

#### NOTICE INVITING TENDER DOCUMENT FOR Tender for Construction of Raw Material godown & Refurbishing of Annex block - NBT/02/2019

National Textile Corporation Limited (W.R.) Mumbai, invite bids for Construction of raw material godown & refurbishing of annex block at New Bhopal Textile Mills, Madhya Pradesh. Sealed tenders are invited from approved and eligible contractors of CPWD/State PWDs/Railways/MES and other Contractors of repute, well established in line and experienced in the execution of similar Spinning Mills of comparable magnitude, who fulfil the terms and conditions of this tender for the following works at Bhopal.

Name of Work	Estimat	EMD (Rs.)	Cost of	Time Allowed for
	ed Cost		Tender	Completion
	(Rs.)		Form (Rs.)	
Tender for Construction of	₹4 Cr.	₹8.00 Lakhs in	₹1000/-	6 Months for
Raw Material godown &		form of DD /	in form of	completing
Refurbishing of Annex		Pay Order	DD / Pay	construction &
block at New Bhopal			Order	utility system with
Textile Mills,				finishing in all
Bhopal, (Madhya Pradesh)				respects.

The Bidders need to meet the following Pre qualifications criteria for being eligible.

- The bidder should have satisfactorily completed at least one industrial project of value Rs. 10 Cr. OR two projects of value Rs. 5 Cr. each OR three projects of value Rs. 2.5 Cr. each in last five financial years.
- 2. Average annual financial turnover should be at least Rs. 10 Cr. during the last 3 year i.e. 2016-17 2017-18 and 2018-19.
- 3. Bidder should submit the Certificate of incorporation of the company or proprietorship certificate or any other relevant document
- 4. The Bidders should have sound financial status, in support of which, the annual turnover statement of the preceding 3 years, Certified Balance sheet of the proceeding 3 years, IT Clearance Certificate for the year 2017-18.
- 5. The bidder shall be a Class I Registered Contractor of CPWD/PWD or equivalent of any State, Central or Quasi Government Institution or reputed contractor having successfully completed Civil construction, Installation of PEB structure, successful installation of utility systems like compressed air piping, water piping, installations of electrical systems, HVAC & AWC systems and fire fighting & sprinkler systems for at least one textile or other industrial project. Project of similar capacity under reputed Consultants in last five years. The bidder shall submit an attested copy of the Registration certificate.

Detailed Tender Documents can be purchased at a cost of Rs. 1,000/- (Non-refundable) by DD/Pay Order drawn on any Nationalized/Scheduled Commercial banks notified by RBI (

excluding co-operative / Rural banks ) in favour of "N.T.C. Ltd. Unit- Western Region" payable at Mumbai during office hours on any working date from 13/06/19 to 03/07/19 from the following address :-

G. M. (Technical/Materials) National Textile Corporation Limited, 3rd Floor, NTC House, 15, N. M. Marg, Ballard Estate, Mumbai – 400 001, Maharashtra Phone: 022- 22686646 / +91 8692823337 (Mr. S Satpute)

Bidders who downloaded the tender document from web site i.e. <u>www.ntcltd.org</u> should submit the prescribed tender fee of Rs. 1,000/-. in form of DD / Pay Order along with EMD of Rs. 8.00 Lakhs is required to be paid by DD/Pay Order drawn on any Nationalized. Scheduled Commercial banks notified by RBI in favour of "**N.T.C. Ltd. Unit- Western Region**" payable at Mumbai along the submission of tender.

Duly filled bids, along with earnest money deposit, sealed & marked in separate envelopes must reach the above address on or before 6.00 p.m. on 3rd July 2019. Bids shall be opened in the presence of bidder's representative who wish to attend at 11.30 a.m. on 4<sup>th</sup> July 2019

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# Section 1: Instruction to Bidders (Page No. 3 to 23)

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# **EXEMPTION FOR EMD & COST OF TENDER**

Concession/Exemption for MSEs Entrepreneurs for granting the MSEs necessary concession/exemptions as per Govt. directives, bidders are requested to submit the copies of registration certificates issued by the Concerned Authorities. The bidder has to specify whether they are Micro or Small Enterprises and if so, whether they are owned by SC/ST Entrepreneurs.

## **IMPLEMENTATION OF INTEGRITY PACT IN NTC**

Bidders are requested to go through the implementation of integrity pact in NTC which is attached as annexure. This tender is hosted on our website: www.ntcltd.org along with the copy of the Integrity Pact, which may be downloaded and submitted dully signed with seal, along with the tender. "Only those venders / bidders, who commit themselves to Integrity Pact would be considered competent to participate in the bidding process.

The name of the independent External monitors (IEM) is Transparency International India. (TII). This tendering process is being monitored by Independent External Monitor, Shri Ashok Kumar Tripathi Retd. District Judge, at Corporation Office of NTC i.e. (5th floor, Core –IV Scope Complex, 7 Lodhi Road, New Delhi- 110003) M. No- 9029020548 / 9911566668, e-mail: atipathi@yahoo.co.in If any party is aggrieved they are free to approach the said IEM in terms of Integrity Pact".

#### ANNEXURE

#### INTEGRITY PACT Between National Textile Corporation Limited (NTC) hereinafter referred to as "The Principal" and

----- herein after referred to as

#### "The Bidder/Contractor"

#### <u>Preamble</u>

The Principal intends to award, under laid down organizational procedures, contract/s for \_\_\_\_\_\_ to \_\_\_\_\_\_ The Principal

Values full compliance 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).

In order to achieve these goals, the Principal will appoint an Independent External Monitor (IEM), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

#### Section 1- Commitments of the Principal

- 1. The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-
- 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.
- 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.
- c. The Principal will exclude from the process all known prejudiced persons.
- 2. If the Principal obtains information on the conduct of any of its employees which is a criminal offence under the IPC/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.

#### Section 2- Commitments of the Bidder(s)/contractor(s)

- 1. The Bidder(s)/Contractor(s) commit themselves 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.
- 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.

- 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 contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 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.
- d. The Bidder(s) /Contractors(s) of foreign origin shall disclose the name and address of the Agents/representatives in India, if any. Similarly the Bidder(s)/Contractors(s) of Indian Nationality shall furnish the name and address of the foreign principals, 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 placed at **Annexure-B1**.
- 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) The Bidder(s)/Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

# Section 3- Disqualification from tender process and exclusion from future contracts.

If the Bidder(s)/Contractor(s), before award or during the 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 per the procedure mentioned in the "Guidelines on Banning of Business Dealings". Copy of the "Guidelines on Banning of Business Dealings" is annexed and marked as **Annexure-B2**.

# **Section 4- Compensation for Damages**

- 1. 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. 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.

# Section 5 – Previous transgression

1. The Bidder declares that no previous transgressions occurred in the last three years with any other Company in any country conforming to the anti- corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

2. If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or action can be taken as per the procedure mentioned in "Guidelines on Banning of Business Dealings."

## Section 6 - Equal treatment of all Bidders / Contractors / Subcontractors

- 1. The Bidder(s)/ Contractor(s) undertake(s) to demand from his subcontractors a commitment in conformity with this Integrity Pact.
- 2. The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.
- 3. The Principal will disqualify from the tender process all bidders who do not sign this Pact or violate its provisions.

#### Section 7 – Criminal charges against violating Bidder(s) /Contractor(s)/ Subcontractor(s) If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the same to the Chief Vigilance Officer.

## Section 8 – Independent External Monitor / Monitors

- 1. The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- 2. The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. It will be obligatory for him to treat the information and documents of the Bidder(s)/ Contractors as confidential. He reports to the Chairman, NTC.
- 3. The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all Project documentation of the Principal including that provided by the Contractor. The Contractor will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to Subcontractors. The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s)/Subcontractor(s) with confidentiality.
- 4. The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the Project 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.
- 5. 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 take corrective action, or to take other relevant action. The monitor can in this regard submit nonbinding 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.
- 6. The Monitor will submit a written report to the Chairman, NTC within 8 to 10 weeks from the date of reference or intimation to him by the *Principal* and, should the occasion arise, submit proposals for correcting problematic situations.

- 7. If the Monitor has reported to the Chairman, NTC, a substantiated suspicion of an offence under relevant IPC/PC Act, and the Chairman NTC has not, within the reasonable time taken visible action to proceed against such offence or reported it to the Chief Vigilance Officer, the Monitor may also transmit this information directly to the Central Vigilance Commissioner.
- 8. The word '**Monitor**' would include both singular and plural. Monitor would be entitled to receive such compensation as may be decided time to time by the CMD/Competent Authority.

#### Section 9 – Pact Duration

This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the contract or contract period (extended if applicable) whichever is later and for all other Bidders 6 months after the contract has been awarded. 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 of NTC.

#### **Section 10 – Other provisions**

- 1. This agreement is subject to Indian Law. Place of performance and jurisdiction is the Registered Office of the Principal, i.e. New Delhi.
- 2. Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- 3. If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- 4. 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.
- 5. In the event of any contradiction between the Integrity Pact and its Annexure, the Clause in the Integrity Pact will prevail."

(For & On behalf of the Principal)

(For & On behalf of Bidder/Contractor) (Office Seal)

Place..... Date.....

Witness 1:

(Name & Address)\_\_\_\_\_

Witness 2:

(Name & Address\_\_\_\_\_

## A. General

#### 1. Introduction & Scope of Work

- (a) National Textile Corporation Ltd is setting up of 20736 spindles Spinning Unit with state of art machineries at place of burnt out synthetic plant at New Bhopal Textile Mills, Bhopal.
- (b) ACivil & PEB Construction work of raw material godown and refurbishing of annex block. It requires strengthening, renovation so that to make it suitably perfect for installation of new 20736 spindles spinning unit. The main area in which strengthening and renovation are required are
  - (i) Civil
  - a. Construction of new raw material godown
  - b. Modifications to existing RCC columns to support new PEB structure
  - c. Construction of new grade slab, flooring & false ceiling
  - d. Renovation/modifications in annex blocks
  - e. Painting and finishing of entire annex block from inside and outside
  - (ii) Construction of new PEB Shed for raw material godown

#### 2. Scope of Bid

- (a) National Textile Corporation Limited (W.R.) Mumbai, (referred to as Employer in these documents) invite bids for construction of raw material godown and refurbishing of annex block at New Bhopal Textile Mills, Bhopal, Madhya Pradesh. Additions and Alterations in existing annex blocks. (As defined in these documents and referred to as "the Works") detailed in Preface. This is a single stage Tender (2 Envelopes System).
- (b) The successful bidder will be expected to complete the works within a period of 6 months including rainy season if applicable.

#### 3. Source of funds

(a) The Works in this contract shall be funded by National Textile Corporation Limited.

#### 4. Eligible Bidders

- (i) The bidder should have satisfactorily completed at least one textile or other industrial project of value Rs. 10 Cr. OR two projects of value Rs. 5 Cr. each OR three projects of value Rs. 2.5 Cr. each in last five financial years.
- (ii) Average annual financial turnover should be at least Rs. 10 Cr. during the last 3 year i.e. 2016-17, 2017-18 and 2018-19.

- (iii) Bidder should submit the Certificate of incorporation of the company or proprietorship certificate or any other relevant document
- (iv) The Bidders should have sound financial status, in support of which, the annual turnover statement of the preceding 3 years, Certified Balance sheet of the proceeding 3 years, IT Clearance Certificate for the year 2017-18.
- (v) The bidder shall be a Class I Registered Contractor of CPWD/PWD or equivalent of any State, Central or Quasi Government Institution or reputed contractor having successfully completed on similar nature of work. Project of similar capacity under reputed Consultants in last five years. The bidder shall submit an attested copy of the Registration certificate.

Note 1: The statements showing the value of existing commitments and ongoing works as well as the stipulated period of completion remaining for each of the works listed should be supported by signed agreements/Purchase Order from clients.

Note 2:- It is Contractors responsibility that all supporting documents & certificates to be attached for qualification criteria.

# 5. **MSME**

As per Gazette of India notification dated 23 March, 2012, MSMEs Party registered under MSME act will be eligible for applicable relaxation subject to meeting the quality and technical specifications described in the tender and their valid registration for the tendered item as a contractor or supplier for construction projects. CONCESSION/EXEMPTION FOR MSES ENTREPRENEURS - EXEMPTION FROM EMD & TENDER COST

For granting the MSEs necessary concession / exemptions as per Govt, directives, bidders are requested to submit the copies of registration certificates issued by the Concerned Authorities. The bidder has to specify whether they are Micro or Small Enterprises and if so, whether they are owned by SC/ST

# 6. Forms of Bid and Qualification Information

(a) All bidders shall fill in Section 2, Forms of Bid and Qualification Information

# 7. One Bid per Bidder

- (a) Each bidder shall submit only one bid for one contract. A bidder who submits or participates in more than one Bid (other than as a Sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.
- (b) Tender documents are not transferable.

# 8. Cost of bidding

(a) The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

9. Site visit

(a) The Bidder may visit the site and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for tender. The costs of visiting the Site shall be at the Bidder's own expense. It is advised to all the bidders to visit the site prior to prebid meeting.

## **B. Bidding Documents**

#### 10. Contents of Bidding Documents

(a) The set of bidding documents comprises the documents listed in the table below and addenda issued in accordance with Clause 11:

Book 1		Invitation for Bids containing Sections as below
Sections	1 2 3 4 5	Instructions to Bidders Forms of Bid and Qualification Information General Conditions of Contract Special Conditions of Contract Appendix
Book 2		Technical Specifications
Book 3		Bill of Quantity
Book 4		Tender Drawings

- (b) Only one set of original bidding document will be provided. The original documents prepared for submission have to be photocopied by the Bidder, for submission together with the Original.
- (c) Each Bidder should submit one copy of BOQ in soft form (USB/CD) enclosed in financial bid.

# 11. Clarification of Bidding Document

- (a) A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by fax at the Employer's address indicated in the invitation to bid. The Employer will respond to any request for clarification which he received earlier than 3 working days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.
- (b) Pre-bid meeting
  - (i) The bidder or his official representative having authorization to attend, is invited to attend a pre-bid meeting which will take place at the office of National Textile Corporation , NTC House, 3rd Floor N.M. Marg, Ballard

Estate, Mumbai – 400 001, Maharashtra State **on 25<sup>th</sup> June 2019** at 11.00 Hours. The purpose of meeting will be to clarify issues if any. The Bidder may send for points of clarifications with respect to tender if any by email to Consultants before Pre- bid meeting after visiting site.

# 12. Amendment of Bidding Documents

- (a) Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing tender addends.
- (b) Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing or by fax to all the purchasers of the bidding documents. Prospective bidders shall acknowledge receipt of each addendum by fax to the Employer. Addenda shall be incorporated in the bids submitted by the Bidder
- (c) To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may extend as necessary the deadline for submission of bids, in accordance with Sub-clause 20 (b) below.

#### C. Preparation of Bids

#### 13. Language of the Bid

(a) All documents relating to the bid shall be in the English language

#### 14. Documents comprising the Bid

- (a) The bid submitted by the bidder shall comprise the following:
  - (i) The Bid (in the format indicated in Section 2) and the Bill of Quantities wherein the Bidder shall fill in the rates; original plus one photocopy
  - (ii) EMD and Qualification Information Form and Documents; original plus one photocopy
  - (iii) Tender document signed & stamped on all pages
  - (iv) Originals only of Specifications and Drawing Volumes duly stamped on all pages by the Bidder
  - (v) Any other materials required to be completed and submitted by bidders in accordance with these instructions

The document shall be filled in without exception

#### 15. Bid Prices

- (a) The contract shall be for the whole of works as described in Sub-Clause 1.1. The Tenderer shall quote his unit rates for the items given in the Bill of Quantities. The unit rate so quoted shall be applicable irrespective of any future change in quantities. Contractor has to quote for all items, if rate for any item/ items not quoted then Bid will be rejected.
- (b) The quoted item rate shall include for all duties, taxes and other levies payable by the Contractor under the contract, and no claim whatsoever, in this respect shall be entertained by the Employer
- (c) The item rate quoted by the bidder shall be fixed during the tenure of the Contract

#### 16. Currencies of Bid and Payment

(a) The rates and the prices given are in Indian Rupees.

#### 17. Bid Validity

(a) Bids shall remain valid for a period not less than 90 (Ninety) days after the date for bid submission specified in Clause 20. A bid corrected by the Bidder as valid for a shorter period shall be rejected by the Employer as non-responsive.

- (b) In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by fax. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid except as provided in 15.(a) hereinafter, but will be required to extend the validity of his bid security for a period of the extension and in compliance with Clause 16 in all response.
- (c) The rates in BOQ shall remain fixed during the extended period of validity/extended period of contract.

# **18. Earnest Money Deposit :**

- (a) The Bidder should submit an EMD of Rs. 8 Lakhs (Rs. Eight Lakhs Only) in the form of Demand Draft/Pay Order. This bid security shall be in favour of National Textile Corporation Limited unit Western Region Mumbai and may be in one of the following forms:
  - (i) Demand draft or Pay order drawn on Nationalized / Scheduled Commercial banks notified by RBI (excluding co-operative / Rural banks) in favour of National Textile Corporation Limited, Mumbai payable at Mumbai
- (b) Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 17.(a) and 17.(b) above shall be rejected by the Employer as non-responsive.
- (c) The EMD of unsuccessful bidders will be returned within 30 days from the end of the bid validity period specified in Sub-Clause 15(a).
- (d) The EMD of the successful bidder will be returned/ discharged when the bidder has signed the Agreement and furnished the required Performance Bank guarantee.
- (e) The EMD may be forfeited
  - (i) If the Bidder withdraws the Bid after Bid opening during the period of Bid validity.
  - (ii) If the Bidder does not accept the correction of the Bid Price, pursuant to Clause 28 or
  - (iii) In the case of a successful Bidder, if the Bidder fails within the specified time limit to
    - a. Sign the Agreement or
    - b. Furnish the required Performance Security
- (f) No interest shall be paid on any EMD/ Performance Bank Guarantee in lieu thereof.

## **19.** Alternative Proposals by Bidders

(a) Alternative bids shall not be considered for any part of the Works.

## 20. Format and Signing of Bid

- (a) The Bidder shall prepare the Bid as specified in clause 13 and following the instruction in clause 20.
- (b) The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the bid where entries or amendments have been made shall be initiated by the person or persons signing the bid.
- (c) The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialled by the person or persons signing the bid.

#### **D.** Submission of Bids

#### 21. Sealing and Marking of bids

(a) There shall be two parts for the bids, part 'A' and part 'B'. The part 'A' shall contain Technical part of the bid and Part 'B' shall contain financial part of the bid. The Bidder shall enclose the original and one photocopy of Part A in one envelope marking it as, Envelope-A, TECHNICAL BID-ORIGINAL. He will then enclose the original and one photocopy of Part-B in another envelope marking it as Envelope B, FINANCIAL BID ORIGINAL. These envelopes shall then be put inside one outer envelope.

#### Part 'A', Technical BID of the bid shall contain

- (i) EMD as per tender requirement. If the EMD is not deposited the tender shall be declared as non-responsive and rejected
- (ii) The Technical Qualification Information indicated in Section 2 duly filled in original and photocopy
- (iii) Conditional Tender will be rejected outright.
- (iv) Originals of tender document duly stamped and initialled on each page by the tenderer as proof of their having scrutinized the documents.

#### Part 'B', Financial bid shall contain

- (i) Form of Bid duly filled in original
- (ii) Book 3 Bill of Quantities wherein the Bidder shall fill in the unit rates in digits and words and each page duly signed and sealed
- (b) The inner and outer envelopes shall
  - (i) Be addressed to the Employer at the following address:
    G. M. (Technical/Materials) National Textile Corporation Limited,
    3rd Floor, NTC House, 15, N. M. Marg, Ballard Estate, Mumbai – 400 001, Maharashtra Phone: 022- 22686646 / +91 8692823337
  - (ii) Bear the following identification
    - a. Bid for Construction of Raw Material godown & Refurbishing of Annex block
    - b. Bid Reference No.: NBT/01/2019
    - c. DO NOT OPEN BEFORE **11.30 Hours on 4th July 2019**
  - (c) In addition to the identification required in Sub-Clause 21(b) , the inner envelopes shall indicate the name and address of bidder to enable the bid to be returned unopened in case it is declared late, pursuant to Clause 22
  - (d) If the outer envelope is not sealed and market as above, <u>the Employer will</u> assume no responsibility for the misplacement or premature opening of the <u>bid.</u>

## 22. Deadline for Submission of the Bids

- (a) Bids must be received by the Employer at the address specified above no later than **6.00 pm on 3rd July 2019**. In the event of the specified date for the submission of bids declared a holiday for the Employer, the Bids will be received up to the appointment time on the next working day.
- (b) The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 11, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

## 23. Late Bids

(a) Any Bid received by the Employer after the deadline prescribed in Clause 21 will be returned unopened to the bidder

## E. Bid Opening and Evaluation

#### 24. Bid Opening

- (a) The Employer will open all the Bids received (except those received late), subject to the Bidder having confirmed to the submittal procedure set out in clause 20., in the presence of the Bidders or their representatives who choose to attend at 11.30 am on 4<sup>th</sup> July 2019. In the event of the specified date of Bid opening being declared a holiday for the Employer, the Bids will be opened at the appointment time and location on the next working day.
- (b) Bids not accompanied by specified EMD shall be considered non responsive and rejected outright.
- (c) The financial bids of only those bidders who have obtained the qualification shall be opened only after evaluating the Technical bids
- (d) The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present during the Bid Opening.

#### 25. Process to be Confidential

(a) Information relating to the examination, clarification, evaluation and comparison of Bids and recommendations for the award of a contract shall not be disclosed t Bidders or any other persons not officially concerned with such process until the award to the successful Bidder had been announced. Any effort by a Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.

#### **26.** Clarification of Bids

- (a) To assist in the examination, evaluations and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including of the unit rates. The request for clarification and the response shall be in writing or by fax, but no change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids in accordance with Clause 28.
- (b) Subject to sub clause 26.(a), no bidder shall contact the employer on any matter relating to its bid from the time of the bid opening to the time the contract is awarded. If the bidder wishes to bring additional information to the notice of employer, he should do so in writing.
- (c) Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decision may result in the rejection of the Bidders' bid.

#### 27. Examination of Bids and Determination of Responsiveness

- (a) Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 4; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding documents.
- (b) A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the Bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality or performance of the Works; (b) which limits in any substantial way, inconsistent with the Bidding documents, the Employer's right or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Bids.
- (c) If a Bid is not substantially responsive, it will be rejected by the Employer and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

#### 28. Correction of Errors

- (a) Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
  - (i) Where there is a discrepancy between rates in figures and in words, the rate in words will govern; and
  - (ii) Where there is a discrepancy between the unit and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern
- (b) The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the Bidder, shall be considered as binding upon the Bidder, if the Bidder does not accept the corrected amount the Bid will be rejected and the Bid security may be forfeited in accordance with Sub-Clause 17.(f)

#### **29.** Evaluation and Comparison of Bids

- (a) The technical proposals shall be evaluated based on the information submitted in the Qualification Information
- (b) Bidder Evaluation

Bidders will be evaluated based on the eligibility criteria.

- (c) The Employer will open, evaluate and compare the financial Bids of only those Bidders determined to be substantially responsive in accordance with Clause 27. The remaining Financial Bids shall be returned unopened.
- (d) The Employer reserves the right to accept or reject any variation, deviation from the bid document, or any alternative offer. Variations, deviations and alternative offers and other factors which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Bid evaluation

# F. Award of Contract

## 30. Award Criteria

(a) Subject to Clause 31, the Employer will evaluate the bid as per qualifying criteria responsive to the Bidding documents and who has offered the lowest evaluated Bid Price. On completion of evaluation the employer will award the contract to the lowest bidder.

## 31. Employer's Right to Accept any Bid and to Reject any or all Bids

(a) Notwithstanding Clause 30, the Employer reserves the right to accept or reject any Bidder or Bidders or any obligation to inform the affected Bidder of Bidders of the grounds for the Employer's action.

## 32. Notification of Award and Signing of Agreement

- (a) The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by fax confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Bid or part of the Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Contract called the "Contract Price").
- (b) The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause 33.
- (c) The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be kept ready for signature of the successful bidder in the office of employer within 15 days of receipt of Letter of Acceptance; the successful Bidder will sign the Agreement and deliver it to the Employer.
- (d) Upon accepting the Performance Security for the Successful Bidder and signing of the agreement, the employer shall issue a LOI / Notice to Proceed' to the Contractor, in which the date of commencement of the Contract shall be indicated.

(e) Upon furnishing of the Performance Security by the successful Bidder, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

# 33. Performance Bank Guarantee

- (a) Within 15 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Security in any of the forms given below for an amount equivalent to 5% of the Contract price.
  - A bank guarantee, Validity should be 12 months from the date of Mobilisation or up to completion of work, whichever is later in the form given in Section 2.
- (b) If the Performance security is provided by the successful Bidder in the form of a Bank Guarantee by a Nationalized Bank
- (c) Failure of the successful bidder to comply with the requirements of sub-clause 33(a) shall constitute a breach of contract, cause for annulment of the award, forfeiture of the bid security, and any such other remedy the Employer ,may take under the contract and the Employer may resort to awarding the contract to the next ranked bidder.

# 34. Mobilisation Advances and Security

(a) The Employer will provide a Mobilisation Advance Payment, maximum 10 % of the Contract Price as stipulated in the Conditions of Contract. , as stated in the Contract Data, against submission of Bank Guarantee 110% of advance amount from Nationalised Bank only, validity of this BG should be 12 months or up to complete recovery of Mobilisation advances.

# **35. Corrupt or Fraudulent Practices**

- (a) The Employer expected the Bidders, Suppliers, Contractors and Consultants; observe the highest standard of ethics during the procurement and execution of such contracts. Therefore, the Employer
  - (i) Defines, for the purpose of this provision, the terms set forth below as follows:
    - a. "corrupt practice" means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the action of the Employer in the procurement process or in contract execution;
    - b. "fraudulent practice" means a misrepresentation or omission of facts in order to influence a procurement process or the execution of a contract;
    - c. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of the Employer, designed to establish bid prices at artificial, non-competitive levels; and

- d. "Coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the procurement process or affect the execution of a contract.
- (ii) Will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive or coercive practices in competing for the Contract in question;

#### SECTION – 2: FORMS OF BID, QUALIFICATION INFORMATION AND LETTER OF ACCEPTANCE, SECURITIES (Page No 24 to 39)

Table of Forms:			).	
-	QUALIFICATION INFORMATION*	25		Form
-	LETTER OF ACCEPTANCE	29	$\overline{}$	
-	NOTICE TO PROCEED WITH THE WORK	30		Formats
-	AGREEMENT FORM	31		
-	BANK GUARANTEE FORMATS	34		

NOTE:-

• THIS FORMS IS TO BE FILLED IN BY THE TENDERER AND RETURNED AS PART OF THIS BID.

#### **Qualification Information**

The information to be filled in by the Bidder in the following pages will be used for purposes of Evaluation of Technical Submission as provided for in Clause 29 of the Instructions of Bidders.

The Contractor shall use this format and prepare the submission in as many pages as he wishes.

Particular care shall be taken to submit certification from the previous clients in support of the Bidder's claims.

1.1 Constitution or legal status of Bidder [*Attach copy*]

Place of registration:

Principal place of business:

Power of attorney of signatory of Bid [Attach]

- 1.2 Turnover in Rs. Crores. (2016-17): \_\_\_\_\_\_ (2017-18): \_\_\_\_\_\_ (2018-19):
- 1.3.1 Work performed as prime contractor (in the same name) on works of a similar nature over the last five years.

Project	Name of	Description	<b>Contract</b>	Value of	Date of	<b>Stipulated</b>	Actual date	Remark
Name	the	<u>of work</u>	<u>no.</u>	<u>contract</u>	issue of	period of	of	<u>explaining</u>
	Employer*			<u>(Rs.</u>	work	<u>completion</u>	completion*	reasons
				Millions)	order			for delays
								and work
								completed

1.3.2 Quantities of work executed as prime contractor (in the same name and style) in the last five years:

Year	Name of the	Name of the	Quantity of wo	Quantity of work performed (cumet/tons/sq m)		
	work	Employer*	RCC WORK	STRUCTURAL	WATERTIGHT	(indicate
			FOR	STEEL WORK	ROOFING	<u>contract Ref</u> )
			BUILDINGS			
2014-2015						
2015-2016						
2016-2017						
2017-2018						
2018-19						

\* Attach certificate(s) from the Client/ Consultant

*# attach certificate from Chartered Accountant* 

1.4 Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

- Description Place & Contract Name and Value of Stipulated Value of Anticipated of work State No. & Date Address of Contract period of works\* date of Employer (Rs. completion completion remaining Millions) to be completed (Rs. Millions) (1) (2) (3)(4) (5) (6) (8)(7)
- (A) Existing commitments and on-going works:

(B) Works for which bids already submitted:

Description	Place &	Name and	Estimated	Stipulated	Date when	Remarks if
of work	State	Address of	value of	period of	decision is	any
		Employer	works (Rs.	completion	expected	
			Millions)	-	-	
(1)	(2)	(3)	(4)	(5)	(6)	(7)

## \* Attach certificate(s) from Client/Consultant

# 1.5 Contractor's Plant and Equipment essential for carrying out the Works shall be listed below

	Item of equipment	Re	equirement	Availa	bility prop	osals
		No.	Capacity	Owned/	Nos/	Age/
				leased/ to	capacit	condition
				be	у	
				procured		
1	Concrete Mini Batching Plant					
2	Mixer with reversible drum					
	Mixer with weigh batcher					
3	Needle vibrators 25mm,40mm, 75mm					
4	Tough Riders					
5	Acquarius make tremix equipment sets					
6	Mechanical screening for sand- set					
7	Poclain/Hitachi Excavator Heavy					
8	JCB excavator					
9	Hydra Crane					
10	D G Set					
11	Vibratory roller					
12	Plate Compactor					
13	Tandem Roller					
14	Sherpa Roller					

15	Water tanker			
16	Tractor/Tippers			
17	Diesel operated Mud Pump			
18	De watering pumps-Elect/Diesel			
19	Grader/Dozer			
20	Welding gen/Rectifiers			
21	Gas cutter equipment sets			
22	Pug cutter			
23	25 meter boom/ 5 Ton Crane			
24	Jim Screw			
25	Ropes/ pulleys/rigs			
26	New laced shuttering boards			
27	Steel staging for slabs and props			
28	Scaffolding			
	Chamfers			
29			ĺ	

1.6 Construction management and QC Organisation, Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data.

Position Name	<u>Minimum</u> Qualification	<u>Years of</u> <u>experience</u>	<u>Years of</u> experience in the				
		<u>(general)</u>	proposed position				
Project Manager							
Site Engineers							
Site Supervisors							
Site Surveyors							
Fabrication Engineer							

- 1.7 A statement regarding the number of Skilled and unskilled workers, the company has on its rolls at the time of tender submission. The statement also should indicate the number of skilled and unskilled workers proposed to be deployed on this project.
- 1.8 Details with appropriate evidence of long span PEB truss/girder fabrication and erection work done successfully in last 5 years.
- 1.9 evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents *[sample format attached]*
- 1.10 Name, address and telephone, telex and fax numbers of the Bidders' bankers who may provide reference if contracted by the Employer.
- 1.11 Information on litigation history in which the Bidder is involved.

Other party(ies)	Employer	Cause of dispute	Amount involved	<u>Remarks showing</u> <u>Present status</u>

- 1.12 Statement of compliance under the requirements of Sub Clause 3.(a) of the instructions to Bidders.
- 1.13 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents.

#### Letter of Acceptance (Letterhead paper of the Employer)

\_\_\_\_-2019

\_\_\_\_\_ [name and address of the Contractor]

Dear Sirs,

То: \_\_\_\_\_

We note that as per bid, you do not intend to subcontract any component of work.

You are hereby requested to furnish Performance Security in form of Bank Guarantee an amount of Rs. --------- within 15 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to ...... and sign the contract, failing which action as stated in Para 33 c of Section 1, clause 33c.

Yours faithfully,

Managing Director Name of the Company

## Issue of Notice to proceed with the work (Letterhead of the Employer)

----- (date)

То

------ (name and address of the Contractor)

Dear Sirs:

Pursuant to your furnishing the requisite security as stipulated in c	clause 33(a) Section
1 and signing of the contract agreement for@	a Bid Price of Rs.
(Rupees	_) you are hereby
instructed to proceed with the execution of the said works in accorda	ance with contract
documents. The date of commencement will be	

Yours faithfully,

G. M. (Technical/Materials)

## Agreement Form

#### Agreement

This agreement, made the \_\_\_\_\_-2019, between Name of the Employer (hereinafter called "the Employer") of the one part and \_\_\_\_\_\_ [name and address of Contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor execute Civil Construction Works of...... (Bid No.\_\_\_\_) (Hereinafter called "the Works") and the Employer has accepted the Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein, at а contract price of Rs. (Rupees )

NOW THIS AGREEMENT WITNESSETH as follows:

- 1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to, and they shall be deemed to form and be read and construed as part of this Agreement.
- 2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
- 3. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying the defects wherein the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.
- 4. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:
  - i) Letter of Acceptance;
  - ii) Contractor's Bid;
  - iii) Book 1 containing Invitation to bid, General Conditions of Contract, Special Conditions of Contract, Appendix
  - iv) Book 2 Technical Specifications;
  - v) Duly filled in Bill of Quantities and Rates-Book 3.
  - vi) Tender Drawings-Book 4.

In witness whereof the parties thereto have caused this Agreement to be executed the day and year first before written.

The Common Seal of

Tender for Co	nstruction of Raw Mater	ial godown &	Refurbishing of A	nnex Block

\_\_\_\_\_

Was hereunto affixed in the presence of: Signed, Sealed and Delivered by the said \_\_\_\_\_\_

In the present of:

Binding Signature of Employer

Binding Signature of Contractor

# Forms of Securities

Approved forms of Securities are attached here with. The performance and Mobilisation Advance are to be given by the successful bidder after the Employer issues the Letter of acceptance.

- Bank Guarantee in lieu of EMD
- Performance Bank Guarantee
- Bank Guarantee for Mobilisation Advance Payment.

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# BANK GUARANTEE IN LIEU OF EARNEST MONEY DEPOSIT

BANK GUARANTEE (To be executed on Stamp Paper of Rs.100/- or such higher value as per this Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Nationalized Bank Issuing the Guarantee.)

To, National Textile Corporation Ltd. (Western Region), NTC House, 15, N. M. Marg, Ballard Estate, Mumbai-400 001

- 1. In consideration of M/s. New Bhopal Textile Mills, Bhopal, Chandbarh Bhopal -462010 (herein called "the Employer") having agreed to extend M/s Contractor incorporated under the provision of the Companies Act, \_\_\_\_ \_demand, under the terms and conditions contained in the Tender No. \_ Dated 2019 (hereinafter called "the said Tender") of Earnest Money Deposit for the due fulfilment by the said Party's of the terms and conditions contained in the said Tender, on the production of a Bank Guarantee for Rs. (Rupees\_\_\_\_\_ Only) name of Bank, address we, ( hereinafter referred to as "the Bank") do to pay to Employer an amount not exceeding Rs. hereby undertake \_(Rupees \_ \_ Only) against any loss of any breach by the said Party of any of the terms and conditions contained in the said tender.
- 2. We\_\_\_\_\_\_ name of Bank do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Employer stating that the amount claimed is due by way of damage caused, to or would be caused to or suffered by the Company by reason of any breach by the said Party of any of the terms of conditions contained in the said Tender or by reason of the party's failure to perform the said Tender. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee.
- 3. We\_\_\_\_\_\_ name of Bank, further agree to the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Tender and that it shall continue to be enforceable till all the dues of the Company under or by virtue of the said Tender have been fully paid and its claims satisfied or discharged or till the I/C G.M. (Technical) National Textile Corporation (W.R.) Ltd, certifies that the terms and conditions of the said tender have been fully and properly carried out by the said Party and accordingly discharge the guarantee. Unless a demand or claim under this Guarantee is made on us in writing on or before the date. \_\_\_\_\_\_ We shall be discharged from all liability under this Guarantee thereafter.
- 4. We\_\_\_\_\_\_name of Bank, further agree with the Company that the Company shall have the fullest liberty without our consents and without affecting in any manner our obligation hereby to vary any of the terms and conditions of the said Tender or the extend time of performance by the said Party from time to time or to postpone for any time or

from time to time any of the powers exercisable by the Company against the said Party and to forbear or enforce any of the terms and conditions relating to the said Tender and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said party or for any forbearance, act of omission on the part of the Company or any indulgence by the Company to the said party or by any such matter of thing whatsoever which under the law relaying to sureties would but for this provision have effect of so relieving us.

5. We, \_\_\_\_\_\_name of Bank, lastly undertake not to revolve this guarantee during its currency except with the previous consent of the Company in writing.

# Notwithstanding anything contained hereinabove:

- a) The liability of the Guarantor under this guarantee is restricted to Rs\_\_\_\_\_\_(Rupees\_\_\_\_\_Only).
- b) This guarantee shall remain enforce until its expiry on \_\_\_\_\_
- c) Unless a suit or action to enforce a claim under this guarantee is made against the rights within \_\_\_\_\_\_ months from the aforesaid date of expiry, i.e. \_\_\_\_\_\_ all the rights of the beneficiary under the said guarantee shall be forfeited and the guarantee shall be released and discharged and discussed from all liabilities thereof.

Witness

For \_\_\_\_\_\_

Signature\_\_\_\_\_

Seal

#### PERFORMANCE BANK GUARANTEE

PERFORMANCE BANK GUARANTEE (To be executed on Stamp Paper of Rs.100/- or such higher value as per this Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Nationalized Bank Issuing the Guarantee.)

In consideration of the National Textile Corporation Limited (Western Region) (hereinafter called "the NTC") having agreed to exempt M/s.\_\_\_\_\_\_ (hereinafter called "the said Contractor(s)" from the demand under the terms and conditions of an agreement dated \_\_\_\_\_\_ made between National Textile Corporation Ltd. (Western Region) and M/s. \_\_\_\_\_\_ for Civil Construction work at New Bhopal Textile Mills, Bhopal, (hereinafter called "the said Agreement") of security deposit for the due fulfilment by the said Contractor(s) of the terms and conditions contained in the said Agreement on production of a bank guarantee for Rs.\_\_\_\_\_\_) only.

We, \_\_\_\_\_ bank (hereinafter referred to as "the Bank") at the request of M/s.\_\_\_\_\_ (Contractors) do hereby undertake to pay to the NTC an amount not exceeding Rs.\_\_\_\_\_ (Rupees \_\_\_\_\_\_

only) against any loss or damage caused to or suffered by the NTC by reason of any breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement.

We, \_\_\_\_\_ Bank do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Government stating that the amount claimed is due by way of loss or damage caused to or is likely to be caused to or suffered by the NTC by reason of breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement or by reason of the Contractor(s) failure to perform the said Agreement. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs.\_\_\_\_\_ (Rupees \_\_\_\_\_\_ only.)

We, \_\_\_\_\_ Bank undertake to pay to the NTC any money so demanded not withstanding any dispute or disputes raised by the Contractor(s) in whether any suit or proceedings before any Court or Tribunal or otherwise, relating thereto our liability under this present being absolute and unequivocal.

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

We, \_\_\_\_\_ Bank further agree that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the existence of the said Agreement and that it shall continue to be enforceable till all the dues of the NTC under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till \_\_\_\_\_\_ whichever is late, or National Textile Corporation Limited has certified that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this Guarantee. Unless a demand or claim under this Guarantee is made on us in writing on or before the \_\_\_\_\_\_ we shall be discharged from all liability under this Guarantee thereafter. We, \_\_\_\_\_ Bank agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance of the said terms and conditions by the said Contractor(s) from time to time, or to postpone for any time or from time to time any of the powers exercisable by the Government against the said Contractor(s) and/or forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor(s) or for any forbearance, act or omission on the part of the Government or any indulgence by the Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision have effect of so relieving us.

The Guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We, \_\_\_\_\_ Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the NTC in writing.

Dated this \_\_\_\_\_ day of \_\_\_\_\_
#### BANK GUARANTEE FOR MOBILISATION ADVANCE PAYMENT

BANK GUARANTEE (ADVANCE) (To be executed on Stamp Paper of Rs.100/- or such higher value as per this Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Nationalized Bank Issuing the Guarantee.)

To, National Textile Corporation Ltd.(Western Region), NTC House, 15, N.M.Marg, Ballard Estate, Mumbai-400 001

With reference to your Letter, Order No......Dated.....Concluded between National Textile Corporation Limited (Western Region) hereinafter referred to as "Employer" and M/s......hereinafter referred to as "The Contractor" for Civil Construction of New Bhopal Textile Mills (NBT) as detailed in the above contract, herein after referred to as "The said contract" and in consideration of the Employer having agreed to make an advance payment, in accordance with the terms of the said contract to the said Contractor. We "The Bank" hereby irrevocably undertake and guarantee to you that if the said Contractor would fail to complete Civil Construction work in conformity with the terms of the said contract for any reason whatsoever or fall to perform the said contract in any respect or should the whole or part of the said on account payment at any time become repayable to you for any reason whatsoever, we shall, on demand and without demur pay to you all and any sum up to a maximum of Rs......

We further agree that the Employer shall be the sole judge as to whether the Contractor has failed to abide by the terms of said contract or has failed to perform the said contract in any respect or the whole part of the on account payment made by the Employer has become repayable.

We further hereby unconditionally undertake to pay the amount due and payable under this guarantee without any demur merely on a demand from the Employer stating the amount claimed. Any such demand made on the bank shall be conclusive and binding upon us. As regards the amount not exceeding Rs...... (Rupees......). We further agree that this Guarantee shall remain in full force for a period of ......Months unless it is released by you, on an application by Contractor made after the Bank Guarantee period has expired or such extended period of Guarantee, whichever is later, provided the Contractor has:

- (a) Completed Civil Construction work its obligations for Civil Construction work under the said Contract and adjusted the advance amount covered under this Guarantee.
- (b) Produced a Certificate of due completion of the aforesaid Civil Construction work under the said Contract.
- (c) Submitted a "No Demand Certificate" signed by your Managing Director/Joint Managing Director.

Should it be necessary to extend this Guarantee beyond the said date we undertake top extend the period of this Guarantee without reference to the Contractor. Immediately after its lodging period or extended lodging period has expired, this document is to be returned to us. No matter whether this document has been returned or not, no claim after the expiry of lodging period/ extended lodging will be accepted.

This Guarantee shall not be affected by any change in the Constitution of the Contractor or us nor shall it be affected by any change in your constitution or by any amalgamation or absorbable by the Absorbing/amalgamated Company or concern.

We further agree that the Employer shall have the fullest liberty without affecting in any way our obligations hereby guaranteed us, as aforesaid, and we hereby expressly waive all our rights of surety ship and other rights if any which are in any way inconsistent with the above or any other provision of the guarantee.

We further agree that the Employer shall be the fullest without affecting in any way our obligation hereunder, with or without our consent or knowledge to vary any of the terms and conditions of the said contract or to extend the time of completion period from time to time or postpone for any time or from time to time any of the powers exercisable by the Employer against the Contractor and either of forbear or enforce any of the terms and conditions relating to the said contract and we shall not be relieved from our liability by reason of any such variation or any indulge or forbearance shown or any act or omission on the part of the Employer or by any such matter or thing whatsoever under the law relating to sureties would but for this provision have the effect of so relieving us.

It shall not be necessary for you to proceed against the Contractor before proceeding against us and the Guarantee herein contained shall be enforceable against us, not withstanding any security which you may obtained or obtain from the Contractor at any time or when proceeding taken against us, hereunder, be outstanding or realized.

We further agree that this Guarantee shall come into force simultaneously with your making the said advance payment to the Contractor and shall not be revoked by us whether before its coming into force or any time during its currency without your previous consent in writing signed by your Managing Director/Joint Managing Director.

Notwithstanding anything contained herein before, our liability under this guarantee is restricted to Rs....(Rupees.....) and it will remain in force upto .....unless a suit to enforce any claim under this Guarantee is filed against us on or before (The claim lodging period should be 60 days beyond the date of expiry of Guarantee, Thus if the Guarantee is valid up to date\_\_\_\_\_\_ the claim lodging period should be \_\_\_\_\_\_, all your rights under this Guarantee shall be forfeited and we shall be relived and discharged from all liabilities there under.

Dated this.....day of .....2019.

COUNTERSIGNED

WITNESS: SIGNATURE: (BANK) NAME:

### SECTION - 3: GENERAL CONDITIONS OF CONTRACT (Page Nos. 40 to 68)

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### 1. Interpretations

In construing these conditions, the specifications, schedule of quantities and the Contract Agreement, the following words shall have the meanings herein assigned to them except, where the subject or context otherwise requires.

- (a) 'EMPLOYER/ OWNER' shall mean National Textile Corporation Ltd. having its registered office at Mumbai and shall include their legal representatives, Assigns, successors or managing Committee or anyone authorized by them on their behalf
- (b) 'CONTRACTOR' shall mean the tenderer and shall include his/ their legal representative/s, assigns/or successors
- (c) 'ARCHITECT/ CONSULTANT shall mean M/s. Suvin Advisors Pvt. Ltd., 332,3<sup>rd</sup> floor, Lodha Supremus II, plot no. F-4 -4/, Road No.22, Near new passport office, Wagale Industrial Estate, Thane west 400 604, their nominees and also the Engineer-in-Charge or Engineer appointed by the mutual consent of the Architect and the Employer
- (d) 'SITE' shall mean the site of the Contract works including any building and erections thereon and any other land (inclusively) as aforesaid allotted by the Employer for the Contractor' use
- (e) 'THIS CONTRACT' shall mean the Articles of Agreement, the General Conditions, the Special Conditions, the Appendix, the Schedule of Quantities, Specifications, and other letters attached hereto and duly signed
- (f) 'NOTICE IN WRITING' or 'WRITTEN NOTICE' shall mean a Notice in writing, typed or printed characters sent (unless delivered personally or otherwise Proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered
- (g) 'ACT OF INSOLVENCY' shall mean any act of insolvency as defined by the Presidency Towns Insolvency Act, or the Provincial Act or any Act amending such original

#### 2. Scope of Contract

The Contractor shall carry out and complete the said work in every respect in accordance with this Contract and with the directions of and to the satisfaction of the Employer / Architect / Engineer-in-charge. The Architect and Engineer-in-Charge on their own may from time to time issue further drawings and/or written instructions, details, directions and explanations which are hereafter collectively referred to as "Works Instructions" in regard to:

(a) The variation or modification of the design, quality or quantity of works or the addition or omission or substitution of any work

Words importing the persons include firms and corporations

Words importing the singular only also include the plural and vice versa where the context requires

- (b) Any discrepancy in the Drawings or between the Schedule of Quantities and/or Drawings and / or Specifications
- (c) The removal from the site of any material brought thereon by the Contractor and the substitution of any other material therefore
- (d) The removal and / or, re-execution of any works executed by the Contractor
- (e) The dismissal from the works of any persons employed thereupon
- (f) The opening up for inspection of any work covered up
- (g) The amending and making good of any defects under clause

The Contractor shall forthwith comply with and duly execute any work comprised in such works Instructions provided always that verbal instructions, directions and explanations given to the Contractor or his representative upon the works by the Architect and Engineer-in-charge shall, be confirmed in writing by the Contractor within seven days, and if not dissented from in writing within a further period of seven days, such shall be deemed to be "Works Instructions" within the Scope of the Contract

## 3. Inspection Of Site

The Employer shall have made available to the Contractor such as data on sub-surface conditions as shall have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works, but the Contractor shall be responsible for his -own interpretation thereof and deemed to have visited the site

## 4. Sufficiency Of Tender

The Contractor shall also be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his Tender for the works and of the rates and prices stated in the priced Bill of Quantities and the Schedule of Rates and Prices, which Tender rates and prices shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper execution and maintenance of the Works

# 5. Programme To Be Furnished

(a) Within the time stated of these Conditions, the Contractor shall, after the acceptance of his Tender, submit to the Engineer for his approval a program showing the order in which he proposes to carry out the works. The Contractor

shall whenever required by the Engineer or Engineers' Representative, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the works

(b) If at any time it should appear to the Engineer that the actual progress of the works does not conform to the approved program referred to in sub-clause of this Clause, the Contractor shall produce, at the request of the Engineer, a revised program showing the modifications to the approved program necessary to ensure completion of the works within the time for completion as decided and reworked to the satisfaction of the Employer

## 6. Drawings and Schedule of Quantities

The Copy of the Contract shall remain in the custody of the Employer. The Contractor on the signing thereof shall be furnished by the Architect with a copy of the priced Schedule of Quantities, one copy of each of the said drawings and the specifications and three copies of all further drawings issued during the progress of the work. The Contractor shall keep' one copy of all the Drawings on the works and Employer, Engineer-in-Charge or the Architect or his representative shall, at all reasonable-times, have access to the same. Before the issue of the Final Certificate to the Contractor, he shall forthwith return to the Architect all drawings and specifications, All the drawings supplied by the Architect will be in the form of Hardcopy

### 7. Contractor To Provide Everything Necessary

The Contractor shall provide everything necessary for the proper execution of the works according to the intent and meaning of the Drawings, Schedule of Quantities and Specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancy in the Drawings or between the Drawings, Schedule of Quantities and Specifications, he shall immediately and in writing refer the same to the Architect who shall decide which is to be followed

#### 8. Authorities, Notices and Patents

The Contractor shall conform to the provision of any act of the Legislature relating to the works and to the Regulations and Bye-Laws of any Authority, and of any Water, Lighting and other Companies and/or Authorities with whose system the structure is proposed to be connected and shall, before making any variations from the Drawings or Specifications that may be necessitated by so conforming, give to the Architect written notice specifying the variation proposed to be made and the reason for making it, and apply for instructions thereon. In case, the Contractor shall not within twenty days receive such instructions, he shall proceed with the work, conforming to the Provisions, Regulations or Bye-Laws in question, and any variation so necessitated shall be dealt with under clause no.13.

The Contractor shall bring to the attention of the Architect all notices required by the said Acts, Regulations or Bye-Laws to be given to any Authority and pay to such

Authority or to any Public office all fees that may be properly chargeable in respect of the works, and lodge the receipts with the Architect.

The Contractor shall indemnify the Employer and Architect against all claims in respect of patent rights, and shall defend all actions arising from such claims and shall himself pay all royalties, license fees, damages, costs and charges of all and every sort that may be legally incurred thereof

#### 9. Setting Out Works

The Contractor shall set out the works and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions and alignment of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall at his own expense rectify such error if so required to the satisfaction of the Architect and the Engineer-in-Charge. The checking of any setting-out or of any line or level by the Engineer-in-charge or the Engineers representative shall not in any way relieve the contractor of his responsibility for the correctness thereof

#### 10. Materials and Workmanship to Conform to Description

All materials and workmanship shall so far as procurable be of the respective kinds described in the Schedule of Quantities and/or Specification and in accordance with the "Works Instructions" and the Contractor shall, upon the request of the Employer/Architect, furnish him with all invoices, accounts receipts and other vouchers to prove that the materials comply therewith. The Contractor shall at his own cost arrange for and/or carry out any test of any materials which the Architect/ the Engineer-in-Charge may require

#### 11. Contractors Superintendence And Representative on the Works

The Contractor shall give all necessary personal superintendence during the execution of the works, and so long thereafter as the Architect or Engineer-in-Charge may consider necessary until the expiration of the "Defects Liability Period" stated in the Appendix thereto. The Contractor shall also, during the whole time the works are in progress, employ a competent representative whose name is informed to the Employer/Architect who shall be constantly in attendance at the building while the men are at work. Any directions, explanations, instructions or notices given by the Architect or Engineer-in-Charge or Employer to such representative shall be held to be given to the Contractor. Such a person shall be a qualified engineer whose qualification and experience must be made known to the Architect / Engineer-in-charge and must have the approval

#### 12. Dismissal of Workmen

The Contractor shall, on the request of the Architect or the Engineer-in-Charge or Employer, immediately dismiss from the works any person employed thereon by him who may, in the opinion of the Architect or the Engineer-In-Charge or the Employer, be incompetent or misconduct himself, and -such person shall not be again employed on the works without the permission of the Architect or Engineer-in-charge

#### 13. Access to Works

The Architect and his representative or the Engineer-In-Charge or the Employer shall at all reasonable times have free access to the works and/or to the workshops, factories, or other places where materials are lying or from which they are being obtained and the Contractor shall give every facility to the Architect and his representative, the Engineer-In-Charge or the Employer necessary for inspections and examination and test of the materials and workmanship. Only persons authorized by the Architect, the Engineer-In-Charge or the Employer, except the Representatives of Public Authorities, shall be allowed on the works at any time

### 14. Engineer-In-Charge/ The Engineer

The term 'Engineer-in-Charge' shall mean the person mutually nominated by the employer and the Architect and acting under the orders of the Employer/Architect to inspect the works. The Contractor shall afford the Engineer-in-Charge every facilities and assistance for the inspection of the works and materials and for checking and measuring the works carried out by the Contractor. The Engineer-In-Charge or any representative of the Employer shall have power to give notice to the Contractor or his representative of non-approval of any work or materials and such work shall be suspended or the use of such material be discontinued. The work will from time to time be examined by the Architect ' the Engineer-in-Charge or the Employer but such examination shall not in any way exonerate the Contractor from the obligation to remedy any defect which may be found to exist at any stage of the work or after the same is completed. In case of Contractor not removing the rejected material nor rectifying the defective work pointed out by the Engineer-in-Charge, the Contractor will be liable to the consequences as per the Agreement. The Contactor shall honor all letters, notices issued by the Engineer-In-Charge as if they are issued by the Architect. The Engineer-In-Charge may be empowered by the Architect to issue certificates for payment and the Employer shall honor such certificates provided the Architect has obtained a written consent from the Employer or has informed the Employer in writing

## 15. Care Of Works

From the Commencement of the Works until the date stated in the Certificate of (a) Completion for the whole of the works pursuant to Clause 48 D hereof the Contractor shall take full responsibility for the care thereof. Provided that if the Employer/Architect issues a Certificate of Completion in respect of any part of the Permanent Works the Contractor shall cease to be liable for the care of that part of the Permanent Works from the date stated in the Certificate of Completion in respect of that part and the responsibility for the care of that part shall pass to the Employer. Provided further that the Contractor shall take full responsibility for the care of any outstanding work, which he shall have undertaken to finish during the Period of Maintenance until such outstanding work is completed. In case any damage, loss or injury shall happen to the Works or to any part thereof, from any cause whatsoever, save and except the excepted risks as defined in sub-clause (2) of this Clause, while the Contractor shall be responsible for the care thereof the Contractor shall, at his own cost, repair and make good the same, so that at completion the permanent works shall be in good order and condition and in

conformity in every respect with the requirements of the Contract and the Engineers instructions. In the event of any such damage, loss or injury happening from any of the excepted risks, the Contractor shall, if and to the extent required by the Engineer-in-charge and subject always to the provisions of the contract, repair and make good the same as aforesaid at the cost of the Employer. The Contractor shall also be liable for any damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of completing any outstanding work or complying with his obligations under clause 47 hereof

(b) Excepted Risks

The "excepted risks" are war, hostilities (whether war be declared or not), invasion, and act of foreign enemies, rebellion, and revolution. insurrection or military or usurped power, civil war, employees of the Contractor or of his sub-contractors and arising from the conduct of Works, riot, commotion or disorder, or a cause solely due to the design of the Works or ionizing radiations or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radioactive, toxic explosive or other hazardous properties of any explosive, nuclear assembly or nuclear component thereof, pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds, or any such operation of the forces of nature are collectively referred to as "the excepted risks"

### 16. Assignment and Sub-Letting

The whole of the works included in the Contract shall be executed by the Contractor and the Contractor shall not directly or indirectly transfer, assign or underlet the Contract or any part share thereof or interest therein without the written consent of the Employer/Architect and no undertaking shall relieve the Contractor from the full and entire responsibility of the Contract or from active superintendence of the works during their progress

## 17. Variation Not to Vitiate Contract

No alteration, omission or variation shall vitiate this contract but in case the Architect and the Engineer-in-Charge in consultation with the Employer thinks proper at any time during the progress of the works to make any alterations in or additions to or omissions from the works or any alteration in the kind or quality of the materials to be used therein and shall give notice thereof in writing under his hand to the Contractor, the Contractor shall alter, add to or omit from as the case may require, in accordance with such notice, but the Contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any deviation from any of the provisions of the Contract, Stipulation, Specification or Contract Drawings without the previous consent in writing of the Architect and Engineer-in-Charge and the Employer jointly.

#### 18. Schedule Of Quantities

The schedule of Quantities, unless otherwise stated, shall be deemed to have been prepared as per mode of measurement specified in Technical Specification and Bill of

### **19.** Sufficiency Of Schedule Of Quantities

rectification of errors in the Contractor's Schedule of Rates.

