PLANNING, DESIGN, FABRICATION, SUPPLY, ERECTION, TESTING, COMMISSIONING AND TRIAL RUN (3 MONTHS) INCLUDING CIVIL, PEB, MEP, FIREFIGHTING WORKS FOR MILK CHILLING UNIT (10000 LPD), STORAGE FACILITY FOR MILK (10 MT) AND COLD STORAGE (300 MT), COMPLETE IN ALL RESPECT ON TURNKEY BASIS, WITH ANNUAL MAINTENANCE AND TECHNICAL OPERATIONS OF THREE YEARS AT HAFED MEGA FOOD PARK, PRIMARY PROCESSING CENTER YAMUNANAGAR, HARYANA

Issued By:
Haryana State Cooperative Supply and Marketing Federation Limited
HAFED Building, Sector 5, Panchkula, Haryana 134108

Name of work: -	Planning, Design, Fabrication, Supply, Erection, Testing, Commissioning and Trial Run (3 Months) including Civil, PEB, MEP, Firefighting Works for Milk Chilling Unit (10000 LPD), Storage Facility For Milk (10 MT) And Cold Storage (300 MT), Complete In all Respect On Turnkey Basis, with annual maintenance and technical operations of three years At HAFED Mega Food Park, Primary Processing Center Yamunanagar, Haryana
Estimated cost:	Rs.998.86 Lakhs
Time Limit: -	6 Months
Earnest Money:	Rs. 9.98 Lakhs

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SECTION-1 (I): PRESS NOTICE

HAFED
NOTICE INVITING TENDERS

E-Tender is invited from the experienced reputed bidders for the following work for HAFED Mega Food Park at PPC Yamunanagar, Haryana.

Name of the Work	**Estimated Cost (Rs. in Lakhs)**	**Bid Security / Earnest Money (in Rs. Lakhs)**	**Cost of Bid Document + E-tendering Fee (Rs.)**	**Time Limit**	**Date and time for bid preparation & submission**
Planning, Design, Fabrication, Supply, Erection, Testing, Commissioning and Trial Run (3 Months) including Civil, PEB, MEP, Firefighting Works for Milk Chilling Unit (10000 LPD), Storage Facility For Milk (10 MT) And Cold Storage (300 MT), Complete In all Respect On Turnkey Basis, with annual maintenance and technical operations of three years At HAFED Mega Food Park, Primary Processing Center Yamunanagar, Haryana	998.86	9.98	6000/- (5000+1000)	6 Months	20.05.2022 at 16:01 Hrs to 20.06.2022 at 17:00 Hrs

- The eligibility criteria for the bidders have been defined in the Tender documents.
- The tender document containing details of required work, quantity, specifications, e tendering schedule etc. and other terms & conditions are available on e-tendering portal, i.e.- http://etenders.hry.nic.in
- The interested parties may download the tender document and must remit the funds on or before 18.06.2022 at 17:00 Hrs
- The date of bid submission is from 20.05.2022 at 16:01 Hrs to 20.06.2022 at 17:00 Hrs through e-Tender portal as mentioned above
- Pre- Bid meeting will be held on 30.05.2022 at 11.00 Hrs. At HAFED Corporate Office, Sector-5, Panchkula, Haryana.
- The technical bids will be opened on 21.06.2022 at 11.00 Hrs at HAFED Corporate Office, Sector-5, Panchkula (Haryana). The schedule of opening of financial bids will be notified on the e-procurement portal separately after opening of the technical bids
- HAFED reserve the right to reject any/all tenders without assigning any reason whatsoever.

Managing Director

SECTION-1 (II):
DETAILED NOTICE INVITING TENDER/BIDS

E-Tender is invited from the experienced reputed bidders for the following work for HAFED Mega Food Park at IMT Rohtak, Rohtak, Haryana.

Name of the Work	**Estimated Cost (Rs. in Lakhs)**	**Bid Security / Earnest Money (in Rs. Lakhs)**	**Cost of Bid Document + E-tendering Fee (Rs.)**	**Time Limit**	**Date and time for bid preparation & submission**
Planning, Design, Fabrication, Supply, Erection, Testing, Commissioning and Trial Run (3 Months) including Civil, PEB, MEP, Firefighting Works for Milk Chilling Unit (10000 LPD), Storage Facility For Milk (10 MT) And Cold Storage (300 MT), Complete In all Respect On Turnkey Basis, with annual maintenance and technical operations of three years At HAFED Mega Food Park, Primary Processing Center Yamunanagar, Haryana	998.86	9.98	6000/- (5000+1000)	6 Months	20.05.2022 at 16:01 Hrs to 20.06.2022 at 17:00 Hrs

1. Under this process, the Technical online bid Application as well as online Price Bid shall be invited at single stage under two covers i.e. Technical & Financial Envelope. Eligibility and qualification of the Applicant will be first examined based on the details submitted online under first cover (Technical) with respect to eligibility and qualification criteria prescribed in this Tender Document. The Price Bid under the second cover shall be opened for only those Applicants whose Technical Applications are responsive to eligibility and qualification requirements as per Tender Document.

2. The payment for Tender Document Fee and e-Service Fee shall be made by eligible bidders/contractors online directly through Debit Cards & Internet Banking Accounts and the payment for EMD can be made online directly through RTGS/NEFT or OTC Please refer to 'Online Payment Guideline' available at the Single e-Procurement portal of GoH (Govt. of Haryana) and also mentioned under the Tender Document. Further to that, the EMD also will be accepted in the form of Bank Guarantee which should be remain valid for 165 days from date of Technical bid opening. In case of Bank Guarantee, the same is required to scan & upload in the online portal. Original Bank Guarantee should be submitted to HAFED Office, Panchkula addressing to Managing Director of HAFED & mentioning the DNIT details on the top of the cover within 3 days of Technical Bid Opening.

3. Intending bidders will be mandatorily required to online sign-up (create use account) on the website https://etenders.hry.nic.in to be eligible to participate in the e-Tender. **The intended bidders fails to pay EMD online or submit EMD in the form of Bank Guarantee during the bid submission shall not be allowed to submit his/her bids for the respective event/Tenders & their bids will be summarily rejected.**

4. The interested bidders must remit the funds (Tender Document Fee, e-Service Fee & others as mentioned in the Portal) at least T + 1 working day (Transaction + One Day) in advance i.e. **on or before 18.06.2022 and make payment Vis RTGS/NEFT or OTC to the beneficiary account number specified under the online generated challan. The intended bidder/Agency thereafter will be able to successfully verify their payment online, and submit their bids on or before the expiry date & time of the respective event/Tenders at** https://etenders.hry.nic.in

The interest bidders shall have to pay mandatorily e-Service fee (under document fee – Non refundable) of Rs. 1000/- (Rupee One Thousand only) online by using the service of secure electronic gateway. The secure electronic payments gateway is an online interface between bidders & online payment authorization networks.

The payment for document fee/ e-Service fee can be made by eligible bidders online directly through Debit Card & Internet Banking.

5. Tender Documents can be downloaded online from the Portal https://etenders.hry.nic.in by the Contractors registering on the Portal.

6. The bids are required to be submitted on single percentage basis above or below given as estimated cost in this tender document in figures as well as in words in the space provided in section– 7 Tender Form for filling rates (form of bid).

7. As the Bids are to be submitted online, these are required to be encrypted and digitally signed, the Bidders are advised to obtain the same at the earliest. For obtaining Digital Certificate, the Bidders may contact the representative of Next Tenders, the service Providers of Electronic Tendering System or any other service provider.

8. The bidders can submit their tender documents on line as per dates mentioned in the key dated mentioned below:

Sr. No.	**HAFED Stage.**	**Contractor Stage**	**Start Date & Time**	**Expiry Date & Time**
1	Tender Authorization & Publishing	-	20.05.2022 16.01 Hrs	20.06.2022 17.00 Hrs
2	-	Downloading of Tender Document & Bid Preparation	20.05.2022 16.01 Hrs	20.06.2022 17.00 Hrs
3	Pre Bid Meeting		30.05.2022 11.00 Hrs	
4	Corrigendum Issue (if any)		07.06.2022 17.00 Hrs	
5.	-	Proof of Submission of Tender Document Fees, EMD, E-Service Fee and (Technical) Documents.	20.05.2022 16.01 Hrs	20.06.2022 17.00 Hrs
6.	Technical Opening & Short listing	-	21.06.2022 11.00 Hrs	
7.	Open Commercial/ Price Bid	-	Will be notified separately	

CONDITIONS:-

1) Conditional tenders will not be entertained & liable to be rejected.

2) In case of the day of opening of tenders happens to be holiday, the tenders will be opened on the next working day. The time and place of receipt of tenders and other conditions will remain unchanged.

3) HAFED reserves the right to reject any tender or all the tenders without assigning any reason.

4) The tender without earnest money will not be opened.

5) The jurisdiction of court will be at Panchkula.

6) The financial bids of the bidders who does not satisfy the qualification criteria in the bid documents will not be opened and no claim whatsoever on this account will be considered.

7) The bid for the work shall remain open for acceptance during the bid validity period to be reckoned from the date of opening of technical bids. If any bidder / tenderer withdraws his bid / tender before the said period or makes any modifications in the terms and conditions of the bid, the bids security of that bidder may be forfeited.

Managing Director,
HAFED,

SECTION-2
INSTRUCTIONS TO BIDDERS (ITB)

Throughout these bidding documents, the terms 'bid' and 'tender' and their derivatives (bidder/tenderer, bidding/tendering, etc.) are synonymous.

Eligibility Criteria: - This Invitation for Bids is open to all bidders who fulfil the qualification criteria prescribed as under:

I. Experience:

Sr. No.	**Description of works**	**DNIT cost (Rs. in Lacs)**	**The bidder must have successfully executed & completed works in last ten years i.e. Civil Construction Works/ Pre-Engineering Building Works / Plant & Machinery works (Rs. in Lakhs)**				
			One work of magnitude of 80% i.e.	**Or**	**Two works of magnitude of 50% each i.e.**	**Or**	**Three works of magnitude of 40% each i.e.**
1	Planning, Design, Fabrication, Supply, Erection, Testing, Commissioning and Trial Run (3 Months) including Civil, PEB, MEP, Firefighting Works for Milk Chilling Unit (10000 LPD), Storage Facility For Milk (10 MT) And Cold Storage (300 MT), Complete In all Respect On Turnkey Basis, with annual maintenance and technical operations of three years At HAFED Mega Food Park, Primary Processing Center Yamunanagar, Haryana	998.86	789.53		499.08		399.26

**This bid is open to all type of vendors whether Civil, Pre- Engineering Building, Plant & Machinery etc. Bidders (Civil/ PEB/ P&M) can participate in the bid showing the nature of works & other required details as per DNIT.*

a) For this, a Certificate from the competent authority shall be submitted along with the applicant incorporating clearly the name of the work, Contract value, billing amount, date of commencement as well as completion of works, satisfactory performance of the Contractor and any other relevant information.

b) **Turnover:** The bidder should demonstrate an average annual turnover of Rs. 7.89 Crores during the last three financial years.

c) **Net worth:** Financial net worth of bidder should be positive as on 31 March of the previous financial year and should be certified by Chartered Accountants.

The net worth shall be worked out as under:

Net Worth = (Paid Up Equity + Reserves) – (Revaluation Reserves + Misc. expenditure not written off and accrued liabilities)

II. **Bid Capacity or Solvency:**
Bid Capacity: The assessed available Bid Capacity of the Bidder shall not be less than Rs. 9.98 Crores.
To be calculated as per follow:

Working Bid Capacity> Total estimated **cost of work(s) at the time of bidding**.
Contractors should calculate the available bid capacity as per given formula.

WBC = 2AN – B

A=	Average Annual Turnover of the bidder for last three financial years from similar nature of projects
B=	Value of the existing commitments and ongoing works of the bidder to be completed during next 6 months (period of completion of works as per bid)
N=	No. of years prescribed for completion of works for which bids are invited i.e. 0.5 in this case.

OR

Solvency Certificate: Solvency of the amount equal to 50% of the estimated cost of the work i.e . Rs. 4.99 Crore. The date of this Certificate must be within 6 months of the date of opening this tender.

The Bidders are advised to raise all their queries and submit their deviations (if any) in the pre bid meeting on any parameter or technical specifications. No deviations will be allowed during execution.

III. Joint Venture or Consortium: JV or Consortium is allowed to meet out the pre-qualification criteria & execution of this work. The documents in terms of similar works, turnover etc submitted jointly by the JV partners will be considered for technical evaluation. The consortium members shall nominate the lead member of the consortium which should be responsible for the overall management, delivery, correspondence, O & M of the project.
a. Joint Ventures are allowed upto maximum of two members to participate in the bid. In case the bidder is a Joint Venture (JV), the members shall authorize one of the JV members to act on their behalf as lead member in exercising all the rights and obligations towards the Client under this document, including without limitation to the receiving of instructions and payments from the Client. Though, lead member shall be responsible for the overall management, delivery and O&M of the project, all the members of consortium/JV shall be jointly and severally responsible for execution of the works in relation to the project.
b. A Proposal submitted by a Joint Venture shall be signed by all members so as to be legally binding on all members, or by an authorized representative who has a written power of attorney signed by each member ‘s authorized representative.
c. If the Proposal is submitted by a joint venture, there shall be a Joint Venture Agreement specific for this contract between the constituent firms/ members, indicating clearly, amongst other things, the proposed distribution of responsibilities both financial as well as technical for execution of the work amongst them. A copy of the JV agreement entered into by the Joint Venture members shall be submitted along with the bid
d. In the case of a Joint Venture, a power of attorney for the authorized representative of each JV member, and a power of attorney for the representative of the lead member to represent all JV members shall be submitted along with the proposal.

IV. Key Personnel & Plant & Machinery:

Bidders need to submit the key personnel name along with their qualifications & Plant & Machinery which will be deployed for this project. Minimum requirement is stated below:

A. Key Personnel

Sr No	Position	Requirement
1	Site Engineer- Civil & MEP	1 No
2	Billing Engineer	1 No
3	Quality Control Lab Technician	1 No
4	Pre-Engineering Building Designer/ Structural Engineer	1 No
5	Refrigeration Engineer	1 No
6	Mechanical Engineer	1 Nos

B. Plant & Machinery

Sr No	P&M	Requirement
1	Excavator	1 No
2	Dumper	1 No
3	Weigh Batch Mixer	1 No
4	Vibrators	8 Nos
5	Shuttering Plates/ Sets	8 Nos
6	Water Tanker	1 No
7	Mini Compactor	1 No
8	Bar bending & cutting machine	2 Nos
9	Total Station for Survey	1 No
10	Other misc	As required

V. Evaluation:

A. Technical Evaluation: Technical Evaluation will be done based on the following table:

Sr. No	Evaluation Criteria	Weightage Percentage (Applicability in case of Consortium/ Joint Venture)
1	Similar Works (The bidder must have successfully executed & completed works in last ten years i.e. Civil Construction Works/ Pre-Engineering Building Works / Plant & Machinery works (Value as mentioned in Section-II)	70% of the lead member & 30% of the associate member
2	Yearly Turnover & Net Worth (Value as mentioned in Section-II)	70% of the lead member & 30% of the associate member
3	Bid Capacity/ Solvency Certificate (Value as mentioned in Section-II)	70% of the lead member & 30% of the associate member
3	Key Personnel	70% of the lead member & 30% of the associate member
4	Plant & Machineries	70% of the lead member & 30% of the associate member
5	P&M Proposed Design & Specifications matching with the required capacity mentioned in the tender documents	Only for the P&M vendor either associated as lead member or for associate member

B. Financial Evaluation: Once Technical Evaluation completed, all technical qualified bidders will be deemed in same position/ eligible for opening their financial bids. After opening the financial bids, the lowest amount quoted by any bidder shall be considered as L1 bidder & the necessary proceedings will be carried out with the L1 bidder only. No other technical aspects / criteria will be reviewed after once financial bids are opened.

SECTION-3
SUBMISSION OF BIDS

INSTRUCTIONS TO BIDDER ON ELECTRONIC TENDERING SYSTEM

These conditions will over-rule the conditions stated in the tender documents, wherever relevant and applicable.

1. Registration of bidders on e-Procurement Portal:

All the bidders intending to participate in the tenders process online are required to get registered on the centralized e-Procurement Portal i.e. **https://etenders.hry.nic.in** Please visit the website for more details.

2. Obtaining a Digital Certificate:

2.1 The Bids submitted online should be encrypted and signed electronically with a Digital Certificate to establish the identity of the bidder bidding online. These Digital certificates are issued by an Approved Certifying Authority, by the Controller of Certifying Authorities, Government of India.

2.2 A Digital Certificate is issued upon receipt of mandatory identity (i.e. Applicant's PAN Card) and Address proofs and verification form duly attested by the Bank Manager / Post Master / Gazetted Officer. Only upon the receipt of the required documents, a digital certificate can be issued. For more details please visit the website – **https://etenders.hry.nic.in**

2.3 The bidders may obtain Class-II or III digital signature certificate from any Certifying Authority or Sub-certifying Authority authorized by the Controller of Certifying Authorities or may obtain information and application format and documents required for the issue of digital certificate from.

2.4 The bidder must ensure that he/she comply by the online available important guidelines at the portal **https://etenders.hry.nic.in** for Digital Signature Certificate (DSC) including the e-Token carrying DSCs.

2.5 Bid for a particular tender must be submitted online using the digital certificate (Encryption & Signing), which is used to encrypt and sign the data during the stage of bid preparation. In case, during the process of a particular tender, the user loses his digital certificate (due to virus attack, hardware problem, operating system or any other problem) he will not be able to submit the bid online. Hence, the users are advised **to keep a backup of the certificate** and also keep the copies at safe place under proper security (for its use in case of emergencies).

2.6 In case of online tendering, if the digital certificate issued to the authorized user of a firm is used for signing and submitting a bid, it will be considered equivalent to a no-objection certificate/power of attorney /lawful authorization to that User. The firm has to authorize a specific individual through an authorization certificate signed by all partners to use the digital certificate as per Indian Information Technology Act 2000. Unless the certificates are revoked, it will be assumed to represent adequate authority of the user to bid on behalf of the firm in the department tenders as per Information Technology Act 2000. The digital signature of this authorized user will be binding on the firm.

2.7 In case of any change in the authorization, it shall be the responsibility of management/ partners of the firm to inform the certifying authority about the change and to obtain the digital signatures of the new person/ user on behalf of the firm/ company. The procedure for application of a digital certificate however will remain the same for the new user.

2.8 The same procedure holds true for the authorized users in a private/ Public limited company. In this case, the authorization certificate will have to be signed by the directors of the company.

3. Pre-requisites for online bidding:

In order to operate on the electronic tender management system, a user‟s machine is required to be set up. A help file on system setup/Pre-requisite can be obtained from NIC or downloaded from the home page of the website - **https://etenders.hry.nic.in** The link for downloading required java applet & DC setup are also available on the Home page of the e-tendering Portal.

4. Online Viewing of Detailed Notice Inviting Tenders:

The bidders can view the detailed N.I.T and the time schedule (Key Dates) for all the tenders floated through the single portal e-Procurement system on the Home Page at https://etenders.hry.nic.in

5. Download of Tender Documents:

The tender documents can be downloaded free of cost from the e- Procurement portal https://etenders.hry.nic.in

6. Key Dates:

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

7. Online Payment of Tender Document Fee, Processing fee, Bid Preparation & Submission (Technical & Commercial/ Price Bid):

7.1 Online Payment of Tender Document Fee + Processing fee: The online payment for Tender document fee, Processing Fee & EMD can be done using the secure electronic payment gateway. The Payment for Tender Document Fee and Processing Fee shall be made by bidders/Vendors online directly through Debit Cards & Internet Banking Accounts and the Payment for EMD shall be made online directly through RTGS / NEFT & OTC.

The secure electronic payments gateway is an online interface between contractors and Debit card / online payment authorization networks.

7.2 PREPARATION & SUBMISSION OF online APPLICATIONS/BIDS:

(i) Detailed Tender documents may be downloaded from e-Procurement website **https://etenders.hry.nic.in** and tender mandatorily be submitted online following the instruction appearing on the screen.

(ii) Scan copy of Document to be submitted / uploaded for Technical bid under online Technical Envelope. The required documents (refer to DNIT) shall be prepared and scanned in different file formats (in PDF/JPEG/MS WORD format such that file size is

not exceed more than 10 MB) and uploaded during the on-line submission of Technical Envelope.

(iii) **FINANCIAL or Price Bid PROPOSAL shall be submitted mandatorily online under Commercial Envelope and original not to be submitted manually)**

8. ASSISTANCE TO THE BIDDERS

For queries on Tenders Haryana Portal, Kindly Contact

Note: Bidders are requested to kindly mention the URL of the ortal and Tender ID in the subject shiel emailing any issue along with the contact detail. For any issue/clarification relating to the Tender (s) published kindly contact the repective tender Inviting Authority.

Tel:-0120-4200462,0120-4001002

Mobile:88262-46593

Email:-support.etender@nic.in

For any techincal related queries please call at 24x7 Help Desk number

0120-4001002,0120-4200462,0120-4001005,120-6277787

For support related to Haryana Tenders in addition to help desk you may also contact on email ID eproc.nichry@yahoo.com, Tel:0172-2700275

Timing: Technical support assistance will be available over telephone Monday to Friday (9:00am to 5:30pm) (Helpdesk Support in team shall not be contracted for online bidding on behalf of the contractors).

Note: Contact e-Procurement helpdesk on or before prior to 4 hours of the scheduled closing date and time of respecive e-tendering event. Also, for queries related to e-payment of EMD kinldy contact the helpdesk at least two days prior to closing date and time of the respective event.

Intended bidders mandatorily requried to register their quries if there is any pertaining to the online bidding and the single e-Procurment portal at email address:- https://etenders.hry.nic.in

NOTE:- ***Bidders participating in online tenders shall check the validity of his/ her Digital Signature Certificate before participating in the online Tenders at the portal*** **https://etenders.hry.nic.in**

(Online Payment Guidelines)

Guideline for Online Payments at e-Procurement Portal of Government of Haryana.

Post registration, bidder shall proceed for bidding by using both his digital certificates (one each for encryption and signing) & Password. Bidder shall proceed to select the event/Tenders he is interested in. On the respective Department‟s page in the e-Procurement portal, the Bidder would have following options to make payment for tender document fee + Processing fee & EMD:

A. Debit Card
B. Net Banking
C. RTGS/NEFT or Over The Counter (OTC)

Operative Procedures for Bidder Payments

A) Debit Card

The procedure for paying through Debit Card will be as follows:

(i) Bidder selects Debit Card option in e-Procurement portal.

(ii) The e-Procurement portal displays the amount and the card charges to be paid by bidder. The portal also displays the total amount to be paid by the bidder.
(iii) Bidder clicks on “Continue” button.
(iv) The e-Procurement portal takes the bidder to Debit Card payment gateway screen.
(v) Bidder enters card credentials and confirms payment
(vi) The gateway verifies the credentials and confirms with “successful” or “failure” message, which is confirmed back to e-Procurement portal.
(vii) The page is automatically routed back to e-Procurement portal
(viii) The status of the payment is displayed as “successful” in e-Procurement portal.
(ix) In case of successful payment, a success message along with unique transaction ID is passed on to e-Procurement system. The e-tendering portal shall store the unique transaction number in its database along with the date and timestamp.
(x) The e-Procurement portal allows Bidder to process another payment attempt in case payments are not successful for previous attempt.

B) Net Banking

The procedure for paying through Net Banking will be as follows:

(i) Bidder selects Net Banking option in e-Procurement portal.
(ii) The e-Procurement portal displays the amount to be paid by bidder.
(iii) Bidder clicks on “Continue” button
(iv) The e-Procurement portal takes the bidder to Net Banking payment gateway screen displaying list of Banks
(v) Bidder chooses his / her Bank
(vi) The Net Banking gateway redirects Bidder to the Net Banking page of the selected Bank
(vii) Bidder enters his account credentials and confirms payment
(viii) The Bank verifies the credentials and confirms with “successful” or “failure” message to the Net Banking gateway which is confirmed back to e- Procurement portal.
(ix) The page is automatically routed back to e-Procurement portal
(x) The status of the payment is displayed as “successful” in e-Procurement portal.
(xi) In case of successful payment, a success message along with unique transaction ID is passed on to e-Procurement system. The e-Procurement portal shall store the unique transaction number in its database alongwith the date and timestamp.
(xii) The e-Procurement portal allows Bidder to process another payment attempt in case payments are not successful for previous attempt.

C) RTGS/ NEFT

This solution shall also allow the bidder to make the EMD payment via RTGS/NEFT this shall add to the convenience of those bidders who are not conversant to use net banking option to make the transaction.

Using this module, bidder would be able to pay from their existing bank account through RTGS/NEFT. This would offer a wide reach for more than thousands bank branches and would enable the bidder to make the payment from almost any bank branch across India.

1. To choose the payment of EMD, the bidder clicks on RTGS/NEFT payment option.
2. Upon doing so, the e-Procurement portal will redirect the bidder to a page where it will generate a Challan.
3. This Challan shall include the beneficiary (virtual) account number and other details like beneficiary IFSC code each.

RTGS / NEFT Payment Procedure

The bidder shall be required to take a print of the challan and make the RTGS/ NEFT on the basis of the virtual account number period on the challan. This provision will ensure that number confidential details regarding the bidder or tender are disclosed to the bank while remitting the RTGS/NEFT.

The bidder would remit the fund at least one day in advance to the last day and make the payment via RTGS/NEFT to the beneficiary account number as mention in the challan. SBI Bank shall receive this amount and credit the payment gateway service provider intermediary Department/ PSUs Escrow Security Deposit account post validating the first part of the beneficiary account number, i.e., the client code only, In case of validation of client code is not successful, the bank shall return the fund and not credit the Techprocess intermediary Department/PSUs Escrow Security Deposit A/c.

D) Over the Counter (OTC)

This solution shall allow the bidder having account with SBI bank, to make the payment from any CMS enables Branch of SBI Bank in India. Bidders can make the payment via cash (if amount is <=[]49,999), Demand Draft or SBI Bank Cheque.

The procedure for paying through OTC mode is as follows:

(i) Bidder selects over the counter remittance option in e-Procurement portal. (ii) The e-Procurement portal displays the amount to be paid. The bidder chooses the bank account number for refund of the amount. (iii) Bidder clicks on "Continue" Button.

(iv) The e-Procurement portal displays the details of payment. The Bidders click on "Print_Challan" and print the OTC Challan.

(v) Bidder submits the OTC Challan at the counter of any designated bank of SBI Bank with Cash/Demand Draft/SBI Bank Cheque (Payment in Cash is allowed upto Rs. 49,999/-).

(vi) SBI bank verifies the URL (format to be discussed and decided) and amount with e-Procurement portal prior to accepting the payment.

