate charging techniques for fast battery recharge

The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.

The Addressable Main Power Supply shall be power-limited per UL8-64 requirements.

The FACP shall have UL/FM compliance/ approval.

2.9.8.26. Event Display

- There shall be an event display field to display the current event. When there are no events then it shall display an ALL CLEAR message.
- It shall be possible to manually scroll all the current events both forwards & backwards.
- Facility shall be provided to add notes to the current event display.
- Each type of event shall be represented in different colours
- It shall be possible to acknowledge the event
- Status Bars shall be provided for events such as Fire, Fault, Disabled and warning. The Status Bar shall flash in different colours when an event occur and shall revert back to its

original status once the event is acknowledged and are no other pending events for acknowledgement.

2.9.8.27. Graphic Screen Display

- It shall be possible to view manually the events in graphic screens, to view the site plan and also to view in graphics the current device in fault or in alarm
- The scrolling of the current event display with corresponding graphics shall also be shown automatically.
- It shall be possible to manually select, view the details of devices and zones by selecting the relevant sub screens.
- It shall also be possible to enable or disable any zone or device and the same shall be restricted to higher level users only.

2.9.8.28. Control Functions

It shall be possible to mute the PC alarm sound and the fire Panel buzzer, activate & silence all sounders and print automatically alarm events from the software. It shall be possible to add/delete new users.

2.9.9. Detectors

The Detector shall be analogue addressable type. The chamber should be easily removable for the purpose of easy maintenance. The address programming shall be done at site only. The detectors shall have a common base to allow easy interchange of various types of detectors.

2.9.9.1. Photo electric Smoke Detectors

All Smoke shall be fitted with plug-in system type connections, from the maintenance and compatibility point of views. An alarm release will not affect a detector's good functioning. After resetting the alarm, the detector will resume operations without readjustment of any kind.

The smoke detector shall have a linear response over all types of fire. It shall be possible to use only a single detector type/model for both above and below false ceiling applications. The detector shall be capable of detecting fast flaming fires and slow smouldering fires equally well. The same shall be achieved by either using a true linear response smoke detector or a multi sensor using Photo + Heat

The detector shall be able to sense incipient fire by detecting the presence of visible and invisible products of combustion. The detector shall be suitable for low voltage (17 to 31V DC) two wire supply. The detector shall be provided with Twin LED indication and the sensitivity of the detector shall not vary with change in ambient temperature, humidity, pressure or voltage variation.

Neither its performance shall be affected by air current up to 1.52mtr per second. The detector shall be suitably protected against dust accumulation/ ingress and it shall be free from maintenance and functionally tested at intervals. All detectors shall be identical in construction design and characteristic to facilitate easy replacement.

The Smoke Detector shall be Analogue Addressable type and be able to send analogue output to the FACP regarding its condition. It shall be able to communicate with the FACP by the pulses emitted from the FACP. It shall have in-built locking mechanism to check the removal and pilferage of the detector.

The base of the Detector shall be electronics free and interchangeable with other smoke or heat detectors. The enclosure shall meet IP 42 protection grade.

It shall be able to withstand temperature variations from - 10 degree centigrade to 50 degree centigrade. Further, Relative Humidity (non-condensing type) up to 80% shall not hamper its performance. The voltage rating shall be from 17V -31V DC though the voltage may be changed depending upon the working voltages of a proprietary FACP.

The detector shall have twin LED's and shall have 360 degree viewing angle. LED on the detector shall blink each time the sensor is scanned by the FACP. If the FACP determines that the sensor is in alarm, the FACP will command the sensor LED to remain on to indicate the same. Each sensor will be capable of being tested for alarm via command from the FACP. Each sensor shall respond to FACP scan with the information about its type for identification.

The detector shall be programmed using a hand-held programmer and address stored in a non-volatile memory within the sensor or by a decade /Rotary switch or shall be thro an electronic addressing and the smoke Detector shall have UL/EN54 approval.

2.9.9.1.1. Duct Housing for Smoke Detectors

The Duct Housing shall be placed in each return air duct to Sense Smoke in the return air. The Duct Housing shall accommodate the addressable Smoke detector as specified above. The Housing shall be capable of withstanding air velocities from 500 to 4000 FPM. It shall have the facility to connect a remote LED. It shall be capable of mounting easily into rectangular or circular ducts. It shall have an integral filter system to reduce dust. Sampling tube shall be easily installed after the housing mounted to the duct.

The duct detector housing shall incorporate an airtight smoke chamber for mounting the detector. The housing shall be capable of mounting either in rectangular or circular ducts. The sampling tube both for inlet & outlet shall be easily installed after housing is mounted to the duct by passing thru the duct housing.

It shall be capable of Local Testing using a test Magnetic switch. The unit shall be reset using a local reset button. The Duct housing shall have UL approval.

2.9.9.2. Addressable Manual Pull Station

The Manual Pull Station shall be addressable type with built in input modules to define the location. It shall come with a key operated reset lock for testing. It shall be dual action type which requires two motions before activation.

The device shall be of durable extruded aluminium or moulded poly carbonate LEXAN housing construction, red in colour and suitable for surface or flush mounting. The word FIRE shall appear in front of the Station in white colour. A clearly visible Single/Multi Colour LED shall be provided which shall flash while polling & shall be permanently illuminated during alarm until reset.

Activation of Manual Pull Station shall initiate operation of the alarm detection circuit. The manual station shall have normally open fire alarm and annunciator contacts and these contacts shall close on activation. Contacts shall remain closed until station is manually reset. Resetting shall be accomplished by re positioning the handle / pull station door and relocking the key lock.

The address of the Pull station shall be done thru the built in DIP, Decade, Rotary switch or thru electronic addressing.

The Manual Call Station shall be fully addressable with its own addressable module and operated by digitized signals from the FACP. The voltage range shall be from 17V to 31V. The operating temperature range shall be minimum from 0 degree C to 48 degree C. Relative Humidity (non condensing) range of performance parameters shall be between 0 to 95%. The Manual Pull Station shall have UL /EN approval.

2.9.9.3. Isolator Modules

This unit shall be placed on the loop preferably after every 20 devices and shall be able to isolate electrical short circuit in the wiring. All the other detectors shall remain functional because of the Class A wiring of the loop

Isolator modules/Base shall be provided to automatically isolate wire-to-wire short circuits on an SLC Class A or Class B branch. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC loop segment or branch. At least one isolator module shall be provided for each floor or protected zone of the building.

If a wire-to-wire short occurs, the isolator module / Base shall automatically open-circuit (disconnect) the SLC. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.

The isolator module / Base shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.

It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated. The Isolator shall have UL approval.

2.9.9.4. Sounder base detectors

The sounder shall be electronic type and shall give discontinuous/ intermittent audible alarm from a command from the Addressable Bell relay modules whenever any detector or call box operates. The sound output from the Hooter should not be less than 85 decibels at the source point.

It shall be capable of being directly mounted on the wall/ceiling. The sounder shall be programmed to get activated in event of an alarm from a single detector/device or a group of detectors/ devices.

The strobes shall be an electronic visible warning signal device that flashes at least once every 1.5 Secs in an event of an alarm. The strobe light shall use Xenon flash tube with low current requirements. The outer cover of the Strobe shall have a printed fire signal warning. The electronic circuits inside the strobes shall be compatible with DC alarm supervision & meet the required safety standards. The strobes shall be mounted on the sounder or on the wall/ceiling and shall be UL Listed. The light intensity shall be at least 1.5 candela at 24 VDC.

The sounder/strobe shall be powered from the FACP panel and no separate power supply should be used.

It shall be capable of being directly mounted on the wall/ceiling. The sounder relay module shall be programmed to activate the sounders in a wing in event of an alarm from a single detector/device or a group of detectors/ devices. The Sounder & Strobe shall have UL & FM approval.

2.9.9.5. Control Relay Module

Output module shall mean addressable points from the FACP with potential free contacts for tripping of AHUs, Operating sounder/Strobe lights, tripping power supply, open access controlled doors, activate P.A system for voice evacuation etc. as required. The Module shall have UL & FM approval.

2.9.9.6. Monitor Module

The input modules shall be of dual/single channel type. The dual channel module shall be selectable for Normally Open or Closed by a 2 bit DIL switch. The module shall be used to interconnect with VESDA detectors for fire, fault, to monitor sprinkler flow switch etc., The Module shall have UL & fm approval

2.9.10. Power Supply Unit

The 5 Amp power supply unit shall be with 24 Volts, 7Ah sealed maintenance free lead acid battery. It shall have an inbuilt trickle and boost charger. An indication shall be provided to indicate the availability of AC power source. An inbuilt buzzer shall be provided which shall indicate that the battery is in deep discharge condition. Vendor shall consider the necessary power supply units as per the system requirements along with panel cost.

2.9.11. Batteries and Charger

2.9.11.1. Battery

The battery Shall be 12 volt, Gel-Cell type. Battery shall have sufficient capacity to power the fire alarm system for not less than 48 hours plus 15 minutes of alarm upon a normal AC power failure.

The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.

2.9.11.2. External Battery Charger

Shall be built in to FACP & completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120/240-volt 50/60 hertz source.

It shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery. It shall have protection to prevent discharge through the charger. It shall have protection for overloads and short circuits on both AC and DC sides.

2.9.12. Cables

All PVC insulated copper, armored, multi strand, ATC, FRLS, Twisted Pair, mylar taped Shielded cables shall be 650V grades and shall generally conform to IS – 8130, IS – 5831 & IS –694 and meet the signal cabling requirement of the system manufacturer. The cable conductor shall be of min 1.5 Sq mm size with 1.64 mm dia with at least 10 Twist per meter.

The cable shield shall be fully connected throughout the loop directly or through the base as the case may be. The strands of cable shall not be cut to accommodate & connect the terminals. Terminals shall have sufficient cross sectional area to take in all the strands. Cables shall be laid by skilled and experienced workmen. Great care shall be taken while laying cables to avoid kinks. At all changes in directions (vertical & horizontal planes) the cables shall be bent smooth with a radius as recommended by the manufacturers.

2.9.13. Conduits

MS /PVC FRLS Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.

Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

Conduit shall be 3/4-inch (19.1 mm) minimum, all conduits / junction boxes / collars shall be painted before installation and there shall be marking (for identification) on the conduits at interval of 2m minimum. Flexible conduits shall be GI type along with suitable fittings.

2.9.14. Terminal Boxes, Junction Boxes and Cabinets

All boxes and cabinets shall be as approved by the client / consultants for their intended purpose.

2.10. Public addressable system

2.10.1. General Requirements

The contractor shall supply, install, test, connect and commission a high quality fast-acting Public Address System complying strictly with BS 5839 part8 and EN60849 approved.

The Public Address System shall comprise of Audio Matrix Units, High quality speakers, Audio rack all mounted on a 19" Rack and fully connected and integrated on the fire alarm loop.

The system shall be used for Professional Sound Reproduction for all the areas where possible special events take place.

Prior to placing order for any equipment, the contractor shall submit comprehensive document comprising working drawings, catalogues and descriptive literature of components, acoustic calculation to meet with BS5839 part8 RASTI (Room Acoustic Speech Transmission Index) requirements of 0.5 on the STI scale and 0,7 on the CIS scale.

The contractor shall be required to train and instruct client's personnel in the correct use, operation and supervision of the system, preferably prior to the handing over of the project.

In order to ensure whole site integration capability, the fire and voice alarm system will be awarded to a single specialist local supplier who will be responsible for the design, global operation, management and interfacing of the system.

The contractor shall make sure that all power tapping of the speakers must be carried out as specified, even if the acoustic calculations indicates less power tapings.

The contractor must ensure minimum of 10dB above the ambient noise levels are achieved.

The system shall be fully programmed to accommodate fire alarm and voice communication zones as indicated on the drawings and schematics. The system shall be configured to allow on site modifications with the minimum of disruption using the PC based software to facilitate future changes or alterations to the buildings.

2.10.2. System Description

The PA system shall be connected on the same Fire Alarm loop with in-built isolators to protect the system in case of any cable faults.

The Public address system will have one control station & spitted into multiple blocks

The system shall be de-centralized in nature with TCP/IP receivers at each end at distributed rack DAU (Distributed Amplifier Unit) shall have all the DSP (Digital Signal Processing), messages, amplifiers, monitoring in such a way that can work in a standalone mode in case the master rack is faulty or down.

The DAU shall utilize the latest DSP (Digital Signal Processing) capabilities in order to perform high quality and site programming flexibility.

All the Racks in the PA system should be connected over TCP/IP Network carrying data & audio channels. The audio channel bandwidth should not exceed 128 kbps per audio channel.

The DAU shall play background / Foreground music and in case of Fire Alarm / Paging announcement, the system shall go to full power as programmed to provide the enough SPL (Sound Pressure Level) levels to comply with BS5839 part8, with minimum of 65dB or 10dB above the noise level whichever is higher.

All system components shall be digitally monitored including and not limited to, Messages, Amplifiers, and back up amplifiers, Speaker Circuits, Audio Matrix units, Paging Microphone, Battery Charger and the 230VAC line. Each amplifier / line circuit shall be monitored individually and shall report any faults back to the Master Audio Matrix Unit(Master controller) as well as the Paging Microphone.

The system shall be capable of sending messages automatically to any zone at any time interval, without affecting the music in the other areas. Each Zone and circuit speaker shall have separate amplifier, system sharing two amplifiers to multiple circuit speakers are not acceptable.

There shall be one back up amplifier for every four amplifiers, the system shall automatically change over to the backup in case of any amplifier failure, and the backup amplifiers shall be monitored as well. The backup amplifier should be rated to the highest of other four amplifiers.

In case of any system component failure, the paging microphone shall override any defective unit and provide paging to the required zone. This Bypass feature must comply to BS5839 part 8. The System can provide any Cause & Effect programs after integrating with the Fire Alarm System, thus Alert/Evacuate messages can be programmed and delayed as well as played on any zone / floor as per the Cause & Effect approved by the Consulting Engineer.

The integrated PA system shall cover all normally accessible areas including the car parks. All stair cases shall have dedicated zone riser. The system shall be capable of being used for everyday background music and public announcement duties with the fire alarm initiated emergency announcements overriding all other facilities.

Initiation of voice alarm shall take immediate priority and shall cancel all other PA operations. The systems shall be capable of broadcasting up to twelve different pre-recorded messages to different zones or group of zones simultaneously.

Evacuate signal relates to a general evacuation message and alert message corresponds to standby instructions. A fire alarm broadcast signal shall cancel any public address operation and shall override it.

When a fireman's microphone is operated, this shall override any automatic voice alarm signal being transmitted to the zone selected. The Alert and Evacuate pre-recorded messages will be

maintained in other zones while live voice fire announcements are being broadcast to selected loudspeaker zones.

The Entertainment Rack shall be located in the **Control/Security Room** enabling the operator to select music from the CD player, FM tuner or the double cassette deck to transmit music to selected zones or all the zones in the building from the touch screen paging microphone. A public address announcement shall override the music transmission to selected zones or all zones.

Paging any zone shall not interrupt music in other zones. All the control panels (Digital Signal Processing Unit) in each building group shall receive audio & shall be controlled through a TCP/IP network. The TCP/IP network unit shall comply to EN60849 & shall have following characteristics;

- Up to 10 simultaneous music/messages file shall be broadcasted into the network.
- Capability of up to 99 PC's on network.
- A monitoring loudspeaker shall be associated with both control station & shall allow the listening of all messages broadcasted on the network.
- 04 building groups (zones) shall be connected on the network which can be expanded to 99 in future using same network.
- The network shall be TCP/IP dedicated.

2.10.3. Controller

The Unit shall be installed next to the Fire Alarm Control Panel (please refer the schematic for the locations). These units shall be connected to the loops of the FACPs and the voice system audio loop. These units shall initiate the broadcast of live speech in the designated public areas using manual controls as well automatically according to the FACP cause & effect. The use of these units shall be primarily for broadcast fire messages and other optional auxiliary messages as well the back ground music which is site and application specific, as well live evacuation messages and instructions from the operator or the fire brigade to direct the people to the safety points of the building.

It comprises the latest technology in Voice Evacuation through DSP (Digital Signal Processing) and has the capability to expand up to 256 channels. The Unit shall be capable of playing back ground Music for up to 32 music/audio channels simultaneously, with high quality music features, fully programmable route from any source to any zone. The Unit must be loop connected (on the FACP loop) and shall be of 19" rack mount.

The controller shall have the minimum following characteristic:

- From 5 to 256 audio inputs (0dB symmetric)
- Up to 32 paging microphone can be connected to the system.
- Each unit can support up to 4 speaker circuits of up to 500W per circuit speaker total of 2000W.
- All communication must be digital between the entire system components, except the output to the 100V line of the speaker circuit and the 100V output of the amplifier units.

- All components / lines / speaker circuits must be monitored according to EN60849.
- 32 channels digital audio bus between modules (master / slave) at bandwidth of 20 KHz.
- Individual digital control for each input and output level from the software
- 100 priority levels
- Digital measurements of (levels and impedance) of amplifiers and the speaker circuit, monitoring shall use these measurements for advanced monitoring technology.
- Up to 99 incidents can be stored in the system memory event.
- Internal clock and clock synchronization with the PC.
- The system shall support open protocols (MODBUS) for third party remote control.
- All messages shall be of WAV files directly can be downloaded to the system through a PC.
- Messages can be routed automatically to any zone at any specified time interval.

2.10.4. 0 DB Input / Outputs

- Audio input impedance: 10K Ohms
- Input sensitivity: 0dB
- Audio output impedance: 50Ohms
- Output levels 0dB
- Max input/output level +14 dBv
- Pass-band 10 Hz to 22KHz
- Sampling 48 kHz 24bit
- Distortion 0.02% to 1 KHz
- Output noise <84 dBu Lin, <88 dBu A-weighted
- Output dynamic >98dBu Lin, >102dBu A-weighted

2.10.5. 100V Inputs/Outputs

- Max power per Channel 500W, and four channel per AMS
- Amplifier gain measurement 1 kHz, 18 kHz
- Line impedance measurement 100V 1kHz, 18kHz
- Ground fault measurement

2.10.6. Amplifier Unit

All power amplifiers must comply with EN60849 requirements. Each amplifier module is fitted with its own 220VAC/24VDC power supply for increase of system reliability.

No fan / forced cooling are required. The unit shall operate on minimum 85% efficiency; analogue amplifiers shall not be accepted.

The amplifier must have the minimum following characteristics:

- 60W, 120W, 240W and 480W range of amplifiers
- Balanced 0dB input at 770mV
- 100V line output
- Thermostatic Ventilation
- Amplifier Status Led / contacts
- Frequency response 40-20KHz

- Distortion at nominal power <1%
- Signal/noise ration: >90dB

2.10.7. Entertainment Rack

The equipment panel shall consist of 1 no. CD player, 1 No. double cassette deck, 1 no. AM/FM tuner. All music transmitted from this position will be routed through the Central Equipment rack to the zone / zones selected through complete windows based programming. The equipment components shall comply with the following requirements

2.10.8. FM/AM Tuner

The tuner shall contain provision for up to six preset stations, two of which shall be dedicated to MW or LW. It shall have the following characteristics:

Sensitivity	:	3uV for FM channels, 20uV for 26dB SNR for AM section
Distortion	:	1% THD
IF rejection	:	70db
Nominal output	:	100mV
Antenna Impedance	:	75 ohms
Tuning method	:	Electronic, onsite adjustable with LED on station indicator

2.10.9. Cassette Deck

The tape deck shall be double cassette sequencer accepting up to two M-track music cassettes with features like auto-music search, audio sensing, auto reverse and auto eject, power on/off of faulty tapes. It shall accept standard C60 and C90 music cassettes. The tape deck shall have the following characteristics:

AC supply input	:	220V, 50 Hz
Output Level	:	0dBm (775mV) 600 ohms mono output
Frequency Range	:	60 Hz to 12500 Hz \pm 3dB
Distortion	:	< 3% THD at 1 kHz
Signal to Noise Ratio	:	< 49dB
Tape Speed	:	4.75 cm/sec
Fast forward / Rewind	:	< 140 sec to rewind C60 cassette

2.10.10. CD Player

The CD player shall be capable of loading up to six discs into a magazine to provide many hours of repeated play. All discs could be played sequentially or randomly by the use of a remote signal.

Frequency response	:	20 Hz to 20,000 Hz
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Signal to Noise Ratio	:	90dB
Distortion	:	0.008 % THD @ 1 kHz
Channel Separation	:	82dB
Quantization	:	16-bit twin DAC

2.10.11. Equipment Rack

The equipment shall be housed in a standard rack of suitable height, with Plexiglas door or metal mesh and lock. Ventilation panels of 1U height shall be provided between each item of equipment.

Details of the proposed equipment shall be forwarded to the Consultant with performance specifications, dimensions, construction and finish for approval.

The site shall be fitted with man / machine interface terminal facilities, which shall allow live speech broadcasts to be addressed to selected areas of the site. The unit shall also allow initiation of stored messages and alarm signals.

2.10.12. Ceiling Mounted Speakers

The speaker shall be suitable for flush mounting to a false ceiling of any configuration. It shall be equipped with a multiple tapping matching transformer to provide easy control of speaker sound volume. Supporting brackets to mount the speaker onto false ceilings of different configurations shall be provided. The speaker shall not have any screw fixing arrangement on its grill.

The speaker must comply with BS5839 part 8 and having the files for sound acoustic calculation and sound modelling. All tapping shall be made to obtain SPL as per BS5839 part 8

It shall satisfy the following performance characteristics;

- Effective frequency range according to BS6840
- SPL @ 1m, 1Watt, dB, Test Signal Bandwidth 100Hz-10 KHz shall be 92dB
- SPL @ full power Octave Bandwidth shall be 95dB
- Rated Power, Watts 6 @ 6/3/1.5/0.75/0.25 tapings
- Acoustic Power (dB-PWL @ 1watt) 1 KHz/2KHz, 92/93dB

2.10.13. Cables

All PVC insulated copper, armoured, multi strand, ATC, FRLS, Twisted Pair, mylar taped Shielded cables shall be 650V grades and shall generally conform to IS – 8130, IS – 5831 & IS –694 and meet the signal cabling requirement of the system manufacturer. The cable conductor shall be of min 1.5 Sq mm size with 1.64 mm dia with at least 10 Twist per meter.

The cable shield shall be fully connected throughout the loop directly or through the base as the case may be. The strands of cable shall not be cut to accommodate & connect the terminals. Terminals shall have sufficient cross sectional area to take in all the strands. Cables shall be laid by skilled and experienced workmen. Great care shall be taken while laying cables

to avoid kinks. At all changes in directions (vertical & horizontal planes) the cables shall be bent smooth with a radius as recommended by the manufacturers.

2.10.14. Conduits

Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements. Where possible, all wiring shall be installed in conduit or raceway. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.

Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors.

Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signalling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.

Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back boxes, except where conduit entry is specified by the FACP manufacturer.

Conduit shall be 3/4-inch (19.1 mm) minimum, all conduits / junction boxes / collars shall be painted before installation and there shall be marking (for identification) on the conduits at interval of 2m minimum.

Flexible conduits shall be GI type along with suitable fittings.

2.11. Emergency talk back System

2.11.1. Objectives

The main objective of the System is to convey clear and audible instructions to all the people on all floors in case of occurrence of fire / other emergency to reach a place of safety in the open, outside the buildings. The sound output should not be so loud that people nearest to the speakers feel uncomfortable, nor so weak that people away cannot discern what is being broadcast. This is achieved by working the system at 60 to 75% power output and distributing speakers uniformly all over floor area. The controller and amplifiers shall be placed in to the Rack of suitable size in entrance lobby.

2.11.2. System Description

The Talk Back System is intercommunication system, It provides the communication between the occupants of the building or the people who are in the floors for maintenance and to communicate with the control room in case of Emergencies.

This system comprises of Talkback Master Console with switching unit, Zone Talk Back Speakers and Power Amplifier to drive these speakers. And also console will have monitor speaker to listen the reply from floor or remote places of the building.

The Wall mounting talkback speakers are located in the strategic locations of floors, each speaker will be considered as a zone. These talkback speakers act as a speaker as well as Microphone with built in Preamp and line amplifier modules of switching unit.

Desk mounting Talkback console will be located in the control room along with switching unit and Power amplifiers. It will have zone selector keypad with LED illumination, gooseneck microphone with pre cum line amplifier modules and monitor speaker.

Switching unit consists of zone speaker relay modules and decoding network. It is interconnected between Power Amplifier, zonal speakers and Talk back console.

2.11.3. System Operation

The schematic diagram of talkback system is as shown in the fig. An announcement from the Talkback console will be heard on zonal speakers depending upon selection on the keypad. An announcement from the console can be broadcasted to the zone speakers individually or all speakers at once by pressing respective switches on Talk back console. The reply from the zonal speakers can be monitored through monitor speaker by pressing Release to listen switch.

2.11.4. Controller

Talkback console is a desk-mounting unit with micro controller controlled keypad with LED indication. It has gooseneck microphone to make an announcements.

- Power on to the system indicated by SYS ON indication.
- To initiate an announcement press the PTT switch, the respective LED turns on.
- Press the respective zone/zones/All call switch/ switches in which an announcement to be initiated, the respective LED turns on.
- Speak in to the microphone, the announcement will be heard on selected zone speakers loud and clear.
- To listen the reply from the field speakers, deselect the selected PTT switch
- After completion of announcement, deselect the selected zone switches and the
- Respective LED's goes OFF.

The controller shall meet the following specification requirements .Phantom Power Supply to Line amp Section and

Console Power supply	:	12 DC Supply from Switching Unit
Current Consumption	:	<8mA
Sensitivity	:	0.7mV at 85 dB SPL
Maximum input Sound level	:	110dB SPL
Distortion	:	<0.6%
Frequency Response	:	100Hz - 16kHz
Output Impedance	:	200 ohm
Dimensions	:	180Hx260Wx50D
Stem Length	:	390mm
Weight	:	Approx 1kg

2.11.5. Amplifier

Amplifier shall necessarily have solid-state circuitry properly trivialized and capable of AC/DC operation. This shall be able to drive low impedance speakers (2 to 16 ohms) and speakers with transformer for 100V/70V systems. All amplifiers, CD players etc shall be housed in the suitable racks located at respective IBMS rooms. Amplifiers shall meet the following technical requirements

- Power output - R.M.S – As per the system requirements.
- Distortion - less than 0.5 at the rated output power at 1 KHz.
- Hum and noise level below rated output. All volume controls minimum 68 db. One microphone volume and master volume control maximum - 60 db.
- Sensitivity - impedance - for microphone 1.5MV 4.7 K - ohms.
- Tone control-base +/- 10 db at 100Hz. treble +/-6 db at 10 KHz.
- Speech filter - microphone channel - 12 db at 200 Hz.
- Auxiliary inputs - for tape recorder or ceramic pickup.
- Frequency response - over the entire speech and music range.

Amplifiers should be in a module of suitable Watts R.M.S only. Maximum 75% capacity should be used. Amplifiers should have standard concealed controls. Mains AC power supply input, D.C output and standby automatically supplying power in case of mains failure, shall be provided.

The amplifiers rack shall be of mild steel with suitable anticorrosion protective coating. The rack shall have provision for fixing to floor/wall. The racks shall have appropriate amplifier mounting rails. The racks shall have lockable steel doors having proper ventilation slots for heat dissipation. Cable entry parts should be provided at the bottom. Terminal blocks for connecting to control desk shall be provided.

2.11.6. Speakers

Zone speakers will have the Call switch to get the attention of the operator of the console for communication. By pressing this switch, it generates an audio and visual indication at the talk back console

Material	:	16 SWG MS box
Painting	:	Duly powder coated with RED Color
Connectivity	:	Two way terminal block
Power Handling Capacity	:	6 W
Sound Pressure Level	:	95 dB
Effective Frequency Range	:	70 Hz to 10 KHz
Rated Input Voltage	:	100V
Rated Impedance	:	1667 W

2.11.7. Equipment Rack

The equipment shall be housed in a standard rack of suitable height, with Plexiglas door or metal mesh and lock. Ventilation panels of 1U height shall be provided between each item of equipment.

Details of the proposed equipment shall be forwarded to the Consultant with performance specifications, dimensions, construction and finish for approval.

The site shall be fitted with man / machine interface terminal facilities, which shall allow live speech broadcasts to be addressed to selected areas of the site. The unit shall also allow initiation of stored messages and alarm signals.

3. BILL OF MATERIAL

3.1. Preamble

- All items of work mentioned in the Schedule of Quantities shall be read and executed strictly in accordance with the description of the item in the Schedule of Quantities & read in conjunction with the appropriate IS and conditions of Contract.
- The rate for each item of work included in the bill of quantities shall unless expressly stated otherwise included cost of: -
 - a. All materials, fixing materials, accessories, hardware, operations, tools, equipment, consumables, civil works wherever involved and incidentals required in preparation for in the full and entire execution and completion of the work called for in the item as per specification and drawings completely.
 - b. Wastage on materials and labour.
 - c. All taxes, duties, Octroi, including works contract tax, sales tax, transit insurance, packing and forwarding charges, loading, transportation, unloading, handling, hoisting, to all levels, setting and fixing in position, disposal of debris and all other labour necessary in accordance with contract documents, good practice and recognized principles.
 - d. Liabilities, obligations and risks arising out of conditions of contract.
 - e. Liaison service charges.
- All requirements of system whether such of them are mentioned in the item or not the specifications and drawings are to be read as complimentary to and part of the schedule of quantities and any work called for in one shall be taken as required for all.
- In the event of conflict between the bill of quantities and other documents, the most stringent shall apply and interpretation of the Architect shall be final and binding.
- The installation price of switchboards, metering panels, DB's or any other items shall include supply and fixing of supporting steel structures/MS channels grouting of the same civil works etc., as required.
- No change in unit rate shall be allowed for any change in quantity or for any other reason whatsoever.

- Supply of materials shall mean supply of materials at site. The rate for supply shall include all taxes, Octroi, insurance, packing and forwarding charges, transportation, unloading at site. However the quote should indicate the tax structure separately with necessary details.
- The successful contractors shall submit the Schematic diagrams, fabrication drawings with details of all equipments wirings diagrams etc., to Client/ Architect for approval prior to supply/commencement of such works. The approval of these drawings will be general and will not absolve to contractor of the responsibility of the correctness of these drawings. At least four copies of the approved drawings shall be supplied to Architects for their distribution to various agencies at site at no cost of Owner.
- The tenderers must see the site conditions such as type of soil, locations etc., and take all factors into consideration while quoting the rates as no extra cost will be allowed on any ground arising out of or relating to the site conditions.
- Any error in description or in quantity or omission of items from the contract shall not vitiate this contract but shall be corrected and deemed to be a variation required by the Architect/Owners.
- The Liaison Service Charges shall include the following:
 - a. Follow up expenses with the Local Statutory authorities from the drawing approval upto servicing the installation and getting the safety certificate.
 - b. Preparation of detailed drawings required by the Local Statutory Authorities.
 - c. Obtaining approval of drawings and installation from Local statutory Authorities as applicable.
 - d. Obtaining route drawings from Local Statutory Authorities as applicable.
 - e. All incidental charge/expenses associated with the above work as applicable.
 - f. Official deposits paid to the above agencies will be reimbursed separately at actual by the Owners.
- The tenderer shall take into account the expenses of pre-commissioning tests to be conducted as per specification of the complete installation by licensed agencies.

3.2. Bill of quantity

Refer the separate sheet of bill of quantity.

3.3. List of Approved Makes

3.3.1. Mechanical works

1 Fire Pump Set : KBL / Mather + Platt / KSB /Grandfous

2.	Pipe Fittings	:	Bharat Forge / Jainsons /VS Brand /B & M
3.	Butterfly Vales	:	Sant/Jainsons/Audco/Lehry Valves
4.	Non – Return Valves	:	Sant/Jainsons/Audco/Lehry Valves
5.	Gate Valves (Screwed End)	:	Sant/Jainsons/Audco/Lehry Valves
6.	G.I./ M.S. Pipes	:	Jindal(Hissar) / Tata / Surya Roshini /Sail
7.	Strainers	:	Sant/Gujrat Oto Filtr / Grand / Frix/ Tel Flow
8.	C.I. Gate Valves	:	Sant/kirloskar/Jainsons
9.	Flow Meter	:	Forbes Marshall / Eureka
10.	Pressure Switch	:	Indfos / Switzer / Delta Control
11.	Pressure Gauge	:	H. Guru / Fiebig / Pricol / Bellscontrol
12.	Anticorrosive Material	:	I W L / Rustech
13.	Hydrant Valves	:	Newage-Surendarnagar/Winco
14.	Branch Pipe with Nozzle	:	Newage-Surendarnagar/Winco
15.	Fire Hoses	:	Newage-Surendarnagar/Winco
16.	Hose Couplings	:	Newage-Surendarnagar/Winco
17.	Hose Reel	:	Newage-Surendarnagar/Winco
18.	Hose Box / Fire Duct Shutter	:	Local fabricated
19.	Fire Extinguishers	:	Safex / Eversafe/ Minimax /Ceasefire
20.	Sprinklers/Watercurtain	:	Rapidrop / Tyco / Viking
21.	Sprinkler Alarm Valve	:	Rapidrop / Tyco / Viking
22.	Flow Switch	:	System Sensor / Potter /Switzer/Levcon
23.	Paint	:	Asian / Berger
24.	Air Release Valves	:	Leader / Bajaj / Hawa
25.	Welding Electrodes	:	Esab 28/ Advani

3.3.2. Electrical Works

1. Electric Motors /Siemens/ABB	:	Grandfous / Kirloskar /Greaves
2. Motor Control Centre Load Controls / Dynamo / Bright Engineering/Ellins / Lotus	:	Vinteck power control / Pragathi Controls /
3. Control / Power Cables	:	Gloster / Universal / Asian / CCI/ Finolex
4. Mccb	:	GE/L&T/Alstom/Merlengerin
5. Cable Tray	:	Storack / Pan / Mag
6. Control Mcb	:	Abb/ Merlengerin / Siemens / Mds
7. Volt Meter Select Switch	:	Salzer / L & T / Kaycee
8. Voltmeter (Ac / Dc)	:	Meco / AE
9. Ammeter (Ac / Dc)	:	Meco / AE
10. Power Contactors	:	Abb / Siemens /L&T/ Schneider
11. Indicating Laps (Led Type)	:	Binay / Teknic
12. Push Buttons	:	Teknic / Siemens
13. Auto / Manual Selector	:	Salzer / Kaycee
14. Timers	:	Eapl / AE
15. Terminal Blocks	:	Elmex / Wago
16. Current Transformers	:	Kalpa / Voltamps / Kappa
17. Over Load Relay	:	L & T / Siemens
18. Single Phase Preventors	:	Minilec / Ae
19. Siren / Hooter	:	Kheraj/Equi.
20. End Terminations	:	Dowewls / Multi

3.3.3.Fire Detection & Alarm With P.A. System

1. Smoke Detectors	:	Bosch/ Airlight/EST/Notifier/Apollo
2. Heat Detectors	:	Bosch/ Airlight/EST/Notifier/Apollo
3. Main Control Panel	:	Bosch/ Airlight/EST/Notifier/Apollo

4.	Manual Pull Stations	:	Bosch/ Airlight/EST/Notifier/Apollo
5.	Hooters / Strobes	:	Bosch/ Airlight/EST/Notifier/Apollo
6.	Modules	:	Bosch/ Airlight/EST/Notifier/Apollo
7.	Battery	:	Hitachi / Drysil / Johnson /Panasonic / Exide / Standard
8.	Copper Conductor Control Finolex	:	Polycab / Varsha/ Anchor/Deepanjan/
9.	Communication Wires	:	Polycab/Varsha/Shakticab/Finecore/Deepanjan
10.	M S Conduits	:	Bharath / GB / Prince
11.	PVC Conduits	:	VIP / Precision / Nelco
12.	Emergency Talkback Console	:	TSG/ Airlight /heinrich/Ahuja
13.	Speaker	:	TSG/ Airlight /heinrich/Ahuja
14.	Amplifier	:	TSG/ Airlight /heinrich /Ahuja
13.	PA System	:	TSG Ambient/ Optimus/ Bosch Prasensa/Honeywell Variodyn/Heinrich
14.	Amplifier	:	TSG Ambient/ Optimus/ Bosch Prasensa/Honeywell Variodyn/Heinrich

3.4. Technical data sheet

3.4.1. Butterfly Valves

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Code/ Standard	:	
4	MATERIAL OF CONSTRUCTION	:	

Sr .No.	Description	:	Data
5	Body	:	
6	Disc	:	
7	Shaft	:	
8	Shaft Seal	:	
9	S.G Iron	:	
10	Test Pressure	:	
11	Coupling binding	:	
12	Quick coupling	:	
13	Testing and Inspection	:	
14	Catalogues	:	

3.4.2.Fire Hose

Sr .No.	Description	:	Data
1	FIRE HOSE	:	
2	Manufacturer	:	
3	Type	:	
4	Code	:	
5	Size & Length	:	
6	Working pressure	:	
7	Test pressure	:	
8	Burst Pressure	:	
9	Complete assembly test (Coupling with hose)	:	
10	Coil diameter for 45 m length	:	
11	Weight gm/m	:	
12	COUPLING	:	
13	Manufacturer	:	
14	General Construction	:	
16	End fittings (quick coupling end)	:	
17	Material of Construction of Lug	:	
18	Coupling binding	:	
19	Quick coupling	:	
20	Testing and Inspection	:	
21	Catalogues	:	

3.4.3.Hydrant Valve

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Size / Model	:	
3	Type	:	
4	Spring / washer	:	
5	MATERIAL OF CONSTRUCTION	:	
6	Body	:	
7	Stop vale	:	
8	Instantaneous Female outlet	:	
9	Blank Cap	:	
10	Hand wheel	:	
11	Spindle	:	

Sr .No.	Description	:	Data
12	Seat tightness test	:	
13	Body test	:	
14	Flow test	:	
15	Testing / inspection certificates/ Catalogues	:	Manufacturers test
16	Approval	:	
17	Testing and Inspection	:	
18	Painting	:	
20	Testing and Inspection	:	
21	Catalogues	:	

3.4.4.Branch pipe with nozzle

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Standard	:	
3	Branch pipe type	:	
4	Nozzle	:	
5	MATERIAL OF CONSTRUCTION	:	
6	Branch pipe	:	
7	Nozzle	:	
8	Coupling	:	
9	Branch pipe Size	:	
10	Nozzle Size	:	
11	Hydro test pressure	:	
12	Flow	:	

3.4.5.Hose reel

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Standard	:	
	Type	:	
3	Test pressure	:	
4	Flow rate	:	
5	Water throw	:	
6	Hose reel	:	
7	Base plate	:	
8	Bearing	:	
9	Hose	:	
10	Shut off nozzle	:	
11	Side reel	:	
12	Stop valve	:	
13	Wall bracket	:	
14	Finish	:	
15	Size	:	
16	Colour	:	

Sr .No.	Description	:	Data
17	Marking	:	
18	Accessories	:	
19	Hose length and dia	:	

3.4.6.Pipes and fittings

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Standard	:	
3	Type	:	
4	Material	:	
5	Class & Grade	:	
6	Type of End connection	:	
7	Maximum testing pressure	:	
8	Test Pressure	:	
9	UNDER GROUND PIPE	:	
10	Manufacturer	:	
11	Type	:	
12	Standard	:	
13	Dimension	:	
14	Grade	:	
15	Initial coat	:	
16	Over lap in wrapping	:	
17	Testing	:	
18	Testing voltage	:	
19	ABOVE GROUND PIPE	:	
20	ENAMEL PAINT	:	
21	Make	:	
22	Color	:	
23	Drying time at 30 deg	:	
24	Thinner	:	
25	Over coating interval at 30 deg	:	
26	PRIMER	:	
27	Make	:	
28	Drying time at 30 deg	:	
29	Over coating interval at 30 deg	:	
30	Thinner	:	
31	BOLTS & NUTS	:	
32	Make	:	
33	Standards	:	
34	Size & Spacing	:	
35	WELDING ELECTRODES	:	
36	Type / make	:	
37	FITTINGS	:	
38	Manufacturer	:	
39	Type up to 50 mm dia	:	
40	Type above 50 mm dia	:	
41	Code/ Standard	:	
42	Flanges	:	

Sr .No.	Description	:	Data
43	Gasket		

3.4.7.Fire Shutter

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	standard	:	
3	Material of construction	:	
4	Finish	:	
5	Glass thickness	:	
6	Size	:	
7	Colour	:	
8	Marking	:	
9	Locking arrangement	:	
10	GA drawing	:	

3.4.8.Fire hose cabinet

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Standard	:	
3	Material of Construction	:	
4	Finish	:	
5	Material of construction	:	
6	Glass thickness	:	
7	Size	:	
8	Color	:	
9	Marking	:	
10	Locking arrangement	:	
11	Type	:	
12	GA Drawing	:	

3.4.9.Air release valve

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Standard	:	
3	Material of construction	:	
4	Maximum test pressure	:	
5	Maximum working temperature	:	
6	Size	:	
7	End	:	

3.4.10. Ball valve

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Standard	:	
3	Material of construction	:	
	Type	:	
4	Maximum test pressure	:	
5	Size	:	
6	End	:	

3.4.11. Alarm valve

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Model	:	
4	Size	:	
5	DESIGN PARTICULARS	:	
a	Inlet flange	:	
b	Outlet flanges	:	
c	Flange dimensions	:	
d	Maximum rated working pressure	:	
6	MATERIAL OF CONSTRUCTION	:	
a	Housing	:	
b	Clapper / clapper bush	:	
c	Rubber clamp	:	
d	Body bush	:	
e	Seat Rubber	:	
f	Water motor gong bell	:	
g	Wet pilot trim	:	
h	Test & Alarm trim	:	
7	PAINTING	:	
a	Primer	:	
b	Finish	:	
8	TESTING AND INSPECTION	:	
a	Visual	:	
b	Hydro test pressure	:	
c	Marking on equipment	:	
d	Manufacture's name	:	
e	Year of manufacture	:	
f	Serial No.	:	
g	Size	:	
h	Rated Pressure	:	
9	DOCUMENTS TO BE SUBMITTED FOR INSPECTION	:	

Sr .No.	Description	:	Data
a	Test Certificate	:	
b	Material test certificate	:	
c	Guarantee Certificate	:	

3.4.12. Sprinkler

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Model	:	
4	End connection Size	:	
5	Operating temperature	:	
6	Orifice size	:	
7	K factor Metric	:	
8	Quartzoid bulb size	:	
9	Heat sensing element	:	
10	Approval	:	
11	Maximum working pressure	:	
12	Construction	:	
13	Finish	:	

3.4.13. Pressure gauge

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Working pressure	:	
4	Size	:	
5	Pressure range	:	
6	Ring type	:	
7	Element	:	
8	Connection size	:	
9	Color	:	
10	MATERIAL OF CONSTRUCTION	:	
a	Case	:	
b	Element	:	
c	Connection	:	
d	Movement	:	
e	Accessories	:	
f	Accuracy	:	
g	Over range protection	:	
h	Siphon type	:	

3.4.14. Pressure Switch

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Element Type	:	
3	Switch type	:	
4	End connection Size	:	
5	Operating temperature	:	
6	Max ambient temperature	:	
7	Switch type	:	
8	Switch rating	:	
9	Accuracy	:	
10	Enclosure protection	:	
11	Type of gland	:	
	Working pressure	:	
	Range	:	
12	Construction	:	
13	Element	:	

3.4.15. Flow Switch

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Static pressure rating	:	
4	Flow rate	:	
5	Contact rating	:	
6	Operating temperature range	:	
7	Enclosure rating	:	
8	Approvals	:	

3.4.16. Gate Valve

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Size	:	
3	Type	:	
4	Standard	:	
5	Pressure class	:	
6	End connection	:	
7	MATERIAL OF CONSTRUCTION	:	
a	Body	:	
b	Bonnet	:	
c	Wedge	:	
d	Stuffing box	:	
e	Gland	:	
f	Hand wheel	:	
g	Stem	:	

Sr .No.	Description	:	Data
h	Body seat ring	:	
i	Wedge seat ring	:	
j	Wedge nut	:	
k	Gasket	:	
l	Gland pack	:	
m	Thrust plate	:	
n	Bolt and nuts	:	
8	TEST PRESSURE	:	
a	Body	:	
b	Seat	:	
c	Model of operation	:	
d	Testing & Inspection	:	

3.4.17. Y strainer

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Size & Qty.	:	
4	Code/Standard	:	
5	Max. Pressure drop through strainer at design flow in clean condition	:	
6	Working Pressure	:	
7	Hydrostatic test pressure	:	
8	Mesh No.	:	
9	Gauge size of wire	:	
10	Ratio of screen to pipe cross sectional area	:	
	MATERIAL OF CONSTRUCTION	:	
a	Body	:	
b	Strainer Element	:	
c	Perforated Sheet	:	
d	Flange & Flat bar	:	
e	Gasket	:	
f	Studs/ Nuts	:	
g	Draining arrangement	:	
h	End connection	:	
i	Finish	:	

3.4.18. Non return Valve

Sr .No.	Description	:	Data
1	Manufacturer	:	
2	Type	:	
3	Size	:	
4	Quantity	:	

Sr .No.	Description	:	Data
5	Code/Standard	:	
7	MATERIAL OF CONSTRUCTION	:	
a	Body	:	
b	cover	:	
c	Door	:	
d	Body seat ring	:	
e	Hinge	:	
f	Hinge pin	:	
g	Bolt nut	:	
h	Gaskets	:	
i	Disc facing ring	:	
j	Counter flange	:	
8	HYDROSTATIC TEST PRESSURE FOR PN 1.6 RATING	:	
a	Body	:	
b	Seat	:	
c	End connection	:	
d	Hand wheel	:	

3.4.19. Flow meter

Sr .No.	Description	:	Data
1	Make	:	
2	Size	:	
3	Model	:	
4	Type	:	
5	Velocity ranges	:	
7	Operating Temperature	:	
8	Pressure rating	:	
9	Operating Pressure	:	
10	Range	:	
11	Lining	:	
12	Electrodes	:	
13	Accuracy	:	
14	Display	:	
15	End Connection	:	

3.4.20. Booster pump

Sr .No.	Description	:	Data
	Pump		
1	Manufacturer		
2	Type		
3	Pumping temperature		
4	Specific gravity at the pumping temperature		
6	Liquid handled		

Sr .No.	Description	:	Data
6	Performance Standard		
7	Pump rated speed (RPM) (Normal design speed)		
8	Solids in suspension		
9	Suction condition		
10	Suitable for parallel operation		
11	Efficiency		
12	Drive		
13	Pump rated Flow		
14	Pump rated head		
15	Guaranteed pump input at rated capacity		
16	Guaranteed Motor input at rated capacity without any +ve tolerance		
17	Pump Shut of head		
18	Rated output of motor		
19	Margin considered over pump KW for selection of motor rating (%)		
20	Pump rated speed		
21	Maximum power input to the pump at rated speed over the entire operating range (KW)		
22	NPSH required at		
a	Minimum flow (M)		
b	Rated flow (M)		
c	Runout flow (M)		
23	Tolerance on discharge at guaranteed TDH		
24	Tolerance on efficiency at guaranteed TDH		
25	Specific speed as per IS 5120		
26	Range of pump operation		
27	Maximum flow (M ³ /hr)		
a	Minimum flow (M ³ /hr)		
b	Pump motor capable of starting with		
30	Discharge valve open (yes/No)		
31	Discharge valve closed (yes/No)		
32	Number of stages		
33	Discharge valve partially open (Yes/No)		
34	Type of closing		
35	Impeller type		
36	Procedure for impeller removal		
37	Size of impeller offered in mm		
38	Maximum impeller size possible for the model mm		
39	Minimum impeller size possible for the model mm		
40	Range of safe and stable operation in terms of rated flow %		

Sr .No.	Description	:	Data
41	Motor make		
42	Direction of rotation viewed from coupling end		
43	Pump suction flanges		
a	Type & orientation		
b	Connection size		
c	Flange dimension standard & class		
44	Pump Discharge flanges		
a	Type & orientation		
b	Connection size		
c	Flange dimension standard & class		
45	Type of coupling		
a	Coupling guard provided (Y/N)		
46	Shaft sealing arrangement		
a	Packing type		
47	Pump shaft bearings		
a	Drive end		
i	Type		
ii	Type of lubrication		
iii	Design life in hours		
b	Non Drive end		
i	Type		
ii	Type of lubrication		
iii	Design life in hours		
48	Casing		
49	Impeller		
50	Shaft		
51	Stuffing box		
52	Bearing		
52	Mechanical seal		
54	Base plate		
55	Nuts ,Bolts & lock washers		
56	Companion flanges		
57	Other components		
a	Supply accessories /Data		
b	Common base frame		
c	Foundation bolts, shims and nuts		
d	Suction & discharge companion flanges		
e	Eye bolts ,lift hook		
f	Running performance		
g	Material certificates		
h	Performance curve		
i	Family curve of offer model		
j	Dimensional drawing of total assembly		
	Motor		
1	Manufacturer		
2	Type		
3	Efficiency class		
4	Number of poles		
6	Rated power		
6	Mains frequency		

Sr .No.	Description	:	Data
7	Rated voltage		
8	Rated current		
9	Starting current		
10	Power factor		
11	Rated speed		
12	Motor efficiency		
a	At full load		
b	At ¾ load		
c	At ½ load		
13	Enclosure class		

3.4.21. Fire alarm panel

Sr .No.	Description	:	Data
1	Manufacturer		
2	Model		
3	Type		
4	System Capacity		
5	Intelligent detectors		
6	Intelligent devices		
7	Display		
8	Number of characters in the display		
9	History		
10	Advanced history filters allow sorting by event, time, date, or address.		
11	Alarm Verification selection per point, with tally		
12	Auto programming and Walk Test reports		
13	QWERTY keypad		
14	Flash scan		
15	Detectors wiring		
16	Detection addressable loops , Main fire control panels, Repeater panel (s) and therefore return to the control panel		
17	Acknowledge Switch		
18	Signal Silence Switch		
19	Drill Switch		
20	System Reset Switch		
21	Lamp Test		
22	Scroll Display Keys		
23	Pre-signal and Positive Alarm Sequence		
24	Smoke Detector Pre-alarm Indication at Control Panel		
25	Action, alert function		
26	Device Blink Control		
27	NFPA 72 Smoke Detector Sensitivity Test		
28	Programmable Trouble Reminder		
29	On-line or Off-line programming		
30	Smoke Control Modes		

Sr .No.	Description	:	Data
31	Drill		
32	Passwords and Users		
33	Two Wire Detection		
34	Block Acknowledge		
35	Sensitivity Adjust		
36	Environmental Drift Control		
37	Custom Action Messages		
38	Print Functions		
39	Local Mode		
40	Resound based on type for security or supervisory		
41	Read status preview - enabled and disabled points		
42	Custom Graphics		
43	Tracking/Latching Duct		
44	Active Event		
45	Non-Fire Alarm Module Reporting		
46	Security Monitor Points		
47	One-Man Walk Test		
48	General Zones		
49	Logic Equations		
50	trouble equations per device		
51	Control-By-Time		
52	Multiple agent releasing zones		
53	Alarm Verification, by device, with timer and tally		
54	CPU		
55	System Circuit Supervision		
56	Field Programming		
57	Primary Input Power		
58	General Purpose Power		
59	Battery Charger Range		
60	Temperature Range		
61	Humidity		
62	Approvals		

3.4.22. Manual call point

Sr .No.	Description	:	Data
1	Make		
2	Model		
3	LED		
4	Key reset		
5	Type		
6	Addressing Requirements		
7	Operating Voltage		
8	Max. SLC Loop Voltage		
9	Max. SLC Loop Current		

Sr .No.	Description	:	Data
10	Operating Temperature Range		
11	Humidity Range		
12	Indication		
13	Approvals		

3.4.23. Control modules

Sr .No.	Description	:	Data
1	Make		
2	Model		
3	Addressing Requirements		
4	Operating Voltage		
5	Max. Current Draw		
6	Average Operating Current		
7	External Supply Voltage		
8	Drain Or External Supply		
9	EOL Resistance		
10	Temperature Range		
11	Humidity Range		
12	Approvals		

3.4.24. Hooter cum strobe

Sr .No.	Description	:	Data
1	Make		
3	Model		
4	Standards		
5	Nominal Voltage		
6	Operating Voltage Range		
7	Standard Operating Temperature		
8	Humidity Range		
9	Input Terminal Wire Gauge		
10	Decibel level		
11	Number of tones		
12	Strobe Flash Rate		
13	Color		
14	Approvals		

3.4.25. Amplifier

Sr .No.	Description	:	Data
1	Make		
2	Model		
3	Class		
	Channel		
4	Maximum RMS Wattage		
5	Dynamics		
6	Operating Frequency		
7	Voltage Gain 100V OUT		
8	Cooling		

Sr .No.	Description	:	Data
9	Emergency Power		
10	Max. output voltage		
11	Slew rate 100V OUT, Rated impedance		
12	Input impedance		
13	Amplifier Output		
14	Other Features		

3.4.26. 2 runs of 1.5 sq. mm, copper conductor

Sr .No.	Description	:	Data
1	Make		
2	Core/Size		
3	Conductor		
4	Core Insulation		
5	Color of Core Insulation		
6	Inner Sheath		
7	Outer Sheath		
8	Color of Outer Sheath		
9	Maximum resistance of conductors		
10	Maximum Capacitance between cores		
11	Voltage Rating		
12	FRLS/ Non-FRLS		
13	Testing standards		
14	Temperature Index		
15	Oxygen Index		
16	Acid Gas generation		
17	Smoke density rating		
18	Period of burning after removal of Flame		
19	Total length of cable decomposed on Removal of flame		
20	Anti-Rodent Test		
21	Standard of Construction		
22	Application		
A	CONDUIT		
1	MAKE		
2	Outer Diameter		
3	Color		
4	Inner Diameter		

4. COMMISSIONING

4.1. Fire Protection System

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 Architect 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 water supply lines for ease of installing pressure gauge, temperature gauge & rota meters. Contractor shall also supply all required pressure gauge, temperature gauge & rota meter 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.

4.1.1.Pre-Commissioning

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 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 pre-treatment. 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 Architect 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 as for above.
- 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.

4.1.1.1. Fire Hydrant 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).

4.1.1.2. Sprinkler System

- a. Start the sprinkler pump and develop the required pressure in the sprinkler pipes.
- b. Open the test valve to test the automatic starting of the pump. If necessary, make necessary adjustments in the setting of pressure switch. The sprinkler water gong alarm shall also operate when the test valve is open. This operation is to be done for each and every section of the sprinkler system and the alarm for each section (via flow switch) shall be checked for operation.
- c. After satisfactory operation of the pump the Contractor shall set up mock fire and test the system.
- d. Check all annunciations by simulating the alarm conditions at site.

4.1.2. Commissioning and Testing

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 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 cut off 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,

Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump,

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.

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. Check all annunciations by simulating the alarm conditions at site.

4.2. Fire Alarm system

4.2.1. General

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. Continuity test and other ground fault test shall be recorded and submitted.

Contractor shall ensure proper balancing of the fire detection & PA systems installed in his scope of work. 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.

4.2.2. Pre-Commissioning

On completion of the installation of all panels ,controller, detectors ,devices & speakers etc. the Contractor shall proceed as follows:

After a Fire Test

- Check all detectors utilizing ionizing radioactive isotopes for contamination and take Appropriate action to deal with any leakage.
- Check and test any detector or call point which may have been adversely affected by the fire, for correct operation.
- Check and test each alarm sounder for correct operation.
- Any defect found should be recorded in the logbook and immediate action taken to correct the fault. Inform the maintenance company and check that repairs to defects are carried out.
- Care should be taken while two detectors get detected in Server Rooms/data centres since the detectors have been cross zoned and connected to Auto Gas Release System, if the fire panel is not reset within 50 seconds. AS soon as the 50 seconds are up, the solenoid valve is activated and the gas is released immediately to effectively extinguish the fire.
- If the fire was not detected or was detected at a late stage then the reasons for this should be investigated and the system modified if required in order to prevent any repetition. Upon completion of all work, and if applicable, investigations, obtain a 'certificate of testing' from the maintenance company engineer and update the records with details of any changes carried out.

After a False Alarm

A false alarm can be a serious condition for any fire system since all confidence in the system can be lost. Each alarm, however, must be treated as a real alarm until proven otherwise. If an alarm is found to be false, the system supervisor should ensure that the following actions are carried out:

- Identify the offending detector or call point, by noting the reading of device and corresponding location on LCD display of Control Panel.
- Establish the cause of the false alarm (if possible). This may require an evaluation of all events, which occurred prior to the alarm condition.
- Record details of the false alarm in the log book and instruct the maintenance company to thoroughly investigate the cause. If one detector or a group of detectors is responsible for more than one false alarm every two Years, or the system produces more than one false alarm per year for each ten detectors then a special investigation should be undertaken by the maintenance company to resolve the Cause.

4.2.3. Fire Detection system

Cable shall be tested with a volt/ohm meter & with a known resistance to verify that there are no stray (unwanted) voltages between cable cores or between cable cores and ground. Unless a different threshold is specified in the system installed equipment manufacturer's specifications, the maximum allowable stray voltage shall not exceed 1 volt ac/dc.