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 prices stated in the Schedule of Quantities and / or the Schedule of Rates and Prices which rates and prices shall cover all his obligations under the Contract, and all matters and things necessary for the proper completion of the works.

#### 20. Measurement Of Works

The Architect and the Engineer-in-Charge may from time to time, intimate to the Contractor that he requires the works to be measured and the qualified Contractor representative shall <u>forthwith attend to assist the</u> Architect or the Architect's representative in taking such measurements and calculations in consultation with the Engineer-in-Charge and to furnish all particulars or to give all assistance required by either of them.

Should the <u>Contractor not attend or neglect</u>, then the measurements taken by the Architect or approved by him in consultation with the Engineer-in-Charge shall be taken to be the correct measurements of the works. Such measurements shall be taken in accordance with the standard method of measurement of building works issued by the Architect.

Not unless the contractor is given notice in such intimations that "in the event of the contractors authorized agent not attending the site at the appointed time, the measurements will be taken Ex-Parte and the contractor will have no right to question the corrections thereon."

The Contractor or his Agent may at the time of measurement take such notes and measurements as he may require.

The measurement and valuation in respect of the Contract shall be completed within "Period of final measurement" stated in the Appendix or if not so stated then within three months of the completion of the contract works as defined in Clause hereof.

## 21. Non Tender Items

The Contractor shall, when ordered in writing by the Architect and with the concurrence of the Employer, perform work not covered by the specifications or included in the Bills of Quantities but forming part of the work contracted for, on the same conditions in all respect in which he agrees to do the main work. Extra work and supply of such material shall be carried out at a rate settled by written agreement between the Contractor and the Architect / the Engineer-in-Charge with the concurrence of the Employer

#### 22. Status of Workmen

None of the employees of the contractor shall be construed or deemed to be the employees of NTC at any time and the Contractor shall indemnify and keep indemnified NTC against any claim, loss or whatsoever in this connection.

There shall never exist any employer and employee relationship between NTC and the manpower engaged by Contractor. NTC shall not have any responsibility to nor shall be held directly or indirectly responsible or liable for the person so employed by the contractor for performing/providing services in terms of this agreement to NTC in terms of its contractual obligations hereunder.

#### 23. Quality of Materials & Workmanship and Tests

- (a) All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instructions and shall be subjected to tests from time to time to such other place or places as may be specified in the Contract, or at all or any of such places. The Contractor shall provide assistance instruments, machines, labor and materials as are formally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the work for testing as may be selected and required by the Engineer.
- (b) Cost of Samples / Shop Drawings

All samples / shop drawings / fabrication drawings shall be supplied by the Contractor at his own cost.

(c) Cost of Tests

The Cost of making any Tests shall be borne by the Contractor.

#### 24. Inspection of Operation

The Engineer and any person authorized by him shall at all times have access to the works and to all workshops on or off the site and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access. All works carried out off the site shall be duly brought to the notice of the Engineer.

#### 25. Examination of work

(a) No work shall be covered up or put out of view without the approval of the Engineer or the Engineer's Representative and the Contractor shall afford full opportunity for the Engineer or the Engineer's Representative to examine and measure any work which is in view and to examine foundations about to be covered up or put out of before permanent work is placed thereon. The Contractor shall give due notice to the Engineer's Representative whenever any such work or

foundation is or are ready or about to be ready for examination and the Engineer's Representative shall, without unreasonable delay, unless the considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such works of examining such foundations.

(b) Uncovering & Making Openings

The Contractor shall uncover any part or parts of the works or make openings in or throughout the same part or parts to the satisfaction of the Engineer-in-Charge. If any such part of parts have been covered up or put off view after compliance with the requirements of sub-clause (i) of this Clause and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating and making good the same shall be borne by the Employer, but in any other case all costs shall be borne by the Contractor.

## 26. Removal of improper Works and Material

- (a) The Engineer-in-Charge shall during the progress of the works have power to order in writing from time to time
  - (i) The removal from the Site, within such time or times as may be specified in the order, of any materials, which in the opinion of the Employer, are not in accordance with the Contract
  - (ii) The substitution of proper and suitable materials and
  - (iii) The removal and proper re-execution, notwithstanding any previous test thereof or interim payment thereof, any work which in respect of materials or workmanship is not, in the opinion of the Engineer, in accordance with the Contract
- (b) Default of Contract in compliance

In case of default on the part of the Contractor in carrying out such order, the Employer shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor after giving due notice in writing by the Employer, or may be deducted by the Employer from any money due or which may become due to the Contractor

## 28. Suspension of Work

(a) The Contractor shall, on the written order of the Engineer, suspend the progress of the Works or any part thereof for such time or times and in such manner as the Engineer may consider necessary and shall during such suspension properly protect and secure the work, so far as is necessary in the opinion of the Engineer. The extra cost incurred by the Contractor in giving effect to the Engineer's instructions under this clause shall be borne and paid by the Employer unless such suspension is

- (i) Otherwise provided for in the Contract, or
- (ii) Necessary by reason of some default on the part of the Contractor, or
- (iii) Necessary by reason of climatic conditions on the site, or
- (iv) necessary for the proper execution of the works or for the safety of the works or any part thereof in so far as such necessity does not arise from any act or default by the Engineer or the Employer or from any of the excepted risks defined in the clause hereof
  Provided that the Contractor shall not be entitled to recover any such extra cost unless he gives written notice of his intention to claim to the Engineer within fifteen (15) days of the Engineer-in-Charge's Order. The Engineer shall settle and determine such extra payment and / or extension of time under clause hereof to be made to the Contractor in respect of such claim as shall, in the opinion of the Engineer-in-Charge, be fair and reasonable.
- (b) Suspension lasting more than 90 days

If the progress of the works or, any part thereof is suspended on the written order of the Engineer and if permission to resume work is not given by the Engineer within a period of ninety days from the date of suspension then, unless such suspension is within paragraph (i), (ii), (iii) or (iv) of sub-clause (a) of this clause the contractor may serve a written notice on the Engineer requiring permission within twenty-eight days from the receipt thereof to proceed with the works, or that part thereof in regard to which progress is suspended and, if such permission is not granted within that time, the Contractor by a further written notice so served may, but is not bound to, elect or treat the suspension where it affects part only of the works as an omission of such part under clause hereof, or, where it affects the whole works, as an abandonment of the Contract by the Employer and shall be determined as per clause.

#### 29. Defects during execution and after completion of works

Any defect, shrinkage, settlement or other faults which may appear during execution or within the "Defects Liability Period" stated in the Appendix hereto, or if none stated then within 12 months after the virtual completion of the works, arising in the opinion of the Employer from materials or workmanship not in accordance with the contract, shall upon the directions in writing of the Employer, and within such reasonable time as shall be specified herein, be amended and made good by the Contractor, at his own cost unless the Architect & Engineer-in-Charge in concurrence with the Employer shall decide that he ought to be paid for such amending and making good, and in case of default the Employer may employ and pay other persons to amend and make good such defects, shrinkage, settlements or other faults, and all damages, loss and expenses consequent thereon or incidental thereto shall be made good and borne by the Contractor and such damage, loss and expenses shall be recoverable from him by the Employer or may be deducted by the Employer upon the Architect's & Engineer-in-Charge's Certificate in writing from any moneys due or that may become due to the contractor, or the Employer may in lieu of such amending and making good by the Contractor deduct from any moneys due to the Contractor a sum to be determined by the Architect and the Engineer-in-Charge in concurrence with the Employer equivalent to the cost of amending such work and in the event of the amount retained under clause

31 being insufficient recover the balance from the Contractor, together with any expenses the Employer may have incurred in connection therewith.

Should any defective work have been done or material supplied by any sub-contractor employed on the works, who has been nominated or approved by the Architect / the Engineer-in-Charge and the Employer jointly as provided in the clause, the Contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the contractor and been subject to the provisions of this clause and the clause thereof. The Contractor shall remain liable under the provisions of this clause notwithstanding the signing by the Architect or the Engineer-in-Charge or the Employer of any Certificate or the passing of any accounts

#### 30. Insurance

Without limiting his obligations and responsibilities, the contractor shall insure in the name of the Employer against all loss or damage for all works under (a) below and in the joint name of the Employer and the Contractor against any loss or damage for all items under (b) below from whatever, cause arising, including riot and excepted risks and for which he is responsible under the terms of the Contract and in such manner that the Employer is covered for the period stipulated hereof and are also covered during the period of Maintenance for loss or damage arising from a cause, occurring prior to the commencement of the Period of Maintenance, and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the Purpose of complying with his obligation under clause hereof:

- (a) The Works for the time being executed to the estimated current contract value thereof, or such additional such as may be specified together with the materials for incorporation in the works at their replacement value.
- (b) The Constructional Plant and other things brought on to the site by the contractor to the replacement value of such constructional plant and other things.

Such insurance shall be affected with an insurer and in terms approved by the Employer and the Contractor shall, deposit with the Engineer or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums. All money payable by insurers shall be received by the Employer and disbursed to the Contractor in installments.

#### 31. Damage to Persons & Property

The Contractor shall indemnify the Employer and the Architect against all claims in respect of injuries or damage to any person or material or physical damage to any property whatsoever which may arise out of or in consequences of the execution and maintenance of the works and against claims, proceedings, damages, costs, charges and expenses whatsoever in respect of but not limited to, to include payment of Wages Act 1936 (Latest), Minimum Wages Act 1948 (Latest), Employers Liability Act 1938 (Latest), Workmen's Compensation Act 1947 (Latest), Industrial Disputes Act 1947 (Latest), Maternity Benefit Act 1961 (Latest) The Contract Labour (Regulation and Abolition Act,

1970 and any modifications thereof or of any law relating thereof in relation thereto including any compensation or damages for or with respect to

- (a) The permanent use of occupation of Land by the works or any-part thereof.
- (b) The right of the Employer to execute-the works or any part thereof on, over, under, in or through any land.
- (c) In case of any expenses arising from any such injury or damage to persons of employer and architects on site, the compensation shall be made by the contractor of the actual expenses without any delays which may arise out of claim filed and settled by the Insurance Company.

#### **32. Third Party Insurance**

- (a) Before commencing the execution of the works the Contractor, but without limiting his obligations and responsibilities under clause hereof, shall insure against his liability for any material or physical damage, Loss or injury which may occur to any property, including that of the Employer, or to any person, including any employee of the Employer, by or arising out of the execution of the Works or in the work being carried out by the Employer, by or arising out of the referred to in provision hereof.
- (b) Minimum amount of Third Party Insurance

Such insurance shall be affected with an insurer and in terms approved by the Employer, and for at least the amount stated in the Appendix to the Tender. The Contractor shall deposit with the Engineer or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums.

(c) Provision to indemnify Employer

The terms shall include a provision whereby, in the event of any claim in respect of which the Employer would be entitled to receive indemnity under the policy being brought or made against the Contractor, the insurer will indemnify the Employer against such claims and any costs, charges and expenses in respect thereof.

#### 33. Accident / or Injury to Workmen

(a) The Employer shall not be Liable for or in respect of any damages or compensations payable at Law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub-contractor.

The Contractor shall indemnity and keeps indemnified the Employer against all such damages and compensation and against all claims, proceedings, costs, and charges, whatsoever in respect thereof or relation thereto

(b) Insurance against Accident etc. to Workmen

The Contractor shall insure against such liability with an insurer approved by the Employer and shall continue such insurance during the whole of the time that any persons are employed by him on the works and shall, deposit with the Engineer or the Engineer's Representative such policy of insurance and the receipt of payment of the current premium.

Provided always that, in respect of any persons employed by any sub-Contractor, the Contractor's obligation to insure as aforesaid under this sub clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such sub-contractor to deposit with the Engineer of the Engineer's Representative, such policy of insurance and the receipt for the payment of the current premium.

#### 34. Remedy on Contractors Failure to Insure

If the Contractor fails to effect and keep in force the insurance referred to in clauses hereof, or any other insurance which he may be required to effect under the terms of the contract, then and in any such case the Employer may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Employer as aforesaid from any monies due or which may become due to the Contractor, or recover the same as a debt due from the contractor.

#### 35. Commencement of Works

The Contractor shall commence the works on site within the period named in the Appendix to the Tender after the receipt by him a written order to this effect from the Engineer and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by the Engineer. The time for commencement and completion of work shall be of the essence of the contract.

#### 36. Possession of Site

(a) Save in so far as the Contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time and the order in which such portion shall be made available to him and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's written order to commence the works, give to the Contractor possession of so much of the Site as may be required to enable the Contractor to commence and proceed with the execution of the works in accordance with the program referred to in Clause hereof, if any, and otherwise in accordance with such reasonable proposals of the Contractor as he shall, by written notice to the Engineer, make and will, from time to time as the works proceed, give to the Contractor possession of such further portions of the site as may be required to enable the Contractor to proceed with the execution of the site as may be required to enable the Contractor possession of such further portions of the site as may be required to enable the Contractor to proceed with the execution of the site as may be required to enable the Contractor to proceed with the execution of the site as may be required to enable the Contractor to proceed with the execution of the site as may be required to enable the Contractor to proceed with the execution of the site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with said program or proposals, as the

case may be. If the Contractor suffers delay or incurs cost from failure on the part of the Employer to give possession in accordance with the term& of this Clause, the Engineer shall grant an extension of time for the completion of the works. In case of dispute the Employer may ask the contractor to leave the site and hand over the possession of the site. The contractor shall do so immediately.

## **37. Time for Completion**

Subject to the requirement in the Contract as to completion of any sections of the works before completion of the whole, the whole of the works shall be completed, in accordance with the provisions of clause hereof, within the time stated in the Contract calculated from the last day of the period named in the Appendix to the Tender as that within which the Works are to be commenced, or such extended time as may be allowed under clause hereof.

## 38. Rate of Progress

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the works or any section is at any time, in the opinion of the Engineer, too slow to ensure completion by the prescribed time or extended time for completion, the Engineer shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer may approve to expedite progress so as to complete the Works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the contractor shall seek the Engineer's permission to do any work at night or on Sundays, if locally recognized as days of rest, or their locally recognized equivalent, such permission shall not be unreasonably refused

# 39. Liquidated Damages for Delay

If the Contractor fails to achieve completion of the works either in whole or part within the time prescribed by clause 39 hereof, then the Contractor shall pay to the Employer the sum stated in the Appendix as liquidated damages for such default for everyday or part of a day which shall elapse between the time prescribed by clause hereof and the date of certified completion of the works. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies in his hands, due or which may become due to the Contractor. The payment or deduction of such damages shall not relieve the contractor from his obligation to complete the works or from any other of his obligations and Liabilities under the contract.

# 40. Certification of Completion of Works

(a) When the whole of the Works have been substantially completed and have satisfactorily passed any final test that may be prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer or to the Engineers Representative accompanied by an undertaking to finish any outstanding work during the period of Maintenance. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Engineer to issue a

Certificate or completion in respect of the works. The Engineer shall, within thirty days of the date of delivery of such notice either issue to the Contractor, a Certificate of Completion stating the date on which, in his opinion, the works were substantially completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the work which, in the Engineer's opinion, requires to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the works specified therein. The Contractor shall be entitled to receive such Certificate of Completion within twenty-one days of completion to the satisfaction of the Engineer of the works so specified and making good any defects so notified.

(b) Certification of completion by Stages

Similarly, in accordance with the procedures set out in Sub-clause (a) of this clause, the Contractor may request and the Engineer shall issue a Certificate of Completion in respect of

- (i) Any section of the permanent works in respect of which a separate time for completion is provided in the Contract and
- (ii) Any substantial part of the Permanent Works, which has been both, completed to the satisfaction of the Engineer and occupied or used by the Employer.
- (c) If any part of the Permanent Works shall have been substantially completed and shall have satisfactorily passed any final test that may be prescribed in the Contract, the Engineer may issue a Certificate of Completion in respect of that part of the Permanent Works before completion of the whole of the works and upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the works during the Period of Maintenance.
- (d) Provided always that a Certificate of Completion given in respect of any section of part of the Permanent Works before completion of the whole shall not be deemed to certify completion of any ground or surfaces requiring reinstatements, unless Certificate shall expressly so state.

## 41. Period of Maintenance/ Defect Liability

(a) Period of Maintenance

The expression "Period of Maintenance" shall mean the period of maintenance named in the Appendix to the Tender, calculated from the date of completion of the Works, certified by the Engineer in accordance with Clause hereof, or, in the event of more than one certificate having been issued by the Engineer under the said Clause, from the respective dates so certified and in relation to the period of Maintenance the expression "the Works" shall be constructed accordingly.

(b) Execution of Work of repair, etc.

To the intent that the works shall at or as soon as practicable after the expiration of the Period of Maintenance be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall finish the work, if any, outstanding at the date of completion, as certified under Clause 42 hereof, after such date and shall execute all such work of repair, amendment, reconstruction, rectification and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Engineer during the Period of Maintenance, or within fourteen days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration.

(c) Cost of execution of work of repair etc.

All such work shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer, be due to the use of materials or workmanship not in accordance with the Contract, or due to neglect or failure on the part of the Contractor to comply with any, obligations, expressed or implied, on the Contractor's part under the Contract. If, in the opinion of the Engineer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

(d) Remedy on Contractor's Failure to carry out work required:

If the Contractor fails to do any such work as aforesaid required by the Engineer, the Employer shall be entitled to employ and pay persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any monies due or which may become due to the Contractor.

(e) Contractor to search

The Contractor shall, if required by the Engineer in writing, search under the directions of the Engineer for the cause of any defect, imperfection or fault appearing during the progress of the works or in the period of Maintenance. Unless such defect, imperfection of fault shall be one for which the Contractor is liable under the Contract, the cost of the work carried out by the Contractor in searching as aforesaid shall be borne by the Employer. If such defect, imperfection of fault shall be one for which the Cost of the work carried out in searching as aforesaid shall be borne by the Employer. If such defect, imperfection of fault shall be one for which the Contractor is liable as aforesaid, the Cost of the work carried out in searching as aforesaid shall be borne by the Contractor and / he shall in such case repair, rectify and make good such defect, imperfection or fault at his expense in accordance with the provisions of clause hereof.

# 42. Payment Withheld

The Engineer may withhold or on account of subsequently discovered evidence nullify the whole or a part of any certificate to such extent as may be necessary in the opinion to protect the Employer from loss on account of

- (a) Defective work not remedied.
- (b) Failure of the Contractor to make payments properly to sub-contractor for materials or labour or to Contractor's employees / workmen or failure to discharge any other obligations under applicable laws.
- (c) A reasonable doubt that the Contract cannot be completed in the balance time.
- (d) Damage to another Contractor's or sub-contractor's work.
- (e) Claims filed or reasonable evidence indicating probable filing of claims.

# 43. Delay and Extension of Time

If, in the opinion of the Employer, the works be delayed

- (a) By force majeure or
- (b) By reason of any exceptionally inclement weather or
- (c) By reason of proceedings taken or threatened by or dispute with adjoining or neighboring owners or public authorities arising otherwise than through the Contractor's own default or
- (d) By the works or delays of other Contractors or Tradesmen engaged or nominated by the Employer or the Architect / the Engineer-in-Charge and not referred to in the Schedule of Quantities and / or specification or
- (e) By reason of "Works Instructions" as per Clause or
- (f) By reason of civil commotion, local combination of workmen or strike or lockout affecting any of the building traders or
- (g) in consequence of the Contractor not having received in due time necessary instructions from the Architect / the Engineer-in-Charge or the Employer for which he shall have specifically applied in writing, the Employer in consultation with the Architect / the Engineer-in-Charge shall make a fair and reasonable extension of time for completion of the Contract Works; in case of such strike or lock-out the Contractor shall, as soon as may be, give written notice thereof to the Architect, the Engineer-in-Charge and the Employer; but, the Contractor shall nevertheless constantly use his endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Architect / the Engineer-in-Charge and the Employer to proceed with the work.

## 44. Termination of Contract by the Employer

The Employer may terminate this contract, if the Contractor being an individual or a firm commit any "act of insolvency" or shall be adjudged an insolvent or being an Incorporated Company having an order for compulsory winding up made against it or pass an effective resolution forwarding up voluntarily or subject to the supervision of the Court and of the official Assignee of the Liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him requiring him to do so, to show to 'the reasonable satisfaction of the Architect / Owner with the concurrence of the Employer that he is able to carry out and fulfill the Contract, and to give security therefore, if so required by the Employer.

Or if the Contractor (whether an individual, firm or Incorporated Company) shall suffer execution to be issued.

Or shall suffer any payment under this Contract to be attached by or on behalf of any of the creditors of the Contractors,

Or shall assign or sub-let this Contract without the consent in writing of the Architect / the Engineer-in-Charge and the Employer first obtain,

Or shall change or encumber this Contract or any payments due or which may become due to the Contract thereunder;

Or if the Architect and the Engineer-in-Charge shall certify in writing the Employer that the Contractor

- (a) Has abandoned the Contract, or
- (b) has failed to commence the works, or has without any lawful excuse under these Conditions suspended the progress of the Works for 14 days after receiving from the Architect / the Engineer-in-Charge written notice to proceed, or
- (c) Has failed to proceed with the works with such due diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or
- (d) has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Architect and the Engineer-in-Charge, written notice that the said materials or work were condemned and rejected by the Architect and the Engineer-in-Charge under these conditions, or
- (e) has neglected or failed persistently to observe and perform all or any of the acts matters or things by this Contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same, or

(f) has to the detriment of good workmanship or in defiance of the Architect's/ Engineer-in-Charge's and Employer's instructions to the contrary sub-let any part of the Contract, then and in any of the said cases, the Employer in consultation with the Architect / the Engineer-in-Charge may not withstanding any previous waiver after giving seven days' notice in writing to the Contractor, determine the Contract, but without hereby affecting the powers of the Architect / the Engineerin-Charge or the obligations and liabilities of the contract, the whole of which shall continue in force-as fully as if contract had not been so determined and-as if the works subsequently executed had been executed by or on behalf of the contractor.

The Employer under advice of the Engineer-in-Charge / Architect may enter upon and take possession of the works and all plant, tools, scaffoldings, sheds, machinery, steam and other power generation unit and materials lying upon the premises or the adjoining lands or roads, and use the same as his own property or may employ the same by means of his own persons and workmen in carrying on and completing the works or by employing any other Contractors or other person or persons to complete the works.

The Contractor shall not in any way interrupt or do any act, matter or things to prevent or hinder such other contractor or other person or persons employed for completing and finishing or using the materials and plant for the works. When the works shall be completed or as soon thereafter as convenient the Architect and the Engineer-in-Charge shall give a notice in writing to the Contractor to remove his surplus materials and plant, and should the Contractor fail to do so within a period of fourteen days after receipt thereof by him, the Employer shall sell the same by public auction, and shall give credit to the Contractor for the amount realized. The Architect and the Engineer-in-Charge shall, thereafter, ascertain and certify in writing under their hands (if anything) shall be due or payable to or by the Employer for the value of the said plant and materials so taken possession of by the Employer and the expense or loss which the Employer shall have been put to in procuring the works to be completed, and the amount if owing to the Contractor and the amount which shall be so certified shall thereupon be paid by the Employer, as the case may be, and the certificate of the Architect and the Engineer-in-Charge shall be final and conclusive between the parties.

#### 45. Termination of Contract by the Contractor

The Contractor may terminate this contract if the payment of the amount payable by the Employer under CERTIFICATE of the Architect and the Engineer-in-Charge with interest as provided for hereinafter shall be in arrears and unpaid for forty five days after notice in writing requiring payment of the amount with interest as aforesaid shall have been given by the Contractor to the Employer, or if the Employer interferes with or obstructs the issue of such Certificate or the Employer commits any "act of insolvency", or (being and Incorporated Company) shall have an order made against him or pass an effective resolution for winding up, either compulsorily or subject to the supervision of the Contracts or if the official Assignee or the Employer shall repudiate the Contracts or if the official Assignee or the Liquidator, in any such winding up, shall be unable within fifteen days after notice to him requiring him so to do, to show to the reasonable satisfaction of the Contractor that he is able to carry out and fulfill the

Contract and to make Contractor, to give security for the same, or if the works be stopped for all payments due, and to become due thereunder and, if required by the three months under the order of the Employer or by any injunction or other order of any Court of Law, then and in any of the said cases the Contractor shall be at liberty to determine the Contract by notice in writing to the Employer and he shall be entitled to recover from the Employer payment for all works executed.

In arriving at the amount of such payment, the net rates contained in the Tender Agreement shall be followed.

#### 46. Certificates and Payments

- (a) Unless otherwise provided, payments shall be made at monthly intervals in accordance with the conditions set out
- (b) Advances on Constructional Plant and Materials

No advances are to be made by the Employer to the Contractor in respect of Constructional Plant and Materials, the conditions of payment and repayment shall be as set out.

(c) Approval only by Maintenance Certificate

No certificate other than the Maintenance Certificate referred to in clause D hereof shall be deemed to constitute approval of the works.

(d) Maintenance Certificate

The Contract shall not be considered completed until a Maintenance Certificate has been signed by the Engineer-in-Charge and delivered to the Contractor stating that the Works have been completed and maintained to his satisfaction. The Maintenance Certificate shall be given by the Engineer within twenty-eight days after the expiration of the Period of Maintenance, or, if different periods of maintenance shall become applicable to different sections or parts of the works, the expiration of the latest such period, or as soon thereafter as any works ordered during such period, pursuant to clause hereof, shall have been completed to the satisfaction of the Engineer and full effect shall be given to the clause, notwithstanding any previous entry on the works or the taking possession, working or using thereof or any part thereof by' the Employer. Provided always that the issue of the Maintenance Certificate shall be a precondition to payment to the Contractor of the second portion of retention money in accordance with the Appendix.

Cessation of Employer's Liability:

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or the execution of the works, unless the Contractor has made a claim in writing in respect thereof before the giving of the Maintenance Certificate under this Clause

## 47. Valuation at Date of Forfeiture

The Engineer-in-Charge shall, as soon as practicable after any such entry and expulsion by the Employer, fix and determine ex parte, or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably earned by or would reasonably accrue to the Contractor in respect of work when actually done by him under the Contract and the value of any of the said unused or partially used materials and any Temporary Works

### (a) Payment after Forfeiture

If the Employer enters and expels the Contractor under this clause, he shall not be liable to pay to the Contractor any money on account of the Contract until the expiration of the Period of Maintenance and thereafter until the costs of execution and Maintenance, damages for delay in completion, if any, and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer-in-Charge. The Contractor shall then be entitled to receive only such sum or sums, if any, as the Engineer-in-Charge may certify as payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

#### 48. Urgent Repairs

If by reason of any accident, or failure, or-other event occurring to in connection with the Works, or any part thereof, either during the execution of the works, or during the Period of Maintenance, any remedial or other work or repair shall, in the opinion of the Employer or the Engineer's Representative, be urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work or repair, the Employer may employ and pay other persons to carry out such work or repair as the Engineer or the Engineer's Representative may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do so at his own expense under the Contract, all expenses properly incurred by the Employer in so doing shall be recoverable from the Contractor. Provided always that the Engineer or the Engineer's Representative, as the case may be, shall, as soon after the occurrence of any emergency as may be reasonably practicable, notify the Contractor in writing.

## 49. Special Risks

- (a) The Employer shall repay to the Contractor any increased cost of or incidental to the execution of the Works, other than such as may be attributable to the cost of construction work condemned under the provision of clause hereof, prior to the occurrence of any special risk, which is however attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this clause hereinafter contained in regard to outbreak of war, but the Contractor shall as soon as any such increase of cost comes to his knowledge forthwith notify the Engineer thereof in writing.
- (b) Special Risks

The Special risks are war, hostilities, (whether war be declared or not), invasion, act of foreign enemies, the nuclear and pressure waves risk described in clause hereof, or insofar as it relates to the country in which the works are being or are to

be executed or maintained, rebellion, revolution, insurrection, military or usurped power, civil war, or unless solely restricted to the employees of the contractor or of his sub-contractors and arising from the conduct of the works, riot, commotion or disorders.

(c) Outbreak of War

If, during the currency of the Contract, there shall be an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the works, the Contractor shall, unless and until the Contract is terminated under the provision of this clause, continue to use his best endeavors to complete the execution of the works. Provided always that the Employer shall be entitled at any time after such outbreak of war to terminate the Contract by giving written notice to the Contractor and, upon such notice being given, this contract shall, except as to the rights of the parties under this clause and to the operation of clause hereof, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

(d) Removal of Plant on termination

If the Contract is determined under the provisions of the last preceding sub-clause, the Contractor shall, with all reasonable dispatch, remove from the site all Constructional Plant, staff, workers; identify those of Sub-Contractors to do so.

# 50. Payment if Contract is terminated

- (a) The amounts payable in respect of any items, so far as the work or service comprised therein has been carried out or performed, and a proper proportion as certified by the Engineer in Charge in Writing of any such items, the work or service which has been partially carried out or performed.
- (b) The cost of materials or goods reasonably ordered for the works which shall have been delivered to the Contractor at site or of which the Contractor is legally liable to accept delivery for works being fabricated off site, or propriety goods ordered in both cases where due prior notice has been given to the Engineer, in writing, such materials or goods becoming the property of the Employer upon such payments being made by him.
- (c) A sum to be certified by the Architect & Engineer-in-Charge in writing being the amount of any expenditure reasonably incurred by the Contractor towards, site office, site stores, fabrication yard, fencing in the expectation of completing the whole of the works insofar as such expenditure shall not have been covered by the payments in this sub-clause before mentioned.
- (d) On any account, if the Contract is terminated by Employer, no liquidated damages shall be payable to the Contractor on account of profit on remaining portion of the contract or loss on account of premature termination. In such a case, the

Contractor will be entitled to remove his material/equipment only after settling the account in full and final with Employer.

Provided always that against any payments due from the Employer under this subclause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Constructional Plant and Materials and any other sums recoverable by the Employer from the Contractor under the terms of the Contract.

## 51. Frustration

Payment in the event Frustration

If a war, or other circumstances outside the control of both parties, arises after the contract is made so that either party is prevented from fulfilling his contractual obligations, or under the law governing the Contract, the parties are released further performance, then the sum payable by the Employer to the Contractor respect of the work executed shall be the same as that which would have been payable under clause 50 / 52 as the case may be hereof if the Contract had been terminated under the provisions of clause 52 hereof.

## **52.** Procedure for Disputes

In case of Dispute or Difference arising between Employer and the Contractor relating to any matter arising out of this contract, such disputes or differences shall be settled in accordance with the Arbitration and Conciliation Act 1996, The Arbitral tribunal shall consist of 3 Arbitrators one each to be appointed by the Employer and the Contractor. The third arbitrator shall be jointly nominated by the two Arbitrators and he hall be the presiding arbitrator. If there is no agreement about nomination of the third Arbitrator, then the third and presiding Arbitrator shall be appointed by the Indian Council of Arbitrations/ president of Institute of Engineers.

The Arbitration proceedings shall be at Mumbai and the operative language shall be English.

The decision of the Majority of Arbitrators shall be binding upon both parties. The Cost of Arbitration proceedings shall be shared equally by the parties. The expenses towards preparation and fees of Arbitrator by each party shall be borne by the parties themselves.

All disputes shall be referred to a sole Arbitrator to be appointed jointly by the parties. If there is no agreement on this, the Sole Arbitrator shall be appointed by the Indian Council of Arbitration/president, Institute of engineers. Decision of the sole Arbitrator shall be binding on the parties.

Performance of the Contract shall continue during the Arbitration proceedings.

## 53. Safety Code

(a) General

Contractor shall submit a Safety organization structure along with the Safety plan for approval before commencing the job.

Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with Owner safety rules as set forth herein prior to start of construction, Contractor shall be furnished copies of Owner's Safety Code' for information and guidance. The contractor shall erect, display and maintain signage at different locations of the site, to show safety requirements during work, regulations regarding protective equipment, clothing and the like.

- (b) Safety Regulations
  - (i) In respect of all labour, directly or indirectly employed in the work for the performance of Contractor's part of this agreement, the Contractor shall at his own expense arrange for all the safety provisions as per (i) Safety codes of C.P.W.D. & Indian Standards Institution (ii) The Electricity Act, (iii) The Mines Act, and (iv) Regulations, Rules and orders made there under and such other act as applicable
  - (ii) The Contractor shall observe and abide by all Fire and Safety Regulations of the Owner. Before starting construction work, Contractor shall consult Owner's safety engineer or Engineer-in-charge and provide all required precautionary measures to this effect. The Contractor must make good to the satisfaction of the Owner any loss or damage due to fire to any portion of the work done under this contract or to any of the Owner's existing property.
  - (iii) The contractor shall obtain necessary licenses and approvals from appropriate authority under labour enactment as required to carry out obligations under this contract including license required under The Contract Labour (Regulation and Abolition Act, 1970)
- (c) First Aid and Industrial Injuries
  - (i) Contractor shall maintain first aid facilities for his employees and those of his Sub-contractors. He shall arrange Medical Treatment without any loss of time in the event of an accident or injury.
  - (ii) All critical injuries shall be reported promptly to Owner. All such injuries shall be thoroughly investigated and a copy of Contractor's report covering cause, remedy and preventive measures (for each personal injury requiring the attention of a physician) shall be furnished to the Engineer-in-Charge in an approved format.

- (iii) The contractor shall have a trained person at the site for administering first aid.
- (iv) The Contractor shall have a Safety Inspector for the works

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## 54. Setting Up Of Field Laboratory

The Contractor shall set up a field laboratory at the site at his own expense to carry out the tests as per requirements

All required equipment as per relevant IS test procedure shall be available along with applicable IS codes. In addition to the above, the Contractor shall provide all other necessary equipments to carry out any other field tests required by the Engineer-in-charge.

All the equipments should be calibrated by a third party periodically and certificates should be kept in the laboratory.

The Contractor shall carry out the various mandatory tests as per BIS Specifications and the technical documents that shall be furnished to him during the performance of the work. All the tests, either on the field or outside laboratories concerning the execution of the work and supply of materials for the same shall be carried out by the Contractor at his own cost. Price quoted by the Contractor shall be deemed to include the cost of such tests and inspections.

#### 55. Taxes

- (a) The Rates in Bills of Quantities inclusive of transporting, loading, unloading, storage, security & all other charges such as toll, local taxes, other payments and compensations, if any in connection with the procurement and handling of materials, fabrication and execution of works or any method or process connected with the works or Temporary works. However GST shall be paid as per actual.
- (b) Notwithstanding anything contained elsewhere in the contract, the Owner shall deduct at source, from the payments due to the Contractor, any taxes required to be deducted at source by law. The amounts so deducted shall be deposited by the Owner with the concerned authorities as per law. It is for the Contractor to deal with the concerned authorities directly in respect of any claim or refund relating to the above deductions and the Owner shall not be liable or responsible for any claims or payments or reimbursement in this regard.

#### 56. Contractors Subordinate Staff and Their Conduct

(a) The Contractor on award of the work shall nominate and depute a qualified graduate engineer having sufficient experience in carrying out works of similar nature, as full time resident project manager of the Contractor for the work, to whom instructions for works may be given. The Contractor shall also provide to the satisfaction of the Owner/ Engineer-in-charge, sufficient and qualified staff to supervise the execution of the works, competent sub agents, foremen and leading hands including those specially qualified by previous experience to supervise the types of works comprised in the contract in such manner as shall ensure the best quality and expeditious working. At any time in the opinion of the Engineer-in-charge, any additional, qualified and experienced staff is considered necessary; they shall be employed by the Contractor without additional charge. The

Contractor shall ensure to the satisfaction of the Engineer-in-charge that his Subcontractor's if any, shall provide competent and efficient supervision over the work entrusted to them.

- (i) If any of the Contractor's agents, sub agents, assistants, foremen or any employee in the opinion of Engineer-in-charge be guilty of any misconduct or be incompetent or insufficiently qualified or negligent in the performance of their duties or that in the opinion of the Owner or the Engineer-in-charge, undesirable for administrative or any other reasons, for such person (s) to be employed on the works, then at the directions of Engineer-in-charge, the Contractor shall at once remove such persons(s) from employment at the works. The person(s) so removed from the works shall not again be employed in connection with the works without the written permission of the Engineerin-charge. Vacancy so created shall be immediately filled at the expense of the Contractor by a qualified and competent substitute. Shall the Contractor be requested to repatriate any person removed from the works he shall do so and shall bear all costs in connection therewith.
- (ii) The Contractor shall be responsible for the proper behavior of all the staff, foremen, workmen and others, and shall exercise proper degree of control over them and in particular without prejudice to the said generality the Contractor shall be bound to prohibit / prevent any employees from trespassing in anyway detrimental or prejudicial to the interest of the community or the properties or occupiers of land or properties in the neighborhood. In the event of such trespassing, the Contractor shall be responsible for all consequent claims or action for damages or injury or any other grounds whatsoever. The decision of the Engineer-in-charge upon any matter arising under this clause shall be final.
- (iii) All employees of the Contractor shall be properly identified by badges of a type acceptable to the Owner, and must be worn at all times on the site.
- (iv) Along with the tender, the bidder shall submit his schematic organization chart of staff to be employed at the works, along with their qualifications and experience.
- (b) Sub Letting Of Work
  - (i) No part of the contract be transferred, assigned or sublet by the Contractor directly or indirectly to any person, firm or corporation whatsoever except as provided for in the succeeding sub clauses without the consent of the Owner.
- (c) Sub-Contracting Of Works
  - (i) The Engineer-in-charge may give written consent to the Contractor for the execution of any part of the works/ specialized part of the works at the site, provided the Contractor submits credentials of each individual agency to the Engineer-in-charge for approval. Sub-contracting the work as a whole by the Contractor shall not be permitted. Furthermore, if it is noticed by the Owner

that the Contractor has not made payments to one or any agencies working under him, without prejudice to the other conditions herein, the Owner reserves the right to make such payments directly to the concerned agency after due verification.

- (d) Contractor's Liability Not Limited By Agencies To Contractors
  - (i) Notwithstanding any subletting with such approval as aforesaid and notwithstanding that the Engineer-in-charge shall have received copies of any sub contracts, the Contractor shall be and shall remain solely responsible for the quality and proper expeditious execution of the works and the performance of all the conditions of the contract in all respects as if such sub contract or subletting by the Contractor had not taken place, and as if such work had been done directly by the Contractor.
- (e) Owner May Terminate Sub Contracts Of Contractor
  - (i) If any Agency of contractor engaged upon the works at the site executes any work which in the opinion of the Engineer-in-charge is not in accordance with the contract, the Owner may by written notice to the contractor, request him to terminate such Agencies. The contractor upon the receipt of such notice shall terminate and dismiss the Agency. The Owner shall have the right to remove such Agency from the site if the Contractor fails to get the Agency immediately vacated.
- (f) No Relief For Action Under This Clause
  - (i) Action taken by Owner under the above clauses shall not relieve the Contractor of any of his liabilities under the contract or give rise to any right or compensation, extension of time or otherwise.
- (g) Contractor's Responsibility With Other Agencies
  - Without repugnance to any other condition, it shall be the responsibility of the (i) Contractor executing the work of civil construction to work in close cooperation and to co-ordinate in the works with the Piling, mechanical, equipment, production electrical, air-conditioning, machinery and intercommunication with other Contractors and other agencies or their authorized representatives, in providing the necessary grooves, recesses, cuts and openings etc. in wall, slabs, beams, and columns etc. and making good the same to the desired finish as per specification, for the placement of cables, conduits, air-conditioning inlets and outlets, grills and other equipment in the false ceiling and other partitions. The Contractor, before starting up the work shall in consultation, with the electrical, mechanical, equipment, inter communication, air-conditioning contractors and other agencies, prepare and put up a joint scheme, showing the necessary openings, grooves, recesses, cuts, the methods of fixing required for the works of the aforesaid, and the finishes therein, to the Engineer-in-charge and get the approval. The Contractor before finally submitting the scheme to the Engineer-in-charge shall have the written agreement of the other agencies. The Engineer-incharge, before communicating his approval to the scheme, with any required

modification shall get the final agreement of all the agencies, which shall be binding. No claim shall be entertained on account of the above.

- (ii) The Contractor shall conform in all respects with the provisions of any statutory regulations, ordinance or bye laws of any local or duly constituted authorities or public bodies which may be applicable from time to time to the works or any temporary works. The Contractor shall keep the Owner indemnified against all penalties and liabilities of every kind, arising out of non-adherence to such status, ordinances, laws, rules, regulations etc.
- (h) Other Agencies At Site
  - (i) The Contractor shall have to execute the work in such place and condition where other agencies shall also be engaged for other works such as electrical and mechanical engineering works or other works etc. No claim shall be entertained due to work being executed in the above circumstances.
- (i) Serving Of Notices
  - (i) To The Contractor

Any notice may be served on the Contractor or his duly authorized representative at the site or by registered mail directly to the postal address furnished by the Contractor at the time of tender. Proof of issue of such notice shall be conclusive of the Contractor having been duly informed of the contents therein.

(ii) To The Owner

Any notice to be given to the Owner under the terms of the contract shall be served by sending the same by Registered mail to or delivering the same at the respective site office of the Owner addressed to the Engineer-in-charge.

## 57. Patents, Royalties, Liens

- (a) The Contractor shall indemnify the Owner from and against all claims and proceedings for or on account of infringement upon any patent, design, trade mark or name or other protected rights in respect of constructional plants, machines or materials used for or in connection with the works, temporary works therefore or any part thereof, and from and against all claims demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.
- (b) Liens
  - (i) If at any time there shall be evidence or any lien, claim for which the Owner might have become liable, which is chargeable to the Contractor, and then the Owner may pay and discharge the same and deduct the amount so paid by him, from any amount which may be or become due to the Contractor.

## SECTION - 4: SPECIAL CONDITIONS OF CONTRACT (Page No 73 to 79)

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## 1. General

The Contractor may please note that Special conditions hereinafter are part of the Contract Documents, which he shall fulfil in all respects. The cost towards these shall be included in BOQ rates. In case of variation the contents in Special conditions of contract shall take precedence over General Conditions of Contract.

#### 2. Drawings

- (a) Tender Drawings issued with the Bid documents give details necessary to understand the work. Good for Construction Drawings shall be released as per project requirements to match the approved construction schedule
- (b) For structural steel fabrication work (PEB) the contractor shall issue the Design Drawings. The fabrication Drawings should as per BIS conventions and get the same approved from The Engineer. His approval shall however not relieve the Contractor of accuracy in details and dimensions. The Fabrication work shall start after such approval.
- (c) The fabrication drawings shall be in AutoCAD format. Contractor shall submit 3 hard copies and Digital files.

#### 3. Addition/ reduction in scope of work

(a) Any additional work within the site, instructed by The Engineer during the contract period shall be carried out by the Contractor as per BOQ rates. The Employer reserves right to reduce the scope of work in the contract

#### 4. Water

(a) Contractor shall arrange to supply adequate quantity of approved quality water for curing, construction and drinking. He shall install the piping work and storage tanks, pumping as per requirement at his own cost.

#### 5. Electric power

- (a) Electric power for construction machinery, equipment, lighting at site shall be arranged by contractor at his own cost. The wiring/cabling/ earthing shall be safe and as per PWD Electrical Inspector's requirements. The installation shall be erected, operated, maintained and monitored on day to day basis by competent electrical supervisor.
- (b) DG sets of adequate capacity shall be installed, run and maintained so as to meet work quantum and schedule requirement.
- (c) Necessary safety gear, gloves shall be available at site for the operating staff.
### 6. Material testing lab at site

- (a) The Contractor shall provide at site and maintain and operate throughout the tenure of contract site laboratory with facilities for testing in situ proctor density, concrete design mix, aggregates, sand, concrete cubes, concrete slump, material density, accelerated cement test, moisture content, gauges for thickness measurements etc. However certain percentage of tests as determined by the Engineer shall be carried out in approved Third party laboratory. Test apparatus shall be calibrated in approved laboratory periodically.
- (b) The laboratory shall be manned and operated by qualified and experienced technicians.

## 7. Progress reports and photographs

(a) Contractor shall prepare and submit following to The Engineer.

Daily Progress Report (DPR) giving details of man power, staff, plant and equipment, cement consumption.

Weekly report giving details of major items of work executed, cement and steel consumed.

Monthly progress report giving details of work executed in the month, cement and steel consumed, stock position, review of construction schedule (M S Project), summary of action taken for Quality, planning of work in the next month and 8 photographs of work executed in the month.

The monthly report of the last month shall be submitted in the first week of current month.

### 8. Environment protection

- (a) Contractor shall take adequate measures to reduce dust, mud, and smoke and noise nuisance to people working at site and in the neighbourhood. Such measures shall inter alia include sheet barricade of adequate height, sprinkling water on aggregate storage, application of modern construction machinery and equipment meeting statutory provisions.
- (b) All the trees at site shall be thoroughly protected by guards as per requirement.

### 9. Site facilities

- (a) The Contractor shall provide and maintain site office with toilet and pantry, conference facilities, furniture, fixtures, drinking water and electrical power as per the drawing attached and as stated in the Appendix.
- (b) The Contractor shall establish his office, laboratory, stores, steel storage and fabrication yard, cement storage shed in watertight construction and of adequate capacity, drinking water facilities, sanitization facilities, rest room, crèche for his staff and workers. Proper access and internal roads for vehicular traffic in all-weather shall be provided.
- (c) Statutory approvals, licenses for above mentioned facilities shall be obtained and maintained by the contractor at his own cost.

# 10. Royalty

(a) Royalty applicable on supply of building and quarried materials to site as also on excavation work at site shall be paid by the contractor and the copies of documents showing evidence of having paid the same shall be lodged with the Employer

# 11. GST & IGST

(a) GST on the contract bills shall be paid by the Employer. Please refer to the BOQ.

## 12. Measurement book

- (a) Measurements of work done shall be written jointly by The Engineer or his representative and contractor's Engineer and signed. The Book shall remain in the custody of The Engineer.
- (b) Measurements of work done in a particular month shall be completed before 7th day of the next month.
- (c) Contractor's Bill shall be accompanied by Xerox copies of duly signed measurements.

## 13. Monthly Running Bill:

Contractor shall prepare and submit monthly running bill covering work done in that particular month. The Engineer shall check, certify and forward to the Employer for further necessary action.

### 14. Terms of payment :

## 14.1 Mobilization advance

Mobilization advance of 10% of the contract value will be paid to the contractor against the Bank Guarantee value of 110% of the advance amount of any Nationalized /Scheduled Commercial Banks notified by RBI (except co-operative/Rural Banks) valid for 12 months from the date of LOI / notice to proceed or up to the total recovery of Mobilization advance whichever is earlier.

10% mobilization advance will be deducted from each Running Bill.

After recovery of the total mobilization advance, the Bank guarantee received against the mobilization advance will be returned to the contractor.

## 14.2 Monthly R.A. Bill:

Monthly consolidated single bill should be presented for settlement. The R.A. Bills will be checked & certified by the Consultant within a period of 20 days and payment shall be paid within 15 working days from the date of certification by Consultants and necessary deductions like 10 % Mobilisation advance, 5 % Retention money & any other payment made and taxes as per Terms. All bills shall be submitted in soft copy as well as hard copy. The reconciliation of Cement & Steel to be submitted along with R.A. bill. All Test reports, J.M.R., Progress report with Photographs also to be submitted along with R.A. Bills.

The Consultants shall be within his right to adjust and deduct the advances such that full recovery will be made at appropriate stage.

## 14.3 Retention Money:

5% contract value will be deducted as retention money from each RA bill (it shall be in addition to the Performance Bank Guarantee of 5% of the contract value).

On submission of final bill/Completion of the contract, 2.5% of the retention money will be released. Balance 2.5% of the retention money will be released against the Bank guarantee of any Nationalized/Scheduled Commercial Banks notified by RBI (except co-operative/Rural Banks) valid for 12 months defect liability period from the date of final completion of work/handing over of site.

Bank Guarantee will be returned after the expiring of the defect liability period i.e., 12 months from the date of completion of work/handing over of site.

### 14.4 Final Bill

Only on obtaining final completion certification from the Consultants & Employer, the Contractor shall submit the FINAL BILL which will be settled within a period of two months provided there is no dispute. The completion certificate will be issued only after all the defects pointed out are rectified completely to the satisfaction of the Consultants and the Employer. The reconciliation of all materials to be submitted along with the bill.

### **15.** Quality assurance and Quality control

The Construction Quality Management is necessary to ensure that the Construction Quality meets or exceeds the intents of the technical specifications and drawings set forth in the Contract Documents. This is a system in which The Construction Manager (contractor) and The Engineer in Charge (employer/consultant) perform defined tasks independently to achieve the Objective cited above.

- (a) Quality Control (QC) is regulatory process to be performed by the Construction manager and which includes following:
  - (i) Specific standards are set for Construction performance, deduced or derived from the Technical Specifications/Drawings/Contract Conditions.
  - (ii) Construction methodology and planning and detailed time schedule.
  - (iii) Planning and deployment of appropriate resources like plant/ machinery/ manpower
  - (iv) Systems for workmanship in process supervision, checks and corrections.
  - (v) Testing of Construction Materials and site facilities.
  - (vi) Quantification of work done.
  - (vii) Meetings/workshops for safety and improvement in quality Plan
- (b) The Construction Manager prepares Quality Plan particular to the Project and same is finalized in conjunction with Engineer in Charge. The Quality Plan shall comprise of
  - (i) QC Organization defines qualifications, hierarchy, authority and responsibility.
  - (ii) Construction method statement.
  - (iii) Procedure for material sample approvals.

- (iv) workmanship checks for work in progress
- (v) Material tests-standard/frequency/tolerances
- (vi) Forms
- (vii) procedure for interaction with Engineer in Charge
- (viii) Bar Chart
- (ix) safety manual
- (c) Quality Assurance (QA) includes defining criteria, applying procedures to ensure that QC system is effective .Thus the main functions of the Engineer in Charge are (1) to verify, vet contractor's Quality Plan and the QC system. (2) To monitor the working of QC systems. (3) Taking remedial measures in case of failures and strengthening the system

The Engineer in Charge makes his Quality Plan which comprises of

- (i) QA Policy and goal.
- (ii) QA standards and procedure, procedure for QA/QC interface.
- (iii) Development of QC norms specific to the project.
- (iv) Organization
- (v) Acceptance criteria
- (vi) Site surveillance and checks to control and prevent non conformities.
- (vii) Audit of completed work
- (viii) Maintaining QA records.
- (ix) Periodic internal QA/QC audits and remedial measures as per requirement.
- (x) Periodic joint site visits and meetings with the Construction Manager to sort out quality related matter.

## 16. Supply of Cement , Reinforcement Steel & Structural Steel for contract work

- (a) The Employer shall supply above materials at free of cost for contract work as per requisition given by the Contractor. The Employer shall arrange the supply at site within 3 weeks of receipt of such requisition.
- (b) Weighment, unloading at site, handling, storage, security and testing of samples in approved laboratory shall be done by the contractor and same shall be included in relevant item rates.

The Contractor shall maintain at all times proper records of material received, consumed and stock of all materials for use by the Contractor in the construction of civil works at the site.

The Contractor shall also provide a proper reconciliation of the material consumed, duly verified by the Consultants, along with the RA bills submitted from time to time.

For purpose of reconciliation of Cement, Reinforcement & Structural steel, the following wastage shall be allowed. Rolling Margin to be established & recorded jointly by Contractor & Engineer in charge / Consultants for every batch / lot of supply. Rolling margin will be considered only for reconciliation. Payment shall be done on unit weight as per IS Code only. Excess wastage shall be recovered from Contractor Bill at rates mentioned in Appendix.

a)	Cement	:	3.00 %
b)	Reinforcement Steel	:	3.50 %
c)	Structural Steel	:	3.50 %

Reinforcement Steel & Structural Steel above wastages shall be returned back to NTC on quarterly basis with reconciliation.

### 18. Variations in Quantity and Non tender items

- a. If the final quantity of work done differs from the BOQ quantity for the particular single item by more than 25% and provided this change causes variation in excess of 5% of the Total Contract Price, then The Engineer shall review, assess and approve a varied rate that shall be applicable for excess quantity.
- b. Wherever applicable, the rates of non-tender items shall be deduced from similar items of work in BOQ and if this cannot be done then from DSR of Madhya Pradesh State PWD for the nearest District HQ.
- c. If above cannot be applied, then the Engineer shall arrive at the rate on the basis of actual cost incurred add 15% towards overheads, profits, transportation, handling, storage etc.

L + M +15%

L= Cost of Labour

M= Cost of Materials

- d. For working out (18( c) above) the Contractor shall submit detailed analysis and supporting documents deemed necessary by the Engineer in advance and get the approval from the Engineer/ Employer before executing the work.
- e. The Engineer may compute the varied rate in 18(a) above by applying 18(b) or 18(c) as may be appropriate.

## **19.** Completion period, completion certificate and taking over

Tender for Construction of Raw Material godown & Refurbishing of Annex Block

- a. The Contractor shall complete the contract works in all respects within the Completion period as per Appendix.
- b. On completion of contract work, the contractor shall give a written Intimation to the Engineer to this effect. Joint Inspection by Employer, The Engineer, and contractor shall be done within 10 days of intimation and the punch list or defect list shall be prepared and signed. The defects shall be rectified within 14 days, again the rectifications work will be verified jointly. After all the defects are rectified to the satisfaction of Employer/the Engineer, Acceptance report will be signed jointly and the Employer shall take over the work within 7 days of signing the Acceptance report.

## 20. Defect liability

- a. The Defect liability period shall be as per Appendix. The contractor shall be responsible to make good at his own expenses every defect which may develop during this period and which in the opinion of The Engineer is due to defective materials /defective workmanship/erroneous construction method.
- b. The Employer shall intimate the defects in writing to the contractor and the contractor shall rectify the same within 7 days of such intimation. Failing this, the Employer shall be within his right to get such defects from other sources and recover the cost from the retention amount.

## 21. Liquidated damages

- a. Liquidated damages to be recovered from the contractor for delay in completing the work shall be as per Appendix 7.
- b. This clause shall be applicable for early completion/delay in Mile Stones if so stated in the Appendix.

### 22. Performance security

- a. Performance Security shall be provided by the contractor to the Employer not later than the date given in the Letter of Acceptance. The amount, time period of keeping in force and banker shall be as specified in the Appendix. The performance security shall be by way of Bank Guarantee.
- b. The format for the Bank guarantee shall be as per Tender Documents.

### 23. Labour and compliances with labour regulations

- a. The contractor shall deploy adequate force of skilled and UN skilled workers, foremen, supervisors of requisite skills to ensure quality construction as per schedule.
- b. During the currency of contract, the contractor, his sub-contractors shall abide all existing or deemed statutory Labour Enactments, Rules, and Regulations as applicable.
- c. The Contractor shall keep the Employer, The Engineer indemnified in case any action is taken by competent authority due to contravention of any Act/rules/regulations including amendments if any.

### 24. Spaces for quarters

- a. The Employer shall provide Open Space at site for contractor's workers residential quarters. Contractor shall barricade such area, maintain sanitation and hygiene and completely vacate and hand over to the Employer within 15 days of termination of contract.
- b. All Statutory permits shall be arranged by the Contractor at his cost. He shall keep the Employer indemnified from any penalties, legal sanctions that may be imposed by the Authorities in this matter.

### 25. Safety at site.

- (a) The Contractor shall maintain high quality safety standards to control and arrest accidents, injuries, occurrences of fire and resultant damages. The compliances in this regards have been listed and discussed herein after. The Contractor may make his assessment and add more items as may become necessary and prepare Contractor's Safety Plan for site operations. Such Plan shall be reviewed in conjunctions with the Engineer and modified to achieve higher standards
- (b) Contractor's Construction Manager shall set up Vigilance cum Safety Committee to implement and monitor the Safety Plan. The constitution of the committee shall be as follows :

Chairman	Construction Manager.
Coordinator	Safety officer/Engineer
Members - minimum 6.	Site engineers/supervisor/Foreman Two from each
	Work group.
Associate	The Engineer/ his representative.