(vii) On successful verification from e-Procurement portal, SBI bank accepts the payment. In case of failure, SBI bank shall return back the OTC challan and payment to the bidder.

(viii) SBI bank commits the payment transaction (in case of successful verification from e-Procurement portal) and sends the Bank Transaction number (I-Sure Reference Number) online against the URN and Amount.

(ix) SBI bank will generate receipt for the payment transaction and issues the same to the bidder.

(x) The e-Procurement system update the bank transaction number against the URN and Amount based on the details sent by SBI bank online prior to generation of the receipt.

(xi) The status of the payment will be displayed as "verification successful" in e- Procurement Portal, when the bidder clicks on the verification option in the portal.

(xii) Bidder would be required to upload the scan copy of receipt as received from SBI Bank as part of proof in next tender portal before submitting the tender.

SECTION 4 (I)

CONDITIONS OF CONTRACT

Clause 1:- The time allowed for carrying out of work as entered in the tender shall be strictly observed by the contractor, and shall be reckoned from the date on which the order to Commence work is given to the contractor. The work shall throughout the stipulated period of the contract be proceeded with all due diligence (time being deemed to be the essence of the contract on the part of the contractor). To ensure good progress during the execution of work the contractor shall be bound in all cases in which the time allowed for any work exceeds one months to complete one-fourth of the whole of the work before one fourth of the whole time allowed under the contract has elapsed, one-half of the work before one half of such time has elapsed and three fourth of the work before the three fourth of such time has elapsed. In the event of the contractor failing to comply with this condition he shall be liable to pay compensation as mentioned below:-

a) If the work is not initiated or left before the middle stage i.e. the work paid is less than 60% then compensation will be levied @ 2% per week of delay subject to a maximum of 10% of the original tender cost, as advertised in the newspaper.

b) If 60% work is over and paid and then left incomplete or delayed then percentage compensation will be levied @ 2% per week subject to a maximum of 5% of the tender cost.

c) If 80% work is already paid and then left in-complete or delayed then percentage compensation will be levied at the rate of 2% per week of the tender cost subject to a maximum of 2% of the tender cost.

d) Penalty applicable for AMC Period: In case supplier does not address the issue after information received by HAFED or Contractor's Team and make delay in response, **penalty** shall be **imposed @ 10% of the entire AMC value quoted by the bidder per week for** the maximum limit of 2 weeks. In case the supplier fails to address the issues & submit report / solutions to HAFED even after extended period of 2 weeks with penalty, the security (Performance Bank Guarantee) will be forfeited.

e) The MD, HAFED will have the power to reduce or waive the penalty/compensation after receiving the representation from the contractor and if it is felt that penalty is wrong-fully imposed but such representation will be entertained only after the contractor first completes the work and then makes the representation. The decision of MD, HAFED will be final and will not be challengeable before the arbitrator or any other court of law in the country.

f) The date of completion of work will be the one on which the contractor has received the completion certificate from the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak.

Clause 2: In any case, in which under any clause or clauses of this contract the Contractor has rendered himself liable to pay compensation amounting to the whole of his security deposit (whether paid in one sum or deducted by instalments), the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak on behalf

of the Federation shall have power to adopt any of following course as he may deem best suited to the interest of Federation.

(a) To rescind the contract of which rescission notice in writing to the Contractor under the hand of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak dispatched by registered post to the address of the Contractor given in the Tender shall be conclusive evidence and in which case the security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of Government.

(b) To employ labour and to supply materials to carry out the work, or any part of the work debiting the Contractor with the cost of the labour and the price of the materials and crediting him with the value of the work done at the same rates as if it had been carried out by the Contractor under the terms of his contract. The certificate of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtakas to the value of the work done, and quantity, rate & amount of the labour and material employed for doing the work shall be final and conclusive against the Contractor.

(c) To measure the work of the Contractor and to take such part there-of as shall be unexecuted out of his hands and to give it to another Contractor to complete. In such case, any expends which may be incurred in excess of the sum which would have been paid to the original Contractor shall be borne and paid by the original Contractor. Certificate in writing of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak in respect of work taken out of the hands of original Contractor, and the excess expenditure incurred shall be final and conclusive. This money may be deducted from any money due to him by Government under the contract or otherwise or from his security deposit.

In the event of any one or more of the above courses being adopted by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, the Contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any material or entered into any engagement or made any advances on account of or with a view to the execution of the work for the performance of the contract and in case the action is taken under any of the provisions aforesaid, the Contractor shall not be entitled to recover or be paid any sum for any work actually executed under the contract, unless and until the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak will have certified in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

Clause 3: In any case in which any of the powers conferred upon the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak by clause 2 hereof, shall have become exercisable and the same shall not be exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such power shall notwithstanding be exercisable in the event of any future case of default by the Contractor and the liability of the Contractor for past and future compensation shall remain unaffected. In the event of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak exercising either of the power (a) or (c) vested in him under the preceding clause he may, if he so desires, take possession of all or any tools, plants materials and stores in or upon the works, or the site there of belonging to the contractor or procured by him and intended to be used for the execution of the work or any part thereof paying or allowing for the same in account at the contract rates or in case of these not being applicable at current market rates to be certified by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak whose certificate thereof shall be final.

Otherwise the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may by notice in writing to the Contractor or his clerk of the works, foreman or other authorized agent require him to remove such tools and plant material or stores from the premises within a time to be specified in such notice. In the event of the Contractor failing to comply with any such requisition, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may remove them at the Contractor's expense or sell them by auction or private sale on account of the Contractor and at his risk in all respects and the certificate of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak to the expense of any such removal and the amount of the proceeds and expenses of any such sale be final and conclusive against the Contractor.

Clause 4: If the Contractor shall desire an extension of time for the completion of the work on the grounds of his having unavoidable hindrance in its execution or on any other ground, he shall apply in writing to GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak within 30 days of the date of the hindrance, on account of which he desires such extension as aforesaid. The Federation shall, if in its opinion (which shall be final) reasonable grounds be shown there-for, authorize such extension of time, if any, as may, in its opinion be necessary or proper.

Clause 5 : Contractor shall deliver in the office of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak the work execution progress on fortnight basis. No extra items will be considered during execution from the contractor side as this contract is turn-key.

Clause 6 : Without prejudice to the rights of Federation under any clause hereinafter contained on completion of the work, the contractor shall be furnished with a certificate by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak of such completion, but no such certificate shall be given, not shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all Surplus materials, and rubbish and cleaned of the dirt from all wood works, doors, windows, walls, floors or other parts of this work. In upon or about which the work is to be executed, or of which he may have had possession for the purpose of the execution thereof and the measurements in the said certificate shall be binding and conclusive against the contractor, If the contractor shall fail to comply with the requirements of this clause as to removal of surplus materials and rubbish, and cleaning off dirt on or before the date fixed for the completion of the work, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may at the expenses of the contractor, remove such surplus materials and rubbish and dispose off the same as he thinks fit and clean off such dirt aforesaid and the contractor shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such surplus materials as aforesaid except for any sum actually realized by the sale thereof less any expense incurred by GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak in connection therewith

Clause 7 : No payment shall be made for work estimated to cost less than rupees one thousand, till after the whole of the works shall have been completed and a certificate of completion given. But in case of works estimate to cost more than rupees one thousand, the contractor shall be submitting the bill thereof, be entitled to receive a monthly payment proportionate to the part thereof then approved & passed by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak whose certificate of such approval and passing of the sum so payable shall be final and conclusive against the contractor. But all such intermediate payments shall be regarded as payments by ways of advances against the final payment only and not as payments for work actually done and completed and shall not preclude the requiring of bad, unsounded and imperfect or unskilful work to be removed and taken away and reconstructed or re-

erected, or be considered as an admission of the due of performance of the contract, or any part thereof in any respect or according of any claim, nor shall it conclude, determine or affecting any way the powers of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak under these conditions, or any of them as to the final settlement and adjustment of the accounts or otherwise, or in any other way , vary or affect the contract. The final bill shall be submitted by the contractor within one month of the date fixed for completion of the work otherwise the GM's HAFED, CFP, Rohtak/Executive Engineer's, HAFED, Rohtak certificate of the measurement and of the total amount payable for the work accordingly shall be final and binding on all parties.

Clause 7 (a): If Retention in running bills or such part thereof as may be due to the contractor under this contract shall be payable to the contractor after a period of three months has lapsed after payment of final bill.

Clause 8: A bill shall be submitted by the Contractor each month on or before the date fixed by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak for the work executed in the previous month. The Contractor shall submit all bills on the printed forms available with the department. The charges in the bills shall always be entered at the rates specified in the tender. In case of any extra work ordered in pursuance of these conditions, and not mentioned or provided for in the tender, at the rates hereinafter provided for such work. Final bill in respect of the Contract shall be submitted by the Contractor within 30 days of the date fixed for completion of the Work or the date of the certificate of completion furnished by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak. GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall take or cause to be taken the requisite measurements for the purpose of having the same verified and the claim, as far as admissible, if possible, before the expiry of 10 days from the presentation of the bill. If the Contractor does not submit the bill within the time fixed as aforesaid, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may depute a subordinate to measure up the said work in the presence of the Contractor, whose countersignature to the measurement list will be sufficient warrant. GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may prepare a bill from such list which shall be binding on the Contractor in all respects.

Clause 9 : The contractor shall submit all bills on the printed forms to be had on application at the office of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, and the charges in the bill shall always be entered at the rates specified in the tender or in the case of any extra work ordered in pursuance of these conditions, and not mentioned or provided for in the tender at the rates hereinafter provided for such work.

Clause 10 : If the specification of estimate of the work provides for the use of any special description of materials to be supplied from the GM's HAFED, CFP, Rohtak/Executive Engineer's, HAFED, Rohtak store or if it is required that the contractor shall use certain stores to be provided by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak(such materials and stores and the prices to be charged thereof as hereinafter mentioned being so far as practicable for the convenience of the contractor, but not so as in any way to control the meaning or effect of this contract, specified in the schedule of memorandum, have to be annexed), the contractor shall be supplied with such materials and stores as required from time to time to be used by him for the purposes of the contract only and the value of the full quantity of materials and stores so supplied at the rates specified in the said schedule or memorandum may be set off or deducted from any sums then due on thereafter to become due to the contractor under the contract or otherwise, against or from the security deposit, or the proceeds of sale thereof if the same is held in Government securities, the same or a sufficient portion thereof being in this case sold for the purpose. All materials supplied to the contractor,

shall remain the property of the contractor, but shall not on any account be removed from the site of the work without the written permission of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtakand shall at all the 'times be open to inspection by him. Any such materials unused and in perfectly good condition at the time of completion or termination of the contract shall be returned to the GM's HAFED, CFP, Rohtak/Executive Engineer's, HAFED, Rohtak store if by a notice in writing under his hand he shall so require, but the contractor shall not be entitled to return any such material unless with such consent and shall have no claims for compensation on account of any such materials so supplied to him as aforesaid being unused by him or for any wastage in or damage to any such materials.

Clause 11 : The Contractor shall execute the whole and every part of the work in most substantial and workman like manner and both as regards materials and otherwise in every respect in accordance with the specifications. The Contractor shall also conform exactly fully and faithfully to the designs, drawings and instructions in writing relating to the work signed by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtakand lodged in the office and to which the Contractor shall be entitled to have access at such office, or at the site of the work for the purpose of the inspection during office hours. The Contractor shall, if he so requires, be entitled at his own expense to make or cause to be made copies of the specifications, and of all such designs, drawing and instructions as aforesaid.

Clause 11 (a): The GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall have full powers, at all times to object of the employment of any workman, foreman, or other employee on the works by the contractor and if the contractor shall receive notice in writing from the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak requesting the removal of any such man or men from the work the contractor shall comply with the request forthwith.

No such workman, foreman or other employee after his removal from the works by request of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall be re-employed or reinstated on works by the contractor at any time, except with the previous approval in writing of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak.

The contractor shall not be entitled to demand the reason from the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak for requiring the removal of any such workman, foreman or other employees.

Clause 12:The GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall have power to make any alteration in, omissions from, addition to or substitutions for the original specifications, drawing designs and instructions that may appear to him to be necessary or advisable during the progress of the work. The Contractor shall be bound to carry out the work in accordance with such instructions given to him in writing signed by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak. Such alterations, omissions, additions or substitutions shall not invalidate the contract. Such altered, additional or substituted work which the Contractor may be directed to do in the manner above specified as part of the work shall be carried out by the Contractor on same conditions in all respects on which he agreed to do the main work. The time for the completion of the work shall be extended in the proportion the altered, additional or substituted work bears to the original contract work and the certificate of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall be conclusive as to such proportion. If the rates for the altered, additional or substituted work cannot be determined in the manner specified above then the Contractor shall, within 7 days of the date of receipt of order to carry out the work, inform the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak of the rate which he intends to charge for such class of work. If the GM HAFED, CFP,

Rohtak/Executive Engineer, HAFED, Rohtak does not agree with this rate, he shall by notice in writing be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider advisable provided always that if the Contractor shall commence work or incur any expenditure in regard thereto before the rates shall have been determined lastly herein before mentioned, then and in such case he shall be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of determination of the rates as aforesaid according to such rate or rates as shall be fixed by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak. In the event of a dispute the decision of the Federation shall be final.

Clause 13 : If at any time after the commencement of the work, the Federation shall for any reason whatsoever not require the whole work, or part thereof, as specified in the contract to be carried out, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall give notice in writing of the fact to the Contractor who shall have no claim to have any payment or compensation whatsoever on account of any profit or advantage, which he might have derived from the execution of the work in full, that which he did not derive in consequence of the full amount of the work not having been carried out. The Contractor shall also not have any claim for compensation by reason of any alterations having been made in the original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated.

Clause 14 : If it shall appear to the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak or his subordinate-in-charge of the work, that any work has been executed with unsound, imperfect or unskilful workmanship or with materials of any inferior description, or that any materials or articles provided by him for the execution of the Work are unsound or of a quality inferior to that contracted for or otherwise not in accordance with the contract, the Contractor shall, on demand in writing which shall be made by GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak specifying the work, materials or articles complained of, notwithstanding that the same may have been passed, certified and paid for, forthwith rectify or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own proper charge and cost. In the event of his failing to do so within a period to be specified by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak in his demand aforesaid, the Contractor shall be liable to pay compensation at the rate of 1% of the estimated cost of the Work (as shown in the tender) for every day not exceeding ten days, while his failure to do so shall continue. In the case of any such failure, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may rectify or remove and re-execute the work or remove and replace with others, the materials or articles complained of, as the case may, be at the risk and expense in all respects of the Contractor.

Clause 15 : All work under or in course of execution or executed in pursuance of the contract shall at all times be open to the inspection and supervision of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak and his subordinates and the Contractor shall at all times, during the usual working hours, and at all other times at which reasonable notice of the intention of GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak or his subordinate to visit the Work shall have been given to the Contractor, either himself be present to receive orders and instructions or have a responsible agent duly accredited in writing present for that purpose. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the Contractor himself.

Clause 16 : The Contractor shall give not less than 7 days' notice in writing to the \ GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak or his subordinate-in-charge of the work before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is so covered up, placed beyond the reach of measurement, and shall not cover up or place beyond the reach of measurement any work without the consent in writing of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak or his subordinate - in - charge of the work. If any work shall be covered up or placed beyond the reach of the measurement without such notice having been given or consent obtained the same shall be uncovered at the Contractor's expenses or in default there of no payment of allowances shall he made for such work or the materials with which the same was executed.

Clause 17 : If the Contractor or his workers shall break, deface, injure or destroy any part of building in which they may be working, or any building, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone posts or wires, trees, grass or cultivated ground contiguous to the premises on which the Work or any part of it is being executed, or if any damage shall happen to the work while in progress from any cause whatever or if any defect, shrinkage or other faults of imperfections appear in the Work within 9 months after a certificate final or otherwise of its completion shall have been given by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak as aforesaid, the Contractor shall, upon a receipt of a notice in writing in that behalf, make the same good at his own expense. In default, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may cause the same to be made good by other workmen and deduct the expense from any sums that may be then, or at anytime thereafter may become due to the Contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof.

Clause 18 : The Contractor shall supply at his own cost all materials plant, tools, cranes, appliances, implements, ladders, cordage, tackle, scaffolding and temporary works requisite for proper execution of the work, whether original, altered or substituted and whether included in the Specifications or other documents forming part of the Contract referred to in these conditions or not or which may be necessary for the purpose of satisfying or complying with requirements of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak as to any matter as to which under these conditions he is entitled to be satisfied or which he is entitled to require together with carriage there-for to and from the work. The Contractor shall also supply without charge the requisite number of persons with the means and materials necessary for the purpose of setting out work and counting, weighing and assisting in the measurement or examination at any time and from time to time of the Work or materials. Failing his so doing the same may be provided by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak at the expense of the Contractor and the expenses may be deducted from any money due to the Contractor or from his security deposit or the proceeds of sales thereof or of sufficient contract portion thereof.

The Contractor shall also provide all necessary fencing and lights required to protect the public from accident. He shall be bound to bear the expenses of defense of every suit, action or other proceedings, at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and costs which may be awarded in any such suit, action or proceedings to any such persons or which may with the consent of the Contractor be paid to compromising any claim by any such person.

Clause 18(a): The final bill of the contractor shall not be paid unless or until he furnishes to the satisfaction of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak a proof of the clarity of submission of all taxes. The contractor shall also be liable to indemnity the Government against all claims made

proceedings and action taken by any person in respect of the price of the earth removed by the contractor from his land for the work against all losses, damages cost and expenses which the Government may suffer or incurred as a result of a such claims.

Clause 19 (a): No labour below the age of 16 years shall be employed on the work.

Clause 19 (b) : The contractor shall not pay his labourers less than the wages paid for similar work in neighbourhood.

Clause 20: No work shall be done on Sunday without the sanction in writing of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak.

Clause 20 (a): In every case in which by virtue of the provisions of section 12, sub- section (1) of the workman's Compensation Act., 1923, Federation is obliged to pay compensation to workman employed by the contractor, in execution of the works, Federation will recover from the contractor the amount of the compensation so paid and without the prejudice to the rights of Federation. Under section 12, sub-section (2) of the Act Federation shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by Federation to the contractor whether under this contract or otherwise.

Federation shall not be bound to contest any claim made against it under section 12, sub- section (1) of the said Act-except on the written request of the contractor and upon his giving to Federation full security for all costs for which Federation might become liable in consequence of contesting such claim.

Clause 21: The contract shall not be assigned or sublet without the written approval of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak. And if the Contractor shall assign or sublet his contract or attempt to do so or become insolvent or commence any in-solvency proceedings or make any composition with his creditors or attempt to do so or give any bribe, gratuity, gift, loan, requisite reward of advantage, pecuniary or otherwise shall either directly or indirectly be given, promised or offered by the Contractor or any of his servants or agents to any public officer or person in the employ of Federation in any way relating to his office or employment or if any such officer or person shall become in any way directly or indirectly interested in the Contract, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may thereupon by notice in writing rescind the Contract and the security deposit of the Contractor shall thereupon stand forfeited and be absolutely at the disposal of the Federation and the same consequences shall ensure as if the Contract had been rescinded under Clause 2 hereof and in addition the Contractor shall not be entitled to recover or be paid for any work there-for actually performed under the Contract.

Clause 22: All sums payable by way of compensation under any of these conditions shall be considered as reasonable compensation to be applied to the use of Federation without reference to the actual loss or damage sustained, and whether or not any damages shall have been sustained.

Clause 22(a): Any excess payment made to the contractor inadvertently or otherwise under this contract or any account whatever and any other sum bound to be due to Federation contractor in respect of this contract or any other contract or work order or on any account whatever may be deducted from sum whatever payable

by Federation to the contractor either in respect of this contract or any work order or contract or any other account by any other department of the Government.

Clause 23: In the case of tender by partners any change in the constitution of the firm shall be forthwith notified by the Contractor to the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak for his information.

Clause 24: All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak who shall be entitled to direct at what point or points and in what manner they are to be commenced and from time to time carried on.

Clause 25 : No claims for payment of an extra ordinary nature such as claims for a bonus for extra employed in completing the work before the expiry of the contractual period at the request of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak or claims for compensation where work has been temporarily brought to a standstill though no fault of the Contractor shall be allowed unless and to the extent that the same shall have been expressly sanctioned debit for payment and extradition any nature to be referred to Federation for decision of the M.D, HAFED.

ARBITRATION CLAUSE

Clause 25 (a) (i): If any dispute or difference of any kind whatsoever shall arise between the Federation/ his authorized agents and the contractor in connection with or arising out of the contract or the execution of the work that is **(i)** Whether before its commencement or during the progress of the work or after its completion, **(ii)** and whether before or after the termination abandonment or breach of the contract, it shall in the first instance be referred to for being settled by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtakin charge of the work at the time and he shall within a period of sixty days after being requested in writing by the contractor to do so, convey his decision to the contractor, and subject to arbitration as hereinafter provided, such decision in respect of every matter so referred, shall be final and binding upon the contractor. In case the work is already, in progress, the contractor will, proceed with the execution of the work on receipt of the decision by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, in charge as aforesaid with all due diligence whether he or the Federation is authorized agent requires arbitration as hereinafter provided or not. If the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, in charge of the work has conveyed his decision to the contractor and no claim to arbitration has been filed with him by the contractor within a period of sixty days from the receipt of letter communicating the decision, the said decision shall be final and binding upon the contractor and will not be subject matter of arbitration at all. If the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak in charge of the work fails to convey his decision within a period of sixty days from the date on which request has been made to the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak request to Divisional Head that the matters in dispute be referred to arbitration as hereinafter provided.

1. All disputes of differences in respect of which the decision is not final and conclusive shall at the request in writing of either party, made in a communication sent through Registered A.D. Post be referred to the sole arbitration of any serving GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak /Divisional Head to be nominated by designation by the M.D.HAFED at the relevant time, there will be

no objection to any such appointment that the arbitrator so appointed is a Federation servant or that he had to deal with the matters to which the contract relates and that in the course of his duties as a Federation servant he had expressed his views on all or any of the matters in dispute. The arbitrator to whom the matter is originally referred being transferred or vacating his office, his successor-in-office as such shall be entitled to proceed with the reference from the stage at which it was left by his predecessor.

In case the arbitrator nominated by the M.D.HAFED is unable or HAFED unwilling to act as such for any reason, whatsoever the M.D. shall be competent to appoint and nominate any other Superintending Engineer as the case may be, as arbitrator in his place and the Arbitrator so appointed shall be entitled to proceed with the reference.

2. It is also a term of this arbitration agreement that no person other than a person appointed by the M.D.HAFED shall act as arbitrator and if for any reason that is not possible, the matter shall not be referred to arbitration at all. In all cases where the aggregate amount awarded exceeds Rs. 25,000/- (Rupees Twenty five thousand only) the arbitrator must invariably give reasons for his award in respect of each claim and counter-claim separately.

3. The arbitrator shall award separately giving his award against each claim and dispute raised by either party including any counterclaim individually and that any lump sum award shall not be legally enforceable.

4. The following matters shall not lie within the purview of Arbitration:-
   a) Any dispute relating to the levy of compensation as liquidated damages which has already been referred to the Divisional Head and its being heard or/ and has been finally decided by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, In charge of the work.
   b) Any dispute in respect of substituted, altered, additional work/Committed work/ defective work referred by the Contractor for the decision of the Divisional Head, In charge of the work, if it is being heard or has already been decided by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak.
   c) Any dispute regarding the scope of the work or its execution or suspension or abandonment that has been referred by the contractor for the decision of the Federation and has been so decided finally by the HAFED.

5. The independent claims of the party other than the one getting the arbitrator appointed, as also counter-claims of any party will be entertained by the arbitrator not withstanding that the arbitrator had been appointed at the instance of the other party.
6. It is also a term of this arbitration agreement that where the party involving arbitration is the contractor, no reference for arbitration shall be maintainable unless the contractor, furnishes to the satisfaction of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, In charge of the work, a security deposit of a sum determined according to details given below and the sum so deposited shall, on the termination of the arbitration proceedings, be adjusted against the cost, if any, awarded by the arbitrator against the claimant party and the balance remaining after such adjustment in the absence of any such cost being awarded, the whole of the sum will be refunded to him within one month from the date of the award:-

AMOUNTS OF CLAIMS	RATE OF SECURITY DEPOSIT
(i) For claims below Rs. 10,000	2% of amount claimed.
(ii) For claims of Rs. 10,000 and Above and below Rs. 1,00,000.	5% of amount claimed.
(iii) For claims of Rs. 1,00,000 and above	10% of amount claimed.

The stamp fee due on the award shall be payable by the Party as desired by the arbitrator and in the event of such party's default the stamp fee shall be recoverable from any other sum due to such Party under this or any other contract.

7. The venue of arbitration shall be such place or places as may be fixed by the arbitrator in his sole discretion. The work under the contract shall continue during the arbitration proceeding.

8. Neither party shall be entitled to bring a claim for arbitration if the appointment of such arbitrator has not been applied within 6 months :-

   a) Of the date of completion of the work as certified by GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, Engineer-in-charge, or
   b) Of the date of abandonment of the work, or
   c) Of its non- commencement within 6 months from the date of abandonment, or written orders to commence the work as applicable , or
   d) Of the completion of the work through any alternative agency or means 'after withdrawal of the work from the contractor in whole or in part and /or its rescission, or
   e) Of receiving an intimation from the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, In charge of the work that final payment due to or recovery from the contractor had been determined which he may acknowledge and /or receive.

   Whichever of (a) to (e) above is the latest.
   If the matter is not referred to arbitration within the period prescribed above, all the rights and claim of any party under the contract shall be deemed to have been forfeited and absolutely barred by time even for civil litigation notwithstanding.

9. It is also a term of this arbitration agreement that no question relating to this contract shall be brought before any Civil Court without first involving and completing the arbitration proceedings as above. If the scope of the arbitration specifies herein covers issues that can be brought before the arbitrator i.e. any matter that can be referred to arbitration shall not be brought before a Civil Court. The pending of arbitration shall not restraint Federation to terminate the contract and make alternative arrangements for the completion of the work.

10. The arbitrator shall be deemed to have entered on the reference on the day he issues notices to the parties fixing the first date of hearing. The arbitrator may, from time to time, with the consent of parties enlarge the initial time for making and publishing the award.

11. It is also a term of this arbitration agreement that subject to the stipulation herein mentioned, the arbitration proceeding shall be conducted in accordance with the provision of the arbitration Act. 1940 or any other law in force for the time being.

Clause 26: Work shall be carried out in accordance with the Technical Specifications mentioned in this DNIT & as per relevant IS Codes. In the event of there being no specifications, then in such case the work shall be carried out in all respects in accordance with the instructions and requirements of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak.