Ensure that the cables are laid as per the approved shop drawing and 3 clamps/saddles per mtr provided for cables. Cables dropped at right places and at required length. Quality of Junction Boxes and properly glanced and Un used holes in Junction boxes fully covered

- Check that there are no joints in cables in between detectors & devices
- Cable continuity to be checked after the installation of detectors & devices
- Check the No of Loops supplied & Installed
- Check whether the nameplates installed on the panel
- Check whether the height of installation & alignment of the enclosure is proper
- Check for proper physical mounting of the panel - Surface, Semi Flushed, Full flushed, Rack, Panel mounting etc.,
- Check whether the cable glands are used to draw cables inside the controller cabinet
- Check whether the unused gland holes covered with rubber grommets
- Check for proper Panel Grounding
- Check whether all the field devices been installed and wired to the system as per respective device's Installation & wiring manual

Check whether all the locations, address, names of each detector & device has been correctly programmed. Check for control logic for AC trip, Actuation of signalling circuits, Zone announcements, Access , PA & Gas based fire fighting system inter locks

At a minimum, FACP shall be tested to verify correct receipt of alarm, supervisory and trouble signals (inputs), operation of evacuation signals and auxiliary functions (outputs), circuit supervision including detection of open circuits and ground faults, and power supply supervision for detection loss of AC power and disconnection of secondary batteries.

All secondary (standby) power shall be disconnected and tested under maximum load, including all alarm appliances requiring simultaneous operation. All Secondary (standby) power shall be reconnected at end of test. For redundant power supplies, each shall be tested separately.

All primary (main) power supplies shall be disconnected and the occurrence of required trouble indication for loss of primary power shall be verified. The system's standby and alarm current demand shall be measured or verified and using manufacturer's data, the ability of batteries to meet standby and alarm requirements shall be verified.

General alarm systems shall be operated for a minimum of 5 minutes and emergency voice communication systems for a minimum of 15 minutes. Primary (main) power supply shall be reconnected at end of test

A Supervisory device shall be actuated and receipt of a supervisory signal at the off-premises location shall be verified. If a transmission carrier is capable of operation under a single or multiple fault condition, and initiating device shall be activated during such fault condition and receipt of a trouble signal at the off-premises location shall be verified, in addition to the alarm signal

Both portions of the detector shall be operated independently as described. Water shall be flowed through an inspector's test connection indicating the flow of water equal to that from a single sprinkler of the smallest orifice size installed in the system for wet pipe systems, or an alarm test by pass connection for dry pipe, pre-action, or deluge systems in accordance with NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water based Fire Protection Systems

Tripping of AHUs, Precision AC, Split ACs, Fresh Air Fans/exhaust fans/smoke vents etc., shall be tripped based on the programmed control logic in an event of alarm

4.2.4. Emergency Talk Back systems

At a minimum, System Controller/ FACP /Amplifier shall be tested to verify correct zone wise transmission of alarm / evacuation message, all call feature, integration with FACP etc.,

All secondary (standby) power shall be disconnected and tested under maximum load, including all alarm appliances requiring simultaneous operation. All Secondary (standby) power shall be reconnected at end of test. For redundant power supplies, each shall be tested separately.

- Check the No of Zones supplied & Installed
- Check for control logic for Zone wise message, activation of all call to work in conjunction with the evacuation procedure & policy
- Check whether the speakers are loaded only up to 80% of the RMS Load of the amplifiers
- Check for correctness of ferruling at the Fire Alarm Panel /System Controller with the relevant drawings & ferrule
- Check for the wattage tapping taken in the speaker & check whether that wattage covers the complete area between speakers

If a UPS system dedicated to the fire alarm system is used as a required power source, operation of the UPS system, standard on Stored Electrical Energy Emergency and Standby Power Systems.

The RMS capacity of each amplifier shall be checked & check the sufficiency of power to each zone by the amplifier list. Ferruling to be done for each core of the cable and cable tagging to be done for each cable.

4.2.5. Testing

The testing procedure for checking the installation, quality and performance of the system shall be submitted by the vendor and the same shall be approved by the Client. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.

- Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- Verify activation of all flow switches.
- Open initiating device circuits and verify that the trouble signal actuates.
- Open signalling line circuits and verify that the trouble signal actuates.
- Open and short notification appliance circuits and verify that trouble signal actuates.
- Ground initiating device circuits and verify response of trouble signals.
- Ground loop circuits and verifies response of trouble signals.
- Ground notification appliance circuits and verify response of trouble signals.
- Check presence and audibility of tone at all alarm notification devices.
- Check installation, supervision, and operation of all intelligent smoke detectors during a walk test. During walk test system must be able to identify two detectors set to same address. All devices tested in walk test shall be recorded in the history buffer.
- Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

4.2.6. Commissioning

The testing procedure for checking the installation, quality and performance of the system shall be submitted by the vendor and the same shall be approved by the Client.

After the system installation has been completed, the entire system shall be checked out, inspected, and functionally tested by qualified, trained personnel, in accordance with the manufacturer's recommended procedures and NFPA standards.

4.3. Final Inspection & Approvals

4.3.1. Statutory Authorities' Tests and Inspections

As and when notified in writing or instructed by the Architect/Consultant, the Contractor shall submit shop drawing and attend all tests and inspections carried out by Water Authority and other Statutory Authorities, and shall forthwith execute free of charge any rectification work ordered by the Architect 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/Consultant 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 Architect may at his discretion instruct the Contractor for additional submissions to the Local Authorities whenever necessary.

The Contractor shall notify the Architect 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 Architect without delay.

4.3.2. 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 Architect/Consultant.

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.

4.3.3. 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 Architect either in whole or in part as he considers necessary/appropriate. Adjustment and/or modification work as required by the Architect 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/Architect/Consultant.

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 Consultant/Architect/Employer.

4.3.4. 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.

4.3.5. 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.

4.4. Guarantee

The contractor shall guarantee both the material and workmanship of first class quality corresponding to standard engineering practice.

For a period of One Year from the date of acceptance of the total installation, contractor has to repair or replace to the satisfaction of the Owner, any or all such work that may prove defective in workmanship, equipment or materials within that period, ordinary wear and tear and unusual abuse or neglect excluded, together with any other work, which may be damaged or displaced in so doing. Any defective materials / workmanship shall be rejected, the contractor has to rectify / replace at his own cost.

Also contractor has to test the entire installation upon completion and ensure that all units are functioning satisfactorily. Guarantee certificate of the materials supplied shall be handed over to the owner.



Unite Service Consultants India Pvt Ltd
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Bangalore 560068, INDIA
www.uniteconsultants.in

CCT SYSTEM

TECHNICAL SPECIFICATION

Client	SYAMA PRASAD MOOKERJEE PORT TRUST
Project Name	RIVERFRONT CRUISE TOURISM CENTRE AT KIDDERPORE
Project Location	KOLKATA, WEST BENGAL
Date	01/04/23
Revision	R0

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1. GENERAL

1.1. Scope of Work

The scope shall include the complete design, engineering, manufacture, supply, delivery, and storage at site, installation, testing and commissioning of a fully functional and complete CCTV system. All accessories and fitting hardware such as brackets / poles together with associated masonry work are included in the scope of work.

Video imaging equipment includes Dome cameras with fixed lens, real time Digital Video recorder; colour monitors environmental protection, etc. Transmission equipment including co-axial cables, control and power cables, FRLS PVC conduits, etc. Monitoring and control equipment including monitors, Digital Video Recorders etc.

The scope is deemed to include all components, accessories and equipment required to implement a fully functional CCTV system regardless of whether they are explicitly mentioned or not.

2. PRODUCT SPECIFICATION AND INSTALLATION

2.1. Camera

Camera shall be a high resolution, CCD camera comprising solid-state circuitry housed in a rugged case. The camera shall incorporate horizontal and vertical aperture correction with line lock synchronization. The camera shall be UL / CE/ FCC certified.

The camera shall be mounted such that a clear, unobstructed view of the scene to be observed is generated. The mounting bracket / pole and accessories shall be designed to ensure a proper, rigid support to the camera and to blend with the aesthetics of the location where the camera is mounted. The installation shall be done in a manner that the camera and its components / accessories are easily accessible for maintenance and there is minimal risk of accidental damage.

2.1.1. Video Monitor

The monitor shall comprise of a high resolution CRT/ LCD and solid-state electronics housed in a rugged metal case. It shall provide a clear and well-defined picture display on the screen. All controls for brightness, contrast, etc. shall be provided on the front panel. The monitor shall feature loop through connections for coupling the video to other monitors. It shall be suitable for rack or table mounting. The monitor shall be UL / CE certified.

2.1.2. Power Supply / distribution

The vendor shall supply all necessary power supplies of various voltages (AC and DC) required for various equipment. The power source shall be an UPS supply. The power supply to each camera shall be drawn separately from the distribution board and looping arrangement is not to be adopted. With regard to the cables, separate conduits and raceways shall be used to route the power and video cables.

2.2. Bullet Camera

- 5MP, 1/2.7"
- CMOS image sensor
- @25/30 fps, H.265 codec ,ultra-low bit rate,
- Built-in IR LED,
- max IR distance: 60 m
- SMART H.264+/H.265+ Digital Zoom
- WDR, 3D NR, HLC, BLC, digital
- Alarm 1 in 1 out

2.3. PTZ Camera,

- 1/2.8" 4Megapixel STARVIS™ CMOS,
- Powerful 32x optical zoom, Digital Zoom
- 16x, Max. 25/30 fps@4M, IR distance up to
- 150 m, Deep-learning-based auto tracking

- 4.9 mm–156 mm, Motion detection,
- Temperature –40 °C to +70 °C, IP67;

2.4. Network Video Recorder (NVR)

- A network video recorder (NVR) is a computer system that records video footage and stores it on a hard disk, a mass storage device, or cloud storage. NVRs are paired with digital internet protocol (IP) cameras to create a video surveillance system.
- (Network Video Recorder) with RAID
- 0/1/5/10 configuration, Embedded LINUX OS with 08 no’s SATA HDDs minimum
- 10TB storage
- 2MP Camera,
- 15fps for 30 Days
- H.265/H.264/MJPEG/MPEG4 codec decoding,
- Front Control Panel with LED.
- Indication, 4 nos. USB, iPhone; iPad;
- Android based Mobile clients, Video Export feature on USB,
- Search Mode: Time/Date;

2.4.1. Specifications

Operating System	Embedded LINUX/WINDOWS
Operation	Front panel, USB mouse, IR remote controller
Video	
Video Inputs	16 composite video 1.0Vpp, 75Ω, BNC
Video Outputs	1 composite video output, 1.0Vpp, 75Ω BNC; 1 VGA; 1 HDMI
Video Standard	PAL
Compression	H.264.H.265
Video Recording	16/32 Channel D1 @ 25fps, Dual encoding streams (D1 and CIF), Multicasting
Image Quality	6 Levels Adjustment
Privacy Masking	4 Customized Privacy Masking Zones for each Camera
Lock	Camera lock by authorized users
Audio Input / Output	16 line in / 1 line out
Audio Compression	G.711
Alarm	
Motion Detection	Up to 396 (22*18) detection zones, Sensitivity: 6 level adjustment
Video Loss and Blank	Trigger recording, PTZ control, alarm output, e-mail
Alarm Input / Output	16 inputs configurable NO/NC / 3 outputs, 30VDC, 1A, NO/NC
Storage	
Internal HDD	Up to 8 SATA hard disks, 16TB storage supported, Default 2TB
External Backup	E-SATA, USB CD-RW or DVD-RW, Network
HDD Management	HDD faulty alarm & Raid (Redundancy)
Recording Mode	Manual, continuous, video alarm trigger (motion detection, video loss

	and blank) and alarm trigger
Pre-alarm Recording	1 to 120 minutes (default: 60 minutes) interval file, pre-recording up to 30 seconds, post-recording up to 5 minutes
Search Mode	Date/time, Event (alarm, motion detection)
Playback	8 channel playback simultaneously (forward/reverse, fast playback, slow playback, freeze)
Digital Zoom	Selected zone can zoom in to full screen during playback
Network Protocol Support	TCP/IP, UDP, DHCP, DNS, IP Filter, PPPOE, DDNS, FTP
Remote Control Function	Monitor, PTZ control, playback, configuration, download
Network Interface	RJ-45 (10/100M)
USB Interface	4 USB 2.0 ports
Serial Interface	RS-232 port for PC connection
PTZ Control Interface	RS-485
Power Input	100 to 240VAC 50Hz/60Hz
Power Consumption	40-100 W
Operating Temperature	- 10°C - 55°C
Relative Humidity	10% - 90 % non-condensing
Mounting	Desktop or Rack Mount (2U Height)
Certification	CE, FCC, CCC,

2.5. Camera Housing

- Rugged construction and Options of mounting to walls, ceilings and poles.
- Suitable for a wide range of indoor and outdoor applications.

2.5.1. Features

- Die-cast and extruded aluminum construction
- Total access design allowing access to camera from all sides
- Adjustable mounting track
- 3/4", 1/2" and 1/4" cable entry glands (PG21, PG16, and PG9)
- Sunshield option
- Compatible for Indoor and outdoor installations
- Epoxy powder coated for corrosion resistance
- Outdoor Housing : Dust-proof, IP66 weatherproof rating
- Pre-assembled heater and blower for Outdoor Installation
- Dual positive locking clamps
- Reversible camera mounting tray to elevate low profile cameras

2.6. Video Monitor

Picture tube	21-inch diagonal, 90° deflection.
Horizontal resolution	Minimum 700 TV lines (min).
Video input	HDMI connector DVI connector VGA connector
Contrast ratio	1000 : 1
Controls	On / off, brightness, contrast, vertical hold, horizontal hold.
Operating temperature	0° to 50°C.
Humidity	10 to 90 % RH (non-condensing).
Certification	UL / CE.

2.7. Video Cable

2.7.1. RG – 59

Type	RG 59
Impedance	75 ohms
Inductance	0.115 micro henries /feet
Capacitance	20.5 pF/feet
Delay	1.54 ns/feet
Conductor DC resistance	49 ohms / 1000 feet
Shield DC resistance	2.6 ohms / 1000 feet
Max. operating voltage	150 VRMS (UL) / 1700 VRMS (non-UL)
Temperature	-40 to +60 degrees Celsius
Conductor material	23 AWG solid bare copper, coded steel 0.023"
Insulation material	Polyethylene
Shield type	Bare copper braid with 95% coverage
Jacket	Non-contaminating PVC (black color)
Use	Suitable for indoor and outdoor

2.8. Power Supply

No. of cores	2 / 3 as per equipment requirement
Construction	1.5 sq. mm. PVC sheath as per relevant IS standards.

SCHEDULE T
SYAMA PRASAD MOOKERJEE PORT, KOLKATA

ANNEXURE-C (Contd.)

**CONCURRENT COMMITMENT(S) OF THE BIDDER (i.e. Works in The Hand Of
The Bidder At The Time Of Submission Of Tender Offer)**

**(To be submitted with Part-I of
Offer) Bidders must fill in the under
noted columns.**

Sl. No.	Full particulars of works to be executed concurrently by the bidder. (i) Name of work. (ii) Client. (iii) W.O. No. & Date.	Sanctioned Tender Value. (in Rs.)	Completion time as stated in tender.	Name and address to whom reference can be made.
1	(i)			
	(ii)			
	(iii)			
2	(i)			
	(ii)			
	(iii)			
3	(i)			
	(ii)			
	(iii)			
4	(i)			
	(ii)			
	(iii)			

(To be submitted with Part-I of Offer) ANNEXURE-C (Contd.)
SCHEDULE 'O' SHEET – 1

The Bidders are also requested to furnish the following particulars: -

A) In case of Limited Company -

- 1) Name of Company :
- 2) Address of its present registered office. :
- 3) Date of its incorporation :
- 4) Full name and address of each of its Directors – any special particulars as to Directors if desire to be stated. :
- 5) Name, address and other necessary particulars of Managing Agents, if any appointed by the Company. :
- 6) Copies of Memorandum, Articles of Association (with the latest amendments, if any). :
- 7) Copies of audited balance sheets of the Company for the last **three years**. :

B) In case of a firm -

- 1) Name and address of the firm. :
- 2) When business started :
- 3) If registered a certified copy of certificate of registration. :
- 4) A certified copy of the Deed of Partnership :
- 5) Full name and address of each of the partners and the interest of each partner in the partnership – any special particulars as to partners if desired to be stated. :
- 6) Whether the firm pays income tax over Rs.10, 000/- per year :

(To be submitted with Part-I of Offer)

SCHEDULE 'O' SHEET – 2.

C) In case of an Individual:

1) Full name and address of the Bidder any special particulars of the Bidder if desired to be stated.

2) Name of the father of the Bidder.

3) Whether the Bidder carries on business in his own name or any other name.

4) When business was started and by whom.

5) Whether any other person is interested in the business directly or indirectly, if so, name and address etc. of such persons and the nature of such interest.

6) Whether the Bidder pays Income Tax over Rs.10, 000/- per year.

Dated:

(Full Signature of Bidder)

(Proforma of Performance certificate/credential of works)

[To be issued on issuing authority's letterhead duly signed with office seal]

1.	Name of the Certifying Authority:	
2.	Name of the work:	
3.	Name of the Contractor:	
4.	Schedule date of commencement and completion of the work as per Work Order:	
5.	Date of actual commencement of work & date of actual completion:	
6.	i) If there is time overrun, whether delay is due to the contractor (Yes/No.): ii) If yes, what is the extent of delay attributable to the contractor:	
7.	Sanctioned Tender value & Actual value executed:	
8.	Quality of work (Excellent/satisfactory/poor):	
9.	Remarks (If any):	

DOCUMENTS TO BE UPLOADED ALONG WITH PART –IScanned copy of the following documents to be uploaded: -

- i) GST registration certificate.
- ii) Valid Trade Licence (Valid for current period & also for type of work).
- ii) Valid Professional Tax Clearance Certificate / Up to date tax payment challan. If this is not applicable, the bidder must submit a declaration in this regard.
- iii) Proof of possessing valid Employees' Provident Fund (EPF) Account. EPF Registration Certificate.
- iv) Proof of being registered with Employees' State Insurance Corporation (ESIC), ESI Registration Certificate
- v) Details of the firm as per Schedule-O (in Part-I) of the tender document duly filled up.
- vi) Credentials in the form of copies of Letters of Award of Works along with corresponding Completion Certificates from owners to justify that the intending bidder satisfies the earlier mentioned pre-qualification criteria.
- vii) Balance sheet and Profit and Loss account / Trading account for the last 3 (three) financial years **(i.e. 2020–2021, 2021-2022 and 2022-2023). The same should be audited as per relevant norms wherever required along with UDIN of the Auditor**
- viii) Bank Draft/ Pay Order etc. regarding **Cost of EMD and Tender documents / valid NSIC certificate.**
- ix) PAN Card
- x) A list of technically qualified and skilled persons would be engaged to supervise and execute the work **(to be mentioned in the letter head of the Firm).**
- xi) Self- declaration of the bidder that the Bidding Firm has Not been debarred / de-listed by any Govt / Quasi Govt. / Public Sector undertaking in India **(to be mentioned in the letter head of the Firm).**
- xii) Self declaration regarding the proprietor/partner(s)/authorized signatory of the bidding firm (in the case of proprietorship firm /partnership firm /limited company, as the case may be) is/are not associated with any other firm bidding for the same work **(to be mentioned in the letter head of the Firm).**
- xiii) A list of works which are in hand at the time of submitting the offer as per the enclosed proforma titled 'Concurrent Commitments of The Bidder' vide 'Annexure-C' (Schedule –T) in Part-I of the tender document.
- xiv) Undertaking of the tenderer to be submitted as per enclosed Pro-forma (Annexure –D-1) in lieu of submission of signed copies of the full Tender document, G.C.C, addenda & corrigendum **in the letter head of the Firm.**

xv) Last page of “Bill of Quantities” & the “Form of Tender” duly filled up (without price quoted) shall be duly signed and stamped by the Bidder.

xvi) Copy of duly Filled up Integrity Pact in Stamp Paper of valued Rs. 100.00

xvii) TDS certificate including 26 AS should essentially be submitted to validate the legitimacy of the work completion certificate.

N.B.-1 The bidder will have to produce the original documents or any additional documents, if asked for, to satisfy the Authorities.

N.B.-2 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have made misleading or false representations in the forms, statements and attachments submitted in proof of the qualification requirements and their EMD will be forfeited for such action.

NIT NO. SMPK/KDS/CIV /T/2830/12 DT. 08.03.2024

**[DOCUMENT TO BE DOWNLOADED, FILLED IN UNDER BIDDER’S LETTERHEAD, SIGNED,
SCANNED AND UPLOADED]**

**Undertaking to be submitted in lieu of uploading/submitted signed copy of full tender
document**

Ref. No.....

Dated:

The Chief Engineer,
Syama Prasad Mookerjee Port, Kolkata,
Civil Engineering Department,
15, Strand Road,
Kolkata – 700 001

Dear Sir,

1. We,..... (Name of Tenderer) have fully read and understood the entire Tender Document, GCC, Corrigendum and Addenda, if any, downloaded from under the instant e-tender and no other source, and will comply to the said document, GCC, Corrigendum and Addenda.

We are submitting this undertaking in lieu of submission of signed copy of the full tender documents GCC, Corrigendum and Addenda.

Yours faithfully,

Signature of Tenderer.....

Name:

Designation:

Date:

Seal of the tenderer:.....

**SYAMA PRASAD MOOKERJEE PORT, KOLKATA
CIVIL ENGINEERING DEPARTMENT
6, Fairlie Place (Fairlie Warehouse, 2nd floor),
Kolkata 700 001.**

NIT No.: SMPK/KDS/CIV /T/2830/12 DT. 08.03.2024

NOTE: Last Date of Download of tender documents: 08.04.2024 (up to 14.00 hours)

Tender is due for submission by 15.00 Hrs. On 08.04.2024

Tender is due to open after 13.00 Hrs. On 09.04.2024

Price Bid

इंडेंट्योर मेमोरियल क्षेत्र के निकट केडीएस, एसएमपी, कोलकाता में रिवरफ्रंट सौंदर्यीकरण कार्यों के साथ-साथ रिवर क्रूज़ टर्मिनल और नदी पर्यटन सुविधा का विकास”

Development of River Cruise terminal and river tourism facility alongwith riverfront beautification works at KDS, SMP, Kolkata – adjacent to Indenture Memorial area



SYAMA PRASAD MOOKERJEE PORT, KOLKATA
सिविल इंजीनियरिंग विभाग / Civil Engineering Department
6, फ़ॉर्ली प्लेस (फ़ॉर्ली वेयरहाउस)/6, Fairlie Place (Fairlie Warehouse, 2nd floor)
कोलकाता - 700 001 /Kolkata - 700 001



NIT No:- SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

(BILL OF QUANTITIES)

Development Of River Cruise Terminal and river tourism facility alongwith riverfront beautification works at KDS , SMP,Kolkata -adjacent to Indenture Memorial Area.

(i) Name of the bidder :-	
(ii) Address of the bidder :-	
(iii) Contact number of bidder :-	
(iv) e-mail ID of the bidder :-	

PART A :- CIVIL ENGINEERING WORKS

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
A1	Retrofitting and rehabilitation works :-						
1	Carry out required repair/rehabilitation / strengthening works of existing old structures to enhance the performance of the structure, extend the service life or increase the load carrying capacity including but not limited to the following steps: (i)Condition Evaluation (ii)Determination of the cause of the deterioration (iii)Selection of repair methods and materials (iv)Preparation of drawings and specifications for approval (v)Execution Process (vi)Deployment of competent sub agency after approval (vii)Appropriate quality control measures (viii)Maintenance after completion of the repair works.						
	The work shall have to be carried out keeping the following parametrs in consideration :- <ul style="list-style-type: none"> • Aging of structures-Expected life and performance • Deterioration of concrete-causes and effects • Durability considerations • Distress diagnostics and performance monitoring-Non-Destructive test methods. • Damage assessment and evaluation models • Structural condition assessment • Analysis and Design of repairs-suitable repair techniques • Materials for protection, repair and rehabilitation • Repair Techniques-Shotcreting, guniting etc • Refurbishment and Strengthening techniques • Seismic retrofitting • Bridge rehabilitation. 	L.S.	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
A2	Piling Works :-						
1	Provide Bored Cast-in-situ M:30 grade R.C.C. pile in position as per specifications in all kinds of soil including cost of boring using drilling mud to stabilize the bore and flushing the bore of excess mud with freshly prepared drilling fluid by using pumps prior to placing concrete by tremie pipe in one continuous operation and including the cost of all materials and labour for placing of concrete and also including the cost of mobilization and hire charges of all equipment necessary for boring, welding of reinforcement cage as necessary and lowering of reinforcement cage, preparation and placing of concrete, including the cost of concrete but excluding the cost of reinforcement and labour for bending binding etc. complete as per Drawing and Technical Specifications and removal of excavated earth with all lifts and lead upto 1000 m. Work to be executed as per IS: 2911 (Part II Sec 2) ,Using tripod, winches .For Pile diameter - 600 mm. (The rate includes providing temporary steel casing upto 3m depth).	Running Meter	1410.000				
2	Supply ready mixed concrete of M 30 Grade with well graded stone chips of 20 mm nominal size containing designed quantity of cement per Cu.m of wet concrete produced in computerised batching plant under controlled condition using approved super plastisizer, designing concrete mix following I.S. 10262 and I.S. 456, transporting the mix with agitation in transit mixer to work site depositing the mix on a platform erected for the purpose at required levels of concreting and then placing the mix in its final location of form work, compacting and curing the same complete as per specification & direction of the Engineer-in-charge including computerised batching plant transit mixer with all accessories vibrators etc. inclusive of all other incidental charges in this connection complete but excluding cost of hire charge of platform and its supporting staging which would be paid through separate item.Rate includes cost of cement and without concrete pump.	Cum	390.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
3	Provide reinforcement for reinforced concrete work in all sorts of structures including distribution bars, stirrups, binders etc initial straightening and removal of loose rust (if necessary), cutting to requisite length, hooking and bending to correct shape, placing in proper position and binding with 16 gauge black annealed wire at every intersection, complete as per drawing and direction-for works in foundation, basement and upto roof of ground floor/upto 4 m - Mild or HYSD bars SAIL/TATA/RINL make.	MT.	24.500				
4	Remove of mud/sludge/slurry/liquid earth obtained during piling work from the working site and disposal of the same beyond the KMC/Municipal or any suitable area with conformity of Municipal Corporation Rules using tanker including loading and unloading the same with pump, clearing the site complete in all respect as per direction of the Engineer-in-charge-For 600mm dia Pile.	Running Meter	1410.000				
5	Carry out Lateral load testing of single pile in accordance with IS Code of practice IS : 2911 (Part IV) for determining safe allowable lateral load on pile :- Upto 50 tonne capacity pile.	Each	1				
6	Vertical load testing (initial) of piles in accordance with IS : 2911 (Part-IV) including installation of loading platform and preparation of pile head or construction of test cap and dismantling of test cap after test etc. complete as per specification & group of two or more up to 50 tonne-Testing load between 100 T and 150 T. Note: This test shall be done on working piles only in a pile group and should satisfy the provisions of routine test as given in IS-2911 (Part IV) 1985	Per test	1				
7	Carry out Integrity testing of Pile using Low Strain / Sonic Integrity Test / Sonic Echo Test method in accordance with IS 14893 including surface preparation of pile top by removing soil, mud, dust & chipping lean concrete lumps etc. and use of computerized equipment and high skill trained personal for conducting the test & submission of results, all complete as per direction of Engineer-in-charge.	Each	47				
8	Carry out -Field Investigation for SPT: -Standard Penetration Tests (S.P.T.) by Split Spoon Sampler in the bore hole as per IS 2131 -20.0m-30.0m	Each	47				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
9	Dismantling R.C. floor, roof, beams etc. including cutting rods and removing rubbish as directed within a lead of 75 m. including stacking of steel bars. (a) In ground floor including roof	Cu.Mtr	19.50				
A3	Structural Work :-						
1	Surface Dress the ground in any kind of soil including removing vegetation inequalities not exceeding 15 cm depth and disposal of the rubbish within a lead upto 75 m as directed.	Sq.Mtr	5000.000				
2	Dismantle all types of plain cement concrete works, stacking serviceable materials at site and removing rubbish as directed within a lead of 75 m- in ground floor including roof - upto 150 mm thick.	Cu.Mtr	1000.000				
3	Dismantle all types of masonry excepting cement concrete plain or reinforced, stacking serviceable materials at site and removing rubbish as directed within a lead of 75 min ground floor including roof.	Cu.Mtr	500.000				
4	Take out shutter of door and window, dismantling by parts (for repair or replacement of damaged parts) , reassembling and refitting and rehangng same with old fittings but with new screws as necessary. (Where different parts of same shutter are renewed under different item, payment under this item will be made once only).	Sq.Mtr	100.000				
5	Provide and fix up to 5th floor level precast cement concrete string or lacing courses, copings, bed plates, anchor blocks, plain window sills, shelves, louvers, steps, stair cases, etc., including hoisting and setting in position with cement mortar 1:3 (1 Cement : 3 coarse sand), cost of required Centering complete-with 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20mm nominal size).	Cu.Mtr	50.000				
6.1	Cutting holes and subsequent mending good damages - Diameter upto 150 mm.						
6.1.1	In brick work [Cement-4.0 Kg/Mtr]	R/Mt.	300.000				
6.1.2	In concrete work (plain or R.C.) [Cement- 3.0 Kg/Mtr]	R/Mt.	300.000				
6.2	Cutting holes and subsequent mending good damages - Diameter exceeding 150 mm and upto 300 mm.						
6.2.1	In brick work [Cement-6.0 Kg/Mtr]	R/Mt.	300.000				
6.2.2	In concrete work (plain or R.C.) [Cement-4.6 Kg/Mtr]	R/Mt.	300.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
7	Earth work in excavation of foundation trenches or drains, in all sorts of soil (including mixed soil but excluding laterite or sandstone) including removing, spreading or stacking the spoils within a lead of 75 m. as directed. The item includes necessary trimming the sides of trenches, levelling, dressing and ramming the bottom, bailing out water as required complete.						
7.1	Depth of excavation not exceeding 1,500 mm.	Cu.Mtr	1360.000				
7.2	Depth of excavation for additional depth beyond 1,500 mm. and upto 3,000 mm. but not requiring shoring.	Cu.Mtr	297.000				
8	Anti-termite treatment to the soil under floor with chemical emulsion by admixing chloropyrofos emulsifiable concentrate (1% concentration) with water by weight including drilling vertically 12mm. dia holes at the junction of floor and wall at 300mm. interval to reach the soil below using hand operated pressure pump to squirt chemical emulsion into the pump to squirt chemical emulsion into the holes at the rate of one litre per hole. The holes shall be sealed after operation to match with the existing floor. The entire work is to be carried out as per specification laid down in para 4.3.1.4 of code I.S.-6313 (Part-III)-1981.	Sq.Mtr	8035.000				
9	Earth work in filling in foundation trenches or plinth with good earth, in layers not exceeding 150 mm. including watering and ramming etc. layer by layer complete. (Payment to be made on the basis of measurement of finished quantity of work)						
9.1	With carried earth arranged by the contractor including cost of carried earth.	Cu.Mtr	150.000				
9.2	With earth obtained from fresh excavation of foundation.	Cu.Mtr	570.000				
10	Filling in foundation or plinth with fine brown sand in layers not exceeding 150 mm as directed and consolidating the same by thorough saturation with water, ramming complete including the cost of supply of sand. (payment to be made on measurement of finished quantity)	Cu.Mtr	4794.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
11	Hire and labour charges for shoring work (including necessary close plank walling, framing, Eucalyptus/Jhou bulla piling, strutting etc) complete as per direction of the Engineer-in-charge for foundation excavation (vertical surface are in contact with supported earth is to be measured.)(This item should be executed on specific direction of the Engineer in charge).						
11.1	Depth upto 1.5 m.	Sq.Mtr	100.000				
11.2	For additional depth beyond 1.5 m. and upto 3.00 m	Sq.Mtr	100.000				
11.3	For additional depth beyond 3.00 m.	Sq.Mtr	100.000				
12	Dismantling R.C. floor, roof, beams etc. including cutting rods and removing rubbish as directed within a lead of 75 m. including stacking of steel bars.						
12.1	In ground floor including roof	Cu.Mtr	200.000				
12.2	Extra rate for each additional floor over the rate of ground floor.	Cu.Mtr	100.000				
12.3	Removal of rubbish,earth etc. from the working site and disposal of the same beyond the compound, in conformity with the Municipal /Corporation Rules for such disposal, loading into truck and cleaning the site in all respect as per direction of Engineer in charge.	Cu.Mtr	1200.000				
13	Providing and laying Cement concrete with graded stone ballast (40 mm size excluding shuttering) -In ground floor -with Pakur Variety Coarse Aggregates in 1:4:8 proportion.	Cu.Mtr	3006.000				
14	Single Brick Flat Soling of picked jhama bricks including ramming and dressing bed to proper level and filling joints with local sand.	Sq.Mtr	4433.000				
15	Supplying and laying Polythene Sheet (150gm / Sqm) over damp proof course or below flooring or roof terracing or in foundation or in foundation trenches.	Sq.Mtr	5000.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
16	Providing and laying Batch Mixed concrete of M 30 Grade with well Graded stone chips of 20 mm nominal size containing designed quantity of cement per Cu. M of Wet concrete produced in computerised batching plant under controlled condition using approved super plasticizer designing concrete mix following I.S 10262 and I.S. 456 transporting the mix with agitation in transit mixer to work site depositing the mix on a platform erected for the purpose at required level of concreting and then placing the mix in its final location of form work compacting and curing the same complete as per specification and direction of the Engineer-in charge including hire charges of computerised batching plant, transit mixer with all accessories vibrators etc. inclusive of all other incidental charges in this connection complete but excluding cost of hire charge of platform and its supporting staging which would be paid through separate item.[with Batching Plant & transit mixer] In Ground Floor & Foundation. [Pakur Variety].						
16.1	Without approved concrete pump- in ground floor level..	Cu.Mtr	2314.000				
16.2	With approved concrete pump- in first floor level.	Cu.Mtr	179.000				
17	Controlled Cement concrete with well graded Pakur Variety stone chips (20 mm graded nominal size) excluding shuttering and reinforcement with complete design of concrete as per IS : 456 and relevant special publications, submission of job mix formula after preliminary mix design after testing of concrete cubes as per direction of Engineer-in charge. Consumption of cement will not be less than 300 Kg of cement with Super plasticiser per cubic meter of controlled concrete but actual consumption will be determined on the basis of preliminary test and job mix formula. In ground floor and foundation. -Using concrete mixture-M 20 Grade.	Cu.Mtr	362.000				
18	Hire and labour charges for shuttering with centering and necessary staging upto 4 m using approved stout props and thick hard wood planks of approved thickness with required bracing for concrete slabs, beams and columns, lintels curved or straight including fitting, fixing and striking out after completion of works (upto roof of ground floor)						
18.1	Upto 4 th floor and in Basement	Sq.Mtr	9705.000				
18.2	In first floor	Sq.Mtr	865.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
19	Reinforcement for reinforced concrete work in all sorts of structures including distribution bars, stirrups, binders etc initial straightening and removal of loose rust (if necessary), cutting to requisite length, hooking and bending to correct shape, placing in proper position and binding with 16 gauge black annealed wire at every intersection, complete as per drawing and direction- For works in foundation, basement and upto roof of ground floor/upto 4 m -Tor steel/Mild Steel -SAIL/ TATA/RINL.	M.T.	363.000				
20	Add extra over the rate of ground floor/initial 4 m for Each basement floor and Each additional floor below/ above ground floor for item No:- 19 above .	Qntl	28500.000				
21	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per Technical specifications including subsequent cutting/removal and sealing of the hole as necessary of nipples after completion of grouting with Cement/Epoxy.	Each	1000.000				
22	Providing & Grouting of dowel tubes / Shear keys / Joints of precast members with M-60 grade cementitious grout (Non Shrink) of approved make by suitable means (Free flowing /pump),curing etc. Complete as per directions of Engineer-in- charge. (The payment shall be made on the basis of actual weight of approved grout injected.) -Stirrer mixed cementitious grout (non shrink) of approved make in dowel tubes / Shear keys / Joints of precast members.	Kg.	250.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
23	Providing and mixing integral crystalline admixture for water proofing treatment to RCC structures like basement raft, retaining walls, reservoir, sewage & water treatment plant, tunnels / subway and bridge deck etc. at the time of transporting of concrete into the drum of the ready-mix truck, using integral crystalline admixture @ 0.80% (minimum) to the weight of cement content per cubic meter of concrete) or higher as recommended by the manufacturer's specification in reinforced cement concrete at site of work. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e. by reducing permeability of concrete by more than 90%, compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure. The crystalline admixture shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the Engineer-in-charge. The product performance shall carry guarantee for 10 years against any leakage.	Kg.	800.000				
24	Providing and applying integral crystalline slurry of hydrophilic in nature for waterproofing treatment to the RCC structures like retaining walls of the basement, water tanks, roof slabs, podiums, reservoir, sewage & water treatment plant, tunnels / subway and bridge deck etc., prepared by mixing in the ratio of 5 : 2 (5 parts integral crystalline slurry : 2 parts water) for vertical surfaces and 3 : 1 (3 parts integral crystalline slurry : 1 part water) for horizontal surfaces and applying the same from negative (internal) side with the help of synthetic fiber brush. The material shall meet the requirements as specified in ACI-212-3R-2010 i.e by reducing permeability of concrete by more than 90% compared with control concrete as per DIN 1048 and resistant to 16 bar hydrostatic pressure on negative side. The crystalline slurry shall be capable of self-healing of cracks up to a width of 0.50mm. The work shall be carried out all complete as per specification and the direction of the engineer-in-charge. The product performance shall carry guarantee for 10 years against any leakage.						
24.1	For vertical surface two coats @ 0.70 kg per sqm	Sq.Mtr	300.000				
24.2	For horizontal surface one coat @1.10 kg per sqm.	Sq.Mtr	300.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
25	Supplying and application of chemical for post installed rebar connection by using "European Organisation for Technical Approvals " approved for seismic criteria In rebar connection, Including drilling hole to the required depth by rotary hammer drill, cleoning with brush & jet of clean air, /filling chemical usIng serrated nozzle to eliminate mixing error and in a voidless manner includIng charges for all tools & plants. Application to be designed for post· installed rebars as per ECZ/TR023 or relevant tested and accepted design guidelines and the design document to be furnished by the manufacturer. The chemical should have ETA approval for seismic criteria of rebar fixing whIch should be furnished by manufacturer. The installation and the setting instructions should be strictly followed as per manufacturer's specifications as approved by Engineer in Charge prior to drilling along with post· installed rebar embedment design report. The existing concrete member should be scanned using rebar scanner to avoid hitting existing reinforcement in concrete during drilling. This rate is excluding the cost of scaffolding. This work should not be excuted without specific permission of Engineer . Injection process should be executed in the presence of officer not below the rank Executive Engineer to supervise the work minutely.[Rebar grouting Is specifically required for extension and strengthening purpose of old or existing RCC structural members with new RCC structural members through rebar fixing chemical item without breaking beam, column, roof slab, lintel, ceiling etc.]						
25.1	Cost of post installed rebaring application with chemical as specflred for 8 mm dia per cm of depth	Centi meter	5500.000				
25.2	Cost of post installed rebaring application with chemical as specified for 10 mm dia per cm of depth	Centi meter	5500.000				
25.3	Cost of post Installed rebering application with chemical as specified for 12 mm dia per cm of depth	Centi meter	5500.000				
25.4	Cost of post Installed rebaring application with chemical as specified for 16 mm dia per cm of depth	Centi meter	5500.000				
25.5	Cost of post Installed rebarIng application With chemical as specified for 20 mm dia per cm of depth	Centi meter	5500.000				
25.6	Cost of post Installed rebarIng application With chemical as specified for 25 mm dia per cm of depth	Centi meter	5500.000				
26	Extra for every additional lift of 1.5 m or part thereof in excavation / banking excavated or stacked materials- for all kinds of soil..	Cu.Mtr	100.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
27	Bailing or pumping out water from foundation trenches. This item should be executed on the specific direction of the Engineer ,when he is satisfied in his absolute discretion, that this has not been necessitated due to any fault on the part of the contractor .Payment, if permitted, will be made on the quantity of water calculated on the basis of initial and final water calculated on the basis of initial and final water level measured before starting and completion of each days work which necessitates a bailing / pumping of water from the trench. The final level of water to be measured, will depend on the level at which the day's work will be taken up. The rate includes any seepage water that may percolate in the trench during pumping).	Per 100 Cu.Mtr .	50.000				
28	Extra over the corresponding item of earth work for removing semi liquid mud or slushy earth by iron pans, buckets etc. This item is to be done with specific approval of Engineer.	Per 100 Cu.Mtr .	50.000				
A4	Structural Steel Work						
1	Hi-tensile Structural steel work in Built-up sections from hot rolled plates fixed with connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. Structural Steel shall be weldable quality. Yeild strength of Hi-tensile built-up section shall be 345 Mpa conforming IS 2062- High tensile steel for building construction.	M.T.	360.000				
2	Hi-tensile Structural steel work in single section, light gauge, cold formed, Galvanized, including cutting, forming, hoisting, fixing in position all complete. Yield strength of Hi-tensile cold-formed section shall be 345 Mpa conforming IS 2062 -Hi-tensile steel in Cold Formed Sections(CFS).	M.T.	250.000				
3	Hi-tensile Structural steel work in single Square Hollow section, Rectangular Hollow section fixed with connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. Structural Steel shall be weldable quality. Yield strength of Hi-tensile SHS and RHS shall be 310 Mpa conforming IS 2062.	M.T.	250.000				
4	Hi-tensile Structural steel work in single Circular Hollow section, fixed with connecting plate, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete. Structural Steel shall be weldable quality. Yield strength of Hi-tensile CHS shall be 310 Mpa conforming IS 2062.	M.T.	78.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Mild Steel Structural accessories, including cutting, fixing in position and applying a priming coat of approved steel primer all complete. Yeild strength of mild steel section shall be 250 Mpa, as per IS2062.						
5.1	Mild steel Anchor bolts	M.T.	148.000				
5.2	Mild steel for accessories including sag rods and flange bracings	M.T.	84.000				
6	Hi tensile galvanized structural fasteners of grade 8.8 and 10.9 as mentioned in IS 800-2007 and IS 4000 conforming to specifications of ASTM A325	M.T.	64.000				
7	Providing & Fixing of Galvalume Sheet (As per Arch. detail) at the Roof Level, including cutting, bending of Galvanume Sheet to shape as shown in drawing and or as directed, and also providing & Fxing the same in perforations for anchoring in beams, Slas, walls etc. in terrace.	Sq.Mtr	10500.000				
8	Provide and apply a two pack polymide cured high build epoxy coating based on laminar micaceous iron oxide pigment. Designed for application on structural steel as an intermediate or finish coat exposed to aggressive coastal and industrial environment. Surface to be degreased and blast clean to Sa 2 1/2 grade minimum of Swedish specification SIS - 05 - 5900 - 1967. If blast cleaning is not practical make full use of mechanical tools along with manual cleaning and wire brushing to remove loose rust/scale to St 2 or 3 grade of Swedish Standard specification. Surface shall be perfectly clean & dry before priming. Method of application : Brush/ Airless Spray. Airless spray recommended for uniform & high film build.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Colour : Brown / Grey Finish : Matt to Eggshell Flash point : Above 200C Mixing ratio : Base : Accelerator 4:1 (by volume) Volume solids : 52% approximately Recommended dry film thickness : 75 - 100 microns per coat Corresponding wet film thickness : 144 - 192 microns Theoretical consumption : 6.9 - 5.2 sqm per Litre Drying time : Surface dry 2 - 4 hrs Handable 16 - 18 hrs Full cure - 7 days Interval before overcoating : Minimum - 18 hrs , Maximum - Indefinite Storage life : Upto 12 months so long as the material is stored in sealed containers under standard wearhouse storage condition. Dry heat resistance : Upto 150 degree celsius.	Sq.Mtr	85000.000				
10	Provide and apply with all necessary arrangements and tools after necessary surface preparation for Aliphatic Isocyanate cured Polyurethane (PU Coating) of matt finish having excellent UV resistance. Colour : Grey (or as per selection Engineer). DFT : 40 - 60 micron ,Volume of Solid : 49 ±2 , Dry to overcoat : 3 hr.	Sq.Mtr	85000.000				
A5	Architectural and Finishing works:-						
1	Brick work with 1st class bricks in cement mortar (1:6)- In foundation and plinth.	Cu.Mtr	120.000				
2	1st class brick work of width 200 mm. with non-modular bricks in cement sand mortar (1:6).						
2.1	In superstructure ground floor	Cu.Mtr	1772.000				
2.2	In first floor	Cu.Mtr	50.000				
2.3	125 mm. thick brick work with 1st class bricks in cement mortar (1:4) in ground floor.	Sq.Mtr	1505.000				
3	250 mm th. Autoclave aerated concrete block Work with size 625 mm x 250 mm x 125 mm-Grade-I, having drying Shrinkage less than 0.05% conforming to IS: 2185 (Part-3)-1984 made up of fly ash (conforming to IS: 3812-1981, with permissible loss on ignition upto 6%), lime , cement and laid in Cement Mortar (1:6) complete in all respect as per direction & satisfaction of Engineer -in Charge . -For light weight filling.	Cu.Mtr	1800.000				
4	Extra for using approved H.B netting in every third layer in item 1 ,2 & 3 above in any floor.	Sq.Mtr	955.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	R.C. shelves (1:1.5:3) either precast or cast in situ with stone chips and necessary reinforcement upto 1% (0.8% main and 0.2% distribution bars), shuttering etc. and 10 mm. thick cement plaster (1:4) including neat cement finishing and cutting chase fitting and fixing in position, mending good damages as necessary complete -50 mm thick panels.						
5.1	In superstructure, ground floor	Sq.Mtr	100.000				
5.2	In first floor	Sq.Mtr	50.000				
6	Labour for Chipping of concrete surface before taking up Plastering work.	Sq.Mtr	1500.000				
7	Plaster (to wall, floor, ceiling etc.) with sand and cement mortar including rounding off or chamfering corners as directed and raking out joints including throating, nosing and drip course, scaffolding/staging where necessary (Ground floor). [Excluding cost of chipping over concrete surface]						
7.1	With 1:6 cement mortar -20 mm thick plaster.	Sq.Mtr	5140.000				
7.2	With 1:4 cement mortar-15 mm thick plaster.	Sq.Mtr	7192.000				
8	Supplying fitting & Fixing of Luxalon @84R Plain Panel Aluminium Louver of Hunter Douglas India -higher strength & roll forming characteristics. SL 4 LOUVERS.	Sq.Mtr	86.000				
9	Cement concrete flooring 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate) finished with a floating coat of neat cement, including cement slurry, but excluding the cost of nosing of steps etc. complete -40 mm thick with 20 mm nominal size stone aggregate.	Sq.Mtr	3500.000				
10	M.S.or W.I. Ornamental grill of approved design joints continuously welded with M.S, W.I. Flats and bars of windows, railing etc. fitted and fixed with necessary screws and lugs in ground floor.- Grill weighing above 16 Kg./sq.mtr and above.	Qntl	600.000				
11	Designing, fabricating, testing, protection, installing and fixing in position semi (grid) unitized system of structural glazing (with open joints) for linear as well as curvilinear portions of the building for all heights and all levels, including:	Sq.Mtr	400.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	a) Structural analysis & design and preparation of shop drawings for the specified design loads conforming to IS 875 part III (the system must passed 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, flashings, fire stop (barrier)-cum-smoke seals, microwave cured EPDM gaskets for water tightness, pressure equalisation & drainage and protection against fire hazard including:						
	b) Fabricating and supplying serrated M.S. hot dip galvanised / Aluminium alloy of 6005 T5 brackets of required sizes, sections and profiles etc. 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 seperator to prevent bimetallic contacts with nuts and washers etc. of stainless steel grade 316, of the required capacity and in required numbers.						
	c) Providing and filling, two part pump filled, structural silicone sealant and one part weather silicone sealant compatible with the structural silicone sealant of required bite size in a clean and controlled factory / work shop 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.						
	d) Providing and fixing in position flashings of solid aluminium sheet 1 mm thick and of sizes, shapes and profiles, as required as per the site conditions, to seal the gap between the building structure and all its interfaces with curtain glazing to make it watertight.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	e) Making provision for drainage of moisture/ water that enters the curtain glazing system to make it watertight, by incorporating principles of pressure equalization, providing suitable gutter profiles at bottom (if required), making necessary holes of required sizes and of required numbers etc. complete. This item includes cost of all inputs of designing, labour for fabricating and installation of aluminium grid, installation of glazed units, T&P, scaffolding and other incidental charges including wastages etc., enabling temporary structures and services, cranes or cradles 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, dully approved by Engineer-in-charge. The item also includes the cost of all mock ups at site, cost of all samples of the individual components for testing in an approved laboratory, field tests on the assembled working structural glazing as specified, cleaning and protection till the handing over of the building for occupation. In the end, the Contractor shall provide a water tight structural glazing having all the performance characteristics etc. all complete as required, as per the Architectural drawings, as per item description, as specified, as per the approved shop drawings and as directed by the Engineer -in-Charge.						
	<p>Note:- 1. The cost of providing extruded aluminium frames, shadow boxes, extruded aluminium section capping for fixing in the grooves of the curtain glazing and vermin proof stainless steel wire mesh shall be paid for separately under relevant items under this subhead. However, for the purpose of payment, only the actual area of structural glazing (including width of grooves) on the external face shall be measured in sqm. up to two decimal places.</p> <p>Note:-2. If area of structural glazing exceeds 2500 Sqm then from the certified laboratories accredited by NABL(National Accreditation Board for Testing and Calibration Laboratories), Department of Science & Technologies, India , following test to be carried out.</p> <p>1. Performance Laboratory Test for Air Leakage Test (-50pa to - 300pa) & (+50pa to +300pa) as per ASTM E-283-04 testing method for a range of testing limit 1 to 200 mVhr"</p> <p>2. Static Water Penetration Test. (50pa to 1500pa) as per ASTM E- 331-09 testing method for a range up to 2000 ml."</p> <p>3. Dynamic Water Penetration (50pa to 1500pa) as per AAMA 501.01- 05 testing method for a range upto 2000 ml"</p> <p>4. Structural Performance Deflection and deformation by static air pressure test (1.5 times desing wind pressure without any failure) as per ASTM E-330-10 testing method for a range upto 50 mm"</p> <p>5. Seismic Movement Test (upto 30 mm) as per AAMA 501.4-09 testing method for Qualitative test" Tests to be conducted on site.</p> <p>6. Onsite Test for Water Leakage for a pressure range 50 kpa to 240 kpa (35psi) upto 2000ml"</p>						
12	Galvanised wire mesh of average width of aperture 1.4 mm and nominal dia of wire 0.63 mm	Sqm	400.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
13	Wood work in door and window frame fitted and fixed in position complete including a protective coat of painting at the contact surface of the frame exluding cost of concrete, Iron Butt Hinges and M.S clamps. (The quantum should be correted upto three decimals). - With Siliguri Sal-at ground floor.	Cu.Mtr	2.150				
14	Supplying fitting and fixing door frame with M.S. angle as per drawing & direction of required section. Butt hinges will have to be supplied as necessary & the holes for counter sunk machine screw & nuts will be such as to fit 8 to 10 mm Iron screw. The counter sunk nut to be welded and such screws and nuts are to be supplied by the contractor. The nuts are to be welded after careful checking with screw. All welding spots should be properly filed or rounded smooth including cost of welding hinges for hinge cleats including supplying the same & also lugs for hasp bolt, socket bolt etc. and necessary M.S. clamps of 25mm x 6mm flat 225mm long as per direction welded to the frame fitted and fixed in position excluding cost of concrete.	Kg.	350.000				
	Mode of measurement : Weight of frame shall be calculated for the M.S. sections of frames. No payment of butt hinges, lugs, clamps, screw etc. & welding shall be made. The weight of section should be calculated at 7.85 gm/Cu.cm						
15	Supplying, fitting and fixing M.S. clamps for door and window frame made of flat bent bar, end bifurcated with necessary screws etc. by cement concrete(1:2:4) as per direction. (Cost of concrete will be paid separately.The concreting will have to be done for equivalent thickness of 2 layers of brick work and for the entire width of the wall. No deduction on brick work will be made)						
15.1	40mm X 6mm, 250 mm Length	Each	35.000				
15.2	40mm X 6mm, 125mm Length	Each	25.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
16	Supplying solid flush type doors of deluxe decorative (both side) quality, conforming to I:S 2202 timber frame consisting of top and bottom rail and side styles of well seasoned timber 65mm wide each and the entire frame fitted with 27.5mm wide battens places both ways in order to made the door of solid core and internal lipping with teak, mahogany or rose wood approved decorative veneers using phenol formaldehyde as glue etc. complete, including fitting, fixing the shutters in position but excluding the cost of hinges and other fittings in ground floor:						
16.1	35mm thick shutters (single leaf)	Sq.Mtr	57.000				
16.2	35mm thick shutters (double leaf)	Sq.Mtr	56.000				
17	Supplying stainless steel functional hinge for casement window as per approved brand as directed by Engineer- in -charge. (Natural White)-250 mm long	Each	56.000				
18	Providing and fixing 12 mm thick frameless toughened glass door shutter of approved brand and manufacture, including providing and fixing top & bottom pivot & double action hydraulic floor spring type fixing arrangement and making necessary holes etc. for fixing required door fittings, all complete as per direction of Engineer-in-charge (Door handle, lock and stopper etc.not to be paid separately).	Sqm	56.500				
19	Supplying bubble free float glass of approved make and brand conforming to IS: 2835-1987-clear, toughened glass conforming to IS: 2553-1992 (part-II).						
19.1	8 mm thick	Sq.Mtr	258.000				
19.2	12 mm thick cleared toughened glass coforming to IS: 2553-1992 (Part-II)	Sq.Mtr	1850.000				
20	Supplying bubble free float glass of approved make and brand conforming to IS: 2835-1987 - 5mm thick clear glass.	Sq.Mtr	10.000				
21	Shutters of 2/3rd panel and 1/3rd glazed of doors and windows as per design (each panel consisting of a single plank without joint and with ordinary glass of 7.4kg. Per sq.m./3mm thick) fitted with putty bed and teak wood beads and nails including fitting and fixing shutters in position but excluding the cost of glass, putty, teak bead, nails, hinges etc. and other fittings, in ground floor.- 50 mm thick shutters with 25 mm thick panel with 1st class Indian Teak.	Sq.Mtr	10.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
22	Supplying, fitting & fixing polycarbonate sheet of approved make & brand conforming to IS: 14443-1997 and having 50 micron UV protection layer under co-extrusion technology, Fire rating being B-s1 as per EN13501-1 certification, fitted and fixed with 60mm wide aluminium channel section top and bottom member in dry-glaze sandwich system, (unit wt. of top and bottom members: 0.375 kg/m & 0.69 kg/m) of approved brand and profile, EPDM quality rubber gaskets, anti dust tape, end closer "C" channel and 75 mm long Self tapping screw being drilled through the centre leg of the bottom section with nuts placed at 300 mm apart without anyway puncturing the polycarbonate sheet, EPDM Washer 16 mm dia & 3 mm thick washer etc complete strictly as per manufacturers specification and direction of Engineer-in-Charge. (Payment to be made on area of finished work). In Roof:- Natural/ Blue/Green/Bronze/Opal/Metallic grey colour- With 4 wall 8mm overall thickness (wt.1.60kg/sqm,Ugvalue being 2.76 W/m2K, Min. cold bending radius of 1200 mm)	Sq.Mtr	3382.000				
23	Supply, fabricating & fixing SKY LIGHT as per architectural drawing and as directed with 10mm Multiwall Polycarbonated Sheet . Fixing method will be strictly followed as per the manufacturer's guidelines which includes :- 1. Polycarbonate Sheet (10 mm) 2. Polycarbonate Joiner 3. Polycarbonate U- Joiner End Cap 4. Stainless Steel T – Fastener 5. Screws 6. Aluminium F Section 7. Aluminium Sheet End Cap 8. Leak Proof Warranty of minimum 15 years	Sq.Mtr	550.000				
24	Aluminium Flashings at Skylight Periphery / Smoke Vents / Structural Openings / Any Other Opening in 2mm thick Aluminium, including all formation, welding and High density Rigid Insulation 100 mm thick, 120 Kg/m3 density, 500mm maximum width around the skylights and other areas if required. Dye Penetration (DP) test to be conducted throughout the entire welding length. Colour to match the roof.	R/Mtr	1500.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
25	Providing & Fixing Dekstrip (Around Structural Penetration) Flexible elastomeric strip for Weatherproofing, Single piece elastomeric sealing washer manufactured from proprietary blend of TPE available in grey. Includes imbedded edge strips manufactured from aluminium along with required accessories and as directed by Engineer - in - charge.	R/Mtr	750.000				
26	Supply and fixing of Single skin 2mm Aluminium gutter, GRADE AA 1100 ALLOY with welding at joints Down Take Aluminium Spout at 5m length by Architect / Engineer-in-Charge. With Liner – 2835/195-250 Colour Coated G.I. Steel Liner SMP Coated, 120GSM Zinc Coating, 0.5 mm TCT, 32-35mm deep ribs spanning up to 1500mm entres, Z-Spacer, Rockwool insulation 50mm thick & 120kg/m3 density, Vapour control layer - double sided aluminium foil 150 micron thick. The Girth of gutter would be 1800mm. Dye Penetration test to be conducted wherever welding has been done.	Rmt.	445.000				
27	Provide exposed brick tile for cladding as per specification	Sq.Mtr	650.000				
A6	Landscape Work :-						
	Hardscape						
1	Providing and fixing at or near ground level precast cement concrete in kerbs (size: 410 mm x 310 mm x width 150 mm at bottom with circular nosing at top) (Nano kerb) of cement concreat M25 Grade without reinforcement, fixing as per approved pattern and setting in position at site after preparing the bed grade and slopes by laying Cement concrete with jhama khoa (1:4:8) as per specification and direction of Engineer-in Charge including filling of joints with 10 mm thick cement mortar (3:1) and back filling the vertical piece properly with earth duly compacted and curing the mortar joints for atleast 3 days including cost and carriage of all materials complete.	Mtr.	1154.450				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
2	Supplying & laying as per IRC-SP:063-2004 paver unit of any shade of approved quality as per relevant IS code, laid in pattern as directed in pavement, footpath, driveway (paver block only), etc including necessary underlay complete in all respect with all labour and material. [Border concrete if necessary to be paid separately] - 60 mm thick interlocking designer concrete paver block M 35 grade for light-traffic zone,commercial & office complex,tourist resort as per IS: 15658-2006 (over 20-40 mm medium sand bed on 250mm thk WBM/ WMM base course & 250 mm thk bound gnular /granular sub-base course including cost of sand for sand bed but excluding cost of base ,sub-base course & subgrade preparation.)						
2.1	Grey	Sq.Mtr	7884.855				
2.2	Coloured Decorative	Sq.Mtr	437.745				
3	Supply and apply of Instakrete make pebblecrete flooring, (gray cement beased) flooring mixed with the natural colour pebble 10 to 12 mm avarage thickness (+/- 2mm). Exposed pebblecrete flooring to be applied on levelled, combed finish PCC/RCC based as per specification & direction of the Engineer-in-charge and it is excluded from the rate.	Sq.Mtr	654.555				
3.1	Forming groove of uniform size as per approved pattern. (In flooring surface as per approved pattern using wooden battens, nailed to the under layer including removal of wooden battens,repairs to the edges of plaster panel & finishing the groove complete as per specification & direction of the Engineer-in-charge.)	Mtr.	9818.325				
4	Supplying,fitting & fixing granite slab 15mm to 18mm thick in floor, lobby, stair, landing and treads etc. over 20mm (avg) thick base of cement mortar (1:2) laid with white cement slurry @ 4.40Kg per Square meter before placing of granite and jointed with white cement slurry @ 2.0 Kg per square meter with necessary pigments and complete as per direction of Engineer-in-charge including cost of all materials, labours, curing and roughening of concrete surface complete. Area of each Granite slab 0.6 to 1.0 Square meter. -In ground floor	Sq.Mtr	954.223				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Supplying, fitting & fixing granite slabs 15mm to 18 mm. thick with uniform texture & without decorative veins in columns, wall, facia, rise etc. with 15 mm thick [avg] cement mortar (1:2) including making suitable arrangements to hold the stones properly by brass / copper hooks including pointing in cement mortar (1:2) (1 white cement : 2 marble dust) with admixture of pigment matching the stone shades all complete as per direction of the Engineer-in-charge including cost of all materials, labours, scaffolding, staging, curing and roughening of concrete surface complete. [Using cement slurry at back side of granite @ 4.4 kg/sq.m & white cement slurry for joint filling @ 1.8 kg/sq.m]. Area of each Granite slab 0.6 to 1.0 Square meter -In ground floor	Sq.Mtr	100.238				
6	Supplying, fitting & fixing Glass mosaic tiles at finished plain wall surface of size 20 mm x 20 mm x 4 mm in all colour, design, fixing in customize design as per direction of Engineer in-Charge. The glass mosaic tiles to be fixed on the wall surface with the help of approved adhesive applied at the rate of 2.5 kg per sqm and grouting of the same. The rate is inclusive of all operation, material and required pattern approved by Engineer-in-Charge. [At Ground Floor] - Plain Type/Mix	Sq.Mtr	23.485				
7	Supplying & laying 3mm thick pre-fabricated plastomeric water proofing membrane conforming to EN 12311-1 & ASTM D 5147, manufactured with atactic poly propylene (APP) modified premium grade asphalt, specially reinforced with non-woven polyester core with polyester reinforcement @160 gms per sqm & both faces covered with thermofusible polyethylene film /Mineral on top face over a coat of primer @ 0.40 lit/sqm of manufacturer's specification on smooth, clean dry surface prepared wherever required. Lap joint shall be provided of 75 mm in longitudinal & 100 mm in transverse direction and fused using LPG/ Propane torch employing extra care ensuring full bondage, complete removal of entrapped air and sealing edges into grooves in appropriate manner as per direction of Engineer -in-charge all complete including materials, labour and applicable taxes. (Payment shall be made on the basis of finished surface area.). Membrane Property: Softening Point > 150 deg C, Cold .Flexibility < -6 deg C, Tensile Strength, N/cm : 600 (longitudinal), 450 (transverse), Tearing Strength, N: 300 (longitudinal), 200 (transverse).	Sq.Mtr	4023.485				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
8	Supplying, providing and installation of 300mm wide D.I drain channel grating (MAKE-MUNICAST/SELECT SIMILAR) with all type of fittings as per specification/vendor details.	Mtr.	156.750				
9	Applying stamping finish to the top surface of freshly laid plain/ reinforced cement concrete of specified grade in porticos, sidewalks, driveways, pool decks and open yards as per direction of the Engineer in-Charge. The process shall include the following:-						
	The concrete shall be placed and screeded to the finished grade, and floated to a uniform surface by using standard finishing techniques. The approved color hardener @ 2.7 kg/sqm shall be applied evenly to the surface of the fresh concrete by the dry shake method by sprinkling in two or more shakes, floated after each shake and trowelled only after the final floating. The approved release agent @ 0.113 kg/sqm shall be applied evenly to the trowelled surface before stamping or the said release agent can be applied to the flexible polyurethane stamp moulds of approved design and in required sizes to achieve final stamped pattern. These stampings shall be placed on the surface of concrete in three to four pieces at a time and tapped gently with rammers of sufficient size & weight to leave proper stamp marks and the process repeated for the remaining concrete surface till the whole surface to be stamped is completed within the time while concrete is in plastic stage of setting.	Sq.Mtr	337.700				
	After stamping, the curing shall be done as per manufactures specifications. After initial curing the imprinted joints shall be grouted using cement slurry mixed with color hardener as per the requirement. The surface shall be sealed by applying acrylic based sealer not less than 0.167 litre/sqm.on finished surface.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	The construction joints shall be provided by groove cutting of size 4mm x 20mm in panel size 3m x 3 m or lesser as per the site conditions and filling the same with 10 mm baker rod and providing and laying (PU) Polyurethane based joint sealer of approved make as per manufacturer's specifications and finished by applying Polyurethane resin based top protective clear coat of minimum 80 micron applied with rollers on properly cured and dry clean surface. (Cost of concrete for flooring is not included in this item which shall be paid separately.)						
10	Supplying, providing and placing of 25-50mm diameter round shaped,gray colour,riverwash finish pebble in loose form (50mm thick) over pit/channel drain grating as per details.	Sq.Mtr	33.000				
11	Supplying,providing and installation of FRP make/other material sitting chair as per details.	Each	140.000				
12	Supplying, providing and installation of big size boughtout sculpture infront of Light House (sculptures as per selection)	Each	1.000				
13	Supplying, providing and installation of boughtout marble made decorative stepped fountain as per details.	LS	1.000				
14	Supplying, providing and installation of boughtout sculptures at different places as per requirement (sculptures as per selection)	Each	10.000				
15	Supplying and providing of boughtout outdoor type furnitures at different landscape areas as per design/choice.	LS	1.000				
16	Supplying, providing and installation of pump with all type of fittings as nozzles,filter,pipe lines,lights,labours etc. as per vendor details.	LS	1.000				
17	Drip irrigation and sprinkler system including all type of fittings as per vendor details.	Sqm	1105.000				
18	Tap irrigation system including all type of fittings as per vendor details.	Sqm	2695.000				
19	Supplying and providing outdoor type light fixtures for illuminating the landscape areas (considered only light fixtures as per specification/select similar)						
	i) Bollard light at deck areas (RITU BOLLARD, ID 6952, 9W LED)	Each	22.000				
	ii) Spike light at mounds and green areas (NEBULA MICRO, ID 4263, 3W LED)	Each	75.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	iii) Decorative tree hang light for existing trees as per choice	Each	25.000				
	iv) Wall recessed light for OAT steps (SUDO MINI-ASY, ID 2747, 6W LED, 130X87X76MM)	Each	65.000				
	v) 4m high pole light for walkways and plazas (RING FORT ARC MINI, ID 5000 A8/A10, 30W LED)	Each	115.000				
	vi) 7m highmast light for banquet lawn (BRUSSEL LIGHT, KP 1065, 4X45W LED, KP 43 MOUNTING)	Each	2.000				
20	Fountain Filterisation System as specified.	L.S.	1.000				
21	Stone Sculpture for Fountain as per drawing, design and specification.	Each	1.000				
22	Other Sculptures for outside areas as per drawing, design and specification.	Each	10.000				
	Softscape						
1	Surface dressing of the ground including removing vegetation and in equalities not exceeding 15 cm deep and disposal of rubbish, lead up to 50 m and lift up to 1.5 m- in all kinds of soil	Sq.Mtr	4455.000				
2	Ploughing the existing ground to a depth of 15 cm to 25 cm and watering the same-n all kinds of soil.	Sq.Mtr	4455.000				
5	Clearing jungle including uprooting of rank vegetation, grass, brush wood, trees and saplings of girth up to 30 cm measured at a height of 1 m above ground level and removal of rubbish up to a distance of 50 m outside the periphery of the area cleared.	Sq.Mtr	2227.500				
6	Supplying and stacking of good earth (adequate for horticulture work) at site including royalty (earth measured in stack will be reduced by 20% for payment)	Cu.Mtr	1072.500				
7	Supplying and stacking sludge (adequate for Horticulture work) at site in dry cake form from approved disposal work site including royalty, all lead and lift etc. (Sludge measured in stack will be reduced by 8%).	Cu.Mtr	308.879				
8	Mixing earth and sludge or manure in the required proportion specified or directed by the Officer-in-charge	Cu.Mtr	2673.000				
9	Spreading of sludge, dump manure,/farm yard manure/animel dung manure and good earth in required thickness. This includes supply of labour, tools & plants excluding materials.	Per 100 Sq.M.	4050.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
10	Supplying and spreading of sand in lawn area, including watering, and dressing complete.	Cu.Mtr	66.000				
11	Preparation of beds for hedging and shrubbery by excavating 60cm deep and trenching the excavated base to a further depth of 30cm, refilling the excavated Earth after breaking clods and mixing with sludge or manure in the ratio of 8:1 (8 parts of stacked volume of earth after reduction by 20%, one part of stacked volume of sludge or manure after reduction by 8%), flooding with water, filling with earth if necessary watering and finally fine dressing, levelling etc., including stacking and disposal of materials declared unserviceable and surplus earth by spreading and levelling as directed, within a lead of 50m lift upto 1.5m complete. This includes supply of labour, tools & plants including materials. Planting hedge plants in two rows at 30cm apart	Per 100 Sq.M.	4050.000				
12	Planting of trees (Avenue plants) in 0.60m dia holea, 1m deep dug in the ground, mixing the soil with decayed farm yard/sludge manure. This includes supply of labour, tools & plants including materials but excluding cost of tree.	Each	200.000				
13	Preparation of mounds of various size and shape by available excavated / supplied earth in layers not exceeding 20 cm in depth, breaking clods, watering of each layer, dressing etc., lead upto 50 meter and lift upto 1.5 m complete as per direction of Officer-in-charge.	Cu.Mtr	668.250				
14	Supplying and planting of different type of trees, palms and shrubs (Supplying well grown plants bushy and healthy, minimum height as specified i.e. exposed height including all leads, carriage, handling, manuring, applying cow urine mix and fertilizer etc.) with minimum maintenance 6 months.	Sq.Mtr	3250.000				
15	Supplying and fixing grasses tiles of grass Maxican Carpet/Selection No. 1 Healthy & fresh grasses (size 1'x1' or bigger) including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from wees and fit for mowing including supplying good earth as required by Engineer-in-charge. (Rate includes supply of labour, tools & plants including materials).	Per 100 Sq.M.	800.000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
16	Maintenance of hedge for one year including application of necessary pesticide, farm yard manure, replacement of damaged hedge plant by new one complete in all respect as per instruction of Engineer-in-charge. This includes supply of labour, tools & plants including materials.	Per 100 Sq.M.	3250.000				
17	Maintanance of trees for one year (Avenue Plants) including watering, trimming, manuring, spraying insecticide and guarding as required. This includes supply of labour, tools & plants including materials.	Each Per Year	200.000				
18	Weeding out of lawn by removal of all weeds and other wild growth with roots by forking including disposal of garden rubbish with all leads and lifts complete if top dressing required (cost of manure, sludge or extra good earth to be paid for separat) as per direction and satisfaction of Engineer in charge - For 1 year @ 2 times for each year- where weeds upto 50%	Sq.Mtr	800.000				
A7	Special Feature Items						
1	Different Architectural features/ fittings / fixtures / furnitures etc .of Cast Iron as per design , drawing and specification.	Qntl	300.000				
2	Providing Replica of Old Ship - repairing or remodeling work- as per design , drawing and specification.	Each	1				
3	Providing, supplying & fixing CONVEX MIRROR as per design , drawing and specification.	Each	15				
4	Outdoor Lighting as per design , drawing and specification.	L.S.	1				
5	General Illumination as per design , drawing and specification.	L.S.	1				
6	Façade Lighting as per design , drawing and specification.	L.S.	1				
7	Dustbin as per design , drawing and specification.	Each	50				
8	ART & SIGNAGE as per design , drawing and specification.	L.S.	1				
9	BANK DEVELOPMENT COST as per design , drawing and specification.	R/Mtr	700.000				
TOTAL PROJECT COST FOR SECTION- A=							