The members shall be different work groups such as Machinery & Mechanical, Electrical Supervisor, Fabrication, carpentry, concreting, and earthwork etc. The members shall reach the employees in the group and make them aware of the safety measures and rules etc. The first Workshop and briefing shall be held at the commencement of work. Subsequently the members shall continue periodic briefings to each group. The Committee meetings may be held bi monthly to review and take suitable action

- (c) For creating greater awareness, appropriate safety posters and signages shall be put up neatly at prominent places. These should be visible.
- (d) The internal circulation roads, storages, site office, fabrication yards, material stacking, construction water lines, cable routes shall be made as per proper plan for smooth movements.
- (e) Following protective equipment/items shall be provided :
  - Safety shoes, helmets for all employees/workers at site.
  - Safety belts, canvass shoes while working on roofing.
  - Safety goggles, leather gloves, face screen by welders, fitters, gas cutters, and khalasis.
  - Shock resistant shoes, hand gloves, for wiremen, electricians.
  - Asbestos fibre gloves/rubber gloves while handling chemicals.
  - Protective heavy quality nylon net to be provided on the underside where work is on at an elevation.
  - Fire extinguishers and sand buckets.
  - 3m high sheet metal barricade to protect the neighbourhood from dust and noise.
- (f) Preliminary requirement of staff and Machinery/plant/equipment:
  - Vehicle drivers, crane drivers/operators, Electricians/wiremen, shall have well
  - Experience, expertise and valid license from RTO/Electrical Inspector
  - Welders/fitters, mechanics should have good work knowledge and ITI licenses
  - Winches, cranes, pulley blocks, wire ropes shall have a valid test report and worthiness certificate of a chartered engineer
  - Approved capacity for load shall be clearly exhibited on cranes
  - transit mixers, trucks, vehicles shall have valid permits
  - At any time minimum 2 trained First Aid workers shall be available. They must be trained for artificial respiration, dressing the wounds, handling the causality in correct way
- (g) Standing instructions for safety :
  - Alcohol and tobacco is prohibited
  - Children/minors not allowed entering site
  - Earth work, fabrication areas to be barricaded
  - Movement of vehicles/Poclain/jcb etc to be controlled by a foreman

Tender for Construction of Raw Material godown & Refurbishing of Annex Block

- Transportation of heavy articles at site to be closely controlled to protect workers / nearby objects
- The main switch boards shall have double earthing. All earth moving equipment to have effective earthing
- Circuit breakers shall be used
- Only armoured cable/ heavy rubber insulated cables of minimum 660 V grade shall be used
- Adequate lighting arrangements to be made
- All electrical installation shall be protected from rains/leaking water etc.
- Cranes/earth moving equipment shall have audio-visual signalling during operation
- Sturdy staging, platforms with railing shall be provided for work at elevation
- First Aid boxes and one stretcher to be available throughout the day and night
- Telephone and address of the nearest Hospital to be displayed in site office
- Vehicle to be available for evacuating causality
- (h) In case of accident arrangements shall be done very fast for evacuation, first aid, and admittance to a Hospital
- (i) Proper records shall be maintained as required by the Factory Inspector

## 26. Resolution of Disputes

The Terms & Condition of this tender document shall prevail in case of any dispute arising out of this contact and any dispute directly or indirectly connected with this contract will be referred to sole arbitration of the Chairman & Managing Director of National Textile Corporation Ltd. New Delhi or any other officer appointed by the Chairman-cum-Managing Director of the corporation for this purpose. The decision of the said arbitrator shall be final, conclusive and binding upon all concerned.

### 27. Force Majeure

The General Manager NBT Mills, BHOPAL shall not be liable for any failure or delay in execution of contract due to any cause beyond their control including fire, floods, strikes, go-slow, lock-out, closure, pestilence dissilience dispute with staff dislocation of normal working conditions, war riots epidemics political upheavals Government actions commotion, breakdown of machinery, shortage of labor-acts, demands or otherwise or any other cause or conditions beyond the control of aforesaid causes or not and the existence of such cause or consequence may operate at the sole discretion of The General Manager NBT Mills, BHOPAL. To extend the time of execution on the part of The General Manager NBT Mills, BHOPAL by such period as may be necessary to enable The General Manager NBT Mills, BHOPAL to affect execution after the cause of delays will have ceased to exist. The provisions aforesaid shall not be limited or abrogated by any other terms of the contract whether printed or written.

## 28. Jurisdiction

All suits or proceedings relating to any dispute or claim arising out of or in course of performance in this contract shall be filed in appropriate court having jurisdiction in the State of Madhya Pradesh as case may be.

# SECTION - 5: <u>APPENDIX</u> (Page No. 84 to 88)

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# **APPENDIX**

1.	Earnest Money Deposit, Performance Bond	:	Earnest Money Deposit of Rs. 8.00 Lakhs is required to be paid by DD/Pay Order drawn on any Nationalized. Scheduled Commercial banks notified by RBI (excluding co-operative/ Rural banks) in favour of <b>"N.T.C. Ltd. Unit- Western Region"</b> payable at Mumbai - Demand Draft from Nationalized Bank payable at Mumbai. The Earnest Money in respect of unsuccessful bidders shall be refunded within Two weeks of finalization of the successful bidder. The earnest Money Deposit in respect of the successful bidder shall be returned on submission of performance Bank Guarantee.
	Clause 22 (Section 4) Special conditions of contract		5% of the Contract value as a Performance Bond in the form of a Bank Guarantee of a Nationalized / Scheduled Commercial Bank notified by RBI (except co-operative/Rural banks) validity for 14 months from date of LOI / notice to proceed.
2.	Retention-Clause 14.3 (Section 4) of Special Conditions of contract	:	5% of the contract value will be the retention money. 5% of the value of each running bill to be deducted from Each R.A. Bill. This shall be in addition to the performance bond. 2.5 % Retention money will be released after final completion of work. Balance 2.5 % will be released against BG of Nationalized/ Scheduled Commercial Bank notified by RBI (except co-operative/Rural banks. Validity of this BG should be 18 months from date of Final completion of work. Bank guarantee will be returned at the end of defects liability period, i.e. 18 months from date of completion of work.
3.	Defects Liability Period- Cause 20 (Section 4) of Special Conditions of contract	:	The Defects Liability period will be 18 months from the date of Completion of Work or 6 Months after rectification of last noticed defects, whichever is later.
4.	Interim Bill-Clause 14.2 (Section 4) of Special conditions of contract	:	Deduction of 5% towards retention, 10% towards recovery of mobilization advance, payments already made and recovery of any other dues/income tax.
5.	Final Bill-Clause 14.4 (Section 4) of Special Conditions of Contract	:	Final Bill shall be complete in all respects including duly signed final measurements, material reconciliation statements, authentication of non tender items by quantity and by rates agreed upon. Payment against final bill will be made as set out in

			Special Conditions of Conract-Clause14, after deducting full mobilization advance, 5% retention, other dues/income tax and recoveries.
6.	Time for Completion-Clause 19 (Section 4) of Special Conditions of contract	:	6 Months from date of getting mobilization advance.
7.	Liquidated Damage-Clause 21 (Section 4) of Special conditions of contract	:	In the event of delay in completion of work, the contractor shall pay liquidated damages at the rate of 0.5% of contract price per week of delay subject to a maximum of 5% of contract price.
8.	Penalty	:	<b>Rs. 10,000/-</b> per incident of unsafe act / non compliance of Legal / Statutory requirements as may be pointed out by the Consultants / Employer. Such fault shall also include acts that are specifically prohibited under various provisions / clauses provided as part of this tender document. If Employer found that the materials used are of substandard, the contractor will have to replace the materials with the standard quality as specified without any additional cost to the employer
9.	Reconciliation of Material	:	The Contractor shall maintain at all times proper records of material received, consumed and stock of all materials for use in the construction of civil works at the site. The Contractor shall also provide a proper reconciliation of the material consumed, duly verified by the Consultants / Employer, and along with the RA bills submitted from time to time and also Final reconciliation Statement with final Bill.
10.	Contract Rates.	:	The Contract rates as per BOQ shall remain firm throughout the currency of the contract. No escalation or price adjustment shall be done due to any reason.
11.	Certified Payments-Clause 14 (Section 4) of Special Conditions of Contract	:	All payments made against the certificate issued by the Architect and Employer shall be deemed as advance payments. Payments made will not be construed as the items are complete and without any defects. Only on receiving completion certificate & settlement of final bill, the work shall be considered as complete and payment made against the final bill be considered as full payment against the work.
12.	Mobilization Time - Clause	:	The Contractor shall mobilize to the satisfaction of the

	14 (Section 4) of Special		Engineer and start construction work at site within a	
	conditions.		period of Ten Days from the date of Notice to Proceed.	
13.	Labour - Clause 23 <b>(Section</b> <b>4)</b> Special Conditions.	:	The Contractor shall comply with the provision of all relevant Acts of Central or State Govt. including Payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maternity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970 or PF Act 1952 any modification thereof or any other law relating thereto and rules made there under from time to time. No child labour should be employed at site.	
14.	Insurance	:	The Insurance Policies to be taken and kept in force by the contractor throughout the construction and defect liability period: These policies will be in joint names of contractor and Employer	
			All risk insurance of work for contract price + 10%	
			Personal injury or death insurance-third party liability up to Rs. Ten lacs per occurrence and covering 10 occurrences during the Contract.	
			Personal injury or death Insurance for Contractor's staff, employees.	
			Motor vehicle insurance including third party.	
15.	Notice to Local Bodies	:	The Contractor shall comply with and give notices required by any Government authority, instrument, rule or order made under any Act of Parliament, State laws or any regulation or bye-laws of any local authority relating to the works.	
16.	Indemnification	:	The contractor shall indemnify and keep the Employer indemnified against any liability in respect of :	
			(i) Any fee or charges payable under any Act of Parliament, State Laws or any Govt. instrument, rule or order and any regulation or bye-laws of any local authority in respect of the works.	
			(ii) Any loss or damage caused to any building road or fence of the company or any other	

			party in the working area due to negligence of the contractor.
17.	Licenses and local approvals	:	The contractor shall obtain at his cost at his cost Govt/Quasi Govt/Municipal licenses/permits required for labour, site facilities, construction work
18.	Mobilization advance Clause 14 (Section 4) of Special conditions of contract		Mobilization advance of 10% of the contract value will be paid to the contractor against the Bank Guarantee of value not less than 110% of the mobilization advance from any Nationalized /Scheduled Commercial Banks notified by RBI (except co-operative/Rural Banks) valid for 6 months from the date of LOI / notice to proceed or up to the total recovery of Mobilization advance whichever is earlier. 10% mobilization advance will be deducted from each Running Bill. After recovery of the total mobilization advance, the Bank guarantee received against the mobilization advance will be returned to the contractor.
19.	Supply of steel and cement and reconciliation. Clause no 16 (Section 4) of special conditions of contract		The employer shall supply Cement including bag & Steel for Construction work as per design and drawings and a wastage allowance of 3.00 % for cement and 3.50 % for steel. Contractor shall construct temporary Cement Godown for 3000 Bags capacity at his own cost. Along with the final measurements and Bill, reconciliation statement shall be prepared by the contractor which shall be checked by the engineer. If cement and steel supplied is found in excess of quantity as per duly certified final measurement plus the wastage allowance stated above, then recovery of excess materials shall be made at following rates : Cement OPC / PPC Rs. 350 per bag of 50 Kg. TMT/TOR bars Rs. 55,000.00 per M.T.
20.	Site office & conference facilities-Clause 9 (Section 4) Special Conditions.		Contractor to provide fully furnished office as per attached drawing to Employer / Consultant, duly air conditioned with computer & internet connection.

# TECHNICAL SPECIFICATIONS

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# PART I

# TECHNICAL SPECIFICATION FOR CIVIL WORK

# TECHNICAL SPECIFICATIONS FOR CIVIL WORK

# 1. <u>GENERAL</u>

# 1.1. <u>Scope of Work</u>

The work contemplated under this contract includes civil Construction for the aforesaid project, all as detailed in the Bill of Quantities, Specifications and Drawings

Such other works which are not included in the aforesaid Bill of Quantities are generally intended to be executed through a separate agency. Not with-standing the above, the Clients reserves the right to order additional works under the same Contract. The Clients also reserves the right to omit any item of work included in the aforesaid Bill of Quantities and award the same to any other Contractor or not perform it at all at their discretion and the Contractor shall not have any claim because of the same.

The Contractor for this work shall be required to work in cooperation and co-ordination with other agencies on site and give them all reasonable assistance and help for the execution of the work in an efficient manner as directed. The words "approved" or "as directed" shall be deemed to convey approval or the discretions of Consultant.

# 1.2. Indian Standard Specifications

The particular Specifications for the work is as detailed hereinafter. The Specification shall be read in conjunction with the relevant Indian Standard Specifications and the obtainable local practice as detailed in various regional handbooks of practice and the work shall be executed accordingly. Where the Specifications in any of the standards are at variance with the Specifications detailed herein, the Specifications herein shall govern.

1.3. Quality of materials & General Standards of work

The Contractor under this contract commits himself to use first class material and assumes full responsibility for the quality of all material incorporated or brought for incorporation in the work. The work shall be executed in accordance with best engineering practice and as per directions Consultant.

1.4. <u>Water and Power for construction</u> Please refer relevant clauses under "Special Conditions of the Contract".

# 1.5. <u>Scaffolding</u>

All scaffolding and ladders required for the proper execution of the work shall be provided by the Contractor.

# 1.6. <u>Measurements</u>

The mode of measurements, wherever possible is specifically mentioned in these documents, where it has not been mentioned, it shall be as per provisions of the relevant Indian Standards. All the measuring tapes and other accessories necessary shall be provided by the Contractor.

# 1.7. <u>Tools and Plant</u>

The tenderer along with his tender furnish a list of tools, plant and machinery which he intends to use on the works in Appendix I of the Bill of Quantities. The list should indicate the exact type of machine, its capacity, and year of manufacture, kind and capacity of propelling force, spare parts readily available and all other pertinent information. The contractor is obliged to use all the machinery mentioned in his list if Consultant considers in necessary.

# 1.8. Surveying and staking

It is the express responsibility of the Contractor to bring to site all surveying instruments necessary for the marking out, fixation of levels, etc. and conduct these survey operations himself with utmost accuracy. The Contractor shall put up stable stakes, bench marks etc. as necessary for the work. Consultant will be present when this work is being carried out and will inspect all these operations with the Contractor's assistance.

## 1.9. <u>Dewatering</u>

Dewatering of all accumulated water in all locations on job site from whatever source or cause until the virtual completion of the entire work, shall be done by the contractor at his own expense and shall not be separately paid for. The rates quoted by the contractor shall be deemed to be inclusive of this.

## 1.10. Access to site, approach roads and roads within the premises.

The contractor shall at his own cost provide all approach roads required in connection with the access to site for transport of materials and labour and such other uses. He shall acquaint himself thoroughly regarding condition and suitability of public roads leading up to the limits of the premises and will provide vehicles for transportation of materials which meet the requirements of these road conditions. It shall also be the responsibility of the contractor to maintain at his own cost these roads till the construction is completed.

## 2. EARTH WORK AND EXCAVATION

2.1. <u>Excavation</u>

Excavation if required at desired places would be considered as per rate contract per cubic meter.

2.2. <u>Dewatering</u>

All water which may get accumulated in the excavations during the progress of work from whatever cause or source shall be bailed or pumped out as necessary. The rates for excavation shall be deemed to include for the same, if not otherwise specified.

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# 2.3. <u>Timbering to excavation (shoring)</u>

Where the soil is soft and sides of excavation needs supporting, suitably designed planking and strutting shall be provided the rates for excavation shall be deemed to include for all planking and strutting as necessary.

# 2.4. <u>Refilling around Foundations</u>

Refilling around foundations shall be done with approved excavated material. Refilling shall be done in layer not exceeding 30cms. Thick, watered adequately and consolidated. The finished surface of filling shall be slightly proud as directed. The rates for refilling around foundations shall be deemed to include for this.

# 2.5. Soil/ Rock classification

All materials to be excavated shall be classified by Engineer, into one of the following classes and shall be paid for at the rate tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of Engineer regarding classification of the material shall be final and binding on contractor and not be a subject matter of any appeal or arbitration. Any earthwork will be classified under any of the following categories:-

# 2.6. Ordinary and Hard Soils

These shall include all kinds of soils containing kantar, sand, silt, murrum and/or shingle, gravel, clay, loam, peat, ash, shale etc. which can generally be excavated by spade, pick-axes and shovel and which is not classified under "soft and decomposed rock" and "hard rock" defined below. This shall also include embedded rock boulders not longer than 1 meter in any direction and not more than 200 mm in any one of the other two directions.

# 2.7. <u>Hard Rock</u>

This shall include all rock occurring in large continuous masses which cannot be removed except by blasting for loosening it. Hardener varieties of rock with or without veins and secondary minerals which, in the opinion of Engineer require blasting shall be considered as hard rock. Boulders of rock occurring in such sizes and not classified under 9a) & (b) above shall also be classified as hard rock. Concrete work both reinforced and un-reinforced to be dismantled will be measured under this item unless a separate provision is made in the Schedule of Quantities.

# 2.8. Soft and Decomposed Rock

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite basalt, sedimentary rocks and all other materials which in the opinion of Engineer is rock but does not need blasting and could be removed with picks, hammer, crow bars, wedges and pneumatic breaking equipment. The mere fact that contractor resorts to blasting for reasons of his own, shall not qualify for classification under "hard rock".

2.9. <u>Blasting</u>

Where blasting has to be resorted to for rock cutting it shall be the responsibility of the contractor to arrange for the following at his entire risk, cost and responsibility.

- i. Permission from all the connected Public Authorities such as Municipal Corporation, Inspector of Explosives, Police, Highway Authorities, etc. shall be obtained.
- ii. Fees, royalties and any other levies, attendant on such blasting work shall be entirely borne by the contractor.
- iii. All precautionary measures such as notices to adjoining property and other agencies working in and around the plot, signaling and watch etc. shall strictly adhere to according to the various regulations in force.
- iv. All risk Insurance in respect of the blasting hazards to men and materials within and in the vicinity of the plot. This insurance shall be apart from the Contractors all Risk Insurance Policy stipulated under General Conditions unless the Contractor incorporates blasting hazards and its coverage in the said general policy.
- V. Storing of blasting materials shall be strictly as per Explosive Regulations.

The tenderer must acquaint himself with the site conditions in regard to blasting, nature of rock likely to be met with, timing and other restrictions in regard to blasting etc. No. claims whatsoever in this regarding signals/siren, etc. should be strictly adhered to.

- 2.10. <u>Disposal of Surplus excavated materials</u> All materials considered surplus shall be removed to destinations and disposed of as directed. The disposal of the material can be in any of the following ways as directed by Consultant
  - i. Filling in low lying areas
  - ii. Filling in at places of filling such as under floors, in

roads, etc. iii. Stacking of material in pre-designated

stacking yard.

iv. Removal of material outside the plot for disposal at the discretion of the contractors.

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2.11. Filling

Filling under floors or other places indicated shall be done with approved material obtain from excavation or approved materials brought from outside by the Contractor. The material should generally be good quality soft or hard murrum or other approved. Filling shall be done in layers not exceeding 30 cms thick and each layer shall be watered adequately and consolidated properly by rollers or pneumatic rammers 8 to 10 tonnes wherever conditions permit. If it is not possible, the consolidation shall be done by hand rollers and heavy pneumatic/hand rammers of 5 tonnes capacity. The surface of the filling shall be finished to lines and levels as required. The filling shall be compacted in such a manner as to

guarantee full stability. The compaction shall be such that minimum relative density obtained on testing is 95%. In general, one test shall be performed for every 1000 m<sup>2</sup> of compacted area.

## 2.12. <u>Termite treatment</u>

2.12.1 General

This is a chemical treatment provided for protection from termites. A complete barrier of chemical insecticides is formed between the building and the ground or earth from where most of termite species enter and attack. The detailed specifications for chemicals and method of application is as per IS 6313 Part I & II.

## 2.12.2 Chemicals

Emulsion containing 0.5% aldrin is considered suitable. Chloropyriphos is also can be used in place of Aldrin as per manufacturers specification.

## 2.12.3 Application

The emulsion is applied in stages and in close conjunction with civil works in foundation and superstructure.

- In foundation pits and trenches treat bottom and sides up to 300 mm ht. at the rate of 5 liters mixture per sq. m.

- On both sides of built-up walls in foundations from plinth to 500mm below @

3 liters/meter.

- On the underside of flooring before laying the base concrete 5 liters per sq. meter.

## 2.12.4 <u>Precautions</u>

The chemicals/ insecticides are poisonous and should be handled with Extreme care.

### 2.12.5 Guarantee

The contractor shall render the building termite free for 10 years and give a

Guarantee to this effect in stamp paper as directed by the engineer in-Charge.

### 2.12.6 Measurements

Out to our plan area of the building at ground level will be measured.

## 2.13. <u>Measurements</u>

Measurements for all excavation, filling, carting away and earthwork shall be in solid measure. The rates quoted by the tenderers are thus for solid measure units. The following factors shall be applied to obtain quantities of solid measure.

- Excavation :No reduction in volume
- Filling watered and consolidated in layers : Volume shall be determined by levels taken before and after compacted filling and by measuring the length and breadth as required.- Loose measure as in trucks or dumping: Volume of loose measure less 25%
- Stack measure as in rubble, etc. : Volume of stack less 40%

The mode of measurement for various types of excavations shall be as under:

- i. In case of trenches, pits and areas, measurements shall be on the basis of the width of foundation and the depth to bottom of foundation (bottom of bed concrete if provided) formation.
- ii. In case of pipe trenches and drains, measurement of width of trench shall be diameter of the pipe plus and allowance of 50 cms. To allow for collars, flanges etc.
- iii. Excavation in rock shall be measured up to levels indicated or required. No undulations as physically appearing after excavation shall be taken into consideration while arriving at the quantities. The rates quoted by the contractor shall be deemed to include for this and no extra is admissible.

## 2.14. <u>Rubble Soling</u>

Rubble for soling shall be locally available stone of approved variety. It shall be hard, durable and free from defects such as fissures, etc. After excavation/filling has been performed to the required levels, rubble shall be hand set as closely as possible and packed well. Stones shall be laid to have their largest area resting on the sub-grade. Rubble packing shall be in one layer of 20/25 cms thick. After the stones are packed in position, the interstices between them shall be carefully filled with stone chips of

Tender for Construction of Raw Material godown & Refurbishing of Annex Block

appropriate sizes. These shall be hammered in to obtain a finished hard and compact and level surface. More spreading of loose spalls or stone chips are prohibited.

The surface shall then be examined for any protrusion and if found the same shall be knocked off to obtain as even a surface as possible.

Under no circumstances, filling in voids with murrum, sand or such other material will be permitted for building. The soling solaid shall be compacted with hand/power roller of 8 to 10 T. capacity. It shall be ensured that soling shall be dry rubble soling only. PVC coated waterproof building paper required to be spread over the rubble soling shall be stretched and spread in a neat manner. It shall be ensured that no tearing or puncturing of the paper occurs on account of indiscriminate use of the area by labourers. In unavoidable cases, these shall be covered with an additional layer of approved waterproof paper of appropriate size (to cover the punctured area with suitable margins) before concreting is started.

2.15. <u>Sub-grade Conditions</u>

The contractor shall acquaint himself of the above before filling up of the tender.

The tenderer should thus make it imperative to inspect the Site and ascertain and familiarise himself with the sub-soil conditions, water table, etc. No claim whatsoever will be entertained on account of conducting these exploratory works or lack of investigation on the part of the Contractor.

### 2.16. Metal Packing

Where metal packing is to be provided, it s h all con-form to the following specifications: -

3" to 3/4" graded hard stone metal (3" to 2") being hand broken and smaller aggregates being obtained from crusher laid in layers 12cms. Thick each and compacted separately with a 8 to 10 tonnes power roller to a thickness of

10cm. each scarifying the top surface with wire brush and brooms, to remove all dusty particles and foreign matters and then blinding the same with stone dust. The final surface shall again be compacted with a power roller of 8 to 10 ton capacity.

### 2.17. Brick Soling

Where brick soling is required to be provided, it shall conform to the following specifications: -

- It shall be laid on edge of the bricks touching each other. Soling where specified in two layers the line of joints in the bottom layer shall cross those in the top layer. Soling where specified in two layers, the line of joints in the bottom layer shall cross those in the top layer.

Soling shall be closely packed leaving no interstices or gaps. Appropriate filler bricks shall be used to make up for dimensions which are part of the whole brick. After the soling is completed the whole surface shall be subjected to consolidation by a light roller. The laying of waterproof paper before floor concrete is laid shall be all as specified above under "Rubble Packing".

## 2.18. <u>RCC Pipes</u>

Where RCC Pipes are required to be provided, it shall confirm to the following specifications:-

- The RCC Hume Pipes should be spun type pipes with necessary reinforcement & beconfirming tolatest Indian Standard IS: 458. The accessories & fixing procedure to be as per the IS code.

## 2.19. Demolition & carting away Debris

Where Demolition is to be done, it shall confirm to the following specifications:-

- Demolition may be done with machinery like electrical concrete breakers, chippers, pneumatic concrete breakers, or manually. Rates for Demolition of Brick masonry, PCC, RCC, Boulder Soling, Brick Flat Soling, Brick on Edge Soling are to be treated as separate items & payment of the same will be made separately. The rates will include carting away the same outside the premises to designated dumping area allotted by Competent Authority.

### 3. <u>CONTROLLED CONCRETE, PLAIN & REINFORCED CONCRETE</u>

### 3.1. <u>General</u>

Concrete and reinforced concrete work shall be carried out generally in conformity with the latest Indian Standards IS: 456 except for provisions indicated herein below. All work is to be carried out with utmost precision and up to date scientific know-how and the contractor shall employ thoroughly competent staff to achieve the highest standards.

### 3.2. <u>Cement</u>

Cement for the work shall be ordinary Portland Cement conforming to the latest Indian Standards IS:269 and of the best normal setting quality unless a quick settling quality is expressly instructed in the specifications or otherwise during the course of the work by Consultant. The contractor shall always purchase Portland cement as fresh as possible after manufacture and where there is reason to believe the cement has been long stored, the consultant may demand a Laboratory Test Certificate regarding the character of cement and the contractor shall furnish the same at no extra cost. The Consultant shall reject any cement which in its opinion does not meet the required standards.

All bags and containers in which cement is packed shall be stored in a dry, weather-tight, properly ventilated structure with adequate provision for prevention and absorption of moisture. The contractor shall at all times maintain for the inspection of Consultant a log book indicating the receipt of cement brand and agent from whom obtained and the age of cement. Cement which has caked or perished by being wet or otherwise shall on no account be used on the work.

Cement shall be consumed on the works in the same sequence as that of their receipt at site. Cement reclaimed from cleaning of bags or from spillage from containers or otherwise shall on no account be used.

### 3.3. <u>Sand</u>

Sand (fine aggregated) shall generally conform to latest Indian Standards (IS: 383). Sand shall be natural sand, crushed gravel sand or crushed stone sand at the discretion of the Contractor. Use of sea sand is prohibited. It shall be composed of hard siliceous material and shall be clean and of sharp angular grit type. Sand shall be properly graded minimizing voids. Allowance for bulkage of sand shall be made.

		Percent by Weigh	<u>nt</u>
Sr. No		Uncrushed	Crushed
1	Material finer than 75 micron I.S sieve:	3.00	15.00
2	Shale	1.00	-
3	Coal and lignite	1.00	1.00
4	Clay lumps	1.00	1.00
5	Total of all above substances including items (I) to (iv) for uncrushed sand and items (iii) and (iv) for crushed sand	5.00	2.00

### 3.3.1. <u>Upper limit for deleterious materials in sand</u>

### 3.3.2. Grading of sand

Unless otherwise directed or approved, the grading of sand shall be within the limits indicated hereunder:-

I.S. Sieve	PERCENTAGE PASSING FOR					
Designation	Grading	Grading	Grading	Grading		
0	Zone I	Zone II	Zone III	Zone IV		
10 mm	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 micron	15 - 34	35 – 59	60 – 79	80 - 100		
300 micron	5 - 20	8 - 30	12 – 40	15 – 50		
150 micron	0 - 10	0 - 10	0 - 10	0 - 15		

### 3.4. <u>Coarse Aggregate</u>

Coarse aggregate shall be approved hard aggregate generally conforming to latest Indian Standards.

### Upper limit for deletion materials in coarse aggregate

The percentages of deleterious substances in the aggregate delivered to the mixer shall not exceed the following:-

		Percent by Weight		
Sr. No		Uncrushed	Crushed	
1	Material finer than 75 micron I.S sieve:	3.00	15.00	
2	Coal and lignite	1.00	1.00	
3	Clay lumps	1.00	1.00	
4	Soft Fragment	3.00	2.00	

5 Total of all above substances 5.0	2.00
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## 3.5. <u>Aggregate, Gradation, Storage, etc.</u>

Aggregates shall be stock piled properly and separately on the basis of gradation indicated herein low.

- Fine ... 0 to 3 mm (1/8" and down)
- Medium ... 3 to 7 mm (1/8" to 5/16")
- Course ... 7 to 30 mm (5/16" to 1.1/4")

Aggregates shall be clean and shall not contain any foreign matter, silt, loose or destructive substances, harmful chemicals, etc.

Aggregates shall be stored in proper bins which shall have good drainage to preclude inclusion of foreign matter and preserve the gradation. Sufficient live storage shall be maintained to permit segregation of successive shipment, placing of concrete at the required rate and such procedures as inspection and testing.

If directed, the aggregates shall be washed before use. The grading of aggregates for use in works shall be as per The Indian Standards. Proper sieve analysis shall be carried out to determine the best gradation obtainable from the available aggregates. The sieve analysis shall be performed as per standard practice and as laid out in the relevant Indian Standards.

A complete set of standard sieves shall be provided by the contractor at the construction site at all times. The graphs in connection with the sieve analysis and the standards of approval for the aggregates shall be as per the Indian Standards.

I.S. SievePercentage passing for singleDesignatisized aggregate of			gle	Percentage passing for Grading aggregate					
on	40	20 mm	16 mm	12.5 mm	10	40	20	16	12.5
63 mm	10	-	-	-	-	10	-	-	-
40 mm	0	10	-	_	-	0	10	-	-
	85	0				95	0		
20 mm			10	-	-			10	-
	0 -	85 -	0			30 -	95 –	0	
16 mm	20	100		10	-	70	100	00	-
			85 -	0				90	
12.5	-	-	100		10	-	-	10	90 -
mm				85 -	0			0	100
	-	-	-	100		-	-		
110 mm					85			-	40 -
	0 -	0 -	0 –	0 -	- 10	10 -	25 –		85

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3.6. <u>Types of concrete, strengths, etc.</u>

The Bill of Quantities specifies various types of concrete. The strengths corresponding to these types are as per table below.

Sr.	Type of Concrete	Compression Strength at 28 days			
No.	• •	Metric Kg/cm2	British Lb./in2		
1.	M 10	100	1420		
2.	M 15	150	2150		
3.	M 20	200	2840		
4.	M 25	250	3560		
5.	M 30	300	4260		
6.	M 45	450	6400		

## TYPES OF CONCRETE

Even though the Bill of Quantities specifies various types of concrete, it is possible that the type may be altered to suit the site conditions. The compressive strength indicated above pertains to pressure test on works test cubes  $15 \text{ cm} \times 15 \text{ cm} \times 15 \text{ cm}$ . after normal curing for 28 days.

The strength of preliminary test cubes shall be as per

IS: 456

The type of concrete for any particular situation or work shall be as per instructions given to the Contractor by the Consultant notwithstanding anything contained in the foregoing clauses.

3.7. <u>Water</u>

Water for all concrete work shall be clean, free from deleterious matter such as oils, acids, alkalis, sugar and vegetable matter. Every attempt shall be made to use water which is fit for drinking purposes. Water storage facilities provided by the contractor shall be maintained properly to preclude contamination of water by any of the harmful substances. The quantity of water to be added to concrete for mixing, shall be such as to afford workability consistent with strength.

# 3.8. Tests of determination of strength of concrete

As will be apparent from the Bill of Quantities, the strength of concrete specified is the criterion and the contractor shall make every effort to obtain the specified strengths by good quality control. In case of concrete which does not obtain the specified strength at 28 days, such work shall be demolished and reconstructed to obtain the requisite strengths as directed by the consultant. To determine whether concrete in any particular part of 102

the work is of the requisite strength or not, test cubes (works test cubes) shall be made from samples collected from the concrete being poured for the particular part and determined as per acceptance criteria detailed hereinafter. The salient features for the collection of samples is as indicated below:

# 3.9. Testing of Concrete Cubes for determining Compression Strength

i. <u>Quality</u> As specified

 ii. <u>Compression Strength</u> The Compression strength shall be as specified for the particular type of Concrete.

# iii. Criteria for acceptance of work

Part or element of concrete work shall be deemed to be acceptable, provided the three cubes tested for 28 days strength conform to the Following:

- a) Average of the three cubes strengths shall not be less than the specified strength.
- b) No individual cube strength shall be less than 90% of the specified strength.
- c) If any individual cube strength exhibits more than 133% of the specified strength, such cube shall be classified as freak and the criteria in (a) and (b) above, shall be applied for the remaining two cubes only and the acceptability determined.
- iv. Quantum of cubes and testing

A set of 6 cubes shall be cast per every 50 M3 of concrete. OR

A set of 6 cubes on every day of concreting.

ÓR

A set of 6 cubes on every important element as decided by the

consultant. The decision of the consultant in this regard shall be

final and binding.

3.9.1 <u>Minimum compressive strength of 15cm, cubes at 7 and 28 days after</u> <u>mixing, conducted in accordance with IS: 516</u>

Class	Preliminary test		Works Test kg/cm2		Maximum size of	Locations
	at 7 days	At 28 days	at 7 days	At 28 days	e mm	for use

M 40	335	500	270	400	20	As indicated in the schedule
M 35	300	440	235	350	20	of quantities
M 30	250	380	200	300	40 or 20	- do -
M 25	220	320	170	250	40 or 20	- do -
M 20	175	260	135	200	40 or 20	- do -
M 15	135	200	100	150	40 or 20	- do -
						- do -

# 3.10. Batching and making of concrete

- i. All batching of aggregates and cement shall be by volume. All the necessary equipment such as measuring boxes, devices for determination of moisture and bulk in sand, slump cone etc. shall be provided by the contractor. Concrete shall be machine mixed until there is a uniform distributing of materials and uniform color and consistency is achieved and under no circumstances for less than two minutes.
- ii. A wooden board approximately 30 cms x 40cms. Shall be put up at the concrete mixer on which shall have been legibly written in English and the local language, the quality of concrete that is being mixed, the proportions and other relevant data.
- iii. <u>Cubes</u>

The size of cubes to the prepared and tested shall be 15 x 15 x 15cm. (6" x 6" x 6").

The number of cubes to be collected from each sample as detailed below shall be six. Three cubes each are intended for testing at 7 and 28 days respectively for determining the strength.

Cubes tested at 7 days should give strength of not less than 70% of the corresponding strength at 28 days. It shall however be expressly understood that the test results at 28 days only shall govern and the 7 days tests are intended to obtain a fair idea only.

iv. <u>Number of tests</u>

The number of cube tests in a work shall be entirely at the discretion and as directed by the Resident Engineer. Cubes shall generally be collected for various structural members and also for works at various levels. It shall also be collected whenever the usual quality for a particular strength is suspect.

- v. <u>Preparation and Testing of Cubes</u> Casting of cubes, preparation of molds for the same, processing and curing the cubes and pressure testing the same shall be as per detailed instructions which will be issued to the contractor from "Client" from time to time or as per relevant Indian Standards as amended up to date and as directed.
- vi. <u>Equipment molds, testing etc.</u> It is the entire responsibility of the contractor to prepare and get the cubes tested and provide for all material, labour, molds, equipment, facility and charges for testing etc. The contractor's rate for concrete work shall be deemed to include for these and no extra whatsoever is admissible on this account.

#### vii. <u>Slump</u>

If in the opinion of the consultant, slump cone tests are required to be performed to establish workability the same shall be carried out free of cost. Slump tests are however, to serve as guide only.

### 3.11. <u>Admixtures</u>

If found necessary admixtures may be used in concrete subject to approval by Consultant. All admixtures will conform to IS: 9103. Admixtures will be procured from reputed manufacturers. Contractor shall submit manufacturer's technical datasheets and test certificates for admixtures to The Engineer before the same are used in actual work. Admixtures shall be melamine polymer base material and free from any chloride compound.

### 3.12. <u>Ready Mix Concrete</u>

### 3.12.1. Scope of Specification

Specification of materials, placing, curing, testing of concrete acceptance criteria for concrete etc. shall be same as stipulated in other clauses of the technical specification.

This part of the specification covers the recommendations for producing concrete in a Central Batching Plant located outside the job site and transporting the same to the job site for placing in required location.

## 3.12.2. Handling and Storage of Materials at Central Batching

### Plant i. Aggregates

Stock piling of aggregates shall be kept at minimum and stockpiles shall be built up in horizontal layers with gradually slopping sides. Suitable arrange for sliding the aggregates from the trucks shall be made and stockpiles shall not be created by en-dumping from the trucks. Vehicle movement over the stockpiles shall be avoided. Overlap of different Section 6 Technical Specification materials shall be avoided. Stockpiles shall be provided on a hard base (preferably concrete). Separation or segregation of finer materials in fine aggregate shall be avoided. In no case height of the stockpile shall be more than 1.2 m.

Materials shall be deposited in storage bins vertically and directly above the outlets. Storage bins shall be kept as full as practicable to minimize changes in grading of aggregates as the aggregates are withdrawn.

Moisture content in the aggregates shall be kept uniform and stable. Use of aggregates having varying amounts of free water shall not be permitted.

ii. <u>Cement</u>

Storage facilities for bulk cement shall be in silos. Bottom slopes for silos with respect to horizontal shall be

- Minimum 50 degree for circular silo
- Minimum 60degree for rectangular / square silo

Non-circular silos will be provided with arrangement of small quantity air flow to be applied intermittently to loosen the cement which is settled tightly in the silo. However quantity of air flow through cement shall be such that the same does not change the set-characteristics of the cement. Cement silos shall be drawn down at intervals of one month to avoid cement caking.

It shall be ensured that the cement brought to work shall not be more than 6 weeks old from the date of manufacture.

iii. <u>Admixtures</u>

Damaged packing shall not be acceptable. Admixtures shall be kept in the packet/ container as supplied by the manufacturer. When seal of a package / container is broken for use care shall be taken that balance quantity is stored in such a manner that this is protected from dampness. For liquid admixtures the lids of the drum / can shall be replaced tightly and in case of admixtures supplied in packages the opened pack shall be wrapped in polythene sheet (of

700 micron) carefully, before putting the same back to the storage and this

Balance quantity shall be used within the time limit after opening the seal of the container / package as specified by the manufacturer. Admixtures shall be used within the expiry period specified by the manufacturer.

Date of manufacture and date of expiry shall be clearly written on each container/ package of the admixture. Admixture shall be used in order of

- Date of expiry
- Date of manufacture

# 3.12.3. Batching

The whole batching process and its equipment shall be such that the following are achieved:

- Weight of different components of concrete shall be maintained within the specified limits of tolerances.
- Handling during batching shall be such that desired grading of the Aggregates shall be maintained.
- Proper sequencing and blending of the ingredients during charging of the mixer.
- Consistency and homogeneity of the concrete produced in respect of unit Weight, slump, air content, strength etc. in successive batches of the same mix proportion.

All batching equipment shall be isolated from any kind of vibration form the mixing plant or other sources. If required proper vibration isolators shall be used.

Batching plant bins shall be of adequate size so that the productive capacity of the plant can be effectively supported. Shape and size of the bins shall be such that aggregate segregation and breakage are avoided and all compartments of the bins are adequately separate for various materials.

Gates used for charging the materials shall be power operated and with suitable controlling device to obtain desired weighing accuracy.

Batching plant shall be capable of producing representative samples at any time during the process of batching.

All equipment including weighing and controlling devices shall be checked frequently. All automatic control devices shall be protected from dust and weather. Weighing equipment shall be regularly cleaned.

# 3.12.4. Mixing

Ready Mix concrete may

be

- Totally mixed in the centralized batching plant before transporting to the job site by non-agitating truck.
- Or mixed on transit in an agitating truck.
- Or partially in the centralized batching plant and partly on transit.

Mixers both stationary and transit mixer shall be charged in such a manner that concrete produced shall be of desired workability, consistency and strength. The following are the general guidelines for the same:

- There should be pre-blending of the ingredients as the same goes into the mixer.
- Cement shall be charged along with other materials but it shall be ensured That the cement enters in the stream after approximately 10% of the aggregates are inside the mixer.

- Water shall enter the mixer first but flow should continue when other ingredients are entering into the mixer. To achieve this and controlling the quantity of water as per the mix design the water pipe shall be designed for proper size and control.
- When it is necessary to charge additional cement in the transit mixer separately, additional mixing time shall be allowed to obtain desired uniform mix.
- Liquid admixtures shall be charged with the water and dry / powdered admixtures shall be ribboned into the mixer along with other dry ingredients. Admixtures shall be charged into the mixer at the same time of mixing sequence for every batch. If more than one admixture is used they shall be batched separately and they shall not be premixed before entering into the mixer.
- Mixing time shall be initially guided by the manufacturer's recommendation. However, mixing time shall be established from mixer performance tests to be conducted at frequent intervals throughout the period of works.
- Mixer shall be provided with audible indicator and combination interlocks which prevent discharge from the mixer before completion of the pre-set mixing time. Mixer shall have the arrangement to start and stop even at the full load.

## 3.12.5. Effect on workability

If the transit mixer is to cover a short distance between the mixing plant and the job site and promptly delivered at the job site and if the weather is reasonably cool, quality of concrete will not be affected much. However in case of a reverse condition quality of concrete may be significantly affected in terms of loss in workability (slump).

- Loss in workability (slump) on transit can be minimized by Expediting delivery and placement and by controlling the concrete temperature.
- Addition of water during mixing on transit. Maximum quantity of water in this addition shall not exceed that quantity necessary to compensate for slump loss of maximum 25mm. However with this addition of water also the designed water cement ratio shall not be exceeded. Quantity of total mixing water, if incorrect shall adversely affect the quality of concrete.
- Withholding some of the mixing water till it reaches the job-site. In this case after addition of balance quantity of water in the transit mixer at the job site an additional 30 revolutions of the mixer at specified mixing speed shall be given so that this balance water is adequately mixed into the concrete.
- Complete mixing can be done at the job site using dry batched ingredients from the central batching plant.
- 3.12.6. Use of Retarders and Plasticizers

In case it is found necessary that retarder is to be used to prolong the time between mixing of the concrete and vibrating the concrete after placing the same will be used after submission of the technical data of the particular retarder along with test results to the Consultant, and receiving due approval.

For achieving higher workability (particularly in case of concrete for using concrete pumps) without increasing the water cement ratio, plasticizers may be required to be used. In that case the Contractor shall submit the technical data along with test results to Suvin Advisors for approval before using the same.

In case more than one admixture is used in the same mix compatibility of the admixtures shall be certified by the manufacturer before using the same.

#### 3.12.7. <u>Mix Temperature</u>

As batch to batch uniformity of concrete in terms of slump, water content etc. are dependent on temperature of the concrete, It is required to ensure that the temperature in concrete throughout the seasons of the year is maintained within maximum and minimum temperature of 35 degree and 20 degree centigrade.

To maintain temperature of concrete within the limits, if found necessary measures can be taken to lower or raise the temperature of water.

### 3.12.8. Transporting Ready Mix Concrete

Method of transporting the concrete from the Centralized Batching / Mixing Plant to the job site shall ensure efficient delivery of concrete and no significant alteration of the concrete properties in term of water cement ratio, homogeneity, slump, air content etc.

Most common method of transporting Ready Mix Concrete to the job site is by Transit Mixers or Mixer rucks.

Stipulated number of revolution or elapsed time shall not be the only criteria for accepting the concrete at job site. Concrete shall be accepted if the following are satisfied:

- Satisfactory placement and consolidation is possible at the desired place of pouring the concrete without initial set.
- Mixing water limit is not exceeded
- Concrete has satisfactory consistency, homogeneity, plasticity and other physical properties.

It is recommended that the delivery time shall be restricted to 30 minutes from the time cement has entered the mixer to completion of discharge at job site.

Before loading concrete in the Transit Mixer at the mixing plant, the containers shall be thoroughly cleaned, washed and kept moist.

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# 3.12.9. Quality of Ready Mix Concrete

Responsibility of in-place quality of ready-mix concrete shall be shared by the Central Batching Plant Operator and the contractor. However, in case the concrete is supplied by the Batching Plant Operator through the contractor, the Contractor shall be accountable for the quality of the concrete.

The Contractor and the Batching Plant Operator shall work in close coordination. The placing crew shall be in direct radio/telecommunication contact with the batch plant to ensure avoidance of delay in dispatching concrete from batch plant, inform batching plant that the contractor is not ready to receive the concrete.

The contractor shall give in writing his requirement of a particular batch of concrete to the Batching Plant Operator. The Contractor shall give copies of all such concrete order forms to the Engineer for records. He shall get his duplicate order forms duly stamped and signed from the supplier / manufacturer.

The operator shall, along with each batch of concrete delivered to the contractor, give him a concrete delivery tickets as per agreed pro-forma. The operator shall give copies of all such delivery tickets to the Engineer through the Contractor for record and also shall get duplicate copies of all such delivery tickets duly received and signed from the contractor.

3.13. <u>Formwork</u>

Generally, all the concrete surfaces are intended to be plastered, unless otherwise specified.

Formwork shall be properly designed and constructed such that it is rigid enough to remain free from bulging, sagging or displacement during placing of concrete. It should also be so constructed as to facilitate removal of the same without damage to concrete. The formwork shall be adequately watertight to prevent any loss of liquid. All formwork shall be accurately erected in regard to size, levels etc. In case of timber formwork, the surface of forms in contact with concrete surfaces shall be wrought. The joints between boards shall be close fitting and very thin for the concrete surfaces designed to have exposed finish and not intended to be plastered. All formwork shall be properly cleaned before any concreting is carried out. Surfaces of forms coming in contact with concrete shall be treated with approved form of emulsions. It shall be ensured that these emulsions do not stain or discolour the natural colour of concrete.

All formwork shall be removed as per latest IS: 456. Formwork shall be removed without shock or vibration. Edges of beams and columns if required to have chamfers shall be obtained by suitably fixing triangular edge beads 50 mm x 50 mm. or directed to the forms. (No extra is admissible to the contractor on account of these incidental and minor works

for sizes up to and including 50 mm x 50 mm. or as directed. Likewise, where drip notches are necessary, they should be formed by suitably shaped fillets nailed in forms. Formwork for all beams and other horizontal construction members shall be built to an upward camber of 1/300" of the span (in the center) to nullify the effects of optical illusion. This camber shall be in addition to such camber as may be required and shown in the Static Calculations.

# 3.13.1. Tolerances in shuttering and concrete surface

Tolerances is a specified permissible variation from lines, grade or dimensions given in drawings, no to tolerances specified for horizontal or vertical building lines or footings shall be construed to permit encroachment beyond the legal boundaries. Unless otherwise specified, the following tolerances will be permitted.

## Tolerances for R.C.C. Buildings.

- i) Variation from the plumb.
  - a) In the lines and surfaces of columns, piers, walls 5 mm per 2.5 m or 15 mm, whichever is less?
  - b) For exposed corner columns and other conspicuous lines.

In any bay or 5 m maximum	-	5 mm
In 10 m or more	-	10 mm

ii) Variation from the level or from the grades indicates on the drawings. a) In slab soffits, ceilings, beam soffit and in arises.

-	5 mm
-	8 mm
-	15 mm
	- - -

b) For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines.

In any bay or 5 m maximum	-	5 mm
In 10 m or more	-	10 mm

iii) Variation of the linear building lines from established position in plan and related position of columns, wall and partitions.

In any bay or 5 m maximum	-	10 mm
In 10 m or more	-	20 mm

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- iv) Variation in the size and locations of sleeves, openings in walls and floors – 5 mm except in the case of anchor bolts.
- v) Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls.
   Minus 5 mm
   Plus 10 mm

# vi) Footings

a)	Variation in dimension in plan		
	Minus	-	5 mm
	Plus	-	50 mm

- b) Misplacement or eccentricity
  2% of footing width in the direction of misplacement but not more than 50 mm.
- c) Reduction in thickness Minus - 5% of specified thickness subject to a Maximum of 50 m.
- vii) Variation in steps

a)	In a flight	s	
	Rise	-	3 mm
	Tread	-	5 mm
b)	In consecu	utive ste	eps
,			

Rise - 3 mm c) Tread - 5 mm

### Tolerances in other concrete structures

- i) All Structures
  - a) Variation of the constructed linear outline from established position in plan.

	In 5 m		- 10 m	ım	
	In 10 m or more		- 15 m	ım	
b)	Variations of dimensions from established positions.	to	individual	structure	features
	In 20 m		- 25 m	ım	
	In buried construction		- 50 m	ım	

c) Variation from plumb, from specified batter or from curved surface of all structures.

In 2.5 m	-	10 mm
In 5 m or more	-	15 mm
In buried construction	-	Twice the above amounts

d) Variation from level or grade indicated on drawings in slab, beams, soffits, horizontal grooves and visible arises.

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In 2.5 m	-	5 mm
In 5 m or more	-	10 mm
In buried construction	-	Twice the above amounts

e)	Variation	in	cross-sectional	dimensio	ns	of	columns,	beams,
	buttresses	, pie	ers and similar n	nembers.				
	Minus			-	5 r	nm	1	
	Plus			-	10 r	nm	ı	

### ii) Footing for columns, piers, walls, buttresses and similar members

a) Variation of dimensions in plan

Minus	-	10 mm
Plus	-	15 mm

b) Misplacement or eccentricity

2% of footing width in the direction of misplacement but not more than 50 mm.

c) Reduction in thickness 5% of specified thickness subject to a maximum of 50 mm.

Tolerances in other type of structures shall generally conform to those given in Clause 2.4 of Recommended Practice for Concrete Formwork CI 347).

Tolerances in fixing anchor bolts shall be as follows:-

- i) Anchor bolts without sleeves  $\pm 1.5$  mm in plan.
- ii) Anchor bolts with sleeves ± 5.00 mm in elevation.a) For bolts up to & including 28 mm dia. ± 5 mm in all directions.
- b) For bolts 32 mm dia and above  $\pm$  3 mm in all direction. Embedded parts  $\pm$  5 mm in all direction.

# 3.14. <u>Transporting and pouring of concrete</u>

No mixing of concrete shall be started unless the situations where they are to be poured are prepared and kept ready. Concrete shall be poured immediately on preparation. Transportation of concrete shall be done as speedily as possible and also in a manner to prevent segregation of aggregates. No retempered concrete shall be allowed to be used on the works. Concrete, in foundations, cellars or such other situations involving depth, shall not be dumped from a height. It shall be lowered and placed in position by proper arrangements.

Before fresh concrete is placed against an already cast and hardened section, such surfaces shall be roughened, swept clean, moistened with water and

treated with cement slurry. Fresh concrete shall then be poured as required. Under no circumstances, will concrete where initial set has commenced be allowed to be used. Dewatering of excavation for concreting where necessary shall be carried out by the contractor as directed and the rates quoted by the contractor are deemed to be inclusive of such dewatering.

# 3.15. Consolidation and processing of concrete

Concrete for all works shall be compacted by means of suitable vibrating equipment. One or more spare vibrators which are in complete working condition shall always be kept ready at site to be put into commission in case of failure of the vibrators under use. The vibrators shall be operated by skilled personnel, thoroughly instructed as regards the mode, frequency, duration etc. regarding vibration. Concrete of low quality may how ever, be permitted by the consultant to be consolidated by hand only after prior permission.

# 3.16. <u>Finish to concrete surfaces</u>

Finish to concrete surfaces at various situations shall be as per directions of the consultant. Where form finish is specified, the final surface shall be smooth and even and no undulations, ridges, spots etc. shall be permitted. They shall also be laid to pattern as directed. In case surfaces intended and directed for form finish, exhibit any of the defects above mentioned, the surfaces shall be rubbed with carborandum or plastered and finished as directed at the risk and cost of the contractor. The decision as to the acceptability or otherwise of a surface will be notified by the consultant and the contractor will implement the instructions accordingly.

# 3.17. Concrete cover for reinforcement

Where not specifically indicated in the drawings, concrete cover for reinforcement shall be as per the latest Indian Standards and as per directions at site from time to time. Proper concrete cover blocks to suit various covers as required shall be provided in adequate numbers sufficiently ahead of the work.

# 3.18. Construction joints

Construction joints in concrete work shall be provided as far as possible only at predetermined places in consultation with the consultant. Joints shall be provided as specified in latest Indian Standards or as directed by the consultant.

# 3.19. Curing

It is very important that all cement concrete work shall be cured properly. All concrete work shall be covered with a layer of sacking, canvas, Hessian or similar absorbent material and kept wet continuously for not less than a fortnight or as directed. Water used for curing shall also be free from any deleterious substances and shall generally be fit for drinking. The work shall be adequately protected from drying, winds and directed sun rays. 114

# 3.20. Openings and inserts

All openings and inserts which are designated in due time or as required for services, will be exactly provided by the contractor including supply of materials. The Contractor should also fix the anchors or such items which may be supplied by the Proprietor in exact position and in perfect lines and levels. Inserts apply to such items as timber, dowels, bolts, loop, brackets, suspension irons, hooks, screw plates, pipe of various types and diameter, edge protection angles etc. Openings in concrete or masonry must be provided in slightly bigger, if directed so, as shown in drawings or as instructed. It must be clearly understood that the provisions of inserts and openings as contemplated in this contract are to be carried out with "utmost precision" and any deviation of the same from that as shown in drawing or instructed, have to be rectified by the contractor at his own cost and risk.

## 3.21. Expansion Joints

The Expansion joints shall be kept as per the drawings. Thermo Cole/ shalitex board/ SilFil material, to be used for the expansion joint or as specified by the consultant.

For expansion joints in walls, specifically in vertical surface thermokole, SILFIL can be used as specified in the drawing and as per specification.

For Expansion joints in floors cutting of the floor to be done, size of expansion joint will be  $10 \times 25$  mm deep or as specified. The joint shall be filled with 15mm PU foam filler & balance 10 mm with polysulphide sealant from top as specified by the consultant.

Or

10 X 10mm of Epoxy filler can be used instead of above said polysulphide sealant from top as per manufacturer specification and as directed.

# 3.22. <u>Puddle Flanges</u>

The Puddle Flanges should be of 'B' Class & should be double flanged. The fixing of the puddle flange, to be done with rubber water bar 150mm wide & 8 mm thick.

# 3.23. Mild Steel and Torsteel/ TMT Reinforcement

All M.S. reinforcement for concrete work shall conform strictly to the latest Indian Standards (IS: 432 - Part I & II). They shall be of tested quality with a permissible stress value of 1400 kg cm2. Height yield strength Ribbed Torsteel of cold twisted steel for reinforcement shall be of tested quality and shall conform to the relevant Indian Standards (IS: 1786). Reinforcement shall be fabricated to shapes and dimensions shown on the drawing and shall be placed where indicated on the drawings or required to carry out the intent of drawing and specifications or as directed by the consultant. Before placing, reinforcement shall be thoroughly cleaned of loose rust, coating etc. which would result in reducing or destroying the bond. Tender for Construction of Raw Material godown & Refurbishing of Annex Block

Oiling the bars to clean them is strictly prohibited. Bending, straightening, cutting etc. operations shall be carried out in a manner not injurious to the material.

All reinforcement shall be bent cold. Unless otherwise directed, reinforcement shall not be spliced at points of maximum stresses. The Consultant shall be informed of the same before such splicing is taken up. Laps and splicing shall conform to the latest Indian Standards. Mechanical couplers may also be used for splicing as per following specification.

Definition:-The only acceptable form of full strength butt joint for a bar in tension comprises a mechanical coupler.

All the Mechanical Splicing shall conform to BS 8110 Part-1 1989 & BS 5400 Part 4

1990 & ACI-381. The Coupler should be satisfying the following criteria.

- When a test is made of representative gauge length assembly comprising reinforcement of the size grade and profile to be used and a coupler of the precise type to be used, the permanent elongation after loading to 0.6fy should not exceed 0.1mm.
- The tensile strength of the coupled bar should exceed 287.5 N/mm2 for grade 250.529N/mm2 for grade 460 hot rolled steel and 506 N/mm2 for grade 460 cold worked steel.

The connection should be possibly away from the point of high stress and should be staggered appropriately.

The Mechanical Splice should be used of approved brand and minimum one test is required for every hundred splices.

The Splicing should be used as directed by Engineer at site.

Reinforcement shall be accurately tied at all inter-sections and laps with 16 SWG soft drawn binding wire, such that the reinforcement will give a rigid structure. Binding wire will not be measured or accounted for separately. The contractor rate for reinforcement will be measured and paid for according to bending lists without allowances for cutting, wastages, binding wire etc. Authorized laps, hooks, chairs, spacers etc. shall, however, be accounted for. In case, the contractor or consultant desires to resort to welding or swivel nuts, these shall however be made as if the laps have been provided and no extra claim whatsoever shall be admissible on this account.

Reinforcement shall be assembled in place with proper concrete cover blocks to suit various covers as required.