Clause 27: In the case of any clause of work for which there is no such specification as is mentioned in rule 1, such work shall be carried out in accordance with the district specifications, and in the event of there being no district specification, than in such case the work shall be carried out in all respects in accordance with the instructions and requirements of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak.

Clause 28 : The expression "works" or where used in these conditions shall unless there be something either in the subject or context repugnant to such worksbe construed and taken to mean the work by or by virtue of the Contract contracted to be executed whether temporary or permanent and whether original, altered, substituted or additional.

Clause 29: The terms and conditions of the agreement have been explained to me/ us and I/ we clearly understand them.

ADDITIONAL CLAUSES

Clause 30: The contractor states that he is not related to any of the officers employed by the HAFED.

Clause 31: No pit shall be dug by the contractor near the site of the work for taking out earth for use on the work. In case of default the pit so dug will be filled in by the Federation at the cost of the contractor.

Clause 32: Fair wage clauses are attached.

Clause 33: The contractor shall have to pay GST and other applicable taxes, in accordance with the rules in force from time to time.

Clause 34: All payments for work done under this contract shall be made by cheque or RTGS (as applicable) to the contractor. The work covered by this contract as shown on plan which have been signed by the contractor are annexed herewith.

Clause 35: Should the tenderer withdraw or modify his tender within three months from the date of opening of tender, he is liable to be black listed and earnest money forfeited.

Clause 36: When a final bill is likely to be for a minus amount, the security deposit will be with-held till the bill is passed and the recoverable amount is first made good.

Clause 37 : All taxes should be included in the rates to be quoted and is payable by the contractor.

Clause 38: The rates given are for the work inclusive of GST and other applicable taxes etc.

Clause 39: It will be the responsibility of the contractor to ensure that the trees at the site of work and in the vicinity or their fruit etc. are not damaged by his labour or agent. The assessed cost of such damage if any will be at the discretion of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak and shall be deducted from the bill of the contractor.

Clause 40: The contractor shall provide at his own cost separate latrine, bathing enclosures and platform for use of the men and women labour and keep them clean to the satisfaction of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak. He should also arrange at his own expenses for clean drinking water, housing, medical facilities necessary for the welfare of the labour employed at his work. In case of his failure, the same shall be provided by Federation at contractor's cost. Any dispute regarding this will be settled by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak whose decision will be binding.

Clause 41: Any material left on the site of work after one month from the date of completion of the work shall become the property of the Federation and no payment shall be made for it.

Clause 42: The amount of the work can be increased or decreased according to the requirement of the Federation and no claim whatsoever on this account will be entertained.

Clause 43: The Federation Reserves option to take away any items of the work or part thereof any time during the currency of the contract and re-allot it to another agency with due notice to the contractor without liability or compensation.

Clause 44: It is not obligatory on the contractor to employ labour through employment exchange but he may avail of the facilities offered by the employment exchange in case he wishes to do so.

Clause 45: No claim on account of fluctuation in prices due to war or any other cause will be entertained.

Clause 46: The contractor shall be liable to make good all damages caused by breakage from the moment the stores, pipes and fittings etc. are handed over to his charge.

Clause 47: No compensation whatsoever will be payable on account of any delay or default in the supply of material mentioned in the List of material to be issued to the contractor by the Federation and consequence delay in the execution of work.

Clause 48: GST/Taxes as applicable will be deducted from gross payment as per govt. instructions.

Clause 49: The contractor shall be liable to pay the ESI/CPF/EPF/ contribution, workers welfare cess etc. as applicable or as applied during the pendency of the contract under the provision of Provident Fund Act/ Labour Act to the persons engaged and shall have the registration with Regional Provident Fund

Commissioner/ and Labour Officer etc. under Provident Fund Act/ Labour Act as applicable from time to time. The Federation shall not be responsible for any default committed under these Acts.

FAIR WAGES CLAUSES

a) The contractor shall pay not less than fair wage to labour engaged by him on the work.
Explanation : 'Fair Wage' means wage whether for time or piece-work notified at the time of inviting tenders of the work and where such wages have not been so notified the wages prescribed by the Public Works Department, Building and Roads Branch, Labour Deptt. Haryana for the district in which the work is done

b) The contractor shall, notwithstanding the provisions of any agreement to the contrary, caused to be paid fair wages to labourers, and indirectly engaged on the work including any labour engaged by his sub-contractors in connection with the said work, as if the labourers had been directly employed by him.

c) In respect of labour directly employed on the works for the performances of the contractor's part of this agreement the contract shall comply with or cause to be complied with the Haryana Public Works Department Contractor's Labour's Regulations made by Government from time to time in regard to payment or wages period deductions from wages recovery of wages not paid and deduction unauthorisedly made maintenance of wage work, wage slip, publication of wages and other terms of employment inspection and submission of periodical returns and all other matters of alike nature.

d) The GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, concerned shall have the right to deduct. from the money due to the contractor, any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for benefit of the workers, non-payment of wages or deduction made from his or their wages, which are not justified by the terms of the contract for non-observance of the regulations referred to in clause (c) above.

e) Vis-à-vis the Federation, the contractor, shall be primarily liable for all payments to be made under and for the observance of the regulations aforesaid without prejudice to his right to claim indemnity from his sub-contractors.

f) The regulations aforesaid shall be deemed to be part of this contract.

g) Attendance card should invariably be issued by the contractors to their workers, which should be returned to the contactors concerned at the time of receiving payment of their wages.

h) Before making payment to the contractors the authorities concerned should obtain a certificate from the contractors that he has made payment to all the workers connected with the execution of the work for which the payment is being made.

i) Contractors employing 50 or more workers on the site of a particular work should provide facilities of housing, latrines, water and light to their workers at their own expense.

j) The normal working hours of workers employed by contractors for the execution of work allotted to them should be 8 hours per day with a break of 2 hours during summer, one hour during winter after continuous work of 4 hours at the latest. The spread over should in no case exceed 10 hours. Workers working beyond these hours should be paid overtime wages at the double the ordinary rate of their wages calculated by the hour.

HARYANA STATE COOPERATIVE SUPPLY AND MARKETING FEDERATION LIMITED (CONTRACTOR'S LABOUR REGULATION)

A. Short title

These regulations may be called HAFED Contractor's Labour Regulations.

B. Definition

In these regulations, unless otherwise expressed, or indicated the following words and expression shall have the meaning hereby assigned to them respectively, that is to say.

(i) Labour means workers employed by HAFED contractor's directly or indirectly, a sub-contractor or other persons or by an agent on his behalf.
(ii) Fair wages means, whether for item or piece work, notified at the time of inviting tenders for the work and where such wages have not been so notified the wages prescribed by the Labour Deptt. Haryana for the district in which the work is done.
(iii) Contractor shall include every person whether a sub-contractor or headman or agent employing labour on the work, taken on contract.
(iv) "Wages" shall have the same meaning as defined in the payment of Wages Act and includes time and piece rate wages.

1. Display of notice regarded wages etc.

The contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly in a clean and legible condition in conspicuous places of the work, notice in English and in the Local Language spoken by the majority of the workers, giving the rate of wages which have been certified by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, or Regional Labour Commissioner as fair wages and the hours of work for which such wages are earned and a copy of such notices to the District Labour Welfare Officer.

2. Payment of Wages

(i) Wages due to every worker be paid to him directly.
(ii) All wages shall be paid in current coin or currency or in both.

3. Fixation of Wage Periods

(i) The contractor shall fix the wage periods in respect of which the wages shall payable.
(ii) No wage period shall exceed one month.
(iii) Wages of every workman employed on the contract shall be paid before the expiry of ten days after the last of the wage period in respect of which the wages are payable.
(iv) When the employment of any worker is terminated by or on behalf of the Contractor, the wages earned by him shall be paid before the expiry of succeeding the one on which his employment is terminated.

(v) All payment of wages shall be made on a working day except the work is completed before the expiry of the wages period in which case final payment shall be made within 48 hours of the last working day.

Notes: -The terms working day means a day, on which the work on which the labour is employed is in progress.

4. Wages book and Wages Slip etc.

(i) The contractor shall maintain a wage book of each worker in such a form as may be convenient but the same shall include the following particulars:-
   a) Rate of daily or monthly wages.
   b) Nature of work for which employed.
   c) Total number of days worked during each wage period.
   d) Total amount payable for the work during each wage period.
   e) All deduction made from the wages within an indication in each case of the ground for which the deduction is made from the wage.
   f) Wages actually paid for each wage period.

(ii) The contractor shall also maintain a wage slip for each worker employed on the work. The wage slip shall contain all the particulars given in the wage book.

(iii) The GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may grant exemption from the maintenance of Wage Book and Wage Slips to a contractor who in his opinion may not directly or indirectly employ more than 50 persons on the work.

5. Fine and deductions which may be made from wages

(i) The wages of workers shall be paid to him without any deduction of any kind except the following:
   a) Fines
   b) Deductions for absence from duty viz, from the place or places Where by the terms of his employment is required to work.
   c) The amount of deduction shall be in proportion to the period for which he was absent.
   d) Deductions for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money for which he is required to account, where such damage or loss is directly attributable to his neglect or default.
   e) Any other deduction which the Government may from time to time allow.

(ii) No fine shall be imposed on a worker and no deduction for damage or loss be made until the worker has been given an opportunity of showing cause against such fines or deductions.

(iii) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to Five paise in a rupee of the wage payable to him in respect of that wage period.

(iv) No fine imposed on any worker shall be recovered from him by instalments, or after the expiry of 90 days from the date in which it was imposed.

6. Register of Fine etc.

(i) The contractor shall maintain a Register of fine and of all deduction for damage or loss Such Register shall maintain the reason for which fine was imposed or deduction for damage or loss made.

(ii) The contractor shall maintain, both in English and local Indian Language, a list approved by the Chief Labour Commissioner clearly stating the acts and commissions for which penalty or fine may be imposed on workmen and display it in a good condition in a conspicuous place on the work

7. Preservation of Registers

The wage book, the wage slips and the Register of fines, deductions required to be maintained under these regulations shall be preserved for 12 months after the date of last entry made in them.

8. Power of Labour Welfare Officer to make Investigation / Enquiry

The Labour Welfare Officer or a person authorized by the Government on their behalf shall have power to make enquiries with a view to ascertaining and enforcing due and proper observance of the fair wage clause and provisions of these regulations. He shall be investigating into any complaint regarding the default made by the contractor or sub-contractor in regard to such provision.

9. Report of Labour Welfare Officer

The Labour Welfare Officer or any other person authorized as aforesaid shall submit a report of the result of his investigation or enquiry to the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, concerned, indicating the extent if any to which the default has been committed and the amount of fine recoverable in respect of the acts of omission and commission of the labourer with a note that necessary deduction from the contractor's bill be made and the wages and other dues be paid to the labourers concerned.

10. Appeal against the decision of Labour Welfare Officer

Any person aggrieved to the decision and recommendation of the Labour Welfare Officer or other person so authorized may appeal against such decision, to the Regional Labour Commissioner within 30 days from the date of decision forwarding simultaneously a copy of his appeal to GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, concerned, but subject to such appeal, the decision of the Labour Welfare Officer shall be final and binding upon the contractor.

11. Representation of Parties

(i) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by:
   a) An officer of a registered trade union to which he is a member.
   b) An officer of Federation of trade unions to which the trade union referred it in clause (a) is affiliated.
   c) Where the worker is not a member of any registered union, an officer of registered trade union connected with, or by any other workman employed in the industry in which the worker is employed.

(ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by:
   a) An employer of an association of employers of which he is a member.

b) An officer of an association of employers to which the association referred to in clause (a) is affiliated.
c) Where the employer is not a member of any association of employers by an officer of an association of employers connected with or by any other employer is engaged.

12. Inspection of Books

The contractor shall allow inspection of Wage Book, the Wage Slips and Register of Fines and deduction to any of this worker or his agent at a convenient time and place after notice is received or to the Labour Welfare Officer or any other person authorised by the Government on his behalf.

13. Submission of Returns

The contractor will be regulated by (Regulation and Abolition Act 1970) and the contract labour (Regulations and Abolition Central Rule 1971) enforced by Haryana Labour and employment Department Memo No. 12 (26-78-4- Labour dated 10-6-79).

The contractor shall submit periodical returns specified from time to time.

14. Licensing of Contractor

Every contractor who employs or who employed on any day of the preceding 12 calendar months, 20 or more workmen, is covered by the act and is required to obtain a license. The contractor should obtain the necessary license as required under section 12 of contract labour (regulation and abolition Act 1970 before commencing the work).

15. Amendments

The Haryana Government may from time to time and or amend these regulations on any question as to application, interpretation or effect of these regulations the decision of the Labour Commissioner to Haryana Government in that behalf shall be final.

1. In case of duplicity/variation/contradiction of term & condition in the printed Tender Document and in special terms & conditions, terms and conditions mentioned in the Special terms & conditions will prevail.

2. The rate will be firm and biding on the contractor during the currency of contractor including extended time period. No escalation shall be paid for any increase in cost of material & labour.

16. The Bidder is advised to visit and examine the site conditions, approach road, traffic, location, surroundings, climate, availability of power, water and other utilities for installation & commissioning, access to site, handling and storage of materials, weather data, applicable laws and regulations, and obtain for itself on its own responsibility all information, as per their understanding, may be necessary for preparing the Bid and entering into the Contract Agreement. All the expenses of visiting the Site and its associated costs shall be borne by the Bidder. The bidder is advised to go through the documents with all details and understand the exact quantum of works. The scope of the works is in turnkey nature and no exclusions at the time of execution will be accepted.

SECTION-4 (II)

SPECIAL TERMS & CONDITIONS OF CONTRACT

In addition to the terms & conditions as stipulated in contract agreement, following special conditions shall also be applicable in this contract:

1. 5% security will be deducted from running bills and the 50 % of same will be refunded after 3 months from the satisfactory completion of work. Balance 50% after completion of defect liability period of two years or after submission of performance bank guarantee of equivalent amount valid upto Defect Liability period.

2. All applicable taxes (GST & others) are to be deducted from all the running bills as per standard norms of GoI.

3. Cess @ 1% of the total cost of this package of project from the payment of contractor under section-3 of the "Building & Other Construction Workers Welfare Cess Act-1996" & registration of establishment under section-7 of the "Building & Other Construction Workers" (regulation of employment and condition of service tax act 1996) shall be deducted from all running & final bills.

4. The rate to be quoted by the contractor shall be inclusive of applicable GST and other taxes.
5. **Valuations of Variations:-**
   Since this is a turnkey contract, no extra items / claims will be accepted by HAFED under any circumstances.

6. **Extent of variations:-**
   Quoted rates for all items shall be firm and binding on the contractor irrespective of any variation No extra payment will be made beyond the total quoted amount.

7. **Measurements:-**
   Measurement of work executed:-
   The contractor shall, without extra charges, provide all assistance with every appliance, labour and other things necessary for measurement and recording levels.

   Except where any general or detailed description of the work expressly shows to the contrary, measurement shall be taken in accordance with the procedure set forth in the specification notwithstanding any provisions in the relevant Indian Standard Method of Measurement or any general or local custom. In the case of items which are not covered by specification, measurement shall be taken in accordance with relevant standard method of measurement issued by the bureau of Indian Standard and if for any item no such standard is available then a mutually agreed method shall be followed.

   GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak or his authorized representative may cause either themselves or through another officer of the HAFED to check the measurements recorded jointly or otherwise as aforesaid and all provision stipulated herein above shall be applicable to such checking of measurement or levels.

It is also a term of his contract that recording of measurement of any item of work in the measurement book and/ or its payment of the interim on account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the Defects Liabilities Period.

8. **Monthly Payments:-**
   The said statement shall be approved or amended by the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak in such a way that in his opinion, it reflects the amount due to the contractor in accordance with the contract, after deduction, of any sums which may have become due and payable by the contractor to the Employer. In case where there is difference of opinion as to the value of any item the GM's HAFED, CFP, Rohtak/Executive Engineer's, HAFED, Rohtak view shall prevail. Within the 7th day of the month following the receipt of the monthly statement, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall determine the outstanding amounts due to the contractor and shall issue to the contractor a certificate called "interim payment certificate" certifying the amount due to the contractor. However, the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak may recommend advance payment against on account bills when there is likely to be delay in authorizing payments for some special reasons which should be recorded.

9. The work shall be carried out as per the latest Respective Indian Standard Codes, Haryana PWD& Technical specifications mentioned in Tender Documents. In absence of specifications from Haryana PWD specifications, specifications from standard Engineering practice, IS codes and as per direction of the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall be followed.

10. The time period for completion of work shall be **Six Months** from the date of handing over of site to the agency.

11. The work shall be inspected and frequency of tests required shall be as per relevant IS Code.

12. The defect liability period shall be 24 (Twenty Four)-calendar months after commissioning of the works. Any defect in material or workmanship observed in the work during execution of work or within Defect liability period shall be rectified by agency at his own cost. In the case the contractor fails to rectify the defects within 15 days, the department shall get the work executed at his risks and costs and recovered from the Contractor.

13. Dispute arising out of this contract shall be limited to the jurisdictions of Panchkula court / Punjab & Haryana High Court, Chandigarh (as applicable) only.

14. All material to be arranged by contractor himself, shall be confirming to relevant ISI specification, duly ISI marked and as per list of approved manufactures/ makes by HAFED attached in the DNIT. Wherever referred ISI codes shall be with its latest amendments.

15. Contractor will have to supply manufacturer's certificate certifying that materials have been manufactured as per ISI specification, duly supported by necessary documentation.

16. Necessary certificate from the manufacturer for all the material brought at site shall be supplied to the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, certifying that this lot of material have been manufactured as per Standard of BIS and confirms to relevant ISI Code.

17. HAFED reserves its right to get any material tested from M/s Shri Ram Institute for Industrial research or other equivalent reputed test house to ensure for quality of material/work. Testing charges shall be borne by the Contractor, but in Case of failure of any lot of material, all the work executed with that lot of the material shall be rejected.

18. Sampling of work in progress shall be carried out by representative of GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, Contractor and shall be got tested as per approved Quality Assurance Plan from M/s Shri Ram Institute for Industrial research Delhi / M/s Delhi Test House, New Delhi and NIT Kurukshetra or any other lab as suggested by HAFED. Fee of testing shall be borne by the Contractor. But in case, if any sample fails, rectification of defective work, to be done upto the entire satisfaction of GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak, as defined in the Technical Specifications in Tender Documents, Relevant IS Codes & Haryana P.W.D. specifications as applicable..

19. All types of works to be carried out by maintaining industrial safety acts., Tools for maintaining the same at site to be arranged by the contractor at his own expenses. In case of any accidents occurred at site, Contractor is fully responsible for the same.

20. The contractor shall submit the CAR (Contractor's All Risks) Policy for the awarded value of the work and valid of the work and valid for the entire duration of the work including the extended period of work, it any. The contractor shall provide to the Federation copy of the insurance policies and document taken out by him pursuance of the contract immediately after such insurance coverage. If the contractor fails to effect and keep in force insurance, as per the terms of contract, the Federation may effect and keep in fore 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 Federation as aforesaid from any money due or which may become due to the contractor, or recover the same as debit due from the contractor.

21. The contractor shall be responsible for preparing all claims and make good for all damage or loss by way of repairs and or replacement of portion of any works damaged or lost. The transfer of title shall not in any way relieve the contractor of his responsibilities during the period of the contract including the Defects Liability Period.
22. The contractor shall abide by the local laws and regulations governing labour applicable from time to time. During continuance of the contract, the contractor shall abide at all times by all existing labour enactments and rules made there under, regulations, notification and by laws (including rules), regulation, bye-laws that may be passed or notification that may be issued under any labour law in future either by the state or the Central Government or the local authority.

23. The rate to be quoted shall include GST and other applicable taxes and noting extra shall be payable to the agency on this account.

24. Nothing shall be paid for any loss and damages done to rain, floods or any other act of God and payment shall be made only for material acceptable to the department.

25. Material purchased in excess shall not be measured and paid for and if not removed within one month after completion of the work, the material shall become the property of the HAFED and no claim on this account shall be entertained.

26. The contractor shall provide suitable measuring arrangement at site for checking of various material supplied by him.

27. In case of duplicity/variation/contradiction of term & condition in the printed Tender Document and in special terms & conditions, terms and conditions mentioned in the Special terms & conditions will prevail.

28. The rate will be firm and biding on the contractor during the currency of contractor including extended time period. No escalation shall be paid for any increase in cost of material & labour.

29. **Electricity & Water**

Electricity
The contractor will bear all electricity & diesel charges during installation, testing, commissioning & trial run of 3 months period, at its own cost.

Water
Contractor is required to make his own arrangement for the water required for the installation, testing & commissioning, trial run of 3 months period, as well as for drinking and other uses of his workers at its own cost. In either case water being provided should be fit for the respective usage and the contractor shall provide the test report of water being used. In case the water is provided by HAFED the same shall be charged at the prevailing rates of HAFED water policy/norms.

30. **Taxes**
It is being specifically intimated that the bidders should include GST and other applicable taxes.

31. Complete designs of P&M design proposal and Civil, Steel structure, MEP, fire fighting works i.e all applicable works to be executed should be duly vetted by IIT Delhi/ Roorkee /NIT/ or any other technical body by the Contractor with the confirmation from HAFED at Contractor's own cost within 30days of issuing the Letter of Acceptance.

32. **Performance Security:**

A. <u>Performance Security for SITC (Supply, Installation, Testing, Commissioning & Trial Run) of Work which shall valid upto Defect Liability Period plus 60 days</u>

The successful Bidder, i.e. the Bidder whose Bid is acceptable to the Employer, shall have to deposit Performance Security equal to 10% of the total contract value after deduction of the AMC value quoted by the bidder within 30 days of receipt of notification of award of the Contract. The performance security may be furnished in the form of Bank Guarantee from any Scheduled/ Nationalised bank in the format given in Bid Documents. The Bank guarantee for performance security shall remain in force as

given in the Bid Document shall be valid up to 60 days beyond the expiry of the Defects Liability Period of two years. The extension of the Bank Guarantee will be extended and submitted by the bidder accordingly if there is any delay on the decision of HAFED.
The proceeds of the performance security shall be payable to the HAFED as compensation for any loss resulting from the Contractor's failure to complete its obligations under the Contract.

B. Performance Security for AMC which shall valid upto AMC Period plus 60 days

The successful Bidder, i.e. the Bidder whose Bid is acceptable to the Employer, shall have to deposit Performance Security equal to 50% of the AMC contract value quoted by the bidder before 30 days of completion of Defect Liability Period. The performance security may be furnished in the form of Bank Guarantee from any Scheduled/ Nationalised bank in the format given in Bid Documents. The Bank guarantee for performance security shall remain valid up to 60 days beyond the expiry of the AMC Period of three years. The extension of the Bank Guarantee will be extended and submitted by the bidder accordingly if there is any delay on the decision of HAFED.
The proceeds of the performance security shall be payable to the HAFED as compensation for any delay /loss resulting from the Contractor's failure to complete its obligations under the Contract.

1. Payment (Clause16)

I. Mobilization advance (Mandatory)

a) The contractor can avail 20% mobilization advance for Supply, Installation, Testing, Commissioning works and Civil, MEP fire-fighting works of the contract value @ 9% of simple interest for capital works to expedite the deployment of technical staff, establishment of office for own & employees staff, material, movement of equipment and machinery etc. at site. This advance shall be paid against bank guarantee from any nationalised bank of India to be given by the contractor. The Employer is rightly entitled to check that mobilisation advance is utilised for the work for which it is given. Mobilization advance shall be recovered @ 20% of gross value of work done from each running account bill, however, in any case full mobilisation advance shall be recovered before 80% of total work completed. The bank guarantee shall be released after 100% of the recovery of Mobilisation advance.

b) Bonus @ 0.5% of contract value per fortnightly shall be paid to contractor for early completion. The bonus incentive for period less than fortnight shall not be paid for.

NOTE:

(i) The interest rate applicable for advance will be 9% per annum (simple interest) on the outstanding advance amount. The advance shall be adjusted by recovery on pro rata basis along with interest from the 1st Supply/RA Bill onwards. The interest shall be calculated on the basis of advance adjusted from the date of cheque towards advance payment to the date of receipt of material at site, on actual number of days.

(ii) All bank guarantees should be issued by Nationalised Banks approved by RBI to be at par with

Nationalised Banks for the limited purpose of acceptance of guarantee or foreign banks having branches in India.

(iii) The successful bidder may raise running bills for supply as soon as supply is completed as per the schedule and bills for Installation & Commissioning job shall be raised as applicable.

II. Terms of Payment

A. Terms of Payment for Supply Installation, Testing, Commissioning & Trial Run:

(a) 70% of contract price (against detailed item wise cost breakup be furnished by the Contractor in advance and accepted/ approved by SPV) on safe receipt of the goods at site and after inspection and approval of the SPV. 20% of mobilization advance will be recovered from each running bills on pro rata basis.

(b) 20% of contract price shall be paid on actual completion of installation/erection and after due inspection and approval by the SPV (against detailed break up cost to be furnished by the Contractor in advance and accepted by the SPV).

(c) The balance 10% shall be paid after successful commissioning and 3 months trial run of plant (on continuous satisfactory running of the complete plant for three month), and acceptance by the SPV's representative, within the scope of this contract.

B. Terms of Payment for Civil, PEB, MEP, Fire-fighting Works: As per RA Bills & based on the joint measurement as site as per BoQ attached with this bid. 20% of mobilization advance will be recovered from each running bills on pro rata basis.

C. Terms of Payment for AMC Period: The payment for AMC shall be made on quarterly basis and the above terms and conditions of payment and clause for mobilization advance is applicable only for Supply, Installation, Erection and Commissioning of equipments & machinery up-to defect liability period. No mobilization advance is to be given for AMC.

SECTION 4 (III)

SCOPE OF WORK

SCOPE OF WORK

Design, detailed engineering, manufacturing, vetting from technical body, inspection at manufacturer's works, packing, forwarding, unloading, erection, testing, commissioning, achieving rated equipment and capacities including Civil, MEP, Firefighting works related, trail run, and handing over to HAFED's satisfaction of the following as given section wise in the list below and not limited to:

A) Design and supply of

- Milk Chilling Unit (10000 LPD), Storage Facility for Milk (10 MT) And Cold Storage (300 MT), MHE, Racking, and related electrical system including all Electrical Panels, Cables, Transformer, Diesel Generator (Power Backup) etc.

B) Erection, testing and commissioning of:

- Milk Chilling Unit (10000 LPD), Storage Facility for Milk (10 MT) And Cold Storage (300 MT), MHE, Racking, and related electrical system including all Electrical Panels, Cables, Transformer, Diesel Generator (Power Backup) etc.

Bidders may add additional items section wise if these are required as per their detail engineering. These additional / optional / alternatives items offered by the bidder will be considered during technical evaluation of the bids and would be subjected to acceptance by the HAFED only through addendum of the tender document.