SYAMA PRASAD MOOKERJEE PORT, KOLKATA
सिविल इंजीनियरिंग विभाग / Civil Engineering Department
6, फ़ॉर्ली प्लेस (फ़ॉर्ली वेयरहाउस)/6, Fairlie Place (Fairlie Warehouse, 2nd floor)
कोलकाता - 700 001 /Kolkata - 700 001



NIT No:- SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

(BILL OF QUANTITIES)

Development Of River Cruise Terminal and river tourism facility alongwith riverfront beautification works at KDS ,
SMP,Kolkata -adjacent to Indenture Memorial Area.

(i) Name of the bidder :-

(ii) Address of the bidder :-

(iii) Contact number of bidder :-

(iv) e-mail ID of the bidder :-

PART B:- ELECTRICAL

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT
				Rs.	P	Rs. P
1	11KV/6.6 KV HT 3WAY RMU PANEL (Indoor type)-Optional					
	Design, Engineering, Manufacturing, Supply and supervision for installation, Testing and Commissioning of 6.6kV HT INDOOR type 3WAY RMU Panel with HT metering arrangement including all suitable ratio of CT's, PTs, Meter etc. with suitable bus bar and other components as per the technical specification & SLD. Electrical Supply Authority approved RMU panel comprising of the following: Incomer-1 : 1 No. 630A, 6.6KV HT Load Break switch with earth switch Incomer-2 : 1 No. 630A, 6.6KV HT Load Break switch with earth switch Outgoing : 1 No. 630A, 6.6KV, 3P, Draw out type VCB of 350MVA, 21kA, for 1 secs with HT Surge Arrestor. Panel Comprising self powered microprocessor based OC/EF relay (Numerical), Built in 24V DC power pack for aux & control supply. Main & interconnecting busbar to be TP PVC / FRLS sleeved with suitable current rating. Incoming/outgoing cables entry is from BOTTOM of the panel. A set of foundation bolts, nuts hard ware and other required accessories to be considered for inter panel alignment, suitable for outdoor application. The RMU panel to be supplied as per local EB Norms.	No.	1			
2	INDOOR TYPE -6.6kV HT VCB PANEL					

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Design, Engineering, Manufacturing, Supply and supervision for installation, Testing and Commissioning of 6.6 kV HT VCB INDOOR panel with suitable bus bar and all other required components. Electrical Supply Authority approved HT panel comprising of 1 No. 6.6kV, 630Amps, 26.2kA, 3P, E-D/O VCB, 350MVA for 3sec with earthing switch. Panel Comprising self powered microprocessor based OC/EF relay (Numerical), Built in 24V DC power pack for aux & control supply. Main & interconnecting busbar to be TP PVC / FRLS sleeved with suitable current rating with Provision to be made for future expansion of the panel. Incoming/outgoing cables entry is from BOTTOM of the panel. A set of foundation bolts, nuts hard ware and other required accessories to be considered for inter panel alignment, suitable for outdoor application. CTs & PT's shall be of suitable rating as per SLD and Technical specification.	No.	1				
3	630kVA, 6KV/433V. DISTRIBUTION TRANSFORMER						
	Supply, installation, testing and commissioning of 630 KVA, 6KV/433V, Vector symbol Dyn11, Z=5.0%, Delta/Star connected, ONAN, 3Phase/3 Phase and neutral, Outdoor type distribution Transformer complete with OLTC, RTCC Panel and all standard accessories, HV cable box and LV box. Transformer shall be as per single line diagram and specifications. The rate shall include civil works such as construction of plinth, foundation etc . However, the exact sizes including type of construction to be specified in a shop drawings, same should be submitted to consultants by Electrical Contractor before execution.	No.	1				
4	HT CABLES & TERMINATION						
A)	SUPPLY OF HT CABLE						
	Supply of 6KV 3C X 240sq.mm XLPE insulated Aluminium Armoured [E] HT cable, as per the local statutory requirements. From RMU to HT Meter, HT Meter to HT VCB panel, HT VCB Panel to Transformer	Mtr	60				
B)	LAYING OF HT CABLE						
	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 11/6.6 KV grade of following size in the existing masonry open duct as required.Above 120 sq. mm and upto 400 sq. mm	Mtr	60				
C)	HT CABLE TERMINATION						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Supplying and making indoor cable end termination with heat shrinkable jointing kit complete with all accessories including lugs suitable for following size of 3 core, XLPE aluminium conductor cable of 6.6 KV grade as required :240 sq. mm	Nos	7				
D)	CONTROL CABLES & TERMINATION						
	Supplying of PVC insulated, steel armoured, Copper Conductor Cables (YFY) for controlling between HT Panels and Transformers						
D.1	24C x 2.5 sq.mm	Mtr	60				
D.2	3C x 4 sq.mm	Mtr	80				
D.3	3C x 2.5 sq.mm	Mtr	120				
D.4	4C x 2.5 sq.mm	Mtr	150				
E)	END TERMINATIONS						
	Using Double compression glands, copper / alu. Lugs as suitable for controlling between HT Panels and Transformers						
E.1	24C x 2.5 sq.mm	Nos	2				
E.2	3C x 4 sq.mm	Nos	4				
E.3	3C x 2.5 sq.mm	Nos	4				
E.4	4 C x 2.5sq.mm	Nos	6				
5	MISCELLANEOUS ITEMS						
5.1	Providing and fixing M.V. danger notice plate of 200 mm X 150 mm, made of mild steel, at least 2 mm thick, and vitreous enameled white on both sides, and with inscription in single red colour on front side as required.	Each	2				
5.2	Providing and fixing H.T. danger notice plate of 250 mm X 200 mm, made of mild steel, at least 2 mm thick, and vitreous enameled white on both sides, and with inscription in single red colour on front side as required.	Each	4				
5.3	Supply, Delivery and installation of Co2 type fire extinguishers: HSN code-84241000						
	4.5 Kg capacity with ISI marked Co2 type fire extinguisher Each 9020.00 squeeze grip type conforming to IS:15683:2006 made from seamless cylinder conforming to IS:7285 duly approved by Chief controller of explosive, Nagpur, fitted with ISI marked controller of explosive, Nagpur, fitted with ISI marked controlled valve conforming to IS:3224, high pressure 1 mtr. long discharge hose and horn complete with initial gas charged with carrying handle and wall mounting bracket suitable for operating between (-)30°C to (+)55°C. Fire rating -13B.	Each	1				
5.4	Supplying of 11kV Hand Gloves	Set	1				
5.5	Supplying of First Aid Box	Set	1				
5.5	Supplying of Shock Treatment Chart	Set	2				
6	DG SET						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
6.1	Supply, Installation, testing and commissioning of 400 KVA Silent type Diesel Generator Set complete with suitable size Acoustic enclosure Diesel Engine suitable for Generator application, developing 1500RPM with an overloading capacity of 10% for one hour in any 12 continuous hours operation generally confirms to BS:5514, directly coupled to 400 KVA at 0.8 Power factor, 415V, 3Phase , 4wires, 50cycles per second self excited, self regulated, with brushless excitation, Alternator generally confirms to BS:5000/IS:4722. DG set shall be complete with radiator, residential type silencer, electronic governor, cable termination box, MS mounting frame, fuel piping, diesel day tank, 24VDC Battery, Battery mounting frame, oil level indicator with gauge board, and all other accessories as per specifications and schedule.	Nos.	1				
6.2	Supply, Installation, testing and commissioning of 320 KVA Silent type Diesel Generator Set complete with suitable size Acoustic enclosure Diesel Engine suitable for Generator application, developing 1500RPM with an overloading capacity of 10% for one hour in any 12 continuous hours operation generally confirms to BS:5514, directly coupled to 320 KVA at 0.8 Power factor, 415V, 3Phase , 4wires, 50cycles per second self excited, self regulated, with brushless excitation, Alternator generally confirms to BS:5000/IS:4722. DG set shall be complete with radiator, residential type silencer, electronic governor, cable termination box, MS mounting frame, fuel piping, diesel day tank, 24VDC Battery, Battery mounting frame, oil level indicator with gauge board, and all other accessories as per specifications and schedule.	Nos.	1				
	Diesel Generator set shall be mounted on cushy foot or similar type of vibration Isolators. The DG Set shall be suitable for auto-mains failure start and auto / manual operations. The cost shall include fuel oil required for testing DG Set at full load. The DG Should be supplied with Auto-Start-Stop Control panel with suitable rating switchgear.						
7	POWER & CONTROL CABLES & TERMINATION OF DG						
7.1	Supply & Laying of LT XLPE / PVC insulated, steel armoured, Aluminium / Copper Conductor Cables						
7.1.1	3.5C x 300 Sq.mm LT XLPE Alu. Cable	Mtr	160				
7.1.2	12C x 2.5 sq.mm LT PVC Copper Cable	Mtr	70				
7.1.3	3C x 2.5 sq.mm LT PVC Copper Cable	Mtr	70				
7.1.4	4C x 2.5sq.mm LT PVC Copper Cable	Mtr	70				
7.2	End Termination - Using Double compression glands, copper / alu. Lugs as suitable for controlling						
7.2.1	3.5C x 300 Sq.mm LT XLPE Alu. Cable	Nos	16				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
7.2.2	12C x 2.5 sq.mm LT PVC Copper Cable	Nos	4				
7.2.3	3C x 2.5 sq.mm LT PVC Copper Cable	Nos	4				
7.2.4	4 C x 2.5sq.mm LT PVC Copper Cable	Nos	4				
8	LT PANEL BOARDS - (Low Voltage Switchgear)						
8.1	MAIN LT PANEL						
	Supplying, installation, testing & commissioning of cubical type Main LT panel suitable for 433V, 3 Phase, 4 Wire 50 Hz AC supply system of suitable size fabricated in compartmentalized design from CRCA sheet steel of 2 mm thick for frame work and covers, 3mm thick for gland plates i/c cleaning & finishing complete with 7 tank process for powder coating in approved shade, having 1000A capacity extensible type four strip aluminium bus bars of high conductivity, DMC / SMC bus bar supports, with short circuit withstand capacity of 50kA for 1 Sec., bottom base channel of MS section not less than 75 mmx 50 mm x 5 mm thick, entire panel shall have a common copper earth bar 25mm x 5mm at the rear with 2 Nos. earth stud, solid connections from main bus bar to switch gears with required size of Copper bus bars and control wiring with 2.5 sq. mm. PVC insulated copper conductor S/C cable, cable alleys, cable gland plates in two half, i/c providing and fixing of following switchgear and components complete as required.						
	(i) Incomer-1:						
	1 No. Air circuit breaker electrical draw out type, 4P, 415 volts 1000A, 50kA for 1 second with electrical interlock each fitted with Microprocessor based protection release with adjustable over load, adjustable short circuit with adjustable time delay, instantaneous short circuit (>15 In), adjustable earth fault with adjustable time delay protection. Motor / closing coil / shunt trip coil shall be 230V AC. Under voltage coil shall be 415V AC, safety shutter & door interlock shall be provided. Ready to close indication, test and test to trip button, O/L, S/C, E/F, microprocessor healthy and microprocessor active LED indications. 3No. 1000/5A, 15VA, CL-1 CT for APFC relay, 3nos. 1000/5A, 15VA, CL-1 CT operated Digital Multifunction meter with RS485, 3nos. 1 set of R,Y B,ON,OFF,TRIP indication lamps, 1no. 4A 3P MCB protected digital Voltmeter with voltmeter selector switch						
	(ii) Incomer-2:						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	1 No. Air circuit breaker electrical draw out type, 4P, 415 volts 800A, 50kA for 1 second with electrical interlock each fitted with Microprocessor based protection release with adjustable over load, adjustable short circuit with adjustable time delay, instantaneous short circuit (>15 In), adjustable earth fault with adjustable time delay protection. Motor / closing coil / shunt trip coil shall be 230V AC. Under voltage coil shall be 415V AC, safety shutter & door interlock shall be provided. Ready to close indication, test and test to trip button, O/L, S/C, E/F, microprocessor healthy and microprocessor active LED indications. 3nos. 800/5A, 15VA, CL-1 CT operated Digital Multifunction meter with RS485, 3nos. 1 set of R,Y B,ON,OFF,TRIP indication lamps, 1no. 4A 3P MCB protected digital Voltmeter with voltmeter selector switch						
	(ii) Incomer-3:						
	1 No. Motorised MCCB, 4P, 415 volts 630A, 50kA for 1 second with electrical interlock each fitted with Microprocessor based protection release with adjustable over load, adjustable short circuit with adjustable earth fault with adjustable time delay protection. 3nos. 800/5A, 15VA, CL-1 CT operated Digital Multifunction meter with RS485, 3nos. 1 set of R,Y B,ON,OFF,TRIP indication lamps, 1no. 4A 3P MCB protected digital Voltmeter with voltmeter selector switch						
	(iii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 1000 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 50kA for 1 Sec.						
	(iv) Interlocking : PLC Controller Based Interlocking arrangement						
	(v) Outgoing Switchgears						
	(a) Section I						
	1 No. 630A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based KWHr. Meter for APFC Panel						
	1 No. 400A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based KWHr. Meter for Feeder Pillar-1						
	1 No. 160A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based KWHr. Meter for Feeder Pillar-2						
	1 No. 320A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based KWHr. Meter for Feeder Pillar-3						
	1 No. 400A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based KWHr. Meter for Spare						
	1 No. 160A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based KWHr. Meter for Spare						
	(a) Section II						
	1 No. 200A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for PHE Panel						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	1 No. 400A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for Fire Panel						
	1 No. 100A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for Infrastructure & Common Area Power Feeder Pillar						
	2 No. 63A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for External Lighting Feeder Pillar-1/3						
	1 No. 63A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for External Lighting Feeder Pillar-2						
	1 No. 63A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for Substation Room Lighting DB						
	1 No. 63A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for Pump Room Lighting DB						
	1 No. 100A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for spare						
	1 No. 125A, 4P, 35kA Thermal Magnetic based MCCB with all accessories, protection and CT Based Dual Source KWHr. Meter for spare						
	TOTAL RATE FOR 8.1	Each No.	1				
8.2	250 KVAR APFC PANEL						
	(i) Incomer:						
	1 No. 630A, 4P, 35kA TM based MCCB with O/L & S/C Protection Release, 630/5A, 5VA, CL-1 CT operated Digital Multifunction Meter, 1No. 4A, TP MCB Protected Digital Voltmeter with selector switch, 12 Stage Automatic Power Factor Correction relay with RS-485 port with control MCB - 1 No. and R,Y,B indication lamps.						
	(ii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 630 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 35kA for 1 Sec.						
	(iii) Outgoing Switchgears:						
	160A, TP, 25 kA, MCCB - 01 Nos.						
	100A, TP, 25 kA, MCCB - 05 Nos.						
	63A, TP, 25 kA, MCCB - 04Nos.						
	32A, TP, 25 kA, MCCB - 02 Nos.						
	50KVAR, 525Volts Gas filled heavy duty Capacitor with 7% Detuned reactor and suitable rating Capacitor duty contactor, Start-Stop Push buttons, A/M Switch, ON-OFF-Trip LED Indication lamps, control MCB and internal control wiring, etc., = 1 Nos.						
	25KVAR, 525Volts Gas filled heavy duty Capacitor with 7% Detuned reactor and suitable rating Capacitor duty contactor, Start-Stop Push buttons, A/M Switch, ON-OFF-Trip LED Indication lamps, control MCB and internal control wiring, etc., = 5 Nos.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	20KVAR, 525Volts Gas filled heavy duty Capacitor with 7% Detuned reactor and suitable rating Capacitor duty contactor, Start-Stop Push buttons, A/M Switch, ON-OFF-Trip LED Indication lamps, control MCB and internal control wiring, etc., = 3 Nos.(One Spare provision)						
	10KVAR, 525Volts Gas filled heavy duty Capacitor with 7% Detuned reactor and suitable rating Capacitor duty contactor, Start-Stop Push buttons, A/M Switch, ON-OFF-Trip LED Indication lamps, control MCB and internal control wiring, etc., = 1 Nos.						
	5KVAR, 525Volts Gas filled heavy duty Capacitor with 7% Detuned reactor and suitable rating Capacitor duty contactor, Start-Stop Push buttons, A/M Switch, ON-OFF-Trip LED Indication lamps, control MCB and internal control wiring, etc., = 1 Nos.						
	TOTAL FOR ITEM 8.2	Each No.	1				
8.3	FEEDER PILLAR-1						
	Supplying & Erection of feeder pillar box made up of 2 mm thick MS Plate alongwith suitable M.S. Angle (IP65). The P.B. have double hinge door at the front & back with suitable locking arrangement. The box will be painted by 2 cores of aluminium paint over 1 coat of red oxide paint.						
	(i) Incomer:						
	1 No. 400A, 4P, 35kA TM based MCCB with O/L & S/C Protection Release, 400/5A, 5VA, CL-1 CT operated Dual Source Digital Multifunction Meter, 1No. 4A, TP MCB Protected Digital Voltmeter with selector switch and R,Y,B indication lamps.						
	(ii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 400 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 35kA for 1 Sec.						
	(iii) Outgoing Switchgears						
	100A, TP Fuse - 2Nos.						
	63A, TP Fuse -1Nos.						
	250A, TP Fuse -1Nos.						
	TOTAL FOR ITEM 8.3	Each No.	1				
8.4	FEEDER PILLAR-2						
	Supplying & Erection of feeder pillar box made up of 2 mm thick MS Plate along with suitable M.S. Angle (IP65). The P.B. have double hinge door at the front & back with suitable locking arrangement. The box will be painted by 2 cores of aluminium paint over 1 coat of red oxide paint.						
	(i) Incomer:						
	1 No. 160A, 4P, 35kA TM based MCCB with O/L & S/C Protection Release, 160/5A, 5VA, CL-1 CT operated Dual Source Digital Multifunction Meter, 1No. 4A, TP MCB Protected Digital Voltmeter with selector switch and R,Y,B indication lamps.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	(ii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 160 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 35kA for 1 Sec.						
	(iii) Outgoing Switchgears						
	63A, TP Fuse -2Nos.						
	100A, TP Fuse -1Nos.						
	TOTAL FOR ITEM 8.4	No.	1				
8.5	FEEDER PILLAR-3						
	Supplying & Erection of feeder pillar box made up of 2 mm thick MS Plate along with suitable M.S. Angle (IP65). The P.B. have double hinge door at the front & back with suitable locking arrangement. The box will be painted by 2 cores of aluminium paint over 1 coat of red oxide paint.						
	(i) Incomer:						
	1 No. 320A, 4P, 35kA TM based MCCB with O/L & S/C Protection Release, 320/5A, 5VA, CL-1 CT operated Dual Source Digital Multifunction Meter, 1No. 4A, TP MCB Protected Digital Voltmeter with selector switch and R,Y,B indication lamps.						
	(ii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 320 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 35kA for 1 Sec.						
	(iii) Outgoing Switchgears						
	160A, TP Fuse -1Nos.						
	100A, TP Fuse -2Nos.						
	63A, TP Fuse -1Nos.						
	TOTAL FOR ITEM 8.5	No.	1				
8.6	EXTERNAL LIGHTING FEEDER PILLAR-1						
	Supplying & Erection of feeder pillar box made up of 2 mm thick MS Plate along with suitable M.S. Angle (IP65). The P.B. have double hinge door at the front & back with suitable locking arrangement. The box will be painted by 2 cores of aluminium paint over 1 coat of red oxide paint.						
	(i) Incomer:						
	1 No. 63A, 4P, 25kA TM based MCCB with O/L & S/C Protection Release with Astronomical Timer						
	(ii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 63 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 25kA for 1 Sec.						
	(iii) Outgoing Switchgears						
	16A, TPN, 10KA MCB - 4NOS.						
	16A, SPN, 10KA MCB - 3NOS.						
	16A, TPN, 10KA MCB - 1NOS. (Spare)						
	16A, SPN, 10KA MCB - 1NOS. (Spare)						
	TOTAL FOR ITEM 8.6	No.	2				
8.7	EXTERNAL LIGHTING FEEDER PILLAR-2						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Supplying & Erection of feeder pillar box made up of 2 mm thick MS Plate along with suitable M.S. Angle (IP65). The P.B. have double hinge door at the front & back with suitable locking arrangement. The box will be painted by 2 cores of aluminium paint over 1 coat of red oxide paint.						
	(i) Incomer:						
	1 No. 63A, 4P, 25kA TM based MCCB with O/L & S/C Protection Release with Astronomical Timer						
	(ii) Bus Bars : 4 Strip Aluminium bus bars (100 % Neutral) of minimum of 63 Amps capacity with heat shrinkable colored sleeves and i/c DMC/SMC supports & their spacing etc. for withstanding of 25kA for 1 Sec.						
	(iii) Outgoing Switchgears						
	16A, TPN, 10KA MCB - 7NOS.						
	16A, SPN, 10KA MCB - 8NOS.						
	16A, TPN, 10KA MCB - 1NOS. (Spare)						
	16A, SPN, 10KA MCB - 1NOS. (Spare)						
	TOTAL FOR ITEM 8.7	No.	1				
9	EARTHING SYSTEM						
9.1	EARTH PITS						
9.1.1	Earthing with 80 mm dia GI pipe (TATA-Medium)x 3.0 Mts. long and 1 x 19/8 stranded GI (Hot Dip) wire (4 Mts. long), 25 mm dia x 150 mm long galvanized bolt, double nuts, double washers including socketing at both ends of stranded GI (Hot Dip) wire by crimping sockets/ thimbles and S & F 40 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts	Nos.	30				
9.1.2	Earthing with Copper plate (610x610x3mm size) having weight of 9.84 Kg and 1 No. 25x5mm Copper strip (3.20 mt long) & 1 no. 6 sqmm PVC insulated stranded Copper wire (4 Mt long) incl. S & F 15 mm dia GI pipe (ISI-Medium) protection (4 mt. long) to be filled with bitumen, partly under the ground level & partly above ground level to an average depth of 3.65 Mts. below the ground level and restoring the surface duly rammed incl. providing 3.0 mt long, 25 mm dia GI pipe (ISI-Medium) for periodic treatment, incl. providing masonry enclosure on the top of the earth electrode of overall size 86.36x86.36x46cm deep (below Ground level) complete with cemented brick work (1:6) of 25 cm width, duly plastered with cement mortar (inside) CI hinged inspection cover of size 36.56x35.56cm with locking arrangement, GI reducer and treatment of soil by using salt & charcoal or coke for plate electrode.	Nos.	6				
9.2	EARTHING STRIPS						
9.2.1	Connecting the equipments body to earth busbar incl. S & F 50 mm x 6 mm Galvanized (Hot Dip) MS flat on wall/floor with GI saddle as required and connection to equipments with incl. drilling holes, bolts, nuts, washers etc.	Mtr.	60				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
9.2.2	Supplying and laying 25 mm X 5 mm copper strip at 0.50 metre below ground as strip earth electrode, including connection/ terminating with nut, bolt, spring, washer etc. as required. (Jointing shall be done by overlapping and with 2 sets of brass nut bolt & spring washer spaced at 50mm)	Mtr.	460				
9.2.3	Connecting the equipments to earth busbar including S & F GI (Hot Dip) wire of size as below on wall/floor with staples buried inside wall/floor as required and making connection to equipments with bolts, nuts, washers, cable lugs etc. as required and mending good damages.						
	4 SWG GI WIRE	Mtr.	300				
10	MV CABLES						
10.1	SUPPLY OF MV CABLES						
	Supplying of the following sizes of XLPE insulated, multistand Al. & Cu. Conductor armoured cables of 1.1KV grade on the surface of wall or on existing cable trays or existing Under Ground cable trench complete with fixing hardware etc. as required.						
i)	3.5C x 400 Sq.mm Aluminium Cable	Mtr.	60				
ii)	3.5C x 300 Sq.mm Aluminium Cable	Mtr.	100				
iii)	3.5C x 185 Sq.mm Aluminium Cable	Mtr.	550				
iv)	3.5C x 150 Sq.mm Aluminium Cable	Mtr.	790				
v)	3.5C x 50 Sq.mm Aluminium Cable	Mtr.	200				
vi)	3.5C x 35 Sq.mm Aluminium Cable	Mtr.	420				
vii)	4C x 16 Sq.mm Aluminium Cable	Mtr.	600				
viii)	4C x 25 Sq.mm Aluminium Cable	Mtr.	250				
ix)	4C x 35 Sq.mm Aluminium Cable	Mtr.	280				
x)	4C x 95 Sq.mm Aluminium Cable	Mtr.	50				
xi)	4C x 185 Sq.mm Aluminium Cable	Mtr.	50				
10.2	LAYING OF MV CABLES						
i)	Laying of one No. cable upto 35 sqmm in underground trench 460 mm wide x 760 mm average depth, with brick protection on the top of the cable with 8 (eight) Nos. bricks per metre, including filling the space between the brick & cable and also the trench with shifted soil, leveling up and restoring surface duly rammed	Mtr.	1173				
ii)	Above 35 sq. mm and upto 185 sq. mm	Mtr.	1586				
iii)	Laying of one cable above 150 sqmm and upto 300 sqmm through existing covered masonry trench incl. taking out RC covers, setting them in order, mending good the damages filling the trench with fine dry sand incl. supplying sand	Mtr.	1500				
iv)	Laying of one cable above 300 sqmm through existing covered masonry trench incl. taking out RC covers, setting them in order, mending good the damages filling the trench with fine dry sand incl. supplying sand.	Mtr.	160				
	Laying only Cable upto 50 sqmm through existing RCC/Hume/ GI Pipe/open masonry trench for single, 2, 3, 3½ & 4 core	Mtr.	377				
i)	Laying only Cable above 50 sqmm but not exceeding 400sqmm through existing RCC/ Hume/GI Pipe/open masonry trench for single, 2, 3, 3½ and 4 core	Mtr.	54				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
10.3	CABLE ROUTE MARKER						
i)	Supplying and fixing cable route marker with 10 cm X 10 cm X 5 mm thick G.I. plate with inscription there on, bolted /welded to 35 mm X 35 mm X 6 mm angle iron, 60 cm long and fixing the same in ground as required.	Each	200				
10.4	MV CABLE JOINTING & END TERMINATION						
	Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed / XLPE aluminium conductor cable of 1.1 KV grade as required.						
i)	3½ X 400 sq. mm (82mm)	Each	6				
ii)	3½ X 300 sq. mm (70mm)	Each	8				
iii)	3½ X 185 sq. mm (57mm)	Each	14				
iv)	3½ X 150 sq. mm (50mm)	Each	8				
v)	3½ X 50 sq. mm (35mm)	Each	2				
vi)	3½ X 35 sq. mm (32mm)	Each	4				
vii)	4 X 16 sq. mm (28mm)	Each	316				
viii)	4 X 25 sq. mm (28mm)	Each	8				
ix)	4 X 35 sq. mm (32mm)	Each	10				
x)	4C x 95 Sq.mm	Each	2				
xi)	4C x 185 Sq.mm	Each	2				
11	HUME PIPE, POLE						
11.1	Providing, laying and fixing following dia RCC pipe NP2 class (light duty) in ground complete with RCC collars, jointing with cement mortar 1:2 (1 cement : 2 fine sand) including trenching (75 cm deep) and refilling etc as required.						
i)	100 mm dia	Mtr.	200				
ii)	300 mm dia	Mtr.	120				
11.2	Erection of Single Steel tubular pole of length as given below with/without sole plate & Cap etc. in CC foundation (Proportion and dimension indicated below), having 600x600x150 mm thick CC (4:2:1) base block below sole plate/pole with hard jhama metal including CC (6:3:1) muffing 0.30 mts. dia and 0.30 mts. above ground level including 3 mm thick neat cemented finish and GI earth bolt after making drilled holes etc. on pole & carriage of pole upto 1.6 Km from Store to work-site including filling up the excavated earth pit with shifted soil and ramming properly						
i)	Up to 9 meter Size 0.6x0.6x1.70 mts	Each	108				
11.3	Supply of metallic pole of following length with required base plate, Lighting junction box of IP-65 rated and single or double arm bracket as required (GI - Hot dip galvanised)						
	Above 4.5 metre and upto 6.5 metre	Each	108				
11.4	Supplying and embedding following dia G.I. pipe (medium class) in pole collar/ foundation (during casting) for cable entry including bending the pipe to the required shape complete as required.						
i)	40 mm dia	Mtr	200				
12	LIGHTING FIXTURES						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
12.1	Supply & installtaion of Bollard LED lights, 9W. The luminaire should have color temperature of 3000K ,CRI≥80, THD <15% and PF ≥0.90. The luminaire shall meet IP65. (Make: K-Lite or equivalent, Product code: KL-7069)	Each	22				
12.2	Supply & installtaion of Spike LED lights, 12W. The luminaire should have color temperature of 3000K ,CRI≥80, THD <15% and PF ≥0.90. The luminaire shall meet IP65. (Make: K-Lite or equivalent, Product code: KL-4267)	Each	74				
12.3	Supply & installtaion of LED Downlight 12W. The luminaire should have color temperature of 3000K ,CRI≥80, THD <15% and PF ≥0.90. The luminaire shall meet IP65. (Make: K-Lite or equivalent, Product code: KL-3653)	Each	22				
12.4	Supply & installtaion of LED Step Light 12W. The luminaire should have color temperature of 3000K ,CRI≥80, THD <15% and PF ≥0.90. The luminaire shall meet IP65. (Make: K-Lite or equivalent, Product code: KL-2766)	Each	62				
12.5	Supply & installtaion of LED Post Light, 45W. The luminaire should have color temperature of 3000K ,CRI≥80, THD <15% and PF ≥0.90. The luminaire shall meet IP65. (Make: K-Lite or equivalent, Product code: KL-4515)	Each	108				
12.6	Supply of 16 meter High mast lighting system with its accessories. Mast shaft shall be in two sections with steel material confirming to BSEN 10025 and material shall be high tensile steel, grade S355, hot dip galvanised confirming to BSEN ISO 1461 and suitable for wind velocity as per IS 875. It shall also include accessories for high mast including head frame, 2 continues steel wire rope 6 mm dia (7/19 construction), trailing cable, double drum winch, Galvanised Lantern carriage arrangement suitable for up to 9 luminaires symmetrically & its control gear boxes and lightning finial. The mast shall have an integral powertool installed inside the base compartment for its operation along with Supply & Fixing of Cu Cable of Power Tool motor, Wiring for Luminaries, Anchor Plate, Foundation Bolt, Nut, Washer, Common Template all complete. Luminaire wiring materials not included in this item.	Each	2				
12.7	Erection of high Mast (16 M) on RCC foundation with cement concrete considering actual SBC of soil, with the help of suitable modern engg. tools and Plants, wiring of luminaries with all wiring materials like PVC insulated flexible cable of suitable copper conductor core of 1.5 mm ² lugs, up to 10 nos. 6A MCB along with construction of shallow foundation with cement concrete for high Mast considering the safe soil bearing capacity as per site condition, as per drawing and design of manufacturer of the mast. The soil test and submission of its report is within the scope of the work.	Each	2				
12.8	Erection, testing & commissioning of up to 12.0 / 12.5 / 16.0 meter high mast on the existing civil foundation by bolts with suitable tools, tackles, machines etc, all complete, as per direction of the EIC.	Each	2				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE	AMOUNT
				Rs. P	Rs. P
12.9	Supply & installaion of LED flood luminaire of 240W, housing made from high pressure die cast aluminum & toughened glass with IP-66 degree of protection and intregral driver. System efficacy of >110 Lumen/Watt , CRI ≥70 and co-related color temperature (CCT) of 3000K (±500K). The luminaire should have 4KV surge protection integrated in driver with 10KV external surge, PF≥0.95, and total harmonic distortion of THD≤10% operating voltage range of 120V-270V should be provided. The Driver used must be a constant current driver with efficiency of ≥85%	Each	18		
12.10	Supply & installaion of 20W 4ft LED MS Patti / Batten (Wall mounted) will give nominal system lumen output of 2000lm and a minimum system efficacy of 100lm/W. The luminaire should have color temperature of 6500K ,CRI≥80, THD <15% and PF ≥0.90. The luminaire shall meet IP20 having extruded aluminium housing with PC diffuser for better light distribution. The luminaire has the features of Input Voltage : AC220-240V, 50Hz	Each	22		
13	MCCB, ENCLOSURE, DB, MCB, RCCB				
13.1	Supplying and fixing 415 V Four Pole MCCB of Breaking capacity 25kA/35kA with fixed thermal and fixed magnetic / adjustable thermal and fixed magnetic setting in existing DBs / enclosure and necessary connection. (Make: Legrand/L&T or equivalent)				
i)	63A, 4P MCCB with Digital Multifunction Meter	Nos.	4.00		
ii)	100A, 4P MCCB with Digital Multifunction Meter	Nos.	5.00		
iii)	160A, 4P MCCB with Digital Multifunction Meter	Nos.	1.00		
iv)	250A, 4P MCCB with Digital Multifunction Meter	Nos.	1.00		
13.2	Supplying and fixing double door Horizontal TPN MCB Distribution board with IP-42/43 protection, concealed in wall after cutting the wall & mending good the damages to original finish incl. Inter connection with suitable size of copper wire and neutral link & provision for earthing attachment				
i)	4 way(LEGRAND MAKE)	Each	2.00		
13.3	Supplying and fixing 240/415 V change over (MCB module) of on din rail of existing DBs/ enclosure and necessary connection.				
i)	63A TPN (LEGRAND MAKE)	Each	2.00		
13.4	Single pole	Each	24.00		
13.5	Supplying and fixing double door sheet steel (16SWG), powder coated cable end box for TPN DB horizontal / vertical enclosure with IP-42/43 protection, on angle iron frame on wall & mending good the damages to original finish with nuts bolts etc incl. provision for earthing attachment -.For 4 way, Double door TPN MCBDB.	Each	2.00		
14	WIRING				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
14.1	Distn. wiring in 22/0.3 (1.5 sqmm) single core stranded 'FR' PVC insulated & unsheathed single core stranded copper wire (Brand approved by EIC) in 19 mm bore, 3 mm thick polythen pipe complete with all accessories embedded in wall to light/fan/call bell points with Modular type switch (Brand approved by EIC) fixed on Modular GI switch board with top cover plate flushed in wall incl. mending good damages to original finish. -2x22/0.3 (Ph. & N) and 1x22/0.3 as ECC						
i)	Average run 6 mtr .	Point	15				
ii)	Average run 8 mtr .	Point	10				
14.2	Wiring in 1.1 KV grade single core stranded 'FR' PVC insulated & unsheathed copper wire (Brand approved by EIC) of following sizes in 25mm PVC casing-capping (Precision make) incl. necy. PVC clips, fittings etc-2 x 56/0.3 (4 sqmm) + 1 x 22/0.3 (1.5 sqmm)	Mtr	100				
14.3	Supplying and fixing polythene pipe complete with fittings as necy. under ceiling/beam, bound with 22 SWG GI binding wire incl. supplying and drawing 1x18 SWG GI Wire as fish wire inside the pipes and fittings and providing 50 mm dia disc of MS sheet (20 SWG) having colour paint at one face fastened at the load point end of the polythene pipe with fish wire (synchronizing with roof/beam casting work of building construction)						
i)	19mm dia 3mm thick Polythene Pipe	Mtr	300				
ii)	25mm dia 3mm thick Polythene Pipe	Mtr	200				
14.4	Supply & Fixing 240 V, 6 A, 3 pin Modular type plug socket (Brand approved by EIC) with 6A Modular type switch, without plug top on 4 Module GI Modular type switch board with 3 Module top cover plate flushed in wall incl. S&F switch board and cover plate and making necy. connections with PVC Cu wire and earth continuity wire etc.	Each	30				
14.5	Supply & Fixing 240 V, 16 A, 3 pin Modular type plug socket (Brand approved by EIC) with 16A Modular type switch, without plug top on 4 Module GI Modular type switch board with top cover plate flushed in wall incl. S&F switch board and cover plate and making necy. connections with PVC Cu wire and earth continuity wire etc.	Each	10				
14.6	Supplying & Fixing GI Modular Switch Board of the following sizes complete with top cover plate flushed in wall for housing the board after cutting the brick wall incl. making earthing attachment, painting and mending good damages to building works - 2 Module	Each	40				
15	CABLE TRAY						
15.1	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray (Galvanisation thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required.						
i)	600 mm width X 50 mm depth X 2.0 mm thickness	Mtr	25				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
ii)	300 mm width X 50 mm depth X 1.6 mm thickness	Mtr	60				
iii)	150 mm width X 50 mm depth X 1.6 mm thickness	Mtr	100				
15.2	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray "bends" (galvanisation not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required.						
i)	600 mm width X 50 mm depth X 2.0 mm thickness	Each	10				
ii)	300 mm width X 50 mm depth X 1.6 mm thickness	Each	10				
iii)	150 mm width X 50 mm depth X 1.6 mm thickness	Each	10				
15.3	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray "Tee" (galvanisation not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required.						
i)	600 mm width X 50 mm depth X 2.0 mm thickness	Each	10				
ii)	300 mm width X 50 mm depth X 1.6 mm thickness	Each	10				
iii)	150 mm width X 50 mm depth X 1.6 mm thickness	Each	10				
16	LIGHTNING ARRESTER						
16.1	S & F Lightning Conductor Air Terminal made of 20 mm dia 1000 mm long GI pipe (ISI Medium) having five discharge prongs of 4 SWG GI (Hot Dip) wire at top duly soldered with 7/16 stranded GI (Hot Dip) wire and 85 mm dia 6 mm thick GI base plate at bottom incl. necessary holes etc. complete duly grouted on the parapet etc. in CC mortar (4:2:1)	Each	24				
16.2	Earthing with 65 mm dia GI pipe (TATA-Medium)x 3.0 Mts. long and 1 No. 50 mm x 6 mm galvanized (Hot Dip) steel strip (4 Mts. long), 20 mm dia x 125 mm long galvanized bolt, double nuts, double washers including finishing both ends by making holes etc. and S & F 65 mm dia GI pipe (ISI-Medium) protection (3 Mts. long) to be filled with bitumen partly under the ground level and partly above ground level to an average depth of 3.65 Mts.	Each	24				
16.3	Extra for providing masonry enclosure on the top of the earth electrode of overall size 86.36 cm x 86.36 cm x 46 cm deep (below Ground level) complete with cemented brick work(1:6) of 25 cm width duly plastered with cement mortar (inside) CI hinged inspection cover of size 36.56 cm x 35.56 cm with locking arrangement, GI reducer including drilling of 46 nos. 12 mm dia holes on the GI pipe.	Each	24				
16.4	Extra for treatment of soil by using salt & charcoal or coke for plate electrode.	Each	24				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
16.5	Connecting the equipments body to earth busbar incl. S & F 50 mm x 6 mm Galvanized (Hot Dip) MS flat on wall/floor with GI saddle as required and connection to equipments with incl. drilling holes, bolts, nuts,washers etc.	R/Mtr	200				
16.6	Hiring charges for scaffolding arrangement including dismantling at the end of work and carriage, for LC installation, per storey of building per vertical run.	Each	40				
16.7	Supply & Fixing of Testing Joints by 20 mm x 3 mm thick GI (Hot Dip) strip 125 mm long grouted on wall having clearance of 6 mm from wall for making connection with thimbles at the end of 7/10 SWG GI (Hot Dip) stranded Wire and 4 SWG GI (Hot Dip) wire of vertical conductor and conductor from earth electrode complete with S & F thimbles, GI bolts, nuts, check-nuts, spring washers etc. as required.	R/Mtr	200				
16.8	Cutting cornices/ steps etc. including cutting recess in buildings etc. & supply & fixing 15 mm bore (ISI-Medium) GI pipe protection as below and mending good damages to the building works: -Length upto 0.5 Mtr.	SET	20				
17	NETWORK						
17.1	Supply & Fixing RJ45 sitable for CAT6 cable (Brand approved by EIC) with PVC board and top cover plate on wall and making necessary connections & testing as required	Each	10				
17.2	Supply & Fixing Telephone socket (RJ11) Modular type (Brand approved by EIC) with PVC board and top cover plate on wall and making necessary connections & testing as required.	Each	10				
17.3	Supplying & Drawing LAN cable (CAT6) (Brand approved by EIC) in prelaid PVC rigid conduit/ in polythene pipe embeded in wall.	R/Mtr	200				
17.4	Supplying & Drawing 2-pair Telephone cables with high density polyethylene insulated solid annealed high conductivity bare copper of dia 0.5mm in prelaid PVC rigid conduit/ in polythene pipe embeded in wall.	R/Mtr	200				
17.5	Supply and installation of 16 Line EPABX for telephone system as per specification.	Each	1				
TOTAL PROJECT COST FOR SECTION-B=							



SYAMA PRASAD MOOKERJEE PORT, KOLKATA
सिविल इंजीनियरिंग विभाग / Civil Engineering Department
6, फ़ॉर्ली प्लेस (फ़ॉर्ली वेयरहाउस)/6, Fairlie Place (Fairlie Warehouse, 2nd floor)
कोलकाता - 700 001 /Kolkata - 700 001



NIT No:- SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

(BILL OF QUANTITIES)

Development Of River Cruise Terminal and river tourism facility alongwith riverfront beautification works at KDS ,
SMP,Kolkata -adjacent to Indenture Memorial Area.