3.24. <u>Measurements</u>

All measurements shall be as given below or where not given, as per latest IS: 1200. Concrete will be compensated for according to its actual volume on M3 and according to unit prices. The computation will be based upon the construction plans only and no site measurements shall be taken for this purpose. All incidental work stated in the Technical Specification and also dewatering at the time of concreting are deemed to have been included for in the unit prices quoted by the contractor. Openings with an area larger than 0.1 sq. mm shall be deducted from concrete quantity and where openings are smaller, these shall not be deducted.

Rates for concrete work items shall be inclusive of formwork, staging, shuttering/ de shuttering.

Reinforcement steel will be compensated for according to the approved bending lists without allowance for cutting, rolling margin and waste, Binding wire, cover blocks etc. will not be measured or paid for separately. The Contractor shall prepare the Bar Bending Schedules and incorporate the same on the reinforcement drawings all as directed and submit it to the consultant for approval.

All opening and inserts which are indicated in good time and as per requirements for services shall be provided at exact positions and no payments shall be made for providing or fixing these. Only such opening or inserts which have not been indicated earlier or such additional openings/inserts required specially due to changes made by consultant shall be paid for.

Excepting for the above, all other measurements shall be as per stipulations under the latest Indian Standards Mode of Measurement for Building works.

# 4. <u>MASONRY, PLASTERING & PAINTING</u>

# 4.1 <u>Materials</u>

4.1.1. <u>Bricks</u>

All bricks shall be table moulded, burnt bricks of first class quality. They shall be hard sound and well burnt with sharp edges and of uniform sizes and shapes. Bricks shall be neither under burnt nor over-burnt and shall be free from cracks, stone floats, nodules of lime or other such defects.

When immersed in water for 24 hours, bricks shall not absorb more water than

20% of its dry weight. Minimum compressive strength of the bricks shall not be less than 70 kg/cm2.

# 4.1.2. <u>Rubble</u>

Rubble used for masonry shall be of best locally available variety. They shall be roughly chisel dressed of uniform colour and fairly equal in size on the face. At least 50% of the stones when individually reckoned shall be greater than 0.015 m3 in volume.

# 4.1.3. Concrete Block

Concrete Block is used for masonry shall be of good quality, properly cured, Sharp edges with specified strength and can be manufactured at site approved by Engineer at site.

# 4.1.4. Cement and Sand

Cement and sand used for masonry and plastering work shall conform to the specifications laid down under "Plain and Reinforced Concrete".

# 4.1.5. <u>Lime</u>

Lime used for plaster work, where lime plaster is specified, shall be best quality eminently hydraulic lime. Lime used for neeru finish shall be good quality fat lime.

# 4.1.6. Additives

Additives, like integral waterproofing compounds, shall be of the approved type from reputed manufacturers. These shall be used strictly in accordance with the manufacturer's instructions.

# 4.2. <u>Samples</u>

When demanded by Employer, the Contractor shall produce samples of materials or carry out tests of samples for consultant's approval. All materials used as also works carried out shall conform to the quality of approved samples. Production of these samples shall be at Contractor's Cost.

# 4.3. Brick Masonry

All bricks shall be thoroughly soaked in water before using till the bubbles cease to come up. No half or quarter brick shall be used except as closers. Brick work shall be accurately raised to plumb.

Brick work shall be raised uniformly all round and no part shall be raised more than

1 meter above another at any time.

In case of 11.5 cm. thick brick walls, hoop iron reinforcement 25mm x 12 to 16 gauges shall be provided in every fourth course. The reinforcement shall be properly bedded in mortar, properly legged etc. all as directed.

The contractor will have to build in holdfasts and such other fittings in brick work without extra cost. Joints in brick work shall not be more than 10mm thick. Brick work shall not be raised more than 10 to 12 courses a day. The work shall be kept watered thrice a day for 10 days and afterwards twice a day for 1 week. All joints shall be thoroughly flushed with motor at every course. Care shall be taken to see that bricks are properly bedded and all joints completely filled to the full depth. The joints of brick work shall be raked out to a depth not less than 10mm. as the work proceeds. The surface of brick work shall be cleaned down and watered properly before the mortar sets. The Contractor shall also make or leave holes recesses as required and fill in the same at a later date as directed, at no extra cost.

# 4.4. <u>Rubble Masonry</u>

All stones shall be soaked in water for a minimum period of 2 hours before being laid in cement or any other mortar as specified.

Stones shall be carefully laid on their natural beds and shall be solidly laid in mortar. No hollow spaces shall be left out. Interspaces shall be filled with smaller stones (hearting stones) and solidly packed in mortar.

Face stones shall be dressed properly to ensure that projections do not exceed 20mm. Stone shall be closely fitted (if necessary with a little dressing) to ensure uniform and close jointed work. Joints in stone masonry shall not exceed 20mm. in thickness. Headers and/or through stones extending to the full thickness of the wall shall be provided one per every square meter of face area.

10 cm dia weep holes shall be provided in the walls retaining earth, one for every 5 sq. meters area. The rate quoted for rubble masonry shall include for such works also.

Stones shall be arranged to break joints as much as possible and long vertical joint lines shall be strictly avoided. Quoins or corner stones shall be 25cms. high 45 cms. long and shall be laid header and stretcher alternately. Beds and joints of quoins shall be dressed and squared back to a depth of at-least 10cms. The corner of quoins shall have a chisel drafted margin of 40mmm on either side. Quoins shall be laid square on their beds.

Where the length of wall is large, expansion gaps shall be kept as instructed by the consultant or as shown in drawings.

All masonry shall be raised in plumb and shall be built in cement mortar 1:5 or as prescribed.

Joints of masonry shall be either raked out to a depth not less than 10 mm. or finished flush as directed.

Masonry shall be thoroughly kept wet for a minimum period of 10 days and cured properly.

# 4.5. <u>CONCRETE BLOCK MASONRY</u>

4.5.1. <u>Material for Preparation of Precast Concrete Blocks:</u>

Unless otherwise specified, cement conforming to IS: 269 specifications for ordinary and low heat Portland cement shall be used.

Aggregate used in manufacture of blocks shall be free from deleterious matter & the requirements of IS: 383. The fineness modulus of the combined aggregate shall be between 3.6 and 4.

Water used shall be of the quality as mentioned in the specification of water for use in concrete works. Water shall be free from matter likely to c a u s e efflorescence in the units.

If found necessary admixtures may be used in concrete subject to approval by Consultant. All admixtures will conform to IS: 9103. Admixtures will be procured from reputed manufacturers. Contractor shall submit manufacturer's technical datasheets and test certificates for admixtures to Consultant before the same are used in actual work.

Admixtures shall be melamine polymer base material and free from any chloride compound.

The Contractor shall submit, for approval, the certificates of laboratory test Data and manufacturer's test certificates for

following:

i. Portland cement concrete

mix ii. Aggregate gradations

iii. Soundness of blocks

iv. Compressive Strength of blocks

# 4.5.2. Specification of Concrete

# <u>Blocks</u>

The properties of concrete blocks shall conform to relevant IS: 2185 (Part 1). i. Sizes of Concrete Blocks

Unless otherwise specified, the nominal & actual dimensions of concrete blocks shall be as indicated below.

Nominal sizes in mm			Actual sizes in mm		
Length	Width	Height	Length	Width	Height
400	300	200	390	300	190
400	200	200	390	200	190
400	100	200	390	100	190

In addition, the blocks shall be manufactured in half lengths to correspond to full lengths.

ii. <u>Classification of Blocks</u>

Blocks shall be classified as grade A, B, C and D, as specified in clause 4 of IS: 2185 (Part 1).

iii. Size Variations

The maximum acceptable variation in sizes of blocks shall be as follows: Variation in length + 5 mm Variation in width & height + 3 mm

iv. Making of Blocks

Concrete shall be mixed in a mechanical mixer. Blocks shall be moulded, compacted and laid over platform. Unless specified otherwise by Consultants, the blocks shall be made in approved type automatic / semiautomatic movable "egg laying" type concrete block making machines, in the sizes as specified or required. On removal from the machine or de moulding the blocks shall be protected until they are sufficiently hardened to permit handling without damage.

v. <u>Curing and Drying</u>

Blocks hardened in accordance with above requirements shall then be cured continuously for 14 days in the curing tank or yard with water fountains (as per CL. 6.4 of IS 2185 part I). Before being used in works, blocks shall be dried for a period of 4 weeks. The initial shrinkage shall be allowed to take place before they are used in the works.

vi. 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 with tolerances specified.

vii. Strength

Unless specified otherwise, the minimum average compressive strength of units & minimum compressive strength of each individual unit shall be as per Table 2 of IS 2185 (Part I) with latest revision, considering the entire base area of block for calculation of the strength.

### 4.5.3. <u>Tests</u>

The following tests are to be conducted as per the method detailed in Appendix A to F of IS 2185 (Part I).

- i. For Measurement of Dimension.
- ii. For determination of Block Density.
- iii. For determination of Comprehensive Strength.
- iv. For determination of Absorption.

- v. For determination of drying shrinkage.
- vi. For determination of Moisture Movement.

The test will be conducted on samples of units selected according to the sampling procedure given here under, to ensure conformity with the physical requirements specified.

# 4.5.4. Sampling

- i. A sample of 20 blocks shall be taken from every consignment of 5000 block of part there for the same size and same batch of manufacture. From these samples, the block shall be taken at random for conducting the tests.
- ii. 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, from the sides accessible and from the interior of the stacks.
- iii. 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 tests shall be made as soon as the samples have been taken.

# 4.5.5. <u>Number of Tests</u>

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, the need arises.

# 4.5.6. Approval

Blocks shall be approved if requirements of the conditions of IS 2185 (Part I) are satisfied.

- i. The number of blocks among those inspected, with dimensions outside the tolerance limit and/or with visual defects, shall not be more than two.
- ii. For Block density and compressive strength, the mean values determined shall be greater than or equal to the minimum limits specified in Table 2 of IS 2185 (part I).
- iii. For drying shrinkage and moisture movement, all the test specimens shall satisfy the requirements of the test. If one or more specimens

fail 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.

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

# 4.5.7. Execution

i) <u>General</u>

All block masonry work shall be laid in cement mortar of required strength and mix. Blocks shall be protected from sun and rain and shall be kept constantly moist on all surfaces before use in the work.

ii) Mortar mix

Unless specified otherwise, the mortar mix for the laying of block masonry work shall be 1:4 (one part cement and four parts course sand).

iii) Joints

All joints in block masonry work shall be 10mm thick. The joints shall be properly racked to form an effective key with plaster.

a) Horizontal (Bedding) Joints

Mortar shall be spread over the entire top surface of the block, including front and rear faces as well as the webs, to a uniform layer of one centimeter thickness.

- b) Vertical (Cross) Joints
  - 1. For vertical joints, the mortar shall be applied on the vertical edges of the front and rear shells of the blocks. The mortar may be applied either to the unit already placed on the wall or to the next unit to be laid alongside of it. However, it will be more convenient to apply mortar on the edges of the succeeding unit when it is standing vertically and then placing it horizontally well- pressed against the previously laid unit. In any case, whatever the method used for applying mortar, care shall be taken to produce well-compacted vertical joints.
  - 2. In the case of two cell blocks, there may be a slight depression on their vertical sides, which shall also be filled up with mortar to secure greater lateral rigidity.

- 3. Mortar shall not be spread too far ahead of the actual laying of the units, to ensure that the mortar does not tend to stiffen and loose its plasticity, thereby resulting in poor bond.
- 4. When the mortar has stiffened slightly, it shall be firmly compacted with a jointing tool. The mortar shall be pressed against the unit, with a jointing tool, after the mortar has stiffened, to effect intimate contact between the mortar and the masonry unit and obtain weather tight joint.
- 5. If necessary, mortar may be added, particularly to the vertical joints, to ensure that they are well-filled.
- 6. Mortar joints shall be moistened with a fine water spray for about 7 days or, alternatively, masonry shall be covered with polyethylene sheets to retain the moisture, all as approved by the Engineer.
- iv) Laying of Blocks

For horizontal joints, all concrete blocks shall be laid with the thicker part of the shell face-up, for easy handling and lying.

Pieces of hollow blocks shall, in no case, be used anywhere. Machine-cut pieces of solid blocks, free of any cracking and chipping, may be used where they are absolutely necessary, subject to prior approval of the Engineer.

All block walls abutting concrete columns or walls shall be bonded to the same at every alternate course of block, with approved 6 mm dia 250 mm long galvanised M.S. dowels or approved G.I. butterfly ties installed in the concrete columns while casting. Block work construction with hollow blocks shall conform to IS: 2572.

The first course of block masonry shall be laid with great care, making sure that it is properly aligned, leveled and plumbed. This will assist the mason, in laying succeeding courses, to obtain a straight and truly vertical wall. Before laying the first course, the alignment of the wall shall be marked on the foundation footings. The blocks for this course shall first be laid dry, that is without mortar over the footing, using a string tightly stretched between properly located corners of the wall to determine the correct position of the blocks, including those of the cross-walls joining it, and also to adjust their spacing. The two corner blocks shall then be removed, a full mortar bed shall be spread on the footing, and these blocks shall be laid back in place, truly level and plumb. The string shall then be stretched tightly along the faces of the two corner blocks, and the faces of the intermediate ones adjusted to coincide with the line. Section 6 Technical Specification Thereafter, each block shall be removed and re-laid over a bed of mortar. After every three or four blocks have been laid, their correct alignment, level and verticality shall be carefully checked.

The construction of walls may be started either at the corners or started from one end, proceeding in the other direction. If the corners of the wall are built first, they shall be built four or five courses higher than the center of the wall. As each course is laid at the corner, it shall be checked with a level or straight-edge to make certain that the faces of the blocks are all in the same plane. Each course, in building the corners, shall be stepped back by a half-block and the horizontal spacing of the block shall be checked by placing a mason's level diagonally across the corners of the block.

When filling in the wall between the corners, a mason's line shall be stretched from corner to corner for each course, and the top outside edge of each block shall be laid to this line.

As each block is laid, excess mortar extruding from the joints shall be cut off with the trowel and thrown back on the mortar board. Should there be any delay, long enough for the mortar to stiffen on the block, the mortar shall be removed to the mortar board and reworked.

Block work shall be constructed only up to a few centimeters below the structural members above, leaving a gap between the block and the structural member. These gaps shall be thoroughly and properly filled with 1:3:6 concrete from both sides, and curing for a few days before plastering or other finishing work is taken up.

In the case of cavity walls, both thicknesses shall be carried up together and, in no case, shall one thickness be carried up more than two courses in advance of the other.

For unsupported lengths of 100 mm thick walls exceeding 3.5 m, 100 x 200 mm wide R.C.C. mullions shall be provided, at 3.5 m centers and tied to the lintels at door height. Similarly, continuous R.C.C. beams of size 100 x 150 mm shall be provided at door height for 100 mm thick walls.

v) <u>Closure Blocks</u>

When installing closure blocks, all edges of the opening and vertical edges of the closure block shall be buttered with mortar. The closure block shall be carefully lowered into place. If any of the mortar falls out, leaving an open joint, the closure block shall be removed, fresh mortar applied and the operation repeated. Closure unit locations shall be staggered throughout the length of wall.

### 4.5.8 <u>Precautionary Measures</u>

The following measures shall be taken to prevent formation of cracks.

- While curing, the block masonry shall be lightly sprinkled with water and not made excessively wet.
- Expansion joints shall be provided in walls exceeding 30 m in length.
- Unless otherwise specified, reinforcement steel of 8 mm dia shall 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, and the cost of such reinforcing steel shall be covered in the rates of relevant items.
- In framed structures, erection of partition and panel walls shall be delayed to take care of deformations due to structural loads.
- Partition walls shall be reinforced in alternative courses with two lengths of 8 mm dia steel to strengthen against excessive deflections of floor slabs, and such cost shall be covered in the rates of relevant items. Joints shall be filled with cement sand mortar (1:4).
  - i. <u>Height of Masonry Construction</u> Block walls are to be constructed up to a maximum height of 1.4m in one lift.
- ii. <u>Bearing Walls</u>
  - When two bearing walls m<u>e</u>et or intersect and the courses are to be laid up at the same time, a true masonry bond between at least 50 percent of the units, at the intersection, shall be ensured a single reinforcement bar of 8 mm dia shall be provided at every such location within the hollow.
  - Hollows at the intersection of two walls are to be filled and compacted with M20 grade concrete, or as specified. However, concrete pouring shall be stopped 25mm below the top surface of the top course to provide a key for the next pour.
- iii. Rendering and Other Finishes

Where plastering is required, all joints of block work shall be fully raked to a depth of at least 12 mm while carrying out the block work.

# 4.5.9. Measurement and Rates

All works shall be measured on the basis of finished dimensions and measured net, except where otherwise specified. Units of measurement shall be as described in items of work.

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Rates shall include all materials, labour, and scaffolding, preparing the surfaces, mortars, curing and finishing complete to the approval of Suvin Advisors

# 4.6. Plastering

Plastering work in general shall proceed from top to bottom. An entire unobstructed area shall be plastered in one operation. The surface to be plastered shall be thoroughly cleaned, watered and roughened to provide key. Joints in brick work shall be raked out and cleaned. The surface shall be watered and well wetted for at least 24 hours before the commencement of work.

The surface to be plastered shall first be dubbed with cement mortar 1:5 to cover all irregularities on faces up to the proudest part. The dubbed surfaces shall then be scored to provide key. Cement plaster of the specified thickness shall be applied over this surface. Where neeru finish is required to be provided over plaster, the finish shall be applied before base plaster has set and be finished smooth. Neeru for this shall be prepared from best quality fat lime, slaked with fresh water and sifted in accordance with relevant Indian Standard Code of Practice. The lime so slaked and sifted shall be ground to a fine paste in a mortar mill (150 turns). Chopped Hessian or jute fiber may be added in required quantity to provide strength, if approved by the consultant. All the above operations shall be carried out at site and only such quantity as shall be used within the next 7-10days shall be prepared at one time.

The entire plastered work shall be truly vertical and to proper lines and levels. All exposed angles shall be carefully flushed to provide a neat and even surface. Any work that does not conform to approved samples or is not to the satisfaction of the consultant shall be rejected and the contractor shall be liable to redo the work at his own cost.

Where plastering is to be done over junction of two different materials (e.g.) concrete, masonry, lintels, sleeper beams etc., the junction shall be covered by a chicken mesh of 100 mm width with margins on either side and then the plaster shall be applied. Where only one of the materials is plastered over, the plaster at junction shall be struck to obtain a cleavage as shown below:

JUNCTION STRUCK TO OBTAIN TRIANGULAR **CLEAVAGE R.C.C COLUMN** Section 6 Technical Specification

CONCRETE BLOCK JUNCTION COVERED BRICK MASONRY 50 50 BY WIRE MESH AND PLASTER APP

JUNCTION 50 BY WIRE MESH AND PLASTER APPLIED OVER IT (WIRE MESH TO BE SECURED ONE SIDE WITH NAILS ONE DAY BEFORE).

Where waterproofing compound is specified to be provided in mortar for plaster, approved integral waterproofing compounds shall be used. These shall be used and plastering work shall be carried out strictly as per manufacturer's recommendations.

4.7. <u>Damp proof Course (D.P.C)</u>

Damp proof course shall be provided over all walls as directed. Concrete for damp proof course shall be of M 15 grade, as defined under "Concrete" Sections and shall be 5 cm. thick and to the full width of the wall. An integral waterproofing compound shall be provided in the concrete in the proportion specified by manufacturer. The rate quoted for D.P.C. shall be inclusive of the integral waterproofing compound as also for shuttering required.

Alternately, layer of roof felt of appropriate width and conforming to IS: 1322 may be provided over a hot coat of bitumen.

# 4.8. <u>Measurements</u>

4.8.1 Masonry

Measurement of masonry shall be taken on the basis of cubic meters or square meters as indicated in the Bill of Quantities. Quantities will be decided on the basis of pertinent plans. Openings & recesses which exceed 0.1 sq.m. will be deducted from quantities. Openings left initially on specific instructions or as required shall be closed at a later date, if so instructed by the consultant, at no extra cost. Similarly, all openings, recesses, grooves etc. shall be provided at no extra cost.

Lintels above door/window openings for openings up to 100cm clear width shall be treated as part of masonry and the cost therefore shall be settled in the same manner as for masonry, irrespective of what material these lintels are made of. For openings of larger than 100cm. clear width, however, lintels shall be paid for under relevant items and due deductions shall be made in masonry.

# 4.8.2. <u>Plastering</u>

Measurements of plastering shall be taken on the basis of square meter, as arrived at from pertinent plans & for a particular type of plaster. Accounts shall be settled on the basis of dimensions of raw structure.

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Doors and windows with plastered jamb shall not be deducted provided the size of opening does not exceed 1 sq.m. in area. In these cases, plaster on jamb stones shall not be indicated on invoice. For openings larger than 1 sq.m in area, area of opening shall be deducted and dimensions of plaster coats on jams determined.

Grooves, notches, drip notches etc. shall be provided in plaster free of cost, wherever indicated by "Client" or shown on drawings. Similarly, no special compensation shall be paid for plastering in recesses, grooves, etc. Provision of wire mesh when plastering junctions of different materials shall be accounted for under relevant item of work. However, providing cleavage or similar miscellaneous works shall be deemed to have been included in the rates quoted by the contractor and shall not be separately paid for.

# 4.9. <u>Painting</u>

4.9.1. General

Work of painting and varnishing shall be one of the last items of work and shall not be taken up until all other internal works except fittings & fixtures have been completed and approved. No work under this section shall start without approval from Engineer. The contractor shall ensure that approval has been obtained for all primer, paints, oils, varnishes, texture rendering materials for each location/ areas to be finished and in respect to shades brand & manufacturer for such finishing materials, well in advance to commencement of work.

### 4.9.2. Scope of Work

The scope of work as enumerated under this tender includes painting of walls, ceiling, plastered and concrete surface, steel work, timber surfaces, pipes, as detailed in the Bill of Quantities.

4.9.3. Quality and Make of Paint

The paints to be used for this work shall be first class quality paint of repute manufacturers and of approved type. In case the tenderer is not a manufacturer of paints, he shall clearly mention the name of the manufacturer of each type of paint.

4.9.4. <u>Sealed Containers</u>

Paints, oils or varnishes of approved shade, brand & manufacturer shall be brought to the site of work by the Contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The empty containers shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from Engineer.

4.9.5. Storage

All the materials shall be stored in a neat and orderly fashion in one single clean space Care shall be taken to maintain this place as clean and dust – free as possible.

## 4.9.6. Specified Workman

All work shall be done by the Contractor through specified skilled workman experienced in the trade.

Work as per Manufacturer's Instructions

All work shall be done strictly as per this specification and manufacturer's printed instructions. In case these specifications differ in any way from manufacturer's instructions, the latter shall apply.

# 4.9.7. <u>Preparation prior to painting:</u>

The surfaces to be painted shall be thoroughly cleaned of all dirt, cement slurry with coir or wire brush. The slight surface cracks shall be made good with hard stopping or filled with approved compound. Unevenness in the surface shall be filled in with plaster of Paris and after filling the same shall be in one true plane. Special care shall be taken in case of exposed concrete or form finish work.

# 4.9.8. Steel/Metal Surfaces

All rust, loose scales and loose paint shall be removed completely with wire brush. All oil, dirt, grease etc. shall be removed to get a perfectly clean surface ready for painting.

# 4.9.9. <u>Wood work</u>

All wood work of door shutters shall be rubbed down with abrasive paper. A cracks, crevices, holes, knots etc. shall be scrapped out, primed and made good with hard stopping, faced up and rubbed down to an even surface. The hard stopping shall be of approved make or made up on the job in accordance with approved practice.

# 4.9.10. <u>Priming</u>

### Plastered/Concrete

### <u>surface</u>

One coat of primer of approved make shall be applied depending on the finishing coats of lime wash/oil bound distemper / plastic bound distemper / Snowcem Cement Paint / Flat Oil paint / Plastic emulsion paint/Synthetic Enamel paint/as specified in the Bill of Quantities.

### Steel/Metal

### <u>surfaces</u>

For all structural steel work, steel doors and door frames, services pipes, etc. one coat of Spell out base paint shall be applied.

<u>Finishing</u> <u>Coats</u> All earlier coats of paints shall be thoroughly dry before subsequent coats are applied and shall be rubbed down with fine sand paper. The finishing coats are intended generally as follows: (The exact type of finish shall be as described in Bill of Quantities).

-	A.C. Sheets Cladding slabs	-	Lime wash
-	Concrete wall plastered surfa	aces -	Oil Bound distemper
			Lime wash.
-	External wall surfaces	-	Lime wash or Snowcem
-	T.W. Door frames	-	Flat oil paint/
			Synthetic Enamel Paint
-	Window Frames	-	Flat oil paint/
			Synthetic Enamel Paint

### 4.9.11. Samples

Before starting work under this section large size sample of all types of coating including preparation of surface shall be made at the site and approval obtained from the engineer before proceeding with the finishing works. Only after specified approval has been given to the samples, work shall commence. The actual work shall be done as per the approved samples.

## 4.9.12. Protection

All work done shall be thoroughly protected from damage at all times by suitable and appropriate methods to the satisfaction of Engineer. All other adjacent areas which may not have received the finish at the same time shall also be thoroughly protected by suitable canvas, paper covering or by some other approved methods.

# 4.9.13. Damage to be made good

Any damage or disfigurement of other works caused by the painting works shall be immediately made good. All paint and varnish spots and other stains shall be thoroughly and carefully removed from all floors, doors, windows, fittings, furniture, glass, hardware and all other surface required, by approved paint removers and the places left clean and tidy to the satisfaction of Engineer.

### 4.9.14. <u>Mode of Measurement</u>

All measurement unless otherwise specified in these documents shall be as per IS: 1200 for mode of measurement.

The rates shall include for all materials like putty, fillets, rubbing, filler compound, primer, paint etc. as also labour for preparatory works and painting all for a completed item of work.

The work shall be executed as per best engineering practice. Consumption of materials and the special precautions etc. shall be as per manufacturer's

specifications. Necessary equipment for brush painting, roller painting as well as spray painting shall be supplied by the Contractor as directed by the engineer in - charge.

# 4.10. White-Wash & Colour - Wash

# 4.10.1. Surface Preparation

The surface shall be thoroughly brushed free from mortar droppings and foreign matters. All plaster damages shall be made good by cement sand mortar and curing it sufficiently before the painting work is taken up.

## 4.10.2. Material

The white wash shall be prepared from fresh shall lime to which shall be admixed with sufficient quantity of whiting and gum. The lime and whiting shall be made into thin cream and screened through clean coarse cloth. 40 gms of gum dissolved in hot water shall be added to each 10 cu. Decimeter of the cream. Indigo up to 3 gms per kg. Of lime dissolved in water shall then be added to the composition. Water at the rate of about 5 liters per kg of lime shall be added to produce a milky solution.

## 4.10.3. Application

In case of colour washing approved mineral colours not affected by lime shall be added to the white wash in required quantities instead of 0indigo. The wash shall be applied with approved brushes in minimum 3 coats. Each coat shall be allowed to dry before applying the next. In case the surface does not present a smooth and uniform finish throughout to the satisfaction of Engineer. More coats shall be added as required at no extra cost.

The finish dry surface shall not be powdery and shall not readily come off on the hand when rubbed.

### 4.11. Dry Distemper

# 4.11.1. Materials

Dry distemper of required colour and of approved brand and manufacture as per BIS: 427-1965 shall be used. The shade shall be got approved from the Engineer before application of the distemper. The dry distemper of approved brand and colour shall be stirred slowly in clean water using 6 deciliters (0.6 liters) of water per kg. Of distemper or as specified by the makes. Warm water shall be used. It shall be allowed to stand for at least 30 minutes (or if practicable overnight) before use. The mixture shall be well stirred before and during use to maintain an even consistency.

Distemper shall not be mixed in larger quantity than is actually required for one day's work.

# 4.11.2. Surface Preparation

The surface shall be prepared as specified hereinafter. Any unevenness shall be made good by applying putty made of plaster of Paris mixed with water including filling up the undulations and sand papering the same after it is dried. A coat of distemper shall be applied over the patches. The patched surface shall be allowed to dry thoroughly before application of regular coats of distemper.

# 4.11.3. Priming

Fresh whiting (ground white chalk dissolved in sufficient quantity of warm water) shall be stirred to form thin slurry and shall be screened through a clean coarse cloth. Two kg of gum and 0.4 kg of copper sulphate shall be dissolved separately in hot water and shall be added to each cum of slurry and water shall be added & stirred to consistency required to make the work ready for use.

A priming coat of whiting shall be applied over the prepared surface & the surface treated with prime coat shall be allowed to dry before application of the distemper coat.

# 4.11.4. Distempering

Dry distempering of approved brand and manufacture shall be used. Two coats of distemper shall be applied over the entire surface with approved distemper brushes (ordinary whitewash brushes shall not be used) in horizontal strokes followed immediately by vertical ones. Each subsequent coat shall be applied only after the previous coat is dried. More coats shall be applied till the surface presents a smooth and uniform finish. The final finished surface shall be even and uniform and shall show no brush marks.

# 4.12. Oil Bound Distemper

# 4.12.1. Materials

Ready mixed paint of approved brand and manufacture and of required shades conforming to IS 428:1969 & other relevant IS specification shall be used. The primer shall be ready mixed cement primer preferably of the same brand and manufacturer. Ready mixed paint as received from manufacturers without any admixtures shall be used and if for any reason thinning is necessary the brand of thinner shall be as per manufacturer's instruction.

# 4.12.2. <u>Preparation of Surface</u>

The surface shall be prepared as specified hereinabove. Any unevenness including pitting in plaster shall be made good by applying putty, made of plaster of Paris mixed with turpentine / oil on the entire dry surface including filling up the undulation and then sand papering after it is dry.

# 4.12.3. Application of Priming Coat

The priming coat shall be applied with cement primer of distemper primer of approved quality depending on the condition of the wall surface as prepared. If the wall is completely dry to receive the priming coat, then distemper primer of same brand & manufacturer of distemper paint as approved, shall only be applied uniformly on the wall with proper brushes. If the wall surface has not dried completely, the priming coats shall be of cement primer of approved brand & manufacture.

# 4.12.4. 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 paint, taking care not to rub out the priming coat. All loose particles shall be dusted off rubbing. One coat of ready mixed distemper properly diluted with thinner shall be applied with brushes in horizontal strokes followed immediately by vertical ones which together constitute one coat.

The subsequent coats shall be applied in the same way. Two or more coats of paint as are found necessary shall be applied over the primer coat to obtain an even shade.

A time interval of at least 24 hours shall be allowed between consecutive coats to permit of the proper drying of the proceeding coat.

15 cm double bristled paint brushes shall be used. After each day's work, brushes shall be thoroughly washed.

A brush in which paint has dried up shall on no account be used for painting work. The containers when not on use shall be kept closed and free from air so that paint does not thicken and also shall be kept safe from dust.

# 4.13. <u>Cement Paint</u>

# 4.13.1. Preparation of Surface

The surface shall be thoroughly cleaned of all mortar dropping, loose pieces & scales, dirt, dust algae, grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of water proof cement paint shall be applied over patches after wetting them thoroughly. The surface shall be thoroughly wetted with clean water before the cement paint is applied.

# 4.13.2. <u>Preparation of mix</u>

Cement paint conforming to IS:5410 – 1992 of Super Snowcem or equal approved brand shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish.

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Cement paint shall be mixed with water in two stages. The first stage shall comprise 2 parts of cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be followed strictly.

The lids of cement paint drums shall be kept tightly closed when not in use order to avoid rapid setting due to its hygroscopic qualities.

# 4.13.3. Application

The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement paint shall be as per manufacturer's specification. The completed surface shall be watered after the day's work.

The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

The surface shall be treated with three or more coats of water proof cement paint as found necessary to get a uniform shade to the satisfaction of Engineer or his representative.

### 4.13.4. Precaution

Waterproof cement paint shall not be applied on plastered surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, paints etc. shall not be applied on gypsum, wood and metal surfaces.

# 4.14. Wall painting with Acrylic Emulsion Paint

Acrylic emulsion paint is not suitable for application on external wood, and iron surface and surfaces which are liable to heavy condensation and are to be used on internal surfaces except wood and steel which are liable for condensation. No priming coat is required for the later.

Acrylic emulsion paint as per IS: 5411 (Part I – Interior use) - 1974 or equal of approved brand and manufacture and of the required shade shall be used.

# 4.14.1. Painting on New Surface

Acrylic emulsion painting to be executed on neeru finish works.

# 4.14.2. Application

The number of coats shall be two or more coats to give a smooth finish meeting the approval of the Engineer. The paint shall be applied in the usual manner with brush or roller. The paint dries by evaporation of the water content and 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 water 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 shall be applied till the surface presents a uniform appearance with velvety smoothness.

## 4.14.3. Precautions

- i) Old brushes if they are to be used with emulsion paints shall be completely dried of turpentine or oil paints by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and kept immersed in water during break period to prevent the paint from hardening on the brush.
- ii) In the preparation of surfaces for plastic emulsion painting, no oil base putties shall be used for filling cracks, holes etc.
- iii) Splashes on floors, etc. shall be cleaned out without delay as they will be difficult to remove after hardening.
- iv) Washing of surfaces treated with emulsion paints shall not be done within 3 to 4 weeks of application.

# 4.15. <u>Painting with Synthetic Enamel Paint</u>

4.15.1. <u>General</u>

Synthetic enamel paint conforming to IS: 1932-1974 of Nerolac or equal approved brand and manufacturer and of the required colour shall be used for the top coat and undercoat of shade to match the top coat as recommended by the manufacturer shall be used.

- 4.15.2. <u>Painting on New Surface</u> Preparation of surface shall be as specified above or as the case may be.
- 4.15.3. <u>Preparation of Surface</u>

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(i) <u>Wood Work</u>

The surface shall be cleaned and all unevenness shall be rubbed down smooth with sand paper and cleaned removed as specified above. Knots if visible shall be covered with a preparation of red lead mixed with strong glue sized and used to. Holes and indentations on the surface shall be filled in with glazier's putty or wood putty or wood putty and rubbed smooth before painting is done. The surface should be thoroughly dry before priming coat is applied.

(ii) Iron and Steel Work

The priming coat shall have dried up completely before painting is stared. Rust and scaling shall be carefully removed by scrapping or by brushing with steel wire brushes. All dust and dirt shall be carefully and thoroughly wiped away from surface.

(iii) <u>Plastered Surface</u>

The surface shall not be painted until it has been dried completely. Before primer is applied, holes, undulations shall be filled up with plaster of Paris and rubbed.

The primer shall be applied with brushes, worked well into the surface and spread even and smooth.

4.15.4. Application

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

(i) <u>Undercoat</u>

One coat of the specified paint of shade suited to the shade of the top coat shall, be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.

(ii) Top Coat

The painting of approved brand and manufacturer shall be laid on evenly and smoothly by means of crossing and laying off which consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately at right angles to the same. The full process of crossing and laying off will constitute one coat. The number of coats as specified in the item shall be applied and the painted surface shall present uniform appearance and finish, free from streaks, blisters etc.

4.16. Varnishing

Ordinary copal varnish or superior quality spar varnish shall be used. The work includes sizing with transparent wood filler. Varnish (conforming to IS: 347-1975) for the finishing and undercoats shall be of approved manufacturer.

4.16.1. <u>Preparation of Surface</u>

New wood work to be varnished shall have been finished smooth with carpenter's plane. Knots shall be cut to a slight depth. Cracks and holes shall be cleaned of dust.

The knots, cracks etc. Shall then be filled in with wood putty made as follows:-

On a piece of wood say  $20 \times 15$  cm face and on the side where cross grains appear, a small quantity of glue size shall be poured and the surface scraped with the edge of a fine carpenter's chisel. Very fine wood powder shall be mixed with the glue and the stiff paste thus formed shall be used for the filling.

The fillings when dry shall be rubbed down with a carpenter's file and then the entire surface shall be rubbed down perfectly smooth with medium grained and fine sand papers and wiped with dry clean cloth so that it presents uniform appearance. In no case shall sand papers be rubbed across the grains, as in this case even the finest marks will be visible when the varnishing is applied.

# 4.16.2. Sizing or Transparent Wood Filler Coat

The surface shall then be treated with either glue sizing or with transparent wood filler coat as stipulated in the description of item.

4.16.3. Sizing

When sizing is stipulated, an application of thin clean size shall be applied hot on the surface. When dry, the surface shall be rubbed down smooth with sand paper, and cleaned. It shall then be given another application of glue size nearly cold. The sized wood work shall again be rubbed down smoothly with fine sand paper and cleaned. The surface shall be perfectly dry and all dust shall be removed not only from the surface but also from the edges and joints before varnishing is commenced. If wood work is to be started, the staining colour shall be mixed with the second coat of the size which must be applied evenly and quickly keeping the colour on the flow. Any joining up with work already dry will show badly.

The object of application of the glue size is to seal the pores in wood to prevent absorption of the oil in the varnish.

Glue sizing in inadvisable on floors, table tops and other horizontal surfaces like to carry wet household utensils which are likely to disturb the size coating and thus expose bare wood. Where glue sizing is omitted to be done the rate for the work shall be suitably reduced.

4.16.4. Transparent Wood Filler Coat

Where instead of glue sizing, transparent wood filler application is stipulated in the item, then the surface prepared as described above shall be given an application of the filler with brush or rag in such any that the filler fills up all the pores and indentations and levels up the surface. It shall be allowed to dry for 24 hours. Then it shall be cut and rubbed with emery paper so that the surface of the wood is laid bare, with the filler only in the pores and crevices of the wood.

## 4.16.5. Application of Varnish

Two coats of varnish shall be applied as stipulated in the description of item.

The undercoat shall be with a floating varnish. This dries hard and brittle and when cut and rubbed down to produce a smooth surface enhancing the gloss of the finishing varnish. The top coat shall be given with stipulated bran d of finishing varnish.

The varnish shall be applied liberally with a full brush and spared evenly with short light strokes to avoid frothing. If the work is vertical the varnish shall be crossed and re crossed and then lay off, latter being finished on the upstrokes so that varnish, as it set flows down and elements brush marks. The above process will constitute one coat. If the surface is horizontal, varnish shall be worked in every direction, with light quick strokes and finish in one definite direction so that it will set without showing brush marks. In handling and applying varnish care should be taken to avoid forming front or air bubbles. Brushes and containers shall be kept scrupulously clean.

Rubbing down and flatting the surface shall be done after each coat except the final coat with fine sand paper.

The work shall be allowed to dry away from draughts and damp air. The finished surface shall then present a uniform appearance and fine glossy surface free from streaks, blisters etc.

Any varnish life over in the small container shall not be poured back into stock tin, as it will render the latter unit unfit for use.

Special fine haired varnishing brushing shall be used and not ordinary paint brushes. Brushes shall be wall worn and perfectly clean.

# 5. FLOORING, DADO AND CLADDING

## 5.1. <u>Marble Mosaic Tiles/Plain Cement Tiles</u>

Marble Mosaic Tiles and/or Plain Cement Tiles shall be of required size and of approved colour. Size shall normally be  $25 \times 25 \times 2$  cm. thick and the total thickness of tiling, bedding etc. to be 5cm. Tiles shall be manufactured and thoroughly cured for at least one month before delivery. Thickness of wearing coat shall be 5mm or 6mm as per latest IS: 1237.

Floor shall be properly watered at least for 8 hours before commencement of laying mortar mix. Mortar mix shall be 1 part of cement, 4 parts of fine crushed stone/sand by volume for bedding purposes. Slurry for full depth of joints shall be cement mortar 1:1 by volume with an approved coloring ingredient to make the mortar the same colour as the flooring.

The slurry shall have a pouring consistency but shall not be too thin. The mortar shall be gently poured from a tin vessel with a pointed nose along the joints without smearing it on the sides of the joint. As soon as the joint is filled in and the cement grout comes to the surface, it shall be well rubbed with a thin rod or edge of a trowel to form a smooth surface. Flooring shall be laid in perfect line and level. After the work has set the flooring shall be polished by machine in three operations. The finished floor shall be properly isolated so that no heavy traffic is permitted for 3 days of its laying. After the final polishing operation the floor surface shall be cleaned with Oxalic Acid and handed over to the Clients in a neat condition.

# 5. 2. Granolithic Flooring (Indian Patient Stone)

Granolithic flooring shall consist of cement, sand and aggregates and shall be 5cm. thick. The proportion shall be 1 part of cement,  $1 \frac{1}{2}$  part of fine aggregates and 3 parts of approved coarse aggregates of hard rock. Fine aggregates shall be 3/16" downwards and coarse aggregates 3/8" down to No.7 sieve. All aggregates specified above should consist of 3 parts of 3/8" screenings and 1 part of 1/8" screenings with sufficient sand and minimum water added to make a workable mix. All aggregates should be properly sifted to be free from all dust of fine materials. The base concrete surface shall be cleaned and panels shall be formed as per approved drawing/instructions with 4mm thick glass strips. The base concrete shall be roughened by hacking and Saturated with water for 8 hours. Immediately before laying the granolithic mix all excess water shall be removed and the surface cleaned of all dust and dirt. The base concrete surface is covered with a thin layer of neat cement grout well brushed in to ensure adequate keying. The granolithic mix is then well tamped into place screeded and floated to the required level and slopes. As soon as the initial set takes place, the surface shall be trowelled smooth or and finished as per approved pattern. Dry cement or mixture of dry cement and shall not be sprinkled on the surface with the object of absorbing moisture or stiffening the mix. Final towelling and broom finishing shall not be started until pressure with the fingers ceases to make any dents. The panels shall have to be cured properly by creating a pond of water.

After allowing a time lag of three weeks (two for curing and setting and one for evaporation of moisture, clean the groove by means of jet of compressed air or any other suitable means to remove all the dust, oily substances, moisture, etc.

For higher thickness panels shall be formed by saw cutting grooves 10mmX30 mm

.Fill the groove up to two- third depth with hot fluid bitumen (Mexphalte 85/25 or equivalent). At no stage of the work should the temperature of bitumen exceed 200 deg C. since it is liable to lose its ductility otherwise. Care should be taken by placing a smooth, greased metal template to prevent staining of floor outside the groove.

Allow the bitumen to cool down to room temperature and then clean the groove once as above, the remove all the dust particles that may have deposited in the meantime.

Fill up the groove completely with a homogeneous mixture of hot bitumen (as above) mixed with 15-20% (by weight) medium length Asbestos fibre. This filling may be allowed to project slightly above the top of the groove to allow for contraction.

After filling has cooled down to room temperature, cut the superfluous material by means of a heated sharp edged trowel

5.3 <u>Granolithic Flooring with Ironite Topping</u>

Granolithic base shall be prepared as 5.2 but thickness shall be leaving 2 cms for Ironite topping. The topping shall consist of 1 part of ironite (by weight) and 4 parts of cement (by weight). Ironite and cement in the above proportion are mixed well in dry state. 1 part of above mixture (by volume) and 2 parts of crushed granite or hard rock 1/4" down (by volume are mixed. Necessary amount of water is added and mixed again and spread lightly over the granolithic surface when it is still wet and leveled with trowel. As soon as the initial set takes place, the surface shall be towelled and finished as per instructions regarding broom finish or smooth finish. The flooring shall be laid in panels of specified size and pattern. The necessary adjustments for ducts, trenches and other openings etc. shall be carried out as required. Curing shall be done by creating a pond of water. Groove of 10mm width x 30mm. depth shall be provided in between adjacent panels.

After allowing a time lag of three weeks (two for curing and setting and one for evaporation of moisture) clean the groove by means of a jet of compressed air or any other suitable means to remove all the dust, oily substances, moisture, etc. Fill the groove up to two third depth with hot (heated to a temperature of 185 deg C) fluid bitumen Mexphalte 85/25 or equivalent). At no stage of the work should the temperature of bitumen exceed 200 deg C. Since it is liable to lose its ductility otherwise Care should be taken by placing a smooth, greased metal template to prevent staining of floor outside the groove.

Allow the bitumen to cool down to room temperature and then clean the groove once again as in (2) above, to remove all the dust particles that may have deposited in the meantime. Fill up the groove completely with a homogeneous mixture of hot bitumen (as in 3 above) mixed with 15 - 20% (by weight) medium length Asbestos fibre. This filling may be allowed to project slightly above the top of the groove to allow for contraction.

After the filling has cooled down to room temperature cut the superfluous material by means of a heated sharp-edged trowel.

- <u>Note:</u> For proper adhesion of bitumen to the floor, the groove should be completely free from moisture and greasy/oily substances throughout the operation.
- 5.3.1. Surface Treatment

Wherever specified the surface shall be treated with hardening solution as under after ten days of curing. The top surface should be clean and free from grease or oil. The surface shall be wetted with water and scrubbed with coir or steel wire brush and thoroughly cleaned by washing with clean water. The floor than shall be allowed to dry.

A solution containing one part of volume of Sodium Silicate and five parts of water should be spread evenly on top surface with a soft brush. Excess material shall be wiped off and floor allowed drying. After washing the floor with clean water, second coat of solution (1 part of Sodium Silicate to 3 parts of water) should be applied. After drying, the floor should be washed with hot clean water.

5.4 Kotah Stone Flooring

Kotah Stone shall be of selected quality, hard, sound, dense and homogenous in texture free from cracks, decay, weathering and flaws. They shall be hand or machine cut as specified in the Bill of Quantities and shall be of approved colour. The stones having yellowish strips shall not be used. The slabs shall conform to the sizes of 60cm. x 60cm. or as required and shall be laid to pattern as directed. The thickness of slabs shall be 35mm. to 40mm. and the total thickness of floor finish including bedding mortar and cement punning and base mortar shall not exceed 70mm. The floor surface to be tiled shall be closely picked or hacked and thoroughly watered and cleaned. Mortar for bedding shall be 1 part of cement, 3 parts of hydrated lime and 6 parts of fine crushed stone or sand. The stone slabs shall be laid on this bedding immediately and as each stone is laid it shall be as per pattern indicated by the consultant.

After the work has set, the surface shall be machine polished to the satisfaction of the consultant. The final polished surface shall then be washed off all dirt, etc. by using Oxalic Acid and handed over in a neat condition. The Payment for flooring item will be made in Square meter basis for the laid area.

The Kotah stone slabs to be used in skirting / dado to be in the size of 125mm x 25 mm thk. They should be polished before fixing. The slabs shall be laid in Cement motor 1 part of cement, 4 parts of coarse sand. The stones to be fixed properly and in line & level. The joints of the Kotah stone to be fixed with cement slurry or colour so as to match with the stone, rubbing, polishing to be done after the fixing is complete

& washed off of dirt etc. by using Oxalic acid & handed over in neat condition or as directed. The payment of this item will be made on Running Meter basis.

5.5 <u>Glazed Tile Dado</u>

Best quality glazed tiles of size 30cm. x 30cm. or 15cm. x 15cm or 10cm x 10cm. shall be laid on 2 cm. thick cement mortar bedding of 1:3 mix with a floating layer of white/coloured cement. Tiles shall be fixed with cement paste of about 6 mm. thickness. The surface is then cleaned of all dirt and joints filled with white/coloured cement. A sample dado shall be prepared ahead of starting the main work and shall be approved by the consultant. Tiles shall be fixed in absolute plumb, straight lines without kinks protrusions and waviness etc. and pointing shall be uniform throughout.

All measurements shall be of finished dimensions deducting all openings in floor, walls etc. No extra shall be paid for specials in glazed tiles such as angles, corners, edge etc. but the area covered by such specials shall be included in the finished dimensions.

### 5.6 <u>Precast Terrazzo Tiles</u>

Precast terrazzo tiles shall be made of 250mm x 250mm x 20mm thick tiles of the tint and colour as approved by the Architects. The tiles shall be pressure made conforming to Indian Standard IS: 1239-1959.The cement in the terrazzo layer shall consist of 50% white cement and 50% grey cement. The marble chips in tiles shall be graded from 6mm to 12mm size. The wearing layer of the tile shall be plain, free of projections, depressions, and cracks. No defective tiles such as wrapped, chipped, cracked or with non-uniform thickness of wearing layer shall be used. All angles shall be right angles and all edges sharp and true. Tiles shall be laid on a mortar bed

30mm thick on the floor paving with six parts of sand and one part of cement, sprinkled over with neat cement (half bag of cement for every 10 sq.mm). All precast tiles shall have been initially machine polished at site after laying to the satisfaction and approval of the Architect.

# 5.7 <u>Terrazzo in situ</u>

All terrazzo work in situ shall be composed of 2 parts of well graded marble chips (6mm to 12mm size), and the one part of mixture of grey and white cement in proportion 1:4 (1 grey : 4 parts white). Terrazzo shall be applied as 12mm finishing cementing under bed of 20 mm. thicknesses in M-15 grade concrete.

# Workmanship

The whole of the work of laying, making, finishing, polishing and setting terrazzo both in situ and precast shall be carried out, by tradesman fully experienced in the class of work required, as shown on the drawings. All terrazzo work shall be finished to true, even plain and line with abutting edges flush and corners and joints true and square. Aluminium or glass strips will be used as dividers and the size of the panel will not exceed 1mt x 1mt.

5.8 <u>Marble Stone</u>

The marble stone shall be white or pink makrana as specified and shall have 30mm thickness. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks decay and weathering. Before starting the work, the contractor shall get the sample of marble approved by the Architect/Designers. Every stone shall be cut to the required size and shaped (chiselled/dressed) on all beds and joints, as to be free from any waviness and to give truly vertical, horizontal, radial or circular joints as required. The dressed slabs shall be of the thickness as specified with a tolerance of 2mm. The item includes lying of stone, curing, finishing, polishing & scaffolding wherever required.

# 5.9 <u>Red Oxide/Coloured Cement Flooring :( Red Cement Floor)</u>

- i) The concrete base shall be well cleaned; 0.9 kg of approved quality of red oxide of iron or of approved coloured cement per sq.m of flooring shall be added to cement mortar 1:3 and incorporated during mixing. One coat of the mixture applied in the floor in the same manner as plastering with cement mortar to required thickness. The surface shall be made even and level, brought to a fine polished finish, by the use of smooth polishing stones.
- ii) When directed, thread lining is to be done in the manner indicated by the Architects and it shall be done when the surface is still plastic.

- If the mortar has become set or hardened before being used, it iii) shall be rejected and removed from the work spot.
- To avoid possibility of cracking of the plaster, the contractor iv) should in all cases obtain instructions regarding the size of the strips or squares to be laid in one operation and complete adjoining strips on different days. Should the mortar crack, or perish through neglect of watering or for other fault of the contractor, the work shall be removed and redone at the contractor's risk and cost.
- The initial thorough cleaning of the base concrete is very v) important. If due to neglect of this, the floor finish becomes hollow the same shall be rejected and redone.
- Before the building is handed over, the floor shall be vi) cleaned thoroughly and polished with "Cardinal" or equivalent polish.

#### 5.10 Acid Proof Tiling

The tiles shall be Acid proof & shall be of 30-40 mm thickness. The tiles shall confirm to the latest Indian Standards & shall be fixed as per manufacturer's specification and as directed.

Vitrified/ceramic tile dado and flooring 5.11 Vitrified/Ceramic tile size and make shall be as mentioned in Bill of Quantity.

20 mm thick backing plaster shall be provide in C.M. 1:4 and the surface keyed with a wise brush and allowed to set for at least 24 hours.

The dado tiles soaked in water shall be fixed to true line and level over the backing plaster surface using cement float. Joints shall be approx.1.5 mm in width. After allowing a setting time of 12 hours the joints shall be grouted to full depth using white cement paste.

The work shall be cured for 2 weeks.

Floor tiles are fixed in a similar way but on cement mortar 1:4 bedding of 20 - 25 mm thickness and to slope a level as directed.

The flooring shall be cleaned with oxalic acid before handing over.

#### 5.12 Granite stone flooring
Granite stone shall be of selected quality, hard, sound, dense and homogenous in texture, free from cracks, delay, weathering and floors. They shall be pre polished and machine cut and shall be of approved colour. The slabs shall confirm to sizes of

60 cm x 60 cm or as required and shall be laid to pattern as directed. The thickness of slabs shall be 25 mm to 30 mm and the total thickness of floor finish including bedding mortar and cement punning and base mortar shall not exceed 60 mm. The floor surface to be tiled shall be closely picked or backed and thoroughly watered and cleared. The patterns are to be dry fixed, approved and then fixed permanently. The joints shall be smooth clean and free from any distortion. The bedding mortar shall be 1 port of cement and 4 ports of fine crushed stone or sand. Pointing to be done in white cement mortar 1:2 to match the shade of granite.

5.13 Granite Tiles Dado / Skirting

Best quality of approved granite tile and approved size shall be laid on 2 cm. thick cement mortar bedding of 1:3 mix. Tiles shall be fixed with cement paste of about 6 mm thickness. The surface is then cleaned of all dirt and joints filled with white / coloured cement. A sample dado shall be prepared ahead of starting the main work and shall be approved by the Engineer. Tiles shall be fixed in absolute plumb, straight lines without links, protrusions and waviness etc. Pointing shall be uniform throughout skirting shall be recessed skirting with a groove in plaster on top of skirting.

- 5.14 <u>Rate to Include</u> <u>The rates for all flooring items generally</u> <u>include</u>
  - i. Use and waste of all temporary fillets, side forms templates, moulds straight edges etc.
  - ii. Final preparation of the base, sub-grade or sub-floor including minor trimming of the base.
  - iii. Cleaning and watering the surfaces immediately before laying the floor as directed.
  - iv. Providing a bedding layer of mortar as specified in the case of slabs, tiles etc to correct levels.
  - v. Cutting rubbing and polishing where applicable.
  - vi. Rounding off corners, edges and junctions of floors with skirting or

dado. vii. Providing V grooves in dado as shown in drawings.

viii. Work in narrow widths, and all heights and locations unless otherwise mentioned.

ix. Curing protecting cleaning all finished surface as specified.

All relevant points specified under "Concrete work" plain and reinforced shall be applicable to "Floor and Paving" also

# 5.15 <u>Concrete flooring</u>

# 5.15.1. <u>Preparation</u>

# 5.15.2. Base concrete

A layer of plain cement concrete (1:3:6) of specified thickness shall be put over already prepared base.

# 5.15.3. <u>Form Work</u>

Before casting, the formwork a precast concrete/steel channel rail acting as a stop end and rail for surface vibrators shall be positioned. At this stage the flatness accuracy of the floor should be determined. The channel should have arrangement to pass the reinforcement / dowels of floor reinforcement to continue to the adjacent panel.

# 5.15.4. Concrete Work

After placing concrete of very stiff consistency and of specified thickness it must be poker vibrated to obtain proper compaction and voids, entrapped air are eliminated.

Poker vibration should be combined with surface vibration to get level and smooth concrete surface and to ensure better overall compaction. The surface vibration should be run twice over the concrete surface. The muddy liquid/slurry coming on the surface shall be removed and the top surface shall be brought to level and batten finished.

Vacuum processing, which involves the use of suction mat and a vacuum pump should be started at this stage. Vacuum processing shall be done for 1.5 to 2 min per centimeter thickness of concrete slab. The surface is then checked, depressions filled with fresh concrete and then finished with batten. Allow the concrete to dry and set such that a man can walk on the surface without making impression and gives a metallic sound when struck with trowel. The surface shall then be finished smooth by power trowels, supplemented by hand trowelling.

Topping hardener if instructed by the Engineer should be worked into the concrete with the floating disc while the concrete still is humid i.e. between floating and trowelling.

### 5.15.5. Measurement

Concrete flooring shall be measured in cubic meters. Vacuum De watering shall be measured in square meters.

- 5.16 Natural stone cladding with machine cut, polished granite slab
  - 5.16.1. Scope of Specification

This specification covers the recommendation for design, installation of machine cut, polished Granite stone mechanically fixed to reinforced concrete frame or solid concrete block masonry as an external cladding in vertical surface.

5.16.2. <u>Related Specifications / Codes</u> Following related specifications / Codes shall also be followed. - BS 8298

### 5.16.3. Materials

- Polished Granite stone slabs of approved colour and dry weight of Approximately 2750 Kg/m3 shall be used as the cladding stone.
- Unless otherwise mentioned thickness of the stone, permissible Variation in dimension, minimum thickness of the stone behind the cramp mortise shall be as specified below.

		Maximum allowable	Minimum thickness
	Total	variation	of the stone behind
	thick		cramp mortise (t)
Stone Location	ness		
External cladding less than 3.7m	30mm	<u>+3</u> mm in total thickness	12 mm
above ground or floor level and		&	
continuously supported		<u>+</u> 2mm in length and	
(incl. Fascias)		height	
External cladding more than 3.7m	40 mm	Same as above	20 mm
above ground or floor level (incl.			
Fascias)			
Sills, copings	30 mm	Same as above	12 mm



External Face ->

The stone units shall be free from any damages including chipping or damage to the faces and breaking of edges.