The section wise list of equipment is as follows:

- The equipment and accessories shall be covered under the warranty/guarantee clauses specified in bidding document.
- Suitable structure for roofing of all elevator towers to be provided. However roofing sheeting will be done by Contractor.

C) Civil, MEP, Firefighting Works

- Conducting of Soil & Water Test at various locations at site for designing of foundations.
- All Civil, MEP works, Fire-fighting works including design, Drawings of P&M and vetting of design and GFC Drawings from Reputed Institute (IIT/NIT) is in the successful Bidder's Scope.
- The Civil works shall cover all
    - Complete Design of Pre-Engineering Building, Vetting of Design of Pre-Engineering Building from Reputed institute (IIT/NIT etc). The successful bidder shall submit the vetted design & drawings to HAFED before executing the work at site.
    - Construction works of the facility including PEB structure above brickwork of 4.2 m height from Road level.
    - External Development for CC Road & RCC Drain, external electrification etc.
    - Boundary Wall (1.8 metre height) and Gate House, Security Rooms, Weighbridge Rooms
    - The Firefighting design shall confirm to the NBC, local government norms and as per the site area.

    (Please see the attached drawings for detailed reference)

D) Design. Drawings, Vetting of Design, Supply, fabrication, Erection & commissioning of Pre-Engineering Building works:

- The successful bidder shall design the entire pre-engineering building & submit the same in Reputed Institute (IIT/NIT) for vetting of the same.
- Once the design got vetted from the institute, the vendor shall submit the same to PMC with all necessary load details & base reactions for record purpose.
- The vendor shall fabricate all the structural element at their manufacturing plant only with automatic welding machine.
- Prior to dispatch of materials before primer/ painting, the vendor will raise a request for factory inspection.
- The materials to be dispatched by the vendor only after approval received from HAFED.

E) Trial Run and Training

- Trail Run of the facility (Plant and machinery in the scope of the tender), starts from the date of commissioning for three months period. The scope under the trial run covers successful running and operation of all the components in the scope; supply of required raw material for successful trial run, etc. for the entire facility during the three months trial run period. All staff and materials required for trail run are to be deployed by the Successful Contractor.
- A minimum of one week training or more if required is to be arranged by the Successful Contractor for the running, operation and production staff proposed by HAFED during the trial run period. Prior Communication and Approval is to be done with HAFED regarding the training. The training should cover all details on running, monitoring, data recording and safety measures, etc. of all the equipment.

Sr No	Subject	Details	Remarks
1	Date of start of trial run	From the date of Commissioning	
2	Period of trial run	3 calendar months	
3	Brief Scope	Maintenance, Running and operation of all the equipment: Successful running and operation of all the components in the scope And A minimum of one week training or more if required is to be arranged by the Successful Contractor for the running, operation and production staff proposed by HAFED	Successful trial run shall be monitored for all the components etc. Minimum of one week training or more as required is to be organised by the Contractor.

Trial run shall be for the period where consistent capacity proof is achieved for every component. Consistent capacity means running the plant at a rated capacity. Raw material and staff required for successful trial run are to be arranged by the Contractor. The time period of Trial Run is to be weekly / fortnightly on one shift basis witihin 3 months trial run period to ensure all parameters should be achieved.

E) Defect Liability period and Warranty, Annual Maintenance of the Plant and Machinery in the scope of the tender:

The defect liability period shall be 24 (Twenty Four)-calendar months after commissioning of the Equipment, Plant and Machinery in the scope of the tender.

Any defect in material or workmanship observed in the work during execution of work or within Defect liability period shall be rectified by agency at his own cost (the contractor's Cost). In the case the contractor fails to rectify the defects within 15 days, HAFED shall get the work executed at his risks and costs and recovered from the Contractor.

The warranty and guarantee certificates of all the components and machinery in the scope of the tender shall be submitted to HAFED at the time of Supply and Installation and the same shall hold true if it is more than the defect liability period. Otherwise, defect liability of two years holds true for all the equipment.

The Bidder shall quote for 3 years (36 calendar months) of Annual Maintenance Services post completion of Defect Liability Period. The same shall also include warranty / guarantee / spare parts / maintenance of the all the equipment& machinery. (If warranty of equipment/machinery is more than the defect liability period of 24 months).

The services during the annual maintenance period of three years shall be the same as mentioned in the defect liability period. However, the cost of spares or machinery/equipment shall be paid by HAFED (if warranty given by original equipment manufacturer has expired) after ascertaining the same. The successful contractor shall prepare a list of the equipment for requirements of spare parts or for the equipment for which replacement may be required and submit the same with its quoted rates to HAFED during the financial bid submission. The quoted rates for the spare parts shall be in limits and shall correspond to the rates quoted for the Supply and installation of equipment in the scope of the tender If any equipment is to be repaired/ replaced which is not in the list of spare parts submitted then the Contractor shall submit three quotations to HAFED of that equipment / spare parts etc and take prior approval from HAFED for any kind of rework or replacement during the three years of maintenance period. HAFED deserves the right to verify the same by competitive third party agency.

Table for Defect Liability Period & Warranty:

Sr No	Subject	Details	Remarks
1	Date of start of defect liability and warranty	From the date of Commissioning	
2	Period of defect liability and warranty	Minimum of 24 calendar months (2 years) and beyond for all the equipment whose Warranty is for more than 24 months as per Original Equipment Manufacturer.	
3	Brief Scope	Rectification and Replacement of the equipment if defects or error in functioning are found.	Reporting and Approval from HAFED

Table for Annual Maintenance Period:

Sr No	Subject	Details	Remarks

1	Date of start of Annual Maintenance	From the date of Completion of defect liability period	
2	Period of Annual Maintenance	Minimum of 36 calendar months (3 years) and beyond for all the equipment whose Warranty is for more than 24 months as per Original Equipment Manufacturer.	
3	Brief Scope	The successful contractor shall prepare a list of the equipment for requirements of spare parts or for the equipment for which replacement may be required and submit the same with its quoted rates to HAFED during the financial bid submission. The quoted rates for the spare parts shall be in limits and shall correspond to the rates quoted for the Supply and installation of equipment in the scope of the tender If any equipment is to be repaired/ replaced which is not in the list of spare parts submitted then the Contractor shall submit three quotations to HAFED of that equipment / spare parts etc and take prior approval from HAFED for any kind of rework or replacement during the three years of maintenance period. HAFED deserves the right to verify the same by competitive third party agency	Reporting and Approval from HAFED

****** It may be noted that if warranty/guarantee is more than 60 months (24 months of Defect Liability and 36 months of Annual Maintenance) then the Contractor has to replace/rectify the same. If warranty exists beyond 36months it is the sole responsibility of the Contractor to maintain the same in case of any damage as stated by Original Manufacturer agency**.

Note:

- **The completion date of commissioning of all equipment will be marked as the final date of commissioning for further reference of Trial Run, Defect Liability Period and subsequently for Annual Maintenance Period.**
- **In case, any equipment is replaced or repaired during Defect Liability period or annual maintenance period (falling in the warranty period given by Original Equipment Manufacturer), all tests are to be performed by the contractor for the new equipment as per the Quality Assurance Plan. Schedule of spares inventory should be presented to HAFED at the time of commissioning.**

SECTION 5(I)

GENERAL CONDITIONS OF CONTRACT

1. **Definitions**

In this Contract, the following terms shall be interpreted as indicated.

a) The Contract" means the agreement entered into between the HAFED and the Contractor, as recorded in the Contract Form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein;

b) "The Contract Price" means the price payable to the Contractor under the Contract for the full and proper performance of its contractual obligations;

c) "The Goods" means all of the equipment, machinery, and/or other materials, which the Contractor is required to supply to the HAFED under the Contract;

d) "Services" means services ancillary to the supply of the Goods, such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training and other such obligations of the Contractor covered under the Contract;

e) "The Contractor" means the individual or firm supplying the Goods and services under this Contract.

f) "Office -in-charge" means the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak designated as such or other Officer appointed from time to time by the HAFED and notified in writing to the Contractor to act as Officer -in-charge for the purposes of contract.

g) "Works" means all goods to be provided and work (Services) to be done by the Contractor under the contract.

2. **Application**

These General Conditions shall apply to the extent that they are not superseded by provisions in other parts of the Contract.

3. **Country of Origin**

3.1 For purpose of this Clause "origin" means the place where the Goods were mined, grown or produced, or from which the Services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembling of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.

3.2 The origin of Goods and Services is distinct from the nationality of the Contractor.

4. **Standards**

The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standard appropriate to the Goods' country of origin and such standards shall be the latest issued by the concerned institution.

5. **Use of Contract Documents and Information**

5. 1. The Contractor shall not, without the HAFED's prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawing, pattern, sample or information furnished by or on behalf of the HAFED in connection therewith, to any person other than a person employed by the Contractor in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend only as far as may be necessary for purposes of such performance.

5. 2. The Contractor shall not, without the HAFED's prior written consent, make use of any document or information enumerated in para. 5.1 Except for purposes of performing the Contract.

5. 3. Any document, other than the Contract itself, enumerated in Para. 5.1 shall remain the property of the HAFED and shall be returned (in all copies) to the HAFED on completion of the Contractor's performance under the Contract if so required by the HAFED.

6. **Patent Rights**

The Contractor shall indemnify the HAFED against all third-party claims of infringement of patent, trademark or industrial design rights arising from use of the Goods or any part thereof in India.

Inspection and Tests

8.1 The HAFED or its representative shall have the right to inspect and/or test the Goods to confirm their conformity to the Contract. The Special Conditions of Contract and/or the Technical Specifications shall specify what inspections and tests and QAP attached in the document the HAFED requires and where they are to be conducted. The HAFED shall notify the Contractor in writing of the identity of any representatives, if retained for these purposes. The contractor has to inform HAFED prior to despatch of any major equipment of the contract document. The contractor can only supply material if the inspection is found satisfactory.

8.2 The inspections and tests may be conducted on the premises of the Contractor or its subcontractor(s), at point of delivery and/or at the Good's final destination. Where conducted on the premises of the Contractor or it's sub- contractor(s), all reasonable facilities and assistance including access to drawings and production data-shall be furnished to the inspectors at no charge to the HAFED . In case of any defects or deficiency notified by the HAFED's inspection authority, the Contractor will rectify and make good the same without delay and not proceed with further processing of such item(s) of Goods without obtaining approval from the inspection authority.

8.3 Should any inspected or tested Goods fail to conform to the Specifications, the HAFED may reject them and the Contractor shall either replace the rejected Goods or make all alterations necessary to meet specification requirements free of cost to the HAFED.

8.4 The HAFED's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival at the destination shall in no way be limited or waived by reason of the Goods having previously been inspected, tested and passed by the HAFED or its representative prior to the Goods shipment from the country of origin.

8.5 Tests upon completion

8.5.1 The Contractor shall give to the HAFED 21 days notice of the date after which he will be ready to make the tests of completion (the Test). Unless otherwise agreed, the Tests shall take place within 14 days after the said date on such day or days, as the HAFED shall notify the Contractor.

8.5.2 If the HAFED fails to appoint a time after having been asked to do so, or does not attend at the time and place appointed, the Contractor shall be entitled to proceed with the Tests in his absence. The tests shall then be deemed to have been made in the presence of the HAFED and the results of the Tests shall be accepted as accurate.

8.5.3 If the Tests are being unreasonably delayed by the Contractor the HAFED may give notice requiring the Contractor to make the tests within 21 days after the receipt of such notice. The Contractor shall make the Tests on such days within that period as the Contractor may fix and of which he shall give notice to the HAFED.

8.5.4 If the Contractor fails to make the Tests within 21 days the HAFED may himself proceed with the Tests. All tests so made by the HAFED shall be at the risk and cost of the Contractor and the cost thereof shall be deducted from the Contractor's price. The test shall then be deemed to have been made in the presence of the Contractor and results of the tests shall be accepted as accurate.

8.5.5 If the Goods/services or any section fails to pass the Tests, the Contractor may require such tests to be repeated on the same terms and conditions. All costs to which the HAFED may be put to by the repetition of the tests under this sub- clause or under sub clause 8.5.14 shall be deducted from the Contract Price.

8.5.6 If the HAFED and the Contractor disagree on the interpretation of the test results each shall give a statement of his views to the other within 14 days after such disagreement arises. The statement shall be accompanied by all relevant evidence. The HAFED will review both the statements and render a final decision within a further period of fourteen (14) days, which shall be binding on the Contractor.

8.5.7 If the Goods/Services or any Section fails to pass the Tests on the repetition thereof under sub-clause 8.5.4 the HAFED after due consultation with the Contractor, shall be entitled to:

a) Order one further repetition of the Tests under the conditions of sub-clause 8.5.4 or

b) Reject the Goods or a section thereof in which event the HAFED shall have the same remedies against the Contractor as are provided under sub-clause 8.5.12.

c) Issue a taking over certificate, if the HAFED so wishes, notwithstanding that the Goods are not complete. The Contractor's price shall then be reduced by such amount as may be agreed to by the

HAFED and the Contractor or failing an agreement, as may be determined through arbitration.

8.5.8 In considering the results of tests carried out under sub-clause 8.5.11 and 8.5.14 and the HAFED shall make allowances for the effect of any use of the Goods by him on the performance or other characteristics of the Goods.

8.5.9 As soon as the Goods/Services or any section thereof has passed the tests, the HAFED shall issue a certificate to the Contractor to that effect.

8.5.10 The Goods and Services shall be accepted by the HAFED when they have been completed in accordance with the contract, except in minor respects that do not affect the use of the Goods for their intended purposes and having passed the tests on completion and a taking over certificate has been issued or deemed to have been issued in accordance with sub-clause 8.5.10

8.5.11 The Contractor may apply by notice to the HAFED for a taking over certificate not earlier than 14 days before the goods will in the Contractor's opinion be complete and ready for taking over under sub-clause 8.5.9.

The HAFED shall within 28 days after the receipt of the Contractor's application either:

a) Issue the taking over certificate to the Contractor stating the date on which the works were complete and ready for taking over, or

b) Reject the application giving his reasons and specifying the work required to be done by the Contractor to enable the taking over certificate to be issued.

If the HAFED fails either to issue the taking over certificate or to reject the Contractor's application within the period of 28 days he shall be deemed to have issued the taking over certificate on the last day of that period.

If the services are divided by the Contract into sections the Contractor shall be entitled to apply for separate taking over certificate for each such section.

8.5.12 The HAFED shall not use any part of the Goods unless taking over certificate has been issued in respect thereof.

If nevertheless the HAFED uses any part of the Goods that part which is used shall be deemed to have been taken over at the date of such use. The HAFED shall on request of the Contractor issue a taking over certificate accordingly. If the HAFED uses any part of the Goods before taking over, the Contractor shall be given the earliest opportunity of taking such steps as may be necessary to carry out the tests on completion.

8.5.13 If the Contractor fails to remedy a defect or damage pointed out by the HAFED within a reasonable time, the HAFED may fix a final time for remedying the defect or damage.

If the Contractor fails to do so, the HAFED may:

a) Carry out the work himself or by others at the Contractor's risk and cost, provided that he does so in a reasonable manner. The costs properly incurred by the HAFED in remedying the defect or damage shall be deducted from the Contract Price, but the Contractor shall have no responsibility for such work, or

b) Require the Contractor to grant the HAFED a reasonable reduction in the Contract Price to be agreed or fixed by arbitration or

c) If the defect or damage is such that the HAFED has been deprived of substantially the whole of the benefits of the Goods or a part thereof, he may terminate the Contract, in respect of such parts of the Goods as cannot be put to the intended use. The HAFED shall, to the exclusion of any remedy be entitled to recover all sums paid in respect of such parts of the Goods together with the cost of dismantling the same, clearing the site and returning plant to the Contractor or otherwise disposing of it in accordance with the Contractor's instructions.

8.5.14 If the defect or damage is such that repairs cannot be expeditiously carried out on the site, the Contractor may with the consent of the HAFED remove from the site for the purpose of repair any part of the works which is defective or damaged, after furnishing a suitable guarantee as may be prescribed by the HAFED .

8.5.15 If the replacement or renewals are such that they may affect the performance of the services, the HAFED may request that the tests on completion be repeated to the extent necessary. The request shall be made by notice within 28 days after the replacement or renewal. The tests shall be carried out in accordance with clauses 8.5.1 to 8.5.3.

8.5.16 Until the final certificate of commissioning has been issued, the Contractor shall have the right of access to all parts of the Goods and to the records of the working and performance of the Goods and Services.

Such right of access shall be during the HAFED 's normal working hours at the Contractor's risk and cost. Access shall also be granted to any duly authorized representative of the Contractor whose name has been communicated in writing to the Contractor.

Subject to the HAFED's approval, the Contractor may also at his own risk and cost Make any tests, which he considers desirable.

8.6 Nothing in the clause 8 shall in any way relieve the Contractor from any warranty or other obligations under this Contract.

7. Packing and Marking

9. 1. The Contractor shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to temperature, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit.

9. 2. The packing, marking and documents within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract and, subject to Clause 18 and any subsequent instructions given by the HAFED .

9. 3. Each package shall be marked to indicate:

a) Name of the Contractor
b) Details of items in
c) Name of the Consignee
d) Purchase Order number
e) Gross, net and tare the package weights of the item
f) Destination

10 Delivery and Documents

Delivery of the Goods shall be made by the Contractor in accordance with the terms specified by the HAFED in its Schedule of Requirements and the Special Conditions of Contract.

11. Insurance

11.1 The Goods supplied under the Contract shall be fully insured in Indian Rupees or a freely convertible currency against loss or damage incidental to manufacture or acquisition, transportation, storage at site, delivery and up to to handing over of the plant and equipment in the manner specified in the Special Conditions of Contract.

11.2 Where delivery of the Goods is required by the HAFED on a CIF basis, the Contractor shall arrange and pay for marine insurance naming the HAFED as the beneficiary.

11.3 The Contractor shall provide a copy of the insurance policy along with invoice to the HAFED who will make arrangements to extend the validity of the policy, if necessary.

11.4 Should any loss or damage occur, the Contractor should -

a. Initiate and pursue claim till settlement, and

b. Promptly make arrangements for repair and/or replacement of any damaged item/s irrespective of settlement of claim by the underwriters.

12. Transportation

12.1 Where the Contractor is required under the Contract to deliver the Goods FOR DESTINATION, as specified in the schedule of requirements. Transportation shall be arranged and paid for by the Contractor, and the cost thereof shall be included in the Contract Price.

12.3 Where the Contractor is required to effect delivery under any other terms, for example, by post or to another address in the source country, the Contractor shall be required to meet all transport and storage expenses until delivery.

12.4 In all the cases, transportation of the Goods up to the project site shall be the responsibility of the Bidder and the cost thereof shall be included/ indicated in the contract price.

12.5 Where the Contractor is required under the Contract to deliver the Goods CIF, no further restriction shall be placed on the choice of the ocean carrier.

13. Incidental Services

13.1 As specified in the General Conditions of Contract, the Contractor may be required to provide any or all of the following services:

a. Performance or supervision of on-site assembly and/or start-up of the supplied Goods;

b. Furnishing of tools required for assembly and/or maintenance of the supplied goods;

c. Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods; and manuals covering the operation and maintenance of automation software and control systems.

d. Performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties, provided that this service shall not relieve the Contractor of any warranty obligations under this Contract; and

e. Conduct of training of the HAFED's personnel, at the Contractor's plant and/or on- site, in assembly, start-up operation, maintenance and/or repair of the supplied Goods.

13.2 Prices charged by the Contractor for the preceding incidental services, if not included in the price for the Goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged from other parties by the Contractor for similar services.

14. Spare Parts requirement after defect liability period:

14.1 As specified in the Special Conditions of Contract, the Contractor may be required to provide the materials and notifications pertaining to spare parts manufactured or distributed by the Contractor:

a. Such spare parts as the HAFED may elect to purchase from the Contractor, provided that this election shall not relieve the Contractor of any warranty obligations under the Contract; and

b. In the event of termination of production of the spare parts:

i. Advance notification to the HAFED of the pending termination, in sufficient time to permit the HAFED to procure its needed requirements; and

ii. Following such termination, furnishing at no cost to the HAFED, the blueprints, drawings and specifications of the spare parts, if and when requested.

15. A. Defects liability:

The defect liability period for the work is 24 months after successful commissioning of plants. During the defect liability period contractor shall be responsible for any damage, defects to equipments/

machinery/plants, services of machinery equipments as per their manual, replacement of any parts/machinery as required for proper functioning of plants.

15.1 Completion of Outstanding Work and Remedying Defects

In order that the Contract Documents and the Works shall be in the condition required by the Contract (fair wear and tear expected) at, or as soon as practicable after, the expiry of the Contact Period, the Contractor shall

a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, as soon as practicable after such date, and
b) execute all work of amendment, rework, and remedying defects or damage, as may be instructed by the Employer or the Employer's Representative during the Contract Period.

If any such defect appears or damage occurs, the Employer or the Employer's Representative shall promptly notify the Contractor in writing.

15.2 Cost of Remedying Defects

All work referred to in Sub-Clause 15.1 (b) shall be executed by the Contractor at his own cost, if the necessity for such work is due to

(a) The design of the Works,.
(b) Plant, Materials or workmanship not being in accordance with the Contract, or
(c) Failure by the Contractor to comply with any of his other obligations.

15.3 Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, the Employer or the Employer's Representative may fix a date on or by which to remedy the defect or damage, and give the Contractor reasonable notice of such date.

If the Contractor fails to remedy the defect or damage by such date and the necessity for such work is due to a cause stated in Sub-Clause 15.2(a), (b), or (c), the Employer may (at his sole discretion):

(i) Carry out the work himself or by others, in a reasonable manner and at the Contractors risk and cost, but the Contractor shall have no responsibility for such work: the costs properly incurred by the Employer in remedying the defect or damage shall be recoverable from the Contractor by the Employer;
(ii) Require the Employer's Representative to determine and certify a reasonable reduction in the Contract Price; or
(iii) If the defect or damage is such that the Employer has been deprived of substantially the whole of the benefit of the Works or parts of the Works, terminate the Contract in respect of such parts of the Works as cannot be put to the intended use: the Employer shall then be entitled to recover all sums paid for such parts of the Works together with the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor, and Sub-Clause 15.1 shall not apply.

15.4 Removal of Defective Work

If the defect or damage is such that it cannot be remedied expeditiously on the Site, the Contractor may, with the consent of the Employer's Representative or the Employer, remove from the Site for the purposes of repair any part of the Works which is defective or damaged.

15. Warranty/Guarantee

15.1 Contractor warrants that the Goods and equipment, supplied, installed and commissioned under the Contract are new, unused, of the most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Contractor further warrants that the Goods supplied under this Contract shall have no defect arising from design, materials or workmanship (except insofar as the design or material is required by the HAFED's Specifications) or from any act or omission of the Contractor, that may develop under normal use of the supplied Goods in the conditions obtaining in the country of final destination. The Contractor also guarantees that the Goods supplied shall perform satisfactorily as per the signed/rated/-installed capacity as provided for in the Contract.

15.2 This warranty/guarantee shall remain valid for 24 months and as per the original manufacturer (if it is more than 24 months) after the Goods have been commissioned/ installed at site, installed and the plant successfully tested, commissioned and accepted by the HAFED. The HAFED shall promptly notify the Contractor in writing of any claims arising under this warranty.

15.3 Upon receipt of such notice, the Contractor shall, repair or replace the defective Goods or parts thereof within fifteen days without costs to the HAFED other than, where applicable, the cost of inland delivery of the repaired or replaced Goods or parts from the port of entry to the final destination.

15.4 If the Contractor, having been notified, fails to remedy the defect(s) within a reasonable period, the HAFED may proceed to take such remedial action as may be necessary, at the Contractor's risk and expense and without prejudice to any other rights which the HAFED may have against the Contractor under the Contract.

16. Payment

16.1 The method and conditions of payment to be made to the Contractor under the Contract shall be specified in the Special Conditions of Contract.

16.2 The Contractor's request(s) for payment shall be made to the HAFED in writing, accompanied by an invoice describing, as appropriate, the Goods delivered and Services performed, and by shipping documents, submitted pursuant to Clause 10, and fulfilment of other obligations stipulated in the Contract.

16.3 Payments shall be made promptly by the HAFED within thirty (30) days of submission of an invoice/claim by the Contractor.

16.4 All payments under this contract shall be made in Indian Rupees only.

17. Prices

1. Prices charged by the Contractor for Goods delivered and Services performed under the Contract shall not vary from the prices quoted by the Contractor in its bid.

2. Price variation on account of change in rates of taxes and duties namely GST etc on the invoices

items/services shall not be payable by HAFED.

18. Change Orders

18.1 The HAFED may, at any time, by a written order given to the Contractor pursuant to Clause 31, make changes within the general scope of the Contract in any one or more of the following:

a. Drawings, designs or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the HAFED :
b. The method of shipment or packing;
c. The place of delivery; or
d. The Services to be provided by the Contractor.

18.2 If any such change causes an increase or decrease in the cost of, or the time required for, the Contractor's performance of any part of the work under the Contract, whether changed or not changed by the order, an equitable adjustment shall be made in the Contract Price or delivery schedule, or both, and the Contract shall accordingly be amended. Any claims by the Contractor for adjustment under this clause must be asserted within thirty (30) days from the date of the Contractor's receipt of the HAFED 's change order.

19. Contract Amendment

19.1 Subject to Clause 18, no variation in or modification of the terms of the Contract shall be made except by written amendment signed by the parties.

20. Assignment

20.1 The Contractor shall not assign, in whole or in part, its obligations to perform under the Contract, except with the HAFED 's prior written consent.

21. Subcontracts

21.1 The Contractor shall notify the HAFED in writing of all subcontracts awarded under the Contract if not already specified in his bid. Such notification, in his original bid or later, shall not relieve the Contractor from any liability or obligation under the Contract.

21.2 Sub contracts must comply with the provisions of clause 3

22. Delays in the Contractor's Performance

22.1 Delivery of the Goods and performance of Services shall be made by the Contractor in accordance with the time schedule specified by the HAFED in its Schedule of Requirements.

22.2 An un-excused delay by the Contractor in the performance of its delivery obligations shall render the Contractor liable to any or all of the following sanctions:
Forfeiture of its performance security, imposition of liquidated damages, and/or termination of the Contract for default.

22.3 If at any time during performance of the Contract, the Contractor or its subcontractor(s) should encounter conditions impeding timely delivery of the Goods and performance of Services, the Contractor shall promptly notify the HAFED in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the Contractor's notice, the HAFED shall evaluate the situation and may at its discretion extend the Contractor's time for performance, in which case the extension shall be ratified by the parties by amendment of the Contract.