(i) Name of the bidder :-	
(ii) Address of the bidder :-	
(iii) Contact number of bidder :-	
(iv) e-mail ID of the bidder :-	

PART C:-

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
EXTERNAL SEWERAGE SYSTEM							
1	Providing and fixing square-mouth S.W. gully trap class SP-1 complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design:-With common burnt clay F.P.S. (non modular) bricks of class designation 7.5 -100x100 mm size P type	Each	4				
2	Constructing brick masonry road gully chamber 45x45x77.5 cm with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) with precast R.C.C. vertical grating complete as per standard design -With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	4				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
3	Constructing brick masonry chamber for underground C.I. inspection chamber and bends with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) C.I. cover with frame (light duty) 455x610 mm internal dimensions, total weight of cover with frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg), R.C.C. top slab with 1:1.5:3 mix (1 cement : 1.5 fine sand : 3 graded stone aggregate 20 mm nominal size), foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand), finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete as per standard design:Inside dimensions 500x700 mm and 45 cm deep for pipe line with one or two inlets : With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	2				
4	Constructing brick masonry circular manhole 1.22 m internal dia at bottom and 0.56 m dia at top in cement mortar 1:4 (1 cement :4 coarse sand) inside cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement foundation concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) and making necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement, all complete as per standard design : 1.68 m deep with SFRC Cover and frame (heavy duty HD-20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg. fixed in cement concrete 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering, shuttering all complete. (Excavation, foot rests and 12 mm thick cement plaster at the external surface shall be paid for separately) :With common burnt clay F.P.S. (non modular) bricks of class designation 7.5.	Each	13				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Supply of UPVC pipes (B Type) & fittings conforming to IS-13592-1992 Rate quoted shall be inclusive of supplying and fixing anchor fastners, stud rods, brackets, hangers, clamps, MS angle supports as per standard for supporting drainage pipes in shafts / ceiling with suitable GI clamps, pads, bolts, nuts and washers etc., Supports shall be with one coat of anticorrosive primer and two coats of enamel paint etc., complete.						
a	200 mm dia	R/Mtr	128				
b	160mm dia	R/Mtr	97				
c	110 mm dia	R/Mtr	80				
6	Supplying insatlling testing and commissioing pre-fabricated Oil and Grease trap for Kitchen with 3000 meals per day capacity .	Each	2				
	EXTERNAL WATER SUPPLY						
1	Supplying, fitting and fixing CPVC (Chlorinated Polyvinyl Chloride) pipes of approved make conforming to IS-15778: 2007 . with all necessary accessories, specials viz. socket, bend, tee, union, cross, elbo, nipple, longscrew, reducing socket, reducing tee, short piece etc. fitted with holder bats clamps, including cutting pipes, fitting, fixing etc. complete in all respect including cost of all necessary fittings as required, jointing materials in any position above ground. (Payment will be made on the centre line measurements of total pipe line including all specials. No separate payment will be made for accesories, specials.(a) For Exposed Work-CPVC Pipes Class-1, SDR-11						
a	25 mm dia (Branch line from ring main)	R/Mtr	150				
b	32 mm dia (Branch line from ring main)	R/Mtr	20				
c	40 mm dia (Branch line from ring main)	R/Mtr	20				
d	50 mm dia	R/Mtr	470				
e	65 mm dia	R/Mtr	470				
f	80 mm dia	R/Mtr	280				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
2	Supplying, fitting and fixing CPVC (Chlorinated Polyvinyl Chloride) pipes of approved make conforming to IS-15778: 2007 . with all necessary accessories, specials viz. socket, bend, tee, union, cross, elbo, nipple, long screw, reducing socket, reducing tee, short piece etc. fitted with holder bats clamps, including cutting pipes, fitting, fixing etc. complete in all respect including cost of all necessary fittings as required, jointing materials in any position above ground. (Payment will be made on the centre line measurements of total pipe line including all specials. No separate payment will be made for accessories, specials.(a) For Exposed Work - Municipal/Borewell supply -25 mm dia (Branch line from ring main).	R/Mtr	50				
3	Providing and fixing gun metal gate valve with C.I. wheel of approved quality (screwed end) :						
a	25mm dia	Each	12				
b	32 mm dia	Each	2				
c	40 mm dia	Each	2				
d	50mm dia (Ring main)	Each	2				
e	65mm dia (Ring main)	Each	2				
f	50mm dia (FWS main line from pump room to Ring main)	Each	3				
g	65mm dia (DWS main line from pump room to Ring main)	Each	2				
4	Providing and fixing ball valve (brass) of approved quality, High or low pressure, with plastic floats complete -25 mm dia	Each	4				
5.1	Providing and fixing enclosed type water meter (bulk type) conforming to IS : 2373 and tested by Municipal Board complete with bolts, nuts, rubber insertions etc. (The tail pieces if required will be paid separately) :80mm dia - Municiple meter	Each	1				
5.2	Providing and fixing C.I. dirt box strainer for bulk type water meter with nuts, bolts, rubber insertions etc. complete conforming to IS : 2373 : 80 mm dia	Each	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
6	Constructing masonry Chamber 60x45x50 cm inside, in brick work in cement mortar 1:4 (1 cement : 4 coarse sand) for water meter complete with C.I. double flap surface box 400x200x200 mm (inside) with locking arrangement and RCC top slab 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) , i/c necessary excavation, foundation concrete 1:5:10 (1 cement : 5 fine sand:10 graded stone aggregate 40 mm nominal size) and inside plastering with cement mortar 1:3 (1 cement : 3 coarse sand) 12 mm thick, finished with a floating coat of neat cement complete as per standard design : With common burnt clay F.P.S.(non modular) bricks of class designation 7.5	Each	1				
7	Supplying, fixing and testing inlet, outlet, vent and overflow pipes, fittings with CI frame and cover to under ground and over head water tank complete with PVC Rungs as shown on the drawings etc., complete, accessories comprising of the following	Set	1				
	Approx. depth = 3.5 to 4.0Mts.						
	i) DI manhole frame and cover (Heavy duty) with locking facility	Nos	14				
	250 dia fire outlet	nos	2				
	100dia (Tanker)	nos	1				
	150 dia FBIC/ test line	nos	2				
	25dia (from Minicipal)	nos	1				
	iii) Outlet puddle flanges	nos	1				
	80dia (Domestic suction outlet)	nos	1				
	100dia (Fire over flow to Raw water tank)	nos	2				
	65dia (Raw water Suction outlet to filter feed pump)	nos	1				
	50dia (Inlet to treated water tank))	nos	1				
	65dia overflow pipe (Raw and treated tank)	nos	2				
	80dia Treated water outlet	nos	1				
	iv) 100dia Vent pipe with mosquito proof mesh	nos	6				
	v) Heavy duty 450mm wide PVC step ladder	nos	60				
	vii)50dia Sleeves for level controller	nos	4				
	viii.)50dia Drain pipe puddle flange	nos	4				
	Note : All puddle flanges to be hot dip galvanised.						
9	Supplying, fixing and testing commissioning of motorised valve for OHT operation , including control pnal, by pass valve , vater lvl controllers , requitred cable etc complete set - 25 mm dia	Set	12				
	STORM WATER DRAINAGE						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
1	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement : 2 fine sand) including testing of joints etc. complete :						
a	150 mm dia. R.C.C. pipe	R/Mtr	180				
b	250 mm dia. R.C.C. pipe	R/Mtr	110				
c	300 mm dia. R.C.C. pipe	R/Mtr	250				
2.1	Constructing brick masonry chamber for underground C.I. inspection chamber (For rain water) and bends with bricks in cement mortar 1:4 (1 cement : 4 coarse sand) C.I. cover with frame (light duty) 455x610 mm internal dimensions, total weight of cover with frame to be not less than 38 kg (weight of cover 23 kg and weight of frame 15 kg), R.C.C. top slab with 1:1.5:3 mix (1 cement : 1.5 fine sand : 3 graded stone aggregate 20 mm nominal size), foundation concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm nominal size), inside plastering 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand), finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete as per standard design:Inside dimensions 455x610 mm and 45 cm deep for single pipe line :With common burnt clay F.P.S. (non modular) bricks of class designation 7.5 □	Each	4				
2.2	Inside dimensions 500x700 mm and 45 cm deep for pipe line with one or two inlets :With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	4				
3	Extra for depth beyond 45 cm of brick masonry chamber : For 455x610 mm size With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	7				
4	for 500x700 mm size With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	7				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Constructing brick masonry circular manhole 1.22 m internal dia at bottom and 0.56 m dia at top in cement mortar 1:4 (1 cement :4 coarse sand) inside cement plaster 12 mm thick with cement mortar 1:3 (1 cement : 3 coarse sand) finished with a floating coat of neat cement foundation concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm nominal size) and making necessary channel in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) finished with a floating coat of neat cement, all complete as per standard design :1.68 m deep with SFRC Cover and frame (heavy duty HD20 grade designation) 560 mm internal diameter conforming to I.S. 12592, total weight of cover and frame to be not less than 182 kg. fixed in cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size) including centering, shuttering all complete. (Excavation, foot rests and 12 mm thick cement plaster at the external surface shall be paid for separately) : With common burnt clay F.P.S. (non modular) bricks of class designation 7.5	Each	13				
6	Boring/drilling bore well of required dia for casing/ strainer pipe, by suitable method prescribed in IS: 2800 (part I), including collecting samples from different strata,preparing and submitting strata chart/ bore log, including hire & running charges of all equipments, tools, plants & machineries required for the job, all complete as per direction of Engineer-in-charge, upto 90 metre depth below ground level.All types of soil -300 mm dia	R/Mtr	600				
7	Supplying, assembling, lowering and fixing in vertical position in bore well, unplasticized PVC medium well casing (CM) pipe of required dia, conforming to IS: 12818, including required hire and labour charges, fittings & accessories etc. all complete, for all depths, as per direction of Engineer -in-charge-150 mm dia.	R/Mtr	450				
8	Supplying, filling, spreading & leveling stone boulders of size range 5 cm to 20 cm, in recharge pit, in the required thickness, for all leads & lifts, all complete as per direction of Engineer-in-charge.	Cu.Mtr	7				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
9	Supplying, filling, spreading & leveling gravels of size range 5 mm to 10 mm, in the recharge pit, over the existing layer of boulders, in required thickness, for all leads & lifts, all complete as per direction of Engineer-in-charge.	Cu.Mtr	7				
10	Supplying, filling, spreading & leveling coarse sand of size range 1.5 mm to 2 mm in recharge pit, in required thickness over gravel layer, for all leads & lifts, all complete as per direction of Engineer -in-charge.	Cu.Mtr	7				
11	Gravel packing in tubewell construction in accordance with IS: 4097, including providing gravel fine/ medium/ coarse, in required grading & sizes as per actual requirement, all complete as per direction of Engineer-in-charge.	Cu.Mtr	7				
12	Providing and fixing factory made precast RCC perforated drain covers, having concrete of strength not less than M-25, of size 1000 x 450x50 mm, reinforced with 8 mm dia four nos longitudinal & 9 nos cross sectional T.M.T. hoop bars, including providing 50 mm dia perforations @ 100 to 125 mm c/c, including providing edge binding with M.S. flats of size 50 mm x 1.6 mm complete, all as per direction of Engineer-in-charge.	Each	15				
13	Providing and fixing suitable size threaded mild steel cap or spot welded plate to the top of bore well housing/ casing pipe, removable as per requirement, all complete for borewell of: 150 mm dia.	Each	15				
14	Providing and fixing M.S. clamp of required dia to the top of casing/ housing pipe of tubewell as per IS: 2800 (part I), including necessary bolts & nuts of required size complete. - 150 mm clamp.	Each	15				
15	Providing and fixing Bail plug/ Bottom plug of required dia to the bottom of pipe assembly of tubewell as per IS:2800 (part I). -150 mm dia.	Each	15				
	PUMPS						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
1	Supplying, installing, testing and commissioning HYDRO-PNEUMATIC water pumps of adequate HP comprising of 2 or 3 centrifugal self priming multi stage pump capable of giving a required discharge at suitable head to work on 3 Ph 50 Hz, 380/415V with necessary unions, flanges, strainers, control valves and von return valves, presure gauges etc., complete system. Selection of pumps wiht mechanically sealed. Pumping system shall comprise of skid mounted panel with multi VFD and necessary starters for smooth operation of pumps. Quote shall include wiring from TPN switch to control panel and to the pumps etc., and it should include the cable trays and supports for tray and pipes also. Rate quoted shall include necessary valves and manifold at suction and delivery side in SS. Also quote should include necessary foundation bolts and anti vibration pads for each pump. All support shall be GI and bolts used for foundation shall be SS.						
a	Application: Domestic water distribution						
	Duty : 2.0 lps each	Set	1				
	Nos. of Pumps : (1 working + 1 stand by)						
	Head : 30MWC						
	Metal Pressure Tank - 100 Ltrs	Nos	1				
	Pressure switch	Nos	2				
	Pressure guage	Nos	2				
	Control panel	Nos	1				
	Control cable as per OEM	Rmt	40				
	65 mm Strainer	Nos	1				
	50 mm NRV	Nos	1				
	50 MM BFV	Nos	1				
	65 mm BFV	Nos	1				
	Cable tray	Rmt	40				
b	Application: : Flushing water distribution						
	Duty : 1.8 lps each , Nos. of Pumps : (1 working + 1 stand by)	Set	1				
	Head : 30MWC						
	Metal Pressure Tank - 100 Ltrs	Nos	1				
	Pressure switch	Nos	2				
	Pressure guage	Nos	2				
	Control panel	Nos	1				
	Control cable as per OEM	Rmt	40				
	65 mm Strainer	Nos	1				
	50 mm NRV	Nos	1				
	50 MM BFV	Nos	1				
	65 mm BFV	Nos	1				
	Cable tray	R/Mtr	40				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
2	Providing ,fixing , testing and commissioning of Submersible type storm Water lift pumps set 2 no's (1 Working + 1 Standby) Close Couple pumps of Water Flow Rate of each pump 16 cum/hr with the head of 15 MWC adequate the casing shall be cast iron and impeller shall be Stainless steel the pump HP capacity shall be provided by manufacturer at suitable head to work on 3Ph, 50Hz, 400/440V with necessary unions, flanges, foundation bolts, RCC footing in 1:2:4 etc. complete. Vendor shall consider he electrical control panel comprising of all accessories such as MCB ,isolation valve,non return valve, pressure switches, pressure transducers, control wiring & End terminations , earth strip of GI 25 x 3 mm,cable tray and any other necessary imports etc. complete.Pump room pumps	Set	2				
	Discharge elbow	Nos	4				
	Pressure switch	Nos	2				
	Pressure guage	Nos	2				
	Control panel	Nos	1				
	Control cable as per OEM	Rmt	40				
	50 mm NRV	Nos	1				
	50 MM BFV	Nos	1				
	Cable tray	R/Mtr	40				
3	Supplying, installing, testing and commissioning approved make water level controller with alarm for the Underground Sump. The quoted rate shall include for necessary wiring in PVC conduit between the control panel, underground sump and overhead tank.(length of cable approx. 60 mts.	Nos	8				
4	Excavation in all types of soil . including forming bottom surface to required level, refilling selected excavated earth around the pipe in layers 150mm thick, watering, consolidating and disposing off the surplus earth with in the site with a lead as directed by the site engineer complete - . Depth upto 2.0 M.	Cu.Mtr	500				
	WATER TREATMENT PLANT - 3.0 m3/hr						
1	Supply, installation, testing and commissioning of pressure sand filter of FRP construction with necessary equipment complete with MPV piping, valves, suitable supports for mounting, pressure guage, orifice plate etc.,complete as per the detailed specification for the efficient working of system. The maximum working Pressure shall be 3.5Kg/Sqcm and dia is 500 mm and height 1800 mm -capacity : 3.0 cum /hr.	Each	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
2	Supply, installation, testing and commissioning of activated carbon filter of FRP construction with necessary equipment complete with MBV piping, valves, suitable supports for mounting, pressure guage, orifice plate etc.,complete as per the detailed specification for the efficient working of system. The maximum working Pressure shall be 3.5Kg/Sqcm and dia is 500mm and height 1800 mm -capacity : 3.0 cum /hr	Each	1				
3	Supply of monobloc pumps for transferring the raw water to the filters 5 m3/hr @ 12- 15 mts head .Raw water to Treated water sump	Lot	1				
4	Supplying, installing, testing and commissioning approved make water softener with necessary Ancillary equipment complete with piping, valves ejector, orifice plate, salt saturator made of corrosion resistant material and hardness testing kit etc., complete as per detailed specification for the efficient working of the system. Consider a Total hardness of 500 ppm, hardness required for treated water less than 150 ppm CaCO3.Max. working pressure = 3.5Kg/Sqcm. 3 m3/hr Size dia is 600 mm and height1800 mm, 1000 L Capacity of HDPE - Salt Regeneration tank and OBR OF 130 cum @ 500 PPM Hardness.Capacity : shall be driven by WTP vendor based on the water hardness parameter.	Each	1				
5	On line Metered Chlorine Dosing system including a 100L capacity storage tank etc., complete.	Each	1				
6	Supply, installation, testing and commissioning of inter unit piping with necessary flanges, bolts, nuts, neoprene gaskets, welding wherever necessary, with necessary control valves, non return valves etc and with one coat of primer and two coats of approved enamel paint etc., complete.	Lot	1				
7	Supply, installation, testing and commissioning of Level Switch for pump control	each	1				
8	Electrical works related for the above items including cabling, Panel , end terminations,laying in cable trays from connected loads upto the panel board etc.,complete.Cable - 50 Rmt ,Cable tray - 40 Rmt	Each	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
9	Installing, testing and commissioning plant, inter unit piping with necessary flanges, bolts, nuts, neoprene gaskets, welding wherever necessary, with necessary control valves, non return valves ,required corecut & sleeves In RCC wall etc and with one coat of primer and two coats of approved enamel paint etc., complete.	Lot	1				
	STP - 40 KLD						
1	Design, Supply, Installation, testing & commissioning of 1 Nos. SS suitable Sized Manually operated Bar Screen made of MS 304 in RCC screen channel as per following specifications.						
	Size - 1000 x 900						
	Cleaning :- Manually Cleaned Screen						
	Bar Spacing :- Coarse screen and fine screen						
	Spacing between the bar in coarse screen : 10mm						
	Spacing between the bar in Fine screen : 6 mm						
	MOC :- Complete in MS epoxy	Nos.	1				
2	Supply, Installation, testing & commissioning of raw sewage transfer pump (submersible type with cutter) The pump shall be coupled to adequate HP, electrical motor, as per technical specifications. The pump shall be 2W+1S ,Duty: 7 m3/hr	Set	2				
3	Supply, Installation, testing & commissioning of tubular type coarse bubble diffuser to provide clog free oxygen for equilization tank, sludge holding tank, Decant tank and treated water tank with PVC fitting, nylon rope braided hose with all accessoies.						
	Length of diffuser : 90 dia x 800 mm long / disc type (Retreivable type to be considered)						
	However, Contractor to design and provide the same as per their Design	Lot	1				
4	Supplying, installing , testing and commissioning Fine pore diffusers with membrane with supporting structure UPVC pipes with necessary accessories for air line connection from header and RCC block support for clamping down to floor.All as per specification (For SBR tanks)						
	Length of diffuser : 90 dia x 1000mm long (Retreivable type to be considered)						
	However, Contractor to design and provide the same as per their Design	Lot	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Supplying, installing, testing and commissioning Air Blower as per specification to supply air for all collection tank, SBR tank, sludge tank and final tank. dedicate set for SBR tank, and additional set for equalisation tank, decant tank, sludge tank, final tank.						
	Air blower for SBR Tanks @ 0.5 bar @ 90 m3/hr-motor 5 hp						
	Air blower for Eq Tank & SHT @ 0.5 bar						
	However, Contractor to design and provide the same as per their Design	Lot	1				
6	Providing and fixing of sludge pumps monobloc for transfer of sewage from aeration tanks to sludge tank once in 19 days	lot	1				
a	Piping (heavy class) in MS/GI/UPVC as per the approval of the consultants, to be designed for suitable and corrosion resistance. The discharged piping shall be designed at velocity 1.5 m/s and the suction header shall be designed at velocity 1.2 m/s. Exposed and submerged piping shall be SS / UPVC and headers of pumps shall be MS/GI.						
b	Material of Construction of Submerged Piping : CPVC	Lot	1				
c	Material of Construction of Pump Headers : GI	Lot	1				
7	Designing, Supplying, installing, testing and commissioning of composite FRP Multigrade Vessel filter. Filter shall be suitable for working pressure of 4 kg/cm ² and shall include media, standard fittings like pressure gauges, sampling cock, backwash, rinse drain, vacuum breaker, including frontal piping, valves. The vessel shall have two coats of epoxy paints inside and outside.						
	Capacity : 7.0 M ³ /Hr.- 600 mm dia FRP filter						
	Diameter : As per manufacturer's recommendation						
	Multigrade pressure sand filter	Set	1				
8	Designing, Supplying, installing, testing and commissioning of composite FRP vessel Activated Carbon Filter. Filter shall be suitable for working pressure of 4 kg / cm ² and shall include media, standard fittings like pressure gauges, sampling cock, backwash, rinse drain, vacuum breaker, including frontal piping, valves, & 1 No water flow rota meter at outlet. The vessel shall have two coats of epoxy paints inside and outside.						
	Capacity : 7.0 M ³ /Hr. FRP vessel- 600 mm dia						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Diameter : As per manufacturer's recommendation						
	Activated Carbon Filter	Set	1				
9	Design, Supply, installation, commissioning of chlorine dosing system each electronic metering pump of 0-6 litres/ hr. capacity with individual HDPE tanks of suitable capacity having S.S. agitators, motor, accessories, injection fitting, solution delivery tube etc. including making electrical connection for auto operation as per dosing tank level, all in complete.	Set	1				
10	Supplying, installing, testing, commissioning of centrifugal Vertical Water Transfer pumps in SS - 304 (CI Casing + SS - 304 Internals) Internals with motor, pressure gauge with isolation cock, Isolation valve, NRV on delivery line. Isolation valve, strainer at suction. The pump shall be suitable for 415±10% volts 3 phase AC supply. Pumps including cost of suction delivery headers in GI heavy class. Provision of guide ropes to guide submersible pump from upper level to operational level in sump basin with channels / angle section of MSEP shall be made by the STP contractor.						
	Filter feed pumps						
	Capacity 7 KLH each - (1W + 1 SB)						
	Head 35 Mts						
	RPM 2900	Set	2				
11	Supply and Installation, Testing and commissioning of horizontal end suction type centrifugal pumping set with C.I. casing. CI Impeller, SS shaft with mechanical rotary shaft seal directly coupled to motor suitable for operation on 400/440 volts, 3 phase 2900 RPM. TEFC electric motor mounted on a common channel baseplate with coupling guard, pressure guage, G.M. isolation cock, suitable Vibration eliminator pads of approved design and cement concrete foundation with M.S. nosing complete as required.						
a	Sludge Screw pump						
	Capacity 1.5 cum/hr each or as required						
	Head 60 MWC						
	RPM 2900	Set	1.00				
b	Sewage sludge re-circulation pumps / Sludge Disposal Pumps						
	Capacity 2.5cum/hr each (1W + 1S) or as required						
	Head 10 Mts						
	RPM 2900	Set	1.00				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
12	Design, installation, testing and commissioning of the following integrated, cubicle type, dead front, extensible, sheet steel vermin proof PLC based with touch screen & in built remote controlling operation control panel anchoring to the foundation. The panel shall be suitable for 500 volts, 50 cycles, 4 wire, supply. Quoted price shall include, 25 mm thick rubber mats, wiring, cabling, cable tray, control wiring and copper earthing from control panel to various equipment like motor starters pump motors etc. The panel shall have separate compartments for bus bar and cable alleys. The following components and accessories shall be mounted within each control panel. The Panel shall be provided with a display of parameters of the STP as required by the Client for proper monitoring of the System and the same shall be capable / compatible to provide / share the data with IBMS System /Facility Software as required by the Client.						
	One No.required.amps TP incoming MCCB complete with the following:						
	i. 0-500 volts 96x96 square mm voltmeter with selector switch and fuses .						
	ii. 0-25 amps 96x96 square mm ammeter with 300/5 amps ratio CT's and selector switch						
	iii. Phase indicating lamps with toggle switches.						
	iv. Indication lamps for ON/OFF/TRIP status of motors.						
	Aluminium bus bar sleeves type, rated at 15 amps for three phase & neutral.						
	OUTGOING FEEDERS / STARTERS						
	Complete for the STP equipments as described above.						
	Spares TP MCCB's - 2 Nos.						
	Control Panel as described above with switchgear ratings for all equipments as per specifications of equipment	Set	1.00				
13	Electrical Cabling (Aluminium Armoured / Copper Flexible) for all equipment feed supplies & Copper flexible for control cabling including GI wires & strips for earthing .	Lot	1.00				
14	GI Cable Trays of suitable sizes for all equipment feed supplies.	Lot	1.00				
15	Commissioning and obtaining the statutory approvals from the concerned including necessary signages . Only technical support	Job	1.00				
TOTAL PROJECT COST FOR SECTION-C=							



SYAMA PRASAD MOOKERJEE PORT, KOLKATA
सिविल इंजीनियरिंग विभाग / Civil Engineering Department
6, फ़ॉर्ली प्लेस (फ़ॉर्ली वेयरहाउस)/6, Fairlie Place (Fairlie Warehouse, 2nd floor)
कोलकाता - 700 001 /Kolkata - 700 001



NIT No:- SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

(BILL OF QUANTITIES)

Development Of River Cruise Terminal and river tourism facility alongwith riverfront beautification works at KDS , SMP,Kolkata -adjacent to Indenture Memorial Area.

(i) Name of the bidder :-	
(ii) Address of the bidder :-	
(iii) Contact number of bidder :-	
(iv) e-mail ID of the bidder :-	

PART D:- FIRE

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
A	Fire Alarm System						
1	Supplying, installation, testing and commissioning of micro processor based intelligent addressable main fire alarm panel,central processing unit with the following loop modules and capable of supporting not less than 240 devices (including detectors) and minimum 120 detectors per loop and loop length up to 2 km, network communication card, minimum 320 character graphics/ LCD display with touch screen or other keypad and minimum 4000 events history log in the non volatile memory (EPROM), power supply unit (230 ± 5 % V, 50 hz), 48 hrs back-up with 24 volt sealed maintenance freebatteries with automatic charger. The panel shall have facility to connect printer to printout log and facility to have seamlessintegration with analog/digital voice evacuation system (which is part of the schedule of work under SH: PA System) and shall be complete with all accessories . The panel shall be compatible for IBMS system with open protocol BACnet/ Modbus over IP complete as per specifications.						
a	Two Loop Panel.	Each	2				
2	Supplying, installation, testing & commissioning of intelligent analog addressable photothermal detector complete with mounting base complete as required.	each	45				
3	Supplying, installation, testing & commissioning of fault isolator complete with base as required.	each	2				
4	Supplying, installation, testing & commissioning of addressable fire control module complete as required.	each	4				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Supplying, installation, testing & commissioning of addressable fire monitor module complete as required.	each	4				
6	Supplying, installation, testing & commissioning of addressable phone control module complete as required.	each	8				
7	Supplying, installation, testing & commissioning of addressable beam detector with short circuit isolator (inbuilt or seperate) complete with emitter and receiver including connections with remote test features etc complete as required.	each	8				
8	Providing ,fixing , testing and commissioning of Addressable Intelligent fixed thernal detectors with rateof raise cum fixed temperature thermister complete with base as required	each	4				
9	Supplying, installation, testing & commissioning of intelligent addressable duct detector including suitable Photo detector complete with base as required.□	each	6				
10	Supplying, installation, testing & commissioning of addressable manual call point complete as required.	each	14				
11	Supplying, installation, testing & commissioning of addressable horn cum strobe complete as required.	each	14				
12	Supplying, installation, testing & commissioning of fire fighter telephone handset complete as required.	each	14				
13	Supplying, installation, testing & commissioning of fire fighter phone jack complete as required	each	14				
14	Supplying & laying of 2x1.5 sqmm fire alarm armoured cable, 600/1000V rated with annealed copper conductor having XLPE insulation, steel wire armouring & FRLS outer sheath complete as required.	rmt	1800				
15	Supplying and fixing 25 mm dia MS flexible pipe with PVC coating along with all ancillaries and accessories like coupler etc. as required.	Metre	450				
B	Fire Hydrant System						
1	Supplying, installation, testing and commissioning of Electric driven Main Fire Pump suitable for automatic operation and consisting of following, complete in all respects, as required :						
	Horizontal type, multistage, centrifugal, split casing pump of cast iron body & bronze impeller with stainless steel shaft, mechanical seal conforming to IS 1520.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Suitable HP Squirrel cage induction motor, TEFC, synchronous speed 1500 RPM, suitable for operation on 415 volts, 3 phase 50 Hz, AC supply with IP 55 protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS-325.						
	M.S. fabricated Common base plate, coupling, coupling guard, foundation bolts etc. as required.						
	Suitable cement concrete foundation duly plastered with anti vibration pads.						
	2280 lpm at 56 m Head	Set	1				
2	Supplying, installation, testing and commissioning of diesel engine driven main fire pump suitable for automatic operation and consisting of following, complete in all respects, as required : (Diesel Driven Pump)						
	Horizontal type, multistage, centrifugal pump of cast of iron body and bronze impeller with stainless steel shaft, mechanical seal conforming to IS 1520.						
	Suitable HP, 1500 RPM water cooled with radiator, diesel engine conforming to relevant IS standard complete with auto starting mechanism, 12 /24 volts electric starting equipment, diesel tank, exhaust pipe extended upto 10 m outside pump house duly insulated with 50 mm thick glass wool with 1.0 mm thick aluminium sheet cladding, residential silencer, instruments and protection as per standard specification, stop solenoid for auto stop in the event of fault with audio indications, painted with post office red colour etc. as required.						
	M.S fabricated, common base plate, coupling, coupling guard, foundation bolts etc. as required.						
	Suitable cement concrete foundation duly plastered and with anti vibration pads.						
	2280 lpm at 56 m Head	Set	1				
3	Supplying, installation, testing and commissioning of electric driven pressurisation pump suitable for automatic operation and consisting of following, complete in all respects, as required : (Jockey Pump)						
	Horizontal type, multistage, centrifugal pump of cast iron body and bronze impeller with stainless steel shaft, mechanical seal conforming to IS : 1520.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Suitable HP squirrel cage induction motor TEFC type suitable for operation on 415 volts, 3 phase 50 Hz AC supply with IP 55 class of protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS : 325.						
	M.S.fabricated Common base plate, coupling, coupling guard, foundation bolts etc. as required						
	Suitable cement concrete foundation duly plastered and with anti vibration pads.						
	180 lpm at 56 m Head	set	1				
4	Supplying, installation, testing and commissioning of electric driven terrace pump suitable for automatic operation and consisting of following, complete in all respects, as required: (Terrace Pump)						
	Horizontal type, multistage, centrifugal, split casing pump of cast iron body & bronze impeller with stainless steel shaft, mechanical confirming to IS : 1520						
	Suitable HP squirrel cage induction motor TEFC type suitable for operation on 415 volts, 3 phase, 50 Hz, AC supply with IP55 class of protection for enclosure, horizontal foot mounted type with Class-'F' insulation, conforming to IS-325.						
	M.S.fabricated common base plate, coupling, coupling guard, foundation bolts etc.as required.						
	Suitable cement concrete foundation duly plastered and with anti vibration pads.						
	450 lpm at 35 m Head	set	4				
5	Fabrication, supply, Installation testing & commissioning of Electrical control panel of cubical construction, floor mounted type, fabricated out of 2mm thick CRCA sheet, compartmentalised with hinged lockable doors, dust and vermin proof, powder coated of approved shade after 7 tank treatment process, cable alley, inter-connection with suitable size copper conductor cable/solid copper strip, having switchgears and accessories, mountings and internal wiring, earth terminals, numbering etc. complete in all respect, suitable for main fire pump, pressurisation pump & diesel pump set complete as per CPWD specification with following in coming and Outgoings, suitable for operation on 415V, 3 phase, 50Hz Ac Supply with enclosure protection class IP 42 as required :	set	1				
a	INCOMING						
	400A, 50kA 4 Pole MCCB, Ics=100% Icu rating						
	Digital Voltmeter 0-500V with selector switch						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Digital Ammeter (0-400 A) with selector switch & CTs etc.						
	LED type RYB phase indicating lamps, ON, OFF, trip indicating lamps						
	Set of Copper Bus Bar 500A						
	OUTGOING						
	(Note : All outgoing feeders for pumps should have digital Ammeter with selector switches, and LED type ON, OFF, trip indicating lamps)						
	Main Fire Pump						
	200 A, 50kA TPN MCCB, Ics=100% Icu, with fully automatic Star/Delta starter suitable for 75 hp pump with overload protection, current sensing type single phase preventor complete with all accessories and internal wiring required for automatic operation, selector switch for local/remote, auto/manual/OFF operation.						
	Jockey Pump						
	100 A, 50kA TPN MCCB, Ics=100% Icu, with suitable HP fully automatic Star/Delta starter with overload protection, current sensing type single phase preventor complete with all accessories and internal wiring required for automatic operation, selector switch for local/remote, auto/manual/OFF operation						
	Diesel Engine Control						
	Control for diesel engine comprising -						
	Automatic/Manual selector switch & 3 attempt starting device, timers and relays as required, push buttons, start/stop in manual mode						
	Indicating lamp for high/ Low Lub. Oil pressure, High Water Temp and Engine on indication.						
	Battery charger suitable for 12V/24 V DC with boost and trickle selector switch, 0-30 V DC volt meter, and 0- 20 A DC Ammeter						
	All standard relays and accessories for automatic operation of diesel engine						
	System Controller						
	Designing, Supply, commissioning of system controller to control operation of main electric fire pump, diesel pump, Pressurization pump, Terrace pump in sequence as per specification consisting of relays, timers. Sensors, annunciation window for fault indication, complete as per specifications.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE	AMOUNT
				Rs. P	Rs. P
6	Fabrication, supply, Insallation testing & commissioning of Electrical control panel of cubical construction, floor mounted type, fabricated out of 2mm thick CRCA sheet, compartmentalised with hinged lockable doors, dust and vermin proof, powder coated of approved shade after 7 tank treatment process, cable alley, inter- connection with suitable size copper conductor cable/solid copper strip, having switchgears and accessories, mountings and internal wiring, earth terminals, numbering etc. complete in all respect, suitable for main fire pump, pressurisation pump & diesel pump set complete as per CPWD specification with following in coming and Outgoings, suitable for operation on 415V, 3 phase, 50Hz Ac Supply with enclosure protection class IP 42 as required :				
a	Booster Pumps	nos	4		
	125 A, 50kA TPN MCCB, Ics=100% Icu, with fully automatic Star/Delta starter suitable for 50 hp pump with overload protection, current sensing type single phase preventor complete with all accessories and internal wiring required for automatic operation, selector switch for local/remote, auto/manual/OFF operation.				
	(Note : All outgoing feeders for pumps should have digital Ammeter with selector switches, and LED type ON, OFF, trip indicating lamps)				
7	Supply and Transportation of XLPE/PVC insulated & PVC sheathed armoured cables of 1.1 KV grade as per IS 7098 Part-I -1988 etc complete				
a	12 C x 2.5 Sqmm. Copper cable Diesel engines	Mtr	25		
b	4 C x 16 Sqmm. Aluminum cable Jockey pumps/ booster pumps	Mtr	275		
c	2 C x 2.5 Sqmm.Copper cable for Instrumentation	Mtr	250		
d	3.5C x 95 sq.mm Aluminum cable for main pumps	Mtr	50		
8	Supplying and installing following size of perforated Hot Dipped Galvanised Iron cable tray (Galvanisation thickness not less than 50 microns) with perforation not more than 17.5%, in convenient sections, joined with connectors, suspended from the ceiling with G.I. suspenders including G.I. bolts & nuts, etc. as required.				
a	100 mm width X 50 mm depth X 1.6 mm thickness	Mtr	20		
b	300 mm width X 50 mm depth X 1.6 mm thickness	Mtr	30		

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
9	Providing and fixing 25 mm X 5 mm copper strip on surface or in recess for connections etc. as required.	Mtr	500				
10	Supply, installation, testing and commissioning of Bourden type, stainless steel dial type pressure gauge with isolation valve and pipe having calibration of 0-16 kg/cm2.	each	7				
11	Providing ,fixing , testing and commissioning of Exhaust pipe of dia 150mm MS medium grade for Diesel engine with mineral wool insulation with aluminum cladding including necessary supports through shaft up to terrace level	Rmt	20				
12	Supplying and fixing of hose cabinet of size 750mm X 600mm x 250mm made of No 16 gauge SWG CRCA sheet with 6mm thick glazed glass door including necessary locking arrangement suitable to accommodate 2 Nos 15 mtr long Hose pipe, 1 No branch pipe, mounted on wall OR raised brick platform and duly painted with Post office red externally and white internally with synthetic enamel paint complete in all respect, for external hydrant as required.	NOS	11				
13	Providing laying, testing & commissioning of 'C' class heavy duty MS Pipe conforming to IS 1239/3589 i/c fittings like elbows, tees, flanges, tapers, nuts bolts, gaskets etc. in ground including welding, excavation & providing cement concrete blocks as supports, anticorrosive treatment with coaltar/asphalt tape as per IS 10221, refilling the trench etc. of following sizes complete as required.						
a	200 mm. dia (wall thickness = 6.3 mm	R/Mtr	12				
b	250 mm. Dia (wall thickness = 6.3 mm	R/Mtr	12				
14	Providing, laying, testing & commissioning of 'B' class heavy duty G.I. pipe conforming to IS 1239 including welding, fittings like elbows, tees, flanges, tapers, nuts, bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required :						
a	25mm nominal dia	R/Mtr	18				
b	50mm nominal dia	R/Mtr	50				
c	80mm nominal dia	R/Mtr	75				
d	100mm nominal dia	R/Mtr	6				
e	150mm nominal dia	R/Mtr	360				
15	Supplying and wrapping the anticorrosive material for buried pipes with coating of Primer and wrapping with 4 mm thick polymer corrosion resistant tape as per IS : 10221 with 15 mm overlap as per specificatios.	R/Mtr	450				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
16	Supplying and fixing single headed internal hydrant valve with instantaneous Gunmetal/Stainless Steel coupling of 63 mm dia with cast iron wheel ISI marked conforming to IS 5290 (Type -A) with blank Gunmetal/Stainless Steel cap and chain as required :						
a	Single headed Gunmetal	Set	16				
17	Supplying, fixing, testing and commissioning of butterfly valve of PN 1.6 rating with bronze/gunmetal seat duly ISI marked complete with nuts, bolts, washers, gaskets conforming to IS 13095 of following sizes as required :						
a	50mm dia	Nos	14				
b	80 mm dia	Nos	1				
c	150 mm dia	Nos	6				
18	Supplying, fixing, testing & commissioning of double flanged sluice valve of rating PN 1.6 with non rising spindle, bronze/gun metal seat, ISI marked complete with nuts, bolts, washers, gaskets and conforming to IS 780 of following sizes as required :						
a	100mm dia	Nos	1				
b	200mm dia	Nos	2				
c	250mm dia	Nos	2				
19	Providing, installation, testing and commissioning of non-return valve of following sizes confirming to IS: 5312 complete with rubber gasket, GI bolts, nuts, washers etc.as required						
a	50mm dia	Nos	4				
b	80mm dia	Nos	1				
c	150mm dia	Nos	3				
20	Providing, installation, testing and commissioning of stainless steel Y-strainer fabricated out of 1.6 mm thick stainless steel, Grade 304, sheet with 3 mm dia holes with stainless steel flange.						
a	80 mm dia	Rmt	4				
b	150mm dia	Rmt	1				
c	200mm dia	Rmt	2				
d	250mm dia	Rmt	2				
21	Supplying and fixing 63 mm dia, 15 m long RRL hose pipe with 63 mm dia male and female couplings duly bound with GI wire, rivets etc. conforming to IS 636 (type-A) as required : - Gunmetal	set	32				
22	Supplying and fixing first-aid Hose Reel with MS construction spray painted in post office red, conforming to IS 884 complete with the following as required.						
	20 mm nominal internal dia water hose thermoplastic (Textile reinforced) type -2 as per IS: 12585						
	20 mm nominal internal dia gun metal globe valve & nozzle.						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
	Drum and brackets for fixing the equipments on wall.						
	Connections from riser with 25 mm dia stop gun metal valve & M.S. Pipe and socket.						
	40m	set	16				
23	Supplying & fixing 63 mm dia gun metal short branch pipe with 20 mm nominal internal diameter size nozzle conforming to IS 903 suitable for instantaneous connection to interconnect hose pipe coupling as required - Gunmetal	Nos	4				
24	Supplying and fixing of fire brigade connection of cast iron body with gun metal male instantaneous inlet couplings complete with cap and chain as reqd. for suitable dia MS pipe connection conforming to IS 904 as required :						
a	2 way - 100 mm dia M.S. Pipe	Nos	1				
b	4 way - 150 mm dia M.S. Pipe	Nos	1				
25	Supplying and fixing air vessel made of 250 mm dia, 8 mm thick MS sheet, 1200 mm in height with air release valve on top and flanged connection to riser, drain arrangement with 25 mm dia gun metal wheel valve with required accessories, pressure gauge and painting with synthetic enamel paint of approved shade as required.	set	1				
26	Providing ,fixing , testing and commissioning of Fire duct Shutter fabricated out of M.S sheet and frame, door (SWG 16) and powder coated of approved red color both inside and out side. The size shall be 900mm x 1200 mm min. & fixed with 6 mm thick Glass, and key with suitable Rubber beading and Locking arrangement as per the tender drawings.	set	6				
27	Providing ,fixing , testing and commissioning of M.S. Hose cabinet stand mounted type fabricated out of M.S. sheet of 16 SWG with powder coated of approved red color both inside and out side and glass fronted (6mm thick glass with rubber beading) door and size of the cabinet shall be 600mm x 750 mm x 250 mm Quoted rate shall be includes suitable stand for mounting, all fasteners etc.	set	11				
28	Providing & fixing of pressure switch in M.S. pipe line including connection etc. as required.	each	13				
C	Fire Extinguishers						

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
1	Supply and fixing of Co2 type Fire Extinguishers 4.5 Kg capacity confirming to IS 2878 made from ISI marked steam less cylinder confirming to IS:7285 & CE certified and fitted with ISI marked controlled valve confirming to IS:3224, high pressure 1 Mtr discharge hose & horn complete with initial gas charged with carrying handle with wheels and wall mounting bracket. Squeeze lever discharge, used un-used indicator, Aphoxy coated paint (Red) with 93% gloss with 2 years warranty Including transportation, all taxes and all labour charges etc complete.	each	17				
2	Providing ,fixing , testing and commissioning of Portable AFFF Foam Type fire extinguisher 9 Lt Capacity, Stored Pressure Type with Pressure Gauge, hose and brackets etc .The discharge Range shall be minimum of 6 mtrs.The Internal Coating of Can shall be Epoxy Powder coating and External painted with Epoxy Polyester Powder coating .The thickness shall not less than 2mm made of Sheet metal.The Fire Extinguishers shall be ISI Approved as per IS 15683:2006.Vendor shall consider the suitable signages along with the extinguishers.	each	4				
3	Supply and fixing of ISI mark (IS:15683) Mono ammonium phosphate powder 90 (MAP) 6 Kg Fire extinguisher, stored pressure type, pressure gauge, gross wt. 9.4 kg, empty wt.3.4 kg, Discharge time minimum 13 sec, controllable discharge mechanism, range min. 4 mts applicable on classes A,B, C & electrically started fire, A rating -4 A, B rating -34 B, can construction: Deep drawn and Co2 mig welding, Valve construction: Forging & Machining, internal coating of can: Epoxy powder coating, External coating of Can:Epoxy polyster powder coating, sheet metal thickness:1.60mm, Helium leak detection tested with 5 years warranty Including transportation, all taxes and all labour charges etc complete.	each	60				
4	Supply and fixing of 2Nos of 9 Ltrs capacity round bottom sand buckets along with bucket sand, Fire buckets with round bottom type enamel painted, white inside & red out side and letter FIRE inblack out side & Handle with mounting bracket.	each	20				
5	Supply and fixing of Fire bucket stand fabricated by M.S. angles to install for Four numbers of buckets as per local fire officers standards.	each	10				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
6	Providing ,fixing , testing and commissioning of Portable waterType fire extinguisher 9 Lt Capacity, Stored Pressure Type with Pressure Gauge, hose and brackets etc .The discharge Range shall be minimum of 6 mtrs.The Internal Coating of Can shall be Epoxy Powder coating and External painted with Epoxy Polyester Powder coating .The thickness shall not less than 2mm made of Sheet metal.The Fire Extinguishers shall be ISI Approved as per IS 15683:2006.Vendor shall consider the suitable signages along with the extinguishers.	each	17				
D	Civil Works						
1	Excavation of trenches of 1500 x1000 mm for laying pipes up to 150mm dia. Including forming bottom surface to required level, refilling the trenches with selected excavated earth around the pipe in layers of 150mm thick, watering, consolidating. Quoted price inclusive of disposing off / Carting away the surplus earth out side the site to a dump yard acceptable local bodies or as directed by the site engineer with a lead of 300 mts. etc. complete.						
a	Excavation in all kinds of soil	Cum	100				
b	Cutting of Rock with chiseling	Cum	5				
2	Providing, laying and fixing following dia RCC pipe NP2 class (light duty) in ground complete with RCC collars, jointing with cement mortar 1:2 (1 cement : 2 fine sand) including trenching (75 cm deep) and refilling etc as required.-300 dia	Mtr.	30				
3	Providing ,fixing , testing and commissioning of PCC (1:2:4) pedestals / supports for Under ground / above ground pipes. Quoted rate shall inclusive of excavation (if required), chipping / chasing, shuttering, plastering (if required) etc. complete.	Cum	2				
4	Providing ,fixing , testing and commissioning of Sealing of shafts at all floor levels by using M.S. angle Iron frame around the shaft M.S. chequered plate of 6mm thick and PCC (100mm thick) of 1:2:4 on the plate for whole shaft area as per drawings and engineer - in - charge. FOR ALL MEP SERVICE SHAFTS	Sq.mt	120				
5	Construction of valve chamber with 230 mm Brick masonry wall with best quality TM bricks & CM 1:4,on a PCC 1:5;10 bed of 150 mm thcik.The wall shall be plastered internally smooth in CM 1:3, water proofing as required and externally rough plastered with sponge finish, including curing. The chamber shall be provided with M.S 8 mm thick plate fabricated top cover in leaves with necessary hinges and locking arrangement. The size of the chamber shall be 1200mm x 1200mm x1500mm in depth.	Nos	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
6	Supply, installation, testing and commissioning of 25 / 20mm dia Air Release Valve	Nos	2				
7	Supply, installation, testing and commissioning of 25mm dia Ball valve	Nos	2				
E	AUTOMATIC SPRINKLER SYSTEM						
1	Providing, laying, testing & commissioning of 'B' class heavy duty G.I. pipe conforming to IS 1239 including welding, fittings like elbows, tees, flanges, tapers, nuts, bolts, gaskets etc. and fixing the pipe on the wall/ceiling with suitable clamp/support frame and painting with two or more coats of synthetic enamel paint of required shade complete as required :						
a	25mm nominal dia	R/Mtr	704.00				
b	32mm nominal dia	R/Mtr	138.00				
c	40mm nominal dia	R/Mtr	121.00				
d	50mm nominal dia	R/Mtr	69.00				
e	65mm nominal dia	R/Mtr	94.00				
f	80mm nominal dia	R/Mtr	53.00				
g	100mm nominal dia	R/Mtr	93.00				
h	150mm nominal dia	R/Mtr	53.00				
2	Supplying, fixing, testing and commissioning of butterfly valve of PN 1.6 rating with bronze/gunmetal seat duly ISI marked complete with nuts, bolts, washers, gaskets conforming to IS 13095 of following sizes as required.						
a	50mm nominal dia	Nos	4.00				
b	100mm nominal dia	Nos	1.00				
c	150mm nominal dia	Nos	2.00				
3	Providing, fixing, testing & commissioning of 15mm dia quartzoid bulb type sprinklers of rating 68 degree centigrade with required accessories -Pendent type/Upright	Nos	406.00				
4	Providing & fixing flow switch in following sizes M.S. pipe including connection etc as required.						
a	100mm nominal dia	Nos	1.00				
b	150mm nominal dia	Nos	2.00				
5	Supply, installation, testing and commissioning of 25mm dia Ball valve - 20 mm dia.	Nos	2.00				
TOTAL PROJECT COST FOR SECTION-D=							



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कोलकाता - 700 001 /Kolkata - 700 001



NIT No:- SMPK/KDS/CIV/T/2830/12 dated 08/03/2024

(BILL OF QUANTITIES)

Development Of River Cruise Terminal and river tourism facility alongwith riverfront beautification works at KDS ,
SMP,Kolkata -adjacent to Indenture Memorial Area.

(i) Name of the bidder :-	
(ii) Address of the bidder :-	
(iii) Contact number of bidder :-	
(iv) e-mail ID of the bidder :-	

PART E :- CCTV

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
1	Supply, Installation, Testing and commissioning of 5 MP IP Vandal Bullet Vari-Focal Camera, 5MP, 1/2.7" CMOS image sensor, low illuminance, high image definition, Outputs max. 5MP (2592 × 1944) @20 fps, and supports 2688 × 1520 (2688 × 1520) @25/30 fps, H.265 codec, high compression rate, ultra-low bit rate, Built-in IR LED, max IR distance: 60 m, ROI, SMART H.264+/H.265+, flexible coding, applicable to various bandwidth and storage environments, Rotation mode, WDR, 3D NR, HLC, BLC, digital watermarking, applicable to various monitoring scenes Intelligent detection: Intrusion, tripwire Abnormality detection: Motion detection, video tampering, no SD card,SD card full, SD card error, network disconnected, IP conflict, illegal access, local alarm, voltage detection, audio abnormal, Alarm: 1 in, 1 out; audio: 1 in, 1 out; supports max. 256 GB Micro SD card, 12V DC/PoE power supply -IP67 protection.	Each No.	10				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
2	Supply , Installation , Testing and commissioning of 4 MP PTZ Camera, 1/2.8" 4Megapixel STARVIS™ CMOS, Powerful 32x optical zoom, Digital Zoom 16x, Max. 25/30 fps@4M, IR distance up to 150 m, Deep-learning-based auto tracking and perimeter protection, SMD PLUS, PoE+, IP67, IK10, Face Detection,Focal Length 4.9 mm–156 mm,Motion detection, video tampering, scene changing, Network disconnection, IP address conflict, illegal access, and storage anomaly, Tripwire and intrusion. Support alarm triggering by target types (human and vehicle). Support filtering false alarms caused by animals, rustling leaves, bright lights. Operating Temperature –40 °C to +70 °C, IP67; IK10; 6000V lightning proof; surge protection; voltage transient protection.	Each No.	11				
3	Supply , Installation , Testing and commissioning of 32 Channel NVR (Network Vedio Recorder)with RAID 0/1/5/10 configuration, Embedded LINUX OS, with 08 nos. SATA HDDs minimum 10TB storage or more (recording requirement all cameras recording at 2MP, 15fps for 30 days),H.265/H.264/MJPEG/MPEG4 codec decoding, Front Control Pannel with LEDs Indication, 4 nos. USB, iPhone; iPad; Android based Mobile clients, Video Export feature on USB, Search Mode: Time/Date; Alarm; Motion Detection (MD); Exact Search (accurate to a second); Smart Search, Dual HDMI Output, Alarm Input (16 nos.), Alarm Output (6 nos.), eSATA Device, 320Mbps each Incoiming & Outgping throughput, Operating Temperature –10°C to 55°C Certification : CE, FCC & UL	Each Set	1				
4	Hard Disk -8TB Enterprise Series	Each	5				
5	Supply, Installation, Testing & Commissioning of 4 Port PoE IEEE802.3af/ IEEE802.3at/ Hi-PoE/IEEE802.3bt, Switching Capacity: 20 Gbps, Packet Forwarding Rate: 14.88 Mpps, MAC: 4K, 8 port 10/100/1000 Mbps, 2 uplink ports, –10°C to 55°C , Thunder proof, PoE watchdog, Long distance PoE.	Each Set	7				
6	Pole mount bracket for PTZ camera	Nos	9				
7	Power cable for ptz camera	Mtr	300				
8	Dlink Cat6 Cable	Mtr	915				
9	32" Monitor Viewsonic	Nos	1				
10	PVC BOX For camera	Nos	19				
11	HDMI Cable 10 meter	Set	1				
12	Pipes, conduits & Laying	Mtr	1215				
13	4 U Rack	Nos.	6				
14	9U Rack	Nos.	1				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE	AMOUNT
				Rs. P	Rs. P
15	Installation and commissioning charges for the entire CCTV works	LS	1		
TOTAL PROJECT COST FOR SECTION- E=					



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PART F:-Dry Dock Closure

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
1	Dismantling all types of masonry excepting cement concrete plain or reinforced, stacking serviceable materials at site and removing rubbish as directed within a lead of 75 m. In ground floor including roof.	Cu.Mtr	2.00				
2	Dismantling all types of plain cement concrete works, stacking serviceable materials at site and removing rubbish as directed within a lead of 75 m. In ground floor including roof. upto 150 mm. thick	Cu.Mtr	2.00				
3	Earth work in excavation of foundation trenches or drains, in all sorts of soil (including mixed soil but excluding laterite or sandstone) including removing, spreading or stacking the spoils within a lead of 75 m. as directed. The item includes necessary trimming the sides of trenches, levelling, dressing and ramming the bottom, bailing out water as required complete. Depth of excavation not exceeding 1,500 mm.	Cu.Mtr	200.00				
4	Supply of U-type Hot rolled sheet piles of steel grade S430GP according to EN 10248 with larsen interlocks as per following specification of Arcel Mittal make or equivalent:- width-750mm, Height-411mm, thickness of web-11.50mm, thickness of flange- 9.30mm, weight per meter Square of wall -115 kg/Sqm, length of pile 11.80m to 12.00m, (Tolerances according to EN 10248).	MT	42.00				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
5	Driving M.S. sheet piles of any kind of approved type and size conforming to IS code in all kinds of soil/ soil mixed with gravel, shingle & pebbles, by monkey hammer including handling, cutting to requisite size, drilling holes, hoisting in position, welding, fabrication of sets of tapper piles, corner piles etc. with clutch bars as may be required including staging, scaffolding and hire charges of driving machinery and equipments, craping and cleaning piles, painting the surface with one coat of surface primer of approved make and brand and two coats of ready mixed oil bound paint (except red lead and black japan) etc including all cost of labours, supply and carriage of equipments to site (by any mean) as per drawing and direction of EIC but excluding the cost of sheet piles. N.B. Measurement of area underground to be taken i.e. straight length of pile multiplied by driven length.	Cu.Mtr	250.00				
6	Painting one coat epoxy anticorrosive primer (grey) with Epilux 610 primer of Berger paints or Equivalent make and brand including smothining surface by sand paper etc upto 20m height. [Note: The aplicators must be specialized in such type of work as per specification. their experience must be duly certified by an institution having ISO-9001]	Sq.Mtr	900.00				
7	Painting two coat epoxy enamel (white) with EPI LUX 4C/R enamel white of Bergerpaints or equivalent make and brand including smothining surface by sand papering etc up to 20m height. [Note: The applicators must be specialized in such type of work as per specification. their experience must be duly certified by an institution having ISO-9001]	Sq.Mtr	900.00				
8	Ordinary Cement concrete (mix 1:2:4) with graded stone chips (20 mm nominal size) excluding shuttering and reinforcement,if any, in ground floor as per relevant IS codes. -Pakur Variety	Cu.Mtr	10.00				
9	Hire and labour charges for shuttering with centering and necessary staging upto 4 m using approved stout props and thick hard wood planks of approved thickness with required bracing for concrete slabs, beams and columns, lintels curved or straight including fitting, fixing and striking out after completion of works (upto roof of ground floor) -Steel shuttering or 9 to 12 mm thick approved quality ply board shuttering in any concrete work.	Sq.Mtr	150.00				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
10	Hire and Labour Charges for shuttering with hard wood for precast R.C. Slab curved, or straight and striking out the same including fitting, fixing the precast slab in position with necessary carriage and haulage, hosting etc, complete in all respect. (only the area in contact with concrete to be measured).	Sq.Mtr	500.00				
11	Ordinary Cement concrete (mix 1:1.5:3) with graded stone chips (20 mm nominal size) excluding shuttering and reinforcement if any, in ground floor as per relevant IS codes.-Pakur Variety.	Cu.Mtr	200				
12	Reinforcement for reinforced concrete work in all sorts of structures including distribution bars, stirrups, binders etc initial straightening and removal of loose rust (if necessary), cutting to requisite length, hooking and bending to correct shape, placing in proper position and binding with 16 gauge black annealed wire at every intersection, complete as per drawing and direction.-For works in foundation, basement and upto roof of ground floor/upto 4 m -Tor steel/Mild Steel of SAIL/TATA/RINL.	MT	5				
13	Supplying and laying PP multifilament woven geo textile filter as per specification and as per site condition having side lapping of min. 250 mm and end lapping of min 250 mm and as directed on the slope of the bank of the river or on the slope of the embankment or in the river bed with all leads. Cutting Geo-textile fabric in proper shape and size as per drawing and as directed by the Engineer-In-Charge including cost of necessary plants and equipments as per requirement. The cost of excavation of the trenches will be paid separately. (Payment will be made on finished area of laying Geo textile filter). Specification for Geotextile filter a) Mass per unit area : 240 gm / Sqm. (min) b) Tensile strength: 40 KN / M or equivalent both warp & weft. At < 15% elongation c) Apparent opening size (A.S.O.): 200 Micron (max.). d) Ultra violet resistance: 70% at 500hrs. e) Water flow rate normal to the plane: 25l/m ² /s (head=100m)	Sq.Mtr	800.00				
14	Filling in foundation or plinth by silver sand in layers not exceeding 150 mm as directed and consolidating the same by thorough saturation with water, ramming complete including the cost of supply of sand. (payment to be made on measurement of finished quantity).	Cu.Mtr	2000				

ITEM NO	DESCRIPTION OF ITEM	UNIT	Qty.	RATE		AMOUNT	
				Rs.	P	Rs.	P
15	Interconnecting of cement concrete block placed on embankment with 16mm dia. 3 strand Polypropylene rope (Wt. of rope 115.90gm/m and breaking strength 3770kgf) - (cost of rope included).	Sq.Mtr	360				
16	Providing & Fixing 25mm dia pvc pipe (Schedule 80 medium duty) in concrete block.	Mtr.	1200				
17	Welding in M.S. structural work with gas or electric:- Continuous weld.	Mtr Run	40				
18	Welding in M.S. structural work with gas or electric:-Tack weld.	point	200				
19	Applying epoxy based reactive joining agent for joining the old concrete with fresh concrete to be applied within manufacturer's specified time as per manufacturers specification. (0.4 Kg / m ² of concrete surface).	Sq.Mtr	100				
20	Supply of one 3-5 HP capacity diesel pump set of running condition on hire basis daily from 8am to 5pm along with necessary pipes for suction and delivery of length approximately 15 mts and 50 mts respectively and other accessories and fittings like foot valve, clips etc, including pump driver/helper required to run the pump set for lifting of waste water from pits manholes, drains etc as per the direction of Engineer-in-Charge at site.	Per Day	10				
21	Provide charges of supplied fuel for running the pump set as per necessity and requirement.	Hour	60				
TOTAL PROJECT COST FOR SECTION-F=							



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(i) Name of the bidder :-	
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SECTION MARKED	ESTIMATED COST	QUOTED AMOUNT
SECTION-A	481792159.27	
SECTION-B	26411725.29	
SECTION-C	8698934.60	
SECTION-D	10110400.81	
SECTION-E	1100405.00	
SECTION-F	8599753.30	
GRAND TOTAL	536713378.27	

THE BOARD OF TRUSTEES FOR THE PORT OF KOLKATA
FORM OF TENDER
Syama Prasad Mookerjee Port, Kolkata.