- Cramp / hook shall be of stainless steel of grade 304 S 11, 316 S 11 and 321 S 31. For coastal and other aggressive environment molybdenum bearing grade should be used. Cramp / hook will be made of two parts, one 'T' shaped and another 'L' shaped. Head of the 'T' shaped part will be inserted in the mortise created in the stone and the other end of the same will be fixed to the 'L' shaped part with stainless steel bolt, nut, flat washer and spring washer. In one of the parts the hole for fixing the bolt will be of oblong shape to allow for adjustment in the effective length of the cramp / hook. 'L' shaped part will be fixed to the concrete frame or solid block masonry work by using anchor fasteners. Unless otherwise mentioned the effective length of the cramp / hook will be sufficient for maintaining a gap of 40 to 50 mm between the stone units and the concrete / masonry surface and also to adjust the length to match with the predetermined extent of variation in plumb.
- Unless otherwise specified Anchor fasteners / expanding bolts will be made of stainless steel. Minimum effective penetration requirement of the fasteners / expanding bolts shall be 75mm in concrete and 100 mm in masonry. Strength of these fasteners and their effective anchorage to the concrete / masonry shall be tested at site by actual pull-out test.
- Two parts Polyester Resin mortar to be used for filling / grouting the cramp / hook in the mortise.
- Unless otherwise mentioned the Sealant to be applied in the gaps all around the stone slabs shall be medium modulus, one part, and elastomeric, high performance, gun-grade Silicon Sealant of non-staining, non-streaking, high weather resistant and high UV resistant type. Minimum width of the sealant shall be 6mm.
- Before selection of the sealant manufacturers' confirmation shall be taken for their suitability and fitness for purpose. Plasticizer used in some sealant may cause staining of the stone which is not acceptable and reference shall be made to the sealant manufacturer to confirm their suitability in this regard also. Manufacturer's guarantee will be required for service life of the sealant as minimum 20 years.

## 5.16.4. Compression & Movement Joints

For designing these joints account should be taken of the time between construction of the frame and erection of the cladding. The shorter the period between these operations the bigger the joints will be required.

The compression joint is to be designed to accept primarily the vertical shortening of a frame, in order to prevent a buildup of compressive forces being transferred to the cladding. These joints are horizontal and should be provided at each floor level immediately under the support for the cladding. The width of the joint should be calculated to allow for maximum column or wall shortening for all causes. The recommended minimum width of the joint should not be less than 15 mm.

Movement joints are required to accommodate the dimensional changes of the both the units and the structure to which they are fixed (which are most likely to be differential). Compression joint should normally accommodate any movement along the height of the building. Movement joints will be required to accommodate the movement along the length of the building.

However these joints are to be designed and provided on the basis of the dimension of the building, material of construction and structural design data etc.

## 5.16.5. Basis of designing the supporting arrangement

Supporting / fixing system should be designed on the basis of the Architectural details, specified size of the Granite slabs etc and considering the following

- Dead load of the stone (for design purpose max. load of 3000 Kg / m3 Of the stone is to be considered)
- Wind pressure and suction equal to the basic wind pressure appropriate to the degree of exposure and height above ground level of individual units, taking into account of higher wind forces at the corners.
- The design for fixing should allow for three way adjustment to ensure proper fit within pre-cut mortise in the stone and to the substrate.

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- It is important that the cladding should not be subject to undesirable stress which might arise from the attachment to the structure being too rigid and due to dimensional changes owing to elastic deformation, thermal movement, differential settlement, drying shrinkage, moisture movement,, creep etc. Allowance shall be made for articulation of cladding components.
- Supporting elements shall be subject to a combination of direct load, bending, shear, torsional stresses.
- Load of two units shall be considered for designing the support / fixing system for each unit.
- The number type and position of the fixing will depend upon the stone to be used thickness & face area of the unit, nature of substrate (e.g. in-situ concrete, block-work).

The contractor shall design the supporting and fixing arrangement including the cramp / hook and fasteners / expanding bolts and submit the same along with working drawings to the Engineer for approval before starting the procurement of materials & execution of the work. The contractor has to guarantee the stability of the entire cladding system including supporting.

### 5.16.6. Execution

The stone units shall be as per approved sample. The units shall be worked to sizes indicated on the approved drawings and within specified limit of deviations and including any special shaping before delivery at site. The mortises, sinking's or notches should be carefully formed to ensure alignment of adjacent stone units and uniform gap at the joints of adjacent stone units as per approved drawings prior to delivery at site. Care should be taken to prevent chipping or other damages to the units during cutting, making mortises or notches and other finishing's, transportation, storage, handling and fixing.

Each stone unit shall be clearly marked with its identification number as per the sequence of fixing.

Storage of the stone units shall be arranged in such a manner that delivery in accurate sequence for site fixing is possible.

Scaffolding, lifting arrangements, temporary supports etc. shall be properly planned and provided as per fixing requirements as well as safety requirements.

Stone units shall be fixed in position, in perfect line and level as per approved drawings by using stainless steel cramp / hook inserted in the cramp mortises and fixing the cramp / hook to the RCC frame or masonry by

using stainless steel fastener / expanding bolt in a drilled hole of required dia and length. Uniform width of the joint shall be maintained in between adjacent stone units.

Cramp / hook shall be grouted in the mortise with two parts, rapid setting Polyester Resin mortar. Care shall be taken that the temporary supports are maintained in position till the supporting system is found to be sufficient to take the load of the stone units.

It is recommended that for accommodating dimensional changes in the structures due to loading etc. the fixing of stone units should be started at least after completion of the entire frame work and construction of walls etc.

It is essential that no grout or other material is allowed to accumulate in the joint. All joints shall be thoroughly cleaned and inspected. After cleaning with the solvent PE filler material shall be inserted in the joints and the same shall be sufficiently fixed against the gap between the stone units to ensure supporting during filling of sealant and controlling the depth of the sealant. Bond breaking tape shall be applied against the part of the cramp / hook inside the joint. Masking in both the sides of the joints shall be done with non-migrating adhesive tape to prevent the sealant adhering to the external face of the stone unit. Thereafter the sealant shall be put in position by using gun / injecting device. The sealant will be finished flush with the stone surface. Any sealant material if found over the external surface of the stone the same will be cleaned and the sealant will be allowed for required curing.

During the execution, the work shall be protected by using suitable covering etc.

On completion of the building work the face of the stone units shall be cleaned of all dust, rust and other stains etc. It is recommended that the scaffolding should be struck as cleaning down proceeds to avoid backsplashing from scaffold boards and rust stains from scaffolding tubes. Surface shall be wiped down with a clean cloth.

5.16.7. Testing

If asked for, the contractor at his own cost shall arrange for the following testing in a laboratory approved by Consultant and submit the test results for obtaining. Engineer's approval before procuring the materials

- Granite stone units – for Water absorption, Dry unit weight and Compressive strength.

- Load carrying capacity of the supporting / fixing arrangement by application of 1.5 times the design load.
- Effective anchorage and strength of the fasteners / expanding bolts by actual pull out test.

The contractor shall submit manufacturer's test certificates for the stainless steel items to the Engineer and if asked for the contractor shall also arrange for reconfirmation of the grade, strength of the material and the quality of welding (if any) from an outside laboratory approved by him.. Cost of the same shall be borne by the contractor.

## 5.16.8. Performance Criteria

Design and execution of the works in natural stone cladding system shall ensure permanent fixing and prevent or control ingress of water through the cladding system and its joints including joints between the cladding and structural frame of the building.

## 5.17. <u>Epoxy Flooring</u>

## 5.17.1. Specification

Flow-applied epoxy floor topping

The designated floor areas shall be surfaced with 2 mm thick floor-applied epoxy resin floor topping as per manufacturer specification. The topping shall achieve a compressive strength of 50 N/mm2 and a flexural strength of 34 N/mm2 at 7 days when tested to BS6319. At 20°C, it shall be capable of accepting foot traffic at 24 hours and vehicular traffic at 48 hours.

## 5.17.2. <u>Surface Preparation</u>

It is essential that epoxy resin is applied to sound, clean and dry surfaces in order that maximum bond strength is achieved between the substrate and the flooring system. All dust and debris should be removed prior to application of the product or its primer.

## 5.17.3. <u>New concrete floors</u>

New concrete, or cementitious substrates, should be at least 28 days old and have a moisture content not exceeding 5%. Laitance deposits on new concrete are best removed by light grit blasting, mechanical scrubbing or grinding.

### 5.17.4. Old concrete floors

Existing concrete floors which require refurbishment must be prepared to ensure a strong adhesive bond between the flooring system and the existing floor. Mechanical cleaning methods are strongly recommended particularly where heavy contamination by oil and grease has occurred or existing coatings are present. To ensure adhesion, all contamination should be removed. Proprietary chemical degreaser may be used on small areas of light contamination only.

### 5.17.5. Steel surfaces

Steel surfaces should be degreased and grit blasted to SA2½ immediately prior to application. The prepared surface should than be treated with one coat of Primer Sealer.

## 5.17.6. Priming

All surfaces treated with epoxy resin should be primed with solvent based epoxy resin primer designed for maximum absorption and adhesion to concrete substrates. Add the entire contents of the hardener tin to the base tin and mix the two primer components thoroughly for at least 2 minutes - under no circumstances should part mixing be considered. Once mixed, the primer should be applied immediately to the prepared substrate using stiff brushes and/or rollers. The primer should be well 'scrubbed' into the substrate to ensure full coverage, but care should be taken to avoid over application or 'pending'. Allow the primer to dry (see table below) before proceeding to the next stage, do not proceed whilst the primer is 'tacky' as this will lead to unsightly marks in the finished surface. Porous substrates may require a second primer coat – when the first coat is directly absorbed into the substrate – but minimum over coating times must still be observed. The minimum over coating times will vary slightly according to the porosity of the substrate.

5.17.7. <u>Application</u>

The applicator should ensure that there are sufficient supplies of plant, labour and materials to make the mixing and subsequent application process a continuous one for any given, independent floor area. Once mixed, the material must be used within its specified pot life. The material should be poured onto the prepared and primed substrate as soon as mixing is complete. It should be spread to the required thickness using a serrated trowel; with care taken not to overwork the resin, spreading evenly and slowly. Immediately after laying, the material should be rolled, using a spiked nylon roller, to remove slight trowel marks, and to assist air release. The rolling should be carried out using a 'back and forth' technique along the same path. An overlap of 50% with adjacent paths is recommended. Further light rolling may be required to remove surface imperfections, or for subsequent release of trapped air, but should be prior to the setting of the product.

5.17.8. Floor Joints

All existing expansion or movement joints should be followed through the new floor surface. Joint sealant & joint geometry should be compatible 154

with the floor type used, intended exposure conditions and likely movement characteristics of the substrate.

## 6. <u>DOORS AND WINDOWS</u>

6.1. <u>Wood work</u>

The work consists of supply of materials, fabrication, joinery, carpentry, delivery and erection at site on Teak wood door & window frames, T.W. flush doors/ paneled doors and glazed window shutters.

## 6.1.1. <u>Materials</u>

Timber shall be of best quality locally available or teak wood wellseasoned, uniform in texture, free from large, loose dead or cluster knots, waves injurious open shakes, discoloration, soft or spongy spots. It shall have uniform colour, reasonably straight grains and shall be free from all defects. The aggregate area of all knots shall not exceed 0.5% of the area of the piece and shall be close grained. Seasoned timber shall be judged from its moisture content as laid down in IS: 287 and should be within the permissible limits.

Wood work abutting against or embedded in masonry or concrete shall be painted with bitumen coat before being placed in position. All timber work shall be treated with an approved anti-termite treatment.

## 6.1.2. Fixing/erection in position of door frames

Before the frames are fixed in position these shall be inspected and passed by Consultant. The frames shall be placed in proper-position and fixed to the walls with suitable holdfasts as shown in drawing. The rate quoted by the Contractor shall be deemed to include for supplying and fixing holdfasts, fixing in position in walls/brickwork with all connected civil works.

In case the door frames are without sills the vertical members shall be buried in floor 50mm. deep. Sills shall be provided where so directed. The door frames without sills while being placed in position shall be provided with temporary wooden bracings well wedged between the styles at the skill level. The sills shall be retained to keep the frames from warping during construction. These frames shall also be protected from damages during construction.

## 6.1.3. Shutters (Block Board)

These shall consist of solid core (fully filled) covered on each face with T.W. Veneer ply or commercial ply as specified in the drawings. This shall be 40mm. or as specified phenol bonded solid with teak wood lipping all around and the commercial or two veneer plies hot pressed and bonded with water resistant formaldehyde synthetic resin as per ISS. The Specification generally should conform to I.S. 2202/1966.

6.1.4. <u>Tolerance</u>

Tolerance on width and height shall be  $\pm$  2mm Tolerance on thickness shall be  $\pm$  1.2mm. The thickness of shutter shall be uniform throughout with a variation not exceeding 0.8mm when measured at any two points.

### 6.1.5. <u>Adhesives</u>

Only Synthetic resin adhesives conforming to I.S.S. No. IS-851/1964 shall be used for bonding core members to one another including core frame and other exposed parts. The adhesive used for bonding cross band to core and face veneers to cross band shall conform to IS: 848/1957 (Phenolic and Amino plastic), or equivalent IS standards.

### 6.1.6. Fittings

The rate quoted for doors shall include for fixing of door shutter with 3 to 4 hinges (brass oxidized heavy, railway type) and the necessary screws for fixing the same and also other fittings as specified in drawings.

- 1. Hinges (brass or oxidized heavy Railway type) 3 to 4 nos. each of size 125 x 75 x 6mm
- 2. Tower bolt 6" in length.
- 3. Aldrop 10" length.
- 4. Mortise or equivalent lock
- 5. Push and kick plate 9" width and length of door.
- 6. Rubber stopper
- 7. Screws

### 6.1.7. Shutters (Paneled/Ledged and braced)

These shutters shall be in lieu of Block Board shutters and shall be with 38/40 mm. frame and 15 mm. thick wooden plank/board and as per drawings with necessary best quality workmanship. The requisite fittings (brass oxidized heavy type) shall be duly supplied and fixed as per requirement panel thickness and material for panels.

The payment shall be based on frame area (out to out) and the rate shall be deemed to include for fittings.

6.1.8. Glazing

The quoted price is inclusive of glass, fixtures and fittings. The details of the glass thickness offered for different types of windows and doors shall be as per the drawings.

6.1.9. Shop Drawing

Before commencing the fabrication work at the factory contractor shall submit detailed shop drawing which gives the exact details of the products and get Consultants / Client's approval.

6.1.10. <u>Sample</u>

If required, the Contractor shall present one sample of any type of window for final approval and comments.

### 6.2. <u>Aluminium doors and windows</u>

#### 6.2.1. <u>General</u>

i. <u>Scope of Work</u>

Supply, fabrication, erection, commissioning and handing over of various Aluminium items covered under B.O.Q. and broadly listed as follows:

- Doors
- Curtain Wall/Fixed Partitions
- Sliding Windows, Louvered windows.
- Openable and Fixed

#### Windows ii. <u>Specifications</u>

- a. Specifications for materials, construction, erection etc. are detailed in subsequent sections.
- b. The sizes of Aluminium sections are mentioned as nominal.

#### iii. <u>Drawings and Samples</u>

- a. Samples of sections, anodising/powder coating, hardware etc. shall also be submitted upon instructions from the Engineer
- b. The Contractor on award of work shall prepare detailed fabrication and working drawings. The Contractor shall submit four sets for approval of the Engineer.

c. Fabrication work shall be taken up on the basis of approved drawings. d. Approval of drawings does not relieve the Contractor of his responsibility to meet with the intents of the specifications.

#### iv. Codes and Standards

The materials shall meet the relevant IS Code and Standards.

#### v. <u>Measurements and Rates</u>

All measurements shall be considered on the basis of out to out dimensions if each item, corresponding to finished structural opening.

#### vi. <u>Checking of Opening Dimensions</u>

a. The Contractor shall check the openings and bring to the notice of the Engineer any discrepancies if any prior to fabrication/ erection work.

b. If any template is required for checking openings, the same shall be provided by the Contractor at his cost.

# 6.2.2. <u>General specifications</u>

# i) <u>Material</u>

All sections shall be made from extruded Aluminium of alloy HE-9-WP conforming to IS: 733-1956.

# ii) Frames and Shutters

- a. Sizes of sections and weights given in subsequent section are nominal. The Contractor shall furnish details as per sections offered by him.
- b. Prior to anodising:
  - Aluminium sections shall be cut to sizes and assembled into frames and shutters.
  - All notches, cuts, holes etc., shall be made
  - Frames/shutters shall be checked for trueness and then dismantled for taking up anodising.
- c. 50 mm x 25 mm thick rough ground shall be provided for sliding windows.
- d. Fly mesh shall be S.S. woven type.

# iii) Anodising

- a. Aluminium sections shall be brushed and silver anodised to satin finish as per IS: 1868/1968 and shall not be less than 20 microns.
- b. The Contractor shall satisfy anodising thickness by giving necessary tests on random samples selected by the Engineer.
- c. Anodised sections shall be provided with protective coating on all exposed surfaces and properly tagged for identification prior to dispatch to site.
- iii) Glazing and Fly mesh

- a. 5 mm. thick clear or frosted Float Glass to be provided unless noted otherwise.
- b. Bronze/grey tinted Float Glass to be provided wherever directed.

# iv) Solid Panels

- P1 : Decorative laminate finished panels: Unless otherwise noted, solid panels shall be fabricated from 12 mm. thick phenol resin bonded Marine ply clad with 1.5 mm. thick decorative laminate of approved make and colour on both sides. All edge shall be sealed with T.W. lipping or decorative laminate.
- P2 : Aluminium sheet clad panels: In case it is specifically noted, these shall be fabricated from 6 mm. thick phenol resin bonded marine ply clad with 18 gauge anodised Aluminium sheet on both sides, pressed and formed, bonded with approved materials, All edges shall be sealed with Aluminium sheet.
- v) <u>Glazing Gasket</u>
  - a. Glazing gasket shall be of dry type performed PVC/Neoprene profile to hold glass or solid panel in Aluminium frame under pressure. Suitable non-metallic setting blocks shall be used to centralise glass in metal frame.
  - b. Rubber gasket shall not be allowed.
  - c. Glazing in metal frames shall be done just before handing over.

# vi) Weather Stripping

Wherever required, soft PVC/Neoprene performed pile profile shall be inserted into extruded grooves/pockets in the sections.

- vii) Construction
  - a. Frames and shutters of hollow rectangular or `Z' sections shall be mechanically jointed with 3 mm. thick Aluminium angle cleats. Aluminium alloy blind or solid rivets and nickel plated self-tapping screws of good quality shall be used for joints and fittings.

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b. Open or non-hollow `z' sections frames and shutters shall preferably be flash butt welded.

### viii) Erection

- a. Frames shall be fixed/anchored in brick or concrete openings with brass or nickel plated screw on all sides.
- b. In case opening is larger than frame (as in case of partitions or doors), the vertical members shall be taken up to RCC slab and anchored rigidly.
- c. Minor adjustment in openings shall be done by the Contractor at his cost.
- d. Glazing and removal of protective coating on sections and cleaning shall be done just prior to handing over.
- e. All tools, ladders, scaffolding etc. required for erection shall be provided by the Contractor.
- ix) Grouting

All metal frames shall be erected in position, fixed and grouted with non-setting polysulphide mastic or equivalent on all sides (from inside and outside) filling all gaps, crevices etc.

#### 6.2.3. Detail specification

Item wise specifications shall be as mentioned herein below. Wherever, it is not mentioned specifically, other specifications shall be as per General Specifications given in Section 2 above.

i) <u>Doors</u>

a.<u>Type</u>

- \_- Single or double leaves
- Single or double swing
- Fully or partly glazed partly solid paneled.
- With/without fixed glazing at sides and top.

#### b. Frame and Shutter

-

- Rectangular extruded sections having in-built grooves to receive glass or solid panel.
  - Glazing can be flush or with Snap-On Aluminium bedding provided with glazing gasket.
- c. <u>Profiles</u>

Section Description	Nominal Size in mm	Nominal Wt.
Frame – Plain	100 x 45 x 2.5	2.00
Frame - Single groove	100 x 45 x 2.5	2.02
Frame – Double groove	100 x 45 x 2.5	2.10
Shutter – TOP	50 x 45 x 2.1	1.10
Shutter – Bottom	45 x 114 x 2.15	2.00
Shutter - Vertical	50 x 45 x 2.1	1.00
Shutter – Middle	45 x 120 x 2.1	2.10
Glazing Clip	20 x 18 x 1.2	0.23

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#### d. Hardware

Door shutters shall be provided with:

- Concealed six lever lock having brass body with S.S. Key operating from both sides.
- 150 mm x 6 mm. thick full shutter wide anodised Aluminium handle cum guard rail fixed with S.S. Bolts and nuts.
- GI pivots at top and bottom.
- Concealed shoot bolt at top and bottom for inactive leaf.
- Single or double action heavy duty floor spring of Everite/Garnish make with S.S. cover plate or efficient gadget door closer.

#### ii) <u>Curtain Wall/Fixed</u>

Partitions a. Type

- Fully or partly glazed partly solid paneled.
- With/without door/window shutters.

#### b. Frames

- Rectangular extruded Aluminium sections having in-built grooves to receive glass or solid panel.
- Glazing can be flush or with Snap-On Aluminium beading provided with glazing gasket.

#### c. <u>Profiles</u>

Section Description	Nominal Size in mm	Nominal
		Wt.
Verticals	100 x 45 x 2.5	2.10

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Horizontal -	100 x 45 x 2.5	2.10
Top & Intermediate		
Bottom	45 x 100 x 2.5	2.02
Beading	20 x 18 x 1.2	0.23

## iii) Fixed View Panel

## a. <u>Frames</u>

- Rectangular extruded Aluminium sections having in-built grooves to receive glass.
- Glazing shall be flush or with Snap-On Aluminium beading provided with glazing gasket.

## b. <u>Profiles</u>

Section Description	Nominal Size in	n Nominal
	mm	Wt.
Vertical and Horizontal	45 x 45 x 2.0	1.00
Beading	20 x 18 x 1.2	0.23
Tee	25 x 25 x 2.0	0.25

### iv) Sliding Windows

a. <u>Frames</u>

Frames shall be 2/3 track as required having in built grooves to accept weather stripping.

b. <u>Shutters</u>

Framing and interlock sections shall be hollow sections with inbuilt grooves for weather stripping and suitable for glazing.

c. <u>Gutters and Valves</u>

Sill member shall be hollow section with special gutter section clipped on to the bottom track to have hollow chamber. PVC valves shall be provided in gutter sections acting as pressure equalisation cum non return valves.

d. <u>Profiles</u>

Section Description	Nominal Size i	n Nominal
	mm	Wt.
Frame 2 Track	65 x 35 x 1.5	0.75
Frame 3 Track	95 x 35 x 1.5	1.10
Frame 4 Track	125 x 35 x 1.5	1.50

Shutter :		
Vertical Horizontal	45 x 20 x 1.5	0.50
		0.00
& Interlock		

## e. <u>Hardware</u>

The sliding shutter shall be provided with

- Needle bearing nylon rollers, to give effective and smooth sliding and bearings concealed in nylon casing.
- Integrated flush type handle cum lock having Aluminium body and stainless steel spring/receiving latch.
- Nylon end cover cum guide on the top and bottom of shutter.
- Nylon anti-lift with pile insert to prevent lifting and tilting of the shutter.
- Frames shall be fitted with tubular rough grounds.

## f. <u>Construction</u>

- The frame shall be mechanically jointed with 3 mm. thick Aluminium angle cleats.
- The shutter shall be mechanically jointed with plated self-tapping screws and Aluminium safety plate. Aluminium alloy blind rivets and nickel plated selftapping screws shall be used for the joints and fittings.

### v) Openable and Fixed Windows

a. <u>Frames</u>

The frames shall be equal leg section having in built grooves to accept weather stripping.

b. <u>Shutter</u>

The shutters shall be side hung; top hung as required and made from hollow `Z' sections within built grooves for double weather stripping. Glazing shall be done with rectangular extended Aluminium beading provided with gasket.

c. <u>Profiles</u>

Section Description	Nominal Size in mm	Nominal Wt. Kg/RM
Frame & Shutter Section	45 x 45 x 2.0	1.10
Mullion	45 x 60 x 1.7	1.00

Beading	35 x 20 x 1.1	0.31

d. <u>Hardware</u>

The open able shutters shall be provided with

- Concealed type friction S.S. 4 bar hinges allowing clearing of glass from both sides from inside and window can stay in any desired position.
- Locking shall be two points with handle or single point as required.

### Notes:

- 1. All edge members shall be anchored/ screwed to brick wall/RCC member on sides and top.
- 2. In case of glazed partitions, vertical members shall be taken up to RCC slab bottom and anchored.
- 3. All frames shall be grouted as per Technical Specifications.
- 4. All components shall be as per Technical Specifications.
- 5. All doors shall be quoted without door closer/floor spring.
- 6. Rates are to be quoted on out to out dimensions of frames. In case of variations in dimensions of frames during execution, rates shall be reworked on pro-rata basis.
- 7. Rough grounds shall be provided for sliding windows and shall be included in rate.
- 8. Workmanship, hardware, glazing, and other specifications shall be as per Technical Specifications and shall form part of Bill of Quantities.
- 9. Opening is mentioned from plastered surfaces without rough grounds and area is shown in  $(M^2)$ . Total area per item is also shown against item in  $(M^2)$ .

#### 6.3. <u>M.S. DOOR FRAMES, ROLLING SHUTTERS, STEEL SLIDING DOORS, M.S.</u> <u>GRATING AND CAT LADDERS</u>

6.3.1. <u>M.S. Door Frames</u>

The M.S. Door framing shall be fabricated out of 14g. M.S. Sheets and fabricated with necessary stiffeners, hinges, holdfasts, etc. as per the drawings/sketches attached with the tender. The contractor shall quote the rate taking into account all the above requisites, including the width of frame and erecting at site in line, level, plumb, etc. and with one coat of shop paint of Red Oxide Primer.

The mode of measurement for payment shall be per number of door or running meter of frames as specified in the Bill of Quantities.

## 6.3.2. <u>Rolling Shutters</u>

The Specifications shall be generally as per the manufactures. However, the following may be noted. The M.S. laths for rolling shutter shall be of required glaze as specified IS Code and the type of rolling shutter shall be pull and push type. The workmanship should be of first class quality. The springs and other materials shall be of best quality. The vertical guides shall be straight and of pressed type and the shutters shall be sizes to suit the requirements of this tender.

## 6.3.3. Steel Sliding / Hinged Doors

The shutters shall be of M.S. Box type and shall be single/double shutter sliding or hinged type and fabricated as specified in drawing. Necessary guide rails shall be fabricated and fixed in position.

The rate quoted shall for all necessary fittings i.e. hinges/sliding arrangement, locking arrangement and painting with Lead Oxide primer.

### Measurement

The mode of measurement for payment shall be as on the basis of clear opening area in the wall.

### 6.4. <u>M.S.WINDOWS</u>

- 6.4.1. All window shutters shall be fabricated to correct shape and size as per drawings approved by the consultant. However, before fabricating any item the contractor has to check the opening dimensions at site. Any discrepancy therein shall be brought to the consultant's notice in writing mentioning the particular windows.
- 6.4.2. All sections for windows shall be extruded sections of approved quality. All extruded sections shall be of approved size as per IS Code No. 1038 of 1983 & IS
  1361 of
  1378.
- 6.4.3. Glass for windows shall be 5.5mm thick or as indicated in drawing. These shall be of best quality approved by the consultant. HPG or equivalent, clear/ ground.
- 6.4.4. The contractor shall have to make all necessary holes in concrete, masonry for fixing of windows. The contractor shall also fix and grout the shutter in line, level and plumb.

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- 6.4.5. The steel members shall be given a coat of approved anti-rust paint.
- 6.4.6. Channel shaped Aluminium beading to be provided around periphery of glass pane. Glass panes to be secured to shutter frames by 10mm x 10mm 'C" channel or square box of Aluminium extruded beading with rubber / pvc gasket. Putty is not allowed.
- 6.4.7. The gap around window frames shall be filled with mastic putty (Shalimar or equivalent) and Asbestos fibre mixture in ratio 3 to 1.
- 6.4.8. Hardware: Peg stay arms, handles, hinges etc. shall be of approved quality as per details shown on drawing and as directed.
- 6.4.9. Fixed or open-able panels of the windows shall be as shown in the drawing.

## 6.4.10. Measurement

The rates quoted by the Contractor under each item in Bill of Quantities shall be for a complete finished item or work and no claims for extra payment by the contractor in this regard shall be admissible. Supplying and fixing of all the fittings and ironmongery shall be deemed to have been included in Contractor's rates and consequently, shall not be paid for separately. The rates quoted by the Contractor shall also be inclusive of painting and/or polishing as indicated in the Bill of Quantities.

The formwork and scaffolding shall be deemed to have been included in the rates quoted by the contractor and shall not be paid for separately for any of the items.

# 7. <u>WATERPROOFING</u>

The existing treatment, if any, will have to be removed by the owners, or by waterproofing Contractor at an extra cost, so as to expose the bare surface.

## 7.1. <u>Seal tight Box Method Waterproofing for Basements and other underground</u> <u>Structure</u>

<u>s</u>

The treatment shall start over the leveling course of about 150mm thick plain cement concrete (PCC) laid even with smooth surface finished with wooden trowel by the owners or Contractor on well compacted soil or rubble packing, as the case may be, in accordance with the strata. On the PCC cement base waterproof layer shall be provided. This surface shall be superimposed by the owners or the Contractor with RCC raft slab designed to withstand the uplift pressure of the subsoil water. After completing the waterproofing treatment on the floor, vertical pipes shall be provided as and where found necessary to release the subsoil water pressure. These pipe holes shall be grouted and plugged after the bottom raft slab is cast. After completion of the raft slab and side walls, the waterproof layer is continued along the outer surface of the walls up to 300 mm above ground or other adjoining apron level. The average thickness of this treatment shall be about 75mm on the floor, and 40mm on the walls.

The excavation of the sides around the wall shall be filled in with soft earth by the owners or Contractor By this method the entire structure shall be encased by treatment to turn into a seal tight box, and the attacking subsoil water does not find any access into it.

Where no space is available on the outer side of basement walls, the following procedure shall be adopted.

- a) Brick masonry of adequate strength shall be provided by the owners through the main contractor at the outside face of the wall of the basement before the latter is cast. Waterproof layer will then be provided on the inner surface of the brick masonry. The RCC wall can then be cast, taking the inner side of the wall and waterproof layer over it as external shuttering for RCC wall. The owner or the Contractor will have then only to provide internal shuttering for the wall.
- b) As regards pile caps, footings, columns, plinth beams etc, the treatment shall be done by providing rubble packing and plain cement concrete (PCC) bedding in the bottom by the owners or Contractor. Over this, brick masonry housing of adequate thickness shall be provided by the owners or Contractor around pile caps, footings, columns, and plinth or tie beams up to the top level of the PCC bedding of the main floor.

The waterproofing shall then be provided over the PCC bedding of the floor and the inner faces of the brick masonry wall. The treatment shall then be taken over the top of the brick masonry wall and continued over the PCC of the main basement floor. This surface will serve as the shuttering for pile caps, beams, etc. and no separate shuttering will be required for them.

The method and thickness of the treatment for floor and walls shall be the same as stated in 7.1 above.

7.2. <u>Injection Grouting & Topstop Method Waterproofing for Water Storage Tanks.</u> After the plumbing work is completed and the normal plaster to the outer surface is provided by the owners through the main Contractor, the treatment starts with giving injections of waterproof compound mixed with cement slurry, into the structure, with nozzle spacing as decided by the Engineer-in-charge. Thus inherent holes, cavities, voids and honeycombs are filled up, making the structure consistent and homogenous, and resistant to water leakage and seepage.

Thereafter, waterproof layer, finished smooth with trowel in cement, is laid on the floor and continued on the side and partition walls up to the full height.

The average thickness of this treatment is 65 mm (depending upon slope required) on the floor and 25mm on the walls.

It is essential that the tank is filled in with water by the owner/main contractor Immediately after treatment is completed and structure tested for water Tightness.

# 7.3. <u>Brickbat Coba & Topstop Method Cement based Water-proofing for WCs, Sanitary</u> <u>Blocks, Kitchen, washing places</u>

<u>etc.</u>

Before waterproofing work is started, all cutting or chasing in the floor and/or walls and all the plumbing work should be completed by the plumber, and the normal plaster to the ceiling and upper part of walls should be provided by the owners through the main contractor.

The Waterproofing Contractor shall start with filing in the depressed or sunk portions of the WCs, bathrooms, washing places, nahanis, etc. with brick bat coba with necessary gradient for easy flowaway of water towards the nahani trap or soil pan, the surface being finished rough with 18mm thick water-proof layer, in order to receive tiling to be done by the owners through the main Contractor. The said waterproof layer shall then be continued on the walls above the floor level for a height of 1 meter.

In toilets average thickness shall be 100mm on slab. The rates quoted shall be inclusive of continuing the treatment on vertical faces for a height of 1 meter and providing vata etc. Measurement shall be taken in plan area.

7.4. Brickbat Coba & Topstop Method Cement based water-proofing for <u>Terraces, Chajjas, Canopies, Staircases, Gutters, etc.</u> Water proofing treatment shall start directly over the RCC slab with laying over waterproof brickbat coba to provide necessary gradient of 1 in 120 (1 inch in 10 feet) for the easy flowaway of rainwater. Finally, the brickbat coba shall be covered with joint less waterproof layer finished smooth with trowel in cement colour, marked into 300mm false squares. This treatment shall be carried along the inner side of parapet and/or other adjoining wall up to a height of about 300mm in the shape of a round vata. The average thickness of this treatment shall be about 100mm with a minimum thickness at water outlets being 50mm. This surface shall be hard and tough, and suitable for all normal domestic activities.

Notes:

- 1. If it is desired to cover the treatment with decorative tiles, marble, china mosaic, etc. the surface shall be finished rough to receive the same.
- 2. Due to the location of rainwater pipes being far apart and/or due to the span being wider than 6 meters and if the water is required to travel on one side only, then the thickness of the treatment shall increase proportionately to maintain the minimum gradient for the easy flow away of rainwater. For this additional thickness of the coba, over and above average 100mm, shall be charged extra. This will also apply in cases where sunk or depressed portion in the slab have to be filled.
- 7.5. <u>Chemical Based Waterproofing</u> The surface on which the waterproofing is to be provided should be cleaned thoroughly from any loose material, after removing any abrupt/sharp undulation. The surface should be made completely bone dry before applying any chemical.

The adhesive coat or the primer, as the case may be, should be applied to the surface in desired layers/ coats, as specified by the manufacturers. Consideration for pot life of the material for effective bond should be the main criteria.

For elastic membrane coat, the number of coats shall depend upon the mode of application viz. brush or roller application, liquid spray application. The membrane thickness shall be minimum 0.2mm though higher thickness shall be preferred for structural reasons. It is understood that, the membrane shall be joint less and continuous as far as feasible. In the event of any intermediate joints the minimum lap length shall be 50 cm. The joints shall be hot sealed, if feasible. Care should be taken to avoid any wrinkles in the membrane layer as well as to relieve the trapped air below the membrane.

The protective coat shall be minimum 2mm. thick and should be able to resist abrasive load due to human traffic. Moreover, if the chemical components adopted in the construction are vulnerable to ultra violet rays, the protective coat should be resistive to such rays and also against normal vagaries of weather. The concrete layer of approved thickness with water proofing compound as protective course can be laid on top as per recommendation of the manufacturers. The contractor has to give guarantee for 10 years in approved stamp papers for the complete water proofing work.

7.6. <u>Polyurethane Insulation and Waterproofing Treatment</u>

The surface on which waterproofing is to be provided should be cleaned thoroughly of any loose material after removing any abrupt/sharp undulations.

The cleaning shall be done by means of wire brush and Compressed Air. The surface shall be made completely bone dry and dust free with the help of dry cloth or by blower.

Polyurethane Foam of required thickness shall then be sprayed with a special high pressure machine. The density of P.U. shall be 50-55 kg/cum. On top of P.U. foam a crust of waterproofing layer shall be laid.

In order to test the waterproofing the roof terrace shall hold 15cm of water for a period of 12 hours without staining the underside of the roof.

Thereafter if required tiles may be laid over a layer of Cement mortar (1:3) mix.

The rate quoted shall be inclusive of continuing the treatment on vertical faces if any for a height of 15cm. and providing vata etc.

### 7.7. <u>Measurement</u>

Measurement shall be taken in plan area for flat roof and surface area for Sloping Roof.

# 8. <u>STRUCTURAL STEEL WORK AND ASBESTOS WORK</u>

## 8.1. <u>Structural steel work</u>

## 8.1.1. <u>Scope of Work</u>

The work covered by this contract comprises the supply, fabrication and erection of Structural Steel work in accordance with the drawings furnished by the consultant and as directed in the Bill of Quantities and Specifications hereinafter.

The Static Calculations shall be worked out by the consultant. The current rules and practices set forth in the latest Indian Standards for materials, fabrication and erection of Structural Steel work including metal arc welding shall be strictly followed unless otherwise indicated hereinafter.

In case the Contractor wishes to suggest certain alterations, substitutions or modifications of design sections, details etc. he shall provide the necessary drawings therefore together with calculations and details. These details shall be checked by the consultant and approved.

It is intended that the Drawings and Specifications include everything requisite and necessary to finish the work properly notwithstanding the fact that every item may not be specifically mentioned. All supplementary parts such as bolts, clips and angles necessary to complete each item shall be deemed to be included though not specifically stated. All work when finished shall be delivered in a complete and undamaged condition.

## 8.1.2. Materials

All materials (such as structural steel sections, bolts, nuts, electrodes for welding etc.) required for the work shall be the best tested quality conforming strictly to the relevant Bureau of Indian Standards (B.I.S) Specifications. Materials shall be new and unused stock free from scale, blisters, laminations, cracked edges and such other defects.

Structural steel shall conform to IS: 226 / IS: 2062. Electrodes for welding shall conform to IS: 814 / IS: 815 or equivalent.

All steel tubes shall conform to IS: 1161 Grade YST-210, unless specified.

All bolts and nuts shall in general conform to IS:1363, IS:1367, IS:5370, IS:5372, IS:5374, IS:6610, IS:6639 and IS:6649, as appropriate. Manufacturers' Test Certificates shall be made available to the Engineer.

## 8.1.3. Storage

All material shall be stored in such a way as to avoid and to prevent deterioration and corrosion.

## 8.1.4. Drawings

The Contractor shall submit 3 sets of Shop and Erection drawings with erection sequence necessary for the construction for approval of "Client" free of charge.

The Contractors shall prepare these drawings / lists as per specifications and code of practice and submit the same in duplicate in advance to "Client" for approvals. The above drawings shall include:-

- Sizes, dimensions and details of members with marking diagram.
- Types and dimensions of welds and bolts.
- List of materials and fasteners.
- Total weight (in Kgs.) of structure covered in drawing.

Later in the event of any necessary changes in the scheme and / or non-availability of any particular section desired, the contractor shall revise his shop drawing accordingly and resubmit in duplicate, for approval without any extra cost.

Approval of shop drawings by the consultant shall not exonerate the contractor of his responsibility for correctness of the dimensions and adequacy of the details for connections.

### 8.1.5. <u>Workmanship</u> (Fabrication)

All workmanship shall be of first quality in every respect, greatest accuracy being observed to ensure that all parts will fit together properly on erection.

All ends shall be cut true to fit the abutting surfaces accurately. Butt ends of compression members shall be in close contact through the area of the joint. Stiffeners, if any, shall bear tightly at both ends.

### 8.1.6. Fabrication

i. <u>Preparation of Material</u>

Material received in shop shall be inspected and defective portion segregated and Employer / Consultant shall be informed within a week of receipt. All material before and after fabrication shall be straight, free from twist, bends or any such surface defects. The section shall be straightened by applying uniform pressure or by cold working.

Fabrication work shall not be taken in hand until the relevant shop drawings have been approved by the consultant.

ii. Marking

Marking of members shall be made on horizontal platform in order to ensure horizontal and straight placement of such members. The tolerance limit in the marking shall be only  $\pm 1$  mm.

iii. Cutting

Cutting of structural members may be affected by shearing, cropping, sawing or machine flame cutting and the resulting edge shall be reasonably clean and straight. Sheared members shall be free from distortion at sheared edges.

Cutting tolerances for members to be connected at both the ends shall be  $\pm 1$  mm. and elsewhere  $\pm 3$  mm. The edge preparation for welding of members more than 12 mm thick shall be done by flame cutting and grinding.

In no case, electric metal arc cutting shall be permitted.

iv. <u>Holes</u>

Holes for the bolt connections shall be drilled to utmost accuracy at the positions indicated on drawing. Maximum deviation for spacing of two holes shall be  $\pm 1$  mm. Finished holes for bolts shall not be more than 2 mm. in diameter than the diameter of the bolt passing through them for bolts diameter up to 24 mm. and not more than 3 mm. greater than the bolt diameters over 24 mm. unless otherwise specified. Holes in the light framing not exceeding 12 mm. thicknesses with the exception of splice holes may be punched full size.

All punching and sub-punching shall be clean and accurate and all drilling free from burs.

No hole shall be made by gas cutting process.

v. Shop Assembly

All steel work intended to be bolted together shall be in close contact over the whole surface and all stiffeners shall bear tightly at top and bottom. Before assembly, the contract surfaces shall be painted with heavy coat of pure Zinc Chromate Red Oxide and raw Linseed oil and the surfaces brought into contact while still wet.

The component parts shall be assembled that they are neither twisted no otherwise damaged and shall be provided with specified cambers, if required.

All steel work intended to be welded together shall be properly assembled and held firmly in position by means of jigs and clamps prior to and during welding. Sequence of welding to be indicated on the detail drawings.

vi. Bolting

For satisfactory bearing, where necessary, washers shall be tapered or otherwise suitably shaped to give the heads and Section 6 Technical Specification nuts of bolts. When tightened, nut shall not bear on the unthreaded body of the bolt. The threaded portion of each bolt shall project through the nut at least one thread.

vii. <u>Welding</u>

Welding of steel shall be in accordance with IS: 816.

After the edge preparation, assembly of structural steel shall be made by using proper jigs and fixtures to ensure correct positioning of members. Cut surfaces with sharp edges shall be clean, perfect and free of rust and members assembled shall be dry and clean on welding edges. Under no circumstances, shall wet, greasy, rusty or dirt covered parts be assembled. To meet exact finish dimensions of the structure, proper allowance shall be made for welding shrinkage while assembling the members and then only temporary tack welding in position shall be done by electric arc welding.

The steel structures shall be welded manually or with automatic welding machines.

The welding runs shall begin only after the assembly is checked and approved by Engineer-in-Charge. All welding at parts shall be carried out by skilled, experienced and competent welders. The edges of the surfaces between two parts to be joined shall be thoroughly brushed with iron brush till bare metal appears before commencing the weld runs. Necessary welding gaps and root gaps are to be provided as per specification and place of welding to be protected from wind and rain when it is to be carried out in open. The suitable electrodes, wire and parts to be welded shall be dry.

For single butt welds and double butt-weld, the re welding of the root is mandatory but only after the metal deposit on the root has been cleaned by back grouting or chipping. The contractor shall allow the welding seams to cool gradually without using by means to accelerate cooling.

For multi-layer welding, before welding of following layer, the formerly welded layer shall be cleaned to metal bright by light chipping and wire brushing. The order and method of welding shall be such that:

- no acceptable deformation appears in the welded members.
- due margin is approved to compensate for contractions due to welding in order to avoid any high permanent stresses.

Special attention shall be given to suitable sequence of welding to keep the internal stresses within the permission limits.

All welds shall be inspected before painting. The weld seams shall correspond to design, shape and size and shall not have any defects such as cracks, incomplete penetration, fusion, undercuts, rough surface, burrs, blow holes and porosity etc. beyond permissible limits.

Any weld which is found to be defective shall be cut by using either chipping hammer or a gouging torch in such a manner that the adjacent material is not injured in any way.

## viii. Machining of butts, caps and bases

Column splices and butt joints of struts and compression members depending on contact for stress transmission shall be accurately machined and close butted over the whole section in column caps and bases, the ends of shafts together with the attached gussets, angles, channels, etc. after bolting and/or welding together as the case may be, shall be accurately machined so that the parts connected butt over the entire surface of contract.

Where sufficient gussets, bolts and/or welds are provided to transmit the entire loading, the column ends need not be machined. A bearing face of column base which is to be grouted direct to a foundation need not be machined provided such face is true and perpendicular to column axis.

## ix. Painting

a) <u>Shop Coat</u>

All steel work shall be properly cleaned of all loose mill scale, rust, dirt and other foreign matter. with wire/mechanised brush or sand blasting as specified in BOQ. Except where encased in concrete and surface area adjacent to edges to be field welded, all steel work shall be given one coat of approved anti-rust (Red Oxide) well worked into the joints. All paint shall be applied to dry surfaces.

b) Inaccessible Parts

Parts inaccessible after assembly shall be given two coats of shop paint of different shade. No spots of bottom coat shall show through.

## c) Contact surfaces

All contact surfaces shall be properly cleaned by effective means but not painted.

d) <u>Surfaces to be field welded</u>

Surfaces which are to be welded after erection shall where practicable not receive a shop coat of paint. If painted, such paint shall be removed before field welding for a distance of at least 50mm on either side of the joint.

## x. Marking and dispatching

Each piece shall be distinctly marked before delivery in accordance with the approved marking diagram and shall bear with other marks as to facilitate erection. The fabricated steel work shall be dispatched from shop to the site in such a sequence, as may be found convenient for erection. However, accuracy of fit for the fabricated steelwork may be checked by temporary erection complete or in parts in shop before dispatch.

### xi. Inspection

The Engineer shall have free access at all reasonable times to those parts of the Contractor's works which are concerned with the fabrication of steel works and shall be afforded all reasonable facilities for satisfying him that the fabrication is being undertaken in accordance with the provision of this specification.

Inspection shall be made at the place of manufacture prior to dispatch.

### xii. <u>Setting out</u>

The contractor shall verify the alignment and levels of foundations, accuracy of main axes, foundation centers well in advance of starting the erection work and shall be responsible for any consequences for non-compliance thereof. In case of any deviations or discrepancies in alignment, levels, etc., it shall be brought to the notice of the Engineer-in-Charge immediately. The various parts of the steel structure shall be so erected as to ensure stability and safety against self-weight, wind, erection, stresses and conditions including those due to erection equipment and its operation and temporary bracing may be provided if desired.

The structure shall be anchored and final erection joints shall be completed after the members of the structure are all positioned, leveled as shown, in drawings and approved by the Engineer.

The bolted joints to be tightened so that entire surface of the bolt heads and nuts, shall rest on member. For parts with sloping surfaces, tapered washers shall be used. All defects and damaged to the structure shall be rectified by contractor at his own cost to the satisfaction of the consultant.

# 8.1.7. <u>ERECTION</u>

i. Storing and Handling

All structural steel on receipt at site shall be carefully unloaded, examined for defects or any damage to be sorted out as per marking and stacked on leveled ground.

Any material found damaged or defective shall be stacked separately and the same to be painted in distinctive colour. Such material shall be dealt with under the orders of the Engineer-in-Charge without <u>delay.</u>

Erection shall be done only by using mechanical equipment like cranes. Poles and derricks shall not be used.

The contractor shall make the following verifications upon the receipt of material at site:

- For quality certificates regarding materials and workmanship conforming to the general specifications and drawings.
- Whether the parts/materials received are complete without defects and defects if any, are well within the admissible limits.

### ii. <u>Erection tolerances</u>

The maximum tolerances for line and level of the steel work shall be  $\pm$  3.0 mm. on any part of the structure. The structure shall not be out of plumb more than 5.00 m. on each 10 m. section of height and not more than 8.00 mm. per 30 m. section.

These tolerances shall apply to all parts of the structure unless the drawings issued for erection purposes, started otherwise.

In general, the tolerance allowed in erection shall be as per the following table:-

Component		Description		Vari	ation allowed
Main	a)	Shifting	of axis		
columns and		column founda respect to build :	ation at ing line		
		i) in	longitudinal	±	5.00
		direction.		mm.	
		ii) in lateral d	irection	±	5.00
				mm.	

b)	Deviation of both major column axis from vertical between foundation and other member's connection levels :	
	i) for a column up to & 10 m	± 5.00 mm from true vertical.
	<ul><li>ii) for a column greater than</li><li>10 m. but less than 40 m. ht.</li></ul>	$\pm$ 5.00 mm. from true vertical for any 10 m. length measured between connection levels but not more than $\pm$ 8.00 mm. per 30 m. length.
c)	For adjacent pairs of columns across the width of the building prior to placing of truss.	± 5.00 mm. on true span.
d)	For any individual column deviation of any bearing or resting level from levels shown on drawing.	± 5.00 mm.
e)	For adjacent pairs of columns either across the width of building or longitudinally level difference allowed between bearing or seating level supposed to be at the same level	

Component		Description	Variation allowed
Trusses	a)	Deviation at center of span of upper chord member from vertical plain running through center of bottom chord.	1/1500 of the span but not greater than 10 mm.
	b)	Lateral displacement of top chord at center of span from vertical plane running through center of supports.	1/250 of depth of truss or 20 mm. whichever is the least.
Crane girders and tracks	a)	Difference in levels of crane rail measured between adjacent columns.	2.00 mm.
	b)	Deviation to crane rail gaug	je ± 3.00 mm
	c)	Relative shifting of ends adjacent crane rail in plan and elevation after Thermit welding.	± 2.00 mm
	d)	Deviation of crane rail axis from center line of web.	± 3.5 mm.
Setting of expansion gaps	At expansion shall tempo deg. 0 The contra as 0.0 degree	the time of setting of nsion gaps, due regard be taken of the ambient erature above or below 30 C. coefficient of expansion or action shall be taken 200012/unit length pe Celsius.	

### 8.1.8. Measurements

The measurements shall be as per the final fabrication drawings. Payment shall be made on the actual tonnage erected. The rate quoted shall be inclusive of welding, riveting or bolting and grouted bolts. The latest Code of Practice of Indian Standard Institution for Method of Measurement purposes.

The rate shall include cost of all handling and transport, fabrication, application of specified primer coat(s) of paint, erection at site, scaffolding, temporary supports, tools, tackles and touching up of primer coat where damaged and where asked for and application of two finish coats of best quality Synthetic Enamel Paint. Welds, bolts, nuts, washers, etc. shall not be measured nor paid for separately.

The measurement of hand railing shall be based on meter run of hand railing consisting of top run and middle run together measured as a single run. The bends in the hand railing near obstructions such as columns, walls, etc. or at the termination points shall not be measured.

The rate shall include all cost for procuring, transporting and handling, fabricating and erecting in position, hand railing excluding the plates for hand railing which shall be measured separately and included in structural steel items.

Calculation of weights of structure shall be based on Unit Section weights given in IS code/B.I.S. Handbook. No allowances shall be made for rolling margin/tolerances.

#### 8.2 <u>Asbestos work</u>

- 8.2.1. <u>Scope of Work</u> The work comprises of the following:
  - a) A.C. Sheet Roofing with accessories
  - b) A.C. Gutters with accessories
  - c) A.C. Sheet Cladding
- 8.2.2. Materials

Asbestos Cement Sheets for roofing, cladding and A.C. rain water gutters shall be procured from the approved manufacturer.

Roofing and cladding shall be carried out with "Corrugated Sheets".

#### 8.2.3. <u>Workmanship</u>

Workmanship shall be strictly in accordance with the code of practice issued by Asbestos Cement Co. and will conform with the drawings and instructions issued by the consultant. A.C. Sheets for roof and cladding will be procured in the specified sizes so as to minimise the wastage. Corrugated Sheets in roof shall be laid from right to left. The first sheet shall be laid uncut but the remaining sheets in the bottom row shall have the top right and corners cut or mitred. The sheets in the second and other intermediate rows shall have the bottom left hand corner of the first sheet cut, all other sheets except the last sheet shall have both the bottom left hand corner and the top right hand corner cut, and the last sheet shall have only the top right hand corner cut. The last or top row sheets shall have the bottom left hand corner cut with the exception of the last sheet which shall be laid uncut.

Wherever four sheets meet at a lap, two of them shall be mitred to provide a snug fit. The length of mitre shall be 20 cm. widths equal to the width of the corrugation. Mitring shall be done with an ordinary wood saw.

The ends of all sheets at the eaves shall be supported and the support shall be placed as near to the margin of the sheets as practicable.

Cat ladder or roof boards shall be used when working to avoid damage to the sheets and to provide security to workmen. These shall also be used when fixing roofing accessories, gutters and accessories.

Corrugated sheets shall be laid with smooth side up-wards. End marked `Top' on the smooth side shall always point the ridge. End lap in sheets shall be 20cm. and side lap shall be of one corrugation, the left hand small corrugation of each sheet being covered by the right hand large corrugation of the next sheet. Holes in A.C. Sheets for fixing shall be 11.11 (7/16") dia. drilled never punched, in the crown of the corrugation. Fixing bolts, screws shall be of 7.94 mm (5/16") dia and all fixing accessories including nuts and washers shall be of galvanised iron. "Everest" bitumen washers shall be screwed lightly at first and tightened when a dozen or more sheets are laid. Screwing the sheets down too lightly on the purlins shall be avoided. Every vertical side lap corrugation will carry a at the edges and also through one of the two fixing accessory intermediate corrugations on each sheet. When the sheets are supported on intermediate purlin as in the case of length over (1.83m) and additional fixing accessories shall be provided through each side lap corrugations only.

No deduction in measurements shall be made either for openings or recesses for chimney stacks, roof lights etc or for khurras, for areas upto 0.40 sq.m. No extra shall be paid either for any extra material or labour involved in forming such openings or increases or in rounding the concrete in junction of roof with parapet walls, chimney khurras, etc. For similar areas exceeding 0.40 sqm. Deductions will be made in the measurements for the full openings but no extra shall be paid for any extra labour, material etc. involved in forming such recesses and openings and in rounding at the junction aforesaid.
A.C. Gutter shall be supported along its girth through its length by adjustable brackets fabricated out of suitable M.S. straps at approx. 45cm c/c fabricated to the same profile as the gutter is fixed to the adjacent M.S. Runners/purlins by suitable M.S. accessories.

Gutters and accessories to be joined shall be perfectly dry and clean. Asbestos ropes 6.35 mm. (1/4") dia. smeared with approved bitumastic jointing compound shall be placed on both sides of the union clip, 1.25cm. Inside from the edge along its inner cut-out.

The space between the ropes shall be filled with approved bitumastic jointing compound and leveled uniformly with a piece of wood or the edge of a trowel to the height of the rope.

Gutters and accessories shall be placed in position with 1.59mm (1/16) space between the butt joints and the prepared union clip shall be fixed underneath the butt joint.

From inside the gutter 7.94mm (5/16") dia. G.I. seam bolts shall be inserted in the ready drilled holes with approved bitumen washer adjacent to the gutter and a G.I. flat washer on top of it and shall be screwed with a nut.

The bolts shall be so positioned that approved bitumen washers shall be correctly centred on the holes in the gutter as also in the union clip.

Over tightening of nuts shall be avoided to prevent sheets/ gutters from

cracking. After a complete gutter line has been fixed in position all

brackets supporting the

gutter shall be adjusted to give the required slopes towards the gutter outlets.

Gutter line shall be tested for water tightness after jointing. All outlets shall be plugged and the entire length of the gutter line filled with water and retained for 24 hours for observations.

### 8.2.4. <u>Measurements</u>

The sloping area of roof coverings and claddings as laid shall be measured in square meters without allowance for laps and corrugations, if any.

Portions of roof covering overlapped by ridge or hip etc. shall be included in the measurement of the roof.

Any opening not exceeding 0.4 m2 shall not be deducted and forming such openings requiring cutting shall be as specified.

#### 8.2.5. Guarantee

The Contractor shall be required to furnish a guarantee in respect of the water tightness of the roof gutters for a period of one year from the date of final completion of work.

#### 8.3 Roofing / Cladding system using precoated steel sheets polyester paint

### 8.3.1. Materials

Roofing/cladding shall be troughed sheeting, with 780 mm over width and 30 mm trough depth, manufactured out of 0.60 mm galvanised colour coated steel. The trough size, width of the sheet and thickness may be differed for various approved manufacturers. The colour coating shall be as specified. Sheeting shall be supplied in continuous lengths to suit shop drawings, maximum length up to 12 m.

### 8.3.2. <u>Fixing</u>

Sheeting shall be fixed to supports with No. 12 24 x 45 mm hex head selfdrilling screws with neoprene washers and nylon caps/heads. Sheets shall have approved side laps with the top sheet laps facing away from the prevailing weather.

Recommended end lap is 150 mm on roofs and 100 mm on sides for roof slope up to 15 deg. Where the slope is less than 15 deg. the end lap should be 230 mm and transverse/longitudinal joints will be sealed with flexible mastic compound of approved quality.