23. Liquidated Damages

23.1 Subject to Clause 25, if the Contractor fails to deliver any or all the goods or perform the services within the times period (s) specified in the Contract, the HAFED shall, without prejudice to its other remedies under the Contract, deduct from the contract prices, as liquidated damages, a sum equivalent to:

(1) 0.5% of the full contract value for every completed week (week comprising of 7 days including holidays and any incomplete week shall be ignored for the calculations of liquidated damages) of delay in the supplies/commissioning.

(2) The total amount so deducted shall not exceed 10% of the Contract value. Once the maximum is reached, the HAFED may consider termination of the contract.

23.1.2 The total amount so deducted shall not exceed 10% of the Contract value. Once the maximum is reached, the HAFED may consider termination of the Contract pursuant to Clause 24.

23.2 Any incremental taxes and levies on account of delay in performance of the Contract by the Contractor shall be to the Contractor's account.

24. Termination for Default

24.1 Contractors default:

24.1.1 If the Contractor shall assign the Contract, without the consent in writing of the HAFED first obtained, or if in the opinion of the HAFED , the Contractor:

a. Has abandoned the Contract, or

b. Without reasonable excuse has failed to commence the Works or has suspended the progress of the works for twenty eight days after receiving from the HAFED written notice to proceed, or

c. Despite previous warnings by the HAFED , in writing, is not executing the works in accordance with the Contract, or neglecting to carry out his obligations under the contract so as seriously to affect the carrying out of the Works.

Then the HAFED may, after giving fourteen days notice in writing to the Contractor, enter upon the Site and expel the Contractor there from without thereby voiding the contract, or releasing the Contractor from any of his obligations or liabilities under the contract, or affecting the rights and powers conferred by the Contract on the HAFED and may himself complete the works or may

employ any other Contractor to complete the Works without prejudice to any other remedy of the HAFED . The HAFED or such other Contractor shall have free use for such completion of so much of the Contractor's Equipment as may be on the Site in connection with the works without being responsible to the Contractor for fair wear and tear thereof and to the inclusion of any right of the Contractor over the same.

24.1.2 The HAFED shall, as soon as may be practicable after any such entry and expulsion by the HAFED fix and determine 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 then actually done by him under the Contract and the value of any unused or partially used materials on the Site.

24.1.3 If the HAFED shall enter and expel the Contractor under this Clause, he shall not be liable to pay to the Contractor any money on account of the Contract until the costs of execution and all other expenses incurred by the HAFED have been ascertained and the amount thereof certified. The Contractor shall then be entitled to receive only such sum or sums, if any, as the HAFED may certify would have been 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 HAFED the amount of such excess and it shall be deemed a debt due by the Contractor to the HAFED and shall be recoverable accordingly.

24.1.4 If the HAFED pursuant to this Clause takes the Works or part thereof out of the Contractor's hands the Contractor's Liability under Clause for delay in completion shall immediately cease, without prejudice to any such liability that may at that time already be recoverable from the Contractor by the HAFED .

24.1.5 Consequent to such termination of Contract, the HAFED shall also be entitled to recover the advance paid, if any, to the Contractor along with interest @ 18% per annum compounded quarterly on the last day of March, June, September and December on the advance paid for the entire period for which the advance was retained by the Contractor.

24.2 Default of the HAFED

24.2.1 In the event of the HAFED :

a. Failing to pay to the Contractor the amount due within 60 days after the same shall have become due under the terms of the Contract subject to any deduction that the HAFED is entitled to make under the Contract, or
b. Becoming bankrupt or (being a company) going into liquidation other than for the purpose of a scheme of reconstruction or amalgamation, or
c. Being unable to continue to meet his contractual obligations for unforeseen reasons due to economic dislocation

The Contractor shall be entitled without prejudice to any other rights or remedies (and in respect of paragraph (a) above as an alternative to the provisions of Clause 16 for Payment to terminate his

employment under the Contract by giving 30 days prior notice in writing to the HAFED .

24.2.2 Upon the giving of such notice the Contractor shall with all reasonable dispatch remove from the Site all Contractor's equipment brought by him thereon.

24.2.3 In the event of such termination the HAFED shall be under the same obligations to the Contractor in regard to payment as if the Contract had been terminated under the provisions of Sub-Clause 25.4.2 hereof but in additions payment specified therein, the HAFED shall pay to the Contractor the amount of any reasonable loss or damage to the Contractor arising out of or in connection with or by consequence of such termination.

24.2.4 Nothing in this clause contained shall prejudice the right of the Contractor to exercise, either in lieu of or in addition to the rights and remedies in this Clause specified, any other rights or remedies to which the Contractor may be entitled.

25. Force Majeure

25.1 Notwithstanding the provisions of Clauses 22, 23, 24, the Contractor shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that, its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.

25.2 For purposes of this clause, "Force Majeure" means an event beyond the control of the Contractor and not involving the Contractor's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the HAFED either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.

25.3 If a Force Majeure situation arises, the Contractor shall promptly notify the HAFED in writing of such condition and the cause thereof. Unless otherwise directed by the HAFED in writing, the Contractor shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.

25.4 Termination in Consequence of Force Majeure

25.4.1 If circumstances of Force Majeure have occurred and shall continue for a period of 182 days then, notwithstanding that the Contractor may by reason thereof have been granted an extension of Time for Completion of the Works, either party shall be entitled to serve upon the other 28 days' notice to terminate the Contract. If at the expiry of the period of 28 days Force Majeure shall still continue the Contract shall terminate.

25.4.2 If the Contract shall be terminated as aforesaid the Contractor shall be paid by the HAFED (in so far as such amounts or items hall not have already been overed by payments on account made to the Contractor) for all work executed prior to the date of termination at the rates and prices provided in the Contract and in addition:

a) The amounts payable in respect of any preliminary items, so far as the work or service comprised therein has been carried out or performed, and a proper proportion as certified by the HAFED of

any such items the work or service comprised in which has been partially carried out or performed.

b) The cost of materials or goods reasonably ordered for the Works or for use in connection with the Works which shall have been delivered to the Contractor or of which the Contractor is legally liable to accept delivery (such materials or goods becoming the property of the HAFED upon such payment being made by him).

c) A sum, to be certified by the HAFED , being the amount of any expenditure, which in the circumstances was reasonably incurred by the Contractor in the expectation of completing the whole of the Works, in so far as such expenditure shall not have been covered by the payments in this Sub-Clause before mentioned.

d) The reasonable cost of removal under Sub-Clause 2 of this Clause and (if enquired by the Contractor) return thereof to the Contractor's works in his country or to any other destination at no greater cost.

e) The reasonable cost of repatriation of all the Contractor's staff and workmen employed on or in connection with the Works at the time of such termination.

Provided always that, against any payments due from the HAFED under this Sub-Clause, the HAFED shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Plant and materials, and any sum previously paid by the HAFED to the Contractor in respect of the execution of the Works.

26. Termination for Insolvency

26.1 The HAFED may at any time terminate the Contract by giving written notice to the Contractor, without compensation to the Contractor, if:

a) The Contractor becomes bankrupt or otherwise insolvent,

b) The Contractor being a Company is wound up voluntarily by the order of a Court receiver, liquidator or Manager appointed on behalf of the debenture holders or circumstances shall have arisen which entitle the court or debenture holders to appoint a receiver, liquidator or a Manager, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the HAFED .

27. Termination for Convenience

27.1 The HAFED, may by written sent to the `Contractor, terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the HAFED's convenience, the extent to which performance of work under the Contract is terminated, and the date upon which such termination becomes effective.

27.2 The Goods that are complete and ready for shipment within 30 days after the Contractor's receipt of notice of termination shall be purchased by the HAFED at the Contract terms and prices. For the remaining Goods, the HAFED may elect:

a. To have any portion completed and delivered at the Contract terms and prices; and/or

b. To cancel the remainder and pay to the Contractor an agreed amount for partially completed Goods and for materials and parts previously procured by the Contractor.

28. Resolution of Disputes

28.1 The HAFED and the Contractor shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract.

28.2 If, after thirty (30) days from the commencement of such informal negotiations, the HAFED and the Contractor have been unable to resolve amicably a Contract dispute, either party may require that the dispute be referred for resolution to the formal mechanisms specified in the Special Conditions of Contract. These mechanisms may include, but are not restricted to, conciliation mediated by a third party, adjudication in an agreed national or international forum, and/or international arbitration. The mechanism shall be specified in the Special Conditions of Contract.

29. Governing Language

29.1 The Contract shall be written in the language of the bid, as specified by the HAFED in the Instructions to Bidders. Subject to Clause 30, that language version of the Contract shall govern its interpretation. All correspondence and other documents pertaining to the Contract, which are exchanged by the parties, shall be written in that same language.

30. Applicable Law

30.1 The Contract shall be interpreted in accordance with the laws of the Union of India.

31. Notices

31.1 Any notice given by one party to the other pursuant to the Contract shall be sent in writing or by telegram or telex/fax and confirmed in writing to the address specified for that purpose in the Special Conditions of Contract.

31.2 A notice shall be effective when delivered or on the notice's effective date, whichever is later.

32. Taxes and Duties

32.1 A Contractor shall be entirely responsible for payment of all taxes, duties, license fees, entry tax etc. until taking over of the works by the 'HAFED '.

33. Right to use defective Goods

If after delivery, acceptance and installation and within the guarantee and warranty period, the operation or use of the Goods proves to be unsatisfactory, the HAFED shall have the right to continue to operate or use such Goods until rectifications of defects, errors or omissions by repair or by partial or complete replacement is made without interfering with the HAFED s' operation.

33. Standard terms & conditions of GST

1.0 The price bid by the contractor shall be inclusive of all taxes including GST upto the closing date for submission of bid in the employer's country on the contractor's equipment, plant, material & supplies (payment, temporary and consumable) acquired for the purpose of the contract and on the services performed under the contract.

2.0 The contractor shall raise taxable invoice provision of GST to HAFED.

3.0 The transaction on which GST will be claimed from HAFED shall be included in the return to be furnished under GST law & the amount claimed from HAFED shall be amounted for in the GST returns and will we deposited with GST authorities within the time prescribed by law in this regard.

4.0 The contractor shall indemnify HAFED for all losses caused to HAFED on account of excess charges of GST, In case it is found at a later stage that that wrong or incorrect payment has been recovered by it from HAFED on account of GST, the same will be refunded forthwith.

5.0 Subsequent Legislation – If, after the date of submission of tenders for the contract there occur changes to any national of state statute, Ordinance, Decree law which causes additional or reduced cost to the contractor, in the execution of the contract, such additional or reduced cost shall, be determined by GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak and shall be added to or deducted from the contract price and the GM HAFED, CFP, Rohtak/Executive Engineer, HAFED, Rohtak shall notify the contractor accordingly.

6.0 Income tax, labour cess and other deductions as applicable/as may be notified by union Government/State Government from time to time will be deducted from gross payment as per Govt. Instructions.

7.0 Nothing in the contract shall relive the contractor from his responsibility to pay taxes/duties/cess etc. that may be levied in the employers country on profits made by him in respect of the contract.

8.0 HAFED will not facilitate towards issuance of any certificate for availing exemption of any taxes through local administration/Deputy Commissioner or otherwise.

9.0 Tax will be deducted at source by HAFED from the payment or credit to be made to the contractor as per provisions of GST law when the provisions of section 51 of CGST Act will be made applicable of HAFED.

10.0 An undertaking in this regard be given by agency at **Annexure-I**.

Annexure-I

Undertaking

1. Certified that the transaction on which GST will be claimed shall be included in the return to be furnished under GST Act and the amount claimed from HAFED shall be accounted for in the returns and will be deposited with GST authorities as required.

2. Certified that GST will not be charged on the exempt supplies made to HAFED.

3. Certified that we shall indemnify the HAFED in case is found at a later stage that wrong or incorrect payment has been received on account of GST, the same will be refunded.

(Signature)

Complete Name.....

Address.....

.....

GSTIN.....

SECTION 5(II)

GENERAL CONDITIONS OF CONTRACT FOR SUPPLY

1. Scope:

The following General Conditions of Contract shall supplement the General Conditions of Contract. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract. The corresponding clause number of the General Conditions is indicated in parentheses.

2. Definitions

(a) The HAFED is Haryana State Cooperative Supply and Marketing Federation Limited and would include the term "Owner".

(b) The Contractor is (Name of Contractor).

3. Country of Origin

The place where the goods were mined, grown or produced from which the services are supplied

4. Equivalency of Standards and Codes

Wherever reference is made in the contract to the respective standards and codes in accordance with which goods and materials are to be furnished, and work is to be performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly set forth in the Contract. Where such standards and codes are national in character, or relate to a particular country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the HAFED 's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the HAFED at least 30 days prior to the date when the Contractor desires the HAFED 's approval. In the event the HAFED determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards set forth in the documents.

5. NA

6. Inspection and Tests

6.1 HAFED may depute any third Party inspection of all Mechanical equipment, electrical motors, pipes before dispatch to site. The inspection expenses (Travelling & arrangement) to be borne by the contractor. The HAFED (Employer) shall inform to the contractor, the name(s) of third party at appropriate time.

6.2 The inspection of the Goods shall be carried out to check whether the Goods are in conformity with the

technical specifications attached to the purchase order form and shall be in line with the inspection/test procedures laid down in the Schedule of Specifications and the Contract conditions.

6.3 Manufacturer must have suitable facilities at their works for carrying out various performance tests on the equipment. The bidder should clearly confirm that all the facilities exist for inspection and shall be made available to the inspecting Authority.

6.4 A load and functional tests as indicated in the specifications must be carried out at the manufacturer's works. Reliability of the equipment shall be demonstrated to the satisfaction of the appointed inspector or inspecting Agency.

6.5 Approved Contractor's drawings shall not be departed from except as provided in the Bidding Document.

6.6 The HAFED shall have the right at all reasonable times to inspect, at the Contractor's premises all Contractor's drawings of any part of the work.

6.7 The Contractor shall provide, within the time stated in the contract or in the programme, drawings showing how the plant is to be designed and any other information required for -

a. Preparing suitable foundations or other means of support.

b. Providing suitable access on the site for the plant and any necessary equipment to the place where the plant is to be erected and

c. Making necessary electrical connections from the panel board provided in the individual sections to the machines.

6.8 Before the goods and equipment are taken over by the HAFED, the Contractor shall supply operation and maintenance manuals together with drawings of the goods and equipment as built. These shall be in such details as will enable the HAFED to operate, maintain, adjust and repair all parts of the works as stated in the specifications.

The manuals and drawings shall be in the ruling language (English) and in such form and numbers as stated in the contract.

Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purposes of taking over until such manuals and drawings have been supplied to the HAFED .

6.9 The goods will be accepted after inspection by the HAFED, his representative or any inspection agency appointed by HAFED.

7. Delivery and Documents (Clause 10)

Upon shipment/dispatch, the Contractor shall notify to the HAFED by cable or email or fax the full details of dispatch including HAFED order no., description of the goods, quantity, mode of transport,

place of loading, date of dispatch etc. The Contractor will mail the following documents to the HAFED with a copy to the Insurance Company**:**

Original and three copies of**:**

(i) The Contractor's invoice showing purchase order no. Goods description, quantity, unit price, total amount;
(ii) Delivery note/case-wise detailed packing list identifying contents of each package/ lorry receipt;
(iii) Manufacturer's/Contractor's guarantee certificate;
(iv) Inspection Certificate issued by the nominated inspection agency, and the Contractor's factory inspection report;
(v) Certificate of origin;
(vi) Insurance policy;
(vii) Any other document evidencing payment of statutory levies.
(viii) The Contractor's certificate certifying that the defects pointed out during inspection have been rectified.
(ix)

Note: The nomenclature used for the item description in the invoice/s, packing list/s and delivery note/s etc. Should be identical to that used in the purchase order. The despatch particulars including name of transporter, LR no. And date should also be mentioned in the invoice/s.

8. Insurance

(a) The **"marine / transit"** insurance to be taken by the contractor / Contractor shall be in an amount equal to 110% of the FOR Destination value of the goods from "warehouse to warehouse" on "All Risks" basis including Strike, Natural calamities but exclusive of War Risks valid for a period not less than 3 months after the date of arrival of Goods at final destination.

(b) **"Storage-cum-erection ALL Risks**" insurance for an amount equal to 110% of the contract value valid for a period not less than 3 months after installation, including one month for testing and commissioning, shall be taken by the contractor / Contractor.

OR

As an alternative to (a) & (b) above, "Marine-cum-erection ALL Risks" insurance policy, covering storage of equipment and other erection materials at site, for an amount equal to 110% of the contract value of supply, installation & commissioning and valid for a period not less than 3 months after installation, including one month for testing and commissioning, shall be taken by the contractor / Contractor.

(c) **Third Party Insurance :** Before commencing the erection work the contractor / Contractor without limiting his obligations and responsibilities, shall insure against his liability for any material or physical damage, loss or injury which may occur to any property including that of the Owner / HAFED, or to any person including any employee of the Owner / HAFED. Such insurances shall be for an amount not less than Rs. 10.00 lakhs per occurrence with the number

of occurrence unlimited.

9. Incidental services

9.1 The incidental services for supply, installation and commissioning contract, as follows shall be provided by the Contractor:

(a) Furnishing of tools required for assembly and maintenance of the supplied goods for 2 years;
(b) Furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods;
(c) On-site assembly and start-up of the supplied Goods;
(d) Conduct of training of the HAFED 's personnel (approx. for 4 man-weeks); at the Contractor's plant and/or on-site, in assembly, start-up operation, maintenance and/or repair of the supplied Goods.
(e) Furnishing of layout drawing etc. as specified in clause 3 of Special Conditions of Contract Part II.

10. Spare Parts

Contractor shall carry sufficient inventories to assure ex-stock supply of consumable spares such as gaskets, plugs, washers, belts, etc. Other spare parts and components shall be supplied as promptly as possible but in any case within 15 days of placement of order after defect liability period and free of cost during the defect liability period.

11. Warranty/Guarantee (Clause 15)

The warranty and guarantee certificates of all the components and machinery in the scope of the tender shall be submitted to HAFED at the time of Supply and Installation and the same shall hold true even if it is more than the defect liability period. Otherwise, defect liability holds true for all the equipments.

ECTION 5(III)
GENERAL CONDITIONS OF CONTRACT FOR INSTALLATION

1.0 SUFFICIENCY OF TENDER

The Contractor by bidding shall be deemed to have satisfied himself as to all the conditions and circumstances affecting the Contract Price, as to the possibility of executing the works as shown and described in the Contract, as to the general circumstances at the site of the works, as to the general labour position at site and to have determined the prices accordingly.

2.0 PROGRAMME OF INSTALLATION AND COMMISSIONING

As soon as practicable after the acceptance of the bid, the Contractor shall submit to the HAFED for his approval a comprehensive programme in the form of PERT network/ bar chart and any other form as may be required by the HAFED showing the sequence of order in which the Contractor proposes to carry-out the works including the design, manufacture, delivery to site, erection and commissioning thereof. After submission to and approval by the HAFED of such programme, the Contractor shall adhere to the sequence of order and method stated therein. The submission to and approval by the HAFED of such programme shall not relieve the Contractor of any of his duties or responsibilities under the Contract. The programme approved by the HAFED shall form the basis of evaluating the pace of all works to be performed by the Contractor. The Contractor shall update the PERT Network every month, submit it to the HAFED and shall inform the HAFED the progress on all the activities falling on schedule for the next reporting date.

3.0 PREPARATION OF DRAWINGS FOR APPROVAL

The Contractor shall prepare and submit all Drawings to the HAFED for approval:

a. Within the time given in the specification or in the programme, such drawings, samples, patterns and models as may be called for therein, and in numbers therein required.

b. During the progress of works and within such reasonable times as the HAFED may require such drawings of the general arrangement and details of the works as the HAFED may require.

Wherever necessary, the Contractor would be provided with a set of architectural drawings for the buildings where the erection works would be carried out and also the equipment details/ drawings for various equipment to be handed over to the Contractor by the HAFED . The specifications/ conditions concerning the submission of drawings by the Contractor are detailed as under:

3.1 Within four weeks from the date of receipt of the Notification of Award, Contractor shall furnish a list of all necessary drawings as briefly described below which the Contractor shall submit for approval, identifying each drawings by a serial number and descriptive title and expected date of submission. This list shall be revised and extended if necessary, during the progress of work depending on the nature of the contract also.

The HAFED/IL&FS shall signify his approval or disapproval of all drawings or such drawings that would affect progress of the contract as per the agreed programme.

If, by reason of any failure or inability of the HAFED to issue within four weeks of time in all the circumstances any drawing or order requested by the Contractor in accordance with sub clause (3) of this clause, the Contractor suffers delay and/or incurs costs then the HAFED shall take such delay into account in determining any extension of time to which the Contractor is entitled under Clause 15 hereof and the Contractor shall be paid the amount of such cost as shall be

reasonable.

i. Brief list of drawings:
ii. Equipment drawings for fabricated items.
iii. Equipment layout for production, packing and service blocks.
iv. Flow diagrams for CIP and various services.
v. Service piping layouts in production, packing and service blocks.
vi. SS piping layout in production and packing blocks.
vii. Electrical cable, conduit/cable tray/cable trench layout.
viii. Other miscellaneous drawings as required for erection work.
ix. Electrical single line diagram, PCC and MCC general arrangement drawing and wiring diagrams.
x. Automation system scheme, controls and network diagrams.

3.2 Drawings showing fabrication details, dimensions, layouts and bill of materials submitted for approval shall be signed by responsible representative of Contractor and shall be to any one of the following sizes in accordance with Indian Standards: A0, A1, A2, A3 and A4.

3.3 All drawings shall show the following particulars in the lower right hand corner in addition to Contractor's name:

i. Name of the HAFED .
ii. Project Title.
iii. Title of drawing.
iv. Scale.
v. Date of drawing.
vi. Drawing number.
vii. Space for HAFED reference or drawing number.

3.4 In addition to the information provided on drawings, each drawing shall carry a revision number, date of revision and brief description of revision carried out. Whenever any revision is carried out, correspondingly revision number must be up-dated.

3.5 All dimensions on drawings shall be in metric units.

3.6 Drawings (three sets) submitted by the Contractor for approval will be checked, reviewed by the HAFED , and comments, if any, on the same will be conveyed to the Contractor. It is the responsibility of the Contractor to incorporate correctly all the comments conveyed by the HAFED on the Contractor's drawings. The drawings, which are approved with comments, are to be re-submitted to the HAFED for purpose of records. Such drawings will not be checked/reviewed by the HAFED to verify whether all the comments have been incorporated by the Contractor.

If the Contractor is unable to incorporate any comments in the revised drawings, Contractor shall clearly state in his forwarding letter such non-compliance along with the valid reasons.

3.7 Drawings prepared by the Contractor and approved by the HAFED shall be considered as a part of the specifications. However, the examination of the drawings by the HAFED shall not relieve the Contractor of his responsibility for engineering design, workmanship, quality of materials, warranty obligations and satisfactory performance on installation covered under the contract.

3.8 If at any time before completion of the work, changes are made necessitating revision of approved drawings, the Contractor shall make such revisions and proceed in the same routine as for the original approval.

3.9 Date of submission

In the event, the drawings submitted for approval require many revisions amounting to re-drawing of the same then the date of submission of the revised drawings would be considered as the date of submission for approval.

3.10 The Contractor shall furnish to the HAFED before the works are taken over, Operating and Maintenance instructions together with Drawings of the works as completed, in sufficient detail to enable the HAFED to maintain, dismantle, reassemble and adjust all parts of the works. Unless otherwise agreed, the works shall not be considered to be completed for the purposes of taking over until such instructions and drawings have been supplied to the HAFED .

4.0 CONTRACTOR'S SUPERINTENDENCE (AND) DEPLOYMENT OF ERECTION TEAM AND CONDUCT OF PERSONNEL

The Contractor shall employ one or more competent representatives, whose name or names shall have previously been communicated in writing to the HAFED by the Contractor, to superintend the carrying out of the works on the site. The said representative or if more than one shall be employed, then one of such representatives shall be present on the site during all times, and any orders or instructions which the HAFED may give to the said representative of the Contractor shall be deemed to have given to the Contractor. The said representative shall have full technical capabilities and complete administrative and financial powers to expeditiously and efficiently execute the work under the contract.

4.1 The Contractor shall, execute the works with due care and diligence within the time for completion and employ Contractor's team comprising qualified and experienced engineers together with adequate skilled. Semi-skilled and unskilled workmen in the site for carrying out the works. The Contractor shall ensure adequate workforce to keep the required pace at all times as per the schedule of completion. Contractor shall also ensure availability of competent engineers during commissioning/start up, trial runs, Operation of the plant/equipment till handing over of the plant.

4.2 The Contractor shall furnish the details of qualifications and experience of their senior supervisors and engineers assigned to the work site, including their experience in supervising erection and commissioning of plant and equipment of comparable capacity.

4.3 When the Contractor or Contractor's representative is not present on any part of the work where it may be desired to give directions in the event of emergencies, orders may be given by the HAFED and shall be received and observed by the supervisors or foremen who may have charge of the particular part of the work in reference to which orders are given. Any such instructions, directions or notices given by the HAFED shall be deemed to have been given to the Contractor.

4.4 The Contractor shall furnish to the HAFED a fortnightly labour force report showing by classifications the number of employees engaged in the work. The Contractor's employment records shall include any reasonable information as may be required by the HAFED . The Contractor should also display necessary information as may be required by statutory regulations.

4.5 None of the Contractor's supervisors, engineers, or laborers may be withdrawn from the work without notice to the HAFED and further no such withdrawals shall be made if in the opinion of the HAFED , it will adversely affect the required pace of progress and/or the successful completion of the work.

4.6 The HAFED shall be at liberty to object to any representative or person, skilled, semi-skilled or unskilled worker employed by the Contractor in the execution of or otherwise about the works who shall, in the opinion of the HAFED , misconduct himself or be incompetent, or negligent or

unsuitable, and the Contractor shall remove the person so objected to, upon receipt of notice in writing from the HAFED and shall provide in that place a competent representative at Contractor's own expense within a reasonable time.

4.7 In the execution of the works no persons other than the Contractor, sub-Contractor and their employees shall be allowed on the site except by the written permission of the HAFED .

5.0 HAFED 'S INSTRUCTIONS

The HAFED may in his absolute discretion, issue from time to time drawings and/or instructions, directions and clarifications which are collectively referred to as HAFED 's instructions in regard to:

5.1 Any additional drawing and clarifications to exhibit or illustrate details.

5.2 Variations or modifications of the design, quality or quantity of work or the additions or omissions or substitution of any work.

5.3 Any discrepancy in the drawings or between the schedule of quantities and/or specifications.

5.4 Removal from the site of any material brought there by the Contractor, which are unacceptable to the HAFED and the substitution of any other material thereof.

5.5 Removal and/or re-execution of any work erected by the Contractor, which are unacceptable to the HAFED .

5.6 Dismissal from the work of any persons employed there upon who shall in the opinion of the HAFED , misconduct himself, or be incompetent or negligent.