To
The Chief Engineer,

I/We _____
_____ having examined the site of work, inspected the Drawings and read the specifications, General & Special Conditions of Contract and Conditions of the Tender, hereby tender and undertake to execute and complete all the works required to be performed in accordance with the Specification, Bill of Quantities, General & Special Conditions of Contract and Drawings prepared by or on behalf of the Trustees and at the rates & prices set out in the annexed Bill of Quantities within **11 (Eleven) Months** from the date of order to commence the work and in the event of our tender being accepted in full or in part. I / We also undertake to enter into a Contract Agreement in the form hereto annexed with such alterations or additions thereto which may be necessary to give effect to the acceptance of the Tender and incorporating such Specification, Bill of Quantities, Drawing and Special & General Conditions of Contract and I / We hereby agree that until such Contract Agreement is executed the said Specification, Bill of Quantities, Conditions of Contract and the Tender, together with the acceptance thereof in writing by or on behalf of the Trustees shall be the Contract.

THE TOTAL AMOUNT OF TENDER Rs. **Not to mention here**

(Repeat in words) **Not to mention here**

I / We require _____ days / months preliminary time to arrange and procure the materials required by the work from the date of acceptance of tender before I We could commence the work.

I / We have deposited with the Trustees' Manager (Finance), SMPK, vide Receipt No. _____ of _____ as Earnest Money.

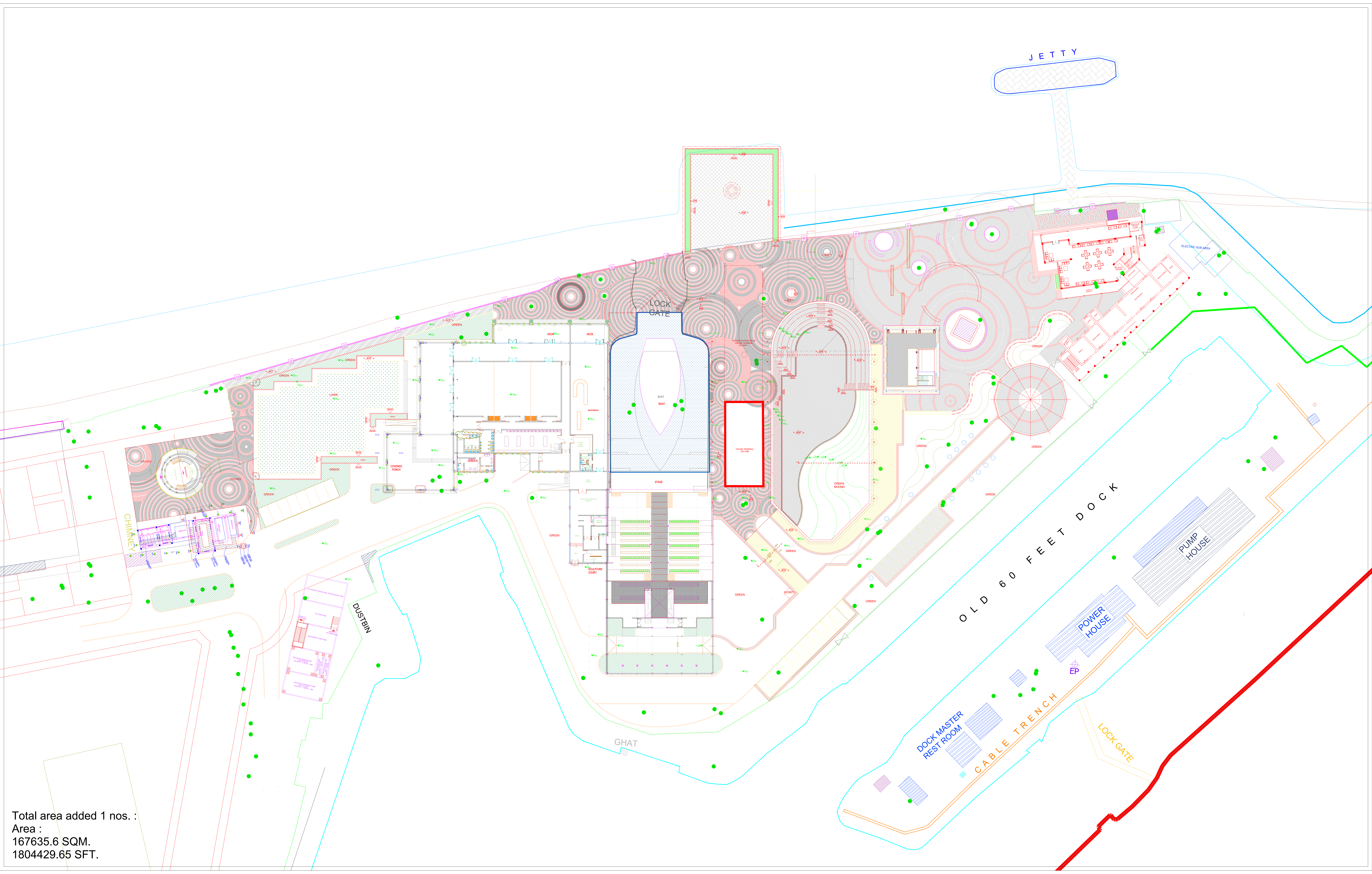
I / We agree that the period for which the tender shall remain open for acceptance shall not be less than four months.

Dated:

(Signature of Bidder with Seal)

Name of the Bidder: -

Address: -



JETTY

LOCK GATE

GHAT

OLD 60 FEET DOCK

PUMP HOUSE

POWER HOUSE

DOCK MASTER REST ROOM

CABLE TRENCH

LOCK GATE

CRANE TOWER

CHIMNEY

DUSTBIN

Total area added 1 nos. :
Area :
167635.6 SQM.
1804429.65 SFT.

संविदा की सामान्य शर्तें

General Conditions of Contract

प्ररूप और करार

Forms and Agreements

न्यासी मंडल द्वारा दिनांक 27 मई, 1993 को संपन्न 6वीं बैठक में संकल्प सं. 92 के अधीन अनुमोदित

Sanctioned by the Trustees under Resolution No. 92 of the 6th Meeting held on 27th May, 1993

जुलाई, 2014 को संपन्न न्यासी मंडल की बैठक में अनुमोदित परिशिष्ट सहित

Including Addendum Sanctioned by the Trustees Meeting held on July, 2014

**कोलकाता पत्तन न्यास
KOLKATA PORT TRUST**

**कोलकाता गोदी प्रणाली
KOLKATA DOCK SYSTEM**

**हल्दिया गोदी परिसर
HALDIA DOCK COMPLEX**

जुलाई/ JULY 2014

संविदा की सामान्य शर्तें / GENERAL CONDITIONS OF CONTRACT

<u>खंड / CLAUSE</u>	<u>पृष्ठ/PAGES</u>
1 संविदा की सामान्य शर्तों में संशोधन AMENDMENT TO GENERAL CONDITIONS OF CONTRACT	-- जीसी 1 ... GC 1
2 परिभाषा DEFINITION	-- जीसी 2 - जीसी 3 ... GC 2 - GC 3
3 इंजीनियर और इंजीनियर के प्रतिनिधि के कर्तव्य एवं शक्तियां / DUTIES & POWERS OF ENGINEER & ENGINEER'S REPRESENTATIVE	-- जीसी 3 - जीसी 5 ... GC 3 - GC 5
4 निविदा/प्रस्ताव और उसकी पूर्वापेक्षाएं THE TENDER/OFFER AND ITS PRE-REQUISITES	-- जीसी 5 - जीसी 9 ... GC 5 - GC 9
5 संविदा और संविदाकारों के सामान्य दायित्व THE CONTRACT & GENERAL OBLIGATIONS OF CONTRACTOR	... जीसी 9-जीसी 14 -- GC 9 - GC 14
6. कार्य का प्रारंभ, निष्पादन और समापन COMMENCEMENT, EXECUTION AND COMPLETION OF WORK	... जीसी14-जीसी 17 -- GC14 - GC 17
7 भुगतान की शर्तें TERMS OF PAYMENT	... जीसी18-जीसी 20 -- GC18 - GC 20
8 फेरफार और उसका मूल्यांकन VARIATION AND ITS VALUATION	... जीसी20-जीसी 22 -- GC20 - GC 22
9 विलंब/ समापन समय का विस्तार / परिनिर्धारित नुकसानी / संविदा का पर्यवसान DELAY/EXTENSION OF COMPLETION TIME/ LIQUIDATED DAMAGE/ TERMINATION OF CONTRACT	... जीसी22-जीसी 24 -- GC22 - GC 24

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जीसी/GC -1

संविदा की सामान्य शर्तों में संशोधन
AMENDMENT TO GENERAL CONDITIONS OF CONTRACT

- खंड-3.4 निविदा/ प्रस्ताव और उसकी पूर्वापेक्षाएं
- CI-3.4 THE TENDER /OFFER & ITS PRE-REQUISITES

उप-खंड (क) के अधीन सारणी
 Table under sub-clause (a)

पूर्ववर्ती /PREVIOUS			यथासंशोधित/ AS AMENDED		
कार्यका प्राक्कलित मूल्य Estimated Value of Work	बयाना राशि Amount of Earnest Money		कार्य का प्राक्कलित मूल्य Estimated Value of Work	बयाना राशि Amount of Earnest Money	
	संविदागत कार्य हेतु For Works Contract	केवल सामग्री या उपकरण की आपूर्ति के लिए संविदा हेतु For Contract of Supplying Materials or Equipment only		संविदागत कार्य हेतु For Works Contract	केवल सामग्री या उपकरण की आपूर्ति के लिए संविदा हेतु For Contract of Supplying Materials or Equipment only
रु. 1,00,000=00 तक Up to Rs. 1,00,000=00	कार्य के प्राक्कलित मूल्य का 5% 5% of the estimated value of work	कार्य के प्राक्कलित मूल्य का 1% 1% of the estimated value of work	रु.10 करोड़ तक Upto Rs. 10 Crore	कार्य के प्राक्कलित मूल्य का 2% 2% of the estimated value of work	कार्य के प्राक्कलित मूल्य का 1% 1% of the estimated value of work
रु. 1,00,000.00 से अधिक Over Rs. 1,00,000.00	अधिकतम रु.20,000/ और न्यूनतम रु. 5,000/- के अध्यक्षीन कार्य के प्राक्कलित मूल्य का 2% 2% of the estimated value of work subject to a maximum of Rs. 20,000/- and minimum of Rs. 5,000/-	अधिकतम रु. 10,000/- और न्यूनतम रु. 1,000/- के अध्यक्षीन कार्य के प्राक्कलित मूल्य का ½% ½% of the estimated value of work subject to a maximum of Rs. 10,000/- and minimum of Rs. 1,000/-.	रु.10 करोड़ से अधिक Over Rs. 10 Crore	प्रथम रु. 10 करोड़ पर 2% + शेष पर 1% 2% on first Rs. 10 Crore + 1% on the balance	अधिकतम रु.10,000/- और न्यूनतम रु.1,000/- के अध्यक्षीन कार्य के प्राक्कलित मूल्य का ½% ½% of the estimated value of work subject to a maximum of Rs. 10,000/- and minimum of Rs. 1,000/-.

[दिनांक 26.02.2013 को संपन्न न्यासी मंडल की बैठक के संकल्प सं. 210 के अधीन न्यासी मंडल द्वारा अनुमोदित संशोधन]

[AMENDMENT SANCTIONED BY THE BOARD OF TRUSTEES VIDE RESOLUTION NO 210 OF THE TRUSTEES' MEETING HELD ON 26.02.2013]

उप-खंड (घ) के अधीन सारणी

Table under sub-clause (d)

<u>पूर्ववर्ती/PREVIOUS</u>			<u>यथासंशोधित/AS AMENDED</u>		
रजिस्ट्रीकरण की श्रेणी	नियत प्रतिभूति की राशि	प्रत्येक निविदा की वित्तीय सीमा	रजिस्ट्रीकरण की श्रेणी	नियत प्रतिभूति की राशि	प्रत्येक निविदा की वित्तीय सीमा
Class of Registration	Amount Of Fixed Security	Financial Limit Of Each Tender	Class of Registration	Amount Of Fixed Security	Financial Limit Of Each Tender
क	रु.10,000/-	रु. 2,00,000/- तक के मूल्य की कोई निविदा	क	रु.50,000/-	रु. 10,00,000/- तक के मूल्य की कोई निविदा
A	Rs 10,000/-	Any tender priced upto Rs 2,00,000/-	A	Rs 50,000/-	Any tender priced up to Rs10,00,000/-
ख	रु.5,000/-	रु. 1,00,000/- तक के मूल्य की कोई निविदा	ख	रु.25,000/-	रु. 5,00,000/-तक के मूल्य की कोई निविदा
B	Rs 5,000/-	Any tender priced upto Rs 1,00,000/-	B	Rs 25,000/-	Any tender priced upto Rs 5,00,000/-
ग	रु.2,500/-	रु. 50,000/- तक के मूल्य की कोई निविदा	ग	रु.15,000/-	रु. 3,00,000/-तक के मूल्य की कोई निविदा
C	Rs 2,500/-	Any tender priced upto Rs 50,000/-	C	Rs 15,000/-	Any tender priced upto Rs 3,00,000/-

[दिनांक 12.10.2012 को संपन्न न्यासी मंडल की बैठक के संकल्प सं. 82 के अधीन न्यासी मंडल द्वारा अनुमोदित संशोधन]

[AMENDMENT SANCTIONED BY THE BOARD OF TRUSTEES VIDE RESOLUTION NO 82 OF THE TRUSTEES' MEETING HELD ON 12.10.2012]

जीसी /GC - 2

1. परिभाषाएं /DEFINITIONS

- 1.0 इसमें इसके पश्चात् यथापरिभाषित संविदा में प्रसंग द्वारा अन्यथा अपेक्षित के सिवाय, निम्नलिखित शब्द और अभिव्यक्ति से इसमें उन्हें समनुदेशित अर्थ अभिप्रेत होंगे।

In the contract, as hereinafter defined, the following words and expressions shall have the meaning herein assigned to them, except where the context otherwise required.

- 1.1 "नियोक्ता" या "बोर्ड" या "न्यासी मंडल " से कोलकाता पत्तन का न्यासी मंडल अभिप्रेत है जो महापत्तन न्यास अधिनियम 1963 की धारा 3 के अधीन गठित एक निगमित निकाय है और जिसमें उनके उत्तराधिकारी, प्रतिनिधि एवं समनुदेशिनी शामिल हैं।

"Employer" or "Board" or "Trustees" means of the Board of Trustees for the Port of Calcutta, a body corporate under Section 3 of the Major Port Trusts Act, 1963, including their successors, representatives and assigns. Employer

- 1.2 "अध्यक्ष" से बोर्ड का अध्यक्ष अभिप्रेत है और इसमें महापत्तन न्यास अधिनियम, 1963 की धारा 14 और 14क के अधीन उसके स्थान पर कार्य करने हेतु नियुक्त व्यक्ति शामिल है।

"Chairman" means the Chairman of the Board and includes the person appointed to act in his place under Sections 14 and 14A of the Major Port Trusts Act, 1963 Chairman

- 1.3 "संविदाकार" से ऐसा/ऐसे व्यक्ति, फर्म या कंपनी अभिप्रेत है जिसकी/ जिनकी संविदाकार निविदा / प्रस्ताव न्यासी मंडल द्वारा स्वीकार किया गया हो और इसमें बोर्ड / अध्यक्ष द्वारा अनुमत संविदाकार के प्रतिनिधि, वारिस, उत्तराधिकारी और समनुदेशिनी, यदि कोई हों, शामिल हैं।

"Contractor" means the person or persons, Firm or Company whose tender/offer has been accepted by the Trustees and includes the Contractor's representatives, heirs, successor and assigns, if any, permitted by the Board/Chairman Contractor

- 1.4 "इंजीनियर" से बोर्ड का ऐसा पदाधिकारी अभिप्रेत है जिसने उसकी ओर से इंजीनियर निविदा आमंत्रित की है और इसमें प्रबंधक (अवसंरचना व नागरिक सुविधाएँ) या ऐसा अन्य पदाधिकारी शामिल है जिसे ऐसे नाम निर्दिष्ट "इंजीनियर" के स्थान पर संविदा के प्रयोजनार्थ इंजीनियर के रूप में कार्य करने के लिए संविदाकार को लिखित सूचना देकर नियोक्ता द्वारा समय-समय पर नियुक्त किया गया हो ।
- "Engineer" means the Board's official who has invited the Engineer tender on its behalf and includes the Manager (Infrastructure & Civic Facilities) or other official as may be appointed from time to time by the Employer, with written notification to the Contractor, to act as Engineer for the purpose of the Contract, in place of the "Engineer" so designated.
- 1.5 "इंजीनियर के प्रतिनिधि" से इंजीनियर का कोई अधीनस्थ या सहायक या कोई ऐसा अन्य पदाधिकारी अभिप्रेत है जिसे इसके खंड 2.4 से 2.6 तक में वर्णित कर्तव्यों के निर्वहन हेतु इंजीनियर द्वारा समय-समय पर नियुक्त किया गया हो ।
- "Engineer's Representative" means any subordinate or Assistant Engineer's Representative to the Engineer or any other official appointed from time to time by the Engineer to perform the duties set forth in Clauses 2.4 to 2.6 hereof.
- 1.6 "कार्य" से संविदा के अनुसार निष्पादित किया जानेवाला कार्य अभिप्रेत है और इसमें प्राधिकृत "अतिरिक्त कार्य" तथा "अधिक कार्य" एवं "अस्थायी कार्य" शामिल हैं ।
- "Work" means the work to be executed in accordance with the Works Contract and includes authorised "Extra Works" and 'Excess Works" and "Temporary Works".
- 1.7 'अस्थायी कार्य' से कार्य के निष्पादन, समापन या अनुरक्षण में या उनके लिए अपेक्षित सभी प्रकार के सभी अस्थायी कार्य अभिप्रेत हैं और इसमें (तद्वारा पूर्व में वर्णित परिभाषाओं को सीमित किए बिना) सभी अस्थायी निर्माण, पाइ बंधाई, सीढ़ियों का निर्माण, लट्टे की जोड़ाई, टंकी की सोखाई, साइट कार्यालय, सीमेंट एवं अन्य गोदाम, भवन सामग्री को इकट्ठा करने के लिए प्लेटफार्म और बिन्स, जैट्टी, अस्थायी मार्ग और सड़कें, अस्थायी पुलिया और मिश्रण प्लेटफार्म शामिल हैं ।

"Temporary Works" means all temporary works of every kind required in or about the execution, completion or maintenance of the works and includes (without thereby limiting the foregoing definitions) all temporary erections, scaffolding, ladders, timbering, soaking vats, site offices, cement and other godowns, platforms and bins for stacking building materials, gantries, temporary tracks and roads, temporary culverts and mixing platforms.

Temporary works

- 1.8 "अतिरिक्त कार्य" से ऐसे कार्य अभिप्रेत हैं जो संविदा को पूरा करने के लिए इंजीनियर द्वारा अपेक्षित हैं परंतु जिन्हें विशेष और पृथक् रूप से

अतिरिक्त कार्य और अधिक कार्य

निविदा के कार्य यानी 'परिमाण बिल' की मदों की अनुसूची में शामिल नहीं किया गया है। "अधिक कार्य" से परिमाण बिल की किसी मद के प्रति किए गए प्रावधान से अधिक कार्य की अपेक्षित मात्रा अभिप्रेत है।

Extra works and Excess works

"Extra Works" means those works required by the Engineer for completion of the Contract which were not specifically and separately included in the schedule of items of the works i.e. (Bill of Quantities) of the tender. "Excess Works" means the required quantities of work in excess of the provision made against any item of the bill of Quantities.

- 1.9 'विनिर्देश' से, जबतक निविदा में अन्यथा कथित न हो, सामग्री और कारीगरी के लिए ब्यूरो ऑफ इंडियन स्टैंडर्ड का सुसंगत और समुचित विनिर्देश/इंटरनेशनल स्टैंडर्ड का विनिर्देश(अद्यतित संशोधन) अभिप्रेत है।

विनिर्देश

Specification

"Specifications" means the relevant and appropriate Bureau of Indian Standard's specifications / International Standard's Specifications (latest revisions) for materials and workmanship unless stated otherwise in the Tender.

जीसी/GC - 3

- 1.10 'रेखाचित्र' से निविदा और विनिर्देश में उल्लिखित रेखाचित्र एवं इंजीनियर द्वारा लिखित रूप में अनुमोदित ऐसे रेखाचित्र के उपांतरण तथा ऐसे अन्य रेखाचित्र अभिप्रेत हैं जो इंजीनियर द्वारा समय-समय पर लिखित रूप में प्रस्तुत या अनुमोदित किए जाएं।

रेखाचित्र

- “Drawings” means the drawings referred to in the Tender and specification and any modification of such drawings approved in writing by the Engineer and such other drawings as may from time to time be furnished or approved in writing by the Engineer. Drawings
- 1.11 “संविदा” से अभिप्रेत है और उसमें शामिल हैं- संविदा की सामान्य और विशेष शर्तें, विनिर्देश, रेखाचित्र, मूल्यांकित परिमाण बिल, निविदा / प्रस्ताव, निविदा / प्रस्ताव का स्वीकृति-पत्र, पृथक् रूप से किया गया संविदागत करार तथा न्यासी मंडल द्वारा उनके विवेकानुसार स्वीकृत दरों और मूल्य की अनुसूची यदि कोई हो। संविदा
- “Contract” means and includes the General and Special Conditions of Contract, Specifications, Drawings, priced Bill of Quantities, the Tender / Offer, the letter of acceptance of the Tender/Offer, the Contract Agreement, if separately entered into and the Schedule of Rates and Price, if any, adopted by the Trustees at their discretion. Contract
- 1.12 “संरचनात्मक संयंत्र” से कार्य या अस्थायी कार्य के निष्पादन, समापन या अनुरक्षण के लिए अपेक्षित किसी भी प्रकार के सभी उपकरण या वस्तुएं अभिप्रेत हैं तथा इसमें (तद्वारा पूर्व में वर्णित परिभाषा को सीमित किए बिना) सभी मशीनरी व उपकरण शामिल हैं, परन्तु वे सामग्री या अन्य वस्तुएं शामिल नहीं हैं जो स्थायी कार्यों का अंग हों या होने के लिए आशयित हों । संरचनात्मक संयंत्र
- “Constructional Plant” means all appliances or things of whatsoever nature required or about the execution, completion or maintenance of the works or temporary works and includes (without thereby limiting the foregoing definition) all machinery and tools but does not include materials or other things intended to form or forming part of the permanent works. Constructional Plant
- 1.13 “कार्यस्थल” से ऐसी भूमि, जलमार्ग तथा अन्य स्थान अभिप्रेत है जिसपर, जिसके नीचे, जिसमें या जिसके जरिए संविदा के प्रयोजनार्थ न्यासी मंडल द्वारा कार्य निष्पादित किया जाना हो। कार्यस्थल
- “Site” means the land, waterways and other places, on, under, in or through which the works are to be executed by the Trustees for the purpose of the Site

Contract.

9

- 1.14 "संविदा मूल्य" से संविदाकार की निविदा/प्रस्ताव के स्वीकृति-पत्र में संविदा मूल्य वर्णित राशि अभिप्रेत है जो इसमें इसके पश्चात् अंतर्विष्ट प्रावधानों के अधीन इंजीनियर द्वारा की जा सकनेवाली वृद्धि एवं कटौतियों के अध्यधीन होगी।
"Contract Price" means the sum named in the letter of acceptance of the Tender/Offer of the Contractor, subject to such additions thereto and deductions therefrom as may be made by the Engineer under the provisions here in after contained. Contract Price
- 1.15 "माह" से अँग्रेजी कैलेण्डर माह अभिप्रेत है।
"Month" means English Calendar Month. माह
Month
- 1.16 "अपवादित जोखिम" ऐसे दंगे हैं जो अबीमाकृत, युद्ध, आक्रमण, विदेशी-शत्रुओं के कार्यकलाप, शत्रुकार्य (युद्ध चाहे घोषित हो या नहीं), सिविल युद्ध, विद्रोह, क्रांति, विप्लव या सैन्य या अनधिकार शक्ति या न्यासी मंडल द्वारा ऐसे कार्य के किसी अंश के उपयोग या अधिभोग के रूप में हो जिसकी बाबत समापन प्रमाण-पत्र जारी किया गया हो (इसमें उन सभी को सामूहिक रूप से अपवादित जोखिम के रूप में निर्दिष्ट किया गया है)।
"Excepted Risks" are riot in so far as it is uninsurable, war, invasion, act of foreign enemies, hostilities (whether war be declared or not), Civil War, rebellion, revolution, insurrection or military or usurped power or use or occupation by the Trustees of any portion of the works in respect of which a certificate of completion has been issued (all of which are herein collectively referred to as the excepted risks). Excepted Risks
- 1.17 जो शब्द मात्र एकवचन को द्योतित करते हैं, उसमें प्रसंग द्वारा अपेक्षित होने पर बहुवचन और विपर्ययेन भी शामिल हैं।
Word importing the singular only, also includes the plural and vice-versa where the context so requires. एकवचन/ बहुवचन
Singular/Plural
- 1.18 संविदा की इन सामान्य शर्तों में शीर्ष एवं पार्श्व टिप्पण को उसका अंश नहीं माना जाएगा या उसके या संविदा के निर्वचन या निर्माण शीर्ष/पार्श्व टिप्पण

में उसपर विचार नहीं किया जाएगा।

10

The heading and marginal notes in these General Headings/Marginal Conditions of Contract shall not be deemed to be part Notes. thereof or be taken into consideration in the interpretation or construction thereof or of the contract.

1.19 जब तक कि अन्यथा अनुबद्ध न हो, "लागत" शब्द में संविदाकार की उपरि लागत को शामिल समझा जाएगा, चाहे वह कार्य स्थल पर या बाहर उपगत हुई हो। लागत

Unless otherwise stipulated the work "Cost" shall be deemed to include overhead costs of the Contractor, whether on or off the site. Cost

2.0 इंजीनियर एवं इंजीनियर के प्रतिनिधि के कर्तव्य एवं शक्तियां
DUTIES & POWERS OF ENGINEER & ENGINEER'S REPRESENTATIVE.

2.1 संविदाकार, इंजीनियर की पूर्ण तुष्टि से संविदा की शर्तों के अनुसार कार्य का निष्पादन, समापन एवं अनुरक्षण करेगा तथा किसी प्रकार के किसी मामले में इंजीनियर के निदेशों का पालन करेगा। इंजीनियर का प्राधिकार

The Contractor shall execute, compete and maintain the works in terms of the contract to the entire satisfaction of the Engineer and Shall comply with the Engineer's direction on any matter whatsoever.

Engineer's Authority

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2.2 संविदाकार, इंजीनियर से तथा इसके खंड 2.5 की सीमा के अंतर्गत इंजीनियर के प्रतिनिधि से अनुदेश प्राप्त करेगा। इंजीनियर के प्रतिनिधि का प्राधिकार

The Contractor shall take instructions from the Engineer and subject to limitation of Clause 2.5 hereof, from the Engineer's Representative.

Authority of Engineer's Representative

2.3 इंजीनियर को निम्नलिखित की पूरी शक्ति एवं प्राधिकार होगा:
The Engineer shall have full power and authority :

(क) कार्य की प्रगति के दौरान समय-समय पर संविदाकार को ऐसे और रेखाचित्र आपूर्ति करना तथा अनुदेश देना जो कार्य के उचित एवं

इंजीनियर की शक्ति
Engineer's Power

पर्याप्त क्रियान्वयन तथा रखरखाव के लिए जरूरी हो और संविदाकार उसका पालन करेगा एवं उससे आबद्ध होगा ।

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(a) to supply to the contractor from time to time during the progress of the works such further drawings and instructions as shall be necessary for the purpose of proper and adequate execution and maintenance of the works and the contractor shall carry out and be bound by the same.

(ख) किसी भी सामग्री एवं कारीगरी के विशिष्ट विवरण में परिवर्तन या संशोधन करना तथा किसी भी समय कार्य का निरीक्षण करना।

(b) to alter or modify the specification of any material and workmanship and to inspect the work at any time.

(ग) कार्य अथवा अतिरिक्त कार्य में किसी फेरफार, परिवर्तन एवं संशोधन करने के लिए आदेश देना ।

(c) to order for any variation, alteration and modification of the work and for extra works.

(घ) संविदा के अनुसार प्रमाण-पत्र जारी करना।

(d) to issue certificates as per contract.

(ङ) संविदाकार एवं न्यासी मंडल के दावों एवं विवादों का निपटान प्रथम रेफरी के रूप में करना।

(e) to settle the claims & disputes of the Contractor and Trustees, as the first referee.

(च) समापन समय के विस्तार की मंजूरी देना ।

(f) To grant extension of completion time.

2.4 इंजीनियर का प्रतिनिधि:

The Engineer's Representative shall :

(i) कार्य की निगरानी एवं पर्यवेक्षण करेगा।
watch and supervise the works.

इंजीनियर के
प्रतिनिधि की
शक्तियाँ
Power of
Engineer's
Representative.

- (ii) कार्य के संबंध में प्रयुक्त होनेवाली किसी सामग्री और कारीगरी की जांच व परीक्षण करेगा।

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test and examine any material to be used or workmanship employed in connection with the work.

- (iii) संविदा के अनुरूप न होने पर उसे किसी सामग्री तथा कारीगरी को अनुमोदित न करने की शक्ति होगी तथा संविदाकार इस संबंध में उसके निदेशों का पालन करेगा।

have power to disapprove any material and workmanship not in accordance with the contract and the contractor shall comply with his direction in this regard.

- (iv) भुगतान के प्रयोजनार्थ या अन्यथा संविदाकार द्वारा किए गए कार्य की माप लेगा।

take measurements of work done by the contractor for the purpose of payment or otherwise.

- (v) किए गए सभी दोषपूर्ण कार्य को भंजित करके संविदाकार के अपने खर्च पर उनके पुनर्निर्माण का आदेश देगा।

order demolition of defectively done work for its reconstruction all by the Contractor at his own expense.

- (vi) उसे परिवर्तन आदेश जारी करने की शक्ति होगी जिसमें डिजाइन का

संशोधन तथा कार्य के समापन समय का विस्तार अंतर्हित नहीं होगा, और

have powers to issue alteration order not implying modification of design and extension of completion time of the work and

- (vii) उसे इंजीनियर में निहित ऐसी अन्य शक्तियां तथा प्राधिकार होंगे जो उसे इंजीनियर द्वारा संविदाकार को लिखित रूप में सूचित करते हुए प्रत्यायोजित की गई हों।

have such other powers and authorities vested in the Engineer, which have been delegated to him in writing by the Engineer under intimation to the Contractor.

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2.5 परंतु यह हमेशा कि इंजीनियर के प्रतिनिधि को निम्नलिखित की कोई शक्ति नहीं होगी :

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Provided always that the Engineer's Representative shall have no power :

इंजीनियर के प्रतिनिधि की शक्तियों की सीमा Limitation of Engineer's Representative's Power

(क) किसी ऐसे कार्य के लिए आदेश देना जिसमें विलंब हो या न्यासी मंडल द्वारा कोई अतिरिक्त भुगतान किया गया हो,

(a) to order any work involving delay or any extra payment by the Trustees,

(ख) कार्य का या उसमें फेरफार करना; तथा

(b) to make variation of or in the works; and

(ग) संविदा के अधीन संविदाकार को उसके किन्हीं कर्तव्यों या बाध्यताओं से मुक्त करना।

(c) to relieve the Contractor of any of his duties or obligations under the Contract.

2.6 परंतु निम्नानुसार यह भी कि :

Provided also as follows :

इंजीनियर की अध्यारोही शक्तियाँ Engineer's Overriding Power

(क) किसी कार्य या सामग्री को अननुमोदित करने में इंजीनियर के प्रतिनिधि की विफलता का प्रतिकूल प्रभाव तत्पश्चात ऐसे कार्य या सामग्री को अननुमोदित करने और उसे गिराने, हटाने, तोड़ने एवं संविदाकार की लागत पर उसका पुनर्निर्माण करने का आदेश देने की इंजीनियर की शक्तियों पर नहीं पड़ेगा तथा संविदाकार द्वारा उठाई गई किसी हानि के लिए उसके द्वारा प्रतिकर का कोई दावा नहीं किया जाएगा।

(a) Failure of Engineer's Representative to disapprove any work or materials shall not prejudice the power of the Engineer thereafter to disapprove such work or materials and to order the pulling down, removal, breaking-up thereof and re-constructing at the contractor's cost and the contractor shall have no claim to compensation for the loss if any sustained by him.

(ख) यदि संविदाकार इंजीनियर के प्रतिनिधि के किसी निर्णय से असंतुष्ट

होता है तो वह मामले को इंजीनियर को निर्दिष्ट करने का हकदार होगा जो तदुपरि ऐसे निर्णय की पुष्टि करेगा उसे उलट देगा या उसमें फेरफार करेगा।

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(b) If the contractor shall be dissatisfied by reason of any decision of the Engineer's Representative, he shall be entitled to refer the matter to the Engineer who shall thereupon confirm, reverse or vary such decision.

(ग) इंजीनियर में निहित शक्तियों और प्राधिकार को उसके द्वारा लिखित रूप में अपने प्रतिनिधि को प्रत्यायोजित किए जाने की शर्तों के अनुसार इंजीनियर के प्रतिनिधि द्वारा संविदाकार को दिया गया कोई लिखित अनुदेश या लिखित अनुमोदन संविदाकार तथा न्यासी मंडल को इस प्रकार आबद्ध करेगा मानो वह इंजीनियर द्वारा दिया गया हो जो समय-समय पर ऐसा प्रत्यायोजन कर सकता है।

(c) Any written instructions or written approval given by the Engineer's Representative to the contractor, within the terms of delegation of power and authority vested in the Engineer to his Representative in writing, shall bind the contractor and the Trustees as though it had been given by the Engineer, who may from time to time make such delegation.

3.0 निविदा/प्रस्ताव और इसकी पूर्वापेक्षाएं

THE TENDER/OFFER AND ITS PRE-REQUISITES

3.1 संविदाकार द्वारा निविदा/प्रस्ताव तैयार किए जाने एवं प्रस्तुत किए जाने निविदा में सभी के

पूर्व यह समझा जाएगा कि उसने कार्यस्थल का निरीक्षण व जांच कर ली है, ऐसी सभी बातों, जोखिम एवं आकस्मिकताओं पर पूरी तरह से विचार कर लिया है जिनका प्रत्यक्ष या अप्रत्यक्ष प्रभाव कार्य पर उसके व्यय एवं उससे होनेवाले लाभ पर पड़ेगा तथा विशेष रूप से यह मान लिया जाएगा कि उसने निम्नलिखित पहलुओं पर विचार कर लिया है:

The Contractor shall, before making out and submitting his tender/offer, be deemed to have inspected and examined the site, fully considered all factors, risks and contingencies, which will have direct and indirect impact on his expenses and profit from the work and shall be specifically deemed to have taken the following aspects into consideration :

The tender must encompass all relevant aspects/ issues.

(क) कार्यस्थल तथा उसके आस-पास की उप-सतह, जलराशिक, ज्वारीय कार्यस्थल एवं

एवं जलवायु-विषयक परिस्थिति सहित उसके रूप और प्रकृति, कार्य के स्थानीय लिए अपेक्षित अस्थायी जलमार्ग-गमनाधिकार हेतु संभावित शुल्क एवं परिस्थिति। लागत सहित कार्य-स्थल पर पहुंचने के साधन तथा अन्य स्थानीय परिस्थितियां।

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(a) The form and nature of the site and its surroundings including their sub-surface, hydrological, tidal and climatic conditions, the means of access to the site and all other local conditions, including the likely charges and costs for temporary way-leave, if any, required for the work. Site & Local condition.

(ख) रेखाचित्र, विनिर्देश, किए जानेवाले कार्य की प्रकृति व परिमाण, कार्य के लिए अपेक्षित सामग्री एवं श्रम की गुणवत्ता, परिमाण व उपलब्धता एवं इंजीनियर की पूर्ण तुष्टि से कार्य को निष्पादित करने की आवश्यकता तथा संविदा की सामान्य और विशेष शर्तों का अनुपालन। रेखाचित्र, विनिर्देश, किए जानेवाले कार्य की प्रकृति एवं परिमाण।

(b) The drawings, specifications, the nature and extent of work to be executed and the quality, quantity and availability of the required materials and labour for the work and the need to execute the work to the entire satisfaction of the Engineer, and also by complying with the General and Special Conditions of Contract. Drawing/ Specification/ Nature & extent of work to be done.

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(ग) कामगारों एवं कार्यस्थल-कार्यालय के लिए अपेक्षित आवास, सभी संयंत्र, उपकरण एवं विनिर्माण सामग्री का संघटन/विघटन एवं भंडारण। संविदाकार के श्रमिक/सामग्री हेतु आवास।

(c) The accommodation required for the workmen and site office, mobilisation/demobilisation and storage of all plant, equipment and Construction materials. Accommodation for Contractor's men/materials.

(घ) संविदाकार के खर्च पर पीने, धोने एवं कार्य के निष्पादन के लिए जल प्राप्ति के स्रोत एवं साधन तथा बिजली की उपलब्धता। पीने आदि के लिए जल/बिजली।

(d) The sources and means of procurement of water for drinking, washing and execution of work, and source and availability of electrical power, all at Contractor's cost. Water for drinking etc./Electrical power.

(ड.) संविदाकार द्वारा कर एवं शुल्क का भुगतान और सभी लागू कानून कर/शुल्क का भुगतान

अध्यादेश और विधि तथा उसके अधीन बनाए गए नियमों, सार्वजनिक एवं सभी कानूनों का निकायों या किसी स्थानीय या अन्य प्राधिकरण के नियमों, विनियमों एवं पालन। उप-विधियों का अनुपालन और ऐसे अनुपालन में संविदाकार की विफलता से उत्पन्न सभी प्रकार की शास्तियों एवं देयताओं के प्रति न्यासी मंडल को क्षतिपूरित रखना।

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(e) Payment of taxes and duties and compliance of all applicable statutes, ordinances and law together with the rules made thereunder, the rules, regulations and bye-laws of public bodies or any local or other authority by the Contractor, keeping the Trustees indemnified against penalties and liabilities of every kind arising from the Contractor's failure in such compliance.

Payment of Taxes/ duties and observance of all statutes.

(च) करार के निष्पादन या बैंक गारंटी एवं क्षतिपूर्ति बांड सहित किसी विधिक लिखत के लिए सभी प्रकार के स्टॉप-शुल्क का भुगतान।

संविदाकार द्वारा स्टॉप-शुल्क का

(f) Payment of all kinds of stamp-duty for executing the agreement or for any legal instrument including Bank Guarantees and Indemnity Bonds.

भुगतान।
Payment of Stamp Duty by the Contractor.

3.2 निविदा आमंत्रण सूचना में अन्यथा अनुबंधित के सिवाय न्यासी मंडल द्वारा आपूरित निविदा फार्म पर संविदाकार की निविदा लिखित रूप में होगी और वह आंकड़ों के मामले में त्रुटिरहित एवं अपमार्जन से मुक्त होगी। भूल-सुधार, यदि कोई हो, काटकर एवं संशोधित आंकड़ों पर आद्यक्षर करके किया जाएगा।

The Contractor's tender shall be in ink on the Tender Forms supplied by the Trustees, unless stipulated otherwise in the Notice Inviting the Tender and shall be faultless in figures and free from erasing. Corrections, if any, shall only be made by scoring out and initialling of the revised figure.

3.3 यदि इंजीनियर या न्यासी मंडल द्वारा अपेक्षित हो तो संविदाकार अपनी निविदा में या बाद में अपने स्वामी / भागीदारों / शेयरधारकों के नाम का प्रकटीकरण अपेक्षित समय पर करेंगे। इस संबंध में चूक को भंग माना जाएगा और यदि कोई संविदा की गई हो तो वह निरस्त किए जाने के दायित्व के अधीन होगी।

स्वामी के नाम का प्रकटीकरण।

If required by the Engineer or the Trustees, the Contractors in their tender or subsequently, shall disclose the names of their

Disclosure of Owner's name.

owners/partners/share holders at the required points of time. The failure in this regard shall be treated as a breach and a contract, if entered into, shall be liable to be cancelled.

- 3.4 (क) जबतक कि निविदा आमंत्रण सूचना/प्रस्ताव में अन्यथा अनुबद्ध न हो, बयाना राशि एवं प्रत्येक निविदा निम्नलिखित पैमाने के अनुसार परिकल्पित बयाना राशि के प्रतिभूति जमा साथ प्रस्तुत की जाए ।

17

(a) Unless otherwise stipulated in the Notice Inviting Tender/ Earnest Money Offer, every tender must be submitted with Earnest Money and Security Deposit. the amount calculated as per the following scale.

कार्य का अनुमानित मूल्य Estimated Value of Work	बयाना राशि Amount of Earnest Money	
	कार्य-संविदा हेतु For Works Contract	केवल सामग्री या उपकरण की आपूर्ति के लिए संविदा हेतु For Contract of Supplying Materials or Equipment only
रु.1,00,000=00 तक Up to Rs. 1,00,000=00	कार्य के अनुमानित मूल्य का 5% 5% of the estimated value of work	कार्य के अनुमानित मूल्य का 1% 1% of the estimated value of work
रु.1,00,000=00 से अधिक Over Rs. 1,00,000=00	अधिकतम रु. 20,000/- तथा न्यूनतम रु. 5000/- के अध्यधीन कार्य के अनुमानित मूल्य का 2% 2% of the estimated value of work subject to a maximum of Rs. 20,000/- and minimum of Rs. 5,000/-.	अधिकतम रु. 10,000/- तथा न्यूनतम रु. 1,000/- के अध्यधीन कार्य के अनुमानित मूल्य का ½ % ½% of the estimated value of work subject to a maximum of Rs. 10,000/- and minimum of Rs. 1,000/-.

(ख) बयाना राशि न्यासी मंडल के कोषाध्यक्ष के पास नकदी में या बयाना राशि का कलकत्ता पत्तन न्यास के पक्ष में आहरित किसी भारतीय राष्ट्रीयकृत बैंक भुगतान करने की किसी कलकत्ता शाखा के बैंकर चेक या 'कलकत्ता पत्तन न्यास' के पक्ष विधि। में आहरित और, यथास्थिति, कलकत्ता/हल्दिया में देय किसी भारतीय राष्ट्रीयकृत बैंक के 'खाते में देय' ड्राफ्ट के रूप में जमा की जाएगी और उसके लिए प्रदत्त रसीद निविदा/ प्रस्ताव के साथ संलग्न कर मुहरबंद लिफाफे में रखी जाएगी।

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(b) Earnest Money shall be deposited with the Trustees' Method of Paying treasurer in cash or by Banker's Cheque of any Calcutta E.M. Branch of a Nationalised Bank of India drawn in favour of Calcutta Port Trust or in the form of any "Account Payee" Draft of any Nationalised Bank of India drawn in favour of "Calcutta Port Trust" and payable at Calcutta/Haldia, as the case may be, and the receipt granted therefor be kept attached to the Tender/Offer in the Sealed Cover.

(ग) अस्वीकृत निविदा की बयाना राशि की वापसी किसी ब्याज के बिना बयाना राशि की कलकत्ता/हल्दिया स्थित किसी राष्ट्रीयकृत बैंक पर आहरित 'खाते में देय' वापसी। चेक के जरिए की जाएगी।

(c) Earnest Money of unaccepted tender shall be refunded Refund of E.M. without any interest through A/c. Payee Cheque drawn on a Nationalised Bank of Calcutta / Haldia.

(घ) न्यासी मंडल के सूचीबद्ध (रजिस्ट्रीकृत) ऐसे संविदाकार जिन्होंने अपनी रजिस्ट्रीकृत फर्मों को रजिस्ट्रीकरण श्रेणी के अनुसार न्यासी मंडल के एफए एवं सीएओ/प्रबंधक बयाना राशि से छूट (वित्त) के पास स्थिर प्रतिभूति जमा की है उन्हें निम्नलिखित पैमाने के अनुसार बयाना राशि जमा करने से छूट प्राप्त होगी:

(d) The enlisted (registered) Contractors of the Trustees who Exemption from have deposited fixed Security with the Trustees' FA & CAO / E.M. to Regd. Manager (Finance) according to his Class of Registration, shall Firms be exempt from depositing the Earnest Money, as per the following scale :

रजिस्ट्रीकरण- श्रेणी Class of Registration	स्थिर प्रतिभूति की राशि Amount of Fixed Security	प्रत्येक निविदा की वित्तीय सीमा Financial Limit of Each Tender
क A	रु. 25,000/- Rs.25,000/-	रु. 5,00,000/- तक के मूल्य की कोई निविदा Any tender priced upto Rs.5,00,000/-

ख B	रु. 10,000/- Rs.10,000/-	रु. 2,00,000/- तक के मूल्य की कोई निविदा Any tender priced up to Rs.2,00,000/-
ग C	रु. 5,000 Rs. 5,000/-	रु. 1,00,000/- तक के मूल्य की कोई निविदा Any tender priced upto Rs.1,00,000/-

(ड)(i) अपेक्षित बयाना राशि के बिना जमा की गई निविदा अस्वीकार किए जाने के दायित्व के अधीन हो सकेगी।

(e)(i) Tender submitted without requisite Earnest Money may be liable to rejection.

(ii) यदि निविदा/प्रस्ताव की वैधता अवधि की समाप्ति के पूर्व निविदाकार कोट की गई अपनी दरों या निविदा/प्रस्ताव में संशोधन करता है और उन्हें न्यासी मंडल के लिए अस्वीकार्य बना देता है और/या अपनी निविदा/प्रस्ताव को वापस लेता है, तो जमा की गई बयाना राशि न्यासी मंडल के विकल्प पर जब्त किए जाने के दायित्व के अधीन हो सकेगी।

(ii) If before expiry of the validity period of his Tender/Offer, the tenderer amends his quoted rates or tender/offer making them unacceptable to the Trustees and/or withdraws his tender/offer, the Earnest Money deposited shall be liable to forfeiture at the option of the Trustees.

(च) स्वीकृत निविदा/ प्रस्ताव की बयाना राशि न्यासी मंडल द्वारा प्रतिभूति जमाके अंश के रूप में रखी जाएगी और उसके लिए बयाना राशि की पिछली रसीद के निरस्तीकरण के बाद संविदाकार को एक पृथक् ट्रेजरी रसीद जारी की जाएगी ।

(f) The Earnest Money of accepted tender/offer shall be retained by the Trustees as part of the Security Deposit, for which a separate Treasury Receipt shall be issued to the Contractor after cancellation of the previous Receipt of Earnest Money.

(छ) कार्य संविदा के लिए शेष प्रतिभूति की वसूली सभी आनुक्रमिक बिल से (अंतिम बिल सहित, यदि आवश्यक हो) ऐसे प्रत्येक बिल में कार्य के सकल मूल्य के 10 प्रतिशत की दर से कटौती करके की जाएगी जिससे कि कुल वसूली समापन स्तर तक वस्तुतः किए गए कार्य के कुल मूल्य के निम्नलिखित प्रतिशत के अनुसार संगणित मात्रा से अधिक न हो ।

बयाना राशि के बिना निविदा का अस्वीकार किए जाने के दायित्व के अधीन होना

Tender without EM liable to rejection.

प्रस्ताव स्वीकार करने के पूर्व बयाना राशि की जब्ती।

Forfeiture of E.M. before acceptance of offer.

बयाना राशि का प्रतिभूति जमा के अंश के रूप में परिवर्तित होना।

E.M. to be converted to part S.D.

शेष प्रतिभूति जमा की वसूली का तरीका

(g) Balance security for works contract shall be recovered by Mode of recovery deduction from all progressive Bill (including final Bill, if of balance S.D. necessary) @ 10% of the gross value of work in each such bill, so that the total recovery may not exceed the quantum computed as per the under noted percentages of the total value of work actually done up to the stage of completion.

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कार्य का मूल्य Value of Work	कार्य संविदा के लिए प्रतिभूति जमा का% % of Security Deposit for works contract.	केवल सामग्री एवं उपकरण की आपूर्ति की संविदा हेतु प्रतिभूति जमा का प्रतिशत % of Security Deposit for contract of supplying materials & equipment only.	प्रतिभूति जमा की वसूली का पैमाना Scale of S.D. recovery.
रु. 10,00,000/- तक के कार्य हेतु For works upto Rs.10,00,000/-.	10% (दस प्रतिशत) 10%(Ten percent)	1% (एक प्रतिशत) 1% (One percent)	
रु. 10,00,000/-से अधिक और रु. 20,00,000/- तक की लागत के कार्य हेतु For works costing more than Rs.10,00,000/- and upto Rs.20,00,000/-	प्रथम रु.10,00,000/- तक पर 10% + शेष पर 7½% 10% on first Rs.10,00,000/- + 7½% on the balance.	प्रथम रु. 10,00,000/- पर 1%+ शेष पर ½% 1% on first Rs.10,00,000/- + ½% on the balance.	
रु. 20,00,000/- से अधिक लागत के कार्य हेतु For works costing more than Rs.20,00,000/-	प्रथमरु. 10,00,000/- पर 10%+अगलेरु. 10,00,000/- पर 7½% + शेष पर 5% 10% on first Rs.10,00,000/-+ 7½ % on the next s.10,00,000/-+ 5% on the balance.	प्रथम रु. 10,00,000/- पर 1%+ अगले रु. 10,00,000/-पर ½%+ शेष पर ¼% 1% on first Rs.10,00,000/- + ½% on the next Rs.10,00,000/- + ¼% on the balance.	

(ज) उपर्युक्त प्रतिशत के अनुसार संगणित सामग्री एवं उपकरण की आपूर्ति की आपूर्ति संविदा संविदा के लिए शेष प्रतिभूति को ट्रस्टी के कोषाध्यक्ष के पास अग्रिम रूप से हेतु प्रतिभूति और आपूर्ति आदेश दिए जाने की तारीख से 30 दिनों के भीतर या तो नकदी के जमाराशि का रूप में या, यथास्थिति, कलकत्ता/हल्दिया में देय कलकत्ता पत्तन न्यास के पक्ष अग्रिम रूप से में आहरित किसी भारतीय राष्ट्रीयकृत बैंक के पानेवाले के खाते में देय ड्राफ्ट जमा किया जाना द्वारा जमा करना होगा ।

(h) Balance Security for Contract of supplying materials and S.D. for equipment computed in terms of the percentages given above, supply shall have to be deposited with the Trustees' Treasurer in contracts to advance and within 30 days from the date of placement of be deposited supply order, either in cash or by A/c. Payee Draft of a in advance. Nationalised Bank of India drawn in favour of Calcutta Port Trust and payable at Calcutta/Haldia, as the case may be.

(झ) न्यासी मंडल द्वारा किसी भी स्तर पर धारित बयाना राशि/प्रतिभूति बयाना राशि/ जमाराशि पर न्यासी मंडल द्वारा निविदाकार /संविदाकार को किसी ब्याज का प्रतिभूति जमाराशि पर भुगतान नहीं किया जाएगा । कोई ब्याज देय नहीं

(i) No interest shall be paid by the Trustees to the Tenderer/Contractor on the amount of Earnest Money/Security payable on Deposit held by the Trustees, at any stage. E.M. /S.D

3.5 (i) इसमें इसके नीचे उप-खंड 3.5(ii) के प्रावधानों के अधीन कटौती के, यदि प्रतिभूति कोई हो, अध्यक्ष और इसमें इसके पश्चात् खंड 9.3 की शर्तों के अनुसार जमाराशि की वापसी संविदाकार को की जाएगी । तथापि, यदि जमाराशि की वापसी का तरीका संविदा में किसी अनुरक्षण अवधि का प्रावधान किया गया हो, तो प्रतिभूति जमाराशि के 50% की वापसी अनुरक्षण की आधी अवधि के समापन पर उक्त राशि के किसी कोषागार रसीद के प्रति की जा सकती है और शेष जमाराशि की वापसी उक्त अनुरक्षण अवधि की समाप्ति पर तथा इंजीनियर द्वारा प्रपत्र जीसी-2 में कार्य का अंतिम समापन प्रमाणपत्र दिए जाने के बाद एवं

संविदाकार द्वारा प्रपत्र जीसी-3 में 'कोई दावा नहीं' प्रमाणपत्र प्रस्तुत किए जाने के बाद की जाएगी ।

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The Security Deposit shall be refunded to the Contractor in terms of Clause 9.3 hereinafter and subject to deduction, if any, under the provision of Sub-clause 3.5 (ii) herein below. If, however, the Contract provides for any maintenance period. 50% of the Security Deposit may be refunded against any of the treasury Receipt for that amount on expiry of half of the maintenance period and the balance deposit on the expiry of the said maintenance period and after the Engineer has certified the final completion of work in Form G.C.2 and the Contractor has submitted his "No Claim" Certificate in Form G.C.3.

Mode of refund of S.D.

(ii) यदि संविदाकार कार्य करने या संविदा की किन्हीं शर्तों का पालन/अनुपालन करने में चूक करता है तो न्यासी मंडल के विकल्प पर प्रतिभूति जमाराशि/बयाना राशि जब्त किए जाने के दायित्व के अधीन हो सकती है। प्रतिभूति जमाराशि, सावधि जमाराशि, बयाना राशि या किसी अन्य संविदा के अधीन संविदाकार को देय या देय होनेवाली किसी राशि से न्यासी मंडल अपनी किन्हीं देयराशियों की कटौती करने के लिए स्वतंत्र होंगे ।

प्रतिभूति जमाराशि की जब्ती

The Security Deposit/Earnest Money may be liable to forfeiture at the option of the Trustees, if the Contractor fails to carry out the work or to perform/observe any of the conditions of the Contract. The Trustees shall also be at liberty to deduct any of their dues from the Security Deposit, fixed Security, Earnest Money or from any sum due or to become due to the Contractor under any other contract.

Forfeiture of S.D.

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- 3.6 यदि संविदा में विशेष शर्त के रूप में अनुबद्ध हो तो, संविदाकार को निविदा/प्रस्ताव के स्वीकृति-पत्र में उल्लिखित राशि एवं अवधि के लिए, उक्त पत्र की तारीख से 15 दिनों के भीतर, इसमें संलग्न प्रोफार्मा में किसी भारतीय राष्ट्रीयकृत बैंक की, यथास्थिति, कलकत्ता/हल्दिया शाखा से अप्रतिसंहरणीय गारंटी के रूप में निष्पादन बांड इंजीनियर के पास प्रस्तुत करना होगा तथा इसमें चूक होने पर संविदा पूर्णत इंजीनियर के विवेकानुसार समापन के कतिपय मामलों में नकद प्रतिभूति जमा के बजाय बैंक गारंटी

दायित्वाधीन एवं बयाना राशि जब्ती के दायित्वाधीन हो सकेगी। इसे या किसी अन्य बैंक गारंटी और/या, जहां अपेक्षित हो, उसका पुनर्वैधीकरण प्राप्त करने की लागत का वहन संविदाकार को करना है तथा ऐसी बैंक गारंटी का समय पर पुनर्वैधीकरण कराने की एकमात्र जिम्मेदारी संविदाकार की होगी और इसमें चूक होने एवं संविदाकार द्वारा किसी संविदागत बाध्यता को पूरा नहीं किए जाने पर इंजीनियर और या न्यासी मंडल गारंटी के प्रति दावा करने और /या उसे एकपक्षीय रूप से प्रवर्तित कराने के लिए स्वतंत्र होंगे।

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If stipulated in the contract as a Special Condition, the contractor shall have to submit to the Engineer a performance Bond in the form of an irrevocable guarantee from Calcutta/Haldia Branch, as the case may be, of any Nationalised Bank of India in the proforma annexed hereto and for the sum and period as mentioned in the letter of acceptance of the Tender/Offer, within 15 days from the date of such letter, failing which the Contract shall be liable to be terminated and the earnest money shall be liable to forfeiture; all at the discretion of the Engineer. The cost of obtaining this or any other Bank Guarantee and/or the revalidation thereof, wherever required, has to be borne by the Contractor and it shall be his sole responsibility to arrange for timely revalidation of such Bank Guarantee, failing which and for non-fulfilment of any contractual obligation by the Contractor, the Engineer and/or the Trustees shall be at liberty to raise claim against the Guarantee and/or enforce the same unilaterally.

Bank Guarantee
in lieu of Cash
S.D. in certain
cases

- 3.7 रु.5 करोड़ से अधिक मूल्य की किसी निविदा की बाबत प्रत्येक निविदाकार/बोली लगानेवाला अपनी निविदा के साथ, जिसमें ठेके की विशेष शर्तें, ठेके की सामान्य शर्तें, बीओक्यू, बयाना राशि आदि शामिल हैं, एक दस्तावेज प्रस्तुत करेगा जिसे सत्यनिष्ठ समझौता करार कहा जाएगा और जो उनके प्राधिकृत प्रतिनिधि द्वारा सम्यक् रूप से हस्ताक्षरित किया जाएगा। सत्यनिष्ठा समझौता करार का प्रोफार्मा जीसीसी में यथाविनिर्दिष्ट रूप में होगा। रु. 5 करोड़ से अधिक मूल्य की निविदा के मामले में सत्यनिष्ठ समझौता करार प्रत्येक निविदाकार द्वारा प्रस्तुत की जानेवाली बोली दस्तावेज का अभिन्न अंग है जिसके बिना निविदा पर विचार नहीं किया जाएगा।

"Every Tenderer/ Bidder shall submit, in respect of a tender value of more than Rs 5 Crore, along with their tender comprising Special Conditions of Contract, General Conditions of Contract,

BOQ, Earnest Money, etc. a document called Integrity Pact Agreement duly signed by their authorized representative. The Proforma of the Integrity Pact Agreement shall as specified in the GCC. In case of tender value more than Rs 5 Crore, the Integrity Pact Agreement is an essential part and parcel of bid document to be submitted by each tenderer, without which the tender shall not be considered."