Roof sheeting shall project a minimum of 75 mm into gutters with the maximum projection into gutters leaving access for cleaning.

### 8.3.3. <u>Flashings / Cappings / Gutters</u>

Flashings, cappings and gutters would be manufactured from 0.6 mm galvanised steel in same colour as roofing/cladding sheet and shall cover the sheets a minimum of 100 mm. Attachment and joints are to be made with mechanical fasteners with nylon heads.

### 8.3.4. <u>Finish</u>

Base steel shall conform to JIS-3312 with zinc coating (minimum average 120 gms/sq.m coating mass total both sides).

Sheet shall be prepainted with polyester paint system (Optional: silicon modified polyester paint systems are also available) colour as selected the coating system would have been tested in accordance with ASTM or equivalent standards and satisfy minimum performance requirements as below:

i.	Scratch and mar resista	Fair	
ii.	: Impact Resista	ance	Greater than 10 joules
iii.	: Pencil Hard	ness	F Minimum
i			No loss of adhesion bent around a diameter equal to 4 times.
v.	Heat Resistance	:	Suitable upto 100 Deg.C
	Accelerated Corrosion		
i.	Salt Spray	:	750 hours
ii.	Humidity Resistance	:	750 hours
iii.	QUV Resistance	:	750 hours

#### 8.3.5. Wind Loads

The roof sheeting shall be fixed in accordance with manufacturers recommended load/span criterion.

### 8.3.6. Installation

The roofing sheets shall be fixed to steel supports. Sheeting would be fixed using steel self-drilling screws with neoprene washers and nylon colour heads.

#### 8.3.7. Measurement

The mode of measurement shall be as per para 8.2.4 given hereinbefore.

### 8.4 <u>Roofing / Cladding system using Aluminium sheets</u>

#### 8.4.1. Materials

Roofing and cladding shall be industrial troughed sheeting with 875 mm effective width and 38 mm trough depth manufactured by "Jindal" or equivalent. The surface finish shall be stucco Embossed. Sheeting shall be supplied in continuous lengths to suit shop drawings. Maximum length of sheet shall be up to 7 meter.

### 8.4.2. Fixing

Steel work which will be in contact with Aluminium should be treated with a coat of non-lead bearing paint before erection. (A three coat painting comprising of two coats of red oxide / zinc chromate primer and one coat of ALUMINIUM PAINT should be ensured). Sheets coming in contact with wet port and cement should be protected by bituminous coating. Sheeting shall be fixed to supports with Aluminium fasteners along with Aluminium curved washer, neoprene washer and nylon caps/heads.

Sheets shall be preferably laid from the end of the building away from prevailing wind. Recommended lap is 150 mm on roofs and 100 mm on sides for roof slope up to 15 Deg. Where the slope is less than 15 Deg. The end lap should be 230 mm. and transverse / longitudinal joints will be sealed with flexible mastic compound of approved quality.

No. of fasteners shall be as per manufacturers recommendations. All attachments for the roof sheeting should pass through the crown of corrugations / troughs whereas for the side cladding the fixture should pass through the troughs.

### 8.4.3. Flashing / Capping

Preformed flashing & capping made of suitable Aluminium alloy shall be used.

8.4.4. Installation

The roof sheeting shall be fixed in accordance with manufacturers recommended load/span criterion. The roofing sheets shall be fixed to steel supports.

8.4.5. Measurement

The mode of measurement shall be as per para 8.2.4 given hereinbefore.

## 9. <u>ROAD WORK (IF APPLICABLE)</u>

### 9.1. <u>Materials</u>

Stone for soling shall be approved hard variety stone and as specified for rubble packing hereinbefore.

Stone for metalling (water bound macadam) shall be approved hard variety (Besalt) stone graded from 50mm down to 15mm. Size shall be as defined in the relevant IRC or equivalent Standards.

Stone for premix macadam work shall be of hard quality suitably graded.

Binder required for the premix macadam work shall be cutback, shelspar B.S. Special Grade or other equivalent and of approved manufacture. Kerb stones and water tables shall be approved variety hard blue trap stone or other type and of size indicated in the Bill of Quantities. The stones shall be dressed on all faces.

### 9.2. <u>Collection and stacking of materials</u>

The materials shall be collected and stacked in a systematic manner on either side of the road with a fairly wide margin. The road being divided to approximate divisions longitudinally material required for each such part length of the road shall be contained and stacked in that length only. Where grading is specified the material shall be stacked in distinct piles for different sizes.

Where average thickness exceeds the average thickness specified in the item, the extra depth shall not be paid for unless the same had been carried out under the orders of the Engineer-in-Charge. Where however such average thickness is found on measurements to fall short of the average thickness specified in the item the contractor rate will be reduced for the shortfall in thickness.

#### 9.2.1. Guarantee

The stacking ground shall be fairly level to facilitate checking the quantity of materials collected and the quantity incorporated in the road subsequently.

Properly sealed bitumen containers (drums) shall be stored in a distinct place/store as directed.

### 9.3. <u>Preparation of Sub grade</u>

After excavation and/or filling are performed to the required levels, chambers, gradient etc the sub grade shall be trimmed properly. It shall then be rolled with 8 to 10 power roller adequately watering the sub grade as the rolling proceeds. Soft patches, pockets, etc. in the sub grade shall be excavated and these shall be filled in with approved variety hard murrum before rolling of the sub grade is commenced.

### 9.4. <u>Soling</u>

Soling shall be prepared all as specified herein before under `Rubble Soling' (Clause

2.9). The thickness of soling shall be as specified in the Bill of Quantities and soling shall be laid in one layer. It shall be laid to proper levels, gradients and cambers all as directed. It shall be rolled and consolidated by 8 to 10 T. power roller. The finished surface of soling shall present a neat hard surface.

## 9.5. <u>Metalling (Water bound Macadam)</u>

Metal shall be mixed in the following proportions:

75 mm size: 50% 38 mm size: 25% 19 mm size: 25%

Screenings required for blindage shall be from 12 mm. down to dust.

Metalling shall be spread in one layer to the required thickness (as specified in the Bill of Quantities). In spreading care shall be taken to take bigger pieces to the bottom and smaller to the top. Spreading shall be finished to proper camber etc. by means of suitable templates placed at intervals as directed. The rolling of water bound macadam surface shall be done with an 8 to 10 ton power roller. Rolling shall always be from edges to center.

Dry rolling (no water) shall first be carried out to an extent such that the roller makes no further impression. The surfaces shall then be adequately watered and screenings shall be spread over the surfaces to a thickness of 12mm. This shall again be rolled and consolidated properly to furnish a neat surface to proper camber, gradient, super elevation etc.

9.6. Premix macadam

Before premix work is started, it is essential that the road surface should be clean, free from dust and completely dry.

Premix macadam shall be 50mm thick (consolidated thickness) consisting of 38mm. thick base coat and 12mm thick seal coat (premix chippings). The metal for base coat shall be in 2 sizes mixed as indicated below:

	Base Coat	Premix chipping		
50 mm premix macadam	38 mm thick	12 mm thick		
	Metal Sizes 25 mm - 75% 19 mm - 25%	Chipping sizes 6 mm		

The quantity of binder both for base coat and seal coat shall be at the rate of 64 kgs. per cubic meter. The application temperature for the binder shall be strictly as per manufactures specifications.

The mixing of bitumen and aggregates shall be carried out in approved mechanical mixers to ensure uniformity and accuracy of mixing.

The road surface which is swept clean and completely dry shall be covered with premixed aggregates material to required thickness. The spreading shall be done with the help of templates to ensure correct camber, gradient etc. The base coat shall first be applied and rolled adequately with an 8 to 10

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ton power roller from edges to center. The base coat shall be finished to camber gradient etc. as directed.

Over the thus finished surface a premix chippings seal coat shall be applied and consolidated in the same manner as for the base coat. The pre-coat chippings shall be spread at the rate of 0.017 m3 per every m2 of surface. The final surface shall strictly conform to the required levels, camber, gradient etc.

### 9.7. Kerb Stones

These shall be laid straight or to curves as directed. Kerb stones shall be founded on cement concrete foundations. They shall be laid jointed and pointed flush in cement mortar (1:4). The joints shall not exceed 12 mm. in thickness.

### 9.8. <u>General</u>

The entire road work shall be carried out in an orderly manner and as per directions issued from time to time. The Contractor shall, if so directed leave side entrance holes in curbs for drainage purposes as directed without any extra cost. Generally the MOST (Ministry of Road and Surface Transport) specification to be followed wherever the same is not mentioned. Vibratory/Pheunametic roller to be used for compaction in road work to get better result as directed by the engineer in-charge.

### <u>NOTE</u>

In case of brick soling, specifications shall be generally the same but bricks shall be laid on edge in two layers in Herringbone pattern & joints filled up with sand as described earlier Consolidations shall be with light roller.

### 10. <u>SUSPENDED FALSE CEILING</u>

**Note:** All Electric fitting etc. are to be supported from ceiling independent of False Ceiling.

### 10.1. With mineral fibre tile & acrylic painted GI framework

#### <u>Materials:-</u>

rofiles with
ot dipped
tee of 24 mm
0.33 mm
ished steel
webs at every
-
r ( 1

4'cross tee	: 30 mm height double webbed tee of 24 mm width made out of 0.25 mm thick sheet and with pre-finished steel (Spacing 600 mm) capping and slot in web at every 600 mm.
2' cross tee	: 25 mm height double webbed tee of 24 mm wide flange with pre-finished steel capping (Spacing 600 mm)
Wall Angle	: 22 mm x 22 mm size angle of 0.46 mm thick and pre-finished bottom flange.
Retention clips, holding clips Optional item.	etc. with corrosion resistant plating.
Panels / Tiles	: 15 mm thick 600 mm x 1200 mm or 600 mm x 600 mm size sound absorbing mineral fibre tiles meeting the following specification.

		<ul> <li>Noise</li> <li>Sound 34 dB</li> <li>Light 1</li> </ul>	reduct Attent Articul reflecta	ion co-e tion / C lation C ince	fficient - Ceiling Clause - 809	0.50 to 0.5 - % to 85%	55	
Fire Propagation as per	:	Class	0	Bs	476	part	6	(1989)
Spread of flame as per	:	Class 1 Bs	476		part	6		(1987)
Humidity resistance (at 40° C)	: 95	% RH for 1	prima 1	ranges				
Weight in Kg. / m2 Insulation value Avg. R Factor (at 24 ° C)	:	3.5 Kg. 0.26						
Load bearing capacity of the system	:	15-16 Kg.	/ Sq. 1	n.				

Main runners (1200 mm c/c spacing) to be suspended from slab / beam Soffit/supporting grid work by 4 mm dia GI rod with butterfly clips etc. at every 1200 mm spacing.

1200 mm cross tees at 600 mm c/c spacing (having over ride at each end for clean look) to be fixed to main runner by `snap on' connections.

600 mm cross tee (only in case of 600 mm x 600 mm grid system) at 600 mm c/c spacing to be connected to 1200 mm cross tee by `Snap On' connections. 15 mm thick. regular edged panels / tiles suitable for 600 mm x 600 mm or 1200 mm x 600 mm grid system to be fixed against the grid prepared by above runners & tees.

Total work to be carried out on the basis of approved scheme / drawing Co- ordinated with all lighting, sprinkler, diffuser and other services and utility pipes / fittings etc. and as per the instruction of the Engineer.

### 10.2. Flush mounted gypboard false ceiling

#### 10.2.1. Materials

- G.I. perimeter channel 27 mm. Wide and 0.5 mm. Thick, flanges 20 mm and 30 mm.
- GI Intermediate channel 45 mm. Wide, 0.9 mm. Thick, flanges 15 mm. each.
- Ceiling Section 0.5 mm thick having knurled wedge of 51.5 mm. And flanges 26 mm. Each with lips of 10.5 mm.
- Accessories Connecting clip, soffit cleat, and 25 mm x 3 mm. M.S. flat, screw fastners, etc.
- 12.5 mm gypboard (manufactured by M/s. India Gypsum), jointing compound, paper tapes etc.

#### 10.2.2. Construction

- GI perimeter channel shall be screw fixed to partitions along the perimeter of ceiling.
- GI intermediate channel shall be suspended from the soffit / supporting grid work by cleats, M.S. flats, etc. with suspenders at 900 mm C/C.
- Ceiling section shall be fixed to intermediate channel at 450 mm C/C with the help of connecting clips.

- The ceiling grid work shall be suspended / supported from the main structural members (which are at 2 M approx. C/C) with additional 48 mm. Wide GI double stud grid work (stud-in-stud to form a square section), at suitable spacing to facilitate suspension of ceiling grid work adequately depending upon ceiling load.
- Gypboard panel board shall be screw fixed to ceiling section with 25 mm. Drywall screws at 230 mm C/C. The edges of the boards shall be jointed and finished to a flush finish with special jointing compound, paper tapes, etc.
- The exposed side of ceiling shall be finished with painting as directed.
- Necessary cut-outs with framing all around to facilitate mounting of light fixtures to be made wherever required.

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## 11. <u>STRUCTURAL GLAZING</u>

#### 11.1. <u>Scope of Specification</u>

This specification covers the criteria for design and performance of the Structural Glazing System consisting of Aluminium framing, double and single glass vision panels, non-vision panels (spandrel) with single glass and insulation panel backing, gaskets, sealants, brackets for fixing to reinforced concrete framing, parapet capping etc.

#### 11.2. System Design

The contractor shall be fully responsible for all aspects of the design of Structural Glazing and related fixings.

It shall be an established system already used successfully and tested for several years in the conditions similar to that of the proposed site. The system shall satisfy all the specified performance criteria and shall conform to international standard of design, manufacturing and installation technology.

The system shall be structurally designed for fixing to the reinforced concrete structure as indicated in the tender drawings. Fixing with slab edges chajja etc. will not be allowed.

#### 11.3. Standards & Codes

Design, materials, fabrication and installation shall comply with all relevant Indian codes and regulations as well as British / American standards. The contractor may adopt other equivalent internationally accepted standards following agreement with the Owner and The Engineer Where there are any difference between these specification and standards the more stringent requirement will apply.

#### 11.4. Design Loadings

- 11.4.1. The structural glazing system shall be designed for the following without any reduction in its performance and without sustaining any damage.
  - i) Own dead load of the glazing system, other dead loads from the Permanent fixtures or services attached to it.

ii) Wind pressure on the glazing system shall be calculated on the basis of iii) and pressure on the glazing system shall be calculated on the basis of

Latest revision of Indian Standard code (IS 875).

iv) Earthquake force on the glazing system shall be calculated according to Latest revision of the relevant Indian Standard code (IS 1893). Section 6 Technical Specification v) Other live loads, such as

Horizontally applied load acting on the external surface of the of the curtain wall arising from maintenance (e.g. access cradle), horizontal live load of 74 Kg/m2 due to occupants.

- 11.4.2. The glazing system shall transmit the static and dynamic design loads to the buildings stricture through the points of support provided for the purpose with an adequate margin of safety.
  - Performance criteria under the test (Peak test pressure shall be 1.5 times the design wind pressure):
    - At both positive and negative application of the peak test pressure there shall be no permanent damage to the framing member, panel or anchorage. Panel and glazing shall remain securely held in position and sealant, gasket shall not be displaced. Framing member shall not be buckled.
    - ii) After loading to the peak test pressure permanent deformation to the framing members shall not exceed 1/500 of the span measured between the points of attachment to the buildings one hour after the loading has been removed. This requirement applies separately to both positive & negative pressure.

### 11.5. Accommodation of movements

11.5.1. The glazing system shall be capable of accommodating the following movements without any reduction in the specified performance of the system

a. Due to deflection under designload b. Due to earthquake forcesc. Due to the effect of repeated windloading d. Due to temperature difference

- e. Due to change in dimension and shape of the components arising from building movements including column shortening, settlement, creep, twisting and racking.
- f. Due to movement of joints whether designed to permit movement or not.
- 11.5.2. Performance criteria under the test (Peak test pressure shall be equal to the design wind pressure):
  - a. At both positive and negative application of the peak test pressure the maximum frontal deflection shall not exceed the following.

- For framing member generally, 1/200 of the span of the member measured between points of attachment to the building or 20 mm whichever is less.
- For framing members supporting double glazing units 1/175 of their length measured along the unit edge or 15mm whichever is less or more restrictive limits if set by the unit manufacturer (BS 6262, code of practice for glazing for buildings).
- For framing members supporting single glazing units 1/125 of their length measured along the pane edge (BS 6262).
- b. After loading to the peak test pressure and unloading permanent deformation to the framing members shall nowhere be more than 1 mm with one hour allowed for recovery after the loading has been removed. This requirement applies separately to both positive & negative pressure.

#### 11.6. <u>Water Penetration Resistance and Drainage</u>

The glazing system and any incorporated opening lights shall be designed to prevent leakage of water onto the internal face and into those parts of the glazing system that would adversely affected by the presence of water.

Performance criteria under test (Peak Test pressure shall be 600 pascals):

- a There shall be no leakage onto the internal face of the glazing system at any time during the test.
- b At the completion of the test there shall be no standing water in locations intended to remain dry.

Where water and condensation can otherwise be entrapped, drainage holes are to be provided. The entire glazing system is to be self-draining with drainage at each floor.

11.7. Air Permeability

The glazing system shall be designed to prevent air flow from the exterior surface to the interior surface through the joints of the glazing system.

Performance criteria under test (peak test pressure 600 Pascals):

a At the peak test pressure the permissible air leakage rate through the sample shall not exceed 1.5 Cum/hr/sqm. for fixed lights and 2.0 Cum/hr/rm of opening joints for openable sash.

11.8. <u>Noise</u>

The glazing system shall be free from wind borne noise under the design wind velocity.

### 11.9. <u>Thermal Properties</u>

The thermal properties of the glazing system (i.e. the U-values of panel and frame members) shall be designed to achieve the following objectives:

- a A reduction in the total energy requirement of the building by preventing excessive solar heat gain into or heat loss from the building.
- b To avoid condensation.

### 11.10. Fire Performance

The curtain wall shall not be composed of materials which readily support combustion, add significantly to the fire load and / or give toxic fumes.

11.10.1. Fire and Smoke stops

There shall be continuity of fire and smoke stops between the glazing system and the compartment walls and floor. Any space and cavities between the two shall be effectively stopped against the spread of the smoke and flame. The fire resistance of such stopping shall be equal to that required for the compartment floor wall against which it abuts. The fire rating of the stops between the floors to be 1 hour minimum, unless otherwise required by the local authorities.

All fire and smoke stops shall be fixed in position in a manner that the same will not be dislodged in the event of fire or under any differential movement of between the curtain wall and other elements of the building.

- 11.10.2. Smoke vents shall be incorporated in the glazing system wherever necessary and with the required free areas, in accordance with the regulations and to the satisfaction of the local authorities. They shall comply with the performance requirements established for the glazing system as a whole and shall be fitted with locking devices that may be opened in case of fire to the approval of the Fire Officer. Externally the fixed panels and the vent panes shall appear same as in elevation.
- 11.11. <u>Electrical continuity and earth bonding</u> The glazing system shall be designed to meet the requirements of BS6651: 1990, code of practice for structures against lightning.

In locations where discontinuities occur the system shall be made continuous or each discontinuous system shall be bonded to the lightning protection system. 11.12. <u>Serviceability</u>

Each glass panel of the glazing system shall be removable, replaceable from the exterior of the building individually at any time after the installation, without affecting the structure and other element of the glazing system.

11.13. <u>Tolerances</u>

Dimensional survey of the building shall be carried out to determine the vertical and horizontal variations from the nominal designed dimensions and the detailed design and shop drawings for the glazing system shall be developed to accommodate the variations.

The glazing system shall be constructed as per the approved shop drawings which shall indicate the tolerance to suit the site dimensions of the building subject to the following permissible limits.

Line : +/ 2mm in any one storey height or structural bay width and +/ 5mm overall.

- Level : +/ 2mm in any one storey height and +/ 5mm overall.
- Plumb : +/ 2mm in any one storey height and +/ 5mm overall.
- Plane : +/ 2mm in any one storey height or structural bay width and +/ 5mm overall.

## 11.14. Durability

The specified performance criteria shall be satisfied for the design life of the curtain wall, provided that the maintenance has been carried out as per the specification submitted by the glazing system manufacturer during approval of the design and shop drawings and agreed by the Owner.

Primary components shall have a service life not less than 30years without the need for maintenance, other than regular cleaning. All framing components, their fixings, means of attachment to the structure, structural sealants and nonstructural sealants which are concealed within the system and which cannot be inspected without dismantling of the glazing system shall be considered as the primary components.

Secondary components shall have a service life not less than 15 years. Exposed finishes to metal components, glazing, window and door equipment, Gasket and compression seals, non-structural sealants which can be inspected and/or replaced without dismantling other components, flashing, gutter, copings and similar metal weathering elements shall be considered as secondary components. Secondary components shall be capable of easy replacement without compromising the weatherproof criteria or without dismantling of the glazing system.

The glazing system contractor shall provide guidance on the required maintenance, replacement periods and method of replacements.

## 11.15. Corrosion

The risk of bimetallic corrosion resulting from the contact of dissimilar material shall be assessed and provision shall be made to isolate the materials.

All Aluminium components in direct contact with cementations surfaces shall be isolated.

11.16. Materials used in the manufacturing of the glazing system shall not be liable to infestation attack by micro-organisms, fungi, insects or other vermin.

## 11.17. <u>Materials and Components</u>

11.17.1. General

All materials, components and finishes should be fit for their intended purpose; they should be durable and best quality of their respective kinds.

### 11.17.2. Aluminium Alloy Components

Aluminium Alloy components shall be as per the following codes / requirements / guidelines.

Extruded Aluminium	:	-shall be fabricated from most appropriate grade of		
Alloy framing members		aluminium alloy complying with BS 1474.		
		-the alloy should be selected to satisfy the requirements of		
		chosen		
Aluminium extrusions forming	:	-shall be designed in accordance with guidelines given in		
the structural framing members		BS		
		8118.		
		-shall have the web, wall and flange thickness sufficient to		
		satisfy the structural requirements and eliminate distortion		
Components including	:	-shall be fabricated from most appropriate grade and		
flashings, closures, and infill		thickness of aluminium alloy complying with BS 1470 in a		
panels formed from aluminium		temper suitable for particular type of application and degr		
alloy sheets		of forming to be used.		
Aluminium sheets for	:	-shall be at least 1.6mm thick		
flashings				
Aluminium sheet coping	:	-shall be sufficiently thick to provide a visually flat surface		
panels and visible closures		and to prevent distortion and permanent deformation		
		caused by solar		

Cleats, sleeves, spigots etc. for	:	-extruded aluminium profiles in accordance with BS 1474
connecting extruded aluminium		-zinc die-casting alloy complying with BS 1004
framing		-Stainless steel as per clause 10.10.18.3
		-mild steel hot deep galvanized as per specification of
		finishes to steel components.

### 11.17.3. Stainless Steel components

Stainless steel sheet to be incorporated in the work shall be of austenitic steel and of grade 316.

## 11.17.4. Fixings

Fixing bolts, anchors, brackets, screws, rivets, nuts shall be manufactured from stainless steel grade 316. Rivets, shear pins etc. can also be provided from Aluminium alloy of appropriate grade complying with BS 1474.

The type, size and positioning of all fixings shall be shown on the shop drawings, together with full details of their installation technique and torque settings where appropriate.

## 11.17.5. <u>Glasses</u>

All glass panes shall be procured from a good quality, internationally recognised glass manufacturer. Edges of all glass shall be clean cut, and ground. Chipped, feathered or vented edges shall not be acceptable. All glasses shall be of best quality, free from bubbles, streaks, waves and other defects.

Glass thickness and type shall be selected using information contained in BS 6262 and BS 952: part 1. Particular regard shall be given to the adequacy of glass thickness to withstand the design loads, the calculated wind pressure and to satisfy safety requirements.

Where toughened glass is incorporated into the construction, consideration shall be given to limiting the risk in normal use of 'spontaneous breakage'.

## 11.17.6. Vision Panels

Vision panels in the glazing system shall be dark blue body tinted or approved glass, high performance solar control, reflective annealed float glass of 6mm thickness. The reflective coating shall be soft / hard stainless steel coating as specified.

## 11.17.7. Non - Vision Glazed Panels

The non-vision spandrel panels and other non-vision areas where there are existing solid external walls behind glazing system will again be fully glazed to match the external appearance in terms of colour, texture and reflection throughout under all normal daytime conditions to the vision panels, and using the same glass above.

In structural glazing system any soft coating or pacifier applied to the glass shall be cut back at the factory by a dimension specified by the sealant manufacturer in order to achieve a satisfactory bond between the glass and the silicon sealant.

## 11.17.8. Insulation and Vapour Control Layers

Thermal insulation shall be semi-rigid, inert, durable, rot and verminproof and should not be degradable by moisture or water vapour. The material used and its method of attachment, clear of the glass, to the supporting components shall be selected to eliminate the risk of bulging, sagging, delaminating or detachment of insulation.

An effective and continuous vapour control layer shall be provided on the warm side of the insulation layer which is incorporated in the glazing system.

11.17.9. <u>Gaskets</u>

Extruded rubber gaskets shall comply with the provisions of BS 4255. Cellular gasket profile shall comply with ASTM C509.

Glazing gaskets forming the weather seals shall be formed into complete frames with factory injection moulded vulcanised corner joints. Gaskets shall be free from contact and migration stain and shall be compatible with all other materials with which they are likely to come into contact.

## 11.17.10. <u>Sealants</u>

In general sealants shall be selected and applied in accordance with guidance contained in BS 6213 and in accordance with the manufacturer's instructions. They shall be procured from a reputed international manufacturer such as Dow Corning or similar. Sealants and their primers shall be compatible with all the materials and finishes with which they are likely to come into contact.

Sealants utilised within the framing systems to seal joints between components shall withstand all stresses during assembly, transportation and installation and shall provide an air and watertight seal in service. The joint and the sealant shall be designed to maximise the life expectancy of the seal. Sealants utilised to affect a seal between the glazing system and the structure shall be of a type suitable to form a seal against air and water penetration whilst allowing differential movements. They shall have predominantly elastic characteristics and shall be either of the following types unless otherwise specified.

- a. Polysulphide sealant complying with BS 4254 or BS
- 5215. b. Silicon sealant complying with BS 5889
- c. One or two parts polyurethane sealants complying with the requirements contained in BS 4254 or BS 5889.

The elastic sealant shall be applied over backer rods set in the joints to control the depth of the sealant and to prevent three side adhesions. Backer rods shall be strictly as per recommendation of the sealant manufacturer and care must be taken to use appropriate open or closed cell foam section.

11.17.11. Sealants for Structural Glazing

Sealants used for structurally holding the glazing on to the frame shall be Dow Corning 999A acetic cured structural silicon or similar approved material. The joints for structural glazing shall be designed by a specialised engineer employed by the contractor and the application shall be strictly as per the manufacturer's recommendation.

Application of structural silicon shall take place within clean, climate controlled factory conditions, shall be carried out by competent fully trained technicians working under continuous supervision. All structural silicon application shall be checked and approved by an expert provided by the sealant manufacturer. A number of completed units as required by this expert shall be cut out to make a random check of the sealant application. The cost of such quality control and assurance procedure shall be borne by the contractor.

The material, design and installation of all structural sealant joints shall be warranted to the owner by the contractor and by the sealant manufacturer for the design life of 30 years. From the date of practical completion.

- 11.18. <u>Finishes</u>
- 11.18.1. General

All finishes applied to the materials constituting the structural glazing system shall be selected with particular attention to the specific location and corrosive environmental conditions of the building in order to provide a service life as defined in this specification with minimum degradation and discolouration. They will be the best quality, durable finishes of their kind available internationally.

Samples of all finishes shall be submitted for approval to Suvin Advisors in duplicate in order to indicate the limits of colour range, surface texture and degree of gloss/matt finish. All subsequent applications shall be within the limits of those approved samples.

## 11.18.2. <u>Steel Components</u>

All steel framing members, reinforcement to framing members, steel-fixing brackets, etc. shall be hot dip galvanised after manufacturing including welding, holing and slotting. Treatment should be appropriate to the life expectancy of the member to which it is applied.

### 11.18.3. <u>Aluminium Alloy Components</u>

Aluminium alloy components would be either anodised or polyester powder coated or PVDF coating.

Polyester powder finishes shall comply with the requirements of BS 6496. The components shall be factory finished by applicators approved by the supplier of the polyester powder. One powder supplier and where possible one applicator should be used for the whole of the works for consistency. All components shall be coated on all significant surfaces to a minimum thickness of 40 microns.

The surface on which silicon sealant is to be applied shall be left without any treatment.

Anodised finish (anodic oxidation coatings) to Aluminium alloy components shall be in accordance with the requirements of BS: 3987 anodising shall be carried out by a single plant for colour matching. All anodised components shall be coated on all significant surfaces to a local thickness of minimum 25 microns.

## 11.18.4. <u>Acceptance Testing</u>

The Contractor shall ensure that the provision is made for acceptance testing. Such inspections shall be made at the applicator's finishing plant before parts are shipped and before small individual parts are assembled into large items. The reports of the inspections shall be submitted to the Contractor for onward transmission to Suvin Advisors. The inspection certificates shall demonstrate that the appearance of the finish complies with the agreed samples that the relevant tests in accordance with the appropriate standard have been carried out and that the finish complies with the appropriate standards in all respects.

## 11.18.5. Protection of finishes

All significant surfaces of painted/ anodised finished for glazing system components shall be protected against abrasion during manufacture, transportation and installation processes. Except as stated below, the protection shall remain in place until all works potentially damaging to the component or its finish are complete. However, no protection should be left in situ for more than six months and should the protection requirement extend beyond this time, than the original protection should be peeled off and immediately renewed. Materials used for temporary protection shall be compatible with and subsequent peelable from the surface without detriment to the finish and should be approved by the paint supplier or anodiser. They should also be used in accordance with the manufacturer's instructions.

### 11.18.6. Site Remedial Operations

Site rectification of damage to the finish of components shall only be carried out with the Engineer's approval and on those elements of works where removal and replacement of the damaged component would cause major disruption. Such remedial measures shall be carried out on small-localised areas of the surface only. Where significant surface damage occurs to clip on components, they shall be removed and renewed.

Remedial paint measures shall be carried out strictly in accordance with the paint manufacturer / anodisers remedial specification and by specialist paint contractors who are approved by them.

### 11.18.7. Durability

All finishes applied to the components of structural glazing system shall have a service life of minimum 15 years after completion of the work for the entire system and without appreciable loss of performance and without the need for maintenance.

### 11.19 Shop drawings, Prototypes and Testing

11.19.1. Shop Drawings and other documents

The contractor shall carryout a complete dimensional survey of the building. He shall then produce design, drawing, calculations, specifications and shop drawings for structural glazing work and the fixed glazing, windows and doors for their comments and in accordance previously agreed programme. If asked by **the Engineer.** Before comments /

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approval of the shop drawings, specifications etc. or at any later date during the contract period, the contractor shall produce the authenticated copies of the codes and standards relevant to the total glazing system or its component as a supporting document.

The drawings shall clearly indicate all constructional details of the proposed system, all components, all connections, fixing to the building, details of glazed units, methods of glazing, flashings, joints seals, smoke barriers etc. Specification shall be submitted in triplicate to Consultant for their comments. They shall then be revised as necessary and resubmitted for final approval. The procurement, production and installation etc. shall be carried out on the basis of those approved drawings and specifications.

## 11.19.2. Prototype and samples

The Contractor shall prepare and submit to **the Engineer.** Fully identified samples of each type of material intended for use in the structural glazing system. Alternative colour samples for Aluminium members and glazed units shall be submitted for a final choice and approval of colour and finishes by the Owner and Consultant.

The Contractor shall build a complete prototype on site as soon as practical, covering at least two column bays horizontally and two bays vertically with all the elements, components and finishes intended for the final installation. The prototype shall be reviewed and approved by the Owner and Consultant and shall be used as a control reference for the quality and appearance for the rest of the installation. All permanent work shall conform to the approved samples and prototypes and failure to do so without authorisation shall entitle the Engineer to reject such work and require replacement and / or renewal by the Contractor at no additional cost. Approval of the samples and prototype by the Owner and Suvin Advisors shall not relieve the Contractor of his responsibility to ensure that complete installation complies fully with the performance specification and standards.

11.19.3. Testing

If asked by the Owner/ **the Engineer** the Contractor shall arrange a specimen (with full scale mock-up of the structural glazing) to be tested at an internationally recognised laboratory for compliance with all design and performance criteria. Witnessing and certification of the testing shall be undertaken by an independent consultant and his report shall be submitted to the Owner / the Engineer. For the project.

The specimen for testing shall be designed and constructed using the same methods, materials and materials for sequences for as for the

structural glazing system to be installed on the building. They shall be of sufficient size and to establish that all typical elements of the structural glazing system are capable of complying with specified performance criteria.

The specimen shall be mounted in the test rig with the same conditions of attachment and supports for elements in the structural glazing system. The structure supporting the test specimen shall be similar in stiffness to that supporting the structural glazing system.

The testing shall be carried out in accordance with internationally recognised standards. The specimen shall be tested for air permeability, water leakage, resistance to wind loads and to demonstrate that the structural glazing system is unaffected by thermal and building movements (including earthquake).

#### 11.20 Fabrication, Storage, Installation and Maintenance

#### 11.20.1. Quality Control

The Contractor shall agree the quality control procedures he will use during manufacture, fabrication and installation with the Engineer **in** writing prior to commencement of the works. At every stage of the works, the contractor shall employ qualified inspectors to continuously check the works for compliance with specification and drawings and regularly report to the contractor and the engineer...

The Owner /Consultant may also employ their own inspectors. The contractor shall provide access and all necessary facilities for them to inspect the works on site or at the workshop at all times during the contract period.

#### 11.20.2. <u>Fabrication</u>

The work shall be fabricated in accordance with general arrangement and shop drawings to the indicated dimensions within permissible deviations. The drawings shall be commented upon by the Consultant before fabrication. The contractor is to allow two weeks for this approval, process in his programme.

Materials and methods used in the fabrication shall be selected to achieve the required performance and appearance. Materials used shall comply with the recognised International Standards and match approved samples. Control samples shall be produced to adequately demonstrate the standard of workmanship and the finish required.

**The Engineer** or any other inspectors employed by the Owner shall be allowed excess to the workshop at all reasonable times during fabrication and the Contractor shall provide all necessary facilities for them to inspect the work as they require.

Metals shall be formed to the required shapes without flaws and defects. Profiles produced shall be consistent throughout their length and within agreed tolerances. Bent shapes shall have straight arises and be free from grain separation, stretch marks and other forms of distortion. Extrusions shall be within the tolerance limits of BS 1747.

Metals shall be welded in accordance with the relevant standards using methods to avoid distortion and discolouration of visible surfaces. Welds shall be fully bonded throughout their length without holes or cracks and shall be strong enough for the design requirements. Welds shall be ground smooth and flush with adjoining surfaces where visible. Welding procedures shall comply with relevant BS standards. Metal to metal joints shall be accurately formed without lapping and offsets in visible surfaces. They shall be rigidly secured to prevent all movement, producing hairline contact lines except for movement and control joints.

Components shall be checked prior to assembly and the final assembly shall be carried out in the shop as far as possible. The contractor shall employ qualified inspectors to check all components and assemblies for compliance with specifications and drawings. The inspectors shall regularly report to the contractor and copies of the reports shall be submitted to the Engineer

All components and assemblies shall be cleaned and finished in the factory prior to delivery to site. They shall be protected in such a manner that will prevent damage, distortion, uneven weathering or degradation under normal conditions of handling and storage. Where necessary, suitable temporary coating and coverings shall be provided to protect the work until completion of the installation.

11.20.3. Storage

Assembled units and components for the works shall be handled in such a manner that will prevent damage, distortion or degradation. They shall all be clearly labeled for identification and traceability.

### 11.20.4. Installation

The work shall be installed in accordance with agreed method statement and drawings and the requirements of the contract documents.

The contractor shall prepare and submit a method statement to the Owner and the Engineer. For approval. The method statement shall contain control procedures to ensure compliance with the project requirements including programme, sequence of erection and co-ordination with other trades.

The position of all elements of the building structure which interface with or about the glazing system wall shall be checked as early as possible prior to the erection of glazing system walling to verify their compliance with the project requirements. All discrepancies shall be reported and the method of rectification shall be agreed with the Engineer. Use of laser equipment for alignment is recommended.

The contractor shall employ qualified inspectors full time on site during installation of the structural glazing system wall to check the compliance of work with all design requirements, specifications and standards. The inspectors shall regularly report to the contractor and copies of the reports shall be submitted to the Engineer. All no-conforming work shall be recorded and remedial proposals shall be reviewed and agreed as soon as possible after the problem has been identified.

The contractor shall employ competent, experienced structural glazing system erectors to carry out the works. The contractor shall maintain records to demonstrate his employees experience and all related training.

Removal of temporary protection applied at fabrication stage and the cleaning of the façade shall be carried out on completion of the works unless otherwise agreed with the Engineer. Upon completion, the contractor shall thoroughly clean the whole installation, check the entire installation including structural members, glazing, all gaskets, seals etc. and make good as necessary, check and adjust all opening windows and doors including seals and ironmongery, check all fixings, fastenings and joints and make good or adjust as necessary and hand over the whole installation in a thoroughly clean and orderly condition, fit for its purpose and its specified performance.

## 11.20.5. Maintenance

A maintenance manual shall be produced by the contractor for the completed works to include, but not limited to, the following:-

- i. The name, address and telephone number of each firm involved in the supply of materials, components, assemblies and finishes.
- ii. A clear description of the construction used to form the various areas of structural glazing.
- iii. Copies of material, component and finishes certification and tour reports.
- iv. A method statement showing the means of access to all parts of the wall and safe loadings.
- v. A method statement covering the procedures for replacement of damaged or otherwise defective materials or components.
- vi. Recommendations for routine inspection, maintenance, cleaning suitable cleaning agents and any lubrication/adjustments to working parts.

vii. A full set of "as built" construction drawings.

The access system for cleaning and maintenance shall be established during the design stage and the relevant loads shall be catered for.

# 11.21 <u>Guarantees</u>

The Contractor shall prove the Owner with a written "Primary Guarantee " in the format specified and agreed with the Owner covering the whole installation against the faults and omissions in design, materials, fabrication and workmanship and non- compliance with performance specification part or whole of the structural glazing system. The period of the Primary Guarantee shall be same as the service life of primary and secondary components.

The Contractor shall receive the "Secondary Guarantees" from the suppliers and manufacturers of all materials and components used in the installation and shall submit the copies to the Owner. The period of the service life of the particular materials or components is within the whole installations.

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## PART II

## TECHNICAL SPECIFICATION FOR PEB WORK

## 1. <u>GENERAL</u>

- 1.1. The scope of work includes complete job with design, labour and supply and erection of materials including transportation, handling and storage, construction aids, tools and tackles, consumables, connection materials like nuts, bolts, washers, straps, screws, supervision, labor and temporary facilities etc. complete, to execute the project work.
- 1.2. The contractors are instructed to visit the site, assess all local problems like material availability, transport, road access to the site, labour availability, water, electricity, octroi, local taxes etc. before tendering. No extra cost and/or time shall be allowed by the owner for any reason, beyond the schedule rates and time, once fixed in the tender.

## 2. <u>SCOPE IN BRIEF</u>

- 2.1. Submission of design basis, Design Calculations and drawings for approval.
- 2.2. Incorporating the comments given by us in the design/drawings & re-submission for approval.
- 2.3. After approval of the design & drawings, based on the same:
  - 2.3.1. You shall pre-fabricate and supply steel columns, trusses, cladding, roofing materials and related material to complete the entire work
  - 2.3.2. You shall unload the same at site
  - 2.3.3. You shall erect install & assemble the warehousing facility as per the drawings in its entirety up to final alignment & fit for handover for the scope as per the tender & contract.

### 3. DETAILED SCOPE IN BRIEF

- 3.1.1. Type: Portal Frame :- Structural design will be based on Prevalent IS codes & shall be so designed that it results in most economical, safe and sound design.
- 3.1.2. Plan Dimensions of the Building :- 88.690m x 117.030m (Out To Out) With 2 nos. of Internal Column. Refer attached drawings for Exact Dimensions.
- 3.1.3. Elevation Dimensions of the Building :-6.650m Clear height at Eaves Centre height of roof : As per applicable & adopted slope Refer attached drawings for Exact Dimensions.
- 3.1.4. Roof slope: 1:10 to 1:12. Refer attached drawings.

However, Vendor may adopt alternative slope to achieve the most economical structure & satisfying the roof drainage requirements based on rain-fall in the area. 3.1.5. Type of roof sheet: -

Bare galvalume with a minimum thickness of 0.5mm & yield strength of 550Mpa. Parts of roof area to be provided with Translucent Poly-Carbonate sheets minimum thickness 2 mm for uniform natural lighting as per arch drawing. The roof sheets shall be fixed to the purlins by self-drilling screws with bitumen washers.

3.1.6. Side Cladding: -

Pre coated GI Sheeting with a minimum thickness of 0.5mm of color as per arch. Drawing with intermediate band of translucent Poly-Carbonate Sheets 2mm thick as per drawing.

The notional bottom trim of sheeting is 775mm from FFL. Refer Drawings for extent of Side-Sheeting on various faces.

3.1.7. Gutter:-

Leak proof GI gutter (minimum 1mm thick) along length of the building as per drawings with GI straps etc. complete. Size of Gutter shall be as per the design.

3.1.8. Down take pipe: -

Suitable down-take pipes made from GI sheet with elbows & junction pieces straps, bell-mouth etc. complete at each column.

3.1.9. Foundation bolts: -

Foundation bolts for all columns as per design requirement including Templates, nuts, washers & any other assembly item complete ready for installation. (Supply only).

3.1.10. Painting: - Shall Conform to IS 1477 Part 1 & 2

You shall shot blast (S.A. 2.5) the MS members, apply 2 coats of Zinc Rich Primer (Total DFT 50 microns) and 2 coats of Epoxy Paint (Total DFT 60 Microns) as per specification.

3.1.11. Loading (Loads and Combinations):-

Self-weight as appropriate.

Suspended weights of electrical & other utilities including Sprinkler system below main roof like walkable false ceiling, supply air ducts: 35 Kg/sqm. (This Load should be used in design of purlins as well.) Live Load: 75kg/Sqm for purlins, 50kg/sqm for main frames. Wind velocity: 39m/sec. as per IS 875 part 3

K1 = 1,

K2 = Upto 10m 1.0

K2 = 10m to 15m 1.05 K3 = 1 211

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K4 = 1

Load combinations: As per IS 875 part 5 and IS 800-2007

SLS

1.0 DL + 1.0 LL

1.0 DL + 0.8 LL + 0.8 WL

0.9 DL + 1.0 WL

ULS

1.5 DL + 1.5 LL

1.2 DL + 1.2 LL + 1.2 WL

0.9 DL + 1.5 WL

3.1.12. Minimum Thickness for various members :-

a. Main Frame Members like Rafters Beams & columns -
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Flanges 8mm Minimum. Webs 6mm Minimum

b. Secondary Members

Roof Purlins Side Runners 2mm Minimum GI (275GSM) Roof Sheets 0.5mm Minimum Side Sheets 0.5mm Minimum

3.1.13. Max. Deflection allowed.

Height/150 For Portal Columns under Wind Span/180 for Rafters under Wind &/Or Live Loads Span/150 For Cantilevers under Wind &/OR Live Loads Span/150 for Purlins & side runners under Wind &/Or Live Loads

3.1.14. The quote shall also include

Turbo-ventilators integrated with translucent sheet domes as per arch drawings. Throat Diameter 600mm. The Turbo-ventilators are shown for reference. The vendor to suggest the no. of ventilators for 3 air changes per hour including the effect of Rolling shutters.

3.1.15. List Of Deliverables (Drawings & Documents): Contractor to submit the list along-with offer.

Contractor to submit shop load histogram of last one year.

3.1.16. Approvals:

You shall submit the Design Calculations for client's approval for Ensuring conformity with Project Specifications. After receiving comments from the client/client's consultant, you shall incorporate the comments which are mutually agreeable, Modify the design and/or drawings & resubmit. After GFC approval You shall proceed with the fabrication and execution of the job.

- 3.1.17. Contractor shall furnish Elaborate support reactions with vector diagram for various loads & load combinations for design of foundations along-with Design Document
- 3.1.18. General technical Condition.

- 3.1.18.1. PEB Manufacturer shall be completely responsible for entire structural design, complete fabrication and transportation to site and safe erection of building at site, within the estimated and accepted time frame. Any Approval from client will not relieve the PEB Manufacturer from the responsibilities for the correctness of his design and drawings.
- 3.1.18.2. PEB Manufacturer shall furnish the manufacturer's certificate for structural steel prior to starting of fabrication.
- 3.1.18.3. PEB Manufacturer shall supply manufacturer's test certificate for sheeting materials and materials for other accessories prior to supply of these material to site.
- 3.1.18.4. General arrangement drawings, indicating clearly all the members sizes connection details, welding details and splicing details shall have to be developed by the PEB vendor the subject steel work and shall have to be submitted to client along with its material list for approval, prior to start of fabrication. It is expressly agreed that notwithstanding any review or failure to review by the engineer of client, Client shall not be liable for the adequacy of design and drawing and that the PEB Manufacturer shall solely be responsible there for and shall not be relieved or absolved in any manner whatsoever of his obligations, duties and liabilities. Contractor to submit all design calculation and connection design to project consultants before start fabrication. Contractor to submit editable copies of all the drawings.
- 3.1.18.5. Roof Accessories :-Molded pipe flashing : pre molded flexible pipe flashing as recommended and supplied by the roofing manufacturer.
- 3.1.18.6. All connection shall be bolted. No Welding at site is permitted
- 3.1.18.7. Contractor shall send their quote along with tonnage and bar chart. 2.5% weight variation will be allowed.

3.1.18.8. Contractor to satisfy all statutory requirements like ESIC/PF/Insurance etc. and any other all applicable in Maharashtra state.

## 4. <u>CERTIFICATE & WARRANTY</u>

- 4.1. Building Leak tightness :- Leak roof guarantee for 10 years
- 4.2. Design Warranty :- Structural Design Warranty certificate tobe issued by vendor in clients format for 20 years.
- 4.3. Translucent Polycarbonate Sheet :- Guarantee for 36 Months.

# PART III

## TECHNICAL SPECIFICATION FOR ELECTRICAL WORK

Electrical Technical Specifications -1

## TECHNICAL SPECIFICATIONS FOR INTERNAL ELECTRICAL WORKS

### L. V. XLPE CABLE

## 1.0 DESIGN CONDITIONS:

All equipment and materials will be selected and rated for use at the following site conditions.

- Ambient air temperature 50° C.
- Ground temperature 30° C.
- Solar gain 1100 w / m2
- Earth resistivity 200 deg. C. cm / w
- Relative Humidity 95% Max.
- Atmospheric condition Corrosive, Humid and Dusty

#### 2.0 SCOPE:

This section shall cover supply, laying, testing and commissioning of medium voltage XLPE cables. This specification gives the general requirement of cables. However, it is the responsibility of the vendor to take the joint measurement and obtain Client's approval.

#### 3.0 STANDARDS:

The following standards and rules shall be applicable:

- IS: 7098 Part I XLPE Insulated electric cables (heavy duty).
- IS: 3961 Recommended current ratings for cables.
- IS: 8130 Aluminium conductors for insulated cables
- Indian Electricity Act and Rules.

### 4.0 MEASUREMENTS:

The cables will be measured in meters. The unit rate shall include cutting the cable into required lengths, packing, loading, unloading, insurance, transportation, delivery to site as per BOQ. testing of cables at site etc. of medium voltage cable. Total quantity in meters shall be measured lug to lug basis.

#### 5.0 GENERAL:

The low voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian Standards specifications, manufacturer's instructions. The cables

### Electrical Technical Specifications- 2

Cables shall be delivered at site in original drums with manufacturer's name, size, and type, clearly written on the drums.

### 6.0 MATERIAL:

The low voltage cable shall be XLPE insulated. PVC sheathed, aluminium or copper conductor, armoured conforming to IS: 7098 Part I.

6.1 TYPE:

The cables shall be circular, multi core, annealed copper or aluminium conductor, XLPE insulated and PVC sheathed, armoured.

## 6.2 CONDUCTOR:

Uncoated, annealed copper / aluminium, of high conductivity up to 4 mm.<sup>2</sup> size, the conductor shall be solid and above 4 mm.<sup>2</sup>, conductors shall be concentrically stranded as per IEC: 228.

6.3 INSULATION: XLPE rated 70° c. extruded insulation

### 6.4 CORE IDENTIFICATION:

- Two core : Red and Black
- Three core : Red, Yellow and Blue
- Four core : Red, Yellow, Blue and Black
- Single core : Green, Yellow for earthing
- Black shall always be used for neutral.

#### 6.5 ASSEMBLY:

Two, three or four insulated conductors shall be laid up, filled with nonhygroscopic material and covered with an additional layer of thermoplastic material.

#### 6.6 ARMOUR:

Galvanised steel flat strip / round wires applied helically in single layers complete with covering the assembly of cores.

#### 6.7 SHEATH:

Electrical Technical Specifications -3

a) XLPE 70 deg.c. rated extruded.

b) Inner sheath shall be extruded type and shall be compatible with the insulation provided for the cables.

c) Outer sheath shall be of an extruded type layer of suitable PVC material compatible with the specified ambient temp. 50 deg. C and operating temperature of cables. The sheath shall be resistant to water, ultraviolet radiation, fungus, termite and rodent attacks. The colour of outer sheath shall be black.

d) Sequential length marking required at every 1.0 mtr. interval on outer sheath.

e) Vendor has to furnish resistance / reactance / capacitances of the cable.

6.8 RATING: Up to and including 1100 Volts.

### 7.0 GENERAL:

All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.

The cable shall be supplied in single length i.e. without any intermediate joint or cut unless specifically approved by the client. The cable ends shall be suitably sealed against entry of moisture, dust, water etc. with cable compound as per standard practice.

8.0 TESTING:
### 8.1 FINISHED CABLE TESTS AT MANUFACTURER'S WORKS:

The finished cables shall be tested at manufacturer's works. Following routine tests for each and every length of cable and copy of test results shall be furnished for each length of cable along with supply. If specified, the cables shall be tested in presence of client's representative.

### a) VOLTAGE TEST:

Each core of cable shall be tested at room temperature at 3 KV A.C. R.M.S. for duration of 5 minutes.

### b) CONDUCTOR RESISTANCE TEST:

The D.C. Resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20° c. to check the compliance with the values specified in IS 8130 - 1976.

### 8.2 CABLE TEST BEFORE AND AFTER LAYING OF CABLES AT SITE:-

a) Insulation Resistance test between phases and phase to Neutral and phase to earth.

b) Continuity test of all the phases, neutral and earth continuity conductor.

Electrical Technical Specifications -4

c) Sheathing continuity test.

d) Earth resistance test of all the phases and neutral.

All tests shall be carried out in accordance with relevant Indian Standard Code of practice and Indian Electricity Rules. The Vendor shall provide necessary instruments; equipment's and labour for conducting the above test. All tests shall be carried out in the presence of the client and results shall be recorded in the prescribed forms.

### 9.0 CABLE MARKING:

EMBOSSING ON OUTER SHEATH:

The outer sheath shall be legibly embossed with following legend:

- ELECTRIC CABLE: 1100 V, SIZE: 3.5 C x ----- mm <sup>2</sup>.
- Manufacturer's Name & year of manufacturing.

### 10.0 CABLE LAYING:

The cables shall be laid in trenches, trays, racks or conduits/pipes. No cable shall be directly buried in the ground, The cables of different voltage grade shall be laid in different trays. Power & control cables shall be laid in different trays.

### 11.0 SEALING, DRUMMING & PACKING:

After tests at the manufacturer's works, both ends of the cable shall be sealed to prevent the ingress of moisture during transportation and storage.

Cable shall be supplied in length of 500  $\pm$  10% meters, packed nonreturnable drums of sufficiently sturdy construction.

Cables of length more than 250 meters shall also be supplied on nonreturnable drums.

The spindle hole shall be 110 mm minimum diameter.

Each drum shall bear on the outside flange, legibly and indelibly in the

English literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. voltage grade, length, conductor size, cable type, insulation type and gross weight shall also be clearly visible. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

### 12.0 LAYING OF THE CABLES:

The cable shall be laid in trenches, trays, racks, or conduit pipes .No cables shall be directly buried in the ground. The cables of different voltage grade shall be laid in different voltage grade shall be laid in different trays. Power and control cables shall be laid in different trays.

Electrical Technical Specifications-5

### LIGHTING DISTRIBUTION BOARDS

### 1.0 SCOPE :

This section relates to specifications for supply, assembly, installation, connection, testing and commissioning of lighting distribution board (LDB) using TPN/FP/DP/SP MCB/ isolator & ELCB for Each phase, Earthing terminal, connector strip for phase, neutral and earth for each circuit,

CRCA sheet steel housing and complete the item installation. Common banking of neutral and earth conductor is not allowed.

### 2.0 SYSTEM :

The lighting distribution boards shall be suitable for operation on 415/220 volt, 50 cycle per second, A.C supply system. The lighting distribution boards shall be capable of withstanding short circuit current of 10 KA.

### 3.0 CONSTRUCTION :

3.1 The DB's shall be factory made and of those and as per the G.A. layout enclosed. General arrangement lay out of the DB's shall be approved by the Owner in charge before manufacture.

3.2 The DB shall be metal clad duly fabricated from 2mm. thick high quality CRCA sheet metal.

3.3 The DB shall be wall mounted and flushed type and dead front operated.

3.4 The DB shall totally be enclosed and made dust, vermin and weather proof such that it meets to IP51 protection classification for indoor and IP65 protection classification for outdoor installation. A detachable cover plate of 2 mm thick CRCA sheet to be provided on front of the board such that all live parts of the electrical accessories mounted on the board can be accessible only on removal of the said cover plate. The cover plate shall be fixed to the board with adequate size zinc passivated machine screws. Above the detachable cover plate, one additional hinged door of 2 mm thick CRCA sheet shall be provided with a suitable locking arrangement. The hinged door shall be provided with a suitable gasket capable of withstanding corrosive & humid atmosphere and to maintain degree of enclosure protection to IP 65 as per IS: 2147 for outdoor installation.

4.0 The DB shall have top / Bottom entry arrangement for incoming and outgoing cables/conduits.

5.0 All hardware to be used in manufacture of the DB shall either be of mild steel zinc passivated or otherwise be treated to prevent corrosion due to humid atmosphere prevailing at the project site.

6.0 All internal electrical connections shall be carried out using 660/1100 volt grade, PVC insulated, Copper conductor of ISI approved make, having rated current carrying capacity to carry continuous full load current of respective switch gear rating at operating conditions prevailing at the project site.

Electrical Technical Specifications -6

7.0 The DB internals shall be earthed with use of Copper wires/strips running throughout the length. Size of the earthing strip/wire shall be as shown in the respective drawing.

8.0 All non-current carrying metal surface of the DB's shall adequately be treated and painted as specified in "Painting" Section mentioned below.

### 9.0 PAINTING :

9.1 All sheet steel work shall undergo a process of degreasing pickling in acid, cold rinsing, phosphating, passivating (seven tank process) and then sprayed with a high corrosion resistant primer . The primer shall be baked in an oven. The finishing treatment shall be by seven tank process . Two coats of epoxy resin paint of approved color shall be applied by spray and stoved.

9.2 The surface imperfection shall then be rectified with applications of putty.

9.3 The DB's shall be provided with electric components and accessories as per the details given in BOQs for the respective electric distribution board. The circuit connection from all the circuit MCB shall be brought to ELEMEX type connector provided on top or bottom of the DB. The connector shall be suitable to receive phase, neutral and earth wire/cable coming from each individual circuit. The connector's shall have circuit identification tag.

10.0 INSPECTION:

10.1 The DB's shall be inspected and checked as per inspection manual of the DB manufacturer.

10.2 Various electrical components and accessories of the DB's shall be checked as per the detail given for the respective DB's.

10.3 The DB's shall be checked for rigid mounting, earthing connection, proper rating & size of components, internal wiring, etc.

10.4 All mechanical fasteners and electrical connections shall be checked and tightened before installation.

### 11.0 INSTALLATION :

11.1 The DB's shall be assembled and aligned together and be installed at site as per installation manual / instruction of the DB manufacturer.

11.2 The DB shall be installed in surface mounted or wall mounted manner at the location as shown in the respective drawings.

11.3 All minor electrical and mechanical work required to be attended to on the DB shall be completed in an approved manner after installation but before energizing the DB's.

11.4 The M.S. angle/channel iron frame used for installation of D.B. shall be hot dip galvanized and painted with two coats of Aluminium Paint.