5.7 Opening up for inspection of any work covered up.

5.8 Amending and making good of any defects.

6.0 RIGHT OF THE HAFED

6.1 Right to direct works:

6.1.1 The HAFED shall have the right to direct the manner in which all works under this Contract shall be conducted, in so far as it may be necessary to secure the safe and proper progress and specified quality of the works. All work shall be done and all materials shall be furnished to the satisfaction and approval of the HAFED .

6.1.2 Whenever in the opinion of the HAFED , the Contractor has made marked departures from the schedule of completion or when circumstances or requirement force such a departure from the said schedule, the HAFED , in order to ensure compliance with the schedule, shall direct the order, pace and method of conducting the work, which shall be adhered to by the Contractor.

6.1.3 If in the judgment of the HAFED , it becomes necessary at any time to accelerate the overall pace of the plant erection work, the Contractor, when directed by HAFED , shall cease work at any particular point and transfer Contractor's men to such other point or points and execute such works, as may be directed by the HAFED and at the discretion of the HAFED .

6.2 Right to order modifications of methods and equipment

If at any time the Contractor's methods, materials or equipment appear to the HAFED to be unsafe, inefficient or inadequate for securing the safety of workmen or the public, the quality of work or the rate of progress required, the HAFED may direct the Contractor to ensure safety, and increase their efficiency and adequacy and the Contractor shall promptly comply with such directives. If at any time the Contractor's working force and equipment are inadequate in the opinion of the HAFED , for securing the necessary progress as stipulated, the Contractor shall if so directed, increase the working force and equipment to such an extent as to give reasonable assurance of compliance with the schedule of completion. The absence of such demands from the HAFED shall not relieve the Contractor of Contractor's obligations to secure the quality, the safe conducting of the work and the rate of progress required by the contract. The Contractor alone shall be and remain liable and responsible for the safety, efficiency and adequacy of Contractor's methods, materials, working force and equipment, irrespective of whether or not the Contractor makes any changes as a result of any order or orders received from the HAFED .

6.3 Right to inspect the work

6.3.1 The HAFED 's representative shall be given full assistance in the form of the necessary tools, instruments, equipment and qualified operators to facilitate inspection.

6.3.2 The HAFED reserves the right to call for the original test certificates for all the materials used in the erection work.

6.3.3 In the event the HAFED 's inspection reveals poor quality of work/materials, the HAFED shall be at liberty to specify additional inspection procedures if required, to ascertain Contractor's compliance with the specifications of erection work.

6.3.4 Even though inspection is carried out by the HAFED or HAFED 's representatives, such inspection shall not, however, relieve the Contractor of any or all responsibilities as per the contract, nor prejudice any claim, right or privilege which the HAFED may have because of the use of defective or unsatisfactory materials or bad workmanship.

7.0 CONTRACTOR'S FUNCTIONS

7.1 The Contractor shall provide everything necessary for proper execution of the works, according to 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 therein, Contractor shall immediately refer the same to the HAFED whose decision shall be final and binding on the Contractor.

7.2 The Contractor shall proceed with the work to be performed under this Contract in the best and workman like manner by engaging qualified and efficient workers and finish the work in strict conformance with the drawings and specifications and any changes/modifications thereof made by the HAFED .

7.3 VARIATIONS

7.3.1.1 The HAFED shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion be desirable, he shall have power to order the Contractor to do and the Contractor shall do any of the following:

a. Increase or decrease the quantity of any work included in the contract,
b. Omit any such work,

c. Change the character or quality or kind of any such work,
d. Change the levels, lines, position and dimensions of any part of the works, and
e. Execute additional work of any kind necessary for the completion of the works and no such variation shall in any way vitiate or invalidate the contract, but the value, if any, of all such variations shall be taken into account in ascertaining the amount of the Contract price.

7.3.1.2 No such variations shall be made by the Contractor without an order in writing of the HAFED . Provided that no order in writing shall be required for increase or decrease in the quantity of any work where such increase or decrease is not the result of an order given under this clause, but is the result of the quantities exceeding or being less than those stated in the Contract/Bill of Quantities.

7.3.1.3 All extra or additional work done or work omitted by order of the HAFED shall be valued at the rates and prices set out in the contract if in the opinion of the HAFED , the same shall be applicable. If the contract does not contain any rates or prices applicable to the extra or additional work, then suitable rates or prices shall be agreed upon between the HAFED and the Contractor. In the event of disagreement the HAFED shall fix such rates or prices as shall, in his opinion, be reasonable and proper.

7.3.1.4 Provided that if the nature or amount of any omission or addition relative to the nature or amount of the whole of the works or to any part thereof shall be such that, in the opinion of the HAFED , the rate or price contained in the Contract for any item of the works is, by reason of such omission or addition, rendered unreasonable or inapplicable, then a suitable rate or price shall be agreed upon between the HAFED and the Contractor. In the event of disagreement the HAFED shall fix such other rate or price as shall, in his opinion, be reasonable and proper having regard to the circumstances.

Provided also that no increase or decrease under sub-clause 7.3.2.1 of this clause or variation of rate or price under sub-clause 7.3.2.2 of this clause shall be made unless, as soon after the date of the order as is practicable and, in the case of extra or additional work, before the commencement of the work or as soon thereafter as is practicable, notice shall have been given in writing:

a. By the Contractor to the HAFED of his intention to claim extra payment or a varied rate or price,

Or

b. By the HAFED to the Contractor of his intention to vary a rate or price.

7.3.1.5 If, on certified completion of the whole of the works, it shall be found that a reduction or increase greater than 15 per cent of the sum named in the Letter of Acceptance results from the aggregate effect of all Variation Orders but not from any other cause, the amount of the Contract Price shall be adjusted by such sum as may be agreed between the Contractor and the HAFED or, failing agreement, fixed by the HAFED having regard to all material and relevant factors, including the Contractor's site and general overhead costs of the contract.

7.3.1.6 The Contractor shall send to the HAFED 's representative once in every month an account giving particulars, as full and detailed as possible, of all claims for any additional payment to which the Contractor may consider himself entitled and of all extra or additional work ordered by the HAFED which he has executed during the preceding month.

No final or interim claim for payment for any such work or expense will be considered which has not been included in such particulars. Provided always that the HAFED shall be entitled to

authorize payment to be made for any such work or expense, notwithstanding the Contractor's failure to comply with this condition, if the Contractor has, at the earliest practicable opportunity, notified the HAFED in writing that he intends to make a claim for such work.

7.4 The work shall be carried out as approved by the HAFED or his authorized representative/s from time to time, keeping in view the overall schedule of completion of the project. The Contractor's job schedule must not disturb or interfere with HAFED 's or other Contractors' or Contractors' schedules of day-to-day work. The HAFED will provide all reasonable assistance for carrying out the jobs.

7.5 Night work will be permitted only with prior approval of the HAFED . The HAFED may also direct the Contractor to operate extra shifts over and above normal day shift to ensure completion of contract as per schedule. Adequate lighting wherever required should be provided by the Contractor at no extra cost. The Contractor should\ employ qualified electricians and wiremen for these facilities. In case of Contractor's failure to provide these facilities and personnel, the HAFED has the right to arrange such facilities and personnel and to charge the cost thereof to the Contractor.

7.6 The Contractor shall, in the joint names of the Contractor and the HAFED , insure the received goods and equipment and so far as reasonably practicable the Works and keep each part thereof insured for the Contract Sum or such other value as may be mutually agreed between the HAFED and the Contractor against all loss or damage from whatever cause arising, other than the excepted risks, from the date of shipment or the date on which it becomes the property of the HAFED , whichever is the earlier, until it is taken over by the HAFED . The Contractor shall insure against the Contractor's liability in respect of any loss or damage occurring whilst the Contractor is on Site for the purpose of making good a defect or carrying out the Tests on Completion.

7.7 The HAFED shall not be liable for or in respect of any damages or compensation 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, save and except an accident or injury resulting from any act or default of the HAFED , his agents, or servants. The Contractor shall indemnify and keep indemnified the HAFED against all such damages and compensation, save and except as aforesaid and against all claims, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

7.8 The Contractor shall insure against such liability with an insurer approved by the HAFED , which approval shall not be unreasonably withheld, and shall continue such insurance during the whole of the time that any persons are employed by him on the works shall, when required, produce to the HAFED or HAFED 's representative such policy of insurance and the receipt for payment of the current premium.

Provided always that, in respect of any persons employed by any sub-Contractor, the Contractor's obligations to ensure 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 HAFED is indemnified under the policy, but the Contractor shall require such sub-Contractor to produce to the HAFED or HAFED 's representative, when required, such policy of insurance and the receipt for the payment of the current premium.

7.9 Whenever proper execution of the work under the Contract depends on the jobs carried out by some other Contractor, in such cases the Contractor should inspect all such erection and installation jobs and report to the HAFED regarding any defects or discrepancies. The

Contractor's failure to do so shall constitute as acceptance of the other Contractor's installation/jobs as fit and proper for reception of Contractor's works except those defects which may develop after execution. Contractor should also report any discrepancy between the executed work and the drawings.

The Contractor shall extend all necessary help/co-operation to other Contractors working at the site in the interest of the work.

7.10 The Contractor shall keep a check on deliveries of the Goods covered in the scope of erection work and shall advise the HAFED well in advance regarding possible hold- up in Contractor's work due to the likely delay in delivery of such Goods to enable him to take remedial actions.

7.11 The Contractor shall be permitted to substitute equipment of equal on better performance subject to approval by the HAFED ; which approval shall not be unreasonably withheld, provided however that the Contractor establishes to the HAFED 's satisfaction that the performance of the substituted equipment is equal or better than the performance of the equipment specified in the contract and without any increase in the Contract price.

8.0 ROLE OF THE HAFED VIS-A-VIS THE CONTRACTOR:

8.1 The Goods, if any, to be supplied by the HAFED for erection, testing and commissioning by the Contractor, shall be as listed in the Contract.

8.2 Besides the utilities/services as specified in battery limits the following assistance/ facilities shall also be provided to the Contractor by the HAFED for carrying out the installation work.

8.2.1 Plant building for reception, processing, and packaging and for services including internal lighting will be made available by the HAFED .

8.2.2 Necessary temporary water for carrying out the installation shall be of contractors responsibility. All necessary distribution tappings onwards shall also be the Contractor's responsibility.

8.2.3 Necessary temporary power for carrying out the installation shall be arranged by the Contractor at Contractor's own cost. The necessary authorisation letter will be issued by the HAFED on written request by the Contractor.

The temporary power may not be reliable at the site and this could affect the welding operations and other installation works. Contractor shall provide stabilizer and Diesel Generators "as necessary", to ensure adequate quality of welds and to ensure no delay in installation due to temporary power instability. No extra cost shall be paid by the HAFED on this account.

8.2.4 If the power is provided by the HAFED, the recovery shall be made from the total purchase order value (supply, installation and commissioning). The charges will be deducted from the labour charges of installation and commissioning and testing bills of the Contractor. However, the Contractor shall supply all the items such as switchgear, cabling etc. required for getting temporary power.

8.3 If the Contractor suffers delay and/or incurs costs from failure on the part of the HAFEDin accordance with the mutually agreed schedule, the HAFED shall determine:

a. Any extension of time to which the Contractor is entitled under Clause 22 of GCC and;

7.0 SUPPLY OF TOOLS, TACKLES AND MATERIALS

The Contractor shall, at his own expense, provide all the necessary equipment, tools and tackles, haulage power, consumables necessary for effective execution and completion of the works during erection and commissioning.

10.0 PROTECTION OF PLANT

10.1 The HAFED shall not be responsible or held liable for any damage to person or property consequent upon the use, misuse or failure of any erection tools and equipment used by the Contractor or any of Contractor's sub- Contractors even though such tools and equipment may be furnished, rented or loaned to the Contractor or any of Contractor's sub-Contractors. The acceptance and/or use of any such tools and equipment by the Contractor or Contractor's sub-Contractor shall be construed to mean that the Contractor accepts all responsibility for and agrees to indemnify and save the HAFED from any and all claims for said damages resulting from the said use, misuse or failure of such tools and equipment.

10.2 The Contractor and Contractor's sub-Contractor shall be responsible, during the works, for protection of work, which has been completed by other Contractors. Necessary care must be taken to see that the Contractor's men cause no damage to the same during the course of execution of the work.

10.3 All other works completed or in progress as well as machinery and equipment that are liable to be damaged by the Contractor's work shall be protected by the Contractor and protection shall remain and be maintained until its removal is directed by the HAFED.

10.4 The Contractor shall effectively protect from the effects of weather and from damages or defacement and shall cover appropriately, wherever required, all the works for their complete protection.

10.5 The work shall be carried out by the Contractor without damage to any work and property adjacent to the area of Contractor's work to whomsoever it may belong and without interference with the operation of existing machines or equipment.

10.6 Adequate lighting, guarding and watching at and near all the storage handling, fabrication, pre-assembly and erection sites for properly carrying out the work and for safety and security shall be provided by the Contractor at Contractor's cost. The Contractor should adequately light the work area during night time also. The Contractor should also engage adequate electricians/wiremen. Helper etc. to carry out and maintain these lighting facilities. If the Contractor fails in this regard, the HAFED may provide lighting facilities as he may deem necessary and charge the cost thereof to the Contractor.

10.7 The Contractor shall take full responsibility for the care of the works or any section or portions thereof until the date stated in the taking over certificate issued in respect thereof and in case any damage or loss shall happen to any portion of the works not taken over as aforesaid, from any cause whatsoever, the same shall be made good by and at the sole cost of the Contractor and to the satisfaction of the HAFED. The Contractor shall also be liable for any loss of or damage to the works occasioned by the Contractor or the Contractor's Sub-Contractor in the course of any operations carried out by the Contractor or by the Contractor's Sub-Contractors for the purpose of completing any outstanding work or complying with the Contractor's obligations.

11.0 UNLOADING, TRANSPORTATION AND INSPECTION

11.1 The Contractor shall be required to unload all the Goods from the carriers, received at site after Contractor's team arrives at site. The Contractor shall plan in advance, based the information received from the HAFED, Contractor's requirement of various tools, tackles, jacks, cranes, sleepers etc. required to unload the material/equipment promptly and efficiently. The Contractor shall ensure that adequate and all measures necessary to avoid any damage whatsoever to the equipment at the time of unloading are taken. Any demurrage/detention charges incurred due to the delay in unloading the material/equipment and releasing the carriers shall be charged to the Contractor's account. The Contractor shall be responsible for receipt at site of all Goods and Contractor's equipment delivered for the purposes of the Contract.

11.2 The Contractor shall safely transport/shift the unloaded Goods and equipment to the storage area.

11.3 All the Goods received by the HAFED prior to arrival of the Contractor at site shall be handed over to the Contractor and there upon the Contractor shall inspect the same and furnish a receipt to the HAFED. The manner in which the inspection shall be carried out is enumerated below:

11.3.1 The materials/equipment would be carefully unpacked by opening the wooden cases/other modes of packing's as the case may be.

11.3.2 Detailed inventory of various items would be prepared clearly listing out the shortages, breakages/damages after checking the contents with respect to the Contractor's packing list, the HAFED's Contract and approved equipment drawings. The Contractor shall also check every equipment for any shortage/shortcoming that may eventually create difficulty at the time of installation or commissioning.

11.3.3 All the information and observations by the Contractor shall be furnished in the form of INSPECTION REPORT' to the HAFED with specific mention / suggestions which in the opinion of the Contractor should be given due consideration and immediate necessary actions, to enable the HAFED to arrange repair or replacement well in time and avoid delays due to non-availability o f equipment and parts at the time of their actual need.

11.3.4 The inspection for all the Goods handed over to the Contractor shall be completed within three week's period.

11.4 The protection, safety and security of the Goods so taken over from the HAFED shall be the responsibility of the Contractor, until they are handed over to the HAFED after erection, commissioning and testing as per the terms of the Contract.

12.0 STORAGE OF GOODS

The Contractor shall be responsible for the proper storage and maintenance of all Goods under Contractor's custody. Contractor shall take all required steps to carry out frequent inspection of equipment/materials stored as well as erected equipment until the same are taken over by the HAFED . The following procedure shall apply for the same.

12.1 The Contractor's inspector shall check stored and installed Goods to observe signs of corrosion, damage to protective coating to parts, open ends in pipes, vessels and equipment, insulation resistance of electrical equipment etc. The Contractor shall immediately arrange a coat of protective painting whenever required. A record of all observations made on Goods, defects noticed shall be promptly communicated to the HAFED and HAFED's advice taken regarding the repairs/rectifications. The Contractor shall thereupon carry out such repairs/ rectifications at

Contractor's own cost. In case the Contractor is not competent to carry out such repairs/ rectifications, the HAFED reserves the right to have this done by other competent agencies at the Contractor's responsibility and risk and the entire cost for the same shall be recovered from the Contractor's bills.

12.2 The Contractor's inspector shall also inspect and provide lubrication to the assembled Goods. The shafts of such equipment shall be periodically rotated to prevent rusting as well as to check freeness of the same.

12.3 The Inspector shall check for any signs of moisture or rusting in any Goods.

12.4 If the commissioning of Goods is delayed after installation of the Goods, the Contractor shall carry out all protective measures suggested by the HAFED during such period.

12.5 Adequate security measures shall be taken by the Contractor to prevent theft and loss of Goods handed over to the Contractor by the HAFED. The Contractor shall carry out periodical inventory checks of the Goods received, stored and installed by the Contractor and any loss noticed shall be immediately reported to the HAFED. A proper record of these inventories shall be maintained by the Contractor. The Contractor should not sell, assign, mortgage, hypothecate or remove Goods which have been installed or which may be necessary for completion of the work without the written consent of the HAFED.

12.6 A suitable grease recommended for protection of surfaces against rusting (refined from petroleum oil with lanclin minimum (70 deg C) and water in traces) shall be applied over all Goods as required once in every six months.

12.7 All Goods shall be stored inside a closed shed or in the open depending upon whether they are of indoor or outdoor design. The space heaters where provided into the electrical equipment shall be kept connected with power supply irrespective of their type of storage. Where space heaters are not provided adequate heating with bulb is recommended. For transformers heating of oil shall be done by giving 440 V supply and short-circuiting the LT terminals. Frequent checks on insulation resistance are essential for all electrical equipment and record of the inspection reports and megger readings shall be maintained equipment wise. Such records shall be presented to the HAFED whenever demanded.

12.8 All the necessary Goods required for protection as described above shall be arranged by the Contractor and such cost shall be included in the Contract Price.

13.0 APPROVALS

13.1 The Contractor shall obtain the necessary statutory approvals and any other state and local authorities as may be required and the cost of obtaining such approvals shall be included in the Contract Price. All the necessary details, drawings, submission of application and proforma will be furnished by the Contractor to the HAFED for verification/ signature. The necessary application duly filled-in, together with the prescribed fees shall be submitted to the appropriate authorities by the Contractor on behalf of the HAFED . However all the actual statutory prescribed fees paid by the Contractor shall be reimbursed by the HAFED upon production of the receipt/vouchers.

13.2 Wherever necessary or required, the Contractor shall furnish the necessary test and/or inspection certificates etc. from the appropriate authorities as per IER (Indian Electricity Rules) and other statutory regulations and the cost for obtaining these certificates shall be included in

the Contract Price.

14.0 REVIEW AND CO-ORDINATION OF ERECTION WORK

The Contractor shall depute senior and competent personnel to attend the site co- ordination meetings that would generally be held at the site every month. The Contractor shall take necessary action to implement the decisions arrived at such meetings and shall also update the erection schedule.

15.0 EXTENSION OF TIME FOR COMPLETION

Should the amount of extra or additional work of any kind or any cause of delay referred to in these conditions, or exceptional or adverse climatic conditions, or other special circumstances of any kind whatsoever which may occur, as described in the General Conditions of Contract, other than through a default of the Contractor, be such as fairly to entitle the Contractor to an extension of time for the completion of the works, the HAFED shall determine the amount of such extension and shall notify the Contractor accordingly. Provided that the HAFED is not bound to take into account any extra or additional work or other special circumstances unless the Contractor has within twenty-eight days after such work has been commenced, or such circumstances have arisen, or as soon thereafter as is practicable, submitted to the HAFED full and detailed particulars of any extension of time to which he may consider himself entitled in order that such submission may be investigated at the time.

SECTION – 6

TECHNICAL SPECIFICATIONS

DESIGN, FABRICATION, SUPPLY, INSTALLATION, TESTING AND COMMISSIONING OF MILK CHILLING UNIT, MILK STORAGE, PUF PANELS, REFRIGERATION PLANT & EQUIPMENTS FOR COLD STORAGE & ANTE ROOM INCLUDING ALL ALLIED EQUIPMENTS

HAFED Invites Bid for Design, Fabrication, Supply, Installation, Testing Commissioning & Trial Run of Plant & Machinery for Milk Chilling Unit, Milk Storage, Cold Storage etc at Primary Processing Center (PPC) Yamunanagar on Turnkey Basis.

The proposed PPC is located of Manakpur, District Yamunanagar. The site lies in Industrial Estate Yamunanagar. The land for the PPC site is approximately 1 Acres which is owned by HAFED.

The site lies 200 km from Delhi.

This PPC is being set up as a spoke of the hub, i.e. Core Processing Center located at Industrial Estate Rohtak.

SCOPE OF WORK

The PPC has the following facilities

. Layout drawing of the proposed facility is attached. The facilities are listed below-

- Cold Storage facility of 300 MT for Fruits & Vegetables. There are two chambers of having internal dimension Chamber-1- (Capacity- 150 MT) shall be 19.9 m (L) x 18.8 m (W) x 7.2 m (H), Chamber-2- (Capacity- 150 MT) shall be 19.9 m (L) x 18.8 m (W) x 7.2 m (H)
- Ante Room/Loading/unloading space having the internal dimension of 18.8 m (L) x 6.0 m (W) x 7.2 m (H).
- Milk Chilling Unit of dimensions 24.8 m (L) x 20.3 m (W) x 8.0 m (H) , Provisional Space for Quality Lab 10.8 m (L) x 5 m (W) x 8.0 m (H) & Office of dimensions 19.9m (L) x 6 m (W) x 8.0 m (H) and Storage Facility for Milk of dimensions 14.11 m (L) x 10.2 m (W) x 8.0 m (H)

DESIGN, STRUCTURAL STABILTY AND PLANT PERFORMANCE.

The broad technical specifications of each component of the proposed facility are given in subsequent paragraphs. However, the overall construction/ installation/commissioning shall be done in accordance with the detailed drawings to be submitted by the Contractor and duly approved by the Employer. This is a turnkey bid & all the civil, MEP, P&M & others as required are to be covered under the scope of work.

The Contractor shall design, supply, install, commission and handover the entire facility based on the broad specification of each components given hereunder.

The Contractor shall be responsible for the structural stability and overall quality of the entire structure and shall provide the structural stability/OEM/QAP/O&M certificates to the Employer.

The Contractor shall be responsible for performance of the entire Milk Chilling Unit/plant, milk storage facility cold storage facility and would demonstrate the plant performance and designed parameters to the Employer.

Important note: The Technical Bid Proposal shall be submitted along with the following documents without which the same will be rejected.

- **Design Proposal and parameters considered with specifications proposed**

- **Brief write up on basis of system design and Plant operation**
- **BOQ with price break- up showing all taxes and duties**
- **P&I drawing**
- **Load details and estimated power consumption**
- **Manufacturer's test certificates/ reports for all equipment**

TECHNICAL SPECIFICATIONS

i) The design parameters and specifications for Cold Storage (**Chiller-1)** Room are given here under:

S. Nos.	Parameter	Value
1	Chill Room Size	Chamber-1- (Capacity- 150 MT) shall be of 19.9 m (L) x 18.8 m (W) x 7.2 m (H)
2	No of Chambers	1
3	Designed Room Temperature	0°C to (+) 2°C (± 2°C)
4	Ambient Temperature	45°C
5	Product to be stored	Fruits & Vegetables
7	Qty. of Product to be Stored in chambers	150 MT
8	Product Incoming temperature	(+)25°C ± 2° C
9	Product outgoing temperature Max.	(+) 2°C ± 2°C
10	Pull down time	36 Hrs.
11	Wall & Ceiling Insulation	100 mm thick PUF insulated composite Panels with 0.5mm thick PPGI/PCGI
12	Thickness of Floor insulation	100 mm thick PUF Slab with 250 micron Polythene sheet as Vapor barrier.
13	Size of Chill room Door	2400 mm W x 3600 mm H x 80 mm thick - 1no's, With Suitable Air Curtains.
14	Type of Door	80 mm Thick Insulated Single leaf Motorized Sliding Door with 0.6 mm thick PCGI lamination on both sides. Aluminum Door leaf profile, PPGI wall frame, SS304 Handle, Pad lock, and Emergency release opener from inside. Heater arrangement in Door Frame &
15	Estimated Heat load in kW / Room	39 KW (11 TR) adding standby total 16 TR. (One standby unit considered)
16	Refrigeration Type	CFC Free Freon R404a - Split Type unit
17	Compressor Type/Description	Semi Hermetic. The compressor on/off based on the load shall be controlled by a micro-processor based digital temperature controller which shall also control the defrost cycle, on/off of fans, fault indications etc, thereby controlling the entire refrigeration system. Controller is provided with BMS compatibility Standby compressor as per condensing unit
18	Type of Cooling:	DX Type.

19	Condensing Unit	Forced Air cooled Condensing units with suitable canopy -3 No's. (2 Working, 1 standby, 5 TR considered) Each containing 5.0 TR compressor, accumulator and oversized copper tube with close packed aluminium fins and at least two air blowing fans of matching capacity and all controls.
20	Evaporator Unit:	Forced air cooled Evaporator/ diffuser units-4 Nos. each independently split type (Condensing+ Evaporating) units connecting with 5.0 TR condensing unit with at least 2 fans each to meet the minimum air flow requirement of 34 to 68 CMH for 150MT storage. Provision for electrical heater defrosting mechanism and water drain out.