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4.0 संविदा एवं संविदाकार की सामान्य बाध्यता

THE CONTRACT & GENERAL OBLIGATIONS OF CONTRACTOR

4.1 (क) संविदा की दस्तावेजें अंग्रेजी भाषा में तैयार की जाएंगी।

अंग्रेजी भाषा का

(a) The contract documents shall be drawn-up in English language.

प्रयोग किया जाए

English language

to be used

(ख) संविदा निम्नलिखित अधिनियमों सहित केवल कलकत्ता उच्च न्यायालय के अधिकार-क्षेत्र के भीतर यथा लागू भारत के सभी सुसंगत अधिनियमों द्वारा शासित होगी :

संविदा पर कानून

की प्रयोज्यता

(b) The contract shall be governed by all relevant Indian Acts.As applicable only within the jurisdiction of the High Court at Calcutta, India, including the following Acts :

Applicability of

laws on the

contract

1. संविदा अधिनियम (भारत),1872

The Contract Act (India), 1872.

2. महापत्तन न्यास अधिनियम,1963

The Major Port Trusts Act, 1963.

3. कर्मकार प्रतिकर अधिनियम,1923

The Workmen's Compensation Act, 1923.

4. न्यूनतम मजदूरी अधिनियम,1948

The Minimum Wages Act, 1948.

5. ठेका श्रम (विनियमन और उत्सादन) अधिनियम,1970

The Contract Labour (Regulation & Abolition) Act,1970.

6. गोदी कर्मकार अधिनियम,1948
The Dock Workers' Act,1948.
7. माध्यस्थम् और सुलह अधिनियम,1996(केवल निश्चित
माध्यस्थम् करार के मामले में
The Arbitration and Conciliation Act (1996) (in the
case of a definite Arbitration Agreement only).

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- 4.2 उसकी निविदा/प्रस्ताव को स्वीकार किए जाने और इंजीनियर या उसके प्रतिनिधि द्वारा ऐसा करने के लिए कहे जाने पर संविदाकार अपने खर्च पर इसके साथ संलग्न फार्म में एक संविदा तैयार करके संविदा करेगा एवं निष्पादित करेगा । जबतक ऐसी संविदा निष्पादित नहीं की जाती है तबतक इसमें इसके पूर्व 'संविदा' शब्द की परिभाषा में निर्दिष्ट अन्य दस्तावेजों को सामूहिक रूप से संविदा माना जाएगा।
- After acceptance of his Tender/Offer and when called on to do so by the engineer or his representative, the contractor shall, at his own expense, enter into and execute a Contract Agreement to be prepared by him in the form annexed hereto. Until such Contract Agreement is executed, the other documents referred to in the definition of the term 'Contract' here-in-before, shall collectively be the Contract.
- 4.3 संविदा के भागरूप पृथक्-पृथक् दस्तावेजों को परस्पर एक दूसरे का स्पष्टीकारक माना जाए। विभिन्न संविदा दस्तावेजों में कोई फर्क, अस्पष्टता, चूक या गलती पाए जाने पर इंजीनियर को उसमें सुधार करने की शक्ति होगी तथा उसका विनिश्चय अंतिम और संविदा के पक्षकारों पर बाध्यकारी होगा ।
- Several documents forming the contract are to be taken as mutually explanatory of one another. Should there be any discrepancy, ambiguity, omission or error in the various contract documents, the Engineer shall have the power to correct the same and his decision shall be final and binding on the parties to the Contract.
- संविदाकार द्वारा संविदा निष्पादित किया जाना
- Contractor to Execute Contract Agreement.
- संविदा दस्तावेजों का निर्वचन- इंजीनियरों की शक्ति
- Interpretation of contract documents- Engineers' Power

4.4 संविदा की सामान्य एवं विशेष शर्तों तथा परिमाण बिल में निर्दिष्ट रेखाचित्रों की दो प्रतियां इंजीनियर द्वारा बिना मूल्य ठेकेदारों को कार्य में उनके उपयोग के लिए प्रदान की जाएंगी परन्तु वे न्यासी मंडल की संपत्ति बनी रहेंगी और इसलिए यदि वे कार्य-स्थल पर नियमित रूप से व्यवहृत होने पर फट या विकृत न हो जाएँ तो कार्य पूरा होने पर संविदाकार उन्हें इंजीनियर या उसके प्रतिनिधि को वापस कर देगा। सभी रेखाचित्र न्यासी मंडल की संपत्ति हैं

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Two copies of the Drawings referred to in the general and special Conditions of Contract and in the Bill of Quantities, shall be furnished by the Engineer to the Contractors free of cost for his use on the work, but these shall remain the property of the Trustees and hence, the Contractor shall return them to the Engineer or his Representative on completion of the work, if not torn or mutilated on being regularly used at site.

All Drawings are Trustees' property.

4.5 संविदाकार द्वारा अपेक्षित होने या कार्य के समुचित निष्पादन के लिए आवश्यक होने पर वह अपने खर्च पर कोई कार्य-संचालन या प्रगति-रेखाचित्र प्रमाणित एवं तैयार करेगा तथा उससे अपेक्षा किए जाने पर वह उसकी प्रतियाँ किसी मूल्य के बिना इंजीनियर को उसकी सूचना और/या अनुमोदन के लिए देगा, परन्तु इसका अर्थ किसी भी रूप में संविदाकार के दायित्व का इंजीनियर में अंतरण नहीं होगा। संविदाकार द्वारा कार्य-संचालन/ प्रगति-रेखाचित्र तैयार किया जाना

The Contractor shall prove and make at his own expense any working or progress drawings required by him or necessary for the proper execution of the works and shall, when required, furnish copies of the same free of cost to the Engineer for his information and/or approval, without meaning thereby the shifting of Contractor's responsibility on the Engineer in any way whatsoever.

Contractor to prepare working/ progress drawings

4.6 इंजीनियर की लिखित अनुमति के बिना संविदाकार संविदा या उसके किसी अंश को प्रत्यक्ष या अप्रत्यक्ष रूप से अंतरित, समनुदेशित नहीं करेगा या उप-पट्टे पर नहीं देगा । यदि ऐसी अनुमति दी भी गई हो तो संविदाकार - संविदाकार कार्य को उप-पट्टे पर नहीं दे सकता है (क) किसी उप-संविदाकार, उसके एजेंटों, सेवकों या कर्मकारों द्वारा किए गए कार्य, चूक एवं उपेक्षा के लिए उसी प्रकार पूरी तरह उत्तरदायी होगा मानो

वे कार्य, चूक तथा उपेक्षा स्वयं संविदाकार या उसके एजेंटों, सेवकों या कर्मकारों द्वारा की गई हो तथा (ख)संविदा से संबंधित पूर्ण एवं समस्त दायित्व और उप-पट्टे पर दिए जाने के बावजूद उसके द्वारा किए जानेवाले कार्यों के सक्रिय अधीक्षण के लिए उत्तरदायी होगा, परंतु यह हमेशा कि "मात्रानुपाती दर" पर श्रमिकों की व्यवस्था को इस खंड के अधीन उप-पट्टे पर दिया जाना नहीं समझा जाएगा।

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The Contractor shall not directly or indirectly transfer, assign or sublet the Contract or any part thereof without the written permission of the Engineer. Even if such permission be granted, the Contractor shall remain responsible (a) for the acts, defaults and neglect of any sub-contractor, his agents, servants or workmen as fully as if these were the acts, defaults or neglects of the Contractor himself or his agents, servants or workmen and (b) for his full and entire responsibility of the contract and for active superintendence of the works by him despite being sublet, provided always that the provision of labourers on a "piece rate" basis shall not be deemed to be sub-letting under this clause.

Contractor cannot sub-let the work

- 4.7 जब तक कि अन्यथा विनिर्दिष्ट न किया गया हो, संविदाकार की निविदा/प्रस्ताव में निर्माण के लिए आवश्यक सभी संयंत्र, स्थायी तथा अस्थायी दोनों प्रकार के कार्य के लिए अस्थायी कार्य-सामग्री आपूर्ति करने, श्रमिक तथा उनके पर्यवेक्षण की व्यवस्था करने, कार्य में प्रयुक्त होनेवाले माल को चढ़ाने, उतारने, बाड़ लगाने, पहरा देने, प्रकाश की व्यवस्था करने, समुचित प्राधिकरणों की फीस, कर एवं शुल्क के भुगतान सहित कार्य के निर्माण, स्थापना, समापन एवं अनुरक्षण के लिए अपेक्षित सभी प्रकार की अन्य वस्तु कार्य-स्थल तक लाने एवं ले जाने पर हुआ उसका खर्च शामिल समझा जाएगा।
- संविदाकार द्वारा प्रस्तावित मूल्य में सभी खर्च शामिल हैं

Unless otherwise specified, the Contractor shall be deemed to have included in his Tender/Offer all his cost for supplying and providing all constructional plant, temporary work. Materials both for temporary and permanent works, labour including supervision thereof, transporting to and from the site and in

Contractors' price is inclusive of all costs

and about the work, including loading, unloading, fencing, watching, lighting, payment of fees, taxes and duties to the appropriate authorities and other things of every kind required for the construction, erection, completion and maintenance of the work.

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- 4.8 संविदाकार कार्य-स्थल के सभी प्रचालनों तथा निर्माण पद्धतियों की पर्याप्तता, स्थायित्व तथा सुरक्षा के लिए अकेले ही उत्तरदायी होगा, चाहे उसके लिए इंजीनियर या उसके प्रतिनिधि से कोई पूर्व अनुमति ले ली गई हो। संविदाकार, इंजीनियर द्वारा बनाए गए अस्थायी या स्थायी कार्य के डिजाइन या विशेष विवरण की सत्यता के लिए उत्तरदायी नहीं होगा; परन्तु संविदाकार उसके सही कार्यान्वयन तथा संविदाकार द्वारा तैयार किए गए, प्रस्तावित/व्यवहृत किसी डिजाइन एवं विशेष विवरण के लिए पूर्णतः उत्तरदायी होगा।
The Contractor shall be solely responsible for the adequacy, stability and safety of all site operations and methods of construction, even if any prior approval thereto has been taken from the Engineer or his Representative. The Contractor shall not be responsible for the correctness of the design or specification of the Temporary and Permanent works formulated by the Engineer; but the Contractor shall be fully responsible for the correct implementation thereof, as also for any design and specification prepared/proposed/used by the Contractor.
- संविदाकार, इंजीनियर द्वारा बनाए गए डिजाइन तथा विशेष विवरण की सत्यता के सिवाय सभी निर्माण प्रक्रिया के लिए उत्तरदायी है
Contractor is responsible for all construction process, except for correctness of design and specification formulated by the Engineer
- 4.9 इंजीनियर या उसके प्रतिनिधि द्वारा अपेक्षा किए जाने पर संविदाकार उसके समक्ष (क) कार्य के निष्पादन के लिए योजना (ख) प्रस्तावित प्रक्रिया और कार्य पद्धति (ग) संयंत्र, उपकरण, श्रमिक, सामग्री तथा अस्थायी कार्यों के प्रस्तावित परिनियोजन के ब्योरे प्रस्तुत करेगा। ऐसी किसी योजना या विवरण पर इंजीनियर या उसके प्रतिनिधि का अनुदेश और /या अनुमोदन संविदाकार को संविदा के अधीन उसकी किन्हीं बाध्यता से मुक्त नहीं करेगा।
Whenever required by the Engineer or his representative, the Contractor shall submit to him the details of his (a) programme
- संविदाकार द्वारा अपने कार्य की योजना प्रस्तुत किया जाना
Contractor to submit his programme of

for execution of the work, (b) proposed procedure and methods work of work, (c) proposed deployment of plant, equipment, labour, materials and temporary works. The submission to and/or any approval by the Engineer or his Representative to any such programme or particulars shall not relieve the Contractor of any of his obligations under the contract.

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यदि किसी कारणवश संविदाकार अपनी पूर्व-निर्धारित योजना के अनुसार कार्य करने में असमर्थ होता है तो जब भी उससे अपेक्षा की जाए, वह कार्य पूर्ण करने की अपनी संशोधित योजना निर्धारित समय के भीतर प्रस्तुत करेगा।

If for any reason the contractor be unable to adhere to his earlier programme, he shall submit his revised programme for completion of work within the stipulated time whenever asked to do so.

- 4.10 कार्यनिष्पादन के दौरान और उसके बाद अनुरक्षण-अवधि के दौरान इंजीनियर संविदाकार द्वारा या उसके प्रतिनिधि द्वारा आवश्यक समझे जाने की अवधि तक संविदाकार कार्य का पर्यवेक्षण द्वारा आवश्यक एवं पर्याप्त पर्यवेक्षण की व्यवस्था की जाएगी। संविदाकार या किया जाना उसका सक्षम एवं प्राधिकृत एजेंट या प्रतिनिधि कार्य-स्थल पर हमेशा मौजूद रहेगा तथा इंजीनियर या उसके प्रतिनिधि द्वारा उसे लिखित रूप में दिए गए अनुदेश इसके खंड 2.5 की सीमा के अध्यक्षीन संविदाकार पर बाध्यकारी होंगे। संविदाकार कार्यस्थल पर रहनेवाले अपने ऐसे प्रतिनिधि/एजेंट के बारे में इंजीनियर या उसके प्रतिनिधि को लिखित रूप में जानकारी देगा।

Necessary and adequate supervision shall be provided by the Contractor to Contractor during execution of the works and as long thereafter supervise the as the Engineer or his representative shall consider necessary works during the maintenance period. The Contractor or his competent and authorised agent or representative shall be constantly at site and instructions given to him by the Engineer or his representative in writing shall be binding upon the Contractor subject to limitation in Clause 2.5 hereof. The Contractor shall inform the Engineer or his representative in writing about such

representative/agent of him at site.

- 4.11 संविदा के निष्पादन के लिए संविदाकार केवल अर्हताप्राप्त, सचेत और अनुभवी व्यक्तियों को नियुक्त करेगा तथा इंजीनियर कार्यस्थल पर परिनियोजित संविदाकार के किसी भी ऐसे स्टाफ, कामगार या अधिकारी के परिनियोजन को रोकने का निदेश संविदाकार को देने के लिए स्वतंत्र होगा जिसका परिनियोजन इंजीनियर की राय में कार्य के समुचित और समय के भीतर पूरा करने में सहायक नहीं होगा तथा संविदाकार किसी आपत्ति के बिना 48 घंटे के भीतर ऐसे अनुदेश का पालन करेगा।

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The Contractor shall employ in execution of the Contract only qualified careful and experienced persons and the Engineer shall be at liberty to direct the Contractor to stop deployment of any of his staff, workmen or official at site and the Contractor shall within 48 hours comply with such instruction without any demur whenever the Engineer shall feel that the deployment of the person concerned will not be conducive to the proper and timely

संविदाकार द्वारा अर्हताप्राप्त व्यक्तियों को परिनियोजित किया जाना तथा संविदाकार के श्रमिकों को हटाने की इंजीनियर की शक्ति

Contractor to deploy qualified men and Engineer's power to remove Contractor's men

- 4.12 इंजीनियर द्वारा लिखित रूप में दिए गए संदर्भ बिन्दु/ लाइन / लेवल के अनुसार कार्य के सही एवं समुचित रूप से सीमांकन का दायित्व संविदाकार का होगा। इंजीनियर या उसके प्रतिनिधि द्वारा किसी सीमांकन या किसी

लाइन, लेवल, सीमांकन आदि के लिए संविदाकार उत्तरदायी है

संरक्षण या लेवल की जांच किए जाने से संविदाकार किसी भी रूप में उसे सही रूप में प्रस्तुत करने के दायित्व से मुक्त नहीं होगा और वह पूरी तरह से सभी खूँटे, दासा, निर्देशचिह्न, साइट रेल्स, खूँटी, तल चिह्न, प्रोफाइल चिह्न तथा कार्य के सीमांकन में प्रयोग की जानेवाली अन्य वस्तुएं उपलब्ध कराएगा, संरक्षित एवं परिरक्षित करेगा।

The Contractor shall be responsible for the true and proper setting out of the works in relation to reference points/lines/levels given by the Engineer in writing. The checking of any setting-out or of any alignment or level by the Engineer or his Representative shall not in any way relieve the contractor of his responsibility for the correctness thereof and he shall fully provide protect and preserve all stakes, templates, bench marks, sight rails, pegs, level marks, profile marks and other things

Contractor is responsible for line, level, setting out etc.

4.13

used in setting out the works.

कार्य आरंभ किए जाने के समय से लेकर इसके खंड 5.12 में उल्लिखित प्ररूप जी.सी.1 में कार्य पूरा होने संबंधी प्रमाण-पत्र जारी किए जाने के समय तक संविदाकार उस कार्य की देख-रेख करने का पूरा दायित्व लेगा। अपवादित जोखिम को छोड़कर कार्य या उसके किसी भाग को होनेवाले किसी नुकसान, हानि या क्षति की प्रतिपूर्ति संविदाकार अपने खर्च पर इंजीनियर के अनुदेश और तुष्टि के अनुरूप करेगा और इसमें चूक होने पर इंजीनियर या उसका प्रतिनिधि किसी अन्य एजेंसी द्वारा उसकी प्रतिपूर्ति कराएगा तथा उसके लिए उपगत एवं इंजीनियर द्वारा प्रमाणित व्यय उचित समझा जाएगा। यह खंड

संविदाकार का दायित्व कार्य की संरक्षा करना है

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कार्य के उस भाग पर लागू नहीं होगा जो कार्य के आंशिक समापन पर न्यासी मंडल द्वारा अपने अधिकार में ले लिया गया हो और वैसे मामले में इंजीनियर के निदेशानुसार अनुरक्षण अवधि (गारंटी अवधि) के दौरान संविदाकार की बाध्यता विनिर्माण या सन्निर्माण दोष के लिए मरम्मत एवं प्रतिस्थापन तक तथा अनुरक्षण अवधि में ऐसी मरम्मत एवं प्रतिस्थापन के दौरान संविदाकार द्वारा कार्य को पहुंचाए गए दोष/नुकसान तक, यदि कोई हो, सीमित होगी।

From the commencement of the works till issue of the completion certificate in Form G.C.1, vide Clause 5.12 hereof, the contractor shall take full responsibility for the care thereof. Save for the excepted risks, any damage, loss or injury to the work or any part thereof shall be made good by the Contractor at his own cost as per instruction and to the satisfaction of the engineer, failing which the Engineer or his Representative may cause the same to be made good by any other agency and the expenses incurred and certified by the Engineer shall deem proper. This Clause will not apply to that part of the work, which might have been taken over by the Trustees on partial completion of the work and in such case the Contractor's obligation will be limited to repairs and replacement for manufacturing or construction defects during the Maintenance period (Guarantee Period) as per the directions of the Engineer as also for defects/damages if any caused to the work by the Contractor during such repairs and replacement in the maintenance period.

Contractor is responsible to protect the work

- 4.14 संविदाकार अपने खर्च पर न्यासी मंडल के या इतर ऐसे कार्मिकों या कार्य के संरचनाओं या सेवाओं या संपत्तियों का संरक्षण एवं संभरण तथा सभी निष्पादन में पूर्वोपाय करेगा जिन्हें रोका गया हो या जो प्रभावित या अस्त-व्यस्त या अन्य संरचनाओं/ संकटापन्न हुआ हो तथा उपर्युक्त संपत्तियों संरचनाओं एवं सेवाओं और/या व्यक्तियों को संविदाकार के कामगारों सहित किन्हीं व्यक्ति को कार्य के निष्पादन एवं पहुंचाए गए सभी अनुरक्षण के संबंध में संविदाकार द्वारा की गई क्षति, हानि या नुकसान के प्रकार के नुकसान के लिए संविदाकार के प्रति न्यासी मंडल की क्षतिपूर्ति करेगा और उन्हें क्षतिपूरित रखेगा। संविदाकार द्वारा ली गई बीमा सुरक्षा की, यदि कोई हो, लागत की प्रतिपूर्ति, संविदा में अन्यथा अनुबंधित के सिवाय, न्यासी मंडल द्वारा नहीं की जाएगी। उत्तरदायी है।

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The Contractor shall at his own cost protect support and take all precautions in regard to the personnel or structure or services or properties belonging to the Trustees or not which may be interfered with or affected or disturbed or endangered and shall indemnify and keep indemnified the Trustees against claim for injury, loss or damage caused by the Contractor in connection with the execution and maintenance of the work to the aforesaid properties, structures and services and/or to any person including the Contractor's workmen. Cost of Insurance Cover, if any, taken by the Contractor shall not be reimbursed by the Trustees, unless otherwise stipulated in the Contract.

Contractor is responsible for all damages to other structures/ persons caused by him in executing the work.

- 4.15 यदि कार्यस्थल पर किसी जीवाश्म, सिक्के, मूल्यवान वस्तु या पुरावशेष एवं भूवैज्ञानिक या पुरातात्विक महत्व के अन्य अवशेष या वस्तु का पता निधि आदि लगता है तो वे न्यासी मंडल की संपत्ति बनी रहेंगी और संविदाकार उनके न्यासी मंडल के बारे में तत्काल इंजीनियर के प्रतिनिधियों को सूचित करेगा और अपने कामगारों द्वारा उन्हें नुकसान पहुंचाए जाने से उनकी रक्षा करेगा तथा इंजीनियर के प्रतिनिधि के अनुदेश के अनुसार न्यासी मंडल के खर्च पर उनका निपटान करने की व्यवस्था करेगा।

The Contractor shall immediately inform the Engineer's Representatives if any fossil, coins, articles of value or antiquity and structures and other remains or things of geological or archaeological importance be discovered at site

Fossils, Treasure travois, etc. are Trustees' property

which shall remain the property of the Trustees and protect them from being damaged by his workmen and arrange for disposal of them at the Trustees' expense as per the instruction of the Engineer's Representative.

- 4.16 संविदाकार द्वारा सभी दावों, मांग, कार्रवाइयों एवं कार्यवाहियों से तथा निम्नलिखित के कारण उनपर होनेवाले सभी खर्च से न्यासी मंडल को क्षतिपूरित रखा गया और क्षतिपूरित किया गया समझा जाएगा:
The Contractor shall be deemed to have indemnified and shall indemnify the Trustees against all claims, demands, actions and proceedings and all costs arising therefrom on account of :
- संविदाकार द्वारा न्यासी मंडल को हानि, क्षति आदि के लिए किए गए सभी दावों के प्रति क्षतिपूरित किया जाना

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- (क) कार्य या अस्थायी कार्य से संबंधित किसी पेटेंट अधिकार, डिजाइन, ट्रेडमार्क या नाम या अन्य सुरक्षित अधिकार का अतिक्रमण । Contractor to Indemnify the Trustees against all claims for loss, damage, etc.
- (a) Infringement of any patent right, design, trademark or name or other protected right in connection with the works or temporary work.
- (ख) कार्य के लिए अपेक्षित सभी सामग्री एवं उपकरण प्राप्त करने के लिए सभी रायल्टी, किराए, टोल-प्रभार, स्थानीय कर का भुगतान, अन्य भुगतान या क्षतिपूर्ति, यदि कोई हो।
- (b) Payment of all royalties, rent, toll charges, local taxes, other payments or compensation, if any, for getting all materials and equipment required for the work.
- (ग) सार्वजनिक या निजी सड़क, रेल-पटरियों, फुटपाथों, क्रेन-पटरियों, जलपथों, जहाजी घाटों तथा न्यासी मंडल या किसी अन्य व्यक्ति की अन्य संपत्तियों पर संविदाकार द्वारा अनधिकृत अवरोध या न्यूसेंस उत्पन्न करना।
- (c) Unauthorised obstruction or nuisance caused by the contractor in respect of Public or Private road, railway tracks, footpaths, crane tracks, waterways, quays and other properties belonging to the Trustees or any other person.
- (घ) कार्य से संबंधित संविदाकार के संयंत्र तथा सामग्री की आवाजाही के कारण किसी राजमार्ग एवं पुल का नुकसान या क्षतिग्रस्त होना ।

(d) Damage/injury caused to any highway and bridge on account of the movement of Contractor's plants and materials in connection with the work.

(ड) संविदाकार के संयंत्र एवं सामग्री के परिवहन के दौरान जलपथ का प्रदूषित होना तथा नदी, जलपाश, सी-वाल या जलपथ से संबंधित अन्य संरचना का क्षतिग्रस्त होना।

(e) Pollution of waterway and damage caused to river, lock, sea-wall or other structure related to waterway, in transporting contractor's plants and materials.

(च) कार्य-स्थल पर या उसके नजदीक न्यासी मंडल की अनुमति से और/या उनकी जानकारी में नियुक्त न्यासी मंडल और अन्य एजेंसियों के कामगारों को इंजीनियर या उसके प्रतिनिधि के निदेशानुसार सभी युक्तियुक्त सुविधाएं तथा आवास उपलब्ध कराने में संविदाकार द्वारा चूक किया जाना ।

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(f) The Contractor's default in affording all reasonable facilities and accommodation as per the direction of the Engineer or his Representative to the workmen of the Trustees and other agencies employed by or with the permission and/or knowledge of the Trustees on or near the site of work.

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संविदा की शर्तों के अनुसार किसी संपत्ति, भवन या संरचना को गिराने पर प्राप्त मलबा और सामग्री न्यासी मंडल की संपत्ति होगी।

Debris and materials, if obtained by demolishing any property, building or structure in terms of the Contract shall remain the property of the Trustees.

विखंडित सामग्री
न्यासी मंडल की
संपत्ति
Dismantled
materials
Trustees'
property

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4.18 संविदाकार द्वारा कोट की गई दरों में निम्नलिखित शामिल समझी जाएंगी:

The Contractor's quoted rates shall be deemed to have been inclusive of the following :

(क) कार्य स्थल को अनावश्यक अवरोध से मुक्त रखना तथा कार्य-स्थल से निर्माण संयंत्र के भग्नावशेष, कूड़ा-करकट, अतिरिक्त मिट्टी या अनापेक्षित अन्य अस्थायी निर्माण हटाना।

(a) Keeping the site free of unnecessary obstruction and removal of site of constructional plant wreckage, rubbish, surplus earth temporary works no longer required.

संविदाकार द्वारा कोट की गई दरों/मूल्य में सब बातें शामिल होंगी
Contractor's quoted rates / price must be all inclusive

(ख) कार्य-स्थल से हर प्रकार के सभी फालतू सामग्री को हटाना और सफाई करना जिससे कार्य पूरा होने के बाद कार्य-स्थल स्वच्छ और साफ-सुथरा रह सके जिसके बिना अन्तिम बिल के प्रति भुगतान रोके जाने के दायित्व के अधीन हो सकता है।

(b) Cleaning and removal from site all the surplus materials of every kind to leave the site clean and tidy after completion of the work, without which payment against final bill may be liable to be withheld.

(ग) कार्य के निष्पादन एवं अनुरक्षण के दौरान गोदी, हुगली नदी और अन्य जलपथों का किसी भी प्रकार के प्रदूषण से प्रभावी संरक्षण सुनिश्चित करने और संविदाकार या उसकी एजेंसी के श्रमिकों द्वारा जल में कूड़ा-करकट, कचरा एवं अन्य सामग्री का फेंका जाना रोकने के लिए एहतियाती उपाय करना।

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(c) Precautionary measures to secure efficient protection of Docks, the River Hooghly and other waterways against pollution of whatever nature during execution and maintenance of the works and to prevent rubbish, refuse and other materials from being thrown into the water by the Contractor's men or those of his agency.

(घ) सभी श्रमिकों एवं कामगारों, स्थानीय या अन्य, के परिनियोजन एवं उनकी मजदूरी, परिवहन, आवास, चिकित्सा और अन्य सभी कानूनी प्रसुविधा तथा प्रवेश परमिट की, जहाँ आवश्यक हो, व्यवस्था करना।

(d) Making arrangements for deployment of all labourer and workers, local or otherwise including payment for their wages, transport, accommodation, medical and all other statutory benefits and entry permits, wherever necessary.

(ङ) स्थानीय प्राधिकरण या इंजीनियर या उसके प्रतिनिधि की अपेक्षा के अनुसार कार्य-स्थल पर या उसके आस-पास निम्नलिखित को रोकने की व्यवस्था करना (i) चूहों, मूषिकाओं, कीड़े-मकोड़े, मच्छरों आदि का नाश करने के लिए प्रभावी कार्रवाई करके एवं स्वस्थ और स्वच्छ परिवेश रखकर चेचक, हैजा, प्लेग या मलेरिया जैसे संक्रामक रोग का फैलना, (ii) मादक द्रव्य, स्वापक पदार्थ, मद्यसारिक पान, शस्त्र एवं गोला-बारूद का अवैध भंडारण और वितरण, (iii) संविदाकार या उप-संविदाकार के कामगारों का विधिविरुद्ध, बलवात्मक या विशृंखल आचरण, (iv) 16 वर्ष से कम आयु के कामगारों का परिनियोजन।

(e) Making arrangements in or around the site, as per the requirements of local authority or the Engineer or his Representative for preventing (i) spread of any infectious disease

like smallpox, cholera, plague or malaria by taking effective actions for destruction of rats, mice, vermin, mosquitoes, etc. and by maintaining healthy and sanitary condition, (ii) illegal storage and distribution of Drugs, Narcotics, Alcoholic liquor, Arms and Ammunitions, (iii) unlawful, riotous or disorderly conduct of the Contractor's or his Sub-Contractor's workmen, (iv) deployment of workmen of age less than 16 years.

- 4.19 संविदाकार को दिए जानेवाले सभी निदेश या नोटिस संविदाकार को सम्यक् रूप से तामील की गई या उसके द्वारा प्राप्त की गई समझी जाएगी यदि उसे नोटिस निविदा में यथाउल्लिखित या संविदाकार के साइट कार्यालय या संविदाकार के रजिस्ट्रीकृत कार्यालय के पते पर डाक में डाला गया हो या दस्ती भेजा गया हो। निदेश या नोटिस के बाद कोई कार्य करने के लिए इन शर्तों में उल्लिखित समय की गणना ऐसे डाक में डाले जाने या प्रेषण के समय से की जाएगी।

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Every direction or notice to be given to the Contractor shall be deemed to have been duly served on or received by the Contractor, if the same is posted or sent by hand to the address given in the tender or to the Contractor's Site Office or to the Registered Office of the Contractor. The time mentioned in these conditions for doing any act after direction or notice shall be reckoned from the time of such posting or despatch.

Notice to Contractor.

- 4.20 इंजीनियर के लिखित रूप में पूर्व प्राधिकार के बिना संविदाकार और उसका उप-संविदाकार या उनके एजेंट एवं श्रमिक तथा संयंत्र, सामग्री एवं उपकरण की आपूर्ति करनेवाला कोई फर्म कोई फोटो या कार्यविवरण प्रकाशित नहीं करेगा या प्रकाशित नहीं कराएगा।
- The Contractor and his Sub-contractor or their agents and men and any firm supplying plant, materials and equipment shall not publish or caused to be published any photographs or description of the works without the prior authority of the Engineer in writing.
- संविदाकार द्वारा फोटो या कार्य-विवरण प्रकाशित नहीं किया जाना।
- Contractor not to publish photograph or particulars of work

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- 4.21 इंजीनियर द्वारा निर्णीत न्यासी मंडल के खर्च पर संविदाकार, इंजीनियर या उसके प्रतिनिधि के निदेश के अनुसार न्यासी मंडल द्वारा नियुक्त किसी अन्य संविदाकार और उनके कामगारों, न्यासी मंडल के अपने स्टाफ एवं कार्य-स्थल बाहरी व्यक्तियों को सुविधाएं प्रदान

पर या उसके आसपास के अन्य सार्वजनिक निकाय के श्रमिकों को सभी किया जाना युक्तियुक्त सुविधाएं और सहयोग प्रदान करेगा तथा इसमें चूक होने पर संविदाकार ऐसी चूक के कारण होनेवाली किसी देरी या उपगत किए गए किसी व्यय के लिए न्यासी मंडल के प्रति उत्तरदायी होगा ।

The Contractor shall at the Trustees' cost to be decided by the Contractor to Engineer render all reasonable facilities and Co-operation as per provide direction of the Engineer or his representative to any other facilities to Contractor engaged by the Trustees and their workmen to the outsiders Trustees' own staff and to the men of other Public Body on or near the site of work and in default the Contractor shall be liable to the Trustees for any delay or expense incurred by reason of such default.

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- 4.22 संविदाकार द्वारा इस प्रकार कार्य किया जाना है जिससे नौ-यातायात तथा जल-स्थल यातायात में न्यूनतम बाधा आए। कार्य के कारण यातायात संचलन में न्यूनतम बाधा आना
The work has to be carried out by the Contractor causing the minimum of hindrance for any maritime traffic or surface traffic. Work to cause minimum possible hindrance to traffic movement
- 4.23 संविदाकार द्वारा निर्माण-स्थल पर लाए जानेवाले निर्माण संबंधी सभी संयंत्र, अस्थायी कल-पुर्जे एवं सामग्री न्यासी मंडल की संपत्ति मानी जाएंगी और संतोषजनक रूप से काम होने तक उनपर न्यासी मंडल का धारणाधिकार बना रहेगा तथा केवल इंजीनियर या उसके प्रतिनिधि की लिखित अनुमति से ही उन्हें कार्यस्थल से अंशतः या पूर्णतः हटाया जा सकता है। संविदाकार के संयंत्र एवं उपकरण पर न्यासी मंडल का धारणाधिकार
All constructional plants, temporary works and materials when brought to the site by the Contractor shall be deemed to be the Trustees' lien on Contractor's Plant & Equipment property of the Trustees who will have lien on the same until the satisfactory completion of the work and shall only be removed from the site in part or in full with the written permission of the Engineer or his Representative.
- 5.0 कार्य का आरम्भ, निष्पादन तथा पूरा किया जाना
COMMENCEMENT, EXECUTION AND COMPLETION OF WORK.
- 5.1 संविदाकार की निविदा/प्रस्ताव का न्यासी मंडल द्वारा स्वीकार किए जाने की सूचना संबंधी इंजीनियर के पत्र की प्राप्ति से 7 दिनों के भीतर या निविदा फार्म कार्य आरंभ करने का प्रारंभिक समय

में संविदाकार द्वारा यथाउल्लिखित ऐसे प्राथमिक समय या न्यासी मंडल तथा प्रगति की द्वारा स्वीकृत समय के भीतर संविदाकार कार्य आरंभ करेगा । उसके बाद सतत् दर बनाए इंजीनियर या उसके प्रतिनिधियों द्वारा अभिव्यक्त रूप से मंजूर किए जाने या रखना। आदेश दिए जाने के सिवाय संविदाकार कार्य को समुचित शीघ्रता से और विलम्ब किए बिना आगे बढ़ाएगा तथा संविदाकार की ओर से समय को ही संविदा का सार माना जाएगा।

The Contractor shall commence the work within 7 days of the receipt of Engineer's letter informing acceptance of the Contractor's tender/offer by the Trustees or within such preliminary time as mentioned by the Contractor in the Form of Tender or the time accepted by the Trustees. The Contractor shall then proceed with the work with due expedition and without delay, except as may be expressly sanctioned or ordered by the Engineer or his Representatives, time being deemed the essence of the contract on the part of the contractor.

Preliminary time to commence work and maintenance of steady rate of progress

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- 5.2 संविदाकार कार्यस्थल पर या उसके नजदीक एक उपयुक्त कार्यालय मुहैया कराएगा और उसे अनुरक्षित करेगा जहाँ इंजीनियर के प्रतिनिधि संविदाकार के उपयोग के लिए पत्र एवं अनुदेश भेज सकते हैं।

The Contractor shall provide and maintain a suitable office at or near the site to which the Engineer's Representative may send communications and instructions for use of the Contractor.

कार्यस्थल पर संविदाकार का कार्यालय Contractor's site office

- 5.3 जबतक संविदा में अन्यथा उल्लेख न किया गया हो या इंजीनियर से पूर्व अनुमति न ली गई हो तबतक संविदाकार ज्वार संबंधी कार्य के कारण या कार्य की सुरक्षा के लिए आवश्यक होने के सिवाय इंजीनियर के प्रतिनिधि द्वारा पालन किए जानेवाले कार्य-समय और न्यासी मंडल की व्यवस्था में पालन किए जानेवाले रविवार एवं छुट्टियों के दिन कार्य निष्पादित नहीं करेगा। यदि कार्य की प्रगति कार्यक्रम से पीछे रह जाए या संविदाकार के किसी कार्य या उपेक्षा के कारण कार्य खतरे में पड़ जाए तो इंजीनियर या उसके प्रतिनिधि के आदेश पर संविदाकार अपने खर्च पर दिन-रात एवं रविवार और सार्वजनिक छुट्टियों के दिन कार्य करेगा। ऐसा आदेश पारित करने में इंजीनियर या उसके प्रतिनिधि की चूक संविदाकार को उसकी किन्हीं बाध्यताओं से मुक्त नहीं करेगी। इस संबंध में इंजीनियर का विनिश्चय अंतिम, बाध्यकारी एवं निश्चायक होगा ।

Unless specified otherwise in the contract or prior permission of the Engineer has been taken, the contractor shall not

Contractor to observe Trustees'

execute the work beyond the working hours observed by the Engineer's Representative and on Sundays and Holidays observed in the Trustees' system, except in so far as it becomes essential on account of tidal work or for safety of the work. If the progress of the work lags behind schedule or the work has been endangered by any act or neglect on the part of the contractor, then the Engineer or his Representative shall order and the contractor at his own expense shall work by day and by night and on Sundays and Public Holidays. Any failure of the Engineer or his Representative to pass such an order shall not relieve the contractor from any of his obligations. The Engineer's decision in this regard shall be final binding and conclusive.

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- 5.4 जबतक संविदा में अन्यथा अनुबद्ध न हो तबतक कार्य के लिए अपेक्षित सभी सामग्री का प्रबंध एवं आपूर्ति संविदाकार द्वारा इंजीनियर या उसके प्रतिनिधि के अनुमोदन से तथा इंजीनियर या उसके प्रतिनिधि द्वारा बाद में की जा सकनेवाली जांच के अध्यक्षीन की जाएगी। इस प्रकार की किन्हीं सामग्री को स्वीकार करने में इंजीनियर अपने एकमात्र विवेकाधिकार का प्रयोग करेगा ।
- इंजीनियर या उसके प्रतिनिधि की अपेक्षानुसार संविदाकार द्वारा सभी सामग्री की आपूर्ति किया जाना
- Unless stipulated otherwise in the contract all materials required for the work shall be procured and supplied by the contractor with the approval of the Engineer or his Representative and subject to subsequent testing as may be required by the Engineer or his Representative. The Engineer shall exercise his sole discretion to accept any such materials.
- Contractor to supply all materials as per requirement of the Engineer or his representative
- 5.5 जबतक संविदा में अन्यथा अनुबद्ध न हो तबतक सभी सामग्री, शिल्प तथा माप लेने की पद्धति भारतीय मानक ब्यूरो की सुसंगत संहिता (नवीनतम संशोधन) और इंजीनियर या उसके प्रतिनिधि के लिखित अनुदेशों के अनुसार होंगी । यदि संविदा में कोई निर्दिष्ट संदर्भ उपलब्ध न हो तो सामग्री एवं शिल्प इंजीनियर की तुष्टि के अनुरूप अपने वर्ग में सर्वश्रेष्ठ होंगे।
- सामग्री और शिल्प
- Unless stipulated otherwise in the contract all materials, Materials &

workmanship and method of measurement shall be in accordance with the relevant Codes (Latest Revision) of the Bureau of Indian Standards and the written instructions of the Engineer or his Representative. Where no specific reference is available in the contract, the material and workmanship shall be of the best of their respective kinds to the satisfaction of the Engineer.

- 5.6 जब भी अपेक्षित हो, संविदाकार की लागत पर नमूना तैयार किया जाएगा तथा इंजीनियर या उसके प्रतिनिधि के समक्ष अनुमोदन हेतु पेश किया जाएगा ।
Samples shall be prepared and submitted for approval of the Engineer or his representative, whenever required to do so, all at the Contractor's cost.

संविदाकार द्वारा अनुमोदन हेतु नमूना प्रस्तुत किया जाना
Contractor to submit samples for approval

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- 5.7 जबतक संविदा में अन्यथा अनुबद्ध न हो तबतक कार्य में परिनियोजित किन्हीं सामग्री या शिल्प की बाबत इंजीनियर या उसके प्रतिनिधि द्वारा अपेक्षित किसी जांच के खर्च का वहन संविदाकार द्वारा किया जाएगा ।
Unless stipulated otherwise in the contract, the cost of any test required by the Engineer or his representative in respect of materials and workmanship deployed on the work, shall be borne by the Contractor.

संविदाकार द्वारा अपने खर्च पर सभी जांच की व्यवस्था किया जाना।
Contractor to arrange all testing at his own cost.

- 5.8 संविदा के अनुसार न्यासी मंडल द्वारा संविदाकार को किन्हीं सामग्री की आपूर्ति के संबंध में निम्नलिखित शर्तें लागू होंगी-
Regarding the supply of any materials by the Trustees to the contractor in accordance with the contract, the following conditions shall apply :

(क) संविदाकार अपने खर्च पर न्यासी मंडल के भंडार से सामग्री ढोने, उनकी पहरेदारी करने, उनका भंडारण करने, उन्हें अपनी सुरक्षित अभिरक्षा में रखने, इंजीनियर या उसके प्रतिनिधि द्वारा यथापेक्षित रूप में उनके उपभोग का विवरण प्रस्तुत करने, इंजीनियर या उसके प्रतिनिधि के निदेशानुसार अतिरिक्त और खाली कंटेनर को न्यासी मंडल के भंडार को वापस करने की व्यवस्था करेगा ।

संविदाकार द्वारा न्यासी मंडल की सामग्री का हिसाब रखा जाना तथा उनकी देखरेख किया जाना

(a) The Contractor shall, at his own expense, arrange for transporting the materials from the Trustees' Stores, watching, storing and keeping them in his safe custody, furnishing of

The Contractor shall account for and look

statement of consumption thereof in the manner required by the Engineer or his representative, return of surplus and empty container to the Trustees' Stores as per the direction of the Engineer or his Representative.

(ख) न्यासी मंडल की सामग्री का अभिरक्षक होने के नाते संविदाकार को जारी की गई किन्हीं सामग्री के लिए वह एकमात्र उत्तरदायी बना रहेगा तथा "अपवादित जोखिम" से भिन्न किसी कारण से उन्हें होनेवाली किसी हानि या क्षति के लिए संविदाकार, इंजीनियर द्वारा विनिश्चय किए गए रूप में न्यासी मंडल की पूर्ति करेगा और किसी भी स्तर पर लिखित रूप में उसकी अनुमति के बिना ऐसी किसी सामग्री को कार्यस्थल से नहीं हटाएगा या हटवाएगा ।

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(b) Being the custodian of the Trustees' materials, the contractor shall remain solely responsible for any such materials issued to him and for any loss or damage thereof for any reason other than "Excepted Risks", the Contractor shall compensate the Trustees' in the manner decided by the Engineer and shall at no stage remove or cause to be removed any such material from the site without his permission in writing.

Contractor to compensate for loss and damage to Trustees' materials

(ग) साधारणतः न्यासी मंडल की सामग्री की आपूर्ति चरणों में और कार्य की प्रगति-दर के अनुसार परंतु इंजीनियर द्वारा यथानिर्णीत कार्य के समापन-समय के उपयुक्त विस्तार की स्वीकृति के सिवाय की जाएगी। संविदाकार, न्यासी मंडल की सामग्री उसे आपूरित किए जाने में होनेवाली किसी देरी के लिए किसी अन्य प्रतिकर, आर्थिक या अन्यथा, का हकदार नहीं होगा । तथापि, संविदाकार समय-समय पर इंजीनियर को ऐसी सामग्री की अपनी अपेक्षा के बारे में संसूचित करेगा।

न्यासी मंडल की सामग्री की आपूर्ति में देरी होने पर संविदाकार का केवल कार्य के समापन-समय के विस्तार का हकदार होना

(c) The Trustees' materials will generally be supplied in stages and in accordance with the rate of progress of work but except for grant of suitable extension of completion time of work as decided by the Engineer. The Contractor shall not be entitled to any other compensation, monetary or otherwise, for any delay in the supply of Trustees' materials to him. The

Delay in supply of Trustees' materials will only entitle the Contractor for extension of

Contractor shall, however, communicate his requirement of such materials to the Engineer from time to time. completion time of work

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(घ) जबतक संविदा में अन्यथा अनुबद्ध न किया गया हो तबतक संविदाकार को जारी की गई न्यासी मंडल की सामग्री के मूल्य की वसूली संविदाकार के बिलों और/या उसकी किसी अन्य देयराशियों से आनुक्रमिक रूप से कार्य में उसके उपभोग के अनुसार और/या इंजीनियर या उसके प्रतिनिधि द्वारा निर्णीत रूप में तथा संविदा में अनुबद्ध दर/दरों पर की जाएगी। संविदाकार द्वारा केवल अपनी निविदा/प्रस्ताव तैयार करते समय इन दरों पर विचार किया जाएगा और यदि भविष्य में इंजीनियर के लिखित आदेश पर संविदाकार से ऐसी कोई सामग्री की खरीद करने एवं प्रदान करने की अपेक्षा की जाती है जिसकी समय पर आपूर्ति करने में वह विफल रहता है तो ये उसमें वृद्धि/परिवर्तन किए जाने का आधार होंगी। सामान्य परिस्थितियों में संविदाकार से न्यासी मंडल की सामग्री के मूल्य की वसूली

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(d) Unless stipulated otherwise in the contract, the value of the Trustees' materials issued to the contractor shall be recovered from the contractor's bills and/or any of his other dues, progressively according to the consumption thereof on the work and/or in the manner decided by the Engineer or his representative and at the rate/s stipulated in the contract. These rates shall only be considered by the contractor in the preparation of his tender/offer and these will form the basis of escalation/variation, if in future the contractor is required to procure and provide any such material on the written order of the Engineer consequent on the Trustees' failure to effect timely supply thereof. Recovery from Contractor for Trustees' materials under normal circumstances

(ङ) यदि इंजीनियर यह तय करता है कि संविदाकार की उपेक्षा के कारण संविदाकार को जारी की गई न्यासी मंडल की कोई सामग्री (i) खो या क्षतिग्रस्त हो जाती है, (ii) आवश्यकता से अधिक उपभोग की जाती है तथा (iii) संविदाकार द्वारा सामान्य बर्बादी से अधिक बर्बाद की जाती है तो उसके मूल्य की वसूली, निम्नलिखित में से जो भी अधिक हो उसपर 19^{1/4} जोड़कर, संविदाकार के बिल से या उसको देय अन्य राशियों से की जाएगी - अन्य परिस्थितियों में संविदाकार से न्यासी मंडल की सामग्री के मूल्य की वसूली

(1) न्यासी मंडल के भंडार को जारी सामग्री की दर एवं

(2) इंजीनियर द्वारा यथानिर्धारित जारी किए जाने की तारीख को सामग्री का बाजार मूल्य।

(e) If the Engineer decides that due to the contractor's negligence, any of the Trustees' materials issued to the contractor has been - (i) lost or damaged, (ii) consumed in excess of requirement and (iii) wasted by the contractor in excess of normal wastage, then the value thereof shall be recovered from the contractor's bills or from any of his other dues, after adding 19 ¼% extra over the higher one of the followings -

- (1) The issue rate of the materials at the Trustees' Stores and
- (2) The market price of the material on the date of issue as would be determined by the Engineer.

Recovery from Contractor for Trustees' materials under other circumstances.

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5.9 इंजीनियर या उसके प्रतिनिधि को किसी सामग्री या कार्य को किसी भी समय निरीक्षण करने और किसी भी समय निम्नलिखित आदेश देने की शक्ति होगी - (i) किसी ऐसी सामग्री को कार्य-स्थल से हटाने का, जो उसकी राय में संविदा या इंजीनियर या उसके प्रतिनिधि के अनुदेश के अनुसार नहीं है, (ii) समुचित और उपयुक्त सामग्री को प्रतिस्थापित करने का, या (iii) किसी कार्य के निवारण या समुचित निष्पादन का, जो सामग्री एवं कारीगरी की बाबत संविदा या इंजीनियर के अनुदेश के अनुसार नहीं है। संविदाकार ऐसे आदेश का अनुपालन अपने खर्च पर और आदेश में अनुबद्ध समय के भीतर करेगा। यदि संविदाकार इसका अनुपालन करने में चूक करता है तो इंजीनियर ऐसी किन्हीं सामग्री का निपटान करने तथा संविदाकार को 7 दिन की पूर्व नोटिस लिखित रूप में देने के बाद संविदाकार की जोखिम एवं खर्च पर किसी बाहरी एजेंसी को नियुक्त कर न्यासी मंडल की सुविधानुसार किसी कार्य को फिर से कराने के लिए स्वतंत्र होगा।

इंजीनियर या उसके प्रतिनिधि को अस्वीकार्य सामग्री/कार्य को संविदाकार द्वारा प्रतिस्थापित किया जाना

The Engineer or his Representative shall have the power to inspect any material and work at any time and to order at any time - (i) for removal from the site of any material which in his opinion is not in accordance with the contract or the instruction of the engineer or his representative, (ii) for the substitution of the proper and suitable materials, or (iii) the removal and proper re-execution of any work which in respect of material and workmanship is not in accordance with the

Contractor to replace materials / work not acceptable to the Engineer or his Representative

contract or the instructions of the Engineer. The Contractor shall comply with such order at his own expense and within the time specified in the order. If the contractor fails to comply, the Engineer shall be at liberty to dispose any such materials and re-do any work in the manner convenient to the Trustees by engaging any outside agency at the risk and expense of the contractor and after giving him a written prior notice of 7 days.

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- 5.10 इंजीनियर या उसके प्रतिनिधि के अनुमोदन के बिना संविदाकार द्वारा किसी कार्य को आवृत्त एवं दृष्टि से ओझल नहीं किया जाएगा और उसके द्वारा अपेक्षित होने पर संविदाकार कार्य के किन्हीं अंश को अनावृत्त करेगा तथा समय-समय पर इंजीनियर या उसके प्रतिनिधि द्वारा दिए जा सकनेवाले निदेश के अनुसार उसमें या उसके जरिए द्वारक बनाएगा और कार्य के इस प्रकार प्रभावित अंश को इंजीनियर की तुष्टि के अनुरूप संविदाकार के खर्च पर प्रतिस्थापित या प्रतिपूर्ति करेगा । कार्य के किसी भाग को आच्छादित करने के पूर्व संविदाकार द्वारा इंजीनियर या उसके प्रतिनिधि का अनुमोदन प्राप्त किया जाना
- यदि प्रारंभिक आच्छादन इंजीनियर या उसके प्रतिनिधि के पूर्व लिखित आदेश के अनुसार किया गया हो तो इंजीनियर द्वारा यथानिर्धारित ऐसे खर्च की प्रतिपूर्ति न्यासी मंडल द्वारा की जाएगी। Contractor to seek approval of Engineer or his Representative before covering up any portion of work
- No work shall be covered up and put out of view by the contractor without approval of the Engineer or his Representative and whenever required by him, the contractor shall uncover any part or parts of the work or make openings in or through the same as may be directed by the Engineer or his representative from time to time and shall reinstate or make good those part of works thus affected to the satisfaction of the Engineer, all at the cost of the contractor.
- The Trustees shall reimburse such cost as determined by the

Engineer, if the initial covering up was with prior written order of the Engineer or his Representative.

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5.11

इंजीनियर या उसके प्रतिनिधि के लिखित आदेश पर संविदाकार कार्य को तबतक रोककर या लंबित रखेगा जबतक उसे कार्य-निष्पादन दुबारा आरंभ करने का लिखित आदेश प्राप्त न हो जाए। इस प्रकार के स्थगन के दौरान संविदाकार कार्य को इंजीनियर या उसके प्रतिनिधि की तुष्टि के अनुरूप सुरक्षित और संरक्षित रखेगा। ऐसे आदेश को प्रभावी करने पर हुए अतिरिक्त व्यय पर न्यासी मंडल द्वारा विचार किया जाएगा जबतक ऐसा आस्थगन -

(क) संविदा में अन्यथा उपबंधित न हो, या

(ख) संविदाकार की ओर से कुछ कमियों के कारण आवश्यक न हो, या

(ग) कार्य-स्थल पर जलवायु-संबंधी स्थिति के कारण आवश्यक न हो, या

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(घ) कार्य के समुचित निष्पादन या कार्य या उसके किसी अंश की सुरक्षा हेतु आवश्यक न हो।

इंजीनियर ऐसे अतिरिक्त भुगतान का निपटान और निर्धारण और/या संविदाकार को अनुज्ञात समापन-अवधि का ऐसा विस्तार करेगा जो इंजीनियर की राय में उचित एवं युक्तियुक्त हो तथा वह अंतिम और संविदाकार पर बाध्यकारी होगा।

On a written order of the Engineer or his Representative, the contractor shall delay or suspend the progress of the work till such time the written order to resume the execution is received by him. During such suspension the contractor shall protect and secure the work to the satisfaction of the Engineer or his Representative. All extra expenses in giving effect to such order shall be considered by the Trustees,

इंजीनियर या उसके प्रतिनिधि के आदेश पर संविदाकार द्वारा कार्य को स्थगित रखा जाना

Contractor to suspend work on Order from Engineer or his Representative

unless such suspension is -

- (a) otherwise provided for in the contract, or
- (b) necessary by reason of some default on the part of the contractor, or
- (c) necessary by reason of climatic conditions on the site, or
- (d) necessary for proper execution of the works or for the safety of the works or any part thereof.

The Engineer shall settle and determine such extra payment and/or Extension of completion time to be allowed to the contractor, as shall, in the opinion of the Engineer be fair and reasonable, and the same shall be final and binding on the Contractor.

- 5.11.1 यदि कार्य आरंभ होने के पहले या बाद में न्यासी मंडल संविदागत पूरे कार्य की अपेक्षा नहीं करते हैं तो इंजीनियर लिखित रूप में उसकी सूचना संविदाकार को देगा और संविदाकार उसके अनुपालन में आगे कार्य को रोक देगा। संविदाकार अप्राप्त लाभ या कार्य के ऐसे अपरिपक्व स्थगन या मूल विनिर्देश, आरेखन, डिजाइन एवं अनुदेश में इंजीनियर द्वारा किए गए किसी परिवर्तन के कारण मूल आशयित कार्य में कटौती मद्धे किसी क्षतिपूर्ति लिए कोई दावा करने का हकदार नहीं होगा।

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If at any time before or after commencement of the work the Trustees do not require the whole of the work tendered for the Engineer shall notify the same to the contractor in writing and the contractor shall stop further works in compliance of the same. The Contractor shall not be entitled to any claim for compensation for underived profit or for such premature stoppage of work or on account of curtailment of the originally intended work by reason of alteration made by the Engineer in the original specifications, drawings, designs and instructions.

- 5.12 जब संपूर्ण कार्य इंजीनियर की तुष्टि के अनुरूप पूरा हो जाता है और कार्य पूर्ण करने संविदा में विहित किसी अंतिम जांच में पास हो जाता है तब संविदाकार संबंधी प्रमाण-पत्र- अपना आवेदन इंजीनियर को दिए जाने के 21 दिनों के भीतर उससे इसके जी.सी.1

साथ संलग्न फार्म जी.सी.1 में कार्य पूर्ण होने का प्रमाण-पत्र प्राप्त करने का हकदार होगा। यदि कुल कार्य का कोई अंश इंजीनियर की तुष्टि के अनुरूप पूरा हो जाता है और न्यासी मंडल द्वारा उसे अधिगृहीत कर लिया जाता है और/या उसका उपयोग किया जाता है तो संविदाकार आवेदन पर फार्म जी.सी.1 में ऐसा आंशिक पूर्णता प्रमाणपत्र प्राप्त करने का हकदार होगा जिसमें इसके द्वारा कवर किए गए कार्य का अंश विनिर्दिष्ट हो जिससे कि जहां तक कार्य के पूर्ण अंश का संबंध है, संविदा की अनुरक्षण अवधि के दौरान, यदि कोई हो, संविदाकार की देयता ऐसे प्रमाणपत्र में उल्लिखित तारीख से आरंभ होगी।

When the whole of the work has been completed to the satisfaction of the Engineer and has passed any final test prescribed in the contract, the contractor shall, within 21 days of submission of his application to the Engineer, be entitled to receive from him a certificate for completion of work in Form G.C.1, annexed hereto. If any part of the total work having been completed to the satisfaction of the Engineer, be taken over and/or used by the Trustees, the Contractor shall on application be entitled to partial completion certificate in the Form G.C.1 indicating the portion of the work covered by it, so that the Contractor's liability during maintenance period of the contract, if any, shall commence from the date mentioned in such certificate so far as the completed portion of the work is concerned.

Completion Certificate- G.C.1.

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6.0 भुगतान की शर्तें /TERMS OF PAYMENT :

6.1 कार्य के अंतिम या तुष्टिप्रद समापन और इंजीनियर द्वारा प्ररूप जी.सी.-2 में प्रमाण-पत्र जारी किए जाने तक कार्य की बाबत कोई भी राशि संविदाकार द्वारा अर्जित या उसे देय नहीं समझी जाएगी।

प्ररूप जी.सी.-2 में प्रमाण-पत्र जारी किए जाने तक सभी अंतरिम भुगतान अग्रिम हैं

प्ररूप जी.सी.-2 में प्रमाणपत्र जारी किए जाने के पूर्व खाते में किए गए भुगतान को, यदि कोई हो, केवल अग्रिम माना जाएगा जो संविदाकार की अपूर्ण संविदागत स्थिति के, यदि कोई हो, संदर्भ में इंजीनियर द्वारा विनिश्चित किए जाने पर पूर्णतः या अंशतः वसूलीयोग्य होगी।

All interim

No sum shall be considered as earned by or due to the Contractor in respect of the work till final and satisfactory completion thereof and until a certificate of final completion in Form G.C.2 has been given by the Engineer.

payments are
advances till
issue of
Certificate in
Form G.C.2

On account payments, if any, made prior to issue of the certificate in Form G.C.2, shall all be treated as mere advance, which shall stand recoverable in full or in part, if the Engineer so decides in the context of Contractor's unfulfilled contract condition, if any.