12.0 TEST :

Prior to commissioning of the DB's following tests shall be carried out.

12.1 Mechanical endurance test shall be carried out by closing and opening of all the MCB's, switches etc.

Electrical Technical Specifications -7

12.2 Insulation resistance test shall be carried out between phases and between phase to earth bus, keeping the isolating switch in open position. Similar test shall be carried out keeping the isolating switch in closed position.

12.3 All the interlocks, controls and tripping mechanism of the switch gears shall be tested for their proper functioning.

Electrical Technical Specifications-8

### INTERNAL WIRING

### 1.0 INTERNAL WIRING:

This section covers, definition of point wiring, system of wiring and supply, installation, connection, testing and commissioning of point wiring for light points, ceiling fan points, exhaust fan points, wall fan points, convenience socket outlet points, power socket outlet points, bell outlet points etc. including fixing of light fixtures, ceiling fan, exhaust fan, wall fan, bell, buzzer etc.

### 2.0 STANDARDS:

The following standards and rules shall be applicable:

- IS : 732 Code of practice for electrical wiring installation (System voltage not exceeding 650 V)
- IS : 1646 Code of practice for fire safety of buildings (General) Electrical installation.
- IS : 9537 Conduits for electrical wiring.
- IS: 3419 Fittings for rigid non metallic conduits
- IS : 6946 Flexible (Pliable) non-metallic conduits for electrical installation.
- IS : 1293 3 pin plugs and sockets.
- IS : 3854 Switches for domestic purpose.
- IS : 4648 Guide for electrical layout in residential building Indian electricity act and rules.

Regulations for the electrical equipment in buildings issued by the Bombay Regional Council of Insurance Association of India. All standards and codes mean the latest.

### 3.0 POINT WIRING:

A point shall consist of the branch wiring from the distribution board together with a switch as required, including point outlet box with three way connector, the ceiling rose or pendant holder or swan holder, or ceiling fan box or socket or suitable termination. A point shall include, in addition, the earth continuity conductor / wire from the distribution board to the earth pin / stud of the outlet

/ switch box and to the outlet points. The point wiring shall be carried out in the under mentioned manner:

- 3.1 Supply, installation, fixing of conduits with necessary accessories, junction / pull / inspection / switch boxes and outlet boxes.
- 3.2 Supplying and drawing of wires of required size including earth continuity wire.

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3.3 Supply, installation and connection of flush type switches, sockets, cover plates, switch plates, etc.

3.4 The point shall be complete with the branch wiring from the distribution board to the outlet point, through switch board, conduit with accessories, junction, pull, inspection boxes, control switch, socket, outlet boxes, ceiling roses, button / swan holder, connector etc.

### 3.5 POINT RATE:

The rate per point shall include supply, installation, connection, testing and commissioning of point as described under "point wiring". The measurements of the points will be enumerated.

### 3.6 SYSTEM OF WIRING:

Unless otherwise mentioned on the drawings, the system of point wiring shall be as follows: The system of wiring shall consist of single core, PVC insulated, 1100 volt grade, copper conductor FRLS wires laid through exposed / concealed PVC conduits as directed.

### 3.7 GENERAL:

The contractor shall submit for approval, the shop drawing of conduit layout indicating the route of the conduits, number and size of the conduits, location of junction / inspection / pull / outlet boxes, size and location of switch boxes, number and size of wires pulled through each conduit and all other necessary relevant details prior to laying of conduits. Only after the drawings are approved, the contractor shall precede the work of conduit laying.

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### 3.8 MATERIAL:

### 3.8.1 PVC CONDUITS:

All non-metallic PVC conduits shall conform to IS: 9537. The conduit shall be used with the corresponding accessories (Refer IS: 3419 specification for fittings for rigid non PVC metallic conduits). PVC conduits shall be rigid plasticized, heavy gauge having 2.0 mm. wall thickness up to 20 mm. diameter conduits and 2.5 mm. wall thickness for all sizes above 20 mm. diameter.

### 3.8.2 BOXES:

All the boxes for switches, sockets and other receptacles, junction boxes, pull boxes and outlet boxes shall be fabricated from 2.0 mm. thick mild sheet painted with two coats of red-oxide and then two coats of enamel paints as called for. Colour of the paints shall be as approved by the owner. The boxes shall have smooth external and internal finished surface. Boxes in contact with earth or exposed to the weather shall be of 2 mm. mild steel and hot dip galvanized after fabrication. Separate screwed earth terminal shall be provided in the box for earthing purpose. All boxes shall have adequate no. of knock out holes of required diameter for conduit entry. Switch boxes to receive switches, socket outlets, power outlets, telephone outlets, fan regulators, etc. shall be fabricated to the approved shape and size to accommodate all the devices without overcrowding. Outlet boxes to receive ceiling fan shall be fitted with adequately sized rod / hook to fix ceiling fan. The boxes shall be of minimum depth of 65 mm. Boxes for use in masonry block or tiled walls shall be square cornered tile type, or standard boxes having square cornered tile type covers. These boxes shall be installed in the center of the masonry block or tiles. Cast metal boxes installed in wet locations and boxes installed flush with the outside of exterior surface shall be gasketed.

### 3.8.3 COVER PLATE:

The cover of the boxes to receive outlet points shall be of best anodized sheet cut to shape and size or manufacturers of switches.

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### 3.8.4 CABLES:

The cables shall conform to IS: 694. For all internal wiring FRLS wires of 1100 volts grade, single core shall be used. The conductors shall be plain annealed copper conductors complying with IS: 1554.

The conductors shall be circular copper conductor. The insulation shall be PVC compound complying with the requirements of IS: 694. It shall be applied by an extrusion process and shall form a compact homogenous body. The thickness of PVC insulation shall be as set out in the relevant standards. The cores of all cables shall be identified by colors in accordance with the following sequence:

- Single phase Red
- Three phase Red, Yellow, Blue
- Neutral Black
- Earth Green

Means of identifying the manufacturer shall be provided throughout the length of cable.

- Unless otherwise specified in the drawings the size of the cables used for internal wiring shall be as follows:
  - In case of circuit wiring for lights, exhaust fans, convenience socket outlet points (P+N+E): 2.5 mm.<sup>2</sup> From D.B. to switch boards.(For Phase and Neutral)
  - 1.5 mm.<sup>2</sup> From D.B. to switch boards.(For Earth)
  - 1.5 mm.<sup>2</sup> From switch boards to outlet points (P+N+E)
  - In case of circuit wiring for power points (P+N+E): 4.0 mm.<sup>2</sup> From D.B. to switch boards.(For Phase and Neutral)
  - 2.5 mm.<sup>2</sup> From D.B. to switch boards .(For Earth)

### 3.8.5 SWITCHES:

Switches shall conform to IS: 3854 and IS: 4615. The switches shall be single pole, single or two way type. They shall be of modular type rated for 250 volt, and of full 6 / 16 A capacities. They shall be provided with insulated dollies and covers. The switches shall be rocker operated with a quite operating mechanism with bounce free snap action mechanism enclosed in an arc resistant chamber.

The switches shall have pure silver and silver cadmium contacts. The switches shall be flush modular type The make of the switches shall be as indicated in the BOQ or make of material or as suggested and approved by the Owner. The switches installed in outdoor area shall be industrial, metal clad type, and shall be provided in weatherproof enclosures, complete with weatherproof gasketed covers.

### 3.8.6 SOCKETS:

The sockets shall conform to IS/IEC: 60309 and IS: 4615. Each socket shall be provided with control switch of appropriate rating. The sockets shall be moulded type, rated for 250 volts, and either of full 5 A or 15 A capacity as mentioned in BOQs. Sockets shall be of three pin type, the third in being connected to earth continuity conductor. The socket shall be flush modular type. The sockets installed in machine room, plant room or wet / damp area shall be metal clad weather proof type. The finishing and make of all the sockets shall be same as light switch. The socket shall have fully sprung contacts and solid brass shrouded terminals to ensure positive electrical connections. The socket shall be provided with automatic shutters, which open only when earth pit of the plug inserts in the socket. The socket shall be provided with three pin plug top suitable to the socket and of the same make as socket.

## 3.8.7 DRAWING OF CONDUCTORS:

The drawing and joining of copper conductor or wires shall be executed with due regard to the following precautions, while drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which may cause breakage of conductors. There shall be no sharp bends.

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Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or ringing.

PVC insulated copper conductor wire ends before connection shall be properly soldered (at least 15 mm length) with soldering flux / copper solder, for copper conductor. Strands of wires shall not be cut for connecting to the terminals.

All strands of wires shall be soldered at the terminals. All strands of wires shall be soldered at the end before connection.

The connecting brass screws shall have flat ends. All looped joints shall be soldered and connected through lugs or looping connectors.

The pressure applied to tighten terminal screws shall be just adequate, neither too much nor too less. Conductors having nominal cross section are exceeding 4 sq. mm shall always be provided with crimping type cable sockets. At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections. Only certified wire man and cable jointers shall be employed to do joining work. For all internal wiring PVC insulated wires of 1100 volts grade shall be used. The sub-circuit wiring for point shall be carried out in looping system and no joint shall allowed in the length of the conductors. No wire shall be drawn in to any conduit, until all work of any nature that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Before the wires are drawn into the conduits the conduits shall be thoroughly cleaned of moisture, dust, and dirt or any other obstruction by forcing compressed air through the conduits.

### 3.8.9 JOINTS:

The wiring shall be by looping back system, and hence all joints shall be made at main switches, distribution boards, socket outlets, lighting outlets and switch boxes only. No joints shall be made inside conduits and junction boxes. Contractors shall be continuous from outlet to outlet. Joints where unavoidable, due to any specified reasons, prior permission in writing shall be obtained from the Owner before making such connections. Joints by twisting conductors are prohibited. Joints shall be made through straight ferrule type compress lugs only.

### 3.8.10 LOAD BALANCING:

Balancing of circuit in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

### 3.8.11 EARTHING:

All earthing systems shall be in accordance with IS: 3043 - 1985 code of practice for earthing.

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### 3.8.12 TESTING OF INSTALLATION:

Before a completed installation is put into service, the following tests shall be complied with:

### 3.8.12.1 INSULATION RESISTANCE:

The insulation resistance shall be measured by applying 500 volt megger with all fuses in places, circuit breaker and all switches closed. The insulation resistance in gega ohms of an installation, measured shall not be less than 50 mega ohms divided by the number of points on the circuit. The insulation resistance shall be measured between

- EARTH TO PHASE
- EARTH TO NEUTRAL
- PHASE TO NEURAL
- PHASE TO PHASE

### 3.8.12.2 EARTH CONTINUITY PATH:

The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

### 3.8.12.3 POLARITY OF SINGLE POLE SWITCHES:

A test shall be made to verify that every no-linked, single pole switch is connected to one of the phase of the supply system.

### 3.8.12.4 COMPLETION CERTIFICATES:

All the above tests shall be carried out in presence of Owner and the results shall be recorded in a prescribed form. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result from shall be submitted to the Owner for approval. On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out.

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### LIGHT FIXTURES

1.0 SCOPE: The scope of work shall cover the supply, assembling and testing of various types of light fixtures as per specification and latest standards.

### 2.0 STANDARDS:

- 2.1 The following standards and rules shall be applicable :
  - a) IS 3646 1960 Code of practice for interior illuminator.
  - b) IS 1913 1969 General and Safety requirements for Electric lighting fittings.
  - c) Indian Electricity Act and Rules issued thereunder.

2.2 All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the relevant British Standard Code of Practice in the absence of Indian Standard.

### 3.0 GENERAL REQUIREMENTS:

3.1 All fixtures shall be LED Type lamp with accessories and fixings necessary for installation whether so detailed under fixture description or not.

3.2 Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box or fixture opening. 3.3 Fixture shall be completely wired with FRLS wires and constructed to comply with the regulations and standards for Electric Lighting Fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name and the factory inspection label unless otherwise approved.

3.4 Wiring within the fixture and for connection to the branch circuit wiring shall not be less than 1.5 sq. mm. copper for 250 Volt application. Wire insulation shall suit the temperature conditions inside the fixture and wires bypassing the choke shall be heat protected with a heat resistant sleeve.

3.6 Non-reflecting surfaces such as fixture frames and trim shall be Aluminium die cast.

3.7 All the fixtures are as per the IP – 2X / 4 X protections for indoor application where as IP - 6X protections for outdoor application.

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3.8 Lighting fixtures shall be designed for minimum glare and for continuous operation under specified atmospheric condition.

3.9 All fixtures shall be complete with accessories like power factor improvement with energy saver.

3.10 LED type fixture shall be of sheet steel casing with corrosion resistance finish. It shall be provided with separate wiring channel with cover plate and an earth terminal. All screw shall be chromium plated only. Internal wiring shall be neatly clipped.

3.11 Industrial low bay / medium bay / high bay fitting shall be of die cast Aluminium housing, high purity Al. Reflector, cover and wire guard.

4.0 REFLECTOR:

4.1 Light reflecting surface shall be mirror finished having the reflection factor of not less than 90%. All parts of reflector shall be completely covered by finish and free from irregularities. It shall be capable of withstanding a 6 mm. radius bend without showing sign of cracking, peeling or loosening from the base metal. Finish shall be capable of withstanding 72 hours exposure to ultra violet sun lamp placed 10 cm. from the surface without discoloration, hardening or warping and retain the same reflection factor after exposure. Test report shall be furnished for each lot of fixtures.

4.2 Lighting fixture reflectors shall generally be manufactured from aluminium sheet of not less than 20 SWG. 4.3 Polystyrene egg-box type louvers shall be provided whenever specified. Appropriate captive type fixing devices shall be incorporated for securing these.

5.0 LAMPS:

5.1 Lamps shall be supplied and installed in all lighting fixtures furnished under this contract.

5.2 Lamps used for temporary lighting service shall not be used in the final lamping of fixture units.

5.3 Lamps shall be of wattage and type as given in the schedules.

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10.0 TEST:

The following routine tests shall be conducted as per the relevant Indian Standards

a)Each fixture shall be tested .

b) Insulation resistance of each fixture shall be tested. And the insulation resistances so measured.

c) Each fixture complete with its proper lamp/lamps shall be shown to operate satisfactorily at its normal voltage and frequency.

d) Each fixture shall be examined visually to ensure that it is complete in all respects and satisfactorily finished.

e) Type and routine test certificates shall be submitted for tests conducted as per relevant IS/BS for the fixture and accessories.

### 11.0 DRAWINGS AND DATA:

As per of the proposal the bidder furnish relevant descriptive and illustrative literature on lighting fixtures and accessories and following drawings/ data for the respective lighting fixtures :-

i) Dimensional Drawings.

ii) Mounting details cable entry facilities and weights.

iii) Light distribution diagrams

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### EARTHING

1.0 GENERAL

All the non-current carrying metal parts of the electrical installation and mechanical equipments shall be earthed properly. The cables armour and sheath, electric panel boards, lighting fixtures, ceiling and exhaust fan and all other parts made of metal shall be bonded together and connected by means of specified earthing system. An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards to the conduit system, earth stud of the switch box, lighting fixture, earth pin of the socket outlets and to any metallic wall plates used.

All the enclosures of motors shall be also connected to the earthing system.

### 2.0 SCOPE OF WORK

The scope of work shall cover supply, laying, installation, connecting, testing and commissioning of:

- Earthing station with G.I / Copper plate of size as given in BOQ.
- Earthing G.I / Copper strips from earthing station to equipotential bar.
- Earthing G.I / Copper strips / wires from equipotential bar to DBs, Bonding of Non-current carrying parts, and metallic parts of the electrical installation.

#### 3.0 STANDARDS

The following standards and rules shall be applicable:

1) IS: 3043 - 1978 Code of practice for Earthing.

2) Indian Electricity Act and Rules

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice.

### 4.0 TYPE OF EARTHING STATION

### 4.1 PLATE EARTHING STATIONS

The Equipment neutral earthing shall be with copper plate earthing station and equipment body earthing shall be with hot dip galvanized iron earthing station.

The plate electrode shall be 600 x 600 x 3.25 mm copper plate for neutral earthing and shall be of hot dip galvanized iron plate having dimensions  $600 \times 600 \times 6.3$  mm thick for body earthing.

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The earth resistance shall be maintained with suitable soil treatment. The resistance of each earth station should not exceed 1 ohm. The earth lead shall be connected to the earth plate through Hot Dip G.I. bolts. The earthing conductors shall be of copper strip in case of copper earthing and hot dip galvanised iron strip in case

of G.I. earthing. G.I. pipe with funnel of approved quality shall be used for watering the earthing electrodes / stations.

The block masonry chamber with chequered plate shall be provided for housing the funnel and the pipe for watering the earthing electrodes / stations. The hardware and other consumables for earthing installation shall be of copper/brass in case of copper earthing and shall be hot dip galvanised iron material in case of G.I. earthing.

Test link / test pit cover through chequered plate.

4.2 PIPE ELECTRODE EARTH STATION:

The earth electrode shall be 3 M long 50 mm dia class "B", Galvanised steel pipe.

The earth resistance shall be maintained with a suitable soil treatment.

The resistance of each earth station should not exceed 1 ohm.

The earth lead shall be fixed to the pipe with a nut and safety set screws. The clamp shall be permanently accessible.

The earthing grid and the earthing conductor shall be hot dip Galvanised iron strips of the size as shown in the drawing.

G.I. pipe with funnel of approved quality shall be used for watering the earth electrode \ station.

The block masonry chamber with chequered plate shall be provided for housing the above referred funnel and pipe.

The hardware and other consumables for earthing installation shall be hot dip Galvanised iron material as shown on the drawing.

### 5.0 METHOD OF MEASUREMENT:

Provision of earthing station complete with excavation, electrode, watering pipe, soil treatment, masonry chamber with cast iron cover etc. shall be treated as one unit of measurement.

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The following items of work shall be measured and paid per unit length covering the cost of the earth wires / strips, clamps, labour etc.

a) Main equipment earthing grid and connection to the earthing station.

b) Connection to the switch board, DB, etc.

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# ERECTION, TESTING AND COMMISSIONING OF ELECTRICAL INSTALLATIONS 1.0 SCOPE

The intent of this specification is to define the requirements for the installation, testing and commissioning of the electrical system like LDB, earthing network, Internal lighting, Light fixtures etc. Requirement of this project shall be as specified in bill of quantities / general specifications or as per the battery limits fixed by the owner / consultant. Necessary drawing approvals & clearances from electrical inspector, local authorities and other statutory bodies shall be in the scope of contractor.

### 2.0 STANDARDS

2.1 The work shall be carried out in the best workman like manner in conformity with this specification, the relevant specification / codes of practice of the Indian Standards Institution, approved drawings and the instructions issued by the authorised representative, from time to time. Some of the relevant Indian Standards are listed elsewhere in this tender document.

2.2 In addition to the standards mentioned in 2.2, all works shall also conform to the requirement of the following :

\_ Indian Electricity Act and Rules framed there under.

\_ Fire Insurance Regulations.

\_ Regulations laid down by the Chief Electrical Inspector of the State /State Electricity Board / Union Territory.

\_ Regulations laid down by the Factory Inspector of the State / Union Territory.

\_ Any other regulations laid down by the local authorities.

\_ Installation & operation manuals of original manufacturers of equipment.

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### 3.0 EQUIPMENT AND ACCESSORIES SPECIFICATIONS:

This defines specifications and requirements mainly for the equipment and accessories, which are generally supplied by the erection agency. All materials, accessories, consumable to be supplied by the contractor shall be selected from the list of specified make and shall conform to the specification given here under. The equipment shall be manufactured in accordance with current Indian Standard specifications wherever they exist or with the BS or NEC specifications, if no such IS standards are available. In the absence of any specification, the materials shall be as approved by the owner / consultant or his authorised representative. All similar materials and removable parts shall be uniform and interchangeable with one another. Makes of bought out items selected by the contractor must be furnished by him as per the proforma given in elsewhere in the document.

### 3.1 CONTROL CABLES:

Control cables for use on 415 V system shall be of 1100 volts grade, copper conductor, PVC insulated, PVC sheathed, armoured and overall PVC sheathed, strictly as per IS: 1554 (Part-I) 1976. Unarmoured cables to be used only if specifically mentioned in schedule of quantities. The size of these cables shall be as specified in bill of quantities or as per approved drawing. The minimum conductor size shall be 1.5 sq.mm. (Cu.).

### 3.2 CABLE GLANDS:

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

### 3.3 CABLE CONNECTORS:

Cable connectors, lugs/sockets, shall be of copper/aluminium alloy, suitably tinned, solderless, crimping type. These shall be suitable for the cable being connected and type of function .

### 3.4 CABLE INDICATORS

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

### 3.5 G.I. PIPE FOR CABLES:

For laying of cables under floor, G.I. class "A" pipes shall be used. M.S. conduits are not acceptable for this purpose. All accessories of pipes shall be threaded type. Size of pipe shall depend upon the overall outer diameter of cable to be drawn through pipe. NO G.I. pipe less then 40 MM. I.D. Shall be used for this purpose.

### 4.0 ERECTION

The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. Equipment shall not be removed from packing cases unless the floor has been made ready for installing them. The cases shall be opened in presence of the Owner / consultant or his authorized representative. The empty packing cases shall be returned to the stores and any document if found with the equipment shall be handed over to the Owner's representative. Any damage or shortage noticed shall be reported to the Owner / consultant in writing immediately after opening of packing cases.

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### 4.1 DISTRIBUTION BOARDS:

### (a) ERECTION:

The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading / unloading during transportation. The contractor shall be responsible for final assembly and interconnection of busbars / wiring. Foundation channel shall be delivered in convenient shipping section by the manufacturer. It shall be grouted in the flooring by the contractor. Switchgear shall be aligned and levelled on their base channels and bolted to them as per the instructions of the Owner / consultant. The earth bus shall be made continuous throughout the length loosely supplied relays and instruments shall be mounted and connected on the switchgear. After erection, the switchboard shall be inspected for dust and vermin proof. Any hole which might allow dust or vermin etc. to enter the panel shall be plugged suitably at no extra cost. The contractor shall fix the cable glands after drilling the bottom / top plates of all switchboards with suitable holes at no extra cost.

### (b) TESTING:

Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground

### 4.2 INSTALLATION OF CABLE NETWORK:

Cable network shall include power, control and lighting cables which shall be laid in underground trenches, cable trays, G.I. pipes, or on building structures as detailed in the relevant drawings, cable schedules or as per the Owner /consultant's instructions. Supply & installation of cable trays, G.I. pipes /conduits, cable glands and sockets of both end isolators, junction boxes, push button stations, etc. shall be under the scope of the contractor.

### (a) GENERAL REQUIREMENTS FOR HANDLING CABLES:

Before laying cables, this shall be tested for physical damage, continuity, absence of cross phasing, insulation resistance to earth and between conductors. Insulation resistance tests shall be carried out with 1000 Vmegger.

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

Sharp bending of cable shall be avoided. The bending radius for PVC insulated and sheathed, armoured cable shall not be less than 10 D, where "D" is overall diameter of the cable. While drawing cables through G.I. pipes, conduits, RCC pipes, ensure that size of pipe is such that, after drawing cables, 40% area is free. After drawing cables, the end of pipe shall be sealed with cotton / bituminous compound.

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Armoured cables shall never be concealed in walls / floors / roads without G.I. pipes, conduits or RCC pipes. Joints in the cable throughout its length of laying shall be avoided as far as possible and if unavoidable, prior approval of site engineer shall be taken. If allowed, proper straight through epoxy resin tight joint shall be made, without any additional cost. A minimum loop of 3 mtr. shall be provided on both ends of the cable, and on both ends of straight through cable joint. This additional length shall be used for fresh termination in future. Cable for this loop shall be paid for supply and laying.

All cable routes shall be carefully measured and cable cut to the required lengths and undue wastage of cables to be avoided. The routes indicated in the drawings are indicative only and the same may be rechecked with the Owner / consultant before cutting of cables. While selecting cable routes interference with structures, foundations, pipelines, future expansion of buildings etc. should be avoided.

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

Wherever cable rises from underground / concrete / masonry trenches to switchgears / push buttons, these shall be taken in G.I. pipes of suitable size, for mechanical protection upto 300 mm. distance of concerned cable gland or as instructed by the Owner / consultant.

The cable pass through foundation / walls of other underground structures, the necessary ducts for opening will be provided in advance for the same. However, should it become necessary to cut holes in existing foundation of structures the electrical contractor shall determine the location and obtain approval of the Owner / consultant before cutting is done.

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### (b) LAYING OF CABLES (UNDERGROUND SYSTEM)

\_ Cables shall be so laid in trench that this will not interfere with other underground structure. All water pipes, sewage lines or other structures which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded / diverted as directed by the owner /consultant.

\_ Cable shall be laid at minimum depth of 750 mm. in case of L.T. from ground level. Excavation will be generally in ordinary soil. The width of trench shall be sufficient for laying of required no. of cables.

\_ Sand bedding 75 mm. thick shall be made below and above the cables. Layer of bricks (full size) shall be laid above sand bedding on the sides and above the cables to cover cables completely. More than one cable can be laid in the same trench. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction of the Owner / consultant.

\_ For all underground cables, route markers should be used :

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

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

c) Cable markers should be installed at an interval not exceeding 30 mtr. along the straight routes of cables at a distance of 0.5 mtr. away from centre of cable with the arrow marked on the cable marker plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

\_ RCC Hume pipe for crossing road in cable laying shall be provided by employer. No deduction shall be made for cable laying in Hume pipe for not providing bricks, sand and excavation. RCC hump pipe at the ends shall be sealed by bituminous compound after laying and testing of cables by electrical contractor.

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After laying of cables, minimum 20% area shall be spare. (a) TERMINATION AND JOINTING OF CABLES:

b) Use of glands:

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

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

ii. USE OF LUGS / SOCKETS:

All cable leads shall be terminated at the equipment terminals, by means of crimped type solderless connectors unless the terminals at the equipment ends are suitable for direct jointing without lugs / sockets. The following is the recommended procedure for crimped joints and the same shall be followed:

a) Strip off the insulation of the cable and with every precaution, not insevere or damage any strand. All insulation's to be removed from the stripped portion of the conductor and ends of the insulation should be clean and square.

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

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

d) Make the crimped joint by suitable crimping tool.

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

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

### iv) IDENTIFICATION OF CABLES / WIRES / CORES:

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

In case of control cables all cores shall be identified at both ends by their wire numbers by mean of PVC ferrules or self sticking cable markers, wire numbers shall be as per schematic / connection drawing. For power circuit also, wire numbers shall be provided if required as per the drawings of

switchgear manufacturer / supplier.

(f) TESTING OF CABLES:

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

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

iii. DC high voltage test shall be made after installation on the following :

a) All 1100 volts grade cables in which straight through joints have been made.

b) All cables above 1100 V grade.

For record purpose test data shall include the measured values of leakage current versus time. The test voltage and duration shall be as per relevant codes and practices of Indian Standards Institution.

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iv. PROFORMA FOR TESTING CABLES: DATE OF TEST

a) Drum No. from which cable taken.

b) Cable from to

c) Length of run of this cable meter

d) Insulation resistance test

- between core-1 to earth mega-ohm
- between core-2 to earth mega-ohm
- between core-3 to earth mega-ohm
- between core-1 to core-2 mega-ohm
- between core-2 to core-3 mega-ohm
- between core-3 to core-1 mega-ohm
- duration used : 1 kV

e) High voltage test Voltage Duration

- between core an earth.
- between individual cores

#### 4.3 EARTHING NETWORK:

### (a) INSTALLATION AND CONNECTION:

The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.

The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column.

The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.

19 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber.

Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe. The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing for earthing.

The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry.

Construction of the earthing station shall in general be as shown in the drawing(Refer standard earthing Drawing) and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian

Standard IS: 3043, Code of Practice for Earthing Installation. The earth conductors (Strips / Wires copper / Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanised Iron clamps and Mild Steel Zinc Passivated screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

### **Electrical Technical Specifications-28**

The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished.

Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

### (b) EARTH LEADS AND CONNECTIONS:

Earth lead shall be bare copper or Galvanised steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. G.I strips buried in the ground shall be protected with bitumen and hessian wrap or polythene faced hessian and bitumen coating. At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface. The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

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(c) TEST:

The entire earthing installation shall be tested as per requirements of Indian Standard Specification IS: 3043. The following earth resistance values shall be measured with an approved earth megger and recorded.

1) Each earthing station

2) earthing system as a whole

3) Earth continuity conductors

Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 5 ohm in each case. Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed. All tests shall be carried out in presence of the Owner's presence. The earth resistance shall be less than 1 ohm for all installations.

### 5.0 SURFACE CONDUIT WORKS:

### 5.1 CEILING / WALL OUTLET BOXES FOR LIGHTS / FANS:

Outlet boxes shall be of steel with cover and so installed as to maintain continuity throughout. These shall be protected at the time of laying by filling with jute / earth / cotton etc. so that no cement mortar finds its way inside during concerning or plastering etc. In beams conduit socket shall be provided in place of outlet boxes. The same shall be used for installation of luminaries. For fixing light fixtures / brackets, outlet boxes complete with knock out for holding conduits shall be used. For lighting fixture suitable for 40/20 watts only one outlet box is required. For fixing ceiling fans, circular outlet boxes, 100 mm. diameter, complete with 12 mm. dia. Mild Steel rod 300 mm. long, for holding 12 mm. dia. Mild Steel cover 125 mm. dia. at bottom shall be used.

### 5.2 DRAW OUT JUNCTION BOXES:

Steel draw out boxes at angle dimensions shall be provided at convenient points on walls / ceilings to facilitate pulling of long runs of cables / wires. The location of these boxes is to be decided prior to fixing, as per site requirement and following should be treated as general guidance for deciding the location of these:

(a) These should be provided at a place where these are not in direct view. Recommended place is 400 / 450 mm. below ceiling, if conduits are running vertically.

(b) Junction box in the offset of bottom of RCC beam and vertical wall should not be provided.

(c) If junction boxes are coming side by side for two or more conduits, one common M.S. box of proper size can be used to act as junction box.

(d) If junction box is to be provided in ceiling, its position should be so located that it is in line with other light / fan points.

(e) Junction boxes should never be used for splitting one conduit into two or more. Junction box for such functions is avoidable and for this, number of conduits to be connected to one switch board should be calculated correctly as per relevant drawing before laying conduits in ceiling.

(g) Locating junction boxes on outer surface of exterior walls of building should be avoided as these are in direct view and are also exposed to weather.

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### 5.3 SWITCH BOXES:

Steel boxes of required sizes, shall be provided to house speed regulators of fans, switches for lights, fans, plug sockets etc. as per requirement shown on relevant in BOQs.. These should be so designed that accessories on sheet could be mounted with tapped holes and brass machine screws, leaving ample space at the back and on the sides for accommodating wires and check nuts at conduit entries. These shall be attached to conduits by means of check nuts on all walls of the boxes through which the conduits are entering. These shall be completely connected leaving edges flush with finished wall surfaces. Cover should be fixed to these switch boxes by means of brass chrome plated machine screws and cup washers. Utmost care shall be taken by contractor to ensure that all switch boxes are in line and level. Inside each switch box, one bolt shall be welded to receive earthing wire.

### 5.4 SWITCH AND SOCKET:

Switches shall be installed at 900 mm above finished floor level unless otherwise indicated on the drawings. The switch controlling the light point or fan shall be connecting on to the phase wire of the circuit and neutral shall be continuous, having no fuse or switch installed in the line except at the D.B All fan regulators of electronic type shall be fixed inside the switch boxes. The cover plates to the switch box shall be fixed by means of sunk head brass cadmium screws. Where two or more switches and fan regulators are installed together,

they shall be provided with one gang cover plate with knockouts to accommodate required number of switches, sockets and regulators. The switch controlling the socket outlet shall be on the phase wire of the circuit. The third pin of the socket shall be connected to the earth continuity conductor of the circuit. The switch boxes, installed back-to-back in the same wall shall be offset from each other, 150 mm horizontally, to preclude noise transmission.

### 5.5 CLEANING AND PROTECTION OF CONDUIT SYSTEM:

The entire conduit system including outlet boxes, junction boxes and switch boxes shall be thoroughly cleaned after completion of erection and tested for not blockage by air / sound or steel wire prior to finishing of building by air / sound or steel wire prior to finishing of building and before drawing in of

cables / wires to safeguard conduit system against filling up with the plaster / cement slurry / water etc. all the outlet and switch boxes will have to be provided with temporary jute / cotton filling, covers and plugs etc. which shall be replaced later on by hylem / sheet cover after wiring as required.

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### 5.6 TESTING OF INSTALLATION:

Before a completed installation is put into service, the following tests shall be complied with:

### (a) INSULATION RESISTANCE:

The insulation resistance shall be measured by applying 1000 volt megger with all fuses in places, circuit breaker and all switches closed. The insulation resistance in giga ohms of an installation, measured shall not be less than 50 mega ohms divided by the number of points on the circuit. The insulation resistance shall be measured between

EARTH TO PHASE EARTH TO NEUTRAL PHASE TO NEURAL PHASE TO PHASE

### (b) EARTH CONTINUITY PATH:

The earth continuity conductors shall be tested for electrical continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance or earth leakage circuit-breaker measured from the connection, with the earth electrode to any point in the earth continuity conductor in the completed installation and shall not exceed one ohm.

### (c) POLARITY OF SINGLE POLE SWITCHES:

A test shall be made to verify that every no-linked, single pole switch is connected to one of the phase of the supply system.

### (d) COMPLETION CERTIFICATES:

All the above tests shall be carried out in presence of Owner and the results shall be recorded in prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result from shall be submitted to the Owner for approval. On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

### 6.0 INSTALLATION OF LIGHTING FIXTURES / FANS:

### 6.1 INSTALLATION OF LIGHTING FIXTURES:

Scope of work under this item shall start from light point, with 3 nos. 1.5 mm.<sup>2</sup> PVC insulated wires from connector to the connector inside the lighting fixture, connections, fixing of lighting fixture complete with all accessories, lamps on wall / roof / steel truss etc. testing the lighting fixture and

commissioning. If wire length of light point is enough to reach connector of light fitting, connector in light point can be deleted.

### 6.2 INSTALLATION OF EXHAUST FANS:

Scope of work under this system shall start from exhaust fan point, with a ceiling rose, 2 core 2.5 mm.<sup>2</sup> PVC insulated wire from ceiling rose to connector of exhaust fan, connections, making fan opening in walls including repair / finishing fixing of exhaust fan complete with accessories and louvers on walls with hold-fasts, testing the exhaust fans and commissioning.

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### 7.0 COMPLETION TESTS:

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

### 7.1 INSULATION RESISTANCE TO EARTH:

This is to be measured with all fuse links in place, all switches ON, all lamps and appliances in position by applying a voltage not less than twice the working voltage (subject to a limit of 500 V). Insulation resistance of the whole or any part of the installation to earth must not be less than 50 megaohms divided by the number of outlets (points and switch positions) except that it need not exceed one mega-ohm for the whole installation.

### 7.2 INSULATION RESISTANCE BETWEEN CONDUCTORS:

Tests to be made between all the conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply. For this test, all lamps shall be removed and all switches put ON. The result of the test must be 50 mega-ohms divided by the number of outlets (points and switch positions) but need not exceed 1 mega-ohm for the whole installation.

### 7.3 POLARITY OF SINGLE POLE SWITCHES:

Tests shall be made to verify that all non-linked single pole switches are on phase conductor (live) and not on neutral or earth conductor. This can be done by connecting test lamps between two terminals of switch and earth. If the lamp lights up when switch is ON and either terminal is touched, the switch is correctly installed.

### 7.4 RESISTANCE OF METAL CONDUITS / SHEETS (EARTH CONTINUITY

### TEST):

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

### 8.0 HANDING OVER / TAKING OVER:

After completion of works and tests specified above, the various installations of the project can be taken over by the employer as and when these are ready in all respects.

### (a) COMPLETION CERTIFICATES:

All the above tests shall be carried out in presence of Owner and the results shall be recorded in prescribed forms. Any default during the testing shall be immediately rectified and that section of the installation shall be re tested. The completed test result from shall be submitted to the Owner for approval.

On completion of an electric installation a certificate shall be furnished by the contractor, countersigned by the certified supervisor under whose direct supervision the installation was carried out. This certificate shall be in a prescribed form as required by the local electric supply authority.

Sr. No.	Description	Make
1	Meters ( Digital)	A.E./Conserve/HPL/Conzerve/L&T
2	S.L.D.B	Legrand/Schneider/HPL/Siemens/MDS/L &T
3	Miniature Circuit Breaker (10 KA)	MDS/ Siemens / L&T/Legrand
4	C.T.	A.E./Reco/Equivalent
5	E.L.C.B.	Legrand/Schneider/HPL/Siemens/MDS/L &T
6	Lighting fixture & Lamps	Phillips/ Wipro/Crompton
7	Power and Control Cables	RPG/ Polycab / Phinolex/ RR cable / Havells
8	PVC conduit pipes (ISI approved)(16 gauge up to 25 mm dia. and 14 gauge above 25 mm dia.)	Garware / Precision / Diamond / Shakti
9	Metallic Plug & Socket	MDS / C.G. / BCH / Legrand / Siemens
10	Rotary Selector Switch	Siemens / L&T/ Kaycee
11	PVC insulation Tape	Steeelgrip / Bhor / Anchor
12	Clip on Terminals	Elemex / Connectwell
13	Junction boxes and accessories	PEI
14	Cable Gland (brass) Nickel plated, (Double compression for flameproof area)	Dowells / Comet/ Baliga
15	PVC Insulated copper wires	Finolex/Polycab/Anchor/Havells/R.R
16	Cable Tray	Indiana / Sadhana / Asian
17	Telephone Tag Block	I.T.I or approved make
18	Telephone wires, Cables ,Step down transformer	Delton / Finolex/R.R.
19	UTP cables CAT-5 and fiber optic cables	R.R Kabell / Havells/ Finolex
20	20 A Metal Clad Industrial 3 pin socket Outlet &	MDS/ Legrand/Siemens

### MAKE LIST TO BE CONSIDERED

plug with 20 A MCB controlling Socket outlet.	]
All housed in 16 SWG CRCA Sheet steel painted	
with 2 coats of Final paints	
	-

2. A sample of every bought out item for the contract works even confirming to the above work shall be got approved and shall be kept at site for inspection.

### PART VI

### TECHNICAL SPECIFICATION FOR FIRE FIGHTING & SPRIKLERS

### **TECHNICAL SPECIFICATIONS FOR FIRE FIGHTING**

1. SCOPE:

This document presents the design criteria to be adopted for firefighting systems to be installed at NBT, Bhopal.

Firefighting systems shall be provided for whole of manufacturing plant, being reconstructed

Apart from the statutory compliance, the objective of this design basis is to deal primarily with the firefighting systems design requirements as per different codes, i.e. NBC, IS etc.

### 2) HAZARDOUS AREA CLASSIFICATION :

This is a spinning plant and will be broadly classified as "Ordinary Hazard" area as per National Building Code-2005 for provision of fire Protection system & Water supply requirements,

The basis shall address the following :

- Basic firefighting arrangements to be installed
- Design parameters such as design area, density, pressure etc. to be adopted.
- Spacing of fire hydrants, sprinklers, extinguishers, velocity to be maintained etc.
- Capacity of the firefighting pumps to be installed and the water reservoir capacity.

### 3) SUMMARY OF PROPOSED FIRE FIGHTING SYSTEMS AREA WISE :

Following type of firefighting equipment shall be provided.

- 1) External hydrants
- 2) Hose reels wherever required.
- 3) Automatic water spray system (Sprinklers)
- 4) Portable extinguishers

### 4) DESIGN CRITERIA :

Design of the firefighting systems shall be based on the assumption that no firefighting resource from outside the plant will be available in case of emergency. Fire within the plant shall be controlled and extinguished from the plant resources only.

Firefighting system shall be designed to fight single major fire at any given point of time.

A combined fire hydrant, sprinkler system is envisaged for this facility.

Firefighting systems shall mainly consist of the following installation and equipment as applicable and depending on the kind and location of the plant.

### A Fire Hydrant System :

This includes mainly the following

- Mild Steel ERW aboveground / underground pipes as per IS: 1239, part-I, 'C' class for size 150mm dia. & below, also fittings as per IS: 1239, part-II 'C' class for size 150mm dia. below.
- Mild Steel ERW aboveground / underground pipes as per IS: 3589, min. 6.35mm thickness for size 200mm dia. & above, also fabricated fittings made of IS: 3589, 6.35mm thickness for size 200mm dia. & above.

- Stainless steel 304 (IS: 3444 gr. 1), single headed or double headed oblique pattern type hydrant valves of 63mm dia. for external fire hydrant & internal fire hydrant applications.
- 15m long, 63mm dia. reinforced rubber lined fire hose pipes type: A as per IS: 14933 with instantaneously SS 304 (IS: 3444 gr. 1) coupling as per IS: 903.
- Stainless steel 304 (IS: 3444 gr.1) universal branch pipes as per IS: 2871.
- Hose reel with drum (as per IS: 884) shall be provided inside building at near landing area of staircase. LPCB/ISI approved hose reel drum with 19mm dia., 30m long rubber hose (ISI marked) with shut-off nozzle & 25mm dia. stainless steel ball valve shall be provided at inlet.
- Pedestal / Wall mounted hose box of 3mm FRP sheet with double door, front glass (4mm thick), hose box size 750mm x 650mm x 250mm to accommodate 2nos. of 15m long hoses & 1no. Universal branch pipe.
- Siamese connection (fire brigade inlet connections with 4nos. 63mm dia. instantaneous inlets including 150mm dia. butterfly valve & 150mm dia. non return valve with 150mm dia. stand post) for the external fire network to charge the system network in case of pump failure (shall be provided near entry gate as per requirement).
- 4 nos. 63 mm dia. collective breeching inlet connections for the fire brigade to fill the fire water tank (shall be provided at fire water tank).

### **Design & Construction :**

- Proposed Fire Hydrant System shall be designed as per IS 3844: 1989 (Code of practice for installation and maintenance of internal fire hydrant and hose reel on premises) & IS 13039:2014 (Code of practice for provision and maintenance of external hydrant system)
- The maximum distance between two fire hydrant valves shall be 30mtr. of external wall measurement of the plant / buildings / tank farm to be protected and shall be placed minimum 5 m and maximum 15 m from face of building which is to be protected
- Fire Hydrant system shall be provided for the entire plant facility with partially underground piping except only at road crossing or where not feasible to lay aboveground.
- All above ground external piping shall be laid on PCC / RCC pedestal at appropriate distance & where not feasible to lay aboveground shall be provided in the trench with removable cover. Support shall be at every 3.5m for 80/100/150mm dia. pipe & support shall be at every 5m for 200mm dia. & above as per IS: 13039.
- All above ground pipes for external / Internal / fire escape hydrants risers shall be painted with fire red paint as per IS: 2932 / IS: 5-shade 536.
- External fire hydrant main shall be laid aboveground particularly in those areas where there is scope for future expansion.
- Pressure gauge with isolation valve shall be provided at four remote areas on fire hydrant main to monitoring the pressure in the network.
- Air release valve shall be provided at height point in system & appropriate location on the network.
- All hydrant outlets shall be situated 1m above finished ground level/floor level as per IS: 3844. / IS: 13039

- External fire hydrants shall be provided with fire hose pipes, branch pipes with universal branch pipe inside fire hose cabinets which will be kept nearer to the hydrant stand posts.
- Proposed fire water main shall be routed in closed loop as far as possible to ensure multidirectional flow. Isolation valves shall be provided in the network to enable isolation of any section of the network without affecting the flow in the rest of the system. Isolation valves shall be located normally near the loop junction. Isolation valves shall be provided at every fire escape hydrant riser.
- Butterfly valve (150mm dia. & below hand lever operated & 200mm dia. & above gear operated as per IS: 13095 of PN 1.6 rating.) on above ground pipe & Gate Valve inside valve chamber on underground pipe shall be used for isolation of proposed fire hydrant system loop.
- Gate Valve (conforming to IS: 14846 of PN 1.6 rating) shall be used on Riser main isolation and placed at 1 m above the ground level.
- RCC Hume Pipes (NP-2 class) shall be provided at road crossing of the underground fire water mains. The firewater main shall be laid at least 1.0 m below the finished road level / finished ground level.
- Sand bedding (coarse sand) shall be of 100mm all around the underground pipe before backfilling of excavated sand.
- Wrapping & coating material for anti-corrosion protection of underground pipes as per IS: 10221, with using anticorrosive tape 4mm thick & 150mm wide as per IS: 15337.
- Wrapping & Coating shall be provided for underground fire water pipes with 4mm anticorrosive tape. Holiday test shall be done at 11KV to 13KV after wrapping of tape on pipes.
- Proposed Fire Hydrant System shall be design to withstand the pressure 14 kg/cm<sup>2</sup> (200psi) for minimum two hours & working pressure of 8.8kg/cm<sup>2</sup>.
- The hydrant system piping to be so design, as minimum pressure available at remotest hydrant outlet shall be 3.5 kg/cm<sup>2</sup> and should not exceed 5.25 kg/cm<sup>2</sup> at every Hydrant Valve.
- Fire Escape Hydrant Valves (FEH) with fire hose cabinets including fire hose pipes, universal branch pipes; hose reels shall be provided in the staircase at each floor landing above the ground floor.
- Hose reel with drum shall be provided along with Fire Escape Hydrant Valve at every floor landing or also if, required in the main plant building where fire hydrant not approach.

### **B.** Automatic Water Sprinkler System :

This includes mainly the following:

- Mild steel ERW as per IS:1239/IS:3589, heavy grade & butt welded fittings with anti-corrosive wrapping coating for underground and heavy grade fittings, painting, structural supports, etc. for above ground applications.
- UL Listed/FM approved sprinkler heads (various temperature rating to suite the location & hazard), supports for above ground piping, isolation valves, drain valves etc.

Tender for Construction of Raw Material godown & Refurbishing of Annex Block

- UL Listed/FM approved Water Flow switches are envisaged on all fire risers to the sprinkler system.
- UL Listed/FM approved Sprinkler alarm valves with necessary test and alarm trim.

### **Design & Construction:**

- Proposed Automatic water sprinkler system shall be designed with guideline as per IS: 15105.
- A sprinkler system consists of a water supply (or supplies) and one or more sprinkler installations; each installation consists of a set of installation control valves and a pipe array fitted with sprinkler heads.
- The maximum floor area to be protected by sprinklers supplied by any one sprinkler system riser shall be as follows:
  - Ordinary hazard = 4831sq.m as per NFPA-13: 2013
  - Extra hazard = 3716sq.m as per NFPA-13: 2013
  - Storage (high pilled storage) = 3716sq.m as per NFPA-13: 2013
  - ➢ IS: 15105: 2002 = 1000 sprinklers.
- Gate valve (conforming to IS: 14846 of PN 1.6 rating) on Upstream of Alarm Valve shall be consider for Isolation of sprinkler System & Butterfly Valve (150mm dia. & below hand lever operated & 200mm dia. & above gear operated as per IS: 13095 of PN 1.6 rating) on Downstream of Alarm valve for Isolation of respective areas.
- The sprinkler heads are fitted at specified locations at the roof or ceiling.
- A sprinkler has two functions to perform. It must first detect a fire, and must then provide an adequate distribution of water to control or extinguish it.
- The sprinklers operate at pre-determined temperatures to discharge water over the affected part of the area below, the flow of water through the alarm valve initiating a fire alarm. The operating temperature is generally selected to suit ambient temperature conditions. Only sprinklers in the vicinity of the fire, i.e. those which become sufficiently heated, operate.
- The flow through the sprinkler piping in case of fire shall be monitored using flow switch which shall be interfaced with the fire alarm system.
- Automatic Water Sprinkler System shall be envisaged for whole of the plant area.

### **5 NETWORK SIZING :**

- The pipes in the network shall be sized such that water flow velocity in the entire fire water main does not exceed 5 m/sec.
- For the Automatic water spray/sprinkler system, the equilibrium water velocity shall not exceed 5 m/sec at any valve or flow monitoring device, or shall not exceed 10 m/sec at in feeder pipe.
- The remotest spray nozzle shall discharge a minimum pressure of 1.4kg/sq.cm.
- The remotest sprinkler shall be discharge a minimum pressure of 1.0kg/sq.cm.

### 6.TESTING :

All the piping in firefighting system shall be tested as per the code referred but not less than  $10 \text{ kg/cm}^2$ .

### 7.PAINTING :

All the piping in firefighting system shall be painted with fire red paint as per IS:2379-1963.

### **8 FIRE WATER PUMPS**

### Existing :

1 no of electric motor driven Main pump set of 137m<sup>3</sup> / hr @ 70m head. 1 no of diesel engine driven Standby pump set of 137 m<sup>3</sup> / hr @ 70m head. 1 no of electric motor driven Jockey pump set of 10.8 m<sup>3</sup> / hr @ 70m head These pumps will be used for hydrant system as before **Proposed :** 

1 no of electric motor driven Main pump set of 137m<sup>3</sup> / hr @ 70m head. 1 no of electric motor driven Jockey pump set of 10.8 m<sup>3</sup> / hr @ 70m head These pumps will be exclusively used for sprinkler system.

- Existing diesel engine operated pump shall be hooked up to sprinkler system as well.
- Firefighting pumps are designed to operate at 150% of the rated capacity at 65% of the rated head.
- Shut-off head shall not exceed 120% of the rated head.
- A Motor Control Centre (MCC) shall be provided in the pump house. This panel shall receive all the signals from the various pressure switches and then relay the signals onwards to indicate action to start/stop, etc. the respective pump.
- The motor control panel shall have an Ingress protection 55 rating. One hooter shall be provided to alert in fire condition & the event of any of the above fault conditions.
- Fire pump status (Run/Trip, On/Off) shall be monitored by the pressure switch logic.
- Potential free contacts shall have to be provided in the Fire pump control panel for interface with the BMS.
- The logic of pump operation shall be as follows:
- Jockey pump shall start automatically upon receipt of a signal from pressure switches installed at the delivery header.

Jockey pump set shall be provided to:

- 1. Maintain the water pressure in the firefighting network line.
- 2. Provide a means of pumping pressurised water to the system in case of small system demands.
- > The jockey pump shall stop automatically upon restoring the set system pressure.
- > The main pumps shall start automatically if the pressure drops further.
- The main pump will have to be stopped manually upon regaining the set system pressure.
- In case of power failure and/or increase in the system demand or main pump fails to start, and then the stand-by diesel engine pump shall start automatically.
- The stand-by pump will have to be stopped manually upon regaining the set system pressure.

### 9 FIRE WATER RESERVOIR

It is presumed that existing fire water reservoir is having adequate capacity for additional pumps being installed for sprinkler system.

10 UTILITIES		
Power supply	:	415 Volts ± 10%
Control supply	:	230 Volts AC
Instrumentation power supply	:	24 Volts DC

### 11 CODES AND STANDARDS

All equipment and installation shall meet requirements of the following codes & standards. Unless otherwise specified, all the firefighting equipment shall conform to the latest applicable IS.

NBC 2005	:	National Building code
IS: 778: 1984	:	Specification for copper alloy gate globe & check valves for water works purpose
IS: 884: 1985	:	Specification for first aid hose reel for fire fighting
IS: 903: 1993	:	Specification for branch pipe, nozzles, nozzle spanner and hose delivery coupling.
IS: 940: 1989	:	Portable fire extinguishers - Water type.
IS: 1239: 2004	:	Specification for Steel tubes, tubular having diameter 150mm or less - Part 1
IS: 2190: 1992	:	Selection, Installation and Maintenance of First–Aid Fire Extinguishers–Code of Practice
IS: 2871: 2012	:	Universal Branch Pipe
IS: 2878: 2004	:	Portable fire extinguishers - Carbon-Dioxide type
IS: 3589: 2001	:	Specification for steel pipes for water & sewage (168.3 to 2540mm outside diameter)
IS: 3844: 1989	:	Code of practice for installation and maintenance of internal fire hydrants and hose reels on premises
IS: 4861: 2010		Dry powder
IS: 5290: 1993		Specification for landing values
IS: 5312		Non return Valve
IS: 5822: Reaffirmed 2004	:	ERW pipe Laving
IS: 9668: reaffirmed 2002	:	Provision and Maintenance of water supplies for Firefighting – code of practice
IS: 10204: 1982	:	Portable fire extinguishers - Mechanical Foam type.
IS: 10221: 1982	:	Code of practice for coating & wrapping of Underground mild steel pipelines
IS: 12469: 1988	:	Specification for Pumps for Fire Fighting System
IS: 13039: 2014	:	Code of practice for provision and maintenance of External hydrant system
IS: 13095: 1991	:	Butterfly valves for general purposes
IS: 14933: 2001	:	Specification for reinforced rubber lined hosepipe (type-B)
IS: 14846: 2000	:	Specification for sluice valve for water works purpose (50 – 1200mm size)
IS: 15325: 2003	:	Code of practice for design of Medium Velocity Water Sprav system
IS: 15337	:	Wrapping & Coating Anti-corrosive tape
IS: 15683: 2006	:	Portable fire extinguishers

#### List of Approved Makes 12

All materials and equipment shall be of the best type available and shall be as per Indian standards and suitable to use in the specified climatic conditions.

No	Items		Approved Makes
1.	Mild steel Pipes		Jindal/Tata
2.	Branch pipe	…	Shah Bhogilal / Winco / Eversafe / Newage
3.	Fire hoses	:	Newage / Eversafe / / CRC
4.	Portable fire extinguishers	:	Safex / Minimax / Kanex
5.	CIDF gate valve (non-rising/ rising stem)	:	Kalpana / C&R / Kirloskar / BDK
6.	Hydrant valve		Shah bhogilal / Eversafe / Safex / Newage
7.	Globe valve/Ball Valve/Gate Valve	:	Leader / BDK / Sant / Zoloto
8.	Air release valve	•••	Shah Bhogilal / Leader / Rapidrop
9.	Wrapping & coating tape (4mm thk tape)		IWL / A.R.Lamination
10.	Fire Red enamel paint	:	Berger Paints / Shalimar Paints / Asian Paints
11.	First-Aid Hose Reel		Ever safe / Sri / Shah Bhogilal / Safex
12.	Rubber Hose	•••	Dunlop/Jyoti
13.	Fire Bucket	:	Kanex / Safex / Minimax
14.	Strainer		Teleflo / Grandprix / Filtration Engg.
15.	Pressure Gauge		General
16.	Pressure Switch		Indfoss / Switzer / General Instruments /
			Switzer / Danfos
17.	Butterfly valve	:	Audco / C & R / Intervalve / Tyco
18.	Sight Glass	:	General Instruments / Revati
19.	Fire Brigade inlet with inbuilt NRV	:	Shah Bhogilal / Newage / Safex
20.	Deluge Valve	:	Eversafe / HD Fire / Tyco / UL Listed
21.	Sprinklers	:	HD Fir / Tyco / Viking /UL Listed
22.	Sprayer	:	HD Fir /Tyco / Viking / UL Listed
23.	Hose box (FRP)	:	Standard Make with ISI marked/LPCB Marked.
24.	Water Flow Switch	:	System Sensor / Potter / UL Listed
			Advance / C & R
25.	Pumps	:	Mather & Platt / Kirloskar / Amstrong /
			Grundfos
26.	Electric Motor	:	ABB / Crompton Greaves / Siemens / Bharat
			Bijlee
27.	Diesel Engine	:	Cummins / KOL / Greaves
28.	Non return Valve	:	Kirloskar / Advance / Carter / C&R /
			Intervalve
29.	Motor Control Centre for Pumps	:	Reputed manufacturer
	(L&T/Siemens/Schneider components		
<b>a</b> .c	make).		
30.	4 way Breaching Connection with in-built	:	Shah Bhogilal / Newage / Safex / Winco
	NKV for Fire Water tank with Box 150		
	mm dia.		

The following makes of materials are sted as conforming to the specifications:

#### **Bidder's Bid**

Description of the Works BID No.	:	Construction & Utility Systems NBT /01/2019.
To Address	:	General Manager (Technical / Materials) National Textile Corporation Ltd.
		Western Regional Office NTC House, 15 N.M. Marg,
		Ballard Estate, Mumbai 400 001.
		Phone: 022-22686646 / +91 8779581518

GENTLEMEN,

Having examined the bidding documents including addendum, we offer to execute the Works described above in accordance with the Conditions of Contract, Specifications, Drawings and Bill of Quantities accompanying this Bid, for a contract price of Rs.\_\_\_\_\_ (Rupees

This bid shall be valid for a period of 90 (Ninety) days from the day the bid is opened.

This Bid and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Bid you receive.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

We also undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988"

We hereby confirm that this Bid complies with the Eligibility, Bid Validity and Bid Security required by the Bidding documents.