Evaporator units position should be designed and positioned in such a way in consideration to Racking arrangement so that the air flow direction is important is proper to racking alignment and all portions of the chambers are covered. All structural support and all hanging arrangements of Evaporators/Condensing units (for equipment which are hanged) in all aspects are to be considered by the successful P&M bidder.

ii) The design parameters and specifications for Cold Storage (**Chiller-2)** Room are given here under:

S. Nos.	Parameter	Value
1	Chill Room Size	Chamber-2- (Capacity- 150 MT) shall be of 19.9 m (L) x 18.8 m (W) x 7.2 m (H)
2	No of Chambers	1
3	Designed Room Temperature	0°C to (+) 2°C (± 2°C)
4	Ambient Temperature	45°C
5	Product to be stored	Fruits & Vegetables
7	Qty. of Product to be Stored in chambers	150 MT
8	Product Incoming temperature	(+)25°C ± 2° C
9	Product outgoing temperature Max.	(+) 2°C ± 2°C
10	Pull down time	36 Hrs.
11	Wall & Ceiling Insulation	100 mm thick PUF insulated composite Panels with 0.5mm thick PPGI/PCGI lamination.
12	Thickness of Floor insulation	100 mm thick PUF Slab with 250 micron Polythene sheet as Vapor barrier.
13	Size of Chill room Door	2400 mm W x 3600 mm H x 80 mm thick -1no's, With Suitable Air Curtains.
14	Type of Door	80 mm Thick Insulated Single leaf Motorized Sliding Door with 0.6 mm thick PCGI lamination on both sides. Aluminum Door leaf profile, PPGI wall frame, SS304 Handle, Pad lock, and Emergency release opener from inside. Heater arrangement in Door Frame &

15	Estimated Heat load in kW / Room	39 KW (11 TR) adding standby total 16 TR. (One standby unit considered)
16	Refrigeration Type	CFC Free Freon R404a - Split Type unit
17	Compressor Type/Description	Semi Hermetic. The compressor on/off based on the load shall be controlled by a micro-processor based digital temperature controller which shall also control the defrost cycle, on/off of fans, fault indications etc, thereby controlling the entire refrigeration system. Controller is provided with BMS compatibility Standby compressor as per condensing unit
18	Type of Cooling:	DX Type.
19	Condensing Unit	Forced Air cooled Condensing units with suitable canopy -3 No's. (2 Working, 1 standby, 5 TR considered) Each containing 5.0 TR compressor, accumulator and oversized copper tube with close packed aluminium fins and at least two air blowing fans of matching capacity and all controls.
20	Evaporator Unit:	Forced air cooled Evaporator/ diffuser units-4 Nos. each independently split type (Condensing+ Evaporating) units connecting with 5.0 TR condensing unit with at least 2 fans each to meet the minimum air flow requirement of 34 to 68 CMH for 150MT storage. Provision for electrical heater defrosting mechanism and water drain out.

Evaporator units position should be designed and positioned in such a way in consideration to Racking arrangement so that the air flow direction is important is proper to racking alignment and all portions of the chambers are covered. All structural support and all hanging arrangements of Evaporators/Condensing units (for equipment which are hanged) in all aspects are to be considered by the successful P&M bidder.

iii) The design parameters and specifications for **Ante Room** are given here under:

S. Nos.	Parameter	Value
1	Chamber Size	As per the Approved Layout.
2	No. of chambers	One
3	Designed Ante-Room Temperature	(+)8°C ± 5°C
4	Product to be stored	Fruits & Vegetables
5	Chamber Insulation Wall & Ceiling Insulation	80 mm thick PUF insulated composite Panels with 0.5mm thick PPGI / PCGI lamination.

6	Thickness of Floor insulation	80 mm thick PUF Slab with 250 micron Polythene sheet as vapor barrier
7	Estimated Heat load in kW / Room	11.00 kW (3.13 TR)
8	Compressor Type/Description	Semi Hermetic. The compressor on/off based on the load shall be controlled by Micro Processor. Standby compressor complete in all means as per Bidder's design is included in the scope of
9	Type of Cooling:	DX Type.
10	Condensing unit	Forced Air cooled Condensing units with suitable canopy -3 Nos. Each containing 2.0 TR compressor, accumulator and oversized copper tube with close packed aluminium fins and at least two air blowing fans of matching capacity. Complete factory assembled units of standard make.
11	Evaporator Unit:	Forced air cooled Evaporator/ diffuser units-3 Nos. each independently connecting with 2.0 TR condensing unit to meet the air flow requirement of ante room with GI Powder Coating casing, copper tubes of suitable length, aluminium fins with suitable air flow should meet Design requirement. with GI Powder Coating casing, copper tubes of
12	Dock Levelers	1 No-Electro Hydraulic with Radius or Hinged lips 2000 mm x 2500 mm
13	Dock Shield	1 No- 3400 mm x 3500 mm
14	SOHD	1 No 2500 mm x 3000 mm
15	Door Opening	**For Cold Storage Chambers-** 2400 mm W x 3600 mm H x 80 mm thick -2no's, With Suitable Air Curtains. **For other spaces** PUF Swing Door (1500mm (width)*2400mm (height)*60mm(thick) -1 No

All structural support and all hanging arrangements of Evaporators/Condensing units (for equipment which are hanged) in all aspects are to be considered by the successful P&M bidder.

Bidders are advised to propose their own design but all the requirements, technical specifications, parameters are to be met.

PUF INSULATION

PUF PANEL SPECIFICATION

Areas mentioned below, where PUF panel work on walls, ceiling and on ground is required:

Layout	As per final approved layout
Chamber Size	As per Layout
No. of chambers	As per layout (Cold Storage Chambers 2 No's with total capacity 300 MT)
Other Areas	As per Layout Ante Room Areas etc

The wall and ceiling of the insulated cold rooms are to be constructed using pre-fabricated, self-supported, sandwich panels insulated with rigid polyurethane foam of required thickness. Sandwiched panels shall be CFC free, manufactured using high-pressure foam injection equipment in a precise ratio and proportion. Continuous Panels are to be used.
The properties of the polyurethane insulation shall be as under:

Physical Properties	**Unit**	**Value**
Total Foam Density	Kg/m^3	40 (minimum)
Compressive Strength At 10% Deformation (in thickness direction)	Kgf/cm^2	1.0 (Min)
Compressive Strength At 10% Deformation (in Length direction	Kgf/cm^2	1.6 (Min)
Tensile - Adhesion Strength (Foam To Steel) -(in thickness direction)	Kgf/ cm^2	0.8 (Min)
Thermal Conductivity Or K-Value At 10° C Mean Temp	W/m°K	0.023 (Max)
Closed Cell Content	%	90 -95
Water Absorption (By Volume)	%	2 (Max)
Flammability		B-3 Grade
Yield Strength	Mpa	240
Tensile Strength	Mpa	240
PUF Thickness for Cold Storage Chambers	mm	100
PUF Thickness Ante Room	mm	80
Zinc coated colored cladding thickness for PUF Panels	mm	0.50

The skin material for the wall and ceiling panels shall of galvanized steel sheet of minimum 0.6 mm thick and shall be CRC conforming to IS: 513 and the base sheet will be hot dip galvanized with zinc coating of 120 GSM as per IS: 277 with grooved profile to enhance support and aesthetics. The coating on GI sheet will be with silicon modified polyester coating (SMP) as per IS: 14246:95. The total top coating including base coat will be 20-25 micron and bottom coat will be 5-8 micron epoxy primer. The cladding sheet shall be provided with a protective polythene guard film of minimum 40 micron to protect panels from scratches during transportation.

The jointing system of the panels shall be designed to ensure a quick and secure assembly at site, with the help of tongue and groove joints. The joints shall be made hermetic and perfectly vapour tight by use of RTV silicone sealants for refrigeration. The wall panels shall be in single lengths to match the room height and width of ceiling / wall panels shall be min 1.0 meter, in order to minimize the number of joints.

The system shall be complete with all ancillary items like, PPGI Sheet flashings, ceiling panel's suspension system complete with suspension system, pressure relief valve, silicone sealants, foam chemicals and all other components & accessories as required.
Although it is proposed to support the service pipes, forced draft air coolers and cable trays for power cabling from the structural members, partial support may at times be necessary for these items from the walls/ ceiling and hence these may be designed accordingly.
The wall panels shall not buckle under the operating weight of the same. Similarly, the ceiling panels should not sag under self-weight as well as the weight of light fitting, etc. which are to be suspended from the ceiling panels.

The bidder should provide the manufacturers' test certificate conforming to CFC free method of Panel manufacturing and paint & zinc coating thickness and other parameters specified above.
The panel shall be supplied and installed as per sizes specified in designed criterion of Storage Chambers, Ante Room etc.

Continuous Panels are to be used. The inspection of testing of PUF panels is to be done as per standard Quality Assurance Plan confirming to IS Codes and European Standards.

Quantities: As per final approved layout

PUF PANEL INSTALLATION

The panels should be installed with skilled work men. Care should be exercised to seal the joints adequately using the best sealant. Following points are the guide lines for a successful work. The Contractor shall submit 3 copies of the panel design and method of installation for approval. Only the final approved drawings with the seal and sign of the consultant should be referred to for the installation work and shall be kept handy at work site.

Mark the outline on the ground, measure the diagonals, mark the portion of doors etc. and these markings are to be approved by the employer - Project in charge before installation.

U-Profiles should be fixed to the ground and leveled for installing wall and partition panels. Install the panels in the groove of the channel and assemble together. The gaps between channel and ground channel and PUF Panel should be plugged with suitable compounds. The joints between the panels should be sealed using Silicon compound. The Silicon compound should be injected into the gap and finished neatly. The wall panels have to be fixed to structure as mentioned in point above. The vertical panels should be assembled in perfect plumb level.

The Ceiling panels where ever required shall be suspended using Aluminum anodized /Powder coated T-Profile with suitable vertical suspenders with thermal break. Use proper clamping device of adequate strength. Use minimum 10/12mm diameter galvanized and threaded steel down rods. Use a turn buckle between two rods for aligning the panels. Use galvanized steel washers and nuts for fixing the panels to the down rods.

Care should be taken to avoid scratches to the panels. The holes made in the panels for passing electric cables, instrumentation cables, refrigeration piping etc. should be sealed using foamed PU. Circular flashing should cover the larger holes from inside and outside. Contractor should also protect the panels from accumulation of dirt and dust during the installation.

Hygiene and Aesthetics of insulation is to be considered.
Continuous Panels are to be used. Appropriate Joints are to be provided wherever necessary.

FLOOR INSULATION WITH PUF SHEETS IN DOUBLE LAYERS
The Floor Insulation shall be made of rigid polyurethane foam slabs in two layers of required thickness, if supplier use PUF sheet of size 1.0 m x 0.5 m corners should be straight OR in single layer of required thickness, if supplier use PUF sheet having tongue and grove jointing system with minimum joints. PUF Sheets conforming to IS: 12436 (1988). The density of PUF Sheet will be 40 ± 2 Kg /m³. The supply includes sufficient quantity of vapor barrier such as tar-felt, polythene sheet and blown bitumen of 85/25 Grade. The floor insulation will be laid as per IS: 661-1974.

PUF floor insulation capable of bearing concentrated load of loaded pallet trucks, rolling load of Pallet truck, electric stacker etc.

Quantities: As per final approved layout

PUF FLOOR INSTALLATION
The floor insulation work should be carried out as below:
Clean the floor surface thoroughly, and apply a coat of Bitumen primer (Sealcoat) and allow it to dry completely.

Apply one coat Bitumen (Grade- 85/25) @1.5 kg/ m² and then fix 2.4 mm thick Tar-felt which will act as a vapor barrier. The Tar-felt should be spread/ stick at least 450 mm on walls all around. The joints should be overlapped by at least 100 mm.

Now apply one coat Bitumen (Grade- 85/25) @1.5 kg/ m² and then fix first layer Insulation i.e. 50 mm thick Puff sheet. Joints of insulation sheets should be properly sealed.

Now again apply one coat Bitumen (Grade- 85/25) @1.5 kg/ m² and then fix second layer of Puff Insulation i.e. 50 mm thick. Joints of insulation sheets should be properly sealed.

Now again apply one coat Bitumen (Grade- 85/25) @1.5 kg/ m² and then fix 2.4 mm thick Tar-felt. The Tar-felt sheet should be spread/ stick at least 350 mm on walls all around. The joints should be overlapped by at least 100 mm.

SPECIFICATIONS OF DOORS

COLD STORGAE DOORS (2 No's) for Storage Chamber

Motorized Sliding Doors & Single Leaf Door with sandwich PUF panel (2400mm (width) x 3600 mm (height) and 80 mm (thick) with 0.6 mm PPGI/PCGI sheet thick on both side, 200 GSM galvanised in RAL 9002 in colour with PUF having density 45±2kg/m3 with air curtains and complete with all accessories.

Extra high density wall frame within build thermal break , Heavy duty Rail profiles (6.8 Kg / m) in aluminium alloy Grade 6063 and Temper T6 grade , Runners wheelchair in AISI 304 grade , 3 sided exchangeable EPDM sealing gasket, fixed in special PVC holder on inside of the door blade frame and C Flushing , Out Side Opener: Design Hermetic Opener with solid AISI 304 Grade Stainless Steel Handle and Nylon Grip & Inside Opener: Solid AISI 304 Stainless Steel Handle with Nylon Grip & Padlock arrangement on track side, with emergency release on non – track side . Automation Microprocessor Based, CE Marked Confirming to European Standard EN12453,-Industrial commercial and Loading Doors and Gates – Safety in use of power operated doors.

Quantity: As per final approved Layout

Note: Dimensions are just for reference and are subject to change as per site conditions.

PUF SWING DOORS FOR ANTE ROOM to other spaces (1 No)
PUF Swing Doors (1500mm (width)*2400mm (height)*60mm (thick)) for operations from Ante Room to Milk Chilling Unit Area and Milk Storage Area.
PUF Hatch Windows (900mmx900mm) are to be included for maintenance purpose. The thickness of PUF material will be as per the position (temperature range**).**
Quantity: As per final approved Layout
Note: Dimensions are just for reference, subjected to change as per site conditions

DOCKING SYSTEM-1 No
1-SPECIFICATIONS OF DOCK LEVELLERS:

Providing & Fixing of Swing Lip Electro Hydraulic Dock Leveller with 6T capacity with dimension - 2000 mm width & 2500 mm Length with self-cleaning hinge swing lip with 2 main hydraulic cylinder with crome hardened plunger with double sealed for lifting the platform & one lip cylinder for lip movement (European standards (EN 1398) & GS safety) . Dock Platform & Lip are made of high quality tear plate : 6/8 mm & 12/14 mm for lip . Safety features - Full hydraulic safety stop , Non retractable sliding toe - guard on both side , Robust steel lip keepers for transverse movement , Black / yellow safety markings , motor safeguard by thermal relay .

Dock Leveller dimension	**2000 mm* 2500 mm**
Upward Movement of Dock	370 mm
Downward Movement of Dock	280mm
Standards	CE
Capacity (EN 1398)	60 KN
Dock leveller height	600 mm

Lip length	400 mm
Lip angle	45 mm
Power Supply	400 V/ 50 Hz/2.5 A
Control Current	24 VDC
Protection Class	IP54
Working Pressure	100 bar
Outside Dia main cylinder	50 mm
Outside Dia Lip cylinder	45 mm
Standard Color	RAL 9005 Black

• **Dimensions are subject to change as per the site conditions**

2-SPECIFICATIONS OF OVERHEAD SECTIONAL DOOR :

Automatic Overhead Sectional Door made up of 40 mm thick pre painted galvanized steel sandwich panels with 610 mm height , panels are fitted with an additional integrated steel reinforcement strip . High insulation value in the highest class of CE standards & considerably reduce the energy consumption . In closed position it can withstand the wind speed of 118 km/H (12 Beaufort). It shall be provided with flexible PVC bottom weather seal to lessen conductivity of heat and cold and to minimize air and water penetration.

Door Dimension	**2500 mm (W) x 3000 mm (H)**
Thermal Insulation	1.6 W/M3k
Thickness of Panel	40 mm with 610 mm high
Air Permeability	Class3
Resistance to water Penetration	Class 3
Resistance to wind Load	Class 4
Vision panel	Oval shaped with size 663 * 343 mm
Lift System	Normal / High & Vertical
Colour	RAL 9002. Baked on polyester paint.
Operational Accessories	Push Button
Safety Accessories	Bottom safety edge / spring break safety device / Cable break safety device & Slack cable safety device
DOOR AUTOMATION :	
Motor Output	0.55 KW
Operating Voltage	415V 3 ph/50 HZ
Control Voltage	24V

Driving Torque	110Nm
Protection	IP 54

3-SPECIFICATIONS OF DOCK SHELTER/DOCK SEAL :

Curtain type Dock Shelter with parallel guide system. Dock Shelter Dimension - Width 3400 mm & Height 3500 mm. The curtain is 3 mm thick made of highly wear and tear resistant double-layer PVC-coated cloth and mounted on the flexible frame. Front Projection depth - 600 mm, side curtain width - 700 mm & Top curtain height - 1000 mm .

CURTAIN SPECIFICATION	
Dimension	**3400 mm * 3500 mm**
Totel weight (gr/m2)	Top - 3500 & side - 3500
Coating	0.5 mm Derflex 85 with matt finish
Tensile Strength (N/mm)	240
Temperature Resistance	Max 90 Degree & Min -30 Degree
Curtain Model	Nblack . 3500 gr/m2
Standard Color	Black with white warning strip
Front Projection Depth	600mm
Side curtain width	700mm
Top curtain height	1000 mm

Accessories:

- Wheel Guides with Anchoring kit (1 set)

- Pair of Mega Bumpers - 250mm (Width) x 100mm (Depth) x 450mm (Height) with heavy steel support

- Pair of Mega Bumpers - 250mm (Width) x 100mm (Depth) x 450mm (Height) with heavy steel support and added front-top hot deep galvanized steel plate, 15mm thick for additional protection from front and top loads

- Pair of Super Bumpers - 150mm (Width) x 80mm (Depth) x 400mm (Height) with heavy steel support and added front-top hot deep galvanized steel plate, 10mm thick for additional protection from front and top loads

- External Traffic Light

- Interlocking system

• **Dimensions are subject to change as per the site conditions**

INSTALLATION OF DOORS AND AIR CURTAINS

Supplier / Contractor are advised to carry out detailed design and obtain Client’s approval prior to supply of the items. In case any additional reinforcement if any required in the wall / ceiling panels

of the rooms shall be provided by the Contractor without any extra cost.

Make opening in PUF insulated wall panel as required for fixing doors. Also do proper recession in floor to install threshold frame.

Open boxes / packing of items and check whether all items are in proper condition. No shortage / damages are observed. In case of shortage/ damage supplier/contractor shall immediately arrange replacement to avoid delay in execution of the project.

Align wall panels with plumb and then carryout proper installation with best engineering practices.

Check proper and smooth functioning of Sliding Doors / Swing doors and air leakage/ tightness.

Carry out installation of Air Curtains also properly.

DETAILED SPECIFICATIONS OF FREON CONDENSING UNIT:

Design Requirement: Air Cooled

Capacity: Suitable

Condensing: 45 Deg. C

Type:

Condensing unit shall be of factory assembled with Semi-Hermetic Compressor & Air Cooled Tube & Fin type condenser and oil separator, valves & Controls, conforming in all aspects to the specifications and system requirements.

Design:

The detailed design of the condensing unit is the responsibility of the Supplier and shall meet the requirements as well as meet relevant manufacturing codes /standard.

The condensing unit is to be supplied by a specialist manufacturer as fully assembled units. The capacity and performance of the condensing unit shall be warranted by the manufacturer.

Construction:

General: All structural elements shall be constructed from heavy-gauge (16), hot-dip galvanized steel, with cut edges given a protective coating of zinc-rich compound. Tubes shall be constructed of Copper, Fins will be Aluminum.

Piping shall be used for Drain lines

Piping to be G.I class B or sizes up to 65 NB & M.S. black pipe conforming to IS¬ 1239.

Valves up to 40 NB to be Gate / Globe type.

Valves 50 NB / larger to be butterfly type.

Material for insulation for refrigerant suction line, accumulators etc.

EPS pipe section

PUF pipe section

With 0.6 mm Aluminium or 0.5 mm G.S. pre-coated sheet cladding Nitrile Rubber / EPDM / chemically cross linked polyethylene pipe section / other acceptable materials with woven glass cloth with UV treated pigmented epoxy Coating

CONTROLS:

Temperature control	Temp Indicators cum controllers for individual freezers and chambers
Refrigerant flow controls	solenoid valves etc.
Defrost Controls for automatic defrosting if required	Recommended in case of continuous freezers and deep freeze chambers.
MCC/PLC control systems	For overall control of various parameters

Note. Location for installing the sensors will depend on site conditions and stacking pattern etc.

INSTALLATION, TESTING & COMMISSIONING:

Installation commissioned as per IS 660	The plant shall be installed, tested as per ASHRAE. Std 15

GENERAL NOTES:

- In refrigerant system the following components needed to be incorporated-

a) Refrigerant flow & safety controls

b) Interconnecting piping – both supply & return lines shall be insulated. In this case the individual accumulators for AC units & level controls etc. are not required.

- The compressors shall be provided with a set of complete special servicing tools, operation/maintenance manual and spares for 5 years operation including oil filter elements etc. Each compressor shall also be provided with suction and discharge line stop valves. Suction and discharge line check valves & stop valves, Suction scale trap with strainer and Safety relief valves, HP & LP pressure gauges and cut outs etc.
  Standby compressor complete in all means as per Bidder's design is included in the scope of works.

- Electrical motor control panel shall be cubical in design with incoming and outgoing feeders for all motors. Stand by feeders shall be provided for compressor motor and for pumps etc. The design of MCC, selection of starters and cabling and earthling job shall be as per detailed Technical Specification given for Electrical Equipment

(iv) Working Drawings for complete refrigeration scheme including refrigeration piping, control, wiring etc shall be prepared in details & submitted to Consultant for approval. Only after approval of the scheme the refrigeration work shall be taken up

(v) Dimensions are subject to change as per the site conditions.

(vi) Cables shall be laid in cable trays where ever required. No extra payment will be given.

INSTALLATION TESTING & COMMISSIONING OF REFRIGERATION PLANT

- Supplier/ Contractor to prepare P & I and layout drawing and obtain approval from Employer.
- Supplier/ Contractor to submit 3 sets of approved drawing and ensure availability of one set of approved drawing with the erection staff at site.
- Supplier/ Contractor shall supply & erect a chain pulley block of adequate capacity with mono-rail arrangement running above all the compressors for lifting of motor, compressor package, etc. for installation, as well as for the future maintenance.
- Supplier/ Contractor to depute a technically qualified project manager at site to carry out installation, testing & commissioning of all equipment as per approved drawing and as per good engineering practice.
- The compressor and motor should be aligned perfectly at the manufactures works. The alignment should be checked at the site prior to commissioning. It should be re-checked for hot alignment and if the alignment is stable and within the tolerance as per manufacturer's recommendation, the motor should be doweled to prevent from moving and facilitate repositioning. Otherwise the procedure recommended by compressor manufacturer should be adopted.
- Supplier/ Contractor shall erect the machines and motors on the prepared foundations; supply holding- down bolts, sub- bases, motor slide rails and all other items that may be necessary, and grout on foundations. Align and adjust motor coupling, fix guards.
- Carry out complete sealing of all cutouts made in the wall / ceiling panels for pipes and electrical fitting installation etc.
- Supplier/ Contractor to commission the complete plant and machinery to the entire satisfaction of the Employer.

COEFFICIENT OF PERFORMANCE (COP) – For optimum energy efficiency the plant should be selected with best possible COP.

OPERATION & MAINTENANCE Plant design must be accompanied by Operation & Maintenance Manual for plant operator which should cover following points in English as well as Hindi languages

- No. of operating hours
- Training of operators
- Monitoring & control – temperature, humidity, CO_2, Defrost cycles, air flow, operation time
- Door seals – checking methods
- Maintenance of equipment / cold store
- Hygiene issues

VARIATION / AMENDMENT CLAUSE

The standards prescribed above are not intended to prevent or discourage variations arising out of new concepts, innovations and R & D in building design & construction, thermal insulation and cooling & refrigeration technology etc. However, any variations or deviations from the above prescribed standards must be supported by scientific / technical details for prior approval of the competent authority, on the basis of merit who may decide the proposal in view of relevant technical details including critical storage requirements, energy efficiency (coefficient of performance), availability of *Standards*, environmental concerns, safety etc. Similarly, periodic amendment of standards for general application may also be undertaken by the National Horticulture Board; in consultation with a committee of subject matter experts duly constituted for this purpose.

ACCEPTANCE TEST

COMMISSIONING AND TESTING DEFINITIONS - For the purpose of commissioning this General Specification the following definitions shall apply.

Commissioning: the advancement of an installation from the stage of static completion to full working conditions and to meet the specified requirements. This will include setting into operation and regulation of the installation.

Setting to work: The process of setting a static system into motion.

Off-site Tests: Tests carried out on items of equipment at manufacturer's works or elsewhere to ensure compliance with the requirements of Specifications and/or relevant Standards or Codes of Practice (or other standards specified).

Site Tests: tests on static plant and systems (e.g. inspection and testing of welds, hydraulic testing of pipe work, etc.) to ensure correct and safe installation and operation.

Performance Testing: the measuring and recording the quantitative performance of the equipment, insulation panels etc.

COMMISSIONING AND TESTING – GENERAL

Any defects of workmanship, materials and performance, maladjustments or other irregularities which become apparent during commissioning or testing shall be rectified by the Contractor at no cost to the HAFED and the relevant part of the commissioning or testing procedure shall be repeated at the Contractor's expenses.

The entire commissioning and testing procedure shall be undertaken by the Contractor's own competent specialist staff or by a competent Independent Commissioning Specialist nominated by and acting for the Contractor and approved by HAFED.

At the appropriate time in the Contract, usually before start of the actual installation work, **the** Contractor **shall furnish the Provisional Commissioning and Testing programme, methods, procedures and formats of test records to the HAFED.**

This shall be updated as the work progresses towards completion.

If considered appropriate, the Contractor shall be required to carry out demonstration to dismantle those parts/components of the installation which are considered difficult/impossible for maintenance access. The Contractor shall be responsible for carrying out all necessary modification work at no extra charge to the Employer to alleviate the difficulties associated with dismantling or maintenance access.

GENERAL COMMISSIONING REQUIREMENTS

Systems shall be properly commissioned to demonstrate that all the equipment deliver the designed

capacities and that air, refrigerant and water flow rates are balanced in accordance with the design. Since the air systems are usually completed ahead of the hydraulic systems, commissioning of the air systems will commence earlier than the refrigerant and water systems.

The Contractor shall ensure that -

Air intake screens and louvres are unobstructed

- Fan and other equipment chambers are clean and free of construction debris.
- Floor gulleys and drainage traps are clear.
- Fans are checked for impeller housing clearance and free of foreign objects.
- Evaporators are clean and fins are combed.
- Cooling coil condensate trays and humidifier drains are unblocked.
- Dampers are clean.
- Ducting and other airways are clean.
- All electrical wiring circuits (power, lighting and controls) are completed, or will be completed at the correct stage during the commissioning period.
- All electrical panels are commissioned and clean.
- Lighting systems are switched on.
- Permanent power supply is available at the electrical panels, and all the connected equipment can be switched on.
- All aspects of the commissioning procedure shall include the following but not limited to:-
- Preliminary checks to ensure that all systems and system components are in a satisfactory and safe condition before start up.
- Preliminary adjustment and setting of all plant and equipment consistent with eventual design performance.
- Energizing and setting to work on all plants.
- Final regulation and demonstration that the installation delivers the correct rate of flow of fluids and air at the conditions specified in the Contract Documents.