- 6.2 न्यासी मंडल की माप पुस्तिका में यथा अभिलिखित वास्तविक कार्य के माप के आधार पर और, यथास्थिति, स्वीकृत, निविदाकृत या सहमत दरों पर, संविदा में अन्यथा उपबंधित के सिवाय और संविदाकार की ओर से कार्यक्षेत्र में किसी परिवर्तन या लोप के लिए इंजीनियर द्वारा विनिश्चित किसी अन्य दर पर केवल संविदाकार को सभी भुगतान किए जाएंगे।

सहमत दरों पर
माप के आधार पर
भुगतान

All payments shall be made to the Contractor only on the basis of measurements of actual work done, as recorded in the Trustees' measurement books and at accepted tendered or at agreed rates, as the case may be, except as otherwise provided in the contract and when the Engineer decides any other rate for change in the scope of work or omission, if any, on the part of the Contractor.

Payment on
the basis of
measurements
at agreed
rates.

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- 6.3 रु. 50,000/- से अधिक के संस्वीकृत निविदा मूल्य के कार्य या ऐसे कार्य के लिए, जिसकी प्रारंभिक अनुबद्ध समापन अवधि 4 महीने या उससे अधिक हो, इंजीनियर या उसके प्रतिनिधि के विवेकाधिकार पर उसके द्वारा उपयुक्त एवं न्यायोचित समझे जानेवाले अंतराल पर लेखागत अदायगी की जा सकती है। परंतु यह हमेशा कि संविदा मूल्य के संदर्भ में पर्याप्त मूल्य के कार्य के निष्पादन के अध्यक्षीन ऐसी लेखागत अदायगी के अंतराल के बारे में इंजीनियर या उसके प्रतिनिधि द्वारा निर्णय किया जाएगा जो साधारणतः लेखागत बिल और/या अग्रिम अदायगी के लिए दो भुगतानों के बीच 1 महीने से कम नहीं होगा।

लेखागत अदायगी
की सीमा

For work of sanctioned tender value more than Rs.50,000/- or having an initially stipulated completion period of 4 months or more, on account payments may be made sat

Limitation for
on account
payment

the discretion of the Engineer or his Representative at intervals deemed suitable and justified by him. Provided always that subject to execution of work of substantial value in the context of the contract price, the interval of such on account payments shall be decided by the Engineer or his Representative, which shall ordinarily not be less than 1 month in between two payments for on account bill and/or advance.

- 6.4 निष्पादित कार्य की माप इंजीनियर के प्रतिनिधि द्वारा उत्तरोत्तर ली जाएगी तथा उसके और/या इंजीनियर द्वारा उपयुक्त एवं उचित समझे जानेवाले अंतराल पर न्यासी मंडल की माप पुस्तिका में दर्ज की जाएगी। इस प्रकार की माप के समय संविदाकार या सम्यक् रूप से अधिकृत उसका प्रतिनिधि या एजेंट उपस्थित रहेगा और इंजीनियर के प्रतिनिधि द्वारा यथापेक्षित हर प्रकार से उसकी मदद करेगा। ली गई माप को माप-पुस्तिका में दर्ज किए जाने के बाद संविदाकार या उसका एजेंट ऐसी माप की समाप्ति पर माप-पुस्तिका में संविदाकार की रबड़ की मोहर पर ऊपर अभिलिखित एवं ऐसे हस्ताक्षर के पूर्व की गई ऐसी सभी माप की स्वीकृति के प्रमाणस्वरूप हस्ताक्षर करेगा। यदि संविदाकार या उसका एजेंट, इंजीनियर के प्रतिनिधि से प्राप्त लिखित सूचना के 3 दिनों के बाद भी सहभागिता करने में चूक करता है तो इंजीनियर के प्रतिनिधि द्वारा माप को एकपक्षीय रूप में लिया जाएगा और वे संविदाकार को मान्य होंगे।

माप को
अभिलिखित करना

Measurement for works done shall be progressively taken by the Engineer's Representative and entered in the Trustees' Measurement Book, at intervals deemed suitable and proper by him and/or the Engineer. The Contractor or his duly accredited Representative or Agent shall remain present at the time of such measurement and assist the engineer's Representative in every manner required by him. After the measurements taken have been entered in the Measurement Book, the Contractor or his Agent shall sign the Measurement Book at the wend of such Measurements over the Contractor's Rubber Stamp as a token of acceptance of all such measurements, recorded

Recording of
measurements

above and prior to such signature. If the Contractor or his Agent fails to participate even after 3 days written notice from the Engineer's Representative, the measurement shall be taken ex-parte by the Engineer's Representative and those shall be accepted by the Contractor.

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- 6.5 कार्य की मात्रा और माप-पुस्तिका में अभिकलित उसके मूल्य के आधार पर संविदाकार बिल को इंजीनियर द्वारा अनुमोदित प्रोफार्मा में टंकित करेगा और उसकी चार प्रतियों पर स्वयं या अपने अधिकृत एजेंट की मोहर लगाकर एवं उसपर सम्यक् रूप से हस्ताक्षर करके उन्हें इंजीनियर के प्रतिनिधि के समक्ष प्रस्तुत करेगा। इंजीनियर या उसका प्रतिनिधि अपने पूर्ण विवेकाधिकार से न्यासी मंडल के स्तर पर बिल की जांच एवं लेखा-परीक्षा किए जाने के समय बिल के प्रति समायोजन के अध्यक्षीन उक्त बिल की "शुद्ध देय" राशि के 75% से अनधिक राशि की सीमा तक बिल के प्रति अग्रिम भुगतान की अनुमति देगा। मापपुस्तिका संविदाकार को सौंपी नहीं जाएगी; परंतु बिल टंकित करने के लिए वह मात्रा, राशि एवं वसूली का सार प्राप्त करेगा।
- संविदाकार द्वारा अपना बिल तैयार एवं प्रस्तुत किया जाना

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Based on the quantum of work and the value thereof computed in the Measurement Book, the Contractor shall type out his bill in the proforma approved by the Engineer and submit the same to the Engineer's Representative in quadruplicate, duly signed by him or his accredited Agent over his Rubber Stamp. The Engineer or his Representative may in his absolute discretion, allow advance payment against such bill to the extent of an amount not exceeding 75% of the "net payable" sum of the said bill, subject to adjustment thereof against the bill at the time of checking and auditing the bill at the Trustees' end. The measurement

Contractor to prepare and submit his bills

Book will not be handed over to the Contractor; but he will obtain the abstracts of quantities, amounts and recoveries to type out the bill.

- 6.6 इंजीनियर या उसके प्रतिनिधि के विवेकाधिकार पर और केवल खराब न होनेवाली स्वीकृत प्रस्ताव/जहाँ निविदा में अंकित मूल्य की प्राक्कलित राशि सामग्रियों के प्रति रु.2,00,000/- या उससे अधिक हो, की बाबत संविदाकार द्वारा अग्रिम भुगतान खरीदी गई एवं कार्य-स्थल पर लाई गई किसी सामग्री के मूल्य के 75% की सीमा तक अग्रिम भुगतान किया जा सकता है। परंतु यह हमेशा कि -

At the discretion of the Engineer or his Representative and only in respect of accepted offers/where estimated amount put to tender would be Rs.2,00,000/- or more, advance payment may be made to the extent of 75% of the value of any material purchased and brought to the site by the Contractor. Provided always that -

Advance payment against Non-perishable materials

- (i) उक्त सामग्री इंजीनियर या उसके प्रतिनिधि की राय में खराब न होनेवाली प्रकृति की हो,

the materials shall, in the opinion of the Engineer or his Representative be of imperishable nature,

- (ii) ऐसी सामग्री के मूल्य का निर्धारण इंजीनियर या उसके प्रतिनिधि द्वारा अपने विवेकाधिकार से किया जाएगा,

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the value of such materials shall be assessed by the engineer or his Representative at their own discretion,

- (iii) संविदाकार के साथ एक औपचारिक करार किया जाता है जिसके अधीन संविदाकार की सामग्री पर न्यासी मंडल का धारणाधिकार सुरक्षित रहता है,

a formal agreement has been drawn up with the contractor, under which the Trustees secure a lien on the contractor's materials,

- (iv) संविदाकार द्वारा कार्यनिष्पादन के स्थगन के कारण या अन्यथा सामग्री को होनेवाली हानि, कमी और दुरुपयोग से सामग्री

की रक्षा संविदाकार द्वारा की जाती है।

the materials are safe-guarded by the contractor against losses, shortage and misuse due to the contractor postponing the execution of the work or otherwise,

(v) गोदी में न्यासी मंडल के सुरक्षित क्षेत्र के भीतर ऐसी सामग्री के भंडारण की दशा में संविदाकार, न्यासी मंडल को स्वीकार्य प्रोफार्मा में और ढंग से एक क्षतिपूर्ति-पत्र प्रस्तुत करेगा जिसके द्वारा संविदाकार किसी भी कारण से ऐसी सामग्री को होनेवाली हानि/क्षति के कारण होनेवाली सभी वित्तीय हानि/क्षति के प्रति न्यासी मंडल की क्षतिपूर्ति करेगा।

in the event of storage of such materials within the Trustees' protected areas in the Docks, the contractor shall submit an Indemnity Bond in the proforma and manner acceptable to Trustees' whereby the contractor shall indemnify the Trustees against all financial loss/damage, on account of loss/damage to such materials for whatever reasons,

(vi) न्यासी मंडल के सुरक्षित क्षेत्र के बाहर ऐसी सामग्री के भंडारण की दशा में संविदाकार, न्यासी मंडल को स्वीकार्य प्रोफार्मा में और ढंग से न्यासी मंडल के पक्ष में अग्रिम की राशि के समान राशि की एक अप्रतिसंहरणीय बैंक गारंटी इंजीनियर के समक्ष प्रस्तुत करेगा। न्यासी मंडल को स्वीकार्य, यथास्थिति, किसी राष्ट्रीयकृत बैंक या अनुसूचित वाणिज्य बैंक की कलकत्ता/हल्दिया शाखा द्वारा गारंटी जारी की जाएगी और वह कार्य में ऐसी सामग्री के उपभोग की अनुमानित अवधि तक वैध रहेगी। जबतक न्यासी मंडल की ओर से इंजीनियर की पूर्व लिखित अनुमति से बैंक गारंटी की वैधता को विस्तारित नहीं करता है तबतक बैंक गारंटी द्वारा जारीकर्ता बैंक,

गारंटी की वैधता की समाप्ति की तारीख को न्यासी मंडल को गारंटीकृत राशि के स्वतः भुगतान का वचन देगा।

in the event of storage of such materials outside the Trustees' protected areas the Contractor shall submit to the Engineer an irrevocable Bank Guarantee favouring the Trustees and for the same sum as is being advance, in the proforma and manner acceptable to the Trustees. The Guarantee shall be of a Calcutta/Haldia Branch of any Nationalised Bank or a Schedule Commercial Bank, as the case may be, acceptable to the Trustees and shall remain valid till the anticipated period of consumption of such materials in the work. The Bank Guarantee must bear an undertaking by the issuing Bank guaranteeing automatic payment of the guaranteed sum to the Trustees by the Bank on the date of expiry of the validity of the Guarantee, unless with the prior written approval of the Engineer on behalf of the Trustees, the Bank has extended the validity of the Guarantee.

(vii) सामग्री के उपभोग पर उपभोग की मात्रा के आधार पर संविदाकार के बिलों या अन्य देयराशियों से अग्रिम राशि उत्तरोत्तर वसूलीयोग्य होगी। अग्रिम की पूरी वसूली के बाद न्यासी मंडल की ओर से इंजीनियर द्वारा सम्यक् रूप से हस्ताक्षरित उप-खंड (v) एवं (vi) में यथावर्णित क्षतिपूर्ति बंधपत्र / बैंक गारंटी संविदाकार को वापस कर दी जाएगी।

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The amount of advance shall be recoverable from the contractor's bills or any other dues, progressively with the consumption of the materials on the basis of quantity consumed. Consequent on full recovery of the advance the Indemnity Bond/Bank Guarantee, vide Sub-clause (v) & (vi) above, shall be returned to the Contractor duly discharged by the Engineer on behalf of the Trustees.

- 6.7 यदि इंजीनियर या उसके प्रतिनिधि द्वारा भुगतान के लिए दुबारा प्रमाणित किया जाता है या न्यासी मंडल द्वारा संविदाकार के किसी खाते में दुबारा भुगतान किया जाता है तो इंजीनियर या उसके प्रतिनिधि का कोई प्रमाणपत्र संविदाकार से पुनर्भुगतान प्राप्त करने से न्यासी मंडल को नहीं रोकेगा या संविदाकार को संरक्षित नहीं करेगा।
- गलत और
अत्यधिक
भुगतान की
वसूली

No certificate of the Engineer or his representative shall protect the Contractor against or prevent the Trustees from obtaining repayment from the Contractor, in case the Engineer or his representative should over certify for payment or the Trustees should over-pay the Contractor on any account. Recovery for wrong and over payment

- 6.8 विवाद के कारण या अन्यथा या अंतरिम या अंतिम भुगतान में न्यासी मंडल की ओर से हुई किसी देरी के लिए या अन्यथा न्यासी मंडल से संविदाकार को देय हो सकनेवाले किसी धन या शेष राशि या बैंक गारंटी की बाबत किसी स्तर पर ब्याज के लिए कोई दावा संविदाकार को अनुज्ञेय या देय नहीं होगा । संविदाकार को ब्याज अनुज्ञेय नहीं

No claim for interest shall be admissible or payable to the Contractor at any stage and in respect of any money or balance or Bank Guarantee, which may be due to the Contractor from the Trustees, owing to dispute or otherwise or for any delay on the part of the Trustees in making interim or final payment or otherwise. Interest not admissible to Contractor

7.0 फेरफार और इसका मूल्यांकन

VARIATION AND ITS VALUATION :

- 7.1 निविदा के परिमाण बिल में उपवर्णित परिमाण को कार्य का अनुमानित परिमाण माना जाएगा और उसे संविदाकार द्वारा संविदा के अधीन उसकी बाध्यता की पूर्ति में उसके द्वारा निष्पादित किए जानेवाले कार्यों का वास्तविक एवं सही परिमाण कभी नहीं समझा जाएगा । निविदा के परिमाण बिल में

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The Quantities set out in the Bill of Quantities of the tender shall be treated as estimated quantities of the work and shall never be deemed as actual or correct quantities of the works to be executed by the contractor in fulfilment of his obligation under the contract. Quantities in Bill of Quantities of Tender

- 7.2 इंजीनियर को कार्य या उसके किसी अंश के परिमाण, गुणवत्ता या रूप में ऐसा फेरफार करने के लिए संविदाकार को लिखित रूप में आदेश देने की शक्ति होगी जो उसकी राय में आवश्यक हो तथा संविदाकार ऐसे आदेश की प्राप्ति पर निम्नानुसार कार्य करेगा : कार्य में फेरफार करने की इंजीनियर की शक्ति

The Engineer shall have the power to order the Contractor in writing to make any variation of the Engineer's power to vary

quantity, quality or form of the works or any part thereof the works that may, in his opinion, be necessary and the Contractor upon receipt of such an order shall act as follows :

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7.2 (क) संविदा में शामिल किसी कार्य के परिमाण को बढ़ा या घटा सकता है।

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

(ख) संविदा में शामिल किसी कार्य को छोड़ सकता है

(b) Omit any work included in the contract.

(ग) संविदा में शामिल किसी कार्य की प्रकृति, गुणवत्ता या प्रकार में परिवर्तन कर सकता है।

(c) Change the Character or quality or kind of any work included in the contract.

(घ) कार्य के किसी अंश के स्तर, पद्धति, स्थिति एवं आयाम में परिवर्तन कर सकता है।

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

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(ङ) कार्य को पूर्ण करने के लिए आवश्यक अधिक एवं किसी प्रकार का अतिरिक्त कार्य निष्पादित कर सकता है ।

(e) Execute extra and additional work of any kind necessary for completion of the works

7.3 ऐसा फेरफार किसी भी प्रकार से संविदा को निष्फल या अवैध नहीं करेगा या उसे संविदा का प्रतिसंहरण नहीं माना जाएगा परंतु इंजीनियर द्वारा किया गया फेरफार संविदा के एकमात्र विनिश्चय के अनुसार मूल्यांकित ऐसे सभी फेरफार पर फेरफार संविदा को निष्फल नहीं करता है

No such variation shall in any way vitiate or invalidate the contract or be treated as revocation of the contract, but the

Variation by engineer do not vitiate the

value (if any) of all such variations evaluated in accordance with the Engineer's sole decision shall be taken into account and the contract price shall be varied accordingly.

- 7.4 परंतु यह हमेशा कि यदि ऐसी बढ़ोत्तरी या कमी इस खंड के अधीन दिए गए किसी फेरफार आदेश का परिणाम नहीं बल्कि बिल के परिमाण में यथाकथित परिमाण से अधिक या कम होने का परिणाम है तो कार्य के परिमाण में 15% तक की बढ़ोत्तरी या कमी के लिए इंजीनियर का लिखित आदेश अपेक्षित नहीं होगा। परंतु यह भी कि इंजीनियर द्वारा दिए गए फेरफार के मौखिक आदेश का अनुपालन संविदाकार द्वारा किया जाएगा और इंजीनियर द्वारा बाद में ऐसे मौखिक आदेश की लिखित रूप में की गई पुष्टि को इस खंड के अर्थातर्गत लिखित रूप में दिया गया आदेश माना जाएगा।

जहाँ फेरफार के लिखित आदेश की जरूरत नहीं है

Provided always that written order of the Engineer shall not be required for increase or decrease in the quantity of any work upto 15% where such increase or decrease is not the result of any variation order given under this clause but is the result of the quantities exceeding or being less than those stated in the bill of quantities. Provided also that verbal order of variation from the Engineer shall be complied with by the Contractor and the Engineer's subsequent written confirmation of such verbal order shall be deemed to be an order in writing within the meaning of this clause.

Where written order for variation is not needed

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- 7.5 (क) संविदाकार तबतक अधिक या अतिरिक्त कार्य के लिए कोई दावा करने का हकदार नहीं होगा जबतक वे इंजीनियर के लिखित आदेश के अधीन न किए गए हों।

अधिक या अतिरिक्त, या छोड़े गए कार्य या प्रतिस्थापित कार्य के लिए भुगतान, इंजीनियर की शक्तियाँ

(a) The Contractor shall not be entitled to any claim of extra or additional work unless they have been carried out under the written orders of the Engineer.

(ख) इंजीनियर के आदेश से किए गए किसी अधिक कार्य या छोड़े गए कार्य की बाबत निविदा में उल्लिखित राशि में जोड़ी जानेवाली या कटौती की जानेवाली राशि का (यदि कोई हो) अवधारण एकमात्र इंजीनियर करेगा।

Payment for extra or additional, or omitted work or substituted work, Engineer's

(b) The Engineer shall solely determine the amount (if any) to be added to or deducted from the sum named in the tender in respect of any extra work done or work omitted by his

order.

powers

(ग) इंजीनियर के आदेश से किए गए सभी अधिक, अतिरिक्त या प्रतिस्थापित कार्य या छोड़ दिए गए कार्य का मूल्यांकन संविदा में उपवर्णित मूल्य के आधार पर, यदि इंजीनियर की राय में वह लागू हो, किया जाएगा। यदि संविदा में अधिक, अतिरिक्त या प्रतिस्थापित कार्य पर सीधे लागू कोई दर या मूल्य अंतर्विष्ट नहीं रहता है तो इंजीनियर स्वीकृत संविदागत प्रतिशत पर, यदि कोई हो, सम्यक् रूप से ध्यान देते हुए न्यासी मंडल द्वारा अंगीकृत दर-अनुसूची के (निविदा स्वीकार करने के समय प्रवृत्त अधिभार सहित), यदि कोई हो, आधार पर उपयुक्त दरों के बारे में निर्णय ले सकता है। अन्य मामलों में इंजीनियर अकेले अपने द्वारा उचित एवं युक्तियुक्त समझे गए रूप में उपयुक्त दर अवधारित करेगा तथा उसका विनिश्चय अंतिम, बाध्यकारी एवं निश्चयक होगा।

(c) All extra, additional or substituted work done or work omitted by order of the Engineer shall be valued on the basis of the rates and prices set out in the contract, if in the opinion of the Engineer, the same shall be applicable. If the contract does not contain any rates or prices directly applicable to the extra, additional or substituted work, then the Engineer may decide the suitable rates on the basis of Schedule of Rates (including surcharge in force at the time of acceptance of tender), if any, adopted by the Trustees with due regard to the accepted contractual percentage, if any thereon. In all other cases the Engineer shall solely determine suitable rates in the manner deemed by him as fair and reasonable, and his decision shall be final, binding and conclusive.

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(घ) यदि संपूर्ण संविदागत कार्य या उसके किसी अंश की प्रकृति या मात्रा के सापेक्ष किसी लोप या परिवर्धन की प्रकृति या मात्रा ऐसी हो जिससे इंजीनियर की राय में कार्य की किसी मद के लिए संविदा में अंतर्विष्ट मूल्य की दर या इस खंड के उप-खंड (ख) एवं (ग) के अधीन यथा मूल्यांकित दर ऐसे लोप या परिवर्धन के कारण अनुचित या अप्रयोज्य हो जाए तो इंजीनियर ऐसी दर या मूल्य नियत करेगा जैसा वह उचित समझे तथा इंजीनियर का विनिश्चय अंतिम, बाध्यकारी एवं निश्चयक होगा।

d) If the nature or amount of any omission or addition relative to the nature or amount of the whole of the

contract work or to any part thereof shall be such that, in the opinion of the Engineer, the rate of prices contained in the contract for any item of the works or the rate as evaluated under sub-clauses (b) and (c) of this clause, is by reason of such omission or addition rendered unreasonable or in-applicable, the Engineer shall fix such other rate or price as he deems proper and the Engineer's decision shall be final, binding and conclusive.

8.0 समापन समय में विलंब/उसका विस्तार/परिनिर्धारित नुकसानी / संविदा की समाप्ति
DELAY / EXTENSION OF COMPLETION TIME / LIQUIDATED DAMAGE / TERMINATION OF CONTRACT

- 8.1 यदि किसी प्रकार के अधिक या अतिरिक्त कार्य या संविदा के अनुसार समापन-समय का आपूरित की जानेवाली न्यासी मंडल की सामग्री की विलंबित उपलब्धता विस्तार या आपवादिक रूप से प्रतिकूल मौसमी स्थिति एवं प्राकृतिक घटना या हड़ताल, तालाबंदी, सिविल अशांति या संविदाकार के नियंत्रण से परे किसी प्रकार की अन्य विशेष परिस्थिति के कारण कार्य पूरा होने में विलंब होता है तो उक्त कारण के घटित होने के 7 दिनों के भीतर संविदाकार समापन समय के उपयुक्त विस्तार के लिए लिखित रूप में इंजीनियर के पास आवेदन देगा और तब इंजीनियर कथित कारणों पर उस रीति से विचार करेगा जैसा आवश्यक समझा जाए तथा या तो आवेदन को खारिज करेगा या अवधारित करेगा एवं संविदाकार पर

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“परिनिर्धारित नुकसानी” खंड (इसकी सं. 8.3) के अधिरोपण सहित या उसके बिना कार्य पूर्ण करने के लिए लिखित रूप में ऐसी विस्तार अवधि अनुज्ञात करेगा जैसा वह उचित समझे तथा उसका विनिश्चय अंतिम और संविदाकार पर बाध्यकारी होगा । यदि परिनिर्धारित नुकसानी अधिरोपित किए बिना इंजीनियर द्वारा समापन-समय का विस्तार मंजूर किया जाता है तो यथा उपर्युक्त जबतक कि इंजीनियर द्वारा संसूचित विनिश्चय में अन्यथा कथित न किया गया हो, विस्तारित समय के भीतर कार्य पूरा न होने की स्थिति में खंड सं. 8.3 में यथावर्णित परिनिर्धारित नुकसानी इसकी समाप्ति की तारीख से लागू होगी।

Should the quantum of extra or additional work of any kind or delayed availability of the Trustees' materials to be supplied as per contract or exceptionally adverse climatic conditions and natural phenomenon or strikes, lock-outs, civil commotion or other

Extension of completion time

special circumstances of any kind beyond the control of the Contractor, cause delay in completing the work, the contractor shall apply to the Engineer in writing for suitable extension of completion time within 7 days from the date of occurrence of the reason and the Engineer shall thereupon consider the stated reasons in the manner deemed necessary and shall either reject the application or determine and allow in writing the extension period as he would deem proper for completion of the work with or without the imposition of "Liquidated Damage" Clause (No.8.3 hereof) on the Contractor and his decision shall be final and binding on the Contractor. If an extension of completion time is granted by the Engineer without imposition of liquidated damage, from the Clause No.8.3 of the Liquidated damage shall apply from its date of expiry, if the work be not completed within the extended time, unless stated otherwise in the decision communicated by the Engineer, as aforesaid.

- 8.2 (क) यदि संविदाकार अनुबद्ध तारीख के भीतर या इंजीनियर द्वारा लिखित न्यासी मंडल रूप में यथासं सूचित उसके विस्तार तक कार्य को पूरा करने में चूक करता को देय है तो संविदाकार दंड के रूप में नहीं बल्कि क्षतिपूर्ति (परिनिर्धारित 'परिनिर्धारित नुकसानी' के रूप में न्यासी मंडल को कार्य अपूर्ण रहनेवाले प्रत्येक सप्ताह नुकसानी एवं या उसके भाग के लिए निविदा/प्रस्ताव संबंधी स्वीकृति पत्र में अन्य क्षतिपूर्ति यथाउल्लिखित कार्य के कुल मूल्य के ½%(आधे प्रतिशत) का भुगतान करेगा। परंतु यह हमेशा कि ऐसी क्षतिपूर्ति की राशि कार्य के उक्त मूल्य के 10% से अधिक नहीं होगी। परिनिर्धारित नुकसानी की राशि का अवधारण इंजीनियर द्वारा किया जाएगा जो अंतिम और बाध्यकारी होगा।

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(a) If the Contractor fails to complete the work within the stipulated dates or such extension thereof as communicated by the Engineer in writing, the Contractor shall pay as compensation (Liquidated Damage) to the Trustees and not as a penalty, ½% (half percent) of the total value of work (contract piece) as mentioned in the letter of acceptance of the tender/offer, for every week or part thereof the work remains unfinished. Provided always that the amount of such compensation shall not exceed 10% of the said value of work. The amount of Liquidated damages shall be determined by the Engineer, which shall be final and binding.

'Liquidated Damage' and other compensation due to Trustees

(ख) न्यासी मंडल को उनके विधिक अधिकारों पर कोई प्रतिकूल प्रभाव डाले बिना इस खंड के उप-खंड में उल्लिखित उक्त प्रतिकर / क्षतिपूर्ति राशि को संविदाकार को देय या देय होनेवाली राशि से वसूल करने का अधिकार होगा। उक्त प्रतिकर/क्षतिपूर्ति राशि के भुगतान या कटौती से संविदाकार कार्य पूरा करने की अपनी बाध्यता या संविदा के अधीन अपनी अन्य बाध्यताओं / दायित्वों से मुक्त नहीं होगा तथा संविदाकार की विफलता के मामले में इंजीनियर के पूर्ण विवेकाधिकार से उक्त कार्य इंजीनियर या उसके प्रतिनिधि द्वारा संविदाकार को लिखित रूप में

न्यूनतम तीन दिन की नोटिस दिए जाने के बाद संविदाकार की जोखिम एवं खर्च पर किसी अन्य एजेंसी द्वारा पूरा कराने का आदेश दिया जा सकेगा।

(b) Without prejudice to any of their legal rights, the Trustees shall have the power to recover the said amount of compensation/damage in Sub-clause (a) of this clause, from any money due or likely to become due to the Contractor. The payment or deduction of such compensation/damage shall not relieve the contractor from his obligation to complete the work or from any of his other obligations/liabilities under the contract and in case of the Contractor's failure and at the absolute discretion of the Engineer, the work may be ordered to be completed by some other agency at the risk and expense of the Contractor, after a minimum three days notice in writing has been given to the Contractor by the Engineer or his Representative.

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- 8.3 संविदाकार को किसी प्रतिकर के लिए दायी हुए बिना न्यासी मंडल अपने पूर्ण विवेकाधिकार से संविदा समाप्त कर सकता है और कार्यस्थल पर जा सकता है एवं निम्नलिखित में से किसी कारण से संविदाकार को लिखित रूप में न्यूनतम 3 दिन की नोटिस देकर उसे वहाँ से निष्कासित कर सकता है तथा इंजीनियर द्वारा यथा संसूचित इस बाबत न्यासी मंडल का निर्णय अंतिम और निश्चयक होगा :

Without being liable for any compensation to the Contractor, the Trustees may, in their absolute discretion, terminate the contract and enter upon the site and works and expel the Contractor from there after giving him a minimum 3 days' notice in writing, due to occurrence of

Default of the Contractors remedies & powers/ Termination of

any of the following reasons and decision of the Trustees Contract.
in this respect, as communicated by the Engineer shall be
final and conclusive :

(i) संविदाकार ने संविदा का परित्याग कर दिया है ।

The Contractor has abandoned the contract.

(ii) इंजीनियर की राय में या तो कार्य की प्रगति संतोषजनक नहीं है या संविदाकार की त्रुटि के कारण सहमत अवधि के भीतर कार्य के पूरा होने की संभावना नहीं है।

In the opinion of the Engineer, either the progress of work is not satisfactory or the work is not likely to be completed within the agreed period on account of Contractor's lapses.

(iii) संविदाकार कार्य आरंभ करने में विफल रहा है या इन परिस्थितियों में उसने किसी विधिपूर्ण कारण के बिना "इंजीनियर या उसके प्रतिनिधि" से कार्य आगे बढ़ाने की लिखित नोटिस प्राप्त करने के बावजूद कम से कम 15 दिन तक कार्य को स्थगित रखा है।

The Contractor has failed to commence the works or has without any lawful excuse under these conditions has kept the work suspended for at least 15 days despite receiving the Engineer" or his Representative" written notice to proceed with the work.

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(iv) इन परिस्थितियों में इंजीनियर या उसके प्रतिनिधि से किन्हीं सामग्री या कार्य की भत्सर्ना किए जाने एवं उसे खारिज किए जाने संबंधी लिखित नोटिस प्राप्त करने के 7 दिनों के बाद भी संविदाकार कार्यस्थल से उक्त सामग्री को हटाने या उसे गिराने या ध्वस्त करने एवं कार्य को प्रतिस्थापित करने में चूक करता है।

The Contractor has failed to remove materials from site or to dismantle or demolish and replace work for 7 days after receiving from the Engineer or his representative the written notice stating that the said materials or work were condemned and rejected by him under these conditions.

(v) संविदाकार संविदा के अनुसार कार्य निष्पादित नहीं कर रहा है या लगातार या खुले तौर पर संविदा के अधीन अपनी बाध्यताओं के कार्यान्वयन की उपेक्षा कर रहा है।

The Contractor is not executing the works in accordance with the contract or is persistently or flagrantly neglecting to carry out his obligations under the contract.

(vi) संविदाकार द्वारा या उसकी ओर से संविदा की प्राप्ति या उसके निष्पादन के संबंध में न्यासी मंडल के किसी अधिकारी, सेवक या प्रतिनिधि या उसकी या उनकी ओर से किसी व्यक्ति को कोई घूस, कमीशन, उपहार या फायदा दिया जाता है।

Any bribe, commission, gift or advantage is given, promised or offered by or on behalf of the contractor to any officer, servant or representative of the Trustees or to any person on his or their behalf in relation to the obtaining or to the execution of the contract.

(vii) संविदाकार दिवालिया न्यायनिर्णीत किया जाता है या अपने लेनदारों के साथ प्रशमन करता है या कंपनी होने पर चाहे अनिवार्य रूप से या स्वैच्छिक रूप से समापन करता है।

The Contractor is adjudged insolvent or enters into composition with his creditors or being a company goes into liquidation either compulsory or voluntary.

8.3.1 न्यासी मंडल की ओर से इंजीनियर द्वारा जारी किए जा सकनेवाले कार्य के पर्यवसान संबंधी पत्र की प्राप्ति पर संविदाकार उसे जारी किए गए न्यासी मंडल के सभी औज़ार, संयंत्र एवं सामग्री उक्त पत्र की प्राप्ति से 7 दिनों के भीतर इंजीनियर द्वारा अभिनिश्चित किए जानेवाले स्थान पर सौंपेगा।

Upon receipt of the letter of termination of work, which may be issued by the Engineer on behalf of the Trustees, the Contractor shall hand over all the Trustees' tools, plant and materials issued to him at the place to be ascertained from the Engineer, within 7 days of receipt of

such letter.

- 8.3.2 कार्य के पर्यवसान संबंधी ऐसे सभी मामलों में न्यासी मंडल को संविदाकार की जोखिम एवं खर्च पर किसी अन्य एजेंसी के जरिए कार्य को पूर्ण कराने की शक्ति होगी और संविदा के अनुसार संविदाकार द्वारा कार्य को सम्यक् रूप से पूर्ण किए जाने पर जो राशि उसे देय होती उससे अधिक राशि कार्य पूर्ण कराने पर खर्च होने पर उक्त राशि संविदाकार से विकलित की जाएगी ।

In all such cases of Termination of work, the Trustees shall have the power to complete the work through any other agency at the Contractor's risk and expense and the Contractor shall be debited any sum or sums that may be expended in completing the work beyond the amount that would have been due to the Contractor, had he duly completed the work in accordance with the contract.

- 8.3.3 संविदा के पर्यवसान पर संविदाकार संविदा के अनुसार वसूली के अध्यक्षीन वस्तुतः उसके द्वारा किए गए कार्य और वस्तुतः उसके द्वारा आपूरित सामग्री के मूल्य के केवल 90% का भुगतान प्राप्त करने का हकदार होगा बशर्ते किए गए कार्य एवं सामग्री न्यासी मंडल द्वारा अधिगृहीत किए जाते समय विनिर्देश के अनुरूप हों। कार्य का भुगतान वस्तुतः किए गए कार्य की माप एवं अनुमोदित संविदा दरों या इंजीनियर द्वारा यथा विनिश्चित अन्य दरों पर किए गए मूल्यांकन के आधार पर किया जाएगा। आपूरित सामग्री के लिए भुगतान इंजीनियर द्वारा यथा विनिश्चित दरों पर किया जाएगा जो किसी भी दशा में न्यासी मंडल द्वारा अधिगृहीत किए जाते समय प्रचलित बाजार दरों से अधिक नहीं होगी। ऐसे सभी मामलों में इंजीनियर का विनिश्चय अंतिम, बाध्यकारी एवं निश्चयक होगा ।

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Upon termination of contract, the Contractor shall be entitled to receive payment of only 90% of the value of work actually done or materials actually supplied by him and subject to recoveries as per contract, provided the work done and materials conform to specifications at the time of taking over by the Trustees. The payment for work shall be based on measurements of actual work done and priced at approved contract rates or other rates, as decided by the Engineer. The payment for materials supplied shall be at the rates as decided by the Engineer, which shall in no case be more than market rates prevailing at the time of taking over by the Trustees. The Engineer's decision in all such case shall be

final, binding and conclusive.

- 8.3.4 न्यासी मंडल को संविदाकार को देय सभी राशि तबतक प्रतिधारित करने की शक्ति होगी जबतक अन्य एजेंसी द्वारा कार्य पूरा नहीं किया जाता है और न्यासी मंडल के प्रति संविदाकार की देयताएं सभी तरह से ज्ञात नहीं होती हैं।

The Trustees shall have the power to retain all moneys due to the Contractor until the work is completed by other agency and the Contractor's liabilities to the Trustees are known in all respect.

- 9.0 अनुरक्षण एवं प्रतिभूति जमाराशि की वापसी

MAINTENANCE AND REFUND OF SECURITY DEPOSIT

- 9.1 कार्य का निष्पादन पूर्ण करने के बाद संविदाकार प्ररूप जी.सी.-1 में कार्य के आरंभिक कार्य-पूर्णता प्रमाणपत्र में उल्लिखित तारीख से संविदा की अनुरक्षण की विशेष शर्त के रूप में विनिर्दिष्ट की जा सकनेवाली अवधि के लिए संविदाकार की उसका अनुरक्षण करेगा। संविदा के अनुसार या इंजीनियर या उसके प्रतिनिधि के अनुदेश के अनुसार सामग्री या शिल्प से इंजीनियर या उसके प्रतिनिधि की अनन्य राय में उपर्युक्त अनुरक्षण अवधि के दौरान कार्य में कोई त्रुटि/गलती प्रतीत हो तो इंजीनियर या उसके प्रतिनिधि की लिखित नोटिस पर ऐसी नोटिस से सात दिनों के भीतर इंजीनियर या उसके प्रतिनिधि की त्रुटि के अनुरूप संविदाकार द्वारा अपने खर्च पर उसका संशोधन किया जाएगा एवं उसे पूरा किया जाएगा जिसमें असफल रहने पर इंजीनियर या उसके प्रतिनिधि संविदाकार की जोखिम एवं खर्च पर अन्य एजेंसी के जरिए त्रुटि का संशोधन कराएंगे और उसे पूरा कराएंगे तथा उसपर एवं उसके अनुषंगी सभी व्यय इंजीनियर द्वारा उपयुक्त समझे जानेवाले रूप में संविदाकार से वसूलीयोग्य होंगे।

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On completion of execution of the work the Contractor shall maintain the same for a period, as may be specified in the form of a Special Condition of the Contract, from the date mentioned in the Initial Completion Certificate in Form G.C.1. Any defect/fault, which may appear in the work during aforesaid maintenance period, arising, in the sole opinion of the Engineer or his representative, from materials or workmanship not in accordance with the contract or the instruction of the Engineer or his representative, shall, upon the written notice of the Engineer or his

Contractor's obligation for maintenance of work.

representative, be amended and made good by the Contractor at his own cost within seven days of the date of such notice, to the satisfaction of the Engineer or his representative, failing which the Engineer or his representative shall have the defects amended and made good through other agency at the Contractor's risk and cost and all expenses, consequent thereon or incidental thereto, shall be recoverable from the Contractor in any manner deemed suitable by the Engineer.

जीसी/GC-25

- 9.2 संविदाकार द्वारा तबतक कार्य पूर्ण किया गया नहीं समझा जाएगा अंतिम कार्य-
और न्यासी मंडल द्वारा तबतक अंतिम रूप से कार्य स्वीकार किया पूर्णता
गया नहीं समझा जाएगा जबतक संविदाकार द्वारा अनुरक्षण प्रमाणपत्र
अवधि, यदि कोई हो, सहित संविदा के अधीन सभी बाध्यताएँ पूर्ण किए
जाने के बाद इसके साथ उपाबद्ध प्ररूप जी.सी.-2 में अंतिम कार्य-
पूर्णता प्रमाणपत्र इंजीनियर द्वारा हस्ताक्षरित एवं संविदाकार को जारी
न कर दिया जाए। न्यासी मंडल के कार्य-स्थल पर जाने या उसपर
कब्जा करने, वहाँ कार्य करने या उसका उपयोग करने से संविदाकार
संविदा के अधीन पूर्णरूपेण एवं अंतिम रूप से कार्य को पूरा करने की
अपनी बाध्यता से मुक्त नहीं होगा ।

65

The Contractor shall not be considered completed and the work shall not be treated as finally accepted by the Trustees, until a Final Completion Certificate in Form G.C.2 annexed hereto shall have been signed and issued by the Engineer to the contractor after all obligations under the Contract including that in the maintenance period, if any, have been fulfilled by the Contractor. Previous entry

Certificate of
final
completion

on the works or taking possession, working or using thereof by the Trustees shall not relieve the Contractor of his obligations under the contract for full and final completion of the work.

- 9.3 उपर्युक्त रूप से संविदा के पूर्ण होने पर संविदाकार इंजीनियर के समक्ष प्रतिभूति (i) न्यासी मंडल द्वारा धारित प्रतिभूति राशि के लिए प्रदान की गई जमाराशि की ट्रेजरी रसीद और (ii) इसके साथ उपाबद्ध प्ररूप जी.सी. 3 में अपना वापसी "आगे कोई दावा नहीं" प्रमाणपत्र (मूल प्रति) प्रस्तुत करके प्रतिभूति जमाराशि की वापसी के लिए आवेदन कर सकता है जिसपर इंजीनियर प्ररूप जी.सी. 2 में प्रमाणपत्र जारी करेगा और इंजीनियर की संस्तुति के दो माह के भीतर न्यासी मंडल, प्रतिभूति जमाराशि के प्रति संविदाकार को देय राशि से संविदाकार द्वारा न्यासी मंडल को देय किसी राशि की बाबत कटौती करने के बाद शेष राशि संविदाकार को वापस करेगा ।

On completion of the contract in the manner aforesaid, the Contractor may apply for the refund of his Security Deposit by submitting to the Engineer (I) The Treasury Receipts granted for the amount of Security held by the Trustees, and (ii) his "No further claim" Certificate in Form G.C.3 annexed hereto (in original), where upon the Engineer shall issue Certificate in Form G.C.2 and within two months of the Engineer's recommendation, the Trustees shall refund the balance due against the Security Deposit to the Contractor, after making deduction therefrom in respect of any sum due to the Trustees from the Contractor.

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- 10.0 संविदा दस्तावेजों का निर्वचन, विवाद और माध्यस्थम्
INTERPRETATION OF CONTRACT DOCUMENTS,
DISPUTES AND ARBITRATION

- 10.1 विनिर्देश, आरेखण, डिजाइन और अनुदेश के अर्थ सहित संविदा के इंजीनियर का निर्वचन से उत्पन्न या सम्बद्ध या शिल्प की गुणवत्ता के बारे में या विनिश्चय

कार्य चालू रहने के दौरान या पूर्ण होने के बाद एवं संविदा के अवधारण, परित्याग या भंग होने के पहले या बाद या कार्य या कार्य के निष्पादन में प्रयुक्त सामग्री के बारे में सभी विवाद, मामले, दावा, मांग या प्रश्न में इंजीनियर का विनिश्चय अंतिम एवं संविदा के सभी पक्षकारों पर बाध्यकारी होगा तथा संविदाकार द्वारा इसे तुरंत प्रभावी किया जाएगा ।

In all disputes, matters, claims, demands or questions arising out of or connected with the interpretation of the Contract including the meaning of Specifications, drawings, designs and instructions or as to the quality of workmanship or as to the materials used in the work or the execution of the work whether during the progress of the works or after the completion and whether before or after the determination, abandonment or breach of the contract the decision of the Engineer shall be final and binding on all parties to the contract and shall forthwith be given effect to by the Contractor.

Engineer's
decision

10.2 यदि संविदाकार इंजीनियर के ऐसे किसी विनिश्चय से असंतुष्ट होता है तो वह ऐसे विनिश्चय की नोटिस प्राप्त करने के बाद 15 दिनों के भीतर यह अपेक्षा करेगा कि उक्त मामला अध्यक्ष को निर्दिष्ट किया जाए जो उसपर विचार एवं विनिश्चय करेगा ।

अध्यक्ष का
अधिनिर्णय

If the Contractor be dissatisfied with any such decision of the Engineer, he shall within 15 days after receiving notice of such decision require that the matter shall be referred to Chairman, who shall thereupon consider and give a decision.

Chairman's
award

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10.3 तथापि, यदि संविदाकार अध्यक्ष के विनिश्चय से असंतुष्ट होता है तो वह ऐसे विनिश्चय की नोटिस प्राप्त करने के बाद 15 दिनों के भीतर यह अपेक्षा करेगा कि लिखित रूप में उसकी नोटिस के 60 दिनों के भीतर अध्यक्ष, न्यासी मंडल द्वारा इस प्रयोजनार्थ अनुरक्षित किए जानेवाले मध्यस्थों के पैनल से एक मध्यस्थ को मामला विनिर्दिष्ट करे और ऐसे किसी निर्देश को भारतीय माध्यस्थम् अधिनियम 1940 या उसके किसी कानूनी उपांतरण के अर्थातर्गत माध्यस्थम् के समक्ष

माध्यस्थम्

प्रस्तुत किया गया समझा जाएगा।

Arbitration.

If, however, the Contractor be still dissatisfied with the decision of the Chairman, he shall within 15 days after receiving notice of such decision require that within 60 days from his written notice, the Chairman shall refer the matter to an Arbitrator of the panel of Arbitrators to be maintained by the Trustees for the purpose and any such reference shall be deemed to be a submission to arbitration within the meaning of Indian Arbitration Act, 1940 or any statutory modification thereof.

- 10.3.1. यदि इस प्रकार नियुक्त मध्यस्थ किसी भी कारण से कार्य करने में असमर्थ या अनिच्छुक होता है या अपनी नियुक्ति त्याग देता है या अपना पद रिक्त करता है तो पैनल से किसी दूसरे व्यक्ति की नियुक्ति एकमात्र मध्यस्थ के रूप में की जाएगी और उसके पूर्वाधिकारी ने जिस स्थिति में कार्य छोड़ा था उससे आगे वह कार्य करेगा ।

If the Arbitrator so appointed is unable or unwilling to act or resigns his appointment or vacates his office due to any reason whatsoever, another person from panel shall be appointed as Sole Arbitrator and he shall proceed from the stage at which his predecessor left it.

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- 10.3.2 जिस तारीख को मध्यस्थ पहली सुनवाई की तारीख नियत करते हुए दोनों पक्षकारों को नोटिस जारी करता है उसी तारीख को उसे निर्देशित किया गया समझा जाएगा ।

The Arbitrator shall be deemed to have entered on reference on the date he issues notice to both the parties fixing the date of first hearing.

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- 10.3.3 जिस समय-सीमा के भीतर मध्यस्थ अपना पंचाट प्रस्तुत करेगा वह भारतीय माध्यस्थम् अधिनियम 1940 या उसके किसी संशोधन में यथा उपबंधित सामान्यतः 4 महीने होगी । मध्यस्थ, यदि आवश्यक समझे, पक्षकारों की सहमति से पंचाट तैयार करने एवं उसे प्रकाशित करने हेतु समय बढ़ा सकता है।

The time limit within which the Arbitrator shall submit his award shall normally be 4 months as provided in Indian

Arbitration Act, 1940 or any amendment thereof. The Arbitrator may, if found necessary, enlarge the time for making and publishing the award, with the consent of the parties.

- 10.3.4 माध्यस्थम् का स्थान मध्यस्थ के एकमात्र विवेकाधिकार से यथा नियत कलकता या हल्दिया होगा। ऐसे प्रत्येक या किसी निर्देश पर क्रमशः निर्देश एवं पंचाट के अनुषंगी कोई खर्च मध्यस्थ के विवेकानुसार किया जाएगा जो उसकी राशि या जिसके द्वारा और जिसे एवं जिस रीति से उसका वहन एवं भुगतान किया जाएगा, उसे अवधारित कर सकेगा ।

The venue of the arbitration shall be either Calcutta or Haldia as may be fixed by the Arbitrator in his sole discretion. Upon every or any such reference the cost of any incidental to the reference and award respectively shall be in the discretion of the Arbitrator who may determine, the amount thereof or by whom and to whom and in what manner the same shall be borne and paid.

- 10.3.5 मध्यस्थ का पंचाट भारतीय माध्यस्थम् अधिनियम 1940 या उसके किसी संशोधन के उपबंधों के अधीन सभी पक्षकारों पर अंतिम एवं बाध्यकारी होगा । मध्यस्थ विवाद की प्रत्येक मद और प्रत्येक पक्षकार द्वारा उसे निर्देशित संबंधित दावे की बाबत पृथक् पंचाट देगा तथा पंचाट देने के कारण का उल्लेख करेगा।

The Award of the Arbitrator shall be final and binding on all parties subject to the provisions of the Indian Arbitration Act 1940 or any amendment thereof. The Arbitrator shall give a separate award in respect of each item of disputes and respective claim referred to him by each party and give reason for the award.

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- 10.3.6 मध्यस्थ संविदा के सभी पक्षकारों के दावों पर संबंधित संविदा की सीमा एवं शर्तों के भीतर ही विचार करेगा ।

The Arbitrator shall consider the claims of all the parties to the contract - within only the parameters of scope and conditions of the contract in question.

- 10.3.7 संविदा में अन्यथा उपबंधित के सिवाय तत्समय प्रवृत्त माध्यस्थम् अधिनियम, 1940 और उसके अधीन बनाए गए नियमों के उपबंध इस खंड

के अधीन माध्यस्थम् कार्यवाहियों पर लागू होंगे।

Save as otherwise provided in the contract the provisions of the Arbitration Act, 1940 and rules made thereunder, for the time being in force, shall apply to the arbitration proceedings under this Clause.

- 10.4 संविदाकार कार्य को स्थगित नहीं रखेगा या उसमें विलंब नहीं करेगा तथा इंजीनियर के विनिश्चय के अनुसार समुचित तत्परता से कार्य को आगे बढ़ाएगा। इंजीनियर भी, उसके अनुसार, संविदाकार को देय एवं भुगतान-योग्य कोई ऐसा भुगतान इस आधार पर नहीं रोकेगा कि कुछ विवाद उत्पन्न हुए हैं और उन्हें माध्यस्थम् को निर्देशित किए जाने की संभावना है।

The Contractor shall not suspend or delay the work and proceed with the work with due diligence in accordance with Engineer's decision. The Engineer also shall not withhold any payment, which, according to him, is due or payable to the Contractor, on the ground that certain disputes have cropped up and are likely to be referred to arbitration.

- 10.5 परंतु यह हमेशा कि :

Provided always as follows:

[क] इसमें इसके ऊपर के पैरा 10.3 से 10.3.7 तक में उल्लिखित कोई प्रावधान संविदा के ऐसे मामले पर लागू नहीं होंगे जहाँ निविदा / प्रस्ताव के स्वीकृति-पत्र में यथा उल्लिखित निविदाकृत राशि रु. 40,00,000/- से कम है।

[a] Nothing of the provisions in paragraphs 10.3 to 10.3.7 hereinabove would apply in the cases of contracts, where tendered amount appearing in the letter of acceptance of the tender / offer is less than Rs.40,00,000/-.

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[ख] संविदाकार, संविदा की शर्तों के संबंध में विस्तृत औचित्य देते हुए कार्य के निष्पादन के संबंध में किसी प्रकार का विवाद या मतभेद विवाद-हेतुक उत्पन्न होने से 30 दिन के भीतर और अंतिम बिल तैयार किए जाने से पहले इंजीनियर के समक्ष उठाना होगा।

[b] The Contractor shall have to raise disputes or differences of any kind whatsoever in relation to the execution of the work to the Engineer within 30 days

from the date of occurrence of the cause of dispute and before the preparation of the final bill, giving detailed justifications, in the context of contract conditions.

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[ग] संविदा में केवल अनुबद्ध अनुरक्षण अवधि के, यदि कोई हो, दौरान उत्पन्न संविदाकार का विवाद संविदा की शर्तों के प्रासंगिक विस्तृत औचित्य सहित इंजीनियर के समक्ष उपर्युक्त अंतिम पूर्णता-प्रमाणपत्र प्ररूप जीसी-2 जारी किए जाने के पूर्व प्रस्तुत किया जाए।

प्ररूप जीसी-3 में प्रमाणपत्र प्रस्तुत करने के बाद संविदाकार संविदा से संबंधित किसी भी मामले पर कोई विवाद या मतभेद नहीं उठा सकता है।

[c] Contractor's dispute if any arising only during the maintenance period, if any, stipulated in the contract, must be submitted to the Engineer, with detailed justification in the context of contract conditions, before the issuance of final completion certificate in Form G.C.-2 ibid.

No dispute or difference on any matters whatsoever, the Contractor can raise pertaining to the Contract after submission of certificate in form G.C.3 by him.

[घ] इसमें इसके ऊपर के उप-खंड 10.5[ख] और 10.5[ग] में विहित समय-सीमा से परे उठाए गए संविदाकार के दावा/विवाद पर बाद में इंजीनियर और / या किसी मध्यस्थ द्वारा विचार नहीं किया जाएगा ।

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[d] Contractor's claim / dispute raised beyond the time limits prescribed in sub-clauses 10.5[b] and 10.5 [c] hereinabove, shall not be entertained by the Engineer and / or by any Arbitrator subsequently.

[ड] अध्यक्ष / न्यासी मंडल को इसमें इसके ऊपर के खंड 10.3 के अनुसार अपने एकमात्र विवेकाधिकार से संविदाकार को कोई निर्देश किए बिना नए मध्यस्थों का नाम जोड़कर और/या

विद्यमान मध्यस्थों का नाम हटाकर मध्यस्थों के पैनल में परिवर्तन करने का अधिकार होगा ।

- [e] The Chairman / Trustees shall have the right to alter the panel of Arbitrators, vide Clause 10.3 hereinabove, on their sole discretion, by adding the names of new Arbitrators and / or by deleting the names of existing Arbitrators, without making any reference to the Contractor.

(कवर-I प्रस्ताव के साथ प्रस्तुत किया जाए)/(TO BE SUBMITTED WITH COVER- I OFFER)

कोलकाता पत्तन का न्यासी मंडल/THE BOARD OF TRUSTEES FOR THE PORT OF KOLKATA

निविदा प्ररूप (अमूल्यंकित)/FORM OF TENDER (UNPRICED)

प्रति/To

प्रबंधक /The Manager (आई एंड सीएफ/I&CF),
हल्दिया गोदी परिसर/ Haldia Dock Complex.

मैं/हम,-----,
जिसने/जिन्होंने कार्य-स्थल की जांच की है, रेखाचित्रों का परीक्षण किया है और विनिर्देशों, संविदा की सामान्य एवं विशेष शर्तों तथा निविदा की शर्तों को पढ़ा है, एतदद्वारा न्यासी मंडल द्वारा एवं उनकी ओर से तैयार किए गए विनिर्देशन, परिमाण बिल, संविदा की सामान्य एवं विशेष शर्तों तथा रेखाचित्रों के अनुसार हमारी निविदा के पूर्णतः एवं अंशतः स्वीकार किए जाने की दशा में उपाबद्ध परिमाण बिल में उपवर्णित दर एवं मूल्य पर कार्य आरंभ करने के आदेश की तारीख से-----
-----महीने/ सप्ताह के भीतर निष्पादित किए जाने के लिए अपेक्षित सभी कार्य निष्पादित एवं पूर्ण करने हेतु निविदा एवं वचनबंध करता हूँ / करते हैं । मैं / हम इसके साथ उपाबद्ध प्ररूप में निविदा को प्रभावी करने के लिए आवश्यक परिवर्तन एवं परिवर्धन सहित ऐसे विनिर्देशन, परिमाण बिल, रेखाचित्र एवं संविदा की विशेष और सामान्य शर्तों को शामिल करते हुए एक संविदागत करार करने का भी वचनबंध करता हूँ / करते हैं तथा मैं/हम एतदद्वारा करार करता हूँ /करते हैं कि जबतक ऐसा संविदागत करार निष्पादित नहीं होता है तबतक उक्त विनिर्देशन, परिमाण बिल, संविदा की शर्तें तथा लिखित रूप में स्वीकृति सहित निविदा न्यासी मंडल द्वारा और उनकी ओर से संविदा होगी।

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I/We _____

having examined the site of work, inspected the Drawings and read the specifications, General & Special Conditions of Contract and Conditions of the Tender, hereby tender and undertake to execute and complete all the works required to be performed in accordance with the Specification, Bill of Quantities, General & Special Conditions of Contract and Drawings prepared by or on behalf of the Trustees and at the rates & prices set out in the annexed Bill of Quantities

within _____ months / weeks from the date of order to commence the work and in the event of our tender being accepted in full or in part. I / We also undertake to enter into a Contract Agreement in the form hereto annexed with such alterations or additions thereto which may be necessary to give effect to the acceptance of the Tender and incorporating such Specification, Bill of Quantities, Drawing and Special & General Conditions of Contract and I / We hereby agree that until such Contract Agreement is executed the said Specification, Bill of Quantities, Conditions of Contract and the Tender, together with the acceptance thereof in writing by or on behalf of the Trustees shall be the Contract.

निविदा की कुल राशि रु. जिसे कवर I प्रस्ताव में उक्तथित नहीं किया जाए

THE TOTAL AMOUNT OF TENDER Rs. NOT TO BE QUOTED IN COVER I OFFER

(शब्दों में दोहराएं) कवर I प्रस्ताव में उक्तथित नहीं किया जाए

(Repeat in words) NOT TO BE QUOTED IN COVER I OFFER

मुझे/हमें कार्य शुरू करने से पहले कार्य के लिए आवश्यक सामग्री की व्यवस्था करने और खरीद करने हेतु निविदा की स्वीकृति की तारीख से _____ दिनों / महीनों के प्रारंभिक समय की आवश्यकता है।

I/We require _____ days / months preliminary time to arrange and procure the materials required by the work from the date of acceptance of tender before I/ We could commence the work.

मैंने/हमने न्यासी मंडल के प्रबंधक (वित्त), एचडीसी के पास -----की रसीद सं----- द्वारा बयाना राशि जमा की है।

I / We have deposited with the Trustees' Manager (Finance), HDC, vide Receipt No. _____ of _____ as Earnest Money.