Yours faithfully,

Authorized Signature:	
Name & Title of Signatory	:
Name of Bidder	:
Address	:

Company Seal/ Stamp

#### PREFACE

#### Points/Notes applicable to Bill of quantity:

1 Bidder shall indicate basic rate of Cement and Reinforcement considered for arriving at the item rate. If NTC decides to supply Cement or Reinforcement free to Bidder during course of the work then the same shall be deducted from Bidder's agreed item rate at unit rate indicated by Bidder below. However structural steel required for PEB to be supplied by the bidder only.

Bidder shall quote only rates of following items here only (not to be considered the same in BOQ)

Sr. No.	Items	Unit	Rate/ Unit
1.	Cement		
2.	Reinforcement Steel		
3.	Structural Steel		

- 2 Bidder shall arrange storage facilities for Water & distribution.
- 3 Work shall be carried out as specified in Technical Specifications and BOQ. Technical Specifications and BOQ are intended to be supplementary/ complimentary. In the event of contradiction/variation, the contents in BOQ shall take precedence.
- 4 The rates in BOQ shall be for completing and finishing the item in all respect; and shall be inclusive of *inter-alia*, supply of materials, labour, scaffolding, staging, construction plant and machinery, tools, tackle and including unloading, loading, storage, carting, transportation, hoisting, laying, fabricating, fixing, soaking, compacting, curing and all other processes required to complete the work.
- 5 Further to 3 above the rates shall also be inclusive of all taxes including GST, local tax, import duty and other building materials brought from outside.
- 6 GST as applicable on Contract Amount shall be paid/ reimbursed by the Employer. The Employer shall have option to deposit the same directly with the concerned Commissariat or to reimburse on production of original documents specific to this project only.
- 10 Concrete, masonry, plaster and other items as per requirement in road construction shall be measured under BOQ (If required)
- 11 All the water proofing work, roofing, roof gutters, and R W Piping items shall carry a guarantee for minimum 5 years or as specified for water tightness.
- 12 Plumbing work in toilets shall be concealed or exposed and clamped as directed. The concealed pipes shall be painted with 2 coats of black bitumastic paint before embedment. Chicken wire mesh shall be nailed and the chases shall be grouted properly. (If required)
- 13 In the Schedule for Water Supply, drainage, sanitary work:

The materials shall be of approved make and heavy quality.

The item rates are for supply, laying, jointing fixing to line and level. Jointing shall be water tight.

Rates for pipe items are inclusive of fittings such as check nuts, union, bend short or long, elbow, flanges to table E, nuts/bolts/washers, gasket, packing, sealant, Y, double Y, offset, nipples, and shoes. Pipes to be run on wall or soffits shall be fixed as per detail sketch.

- 14 For excavation over area, the grading level shall be stipulated. The foundation excavation depth in this region shall be w r to grading level. (If required)
- 16 The bidder shall clean the site completely including removal of debris, bushes, and loose materials. This work is a part of general mobilization and shall be at his own cost.

Cu.M.	Cubic Metric
Sq.M.	Square Meter
Rmt	Running Meter
Kg	Kilogram
Ltr	Liter

#### ADDITIONAL TECHNICAL SPECIFICATIONS

The BOQ rates include such tests.

#### **<u>Structural Steel Fabrication Work</u>. (If required)**

Concrete platform for fabrication shall be level, reasonably smooth finish and of adequate strength .DC welding

Generators or rectifiers shall be used for welding

Structural sections shall be thoroughly cleaned and fully straightened before use.

Welding process shall be Shielded manual arc welding. DC Welding Generators or Rectifiers shall be used. Welding transformers not acceptable.

Bidder shall select appropriate welding sequence to control distortions/shrinkage. The

prescribed thickness shall be achieved in 2 passes.

For root pass electrodes of 2.5 mm G (E 6011) and for further passes 3.5 mm G (E 7018) shall be used.

#### **Concrete flooring**

Flooring work in production hall shall be carried out as per the detailed drawing. The PCC base surface shall be cleaned and steel channels to suit the concrete thickness shall be set up to create panels, with correct top level, plumb and line. The channel surface shall be clean and well oiled. The channels shall have provision for steel reinforcement dowels. The channels shall be rigidly secured by driving steel pins and lateral supports. PVC membrane shall be provided if directed. The surface shall be well watered 24 hours ahead.

Before commencing concreting operation the excess water shall be removed and reinforcement and dowels provided as per drawing. Concrete mix shall be stiff. The aggregates shall be angular. Sand shall be used. As fine aggregate, Concrete shall be laid in the panel from edge towards center and shall be vibrated by needle vibrator till the panel is completely filled and finally with batten mounted screed vibrator, simultaneously filling depressions with fresh concrete and removing excess if any. Float, excess water, mud will appear on the surface which has to be removed manually. The operation is continued to obtain absolutely level top surface.

The concrete is allowed to set for a time period such that the surface becomes hard enough to give metallic sound when struck with steel trowel and no foot mark can form on the surface. Trowelling is done at this stage with power trowels to obtain smooth and level finish. No cement slurry/ mortar/ neat cement shall be used at any stage.

Curing shall be done by 'ponding' for minimum 15 days.

The grooves shall be as per drawing and shall be saw cut with a heavy duty mechanically operated circular saw. The groove filling shall be done as shown in the drawing.

### Joints in Concrete Flooring and panel dimensions. (If required)

The flooring panels shall be laid as per detailed drawing. The panel width is governed by length of the batten, which is generally 3.6 M. After allowing margins, the limiting width becomes 3.00 M the flooring shall be cast in alternate longitudinal strips, keeping construction joints in a planned way to match drawing.

Thus, during casting operation, 2 types of joints are formed. 1) The longitudinal joint. 2) Construction joint. In addition transverse contraction joints have to be provided these joints are saw cut between 72 hrs and 120 hrs of casting. The dowels shall be provided as shown in the detailed drawing. The saw cut dimensions shall be 10 mm width and 50 mm depth. The joints shall be filled and sealed as per drawing. The sealants shall be polysulphide based. It is important to ensure that saw cut line is collinear with longitudinal casting line and the construction joint edge, as the case may be. Usually this is achieved by providing markers.

#### Specifications for kotah stone flooring:

The sub base surface shall be thoroughly cleaned and brought to the desired level within a tolerance of 5mm. The undulations shall be made up by chipping or adding pcc 1:2:4 bedding as directed by the Engineer. Water shall be sprinkled just before laying the bedding.

Stones shall be fresh green or blue free from cracks, veins cleavages and other defects. The thickness shall be as described in BOQ. The edges shall be straight cut and vertical for the full depth. Stones prepared for laying shall be soaked for 30 minutes in water and inspected before laying.

Cement sand mortar in the proportion 1:4 shall be used for bedding. A single batch of mortar shall be such that it is consumed in less than 40 minutes.

Proper level reference `dhadas`shall be established for maintaining level. The bedding shall be 25 mm to 30 mm. Before putting stone the bedding is compacted with wooden battens.

Stone is laid on the bedding and brought to proper position and level by using mallet and then removed to see the void portion .The voids are filled with mortar, and cement slurry is spread on the bedding and handpicked with spatula. Thickcement paste of butter consistency is applied on edges and the stone is set in position while lightly tapping with mallet till the cement slurry rises to the surface from the joints. The joints shall be 1.5mm thick. .

The joints are grouted with cement slurry of pouring consistency for a depth of at least 5-10mm.Just before grouting the joint is cleaned with a sharp knife. The joint grouting is done 12-24 hrs after setting of the stones.

The area thus competed shall be water ponded and cured for 15 days when polishing will be started.

Machine polishing is done in 3 coats using grinding stones of 120 no for the first run and 320 no for the second run. The flooring joints are again grouted with thin white cement slurry and the final run is applied to obtain smooth surface free of undulations and free from polishing stone marks.

Finally the floor is washed with clean water and oxalic acid solution of strength 35gms per sq met of floor area. Approx. 4.5 kg of grey cement will be used for slurry over bedding and side buttering per sq met of laid area, The stone thickness, machine cut/hand cut, and final wax polishing if any will be as stated in the BOQ.
# LIST OF THE APPROVED MAKE AND QUALITY OF MATERIALS TO BE USED IN THE CONSTRUCTION WORK.

Sr.	Item	Make
No.		
1.	Cement	ORDINARY PORTLAND CEMENT CONFORMING TO
	Opc:43 Grade IS : 8112	IS: 269 (1989) OR APPROVED BY EMPLOYER /
	OPC : 53 Grade IS : 12269	ARCHITECT/ CONSULTANTS.
	PPC: 455/ IS: 1489	ULTRATECH/JK/ SANGHI/ ACC/ AMBUJA/
		BINANI
2	White Cement	Birla. J.K.
3.	Reinforcement Tor Steel & Mild	AS PER IS: 2502/ IS: 2751/ IS: 1786 (1979) OR
	Steel Bars Fe 415	Each Bidder should submit one copy of BOQ in
		soft form (USB/CD) enclosed in financial bid.BY
		EMPLOYER Re. Steel - TATA/ SAIL/ RINL
		/JSW/JSPL/ELECTROTHERM
4	Structural Steel sections-	AS PER IS : 226 (1975)/ IS : 961 (1975)/ IS : 1977 (1975)/
	Chanels, Angles, Plate, Beams,	IS : 2062 (1984)/ IS : 8500 (1977) / IS : 432 OR
	Flats , Bars ( Square & Round )	APPROVED MAKE BY EMPLOYER / Consultants
		SAIL/ TATA/ VIZAG / RINL / JINDAL
5	Coarse And Fine Aggregate	AS PER IS: 383. OR Quarry approved by Consultants /
		Employer
6	Cement Paint	SNOWCEM / ASIAN PAINT / BERGER
7	Ceramic Tiles	NITCO / SPL / KAJARIA / HR JOHNSON
	(Glazed/Matt/Other)	
8	Tile Grouts	LATICRETE / BAL ADHESIVE
9	Paint (Emulsion/Distemper/	ASIAN PAINT / ICI/ BERGER PAINT
	WP Cement Based)	
11	A.C. Sheets (Asbestos Free)	EVEREST / CHARMINAR/ RAMCO
12	Rolling Shutters	SWASTIK / SARVODAYA / BHARAT/ SHIVAM/
		MILESTONES/ RAMA/ APPROVED MAKE
13	Fire Proof Doors	R.D.G. ENGINEERING / F.T.E./SHAKTI MAT-DOR
14	Steel Windows	AGEW / SEN HARVIC/ DEVAS METAL/ DHIMAN
15	PVC Water Stoppers	CALIPLAST/FIXOPAN
16	Floor Hardener	FOSROC / J.B.ASSOCIATES / MBT / PIDILITE
17	Floor Sealing	FOSROC / J.B.ASSOCIATES/ NINA
18	Light Gauge Cold Rolled 'Z'	ADVANCE / PMC / NSL / TIGER / KIRBY
	Section For Purlins & Cladding	
	Runners	
19	Welding Rods	ADVANI / ESSAB
20	Erection Nuts And Bolts	GKW / F.T. & N.B. LTD. / IS:1367./ HILTI / FISCHER
21	All Sanitary Fittings Like W.C.	HINDUSTAN SANITARY WARE / PARRY WARE

Sr.	Item	Make
No.		
	Pan/ Wash Basin/ Urinals Etc.	
22	All Plumbing Fixtures	JAQUAR(CHROME PLATED)/PLUMBER
23	Glasses For Doors And	MODI GUARD / SAINT GOBAIN / ASAHI
	Windows & Mirrors	
24	Shuttering Plywood	ANCHOR / KITPLY / JAYSHREE / MANGALAM
25	Anti-Termite Treatment	BAYER/ TRISUL/ NOCIL
26	Aluminum Glazing And	INDRAJII ASSOCIATES / SUPREME / CRYSTAL
27	Residence States	
2/	Dricks Deutition Roand	AFFROVED LOCAL WARE.
28	Construction Chamical	NOVAPAN/ DISON/ GREENPLY
29	DVC by DVC Bing	FUSROC / FIDILITE / WIDT
21	C L Pine	TATA / INDAL / ZENITH
31	RHS Soctions	TATA / JINDAL / ZENIIII
32	Falso Coiling Systems	EVEREST / RAMCO
34	Vipul Floor	ARMSTRONG/LC/NITTOBO
35	Soalant Silicono/Polygulnhido	CE / PIDILITE / FOSROC / IBASSOCIATES
36	Epoxy Over Elooring	EOSROC / MBT/CIPV
37	Water Proofing Membrane -	STP/ BITLIMAT
57	Bitumen Based	
38	Non Shrink Grouts	FOSROC/MBT
39	FRP Gutter	Everest Vadodara, Jay Rai Vadodara, Rooffit
40	Bitumen	SHALIMAR TAR PRODUCTS/ MATHURA OIL
		REFINERY
41	Flush Door	Anchor / KIT / Green
42	Deleted	
43	DELETED	
44	Laminates	NOVAPAN/ GREENPLY/ FORMICA
45	Plywood	Century / Archid / GREENPLY / Duro
46	Terrazzo Tile	NITCO/SONA
46	Free Access Flooring	UNITILE - UNITED ACCESS FLOORS P LTD/ TEJAS
47	Paving Stones	UNISTONE OR EQUIVALENT
48	Wax Polish	MANSION OR EQUIVALENT
49	Sanitary Fixtures	HINDWARE/ PARRYWARE
50	Urinal Sensors	SMS DEVICES / ADS/TOSHI
51	Stainless Steel Hinges	CANON/ UNION
52	Door Hardware / Closer	GEZE/ DORMA/ BRITON
53	Locks And Handles	Godrej / DORSET/ Yale / Steel Door Lock
54	Anchor Fastener / Anchor	HILTI/ FISHER
	Bolts	
55	Corner Beads & Specials	ARPITHA OR EQUIVALENT
56	Gypsum Partition & Gypsum Ceiling	INDIA GYPSUM

C.u	Itom	Malea
Sr. No.	Item	Маке
57	Electrodes	ADVANI / ESSAB
58	Mineral Fiber Ceiling System	ARMSTRONG/ NITTOBO/ INDIA GYPSUM/
59	H.T. Bolts	UNBRAKO
60	Steel Doors (General Purpose)	UNBRAKO/SHAKTIMAT -DOR/ DHIMAN
61	DELETED	
62	Aluminum Sections	INDAL / JINDAL/ HINDALCO
63	DELETED	
64	Bare Galvalume sheets for roof & Cladding (Substrate)	NIPON/DONGBU/ BHP/ BLUESCOPE/ SHREE PRECOATED /JSW/ ISPAT
65	Roof / Cladding System Manufacturer	SHREE PRECOATED / CRIL / BLUESCOPE/LLOYD
66	Glass Wool And Related Products/ Mineral Wool & Insulation	UP-TWIGA/ OWENS CORNING/ LLOYDS / TASMAN/ POLYNUM
67	Polycarbonate Sheets	GE PLASTICS / FLEXITUFF/ JAIN
68	Self-Drilling Screws	HILTI/ BUILTEX
69	Logo/ Signs/ Name Plates	SIGNAGE SYSTEMS INDIA
70	Pre - Engineered Building	KIRBY BUILDING / INTERARCH/ LLOYD STEEL/TIGER STEEL/PEBS PENNAR/PHENIX /EVEREST BUILDING/BUILD FAB/TATA BLUESCOPE
71	Ms Sliding Motorized Door	HEIDZ INDIA LTD./GANDHI AUTOMATION
72	DELETED	DELETED
73	G.I. Fitting And Valves	UNION/ZOLOTO/ R Brand
74	Stainless Steel Sink	NIRALI/ KINGSTONE/ NEELKANTH
75	Deleted	
76.	Gunmetal Valve (Fullway Valve)	ZOLOTO/LEADER/GG (Bronze)
77	C.I. Manhole Cover	RIF/B.C/KAJECO / NECO
78	Stone Were Pipe And Gully Traps	HIND/ PERFECT

#### Notes:-

- 1. The bidder must quote the rate considering the above make of materials.
- 2. Before procurement of the all materials bidder shall submit the sample and shall have the same approved by Consultants.
- 3. Alternative makes if any shall be assessed by Consultants & his decision shall binding.

#### **REFERENCE LIST OF BIS CODES**

The General reference list is given below. It is clarified that mode of measurement as per Technical Specifications & Bill of Quantities shall take precedence over these codes. Latest revisions of the following codes should be used

Sr. No.	INDIAN	SUBJECT
	STANDARD	
1.	269	Ordinary, Rapid Hardening And Low Heat Portland Cement
2.	383	Coarse And Fine Aggregates From Natural Sources For Concrete
3.	455	Portland Blast Furnace Slag Cement
4.	650	Standard Sand For Testing Of Cement
5.	1489	Portland Pozzolana Cement
6.	1727	Methods Of Tests For Pozzolanic Materials
7.	2386 PT III	Methods Of Test For Aggregates For Concrete
8.	2386 PT I	Particle Size And Shape
9.	2386 PT 11	Estimation Of Deleterious Materials And Organic Impurities
10.	4031	Methods Of Physical Tests For Hydraulic Cement
11.	4032	Method Of Chemical Analysis Of Hydraulic Cement
12.	383	Coarse And Fine Aggregates From Natural Sources For Concrete
13.	456	Code Of Practice For Plain And Reinforced Concrete
14.	1322	Bitumen Felts For Water Proofing And Damp Proofing
15.	2386 PT I	Test For Particle Size And Shape
16.	2386 PT II	Test For Estimation Of Deleterious Materials And Organic Impurities
17.	2386 PT III	Test For Specific Gravity, Density, Voids, Absorption And Bulking

Sr. No.	INDIAN STANDARD	SUBJECT
18.	2386	Method Of Test For Aggregate For Concrete
19.	2386 PT IV	Mechanical Properties
20.	2645	Specifications For Integral Water Proofing Compounds
21.	432	Mild Steel And Medium Tensile Steel Bars And Hard Drawn Steel Wire And Concrete Reinforcement
22.	432 PT I	Mild Steel And Medium Tensile Bards
23.	456	Code Of Practice For Plain And Reinforced Concrete
24.	516	Methods Of Test For Strength Of Concrete
25.	1139	Hot Rolled Mild Steel, Medium Tensile Steel And High Yield Strength Steel Deformed Bars For Concrete Reinforcement
26.	1199	Method Of Sampling & Analysis Of Concrete
27.	1566	Hard Drawn Steel Wire Fabric For Concrete Reinforcements
28.	1786	Cold Drawn Steel Wire Fabric For Concrete Reinforcements
29.	2502	Code Of Practice For Bending And Fixing Of Bars For Concrete Reinforcement
30.	1077	Common Burnt Clay Building Bricks
31.	2212	Code Of Practice For Brick Work Classification
32.	3102	Of Brunt Clay Solid Bricks Method Of Test For
33.	3495 (PTS I To IV)	Clay Building Work Method For Sampling Of
34.	5454	Clay Building Bricks
35.	1122	Method For Determination Of Specific Gravity & Porosity Of Natural Building Stones

Sr. No.	INDIAN STANDARD	SUBJECT
36.	1124	Method Of Test For Water Absorption Of Natural Building Stones
37	1130	Marble (Blocks, Slabs & Tiles)
38.	205	Non Ferrous Metal Butt Hinges
39.	206	Tee And Starp Hinges
40.	287	Recommendation For Maximum Permissible Moisture Contents Of Timber Used For Different Purpose
41.	303	Plywood For General Purpose
42.	451	Technical Supply Condition For Wood Screws
43.	723	Steel Counter Sunk Head Wire Nails
44.	1003	Timber Paneled And Glazed Shutters
45.	1003 (PT I)	Door Shutters
46.	1003 (PT II)	Window & Ventilators Shutters
47.	1141	Code Of Practice For Seasoning Of Timber
48.	1200 (PT XIV)	Glazing
49.	1200 (PT XXI)	Wood Work And Joinery
50.	1328	Veneered Decorative Plywood
51.	1341	Steel Butt Hinges
52.	1659	Fibre Hard Board
53.	1659	Block Board
54.	1761	Transparent Sheet Glass For Glazing & Framing Purpose
55.	1911	Schedule Of Unit Weights Of Building Material
56.	2191	Wooden Flush Door Shutter (Cellar & Hollow Core Type)

Sr. No.	INDIAN STANDARD	SUBJECT
57.	2191 (PT I)	Plywood Face Panels
58.	2202	Wooden Flush Door Shutters (Solid Core Type )
59.	2202 (PT I)	Plywood Face Panels For Wooden Flush Door Shutters
60.	3618	Phosphate Treatment Of Iron And Steel For Protection Against Corrosion
61.	4021	Timber Door, Window And Ventilator Frames
62.	63	Whiting For Paints
63.	226	Structural Steel (Standard Quality)
64.	277	Specification For Galvanized Steel Sheets (Plain And Corrugated)
65.	800	Code Of Practice For Use Of Structural Steel In General Building Construction
66.	806	Code Of Practice For Use Of Steel Tube In General Building Construction
67.	813	Scheme Of Symbols For Welding
68.	814	Covered Electrodes For Metal Are Welding Of Structural Steel
69.	814 (PT II)	For Welding Sheets
70.	815	Classification And Code Of Covered Electrodes For Metal Are Welding Of Mild Steel And Low Alloy High Tensile Steel
71.	818	Code Of Practice For Safety And Health Requirements In Electric And Gas Welding And Cutting Operation
72.	1938	Steel Doors, Windows And Ventilators
73.	1608	Method For Bend Test For Steel Products Other Than Sheet, Strip, Wire And Tube

Sr. No.	INDIAN	SUBJECT
	STANDARD	
74.	1977	Method Of Tensile Testing Of Steel Products
75.	2062	Structural Steel (Ordinary Quality)
76.	4351	Structural Steel (Fusion Welding Quality)
77.	777	Steel Door, Door Frames
78.	1130	Glazed Earthen Ware Tiles
79.	120 (PT XI)	Marble (Blocks, Slabs And Tiles)
80.	1443	Cement Concrete Flooring Tiles
81.	1661	Code Of Practice For Laying And Finishing Of Cement Concrete Floor In Tiles
82.	2571	Code Of Practice For Application Of Cement Lime Plaster Finishes
83.	102	Code Of Practice For Laying In Situ Cement Concrete
84	103	Ready Mixed Paint, Brushing, Red, Lead Nonsetting, Priming
85.	133	Ready Mixed Paint, Brushing, White Lead, For Priming And General Purpose
86.	137	Enamel, Interior (A) Under Coating (N) Finishing Color As Required
87.	158	Ready Mixed Paint, Brushing, Matt Or Egg Shell Flat, Finishing, Interior, To Indian Standard Color As Required
88.	218	Ready Mixed Paint, Brushing Bituminous, Black, Lead Free, Acid Alkali, Water And Heat Resisting For General Purpose
89.	1200 (PT XII)	Creosote And Anthracene Oil For Use As Wood

## PREAMBLE FOR ELECTRICAL WORK

1	The items given in this schedule are provisional. The Contractor shall be paid for the actual quantity of work executed as measured at the site at the rates tendered. The Owner reserves the right to increase or decrease any of the quantities, or to ommit totally any item of work. Any claim by the Contractor on these accounts will not be entertained.
2	All the items of work given in this schedule of quantities shall be executed strictly in accordance with the latest Indian Standard Specifications and the requirements of the Electricity Supply Authority read in conjunction with the relevant drawings and Specifications.
3	The Contractor shall visit the site and shall satisfy himself as to the conditions under which the work is to be performed. He shall also check and ascertain the location of any existing structure or equipment or any other situation which may affect the work. No extra claim as a consequence of ignorance or on ground of insufficient description will be allowed at a later date.
4	All equipment and material shall be IS approved.
5	All approvals shall be obtained from Owner / Consultant
6	All equipment and material shall be inspected at manufacturer's works as per relevant IS by the Owner or his representative before despatch to site.
7	All vendor drawings shall be approved by the Owner/Consultant before fabrication work starts.
8	All Testing and Commissioning shall be as per relevant IS for equipment and IS:732:1989 for the installation. All these testing records are to be maintained and submitted for Owner / Owner's representative.
9	All items of work under this Contract shall be executed strictly to fulfill the requirements laid down under "Basis of Design" in the specifications. Type of equipment, material specification, methods of installation and testing and type of control shall be in accordance with the specifications, approved drawings and the relevant Indian Standards, however capacity of each component and their quantities shall be such as to fulfill the above mentioned requirement.
10	The unit rate for all equipment or materials shall include cost in INDIAN RUPEES (INR) for equipment and materials including all taxes and duties and also including forwarding, freight, insurance and transport into Contractor's store at site, storage, installation, testing, balancing, commissioning and other works required.
11	The rate for each item of work included in the Schedule of Quantities shall, unless expressly stated otherwise, include cost of :
а	All materials, fixing materials, accessories, appliances tools, plants, equipment, transport, labour and incidentals required in preparation for and in the full and entire execution, testing, balancing, commissioning and completion of work called for in the item and as per Specifications and Drawings.
b	Wastage on materials and labour.

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c	Loading, transporting, unloading, handling/double handling, hoisting to all levels, setting, fitting and fixing in position, protecting, disposal of debris and all other labour necessary in and for the full and entire execution and for the job in accordance with the contract documents, good practice and recognize principles.
d	Liabilities, obligations and risks arising out of Conditions of Contract.
e	All requirements of Specifications, whether such requirements are mentioned in the item or not. The Specifications and Drawings where available, 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.
f	SOQ shall be read in conjuction with technical specification, drawings. In the event of conflict between Schedule of Quantities and other documents including the Specifications and drawings, the most stringent shall apply. The interpretation of the Consultant/Project Manager shall be final and binding.
12	The Contractor shall procure and bring Materials/Equipment to the site only on the basis of drawings approved for construction and not on the basis of Bill of Quantities which are approximate only. This also applies to the Contractor's requisition for Owner supplied materials.
13	The contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structure shall be provided with anchor fasteners.
14	On award of the work, contractor shall submit a schedule of construction in the form of a BAR chart for approval of the Project Manager.
15	On award of the work the contractor shall be issued two (2) sets of consultant's drawings.
16	Shop drawings are detailed working drawings coordinated with other trading work, which incorporate the contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided.
17	All drawings will be made on Auto CAD and colored prints has to be produced for site work.
18	This Schedule shall be fully priced and the extensions and totals duly checked. The rates for all items shall be filled in INK including NIL items.
19	No alteration whatsoever is to be made to the text or quantities of this Schedule unless such alteration is authorised in writing by Consultant. Any such alterations, notes or additions shall, unless authorized in writing, be disregarded when tender documents are considered.
20	In the event of an error occurring in the amount of the Schedule, as a result of wrong extension of the unit rate and quantity, the unit rate quoted by the tenderer shall be regarded as firm and the extensions shall be amended on the basis of rates.
21	Any error in totaling in the amount column and in carrying forward total shall be corrected. Any error, in description or in quantity, omission of items from this Schedule shall not vitiate this Contract but shall be corrected and deemed to be variation required by the Consultant/Project Manager.

22	Rates have been called for a number of items of works, as alternatives which, for the present do not form part of the total value of tender. However the rates for these items shall be quoted, with due care so that in the event of choice of an alternative item of work, said rate shall form part of the contract and shall not violate the contract any way.
23	The contractor shall , from time to time, clear away all debris and excess materials accumulated at the site failing which the same shall be done by Project Manager at contractor's risk and cost and cost of clean up shall be deducted from the contractors prorata bill.
24	After the fixtures, equipment and appliances have been installed and commissioned, contractor shall cleanup the same and remove all plaster, paints, stains, stickers and other foreign matter or discoloration leaving the same in a ready to use condition.
25	On completion of all works, contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done by the Project Manager at the Contractor' risk and cost. Cost of the cleanup shall be deducted from the contractor's bills on pro-rata basis in proportion to his contact value.
	GENERAL NOTES :-
А.	<u>CIRCUIT CUM POINT WIRING</u>
	The rates for all point wiring items shall also include supplying and fixing of the following:
1	This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.
2	Approved Powder Coated lighting channel of size 38x38mm, 1mm thick with clamps to suspend from false ceiling grid.
5	All fixing accessories such as clips, brass screws etc.
7	Embedding conduits and accessories in walls and floors etc. during construction and / or cutting chases (with chase cutting machine) and making good the same as necessary in the case of concealed conduit work.
8	Switch, socket outlet and necessary blank plates wherever required.
9	PVC insulated copper conductor stranded flexible PVC insulated wire of Green colour or Green colour with yellow band for earthing of fixtures, outlet boxes and third pin of socket outlet.
10	Repainting of conduits, outlet boxes and junction boxes wherever damaged.
11	All wires shall be IS approved, 1100 volt grade, stranded flexible PVC insulated, FRLS wires.
12	Suitable rating of plugs top shall also be provided within the quoted rates for all industrial type and splash proof socket outlets.
13	Separate neutral and earthing wire shall be provided for each circuit.
14	Lighting and power circuit to be kept separate.
С.	CABLES, MAINS AND SUB MAINS
	The rate shall also include the following :
1	This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.
2	Cable supporting structural members including spacers, clamps etc, bushes and other fittings .

3	Providing all fixing accessories such as clamping devices nuts, bolts and screws.
4	Wherever the cables are of Copper / Aluminium and bus bars of copper bimetallic lugs shall be used.
5	All cable shall be laid with one diameter gap.
6	All cables shall be IS approved.
7	All Cable Glands shall be Double compression glands.
8	Fire retardent paint one meter on both side of wall penetration and at termination as per specifications.
9	Burried LT cables to be laid atleast 750 mm below ground.
D	DISTRIBUTION BOARDS
	The rates for the distribution boards apart from the Breakers and instruments shall also include the following :
1	This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.
2	Supporting rigid steel framework.
3	Cubicle type, 14 gauge CRCA sheet steel enclosed.
4	Complete with interconnections and distribution bus bars.
5	Proper bonding to earth.
6	Painting/lettering on Breakers and distribution boards, the location they serve, providing on each panel its circuit diagram.
7	Providing cable clamps / supports within distribution boards cable alley.
8	TPN ACB's / MCCB's shall mean 3 pole ACB's / MCCB's with adequate size of neutral link.
9	All MCB's shall be of minimum 10 KA breaking capacity.
10	The breaking capacity of MCCB's are mentioned panel wise. All MCCB's shall be with thermal magnetic releases upto 200 amps and miroprocessor based above 200 amps capacity, unless specified otherwise.
11	All motor feeders MCCBs shall be of motor duty.
12	2 Distribution panels shall be Powder Coated with Siemens gray paint shade no. RAL-7032 of IS-5.
13	<sup>3</sup> Degree of protection for following type of distribution panel enclosure shall be as per IS:13947-1993.
a	IP 52 for indoor panels.
b	IP 65 for outdoor panels.
C	IP 42 for final distribution boards.
14	Image: All MCCB's shall be provided with operating mechanism for door interlock.
15	Current density of aluminium busbars shall be 0.8 A/sq mm and current density of copper shall be 1.4A/sq.mm
16	$\frac{1}{2}$ Tinned copper / GI earth bus as specified in the BOQ shall be provided through out the length of each board.
1	
1/	All measuring instruments (Meters) shall be of digital electronic with LED of approved make and compatible with BAS.

a.	All panels shall have provision of the following:
b.	Pad locking of Switch board doors.
с	Pad locking of MCCB's handles in "OFF" Position.
19	All MCB's used for protection of resistive and lightly inductive load shall be type "B" characteristic and inductive transducers in Main Switch Board sections.(motor) load shall be of type "C" characteristic and discharge lamps and UPS etc. shall be of type D characteristic.
20	All PTs / control transformer shall be provided with centre tap earth secondary.
Ε	EARTHING INSTALLATION (FOR POWER DISTRIBUTION SYSTEMS)
	Rates shall also include the following :
1	This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.
2	All fixing accessories such as saddles, screws rawl plugs etc.
3	Jointing by rivetting and brazing after rivetting in case of copper and welding / bolting in case of GI Earthing.
4	Cutting chases / holes and making good the same wherever required.
5	Effecting adequate and proper interconnections.
6	Use of copper thimbles.
7	Earthing system shall comply to IS:3043-1987.
8	All earthing pits shall be interconnected.
9	All equipment motors, DB's, panels to be connected on both ends (double earthing) with suitable strip / wires.
10	Soil resistingly test shall be conducted of the area where earth pits are to be located.
G	SUPPLY & INSTALLATION OF LIGHTING FIXTURES
<b>G</b> 1	<b>SUPPLY &amp; INSTALLATION OF LIGHTING FIXTURES</b> This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.
G 1 2	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :
G 1 2	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.
G 1 2	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.
G 1 2	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.
G 1 2	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.
G 1 2 H	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.         LT CONTROL CABLES
G 1 2 H	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.         LT CONTROL CABLES         The rates under this section shall also include the following:
G 1 2 H 1	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.         LT CONTROL CABLES         The rates under this section shall also include the following:         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.
G 1 2 H 1 2	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.         LT CONTROL CABLES         The rates under this section shall also include the following:         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         Providing and fixing approved cable supports and grouting the same as required.
G 1 2 H 1 2 3	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as : <ul> <li>a. Including All lamps, accessories unless otherwise specified.</li> <li>b. Internal wiring between accessories.</li> <li>c. Earthing terminal.</li> <li>d. Complete provision for supply &amp; installation.</li> </ul> IT CONTROL CABLES           The rates under this section shall also include the following:           This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.           Providing and fixing approved cable supports and grouting the same as required.           Effecting proper connections at terminations.
G 1 2 H 1 2 3 3 4	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as : <ul> <li>a. Including All lamps, accessories unless otherwise specified.</li> <li>b. Internal wiring between accessories.</li> <li>c. Earthing terminal.</li> <li>d. Complete provision for supply &amp; installation.</li> </ul> LT CONTROL CABLES           The rates under this section shall also include the following:           This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.           Providing and fixing approved cable supports and grouting the same as required.           Effecting proper connections at terminations.           Ensuring that provision is left in buildings and trenches as the work proceeds, for incorporating of cable supports at a later date.
G 1 2 H 1 2 3 4 5	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.         LT CONTROL CABLES         The rates under this section shall also include the following:         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         Providing and fixing approved cable supports and grouting the same as required.         Effecting proper connections at terminations.         Ensuring that provision is left in buildings and trenches as the work proceeds, for incorporating of cable supports at a later date.         Providing all, fixing accessories such as clamping devices, nuts and bolts etc.
G 1 2 H 1 2 3 4 5 6	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as :         a. Including All lamps, accessories unless otherwise specified.         b. Internal wiring between accessories.         c. Earthing terminal.         d. Complete provision for supply & installation.         LT CONTROL CABLES         The rates under this section shall also include the following:         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         Providing and fixing approved cable supports and grouting the same as required.         Effecting proper connections at terminations.         Ensuring that provision is left in buildings and trenches as the work proceeds, for incorporating of cable supports at a later date.         Providing all, fixing accessories such as clamping devices, nuts and bolts etc.         Clamping to supports where laid in trenches.
G 1 2 H 1 2 3 4 5 6 7	SUPPLY & INSTALLATION OF LIGHTING FIXTURES         This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.         The rates shall include all components that may be required to make the supply & installation complete in all respects such as : <ul> <li>a. Including All lamps, accessories unless otherwise specified.</li> <li>b. Internal wiring between accessories.</li> <li>c. Earthing terminal.</li> <li>d. Complete provision for supply &amp; installation.</li> </ul> LT CONTROL CABLES           The rates under this section shall also include the following:           This schedule of Quantities shall be read in conjuction with the technical specification, General & Special conditions as well as all tender drawings.           Providing and fixing approved cable supports and grouting the same as required.           Effecting proper connections at terminations.           Ensuring that provision is left in buildings and trenches as the work proceeds, for incorporating of cable supports at a later date.           Providing all, fixing accessories such as clamping devices, nuts and bolts etc.           Clamping to supports where laid in trenches.           Providing proper supports for cable terminals as called for.

# Bill of Quantities

CATEGORY : CIVIL WORKS - ANNEX AREA											
SR. NO	WORK ITEM	UNIT	Total	GRAND TOTAL	Rate per unit	Total Amount					
1	Plaster Dismantling	m <sup>2</sup>	6042.78	6042.78							
2	20thk External Wall finish -sand faced cement plaster	m <sup>2</sup>	6042.78	6042.78							
3	12thk Internal wall finish plaster	m <sup>2</sup>	5527.47	5527.47							
4	External Paint	m <sup>2</sup>	6042.78	6042.78							
5	Internal Paint	m <sup>2</sup>	5527.47	5527.47							
6	100 dia PVC D/T Pipe	m	246.90	246.90							
7	Tremix Flooring	m <sup>2</sup>	1595.94	797.97							
8	Doors	m <sup>2</sup>	142.87	142.87							
9	Windows	m <sup>2</sup>	51.00	51.00							
10	Ventilator	m <sup>2</sup>	5.91	5.91							
11	Rolling Shutter	m <sup>2</sup>	93.60	93.60							

CAT	EGORY : CIVIL WORKS - RM GO	DOWN	J			
SR. NO	WORK ITEM	UNIT	Total	GRAND TOTAL	Rate per unit	Total Amount
1	Excavation (Upto 2m) in soil	m <sup>3</sup>		177.02		
	For Foundation		142.02			
	For Plinth Beams		16.28			
	Excavation In Plinth		18.72			
2	Backfilling With Excavated Soil	m <sup>3</sup>	119.42	119.42		
3	Disposal of surplus excavated material	m <sup>3</sup>		57.61		
	For Foundations		22.61			
	For Plinth Beams		16.28			
	Excavation In Plinth		18.72			
4	Reinforcing Bars Deformed	Mt		13.88		
	For Foundations		1.09			
	For Plinth Beams		2.89			
	For Grade Slab		9.90			
5	Shuttering For Substructure	m <sup>2</sup>		181.60		
	For Foundations		33.60			
	For Plinth Beams		148.00			
	Shuttering For Superstructure					
6	Upto 10m	m <sup>2</sup>		99.00		
	For Slabs		99.00			
7	PCC	m <sup>3</sup>		145.21		
	For Foundations		5.81			

	For Plinth Beams		7.40		
	Below Grade Slab		132.00		
8	RCC For Substructure	m <sup>3</sup>		39.00	 
	For Foundations		16.80		 
	For Plinth Beams		22.20		 
9	RCC For Grade Slab	m <sup>3</sup>	198.00	198.00	
10	Rubble Soling Base	m <sup>3</sup>	303.60	303.60	 
11	Rolling Shutter	m <sup>2</sup>	2.00	2.00	 
12	Structural Steel	MT	46.20	46.20	 
13	Painting to Structural Steel	m <sup>2</sup>	1617.00	1617.00	
14	GI Sheeting	m <sup>2</sup>	1452.00	1452.00	
15	Polycarbonate Sheeting	m <sup>2</sup>	726.00	726.00	
16	100 dia PVC D/T Pipe	m	84.00	84.00	
17	Tremix Flooring	m <sup>2</sup>	1320.00	1320.00	

### Bill of Quantities for Electrical

# ELECTRICAL BOQ FOR ANNEX BLOCK REFURBISHING

			Ten	der Part		S	upply Bill	Inst		
S. No.	Description	Uni t	QTY.	Suppl y Rate( Rs.)	Install. Rate(Rs .)	Qty ·	Amount(Rs .)	Qty	Amount(Rs .)	Remar k
	PART -A									
1	Supply & Installation of cables with accessories									
1.1	Supply of XLPE insulated L.T copper armoured cables									
1.1.1	3 x 1.5 Sq.mm	Mtr.	100							
1.1.2	3 x 2.5 Sq.mm	Mtr.	350							
1.1.3	4 x 4 Sq.mm	Mtr.	200							
1.1.4	4 x 10 Sq.mm	Mtr.	100							
1.1.5	4x16Sq.mm	Mtr.	QR							
1.1.6	4x25Sq.mm	Mtr.	QR							
1.1.7	4x35Sq.mm	Mtr.	QR							
1.1.8	4x50Sq.mm	Mtr.	QR							
1.1.9	4x70Sq.mm	Mtr.	QR							

2	Supply & installation of 2.5 Sq.mm multistrand copper conductor flexible cable						
2.1.1	Red color	Mtr.	500				
2.1.2	Yellow color	Mtr.	500				
2.1.3	Blue color	Mtr.	500				
2.1.4	Black color	Mtr.	1500				
3	Supply & installation of 1.5 Sq.mm multistrand copper conductor flexible cable						
3.1.1	Green color	Mtr.	1000				
4	Supply of PVC insulated copper flexible cables						
4.1.1	3C x 2.5 Sq.mm	Mtr.	200				
4.1.2	1C x 2.5 Sq.mm	Mtr.	200				
4.1.3	1C x 4 Sq.mm	Mtr.	QR				
4.1.4	1C x 6 Sq.mm	Mtr.	QR				
5	Supply , glanding and temination of following L.T cables with heavy duty lugs (copper lugs for alumium and copper cables ) heavy duty double compression cable glands						
<b>5.1(A</b> )	Copper armoured cables						
а	3 x 1.5 Sq.mm	Set	25				

b	3 x 2.5 Sq.mm	Set	45				
с	4 x 4 Sq.mm	Set	25				
d	4 x 10 Sq.mm	Set	16				
e	4x16Sq.mm	Set	QR				
f	4x25Sq.mm	Set	QR				
g	4x35Sq.mm	Set	QR				
h	4x50Sq.mm	Set	QR				
i	4x70Sq.mm	Set	QR				
6	Supply , glanding and temination of following L.T cables with heavy duty lugs (copper lugs for alumium and copper cables ) heavy duty double compression cable glands						
<b>6.1</b> (A )	Copper flexible cables						
а	3C x 2.5 Sq.mm	Set	50				
	PART - B						
7	Supply & Installation of Lighting Fixtures with accessories						
	Supply & Installation of IB LEDS IMRC01-36WH , Recessed Mounted 2x2 LED with Diffuser-Quadglo OR Equivalent						
7.1	Epoxy White Powder Coated ,CRCA housing ,Efficient PMMA/PS from Visor,High efficiency LED >120 lm/W,CRI >70,Long life 40000 hrs. at L70,No UV/IR radiation,CCT tolerance as per ANSI NEMA,in 4000K/6500K,IP 20	Nos.	44				

	IB LED IIBN03-18XX LED Aluminium battan OR Equivalent						
7.1.1	Excluded Aluminium housing ,Efficient PMMA/ front visor,High efficiency LED >120 lm/W,CRI >80,Longlife 50000 hrs. at L70,No UV/IR radiation,CCT tolerance as per ANSI NEMA,Option available in 4000K/5700K/6500K,IP 20.	Nos.	82				
	IB LED IIEL03-36XX LED Channel OR Equivalent						
7.1.2	Polycarbonate Housing,Polycarbonate Diffuser,No UV & IR Radiation,Safe operating voltage range - 140-280VAC,Power factor >0.95; THD <10%,Surge Protection - 3.5 KV min. at CM & DM,CRI >80,Working humidity - 10% to 90% RH,IP 65,Driver efficiency >0.85,CCT - 5700K.	Nos.	26				
	IB LED IIEL03-36XX Prim IP-65 (Dust & Jet Proof) OR Equivalent						
7.1.3	Polycarbonate Housing,Polycarbonate Diffuser,No UV & IR Radiation,Safe operating voltage range - 140-280VAC,Power factor >0.95; THD <10%,Surge Protection - 3.5 KV min. at CM & DM,CRI >80,Working humidity - 10% to 90% RH,IP 65,Driver efficiency >0.85,CCT - 5700K.	Nos.	102				
	IB LED IRDLS21RD-12XX (4000/5700/6500degK) Surface Mounted LED Downlighter-Ray Circle OR Equivalent						
7.1.4	Epoxy white powder coated die cast aluminium housing,Efficient PMMA front visor,Highly reflective guide plate,High efficiency LED >120 lm/W,CRI >80;,Longlife 30000 hrs. at L70,No UV/IR radiation,CCT tolerance as per ANSI NEMA,CCT tolerance as per ANSI NEMA,IP 20.	Nos.	35				
	IB LED IRDLS21RD-18XX (4000/5700/6500degK) Surface Mounted LED Downlighter-Ray Circle OR Equivalent						
7.1.5	Epoxy white powder coated die cast aluminium housing,Efficient PMMA front visor,Highly reflective guide plate,High efficiency LED >120 lm/W,CRI >80;,Longlife 30000 hrs. at L70,No UV/IR radiation,CCT tolerance as per ANSI NEMA,CCT tolerance as per ANSI NEMA,IP 20.	Nos.	30				
	PART - C						

8	Supply and installations of Ceiling fans & Exhaust fans						
8.1	Supply of (48") 1200 mm sweep ceiling fan with electronic regulators	Set	15				
8.1.1	Supply of industrial type heavy duty ,air circulators , wall mounting fans 18" (450 mm) suspended from the truss / on wall / pedastal	Set	2				
8.1.2	Supply of wall mounting fans 16" (400mm) light duty for office	Set	QR				
8.1.3	Supply of Domestic light duty exhaust fan 12" (300mm), 1350 rpm , 1 phase with double ball bearing with grill	Set	10				
	PART - D						
9	Supply and installation of earthing system						
9.1	Chemical earthing electrode	Set	QR				
9.1.1	Copper plate type earthing electrode	Set	QR				
9.1.2	Hot dip G.I strip of size 50 X 6 mm	Mtr.	400				
9.1.3	Hot dip G.I strip of size 25 X 3 mm	Mtr.	400				
9.1.4	Hot dip G.I strip of size 25 X 6 mm	Mtr.	QR				
9.1.5	Copper strip of size 40 X 6 mm	Mtr.	QR				
9.1.6	Copper strip of size 25 X 3 mm	Mtr.	QR				
9.1.7	8 SWG copper wire	Mtr.	QR				
9.1.8	10 SWG copper wire	Mtr.	250				
9.1.9	14SWG copper wire	Mtr.	75				
	PART -E						
10	Supply and installation of perforated type, G.I Hot Dip type cable tray of height 50 mm (2.0 mm thick)						
10.1	Straight length						
10.1.1	600 mm wide	Mtr.	QR				
10.1.2	400 mm wide	Mtr.	QR				
10.1.3	300 mm wide	Mtr.	100				
10.1.4	200 mm wide	Mtr.	QR				
10.1.5	100 mm wide	Mtr.	50				
10.1.6	50 mm wide	Mtr.	QR				

	PART - F						
11	Supply and installation of PVC & MS Conduit material for Light point wiring						
11.1	Light point wiring in PVC conduit						
11.1.1	20 mm PVC conduit	Mtr.	QR				
11.1.2	25 mm PVC conduit	Mtr.	QR				
11.1.3	32 mm PVC conduit	Mtr.	QR				
11.2	Light point wiring in MS conduit						
11.2.1	20 mm MS conduit	Mtr.	QR				
11.2.2	25 mm MS conduit	Mtr.	1050				
11.2.3	32 mm MS conduit	Mtr.	QR				
11.3	Supply of Casing and caping of 25 mm size with complete accessorie	Mtr.	300				
11.4	Supply of Casing and caping of 50mm size with complete accessorie	Mtr.	50				
12	Wiring in Heavy duty M.S. conduit						
12.1	Supply & Point wiring of <b>primary point</b> for <b>light &amp; Socket</b> with 3 core (phase, Neutral & earth) copper wires in exposed or concealed M.S. conduit for all lights , 2.5 sq.mm. For mains from SLDB to switch board or SLDB to first light point.	Mtrs.	QR				
12.2	Supply & Point wiring of <b>Secondary point</b> for <b>light with &amp;</b> <b>Socket</b> 3 core (phase, Neutral & earth) copper wires in exposed or concealed M.S. conduit wherever used for all lights , 1.5 sq.mm. wires from first light point to sub sequent light points.	Mtrs.	QR				
12.3	Supply & Point wiring for <b>Primary point for fans with 3 core 1.5</b> sq mm (phase, Neutral & earth) copper wires in exposed or concealed M.S. conduit for all lights, fans, WC ex. Fans etc. from First light to subsequent light points.	Mtrs.	QR				
	PART -G						
13	Supply & Installation of Distribution Boards and Power socket outlet with necessary mounting accessories box etc.						
13.1	Industrial type						
13.1.1	16 A, 4 Way 3 Phase MCB DB along with 40 A DP ELCB one each phase and 1 number 63 A TPN MCB as incomer	Set	QR				

13.1.2	16 A, 6 Way 3 Phase MCB DB along with 40 A, DP ELCB one each phase and 1 number 63A TPN MCB as incomer	Set	QR				
13.1.3	20A, 240 V, 3 pin industrial Rayrolle socket plug and 20 Amp SP MCB controlling socket outlet - all housed in 16 swg sheet steel enclosure.	Set	3				
13.1.4	20 A, 440 V, 5 pin Industrial Reyrolle socket with plug and 20 Amp TPN MCB controlling socket outlet - all housed in 16 swg sheet steel enclosure.	Set	2				
13.1.5	32 A, 440 V, 5 pin Industrial Reyrolle socket with plug and 20 Amp TPN MCB controlling socket outlet - all housed in 16 swg sheet steel enclosure.	Set	2				
13.1.6	63 A, 440 V, 5 pin Industrial Reyrolle socket with plug and 20 Amp TPN MCB controlling socket outlet - all housed in 16 swg sheet steel enclosure.	Set	2				
13.2	Supply of Decorative type switch boards						
13.2.1	Decorative type combined switch board with 1 LAN point and 1 telephone point with acessories to mount on DLP trunking	Set	6				
13.2.2	Supply & Installation of concealed box for switch of following size . Modular type.	Set	10				
13.2.3	12 way concealed box with white plate with switch & socket	Set	10				
13.2.4	8 way concealed box with white plate with switch & socket	Set	32				
13.2.5	6 way concealed box with white plate with switch & socket	Set	5				
13.2.6	4 way concealed box with white plate with switch & socket	Set	6				
13.2.7	3 way concealed box with white plate with switch & socket	Set	5				
13.2.8	2 way concealed box with white plate with switch	Set	11				
13.2.9	1 way concealed box with white plate with switch	Set	5				
13.3. 0	Regulator module (stepless) with a switch	Set	15				
	PART- H						
14	Supply and installation of M.S structural steel						
14.1	Fabrication of base / mounting frames for panels , cable tray supports , mounting bracket , etc. From M.S channel , angle , flats as per the requirement with painting of one coat of redoxide and one coat of approved shade of paint.	Kgs.	100				
14.1.1	Anchor fastners 75 * 8 mm	Set	10				
14.1.2	Anchor fastners 100 * 12 mm	Set	10				

14.1.3	Anchor fastners 120 * 12 mm	Set	10				
14.1.4	Anchor fastners 150 * 12 mm	Set	10		1		
14.1.5	Anchor fastners 100 * 10 mm	Set	10				
14.1.6	Anchor fastners 120 * 10 mm	Set	10				
14.1.7	Emergency lights (legrand make)	Set	6				
	PART -I						
15	Supply & installation of Junction boxes, Cat -6 Cable						
15.1	Supply of polycobonate junction boxes 100 x 100 mm with 4 way 10 A , terminals and						
15.1.1	duel cable entry provision	Set	6				
15.1.2	Supply of DLP trunking						
а	DLP plastic trunking with cover , partition plate of size 150 x 50 (duel compartment) with all required acessories	Mtrs	110				
b	DLP plastic trunking acessories - end cap	Set	10				
с	DLP plastic trunking acessories - 90 degree bend (external / Internal)	Set	20				
d	DLP plastic trunking acessories -T joint (Flat junction)	Set	10				
15.1.3	Supply of 12 pair JFA cable with all acessories such as J.B,Tag box etc	Mtrs	150				
	PART -J						
16	Supply & installation of Communication System						
16.1	Supply &Installation of following multipair telephone tag blocks with strip connectors complete with MS box having hinged door, duly painted.						
a	For 5 pairs	Set	QR				
16.2	Supply & Installation of following 0.51 mm dia, annealed copper PVC insulated unarmoured telephone cables of DELTON / FINOLEX make in the above concealed conduits.in ground including necessary excavation and backfilling in soft soil, sand bricks etc. in an approved manner or installed on wall / cable tray with necessary clamping materials, hardware.						
а	5 pair cable	Mtrs.	620				
16.3	Supply & installation of telephone socket outlet box with enclosure on wall with plug.	Nos.	6				

16.4	Supply & Installation of following sizes of PVC conduits and all accessories, junction boxes, bends, pull boxes, cleats, conduits, fixed to the ceiling or wall in an approved manner at a regular interval of 600 mm (for UTP cable)						
a	20 mm dia PVC conduit, 1.6 mm wall thickness	Mtrs.	360				
b	25 mm dia PVC conduit, 1.6 mm wall thickness	Mtrs.	125				
16.5	Telephone Instruments (Makes - Panasonic / Beetal / Motorola)	Nos.	6				
16.6	Desk Top ( Computers )( Makes - IBM / Dell/ HP / Compaq)	Nos.	5				
16.7	Supply & Insallation of CAT - 6 cable in the above conduits.	mtrs.	480				
16.8	Supply & installation of Data outlet with Bck box and plate RJ 45 with enclosure mounted on the wall.	Nos.	3				
16.9	Supplying & Fixing modular blanking plate on exiting modular plate/ switch box.						
а	RJ-11 Telephone Socket	Nos.	10				
b	RJ-45 Lan Socket	Nos.	15				
	PART - K						
17	Supply & Installation of Air Conditionar Unit						
17.1	Supply of Hitachi Make Cassette & Hi Wall Unit ( R-22)						
a	3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )	No.	1.0				
a b	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> </ul>	No. Nos.	1.0 7.0				
a b 17.2	3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi ) 2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi ) Supply & Installation of PVC Pipe	No. Nos.	1.0				
a b 17.2 a	3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi ) 2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi ) Supply & Installation of PVC Pipe 25mm PVC Drain Pipe with Heatlone Insulation.	No. Nos. Rmt	1.0 7.0 175				
a b 17.2 a b	<ul> <li>3.0 TR Cassette Unit (Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated (Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> </ul>	No. Nos. Rmt Rmt	1.0 7.0 175 75				
a b 17.2 a b c	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> <li>Copper Tube 5/8" X 3/8"</li> </ul>	No. Nos. Rmt Rmt Rmt	1.0 7.0 175 75 100				
a b 17.2 a b c d	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> <li>Copper Tube 5/8" X 3/8"</li> <li>Copper Tube 3/4" X 3/8"</li> </ul>	No. Nos. Rmt Rmt Rmt Rmt.	1.0 7.0 175 75 100 100				
a b 17.2 a b c d 17.3	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> <li>Copper Tube 5/8" X 3/8"</li> <li>Copper Tube 3/4" X 3/8"</li> <li>For MS Stand for Outdoor unit.</li> </ul>	No. Nos. Rmt Rmt Rmt Rmt.	1.0 7.0 175 75 100 100				
a b 17.2 a b c d 17.3 a	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> <li>Copper Tube 5/8" X 3/8"</li> <li>Copper Tube 3/4" X 3/8"</li> <li>For MS Stand for Outdoor unit.</li> <li>Cassette unit</li> </ul>	No. Nos. Rmt Rmt Rmt Rmt. No.	1.0 7.0 175 75 100 100 1				
a b 17.2 a b c d 17.3 a b	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> <li>Copper Tube 5/8" X 3/8"</li> <li>Copper Tube 3/4" X 3/8"</li> <li>For MS Stand for Outdoor unit.</li> <li>Cassette unit</li> <li>Split Unit</li> </ul>	No. Nos. Rmt Rmt Rmt. Rmt. No. Nos.	1.0 7.0 175 75 100 100 100				
a b 17.2 a b c d 17.3 a b c	<ul> <li>3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )</li> <li>Supply &amp; Installation of PVC Pipe</li> <li>25mm PVC Drain Pipe with Heatlone Insulation.</li> <li>32mm PVC Drain Pipe with Heatlone Insulation.</li> <li>Copper Tube 5/8" X 3/8"</li> <li>Copper Tube 3/4" X 3/8"</li> <li>For MS Stand for Outdoor unit.</li> <li>Cassette unit</li> <li>Split Unit</li> <li>Drain Pump</li> </ul>	No. Nos. Rmt Rmt Rmt Rmt. No. Nos. No.	1.0 7.0 175 75 100 100 100 1 2.0				
a b 17.2 a b c d 17.3 a b c d	3.0 TR Cassette Unit ( Makes - Mitsubishi / Blue Star / Hitachi )         2.0 Tr Hi Wall Unit 3 star rated ( Makes - Mitsubishi / Blue Star / Hitachi )         Supply & Installation of PVC Pipe         25mm PVC Drain Pipe with Heatlone Insulation.         32mm PVC Drain Pipe with Heatlone Insulation.         Copper Tube 5/8" X 3/8"         Copper Tube 3/4" X 3/8"         For MS Stand for Outdoor unit.         Cassette unit         Split Unit         Drain Pump         2 Pole MCB , 25 A	No. Nos. Rmt Rmt Rmt. No. Nos. Nos.	1.0         7.0         175         75         100         100         100         2.0         7.0				