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मैं / हम इस बात से सहमत हूँ/हैं कि स्वीकृति के लिए निविदा खुली रहने की अवधि चार महीने से कम नहीं होगी।

I / We agree that the period for which the tender shall remain open for acceptance shall not be less than four months.

दिनांक/Date: (मुहर सहित बोली लगानेवाले के हस्ताक्षर/Signature of Bidder with Seal)

साक्षी/WITNESS:

हस्ताक्षर/Signature: बोली लगानेवाले का नाम/Name of the Bidder :

नाम/Name (स्पष्ट अक्षरों में) पता/Address :

Name(In Block Letters):

पता/Address:

पेशा/Occupation:

कोलकाता पत्तन न्यास / KOLKATA PORT TRUST

हल्दिया गोदी परिसर / HALDIA DOCK COMPLEX

प्ररूप / FORM जी.सी. / G.C.-1

संविदाकार / Contractor-----

पता / Address-----

कार्य पूर्ण करने की तारीख / Date of completion :

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प्रिय महोदय / Dear sir(s),

यह प्रमाणित किया जाता है कि निम्नलिखित कार्य, यथा :-

This is to certify that the following work viz :-

कार्य का नाम/ Name of work :
.....

.....
प्राक्कलन सं./Estimate No. ई.ई.ओ. / E.E.O-----दिनांक/ Dt.....

सी.ई.ओ. /C.E.O.....-दिनांक./Dt.....

कार्य आदेश सं./Work Order No.....

आबंटन/Allocation.....

संविदा सं./Contract No.

जो आपके द्वारा किया गया, वह अधोहस्ताक्षरी की राय में संविदा की शर्तों के अनुसार वर्ष 20-----
के -----के -----दिन को हर तरह से पूर्ण है और आपसे यह अपेक्षित है कि
आप संविदा की सामान्य शर्तों के खंड 62 के अनुसार एवं संविदा के प्रावधानों अधीन वर्ष 20----- के
-----के -----दिन से वर्ष 20----- के -----के -----
दिन तक-----सप्ताह/माह/वर्ष की अवधि तक कार्य का अनुरक्षण करें।

which was carried out by you is in the opinion of the undersigned complete in
every respect on the _____ day of _____ 2000 in
accordance with terms of the Contract and you are required to maintain the work
as per Clause 62 of the General Conditions of Contract and under provisions of
the Contract for a period of _____ weeks / months / years
from the _____ day of _____ 2000 to _____
day of _____ 2000 .

भवदीय / Yours faithfully,

हस्ताक्षर/Signature.....

(इंजीनियर/ इंजीनियर के प्रतिनिधि / ENGINEER/ENGINEER'S REPRESENTATIVE)

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नाम/Name.....

पदनाम/ Designation.....

कार्यालय की मुहर/OFFICE SEAL

कोलकाता पत्तन न्यास / KOLKATA PORT TRUST

हल्दिया गोदी परिसर / HALDIA DOCK COMPLEX

प्ररूप/FORM जी. सी./G.C.-2

अंतिम कार्य-पूर्णता प्रमाणपत्र/Certificate of Final Completion

वित्तीय सलाहकार एवं मुख्य लेखा अधिकारी/The Financial Adviser & Chief Accounts Officer

प्रबंधक(वित्त), हल्दिया गोदी परिसर/The Manager (Finance), Haldia Dock Complex.

यह प्रमाणित किया जाता है कि निम्नलिखित कार्य यथा :-

This is to certify that the following work viz:-

कार्य का नाम/ Name of work :

प्राक्कलन सं. /Estimate No. ई.ई.ओ./ E.E.O.....दिनांक/ dt.....

सी.ई.ओ/ C.E.O-----दिनांक/dt.....

कार्य आदेश सं./Work Order No.....

संविदा सं./Contract No.

संकल्प एवं बैठक सं. / Resolution & Meeting No.

आबंटन/Allocation :

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जो श्री/मेसर्स ----- द्वारा किया गया, वह संविदा की शर्तों के अनुसार अब हर तरह से पूर्ण है और यह कि संविदाकार द्वारा संविदा के अधीन सभी बाध्यताओं को पूरा किया गया है।

which was carried out by Shri/Messrs..... is now complete in every respect in accordance with the terms of the Contract and that all obligations under the Contract have been fulfilled by the Contractor.

हस्ताक्षर/Signature.....

(इंजीनियर/इंजीनियर के प्रतिनिधि/ENGINEER/ENGINEER'S REPRESENTATIVE)

नाम/NAME.....

पदनाम / DESIGNATION.....

कार्यालय की मुहर/OFFICE SEAL

कोलकाता पत्तन न्यास/KOLKATA PORT TRUST

हल्दिया गोदी परिसर /HALDIA DOCK COMPLEX

प्ररूप/FORM जी.सी./G.C.-3

(‘NO CLAIM’ CERTIFICATE FROM CONTRACTOR)

(संविदाकार का ‘कोई दावा नहीं’ प्रमाणपत्र)

प्रबंधक / The Manager (आई एंड सीएफ / I&CF)

हल्दिया गोदी परिसर / Haldia Dock Complex

कोलकाता पत्तन न्यास / Calcutta Port Trust

हल्दिया / Haldia.

(ध्यानार्थ / Atten:.....)

प्रिय महोदय / Dear Sir,

मैं / हम एतद्वारा घोषित करता हूँ / करते हैं कि मैंने / हमने निम्नलिखित कार्य के निष्पादन के लिए कोलकाता पत्तन न्यास से पूरा और अंतिम भुगतान प्राप्त किया है/यथा :-

I / We do hereby declare that I / we have received full and final payment from the Calcutta Port Trust for the execution of the following work viz:-

कार्य का नाम / Name of work:

कार्य आदेश सं. / Work Order No :-

संविदा सं. / Contract No. _____

करार सं. / Agreement No.....दिनांक / Dt.....

तथा उपर्युक्त कार्य की बाबत कोलकाता पत्तन न्यास के प्रति मेरा / हमारा और कोई दावा नहीं है।
and I / we have no further claim against the Calcutta Port Trust in respect of the
above-mentioned job.

भवदीय / Yours faithfully,

(संविदाकार के हस्ताक्षर / Signature of the Contractor)

दिनांक / Dated _____

संविदाकार का नाम / Name of Contractor.....

पता / Address:.....

(संविदाकार की आधिकारिक मुहर / OFFICIAL SEAL OF THE CONTRACTOR)

कोलकाता पत्तन न्यास / KOLKATA PORT TRUST

करार के प्ररूप का प्रोफार्मा / PROFORMA OF FORM OF AGREEMENT

यह करार 20 ----- के -----के -----दिन को एक ओर कोलकाता पत्तन के न्यासी मंडल, जो महापत्तन न्यास अधिनियम, 1963 और उसके अधीन बनाए गए नियमों एवं उसमें किए गए कानूनी उपांतरण के अधीन गठित एक कानूनी निकाय है एवं जिसका रजिस्ट्रीकृत कार्यालय 15, स्ट्रैंड रोड, कलकत्ता - 700001 में है (जिसे इसमें इसके पश्चात "नियोक्ता" कहा गया है और इस अभिव्यक्ति में जबतक कोई बात संदर्भ द्वारा अपवर्जित या उसके प्रतिकूल न हो तबतक इसमें उसके परवर्ती पदधारक शामिल समझे जाएंगे) तथा दूसरी ओर -----के बीच (जिसे इसमें इसके पश्चात् "संविदाकार" कहा गया है और इस अभिव्यक्ति में जबतक कोई बात संदर्भ द्वारा अपवर्जित या उसके प्रतिकूल न हो तबतक इसमें उसके वारिस, निष्पादक, प्रशासक, प्रतिनिधि, परवर्ती पदधारक एवं अनुज्ञात समनुदेशिती शामिल समझे जाएंगे) निष्पादित किया जाता है।

THIS AGREEMENT made ----- day of _____ 20____ between the "Board Of Trustees for the Port Of Calcutta , a statutory body constituted under Major Port Trust Act ,1963 under the rules there under and statutory modification thereto

having Registered Office at 15, Strand Road , Calcutta -700001 (hereinafter called "EMPLOYER" which expression unless excluded by or repugnant to the context be deemed to include his successor/s in office) on the one part and _____ (hereinafter called the "CONTRACTOR" which expression shall unless excluded by or repugnant to the context be deemed to include his heirs, executors, administrators, representative, successor in office and permitted assigns) of the other part.

चूँकि न्यासी मंडल इस बात का इच्छुक है कि कतिपय कार्य, यथा -----
-----निष्पादित किए जाएँ और उन्होंने ऐसे कार्य के निष्पादन, पूर्णता एवं अनुरक्षण के लिए संविदाकार की निविदा / प्रस्ताव को स्वीकार किया है।

WHEREAS The TRUSTEES are desirous that certain works should be executed viz _____ and have accepted a Tender/Offer by the contractor for the execution, completion and maintenance of such works .

अब यह संविदागत करार निम्नलिखित का साक्षी है :-

NOW THIS CONTRACT AGREEMENT WITNESSETH as follows :-

1. इस करार में प्रयुक्त शब्दों, अभिव्यक्तियों का वही अर्थ होगा जो इसमें इसके पश्चात् निर्दिष्ट संविदा की सामान्य शर्तों में उन्हें क्रमशः समनुदेशित किए जाते हैं ।

In this agreement words, expressions shall have the same meanings as are respectively assigned to them in General Conditions Of Contract, hereinafter referred to.

2. निम्नलिखित दस्तावेजों को इस करार का अंश माना जाएगा और उसी रूप में इसे पढ़ा एवं समझा जाएगा, यथा :-

- i. उक्त निविदा/प्रस्ताव और निविदा/प्रस्ताव की स्वीकृति
- ii. रेखाचित्र
- iii. संविदा की सामान्य शर्तें
- iv. संविदा की विशेष शर्तें (यदि कोई हों)
- v. निविदा की शर्तें
- vi. विनिर्देशन
- vii. परिमाण बिल
- viii. सभी पत्राचार जिनके द्वारा आपसी सहमति से किसी भी रूप में संविदा में परिवर्धन, संशोधन, फेरफार या उपांतरण किया जाता है ।

The following documents shall be deemed to form and be read and construed as part of this Agreement, viz :-

- i. The said Tender/Offer & the acceptance of Tender/ Offer.
- ii. The Drawings.
- iii. The General Conditions Of Contract.
- iv. Special Conditions Of Contract (If any).
- v. The Conditions Of Tender.
- vi. The Specifications.
- vii. The Bill Of Quantities.
- viii. All correspondences by which the contract is added, amended, varied or modified in any way by mutual consent.

3. इसमें इसके पश्चात् यथा उल्लिखित न्यासी मंडल द्वारा संविदाकारों को किए जानेवाले भुगतान के प्रतिफलस्वरूप संविदाकार एतद्वारा न्यासी मंडल के साथ संविदा के प्रावधानों के अनुरूप हर तरह से कार्य निष्पादित, पूर्ण एवं अनुरक्षित करने की प्रसंविदा करता है।

In consideration of the payments to be made by the Trustees to the Contractor as hereinafter mentioned the contractor hereby covenant with the Trustees to execute, complete and maintain the work in conformity in all respects with the provisions of Contract.

4. कार्य के ऐसे निष्पादन, पूर्णता और अनुरक्षण के प्रतिफलस्वरूप न्यासी मंडल एतद्वारा संविदाकार द्वारा विहित समय पर एवं रूप में संविदाकार को भुगतान करने की प्रसंविदा करता है।

The Trustees hereby covenants to pay to the contractor in consideration of such execution, completion and maintenance of the works the Contract Prices at the times and in the manner prescribed by the contractor .

इसकी साक्षी के रूप में इसके पक्षकारों ने उपरिलिखित दिन एवं वर्ष को इस पर अपनी सामान्य मुद्रा अंकित की है (या अपने हस्ताक्षर किए हैं और मुहर लगाई है) ।

IN WITNESS whereof the parties hereto have caused their respective Common Seals to be hereunto as fixed (or have set their respective hands and seals) the day and year first above written.

उपरिलिखित दिन एवं वर्ष को यह विलेख निष्पादित किया है ।

have executed these presents on the day and year first above written.

-----की मुहर
निम्नलिखित की उपस्थिति में इस पर लगाई गई :
The Seal of-----

was hereunto affixed in the presence of :

नाम/Name :-

पता/Address :.....

या

उक्त

द्वारा

निम्नलिखित की उपस्थिति में हस्ताक्षरित, मुहरबंद एवं प्रदत्त :

OR

SIGNED, SEALED AND DELIVERED

By the said

In the presence of :

नाम/ Name :-

पता/Address:..... :-

न्यासी मंडल की सामान्य मुद्रा निम्नलिखित की उपस्थिति में इस पर अंकित की गई :

The Common Seal of the Trustees was hereunto affixed in the presence of :

नाम / Name :-

पता / Address :.....

भारत के किसी राष्ट्रीयकृत बैंक की, यथास्थिति, कोलकाता/हल्दिया शाखा द्वारा नकदी प्रतिभूति जमाराशि के बदले रु.50/- के या इंजीनियर/न्यासी मंडल के विधिक सलाहकार द्वारा यथा विनिश्चय किए गए न्यायिकेतर स्टांप पेपर पर जारी किए जानेवाले अप्रतिसंहरणीय बैंक गारंटी (निष्पादन बांड) का प्रोफार्मा।

Proforma Of Irrevocable Bank Guarantee (PERFORMANCE BOND) in lieu of cash Security Deposit, to be issued by the Kolkata/ Haldia Branch, as the case may be, of any nationalised Bank of India on Non-Judicial Stamp Paper worth Rs 50/- or as decided by the Engineer/ Legal Adviser of the Trustees.

संदर्भ/Ref.बैंक गारंटी सं./Bank Guarantee No.....

प्रति/To

कोलकाता पत्तन का न्यासी मंडल/The Board of Trustees for the Port of Kolkata,
15, स्ट्रैंड रोड/Strand Road
कोलकाता/Kolkata - 700 001

प्रिय महोदय / Dear Sirs,

कोलकाता पत्तन के न्यासी मंडल द्वारा (जिसे इसमें इसके पश्चात् "नियोक्ता" कहा गया है और इस अभिव्यक्ति में जबतक उसके संदर्भ या अर्थ के प्रतिकूल न हो तबतक इसमें उसके उत्तराधिकारी, प्रशासक और समनुदेशिती शामिल समझे जाएंगे) -----को, जिसका रजिस्ट्रीकृत कार्यालय -----में है (जिसे इसमें इसके पश्चात् "संविदाकार" कहा गया है और इस अभिव्यक्ति में जबतक उसके संदर्भ या अर्थ के प्रतिकूल न हो तबतक इसमें उसके उत्तराधिकारी, प्रशासक, निष्पादक और समनुदेशिती शामिल समझे जाएंगे), दिनांक-----के नियोक्ता का कार्यालय आदेश जारी कर एक संविदा अधिनिर्णीत किए जाने, और संविदाकार द्वारा उसे स्पष्टतः स्वीकार किए जाने पर "

" के लिए रु.----- मूल्य के दिनांक -----के अधिनिर्णय सं.-----से संबंधित एक 'संविदा' का निर्माण किए जाने, तथा संविदाकार द्वारा नियोक्ता को रु.----- (रुपये -----मात्र) के बराबर संपूर्ण संविदा के यथार्थ निष्पादन के लिए संविदा निष्पादन गारंटी परिसिद्ध करने के लिए सहमत होने के प्रतिफलस्वरूप

In consideration of the Board of Trustees For the Port of Kolkata, - (hereinafter referred to as the " EMPLOYER" which expression shall unless repugnant to the context or meaning thereof include its successors, administrators and assigns) having awarded to -----, with registered office at----- (hereinafter referred to as the "CONTRACTOR " which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators, executors and assigns) a CONTRACT by issue of EMPLOYER'S work order dated _____ the same having been unequivocally accepted by the Contractor resulting in a 'CONTRACT' bearing Letter Of Award No _____ dated----- Valued at Rs-----for " " and the contractor having agreed to prove a Contract performance Guarantee for the faithful performance of the entire Contract equivalent to Rs.----- (rupees ----- only) to the EMPLOYER.

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हम, कोलकाता / हल्दिया स्थित ----- बैंक, जिसका प्रधान कार्यालय -----में है (जिसे इसमें इसके पश्चात् "बैंक" कहा गया है और इस अभिव्यक्ति में जबतक कोई बात उसके संदर्भ या अर्थ के प्रतिकूल न हो तबतक इसमें उसके उत्तराधिकारी, प्रशासक, निष्पादक

एवं समनुदेशिती शामिल समझे जाएंगे) एतद्वारा -----तक किसी समय यथा पूर्वोक्त रु. -----
----- (रूपये -----मात्र) तक संविदाकार द्वारा देय कोई या सभी राशि
नियोक्ता को उसकी मांग पर किसी आपत्ति, आरक्षिति, प्रतिवाद, अवलंबन या अभ्यापत्ति के बिना
और/या **संविदाकार** को निर्दिष्ट किए बिना अदा करने की गारंटी देते हैं एवं वचनबंध करते हैं। नियोक्ता
द्वारा बैंक से की गई ऐसी कोई मांग **नियोक्ता** और **संविदाकार** के बीच कोई मतभेद होते हुए भी या
किसी न्यायालय, अधिकरण, मध्यस्थ या किसी अन्य प्राधिकारी के समक्ष कोई विवाद लंबित होते हुए भी
निश्चयक एवं बाध्यकारी होगी। बैंक नियोक्ता की पूर्व सहमति के बिना इस गारंटी के चालू रहने के
दौरान इसे प्रतिसंहत नहीं करने का वचनबंध करता है तथा आगे करार करता है कि इसमें अंतर्विष्ट गारंटी
नियोक्ता द्वारा अपनी गारंटी उन्मोचित किए जाने तक प्रवर्तनीय बनी रहेगी।

We, the _____ Bank, _____, Kolkata/
Haldia having its Head Office at _____ (hereinafter referred to as the "Bank",
which expression shall unless repugnant to the context or meaning thereof, include its
successors, administrators, executors and assigns) do hereby guarantee and undertake
to pay the Employer on demand any and all monies payable by the Contractor to the
extent of Rs.----- (Rupees _____ only) as aforesaid at any time
upto _____ without any demur, reservation, contest, recourse or protest
and/or without any reference to the CONTRACTOR, Any such demand made by
Employer on the Bank shall be conclusive and binding notwithstanding any difference
between EMPLOYEER and CONTRACTOR or any dispute pending before any Court,
tribunal, Arbitrator or any other Authority. The Bank undertakes not to revoke this
guarantee during its currency without previous consent of employer and further agrees
that the guarantee herein contained shall continue to be enforceable till the Employer
discharges his guarantee.

इस गारंटी के अधीन बैंक के दायित्व को किसी भी तरह से प्रभावित किए बिना **नियोक्ता** को **संविदाकार**
द्वारा **संविदा** के निष्पादन के लिए समय-समय पर समय-सीमा का विस्तार करने की पूर्ण स्वतंत्रता होगी।
इस गारंटी को प्रभावित किए बिना नियोक्ता को उनमें निहित किन्हीं शक्तियों के प्रयोग या संविदाकार के
विरुद्ध रहनेवाले किसी अधिकार को समय-समय पर मुलतवी करने और **नियोक्ता** एवं **संविदाकार** के बीच
संविदा में अंतर्विष्ट या विवक्षित किन्हीं प्रसंविदा को प्रवर्तित करने या प्रवर्तित करने से प्रविरत रहने के
लिए किसी भी समय कोई या अन्य रूप में उनका प्रयोग करने या **नियोक्ता** को उपलब्ध उपचार या
प्रतिभूति के किसी अन्य उपक्रम का प्रयोग करने की पूर्ण स्वतंत्रता होगी । नियोक्ता द्वारा उपर्युक्त
मामले या उनमें से किसी के प्रति निर्देश से या **नियोक्ता** द्वारा किए गए किसी कार्य या लोप या
नियोक्ता द्वारा दर्शित किसी अन्य उदारता या किसी प्रकार के किसी अन्य ऐसे मामले या बात के
कारण, जिसका प्रभाव इस प्रावधान के न रहने पर विधि के अधीन बैंक को मुक्त करना होता, अपनी
स्वतंत्रता के प्रयोग से बैंक इस विलेख के अधीन अपनी बाध्यता से मुक्त नहीं होगा ।

EMPLOYER shall have the fullest liberty without affecting in any way the liability of
the Bank under this guarantee from time to time to extend the time for performance
of the CONTRACT by CONTRACTOR. Employer shall have the fullest liberty,

without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or any right which they might have against Contractor, and to exercise the same at any time in any manner, and other to enforce or to forebear to enforce any covenants, contained or implied, in the CONTRACT between EMPLOYER and CONTRACTOR or any other course of remedy or security available to EMPLOYER . The Bank shall not be released of its obligations under these presents by any exercise by EMPLOYER of its liberty with reference to the matters aforesaid or any of them or by reason of any other acts of omission or commission on the part of employer or any other indulgence shown by EMPLOYER or by any other matter or thing whatsoever which under Law would, but for this provision, have the effect of relieving the bank.

बैंक यह भी करार करता है कि **नियोक्ता** अपने विकल्प पर **संविदाकार** के विरुद्ध कार्यवाही किए बिना और **संविदाकार** के दायित्वों से संबंधित कोई प्रतिभूति या अन्य गारंटी **नियोक्ता** के पास होते हुए भी प्रथमतः मुख्य ऋणी के रूप में बैंक के प्रति गारंटी प्रवर्तित कराने का हकदार होगा ।

The Bank also agreed that EMPLOYER at its option shall be entitled to enforce this Guarantee against the Bank as principal debtor, in the first instance without proceeding against CONTRACTOR and notwithstanding any security or other guarantee that EMPLOYER may have in relation to the CONTRACTOR'S liabilities.

इसमें इसके ऊपर अंतर्विष्ट किसी बात के होते हुए भी इस गारंटी के अधीन हमारा दायित्व रु.-----
------(रुपये -----मात्र) तक निर्बंधित है और यह -----
-----सहित एवं तक प्रवृत्त बनी रहेगी तथा यह समयसमय पर ऐसी अवधि के लिए विस्तारित की जाएगी जिसकी ओर से यह गारंटी दी गई है ।

Notwithstanding anything contained herein above our liability under this guarantee is restricted to Rs

(rupees only) and it shall remain in force up to and including and shall be extended from time to time for such period, on whose behalf this guarantee has been given.

आज वर्ष 20-----के -----के -----दिन को-----में

Dated, this day of20 at

साक्षीगण/WITNESSES

(हस्ताक्षर/Signature) (हस्ताक्षर/Signature)

(नाम/Name) (नाम/Name)

(कार्यालय का पता/Official address)

(बैंक की मोहर सहित पदनाम)
Designation with Bank Stamp

+अटर्नी अधिकार सं.-----के अनुसार अटर्नी
Attorney as per power of Attorney No.

दिनांक/Dated-----

कोलकाता पत्तन न्यास(केओपीटी), जिसे इसमें इसके पश्चात् "प्रिंसिपल/नियोक्ता" कहा गया है
और

-----, जिसे इसमें इसके पश्चात् "बोली लगानेवाला/संविदाकार" कहा गया है
के बीच

सत्यनिष्ठा समझौता

Integrity Pact

Between

Kolkata Port Trust (KoPT) hereinafter referred to as "**The Principal/ Employer**"

And

..... hereinafter referred to as "**The Bidder/Contractor**"

उद्देशिका/Preamble

प्रिंसिपल निर्धारित संस्थागत प्रक्रियाओं के अधीन के लिए संविदा अधिनिर्णीत करने का इरादा रखता है। प्रिंसिपल देश की सभी सुसंगत विधियों, नियमों, विनियमों, संसाधनों के आर्थिक उपयोग और अपने बोली लगानेवाले(लों) और / या संविदाकार(रों) के साथ अपने संबंधों में निष्पक्षता / पारदर्शिता के पूर्ण अनुपालन को महत्व देता है।

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The Principal intends to award, under laid down organizational procedures, contract/s for The Principal values full compliances with all relevant laws

of the land, rules, regulations, economic use of resources and of fairness/transparency in its relations with its Bidder(s) and/or Contractor(s).

इन लक्ष्यों को प्राप्त करने के लिए प्रिंसिपल द्वारा नियुक्त एक स्वतंत्र बाहरी मॉनीटर (आईईएम) उपर्युक्त सिद्धांतों के अनुपालन हेतु निविदा प्रक्रिया और संविदा के निष्पादन की निगरानी करेगा।

In order to achieve these goals, an Independent External Monitor (IEM) appointed by the principal, will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

अतः अब

NOW, THEREFORE,

निम्नलिखित उद्देश्य की पूर्ति के लिए की जानेवाली संविदा के चालू रहने के पूर्व उसके दौरान एवं बाद किसी प्रभाव / पूर्वाग्रहयुक्त संव्यवहार से मुक्त निष्पक्ष एवं पारदर्शी प्रणाली अपनाकर भ्रष्टाचार के सभी प्रकारों से बचने के लिए -

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

प्रिंसिपल/नियोक्ता को उच्च लागत और ऐसे कार्य/उपापन/निपटान पर भ्रष्टाचार के विरूपणकारी प्रभाव से बचकर परिभाषित विनिर्देशों/कार्य के दायरे के अनुरूप प्रतिस्पर्धात्मक मूल्य पर वांछित स्टोर/ उपकरण प्राप्त करने/उनका निपटान करने और/या संविदागत कार्य निष्पादित कराने में समर्थ बनाने तथा **बोली लगानेवाले/संविदाकार** को यह आश्वासन देकर संविदा प्राप्त करने में रिश्वत देने या किसी अन्य भ्रष्ट कार्य में लिप्त होने से बचाने, जिससे उनके प्रतिद्वंद्वी भी रिश्वत देने या अन्य भ्रष्ट कार्य में लिप्त नहीं होंगे, तथा **प्रिंसिपल/नियोक्ता** निम्नलिखित पारदर्शी प्रक्रिया अपनाकर अपने पदाधिकारियों के किसी भी प्रकार के भ्रष्टाचार पर रोक लगाने के लिए प्रतिबद्ध होंगे।

Enabling the PRINCIPAL/EMPLOYER to get the contractual work executed and/or to obtain/dispose the desired said stores/ equipment at a competitive price in conformity with the defined specifications/ scope of work by avoiding the high cost and the distortionary impact of corruption on such work /procurement/ disposal and Enabling BIDDERS/ CONTRACTORS to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the PRINCIPAL/EMPLOYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

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खंड/Section 1 - प्रिंसिपल/नियोक्ता की प्रतिबद्धता/Commitments of the Principal/ Employer

(1) प्रिंसिपल, भ्रष्टाचार को रोकने और निम्नलिखित सिद्धांतों का पालन करने हेतु आवश्यक कदम उठाने के लिए प्रतिबद्ध है :

The Principal commits itself to take measures necessary to prevent corruption and to observe the following principles:

क. प्रिंसिपल का कोई भी कर्मचारी, व्यक्तिगत रूप से या परिवार के सदस्यों के जरिए निविदा के लिए या किसी संविदा के निष्पादन हेतु स्वयं या किसी अन्य पक्ष के लिए किसी ऐसी सामग्री या अनावश्यक हितलाभ की मांग नहीं करेगा, उसके लिए वचन नहीं लेगा या उसे स्वीकार नहीं करेगा जिसका वह विधिक रूप से हकदार नहीं है।

a. No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

ख. प्रिंसिपल, निविदा प्रक्रिया के दौरान सभी बोली लगानेवाले (लों) से निष्पक्ष और युक्तियुक्त व्यवहार करेगा। प्रिंसिपल, विशेष रूप से, निविदा प्रक्रिया के दौरान और उससे पहले सभी बोली लगानेवाले(लों)

को समान जानकारी प्रदान करेगा और किन्हीं बोली लगानेवाले(लों) को ऐसी गोपनीय/अतिरिक्त जानकारी प्रदान नहीं करेगा जिसके जरिए बोली लगानेवाला(ले) निविदा प्रक्रिया या संविदा के निष्पादन के संबंध में लाभ प्राप्त कर सकें ।

b. The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will, in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential/additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

ग. प्रिंसिपल सभी ज्ञात पूर्वाग्रहग्रस्त व्यक्तियों को उक्त प्रक्रिया से बाहर कर देगा ।

c. The Principal will exclude from the process all known prejudiced persons.

(2) यदि प्रिंसिपल को अपने किसी कर्मचारी के ऐसे आचरण के संबंध में जानकारी प्राप्त होती है जो भारतीय दंड संहिता (आईपीसी) / भ्रष्टाचार निवारण (पीसी) अधिनियम के अधीन एक दंडिक अपराध है या यदि इस संबंध में कोई पर्याप्त संदेह होता है, तो प्रिंसिपल, मुख्य सतर्कता अधिकारी को सूचित करेगा और इसके अतिरिक्त अनुशासनात्मक कार्रवाई शुरू कर सकता है ।

If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the Indian Penal Code (IPC)/Prevention of Corruption (PC) Act, or if there be a substantive suspicion in this regard, the Principal will inform the Chief Vigilance Officer and in addition can initiate disciplinary actions.

खंड/Section-2 - बोली लगानेवाले(वालों)/संविदाकार(रों) की प्रतिबद्धता

Commitments of the Bidder(s) / Contractor(s)

(1) बोली लगानेवाला(ले) / संविदाकार(गण) भ्रष्टाचार को रोकने के लिए आवश्यक सभी उपाय करने हेतु प्रतिबद्ध है। वह/वे निविदा प्रक्रिया में अपनी सहभागिता एवं संविदा के निष्पादन के दौरान निम्नलिखित सिद्धांतों का पालन करने के लिए प्रतिबद्ध है/हैं।

The Bidder(s)/Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

क. बोली लगानेवाला(ले)/ संविदाकार(गण) निविदा प्रक्रिया के दौरान या संविदा के निष्पादन के दौरान बदले में किसी प्रकार का लाभ प्राप्त करने के लिए सीधे या किसी अन्य व्यक्ति या फर्म के जरिए निविदा प्रक्रिया या संविदा के निष्पादन में संलग्न प्रिंसिपल के किसी कर्मचारी या किसी अन्य व्यक्ति को कोई ऐसी सामग्री या अन्य हितलाभ नहीं देगा/देंगे, उसके लिए प्रस्ताव नहीं करेगा/करेंगे, वचन नहीं देगा/देंगे जिसका वह/वे विधिक रूप से हकदार नहीं है/हैं।

a. The Bidder(s) /Contractor(s) will not directly or through any other person or firm, offer, promise or give to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material or other benefit which he/she is not legally entitled to, in order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

ख. बोली लगानेवाला(ले)/संविदाकार(गण) अन्य बोली लगानेवालों के साथ, औपचारिक या अनौपचारिक, कोई अप्रकटित करार या समझौता नहीं करेगा/करेंगे। यह प्रतिस्पर्धा को रोकने या बोली प्रक्रिया में कार्टलाइजेशन लागू करने के लिए विशेष रूप से कीमतों, विनिर्देशों, प्रमाणीकरण, समनुषंगी संविदा, बोली के प्रस्तुतीकरण या गैर-प्रस्तुतीकरण या किन्हीं अन्य कार्यों पर लागू होता है।

b. The Bidder(s)/Contractor(s) will not enter with other Bidders into any undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contract, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

ग. बोली लगानेवाला(ले)/संविदाकार(गण) सुसंगत आईपीसी/पीसी अधिनियम के अधीन कोई अपराध नहीं करेगा/करेंगे ; इसके अतिरिक्त बोली लगानेवाला(ले)/ संविदाकार(गण) प्रतिस्पर्धा या निजी लाभ के प्रयोजनार्थ अंतर्विष्ट या इलेक्ट्रॉनिक रूप से प्रेषित जानकारी सहित योजनाओं, तकनीकी प्रस्तावों और कारबार के ब्योरे के बारे में कारबार संबंध के अंश के रूप में प्रिंसिपल द्वारा प्रदान की गई किसी जानकारी या दस्तावेज़ का अनुचित उपयोग नहीं करेगा/करेंगे या अन्य को नहीं देगा/देंगे।

c. The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act; further the Bidder(s)/Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

घ. विदेशी मूल का बोली लगानेवाला(ले)/संविदाकार(गण) भारत में एजेंटों / प्रतिनिधियों के, यदि कोई हों, नाम और पते का प्रकटीकरण करेगा/करेंगे। इसी प्रकार भारतीय राष्ट्रीयताप्राप्त बोलीलगानेवाला(ले) संविदाकार(गण) विदेशी प्रिंसिपल के,यदि कोई हों, नाम और पते प्रस्तुत करेगा/करेंगे। बोली लगानेवाले(लों)/संविदाकार(रों) द्वारा "विदेशी आपूर्तिकर्ताओं के भारतीय एजेंट से संबंधित दिशानिर्देश" में यथा उल्लिखित अतिरिक्त ब्योरे का प्रकटीकरण किया जाएगा। इसके अतिरिक्त, दिशानिर्देशों में यथाउल्लिखित भारतीय एजेंट / प्रतिनिधि को किए गए सभी भुगतान भारतीय रुपए में ही होंगे। "विदेशी आपूर्तिकर्ता के भारतीय एजेंट से संबंधित दिशानिर्देश" की प्रतिलिपि अनुलग्नक-क के रूप में संलग्न और चिह्नित की गई है।

d. The Bidder(s)/Contractor(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly the Bidder(s)/Contractor(s) of Indian Nationality shall furnish the name and address of the foreign principles, if any. Further details as mentioned in the "Guidelines on Indian Agents of Foreign Suppliers" shall be disclosed by the Bidder(s)/Contractor(s). Further, as mentioned in the Guidelines, all the payments made to the Indian agent/representative have to be in Indian Rupees only. Copy of the "Guidelines on Indian Agents of Foreign Suppliers" is annexed and marked as Annex-A.

ड. बोली लगानेवाला/(ले)/संविदाकार(गण) अपनी बोली प्रस्तुत करते समय संविदा अधिनिर्णीत किए जाने के संबंध में ऐसे सभी भुगतान का प्रकटीकरण करेगा /करेंगे जो उन्होंने एजेंटों,दलालों या किन्हीं अन्य बिचौलिये को किया है, करने के लिए प्रतिबद्ध हैं या करने का इरादा रखते हैं।

e. The Bidder(s)/Contractor(s) will when presenting his bid, disclose any and all payments he has made, is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

(2). बोली लगानेवाला(ले)/संविदाकार(गण) अन्य व्यक्तियों को उपरिलिखित अपराध करने के लिए नहीं उकसाएगा/ उकसाएंगे या ऐसे अपराध करने में सहायक नहीं होगा/होंगे।

The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

खंड / Section- 3-निविदा प्रक्रिया से निरहता और भविष्य की संविदाओं से अपवर्जन

Disqualification from tender process and exclusion from future Contracts

यदि अधिनिर्णय के पूर्व या कार्यनिष्पादन के दौरान बोली लगानेवाला(ले) / संविदाकार(गण) उपर्युक्त खंड-2 के अतिक्रमण के जरिए या किसी अन्य रूप में, यथा अपनी संबंधित विश्वस्तता या विश्वसनीयता भंग करता है/करते हैं तो प्रिंसिपल निविदा प्रक्रिया से बोली लगानेवाला(ले) / संविदाकार(गण) को निरहित करने या जैसा उपयुक्त समझे, वैसी कार्रवाई करने का हकदार है।

If the Bidder(s)/Contractor(s) before award or during execution has committed a transgression through a violation of Section 2 above, or in any other form such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidder(s)/Contractor(s) from the tender process or take action as considered appropriate.

खंड / Section 4 - नुकसानी के लिए प्रतिकर / Compensation for damages

(1) यदि प्रिंसिपल ने बोली लगानेवाले(लों) को खंड 3 के अनुसार अधिनिर्णय से पहले निविदा प्रक्रिया से निरहित कर दिया है तो प्रिंसिपल बयाना जमाराशि /बोली प्रतिभूति के बराबर राशि की मांग करने एवं नुकसानी की वसूली करने का हकदार है।

If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/Bid Security.

(2) यदि खंड 3 के अनुसार प्रिंसिपल ने संविदा का पर्यवसान कर दिया है या यदि खंड 3 के अनुसार प्रिंसिपल संविदा का पर्यवसान करने का हकदार है तो प्रिंसिपल संविदाकार से संविदा मूल्य की परिनिर्धारित नुकसानी या निष्पादन बैंक गारंटी के बराबर राशि की मांग करने एवं वसूल करने का हकदार होगा ।

If the Principal has terminated the contract according to Section 3 or if the Principal is entitled to terminate the contract according to Section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages of the contract value or the amount equivalent to Performance Bank Guarantee.

खंड/Section- 5 पूर्वतन अतिक्रमण/Previous transgression

(1) बोली लगानेवाला यह घोषित करता है कि सत्यनिष्ठा समझौते पर हस्ताक्षर करने की तारीख से पिछले 3 वर्षों में भ्रष्टाचार विरोधी दृष्टिकोण के समनुरूप किसी देश में किसी अन्य कंपनी या भारत में किसी अन्य सार्वजनिक क्षेत्र के उपक्रम / उद्यम, महापत्तन, सरकारी विभागों के साथ कोई पूर्व अतिक्रमण नहीं हुआ है जो निविदा प्रक्रिया से उसके बहिष्कार को सही साबित कर सकता है।

The Bidder declares that no previous transgressions occurred in the last 3 years from the date of signing the Integrity pact with any other Company in any country conforming to the anti corruption approach or with any other Public Sector Undertaking / Enterprise in India, Major Ports/ Govt. Departments of India that could justify his exclusion from the tender process.

(2) यदि बोली लगानेवाला इस विषय पर गलत विवरण देता है, तो उसे निविदा प्रक्रिया से निरहित किया जा सकता है या उसपर ऐसी कार्रवाई की जा सकती है जो उचित समझी जाए।

If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as considered appropriate.

खंड/Section 6- सभी बोली लगानेवालों/संविदाकारों/उप-संविदाकारों के साथ समान व्यवहार
Equal treatment of all Bidders/Contractors/Sub-Contractors

(1) बोली लगानेवाला(ले)/ संविदाकार(गण) सभी उप-संविदाकारों से इस सत्यनिष्ठा समझौते के अनुरूप वचनबद्धता की मांग करने और संविदा हस्ताक्षरित करने से पहले प्रिंसिपल के समक्ष उसे प्रस्तुत करने का वचनबंध करता है/करते हैं।

The Bidder(s)/Contractor(s) undertake(s) to demand from all subcontractors a commitment in conformity with this Integrity Pact, and to submit it to the Principal before contract signing.

(2) प्रिंसिपल सभी बोली लगानेवालों, संविदाकारों और उप-संविदाकारों के साथ इसी तरह की समान शर्तों पर करार करेगा ।

The Principal, will enter into agreements with identical conditions as this one with all Bidders, Contractors and Sub-contractors.

(3) प्रिंसिपल ऐसे सभी बोली लगानेवालों को निविदा प्रक्रिया से निरहित करेगा जो इस समझौते पर हस्ताक्षर नहीं करते हैं या इसके प्रावधानों का अतिक्रमण करते हैं।

The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

खंड/Section 7- अतिक्रमणकर्ता बोली लगानेवाले(लों)/संविदाकार(रों)/उप-संविदाकार(रों)
के विरुद्ध अन्य विधिक कार्रवाई
Other Legal actions against violating Bidder(s)/ Contractor(s)/ Sub Contractor(s)

इस सत्यनिष्ठा समझौते में अनुबद्ध कार्रवाई ऐसी किसी अन्य विधिक कार्रवाई पर प्रतिकूल प्रभाव डाले बिना है जो किसी सिविल या दांडिक कार्यवाही से संबंधित प्रवृत्त वर्तमान विधि के उपबंधों के अनुसार की जा सकती है।

The actions stipulated in this Integrity pact are without prejudice to any other legal action that may follow in accordance with provisions of the extant law in force relating to any civil or criminal proceedings.

खंड/Section 8 - स्वतंत्र बाहरी मानीटर (आईईएम) की भूमिका

Role of Independent External Monitor(IEM):

(क) मानीटरों का कार्य स्वतंत्र और निष्पक्ष रूप से इस बात की समीक्षा करना होगा कि यदि पक्षकार इस समझौते के अधीन बाध्यताओं का पालन करते हैं तो किस सीमा तक।

(a) The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this pact.

(ख) मॉनीटर पक्षकारों के प्रतिनिधियों के अनुदेशों के अधीन नहीं होंगे और वे अपना कार्य निष्पक्ष और स्वतंत्र रूप से करेंगे।

(b) The Monitors shall not be subject to instructions by the representatives of the parties and shall perform their functions neutrally and independently.

(ग) दोनों पक्षकार स्वीकार करते हैं कि मॉनीटर के पास संविदा से संबंधित सभी दस्तावेजों तक पहुँच का अधिकार है।

(c) Both the parties accept that the Monitors have the right to access all the documents relating to the contract.

(घ) जैसे ही मॉनीटर यह देखता है या उसके पास यह विश्वास करने का कारण होता है कि इस समझौते का अतिक्रमण हुआ है तो वह उसकी सूचना प्रिंसिपल द्वारा नामनिर्दिष्ट प्राधिकारी एवं कोलकाता पत्तन न्यास के मुख्य सतर्कता अधिकारी को देगा ।

(d) As soon as the Monitor notices, or has reason to believe, a violation of this pact, he will so inform the authority designated by the Principal and the Chief Vigilance Officer of Kolkata Prot Trust.

(ङ) **बोली लगानेवाला(ले)/संविदाकार(गण)** स्वीकार करता है/करते हैं कि मॉनीटर को **बोली लगानेवाले/संविदाकार** द्वारा उपलब्ध कराए गए दस्तावेजों सहित **प्रिंसिपल** के सभी संविदा दस्तावेजों तक निर्बंधन के बिना पहुँच का अधिकार है। **बोली लगानेवाला/संविदाकार** मॉनीटर को भी उसके अनुरोध और वैध हित के प्रदर्शन पर अपनी संविदा दस्तावेज तक, यदि कोई हो, अनिर्बंधित और अशर्त पहुँच की स्वीकृति देगा। यह उप-ठेकेदारों के लिए भी लागू है। मॉनीटर, बोली लगानेवाले/संविदाकार/उप-संविदाकार (रौं) की जानकारी और दस्तावेजों की गोपनीयता मानने के लिए संविदागत दायित्व के अधीन होगा।

(e) The BIDDER/ CONTRACTOR(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the PRINCIPAL including that provided by the BIDDER/ CONTRACTOR. The BIDDER/ CONTRACTOR will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation, if any. The same is applicable to sub-contractors. The Monitor shall be under contractual obligation to treat the information and documents of the Bidder/Contractor/ Sub-contractor(s) with confidentiality.

(च) प्रिंसिपल/नियोक्ता पक्षकारों के बीच होनेवाली संविदा से संबंधित सभी बैठकों के बारे में मॉनीटर को पर्याप्त जानकारी प्रदान करेगा, बशर्ते ऐसी बैठकों का प्रभाव प्रिंसिपल और संविदाकार के बीच संविदागत संबंधों पर पड़े। पक्षकार मॉनीटर को ऐसी बैठकों में भाग लेने का विकल्प प्रदान करते हैं।

(f) The Principal/ Employer will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor, the option to participate in such meetings.

(छ) मॉनीटर प्रिंसिपल/नियोक्ता/बोली लगानेवाले/संविदाकार द्वारा उसे दिए गए निर्देश या सूचना की तारीख से 8 से 10 सप्ताह के भीतर प्रिंसिपल/नियोक्ता/ कोलकाता पत्तन न्यास के मुख्य सतर्कता अधिकारी द्वारा नामनिर्दिष्ट प्राधिकारी को एक लिखित रिपोर्ट प्रस्तुत करेगा और प्रयोजन होने पर समस्यात्मक स्थिति को सुधारने के लिए प्रस्ताव प्रस्तुत करेगा। **बोली लगानेवाला/संविदाकार** इस समझौते के प्रयोजनार्थ नियुक्त स्वतंत्र बाहरी मॉनीटर(रों) से संपर्क कर सकता है।

(g) The Monitor will submit a written report to the designated Authority of Principal/ Employer/ Chief Vigilance Officer of Kolkata Port Trust within 8 to 10 weeks from the date of reference or intimation to him by the Principal/ Employer/ Bidder/ Contractor and should the occasion arise, submit proposals for correcting problematic situation. BIDDER/ CONTRACTOR can approach the Independent External Monitor (s) appointed for the purposes of this Pact.

(ज) जैसे ही मॉनीटर को इस इस करार का अतिक्रमण दिखाई देता है या दिखाई देने का विश्वास होता है, वह प्रिंसिपल के प्रबंधन को उसकी सूचना देगा और प्रबंधन से समाप्त करने या सुधारात्मक कार्रवाई करने या अन्य सुसंगत कार्रवाई करने का अनुरोध करेगा। इस संबंध में मॉनीटर गैर-बाध्यकारी सिफारिशें प्रस्तुत कर सकता है। इससे परे, मॉनीटर को पक्षकारों से यह मांग करने का कोई अधिकार नहीं है कि वे किसी विशेष तरीके से कार्य करें, कार्रवाई से विरत रहें या कार्रवाई होने दें।

(h) As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or to take corrective action, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

(झ) यदि मॉनीटर ने सुसंगत आईपीसी/पीसीए के अधीन किसी अपराध के प्रमाणित संदेह के बारे में प्रिंसिपल को रिपोर्ट की है और प्रिंसिपल/नियोक्ता ने युक्तियुक्त समय के भीतर ऐसे अपराध के विरुद्ध अग्रसर होने के लिए कोई प्रत्यक्ष कार्रवाई नहीं की है या मुख्य सतर्कता अधिकारी को रिपोर्ट नहीं की है, तो मॉनीटर यह जानकारी सीधे केंद्रीय सतर्कता आयुक्त, भारत सरकार के पास भेज सकता है।

(i) If the Monitor has reported to the Principal substantiated suspicion of an offence under the relevant IPC/PCA, and the Principal/ Employer has not, within reasonable time, taken visible action to proceed against such offence or reported to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

(ज) 'मॉनीटर' शब्द में एकवचन और बहुवचन दोनों शामिल होंगे

(j) The word 'Monitor' would include both singular and plural.

खंड/Section 9 - अन्वेषण की सुविधा/Facilitation of Investigation:

इस समझौते के किन्हीं प्रावधान या कमीशन के भुगतान के अतिक्रमण के किसी आरोप के मामले में प्रिंसिपल/नियोक्ता या उसके अभिकरण बोली लगानेवाले/संविदाकार की लेखा-बहियों सहित उनके सभी दस्तावेजों की जांच करने के हकदार होंगे तथा **बोली लगानेवाला/संविदाकार** आवश्यक जानकारी और दस्तावेज **अंग्रेजी में** उपलब्ध कराएगा एवं ऐसी जांच के प्रयोजनार्थ सभी संभव सहायता करेगा ।

In case of any allegation of violation of any provisions of this Pact or payment of commission, the PRINCIPAL/EMPLOYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER/CONTRACTORS and the BIDDER/CONTRACTOR shall provide necessary information and documents **in English** and shall extend all possible help for the purpose of such examination.

खंड/Section 10 - समझौते की अवधि/Pact Duration:

यह समझौता तब शुरू होता है जब दोनों पक्षकार विधिक रूप से इसे हस्ताक्षरित करते हैं और इसका विस्तार 2 वर्ष तक या वारंटी अवधि सहित संविदा के पूर्ण निष्पादन तक, इनमें से जो भी बाद में हो, होगा। यदि बोली लगानेवाला/संविदाकार असफल रहता है, तो यह सत्यनिष्ठा समझौता संविदा हस्ताक्षरित किए जाने की तारीख से 6 महीने के बाद समाप्त हो जाएगा।

The pact beings with when both parties have legally signed it and will extend upto 2 years or the complete execution of the contract including warranty period whichever is later. In case bidder/contractor is unsuccessful this Integrity Pact shall expire after 6 months from the date of signing of the contract.

यदि इस समय के दौरान कोई दावा किया जाता है/दायर किया जाता है, तो वह तबतक बाध्यकारी होगा और यथा ऊपर निर्दिष्ट इस समझौते के व्यपगत होने के बावजूद वैध बना रहेगा जबतक कि इसे केओपीटी के अध्यक्ष द्वारा खारिज/अवधारित नहीं किया जाता है /

If any claim is made/lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified above, unless it is discharged/determined by Chairman, KoPT.

खंड/Section 11 - अन्य प्रावधान /Other Provisions:

(1) यह करार भारतीय विधि के अध्यक्षीन है। कार्यनिष्पादन और अधिकारिता का स्थान कोलकाता में प्रिंसिपल का रजिस्ट्रीकृत कार्यालय है।

This agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal in Kolkata.

(2) परिवर्तन और पूरक एवं समाप्ति की नोटिस लिखित रूप में अंग्रेजी में तैयार किया जाना अपेक्षित है।

Changes and supplements as well as termination notices need to be made in writing in English.

(3) यदि संविदाकार कोई भागीदारी फर्म या सहायता संघ है, तो यह समझौता सभी भागीदारों या सहायता संघ के सदस्यों द्वारा हस्ताक्षरित होना चाहिए।

If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

(4) यदि इस करार के एक या कई प्रावधान अवैध हो जाते हैं, तो इस करार का शेष वैध रहता है। ऐसे मामले में, पक्षकार अपने मूल आशय के प्रति एक समझौता करने का प्रयास करेंगे।

Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

(प्रिंसिपल के लिए और उसकी ओर से)
(For & on behalf of the Principal)

(बोली लगानेवाले/संविदाकार के लिए और उसकी ओर से)
(For & on behalf of Bidder/Contractor)

(कार्यालय की मुहर)
(Office Seal)

(कार्यालय की मुहर)
(Office Seal)

स्थान/Place :

दिनांक/Date :

साक्षी/Witness 1:

(नाम और पता)
(Name & Address)

साक्षी/Witness 2:

(नाम और पता)
(Name & Address)

अनुबंध-क/ANNEXURE-A

विदेशी आपूर्तिकर्ताओं के भारतीय एजेंटों के लिए दिशानिर्देश

GUIDELINES FOR INDIAN AGENTS OF FOREIGN SUPPLIERS

1.1 सभी निविदाओं के लिए विदेशी आपूर्तिकर्ताओं के भारतीय एजेंटों का अनिवार्य रजिस्ट्रीकरण होगा। जो एजेंट केओपीटी के साथ रजिस्ट्रीकृत नहीं है वह विहित आवेदन-फ़ार्म में रजिस्ट्रीकरण के लिए आवेदन करेगा।

There shall be compulsory registration of Indian agents of Foreign suppliers for all Tenders. An agent who is not registered with KoPT shall apply for registration in the prescribed Application-Form.

1.2 केओपीटी द्वारा आदेश दिए जाने के पूर्व रजिस्ट्रीकृत एजेंट प्रिंसिपल द्वारा प्रदत्त ऐसे प्रमाणपत्र की एक प्रमाणित फोटोस्टैट प्रति (नोटरी पब्लिक द्वारा सम्यक् रूप से प्रमाणित)/मूल प्रति फाइल करेगा जो एजेंसी करार की पुष्टि करता हो एवं एजेंट द्वारा उपभोग की जानेवाली हैसियत उसे प्रदान करता हो तथा प्रिंसिपल द्वारा एजेंट को प्रदान किए जानेवाले कमीशन/पारिश्रमिक/ वेतन/प्रतिधारण-शुल्क की पुष्टि करता हो ।

Registered agents will file an authenticated Photostat copy (duly attested by a Notary Public)/Original certificate of the principal confirming the agency agreement and giving the status being enjoyed by the agent and the commission/remuneration/salary/retainer ship being paid by the principal to the agent before the placement of order by KoPT.

1.3 जहां भारतीय प्रतिनिधि अपने प्रिंसिपल की ओर से सूचित करता है और विदेशी पार्टियां यह कथित करती हैं कि वे भारतीय एजेंटों को कोई कमीशन नहीं दे रही हैं एवं भारतीय प्रतिनिधि वेतन के आधार पर या प्रतिधारक के रूप में कार्य कर रहा है तो आदेश को अंतिम रूप देने के पूर्व पक्षकार(यानी प्रिंसिपल) द्वारा इस आशय का एक लिखित घोषणा-पत्र प्रस्तुत किया जाना चाहिए।

Wherever the Indian representatives have communicated on behalf of their principals and the foreign parties have stated that they are not paying any commission to the Indian agents, and the Indian representative is working on the basis of salary or as retainer, a written declaration to this effect should be submitted by the party (i.e. Principal) before finalizing the order.

2.0 भारत में एजेंटों / प्रतिनिधियों के विवरण का, यदि कोई हो, प्रकटीकरण

DISCLOSURE OF PARTICULARS OF AGENTS/REPRESENTATIVES IN INDIA. IF ANY.

2.1 विदेशी राष्ट्रियता के निविदाकर्ता अपने प्रस्ताव में निम्नलिखित विवरण प्रस्तुत करेंगे:

Tenderers of Foreign nationality shall furnish the following details in their offer:

2.1.1 भारत में एजेंटों / प्रतिनिधियों के,यदि कोई हों, नाम और पते तथा प्रिंसिपल के साथ अभिबंधन के लिए दिए गए प्राधिकरण और प्राधिकार की सीमा । यदि एजेंट / प्रतिनिधि कोई विदेशी कंपनी हो, तो यह पुष्टि की जाए कि वह वास्तविक सारवान कंपनी है और उसके ब्योरे प्रस्तुत किए जाएँ।

The name and address of the agents/representatives in India, if any and the extent of authorization and authority given to commit the Principals. In case the agent/representative be a foreign Company, it is to be conformed whether it is real substantial Company and details of the same shall be furnished.

2.1.2 भारत में ऐसे एजेंटों/प्रतिनिधियों के लिए उक्तथित मूल्य में शामिल कमीशन/पारिश्रमिक की राशि।

The amount of commission/ remuneration included in the quoted price(s) for such agents/ representatives in India.

2.1.3 निविदाकर्ता का इस आशय का पुष्टीकरण कि भारत में उसके एजेंटों/प्रतिनिधियों को देय कमीशन/पारिश्रमिक का, यदि कोई हो, भुगतान केओपीटी द्वारा केवल भारतीय रुपयों में किया जाए ।

Confirmation of the Tenderer that the commission/remuneration if any, payable to his agents/ representatives in India, is to be paid by KoPT in Indian Rupees only.

2.2 भारतीय राष्ट्रियता के निविदाकर्ता अपने प्रस्तावों में निम्नलिखित विवरण प्रस्तुत करेंगे:

Tenderers of Indian Nationality shall furnish the following details in their offers:

2.2.1 विदेशी प्रिंसिपल की राष्ट्रियता और उनकी स्थिति निर्दिष्ट करते हुए यानी क्या वे प्रिंसिपल का प्राधिकार-पत्र धारण करनेवाले निर्माता या निर्माता के एजेंट हैं जिसके द्वारा एजेंट को सीधे या एजेंटों/प्रतिनिधियों के जरिए भारत में निविदा के प्रत्युत्तर में प्रस्ताव प्रस्तुत करने के लिए विशेष रूप से प्राधिकृत किया गया है, उनके नाम और पते ।

The name and address of the foreign principals indicating their nationality as well as their status, i.e. whether manufacturer or agents of manufacturer holding the Letter of Authority of the Principal specifically authorizing the agent to make an offer in India in response to tender either directly or through the agents / representatives.

2.2.2 निविदाकर्ता द्वारा स्वयं के लिए उक्तथित मूल्य में शामिल कमीशन/पारिश्रमिक की राशि।

The amount of commission/remuneration included in the price(s) quoted by the Tenderer for himself.

2.2.3 निविदाकर्ता के विदेशी प्रिंसिपल का इस आशय का पुष्टीकरण कि उक्तथित मूल्य में निविदाकर्ता के लिए आरक्षित कमीशन /पारिश्रमिक का, यदि कोई हो, भुगतान भारत में केओपीटी द्वारा समतुल्य भारतीय रुपये में किया जाए।

Confirmation of the foreign principals of the Tenderer that the commission/remunerations, if any, reserved for the Tenderer in the quoted price(s), is to be paid by KoPT in India in equivalent Indian Rupees.

2.3 किसी भी मामले में, संविदा को कार्यान्वित किए जाने की स्थिति में, भुगतान की शर्तों में संविदा के अधीन बाध्यताओं से मुक्ति के बाद 90 दिन की समाप्ति पर भारत में एजेंटों/प्रतिनिधियों को भारतीय रुपये में देय कमीशन/ पारिश्रमिक के,यदि कोई हो, भुगतान का प्रावधान रहेगा ।

In either case, in the event of contract materializing, the terms of payment will provide for payment of the commission/remuneration, if any payable to the agents/representatives in India in Indian Rupees on expiry of 90 days after the discharge of the obligations under the contract.

2.4 उपर्युक्त पैरा 2.0 में यथापेक्षित सही और विस्तृत जानकारी प्रस्तुत करने में चूक करने से संबंधित निविदा अस्वीकृति के लिए दायी होगी या किसी संविदा के कार्यान्वयन की दशा में वह केओपीटी द्वारा पर्यवसान के लिए दायी होगी। इसके अलावा केओपीटी के साथ कारबार संबंधी लेन-देन पर पाबंदी लगाने के लिए शास्ति या नुकसानी होगी या कथित राशि का भुगतान करना होगा।

Failure to furnish correct and detailed information as called for in paragraph-2.0 above will render the concerned tender liable for rejection or in the event of a contract materializing, the same liable to termination by KoPT. Besides this there would be a penalty of banning business dealings with KoPT or damage or payment of a named sum.

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