Progressive Commissioning - The Contractor shall not wait for completion of every part of the work but shall arrange for a progressive commissioning programme to achieve practical overall completion and have the whole work ready to be handed over by a date to suit the completion date agreed in the Contract.

Specialist Commissioning - The Contractor shall be responsible for initially setting the plants to work and shall arrange for any Specialist Plant or Equipment such as Microprocessor based Control System to be commissioned and tested by the Specialist Equipment Manufacturer's skilled Commissioning Engineer and/or technician, if it is felt necessary.

Contractor to Inform HAFED- The HAFED shall be informed in good time of all site tests for plant, ducting and piping.

Witness by HAFED or its authorized representative - The final tests shall be carried out in the presence of the HAFED or its authorized representative, or the Contractor representative, in accordance with the requirements of witness testing and commissioning as stipulated in the Acceptance Protocol. The Contractor shall give at least 72 hour's notice, in writing, when any part or parts of the installation will be tested.

Test Equipment and Labour - The Contractor shall provide all skilled labour, testing gear (including pumps, tools, air and water flow instruments and thermometers, etc.) and attendants for all tests including those by Specialist. The Contractor shall be solely responsible for the proper filling, emptying and flushing of the plants and pipes to be tested and shall make good any defects emerging from the tests, or made manifest under testing or re-testing, until the whole of the plant is free from defect and is in complete working order to the satisfaction of the HAFED or its authorized representative.

DOCUMENTS AND DATA REQUIRED FOR HAND-OVER MEETING

General - The Contractor shall note that the system cannot be handed over until all the foregoing requirements (where applicable) have been carried out to the satisfaction of the HAFED.

Test Certificates - Before the handover inspection, the Contractor shall provide the follow test/record certificates where applicable:

Copies of manufacturer's works tests/record certificates on plant items comprising heat generating plant, heat exchangers, refrigerant unit, tanks, vessels, motors, fans, pumps, etc.

Copies of balance vacuum test, balance pressure testing, and hydraulic pressure test/record certificates for works carried out on site.

Copies of refrigeration plant efficiency test/record certificates.

Copies of all performance test/record certificates including water balancing, air balancing, room conditions, etc. These certificates shall be accompanied with all appropriate charts and diagrams.

Copies of all noise test/survey records on every noise emitting plant and machineries, individual room/space and a statement of compliance with the statutory requirements under the current Noise Control Ordinance.

As Fitted' Drawings - All necessary copies of 'As fitted' drawings as detailed in the Contract Documents and this General Specification.

Operation Maintenance and Services Manuals - All necessary copies of Operating and Maintenance Manuals as detailed in the Contract Documents and this General Specification. The Contractor shall include functional spare parts and contact lists of the suppliers in the manual.

- **Manufacturer's Name Plate -** Every item of plant supplied by a Manufacturer shall be fitted with a clearly engraved, stamped or cast manufacturer's name plate properly secured to the plant item and showing :-
- Manufacturer's Name
- Serial and/or Model No.
- Date of Supply
- Rating/Capacity
- Test and Working Pressure (where applicable)

Labels and Related Instructions - Provision of all labelling and the related instructions shall comply as per details given in the specifications.

RACKING STORAGE SYSTEM:

SINGLE DEEP PALLET RACKING SYSTEM SUITABLE FOR COLD STORAGE ROOM:

Temperature Range	As per Design Basis suitable for Chiller Chambers
Rack -beam to beam height	1700 (H) mm (±50 mm)
Pallet Size	1000 x 1200 x 1500 (H) MM
Layout	As attached
Chamber Size	As per Layout
No. of Chambers	As per Layout
Load per pallet	1000 Kgs. (1200 Kgs with safety factor)
Factor of safety	1.2 for load, overall1.5
Color	Preferable -Upright: Blue and beam: orange, as per industrial standards
No. of Levels	G+3
Equipment Considered for operation	Stacker, forklift and pallet trucks
Bottom clearance	350 MM, as per industrial standards and site conditions
Accessories	Row Guard, column guard, back stopper in last rows
Label holder	required two nos. of on every level-Acrylic type
Certificates to be submitted	Steel test certificate, stability certificate, third party design certificate/warranty letter, load bearing certificate with deflection test under load.

The contractor has to ensure that the required capacity through racking is met chamber wise.

SPECIFICATIONS OF MATERIAL HANDLING EQUIPMENT (MHE):

Sr No	Material Handling Equipment (MHE)	Qty	Specification
1	Electric Pallet Truck (Including Battery Charging Unit with Extra Battery)	1 No's	Load Capacity: 2000 Kg's Working Place (+)0ºC to (+)25ºC Lift Height: 4500 mm suitable for reefer truck etc. Working Place : Chiller room and Ante Room
2	Supply of Electric Stacker (Including Battery Charging Unit with Extra Battery)	1 No's	Load Capacity: 1500 kg's Lift Height: 5500 mm Working Place : Chiller room
4	Hand Pallet Truck	5 No's	Capacity: 2500 kg's Lift Height: 200 mm
5	Plastic Pallet	300 No's	Heavy Weight (HW) OD: 1200 x 1000 x 160 mm Static load: 6000 kg's Dynamic Load: 1200 Kg's Racking Load: 1000 kg's

P.S- Dimensions are just for reference and are subject to change as per design and site conditions

MILK CHILLING AND STORAGE FACILITY FOR MILK

CAN CONVEYOR

- **Type-**Roller, Floor mounted/As per Industrial Norms
- **Application-**Conveying of milk filled cans
- **Indicative Size-** As per capacity for 10000 LPD
- **MOC Recommended-** Frame- SS/AISI- 304, Rollers- GI/NB Pipe
- **Design Features-** Frame of Roller Conveyor should be from Stainless steel with 4 pairs of Pipe legs, ending with adjustable ball feet. Roller conveyor should be completely folding type with nuts & bolts. Frame should be in two parts (for transportation), with easy to join & fasten feature. Legs should be with foldable cross bracing. Rollers should be fabricated from heavy duty GI Pipe, provided with ball bearings on both ends. Chain function may be provided. Qty. as per Bidder's design fulfilling the capacity.
- **Key Functions-**
    - Visual inspection
    - Load bearing capacity of conveyor shall be checked with capacity (indicative size-10 No x 40 liters full cans). Under weight, there should not be abnormality and cans should be effortlessly pushed.

CAN TIPPING BAR

- **Type-** Floor mounted/As per Industrial Norms
- **Application-** Tipping of Filled milk cans to unload milk into weigh bowl
- **Size-** Standard for 40 liters can/ As per Industrial Norms
- **MOC Recommended- Frame** - SS/AISI-304
- **Design Features-** Tipping should be made up material of sufficient strength to withstand sudden force exertions. Profile should be such that that it helps the person ergonomically to tilt cans easily. Bar shall be supported on two AISI 304 pipe legs provided with floor mounted & grout able stainless steel plates with anchor bolts
- **Key Functions-**
    - Visual inspection
    - Suitability for resting neck of 40 liters ISI Milk Can.
    - Height suitable as per site.

ELECTRONIC WEIGH BOWL

- **Type-** Weigh bowl on load cells with digital display and linked to CPU
- **Application**- Tipping of Filled milk cans to unload milk in to weigh bowl, electronically data recording, computer based and dynamic reporting
- **Capacity-** 500 Litre
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**- Stainless steel weigh bowl, suspended on floor grouted frame work with load cells. Should be with digital monitor linked to a computer.
- Weigh bowl should as per industry design, with a strainer, milk drain valve operated with a hand lever.
- **Accessories-**
    - Dead weights as prescribed
    - Multifunction print/copy/scanner & Printer (HP/Cannon)
    - Computer i5, Windows 8/10,6 GG RAM, 1 TB Hardisk, Minimum 19.5 inch LED monitor
    - Software as per Milk Receiving application
    - Keyboard
    - 2 KVA UPS with battery for computer and operating instruments.
- **Key Functions**

- Visual inspection
- Accuracy of weighing with standard dead weights.
- Complying Indian Weights & Measures Rules.

CAN DRIP SAVER (As per Bidders design confirming industrial norms)

- **Type-** Floor mounted
- **Application-** Collection of milk drips from milk cans after pouring
- **Capacity**- 6 cans
- **MOC Recommended-** Stainless Steel, AISI-304
- **Design Features-**
  - SS round pipe frame with inclination to support inverted can. Drips collection tray at the bottom, fabricated from 2 mm thick stainless steel conforming to AISI-304, sufficient slope towards one side for collection of milk, Drain with a butterfly valve.
  - Frame grouted on the floor.
  - Length of frame sufficient to hold 6 No. aluminium cans of 40 liters.
- **Key Functions-**
  - Visual inspection
  - Dimensional details as per approved GA drawing.

DUMP TANK

- **Type-** Rectangular, sloping bottom with open-able top cover in two parts/Or as per bidder's design for smooth operation
- **Application**- Collection of raw milk from weigh bowl .
- **Capacity**- 1000 Liters
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**- The dump tank shall be of horizontal and of rectangular construction tank (bidder may propose other design as per standard norms of dairy industry) suitable for placement below the weigh bowl, provided with milk inlet nozzle. The tank should have sufficient slope in the bottom towards outlet for complete drainage of milk. Cup type outlet nozzle shall be of suitable size butterfly valve ending with SMS union. Dump tank should be self-supported on pipe legs ending with height adjustable ball feet. Top cover should be in two parts - half the cover should be bolted and with inlet nozzle to receive milk from weigh bowl without spillage and remaining half should be removable type.
- **Key Functions-**
  - Visual inspection
  - Dimensional details as per approved GA drawing.
  - Filling with water and checking complete drainage of water towards outlet.

MILK TRANSFER PUMP

- **Type-** Centrifugal
- **Application-** Transfer of raw milk from dump tank via chiller to storage tank
- **Capacity**- 5000 LPH at 25 MWC.
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features-** The pump shall be of sanitary design in stainless steel construction. All the stainless steel surfaces should be polished to 150 grits.
- Pump shall be suitable for operation in the temperature range of 4- 90°C.
- Suitable impellor, dynamically balanced.
- Mechanical seal on the extended shaft, coupled to flanged electric motor, of Class-I efficiency. Electric motor shall be squirrel cage TEFC with IP55 protection, suitable for 415 V, 50HZ, AC supply.
- Inlet & outlet connections ending with SMS unions.
- The inlet to be 230 mm above the finished floor level.
- Provide with 3 Nos legs with adjustable ball feet.
- Motor protected with well-ventilated stainless steel shroud, easy to open.
- **Spare/ Tools-**

- Minimum 2 No. Spare mechanical seal
- Minimum 2 No. Spare housing gaskets
- Minimum 1 No. C-spanner

- **Key Functions-**
  - Flow rate at discharge head shall be checked for conformity.
  - Operational efficiency - current drawn.

MILK CHILLER

- **Application & Capacity:** 35 to 4°C using chilled water of 1°C.
- **Capacity**-5000 LPH
- **Design Features-** Plate heat exchanger in SS construction with gasket. The heat exchanger frame is SS cladded. The cooling surface consists of a number of corrugated plates clamped together in a frame and sealed at the edges by means of gaskets. The plates have ports at the corners, and the gaskets are so arranged that the two media of the heat transfer process flow through alternate spaces between the plates. The flow pattern is generally chosen so that the two media are in counter current flow.

MILK STORAGE TANK

- **Application-** To store raw/chilled milk
- **Capacity-** 5000 Liters -2 No's
- **Design**-With double/two Compartment Construction Specification-Milk tank, horizontal type having two compartments, insulated. The storage tanks should have-SS manhole, ladder and cat walk, sight and light glass, dial type thermometer, lifting lugs, agitator with motor, CIP spray ball, anti-foam inlet, milk outlet with 2 way SS valve, Alcove, sample cock, overflow connection, PT-100.
- The tank shall be used to store chilled milk at 4°C.The insulation will take care of temperature Acceptable rise in milk temperature in 24 hours is 1°C.
- The tank when filled up to 25 mm below the light - sight glass openings will hold capacity of 5000 liter
- The inner shell shall be 2 mm thick AISI 304 quality stiffened with M.S. channel rings.
- The dish ends will be 2.5 mm thick AISI 304 conical type The front dish will have
- A manhole : elliptical with swing arm
- Thermometer: pocket with Digital temp. display
- Thermometer: bracket
- Light and sight glass (toughened)
- An air vent will be provided at the top. (SS 304 material)
- Ladder brackets, Ladder will be provided on one side. (SS 304 material)
- Non foaming type milk inlet. No foam inlet of 51 mm with SMS nipple will be provided at top of the tank of front dish end with a circular, removable bend (for cleaning) ensuring foam-less filling of milk.
- The rear dish will be graduated with level marking engraved on every 500 liter mark.
- Cradle: The tank will rest on 4 mm thick AISI 226 cradle stiffened with channel rings
- The tank shall be insulated in such a way that rise in milk temperature in 24 hours is less than 1°C.
- 2 mm SS AISI 304 outer will be wrapped around the insulated inner tank.
- Cup type outlet will be fitted to the tank bottom on front side and 51 mm pipe outlet be given with SMS 51 mm (two way) top tightening one side flange SS valve.
- Agitator: Stainless steel agitator with 4 blades and bottom bearing will agitate the milk. The gear motor with 38-40 R.P.M. will be provided.
- Lifting lugs: 4 lifting lugs will be provided. The tank will rest 450 mm high from ground level on 6 vertical pipe legs of SS 304 adjustable ball feet. Leveling will be done by ball fit's. Six wear plates of AISI 304 will be provided under S.S. ball fit's.
- For C.I.P. 2 no's of spray balls to be provide with interconnecting pipe at the top.
- Testing: All joints to be checked with die - penetrate test. Tank to be test with water fill up before insulation. Temperature testing. Visual testing
- Finish : The tank will be ground smooth and finished to dairy finished polished to 150 grit.

MILK STRAINER

- **Type-** Pipe-in -pipe / Duplex type
- **Application-** Straining of raw milk at ambient temperature
- **Capacity-** 2000 LPH- 10000 LPH (As per bidder's design fulfilling the capacity requirements)
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**- Fabricated from stainless steel conforming to AIS-304, with easy to open SMS union for removal and cleaning of filtering mesh.
    - Interchangeable with a set of butter fly valves at inlet & outlet of both the filter.
    - Indicative Mesh size - 60
    - Inlet & outlet connections - 51 mm/ ending with SMS unions.
    - Air vent with needle valves.
    - CIP compliant.
- **Key Functions-**
    - Visual inspection
    - Filtering efficiency not less than 90% - to check sediment pre and post filtration.

BALANCE TANK FOR CIP

- **Type-** Vertical, self-supported with sloping bottom, plain tank.
- **Application**- Water Flushing & CIP cleaning of pipelines.
- **Capacity**- 200 lit minimum
- **MOC Recommended**- AISI- 304
- **Design Features**- Milk Balance Tank should be fabricated from 2 mm thick Stainless Steel conforming to AISI – 304. Vertical & cylindrical design with sloping bottom, self-supported on 3 Nos. pipe legs ending with adjustable ball feet. The tank should be provided with bisectional top cover, water inlet size of 40 NB with ball valve, outlet with 51 mm Butterfly valve.
- **Key Functions-** Visual inspection and dimensional check.

STAINLESS STEEL PIPES & FITTINGS

- **Type-** Dairy standards, polished, ERW pipes with crushed beads and all fittings of SMS standards
- **Application-** Interconnecting equipment for flow of milk as per P & I as well as for CIP cleaning.
- **Capacity-** As required.
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features-**
    - Weldable unions.
    - All product lines openable for visual inspection.
    - TIG welding with purging.
    - All inside joints in product contact - ground smooth
    - All gaskets - food grade quality.
    - All union joints accessible for opening, dismantling and inspection.
    - Pipes supported and clamped on AISI 304 Hollow Sections.
- **Key Functions-** Hydraulic testing of product lines at 3 bar, CIP lines at 5 bar and water pipe lines at 3 bar for 30 minutes.

TANKER LOADING PUMP

- **Type-** Centrifugal/ closed impellor/As per bidder's design.
- **Application-** Transfer of raw chilled milk from milk chilling unit to Road Milk Tanker
- **Capacity**- 10000 LPH at 25 MWC.
- **MOC Recommended-** Stainless Steel, AISI-304
- **Design Features-** The pump shall be of sanitary design in stainless steel construction. All the stainless steel surfaces shall be polished to 150 grits.
- Pump shall be suitable for operation in the temperature range of 5- 90°C.
- Suitable impellor, dynamically balanced.
- Mechanical seal on the extended shaft, coupled to flanged electric motor, of Class-I efficiency. Electric motor should be squirrel cage TEFC with IP55 protection, suitable for 415 V, 50HZ, AC supply.
- Inlet & outlet connections ending with SMS unions.
- The inlet is to be at suitable height above the finished floor level.

- Provide with 3 Nos legs with adjustable ball feet.
- Motor protected with well-ventilated stainless steel shroud, easy to open.
- **Spares/ Tools-**
  - Minimum 2 No. Spare mechanical seal
  - Minimum 2 No. Spare housing gaskets
  - Minimum 1 No. C-spanner
- **Key Functions**
  - Flow rate at discharge head shall be checked for conformity.
  - Operational efficiency - current drawn.

ROTARY CAN WASHER

- **Capacity-** 150 cans/ Hr.
- **MOC-** SS 304

CAN SCRUBBER

- **Type-** Rotary & stationary brush
- **Application-** Scrubbing/ brushing of Milk cans internally as well as externally.
- **Capacity-** 150 cans/ Hr.
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**-
  - Stainless Steel immersion bath
  - Nylon brushes - rotary for internal scrubbing and fixed for external scrubbing
  - Brush drive motor and transmission assembly at one end, protected from water ingress/ enclosed in waterproof cover.
  - Shaft with sealing to prevent water leakage.
  - Drain and overflow nozzles in the bath.
  - Recommended volumetric capacity of bath 425 liters.
- **Key Functions**-
  - Validation with operational check.
  - Visual inspection & Dimensional check

WASH POINT

- **Type-** Wall mounting with hose pipe hanger
- **Application**- For washing & cleaning by mixing cold and hot water as per requirement
- **Capacity/ Size-** 20 NB
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**- Two inlet nozzles - one each for ambient temperature water and hot water, each with NRV and ball valve, size 20 NB Outlet nozzle with serrated nipple.
- Flexible rubber hose of Dunlop, suitable for up to 90 deg C, 20 NB x 5 meter long
- **Key Functions**- Validation with operation

CHILLED WATER GENERATOR

Function	To produce continuous chilled water having output temp <4°C required to chill the milk at 4 deg.c. approx@ 2500 LPH
Refrigeration Tonnage	15 TR (7.5 x 2 Nos) at -5°C evaporation & +40°C condensation
Compressor Type	Scroll compressor (2 Nos)
Suction Line Accumulator	Suction line accumulators suitable for above compressor with rubber foundation arrangement and suction and discharge connection.
Air Cooled Condenser	Oversize copper condenser with sufficient aluminium fins per inch with three numbers of fans having sufficient CFM
Liquid Receiver	Freon receiver with necessary service made out of M. S. 'C' class pipes painted with enamel paints (2 Nos)
Refrigeration Controls	Thermostatic expansion valve, HP & LP cutouts, HP & LP gauges, Solenoid valve, sight glass, driver/filter, charging valves & Isolation valves etc (2 Nos)

Evaporating Coil	One lot of @ 1000 Mtrs long of 5/8" OD copper tubes having wall thickness 22 SWG There will be two independent circuits of 500 Mtrs connected with working compressors. The coil will be supported vertically as well as horizontal by aluminium angle, both coil are independently connected with its separates thermostatic expansion valve and suction header (1 Lot)
Copper Pipes & Fittings	Copper pipes, Elbows, reducer etc. to interconnecting all refrigeration equipment.(1 Lot)
Structural Skid	Base frame compressor, condensing unit and control panel is to be fabricated out of angle, channel and wire mesh door/ cover to be supplied along with base frame for protection of air-cooled condenser and compressor. The frame is painted with 2 coat of enamel paints
AGITATOR	Vertical slow speed agitator along with agitator motor for circulation of chilled water inside the tank (1 Set)
ICE BANK TANK	M. S. Ice bank tank size **5 M X 1.8 M X 1.8 M** high. The tank is fabricated out of good quality M. S. Sheets and structural materials and insulated by 100 mm thick thermacole
Chilled water circulation pumps	Capacity 2500 LPH (2 Nos.) with suction and discharge valves and NRVs with complete pipe fittings

UTILITES FOR MILK CHILLING AND STORAGE SECTION

OTHER MISCELLANEOUS UTILITIES INCLUDED IN THE SCOPE OF WORKS:

- Soil tests for determining the bear capacity and water test for determining the water properties are to be including in the scope of works.
- Rolling shutter 2 No's. for milk reception dock for can reception and manual operation, milk tanker**.** Reception dock must have iron tile frame filled with concrete suitable for loading/unloading 40 kg milk can. Width of Reception Dock-as per Final Approved GS Drawings and Industrial Standards
- **Air compressor as applicable**
- **Standby milk chilling pumps, motors, compressors and all other required equipment are to be provided by the bidder**
- **Complete CIP systems** with all accessories, semi-automatic type, Insulated Acid/lye/hot water tank of 1KL cap ,PHE/THE Heater, supply pump, Hot water control valve, PLC operated system, Conductivity & flow switch, temp transmitter on return line, pneumatic butter fly valves, FDV etc.
- **RO unit /Water Softener for Hot Water Generator/Refrigeration as applicable.**
- **All raw and finished water tanks after treatment are to be included in the scope of works.**

SERVICE PIPELINES

- **Type-** MS C-class & insulated for hot water and heavy duty PVC for raw/process water
- **Application-** Providing hot or raw/process water wherever required
- **Size-** As required
- **Design Features**- Hot water pipes - MS C class, approved make, complete with all the fittings as per approved P & I drawing. Hot insulated with resin bonded fibre wool and cladding with aluminium sheet, from and to hot water generator.
  Raw/process water from the pump house to water storage tanks and tanks to utilization points as per approved P & I drawing.
- **Key Functions-** Hydraulic testing of pipe lines at 3 bar.

ELECTRICAL CABLING

- **Type-** Cable laying open type on cable trays, supported along the walls.
- **Application**- Connecting all motors and power distribution to various equipment panels
- **Design Features**- Rating of cables as per individual loads.
- Aesthetically laying of the cables in the trays and drops to the equipment thru GI pipes. All connectors thru glands and connections with correctly rated thimbles.
- Earthing cabling as per equipment requirements.
- **Key Functions**- Should meet all relevant rules under Indian Electricity Acts

WATER PUMP (FOR INDUSTRIALUSE OF P&M EQUIPMENT IN SCOPE OF THE WORKS)

- **Type-** Bore well Submersible Pump set
- **Application -** To lift water from the boring (excluded from scope) to overhead water storage tanks.
- **Capacity**- 80 LPM at maxm 90 MWC.
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**-
  - Lower suction head made of precision cast stainless steel
  - In built Strainer
  - Stainless steel NRV to prevent backflow
  - Suitable for 3-phase/ 415V/50 Hz
- **Accessories**- With metering/ water meter, 25 NB size
- **Key Functions-** Flow rate validation.

WATER STORAGE TANK (FOR INDUSTRIALUSE OF P&M EQUIPMENT IN SCOPE OF THE WORKS)

- **Type-** Rigid, acrylic, vertical & cylindrical
- **Application**- Receiving raw water from Bore well, storage and distribution to utilization areas
- **CAPACITY**- 5000 Lit.
- **MOC Recommended**- Acrylic
- **Design Features**-
  - Flat bottom, self-supported on RCC/ Structural platform.
  - With 450 dia manhole, inlet, outlet, drain and overflow nozzles
  - Hygienic design
  - Suitable for outdoor Installation
- **Key Functions**- Capacity validation with MTC

EFFLUENT TREATMENT PLANT (FOR INDUSTRIALUSE OF P&M EQUIPMENT IN SCOPE OF THE WORKS)

- **Type-** Chemical & biological treatment of effluent
- **Application**- To reduce impurities and BOD/COD as per State Pollution Board Norms
- **Capacity**- minimum 12000 Lit discharge per day .
- **MOC Recommended**- Stainless Steel, AISI-304
- **Design Features**- Only P&M works in the scope.
- **Influx Effluent quality (Maxm)** :
  - BOD- 1800 ppm,
  - COD - 3500 ppm
  - TSS - 1200 ppm
  - pH - 6 to 10
- **Treated Effluent:**
  - BOD - <30
  - COD - <250
  - TSS - < 100
  - pH - 6.5 to 8.5

- **Key Functions-** To meet state pollution board norms.

PS- The equipment, utilities are listed as per requirements, Bidders are advised to design as per their own proposal fulfilling the entire scope of works and battery limits.

QUALITY TESTING LABORATORY FOR MILK

Type- Milk Testing Laboratory
Application- Sampling & testing of milk as per requirements under FSSAI
Capacity- Standard Lab for Milk Chilling Center (1000 LPD).

Design Features- Laboratory shall have facilities for sampling & testing of milk for chemical analysis including sample preservation for 24 hours.

The Scope of Quality Lab will include the required aluminimum glass partition chamber with false ceiling, Air conditioners (1.5 ton spilt AC Two No's.), all required furniture and Mechanical Electrical Plumbing, Firefighting works required specifically for Quality Lab.

Testing facility to include Electronic milk analyzer (linked to AMCU), Gerber testing kit for fat testing, testing facility for SNF by gravitational method (Lactometer), Total solids determination facility, Kits for detection of preservatives & adulterants in milk , kits for platform tests (Alcohol/ COB/acidity/pH) . All the necessary equipment & glass wares including chemicals and consumables
KPI- Should meet FSSAI testing requirements.

Indicative list of equipment for Testing Laboratory is as follows:

MILK ADULTERATION KIT FOR DETECTION OF FOLLOWING
Urea, Starch, Soda, Detergent, Sugar, Hydrogen peroxide, Formalin, Glucose, Salt, Boric Acid, Borax, M.O.T, Sweet or sour milk and maltose.

MILK SAMPLING KIT
a) 2 No's- SS Can Plunger
b) 12 No-100 ml sample bottle
c) 02 No- Sample bottle stand for 12 bottles each

FAT TESTING KIT GERBER METHOD
a) 1 No. Electrical Testing Centrifuges ' for 12 Test
b) 10 Nos. Butyrometer ISI Marked
c) 02 Dozen Lock stopper
d) 05 No. Lock stopper Key
e) 06 No. Milk Pipette ISI Mark
f) 04 No. - 1 ml Tilt Measure for Amyl Alcohol
g) 04 No. - 10 ml Tilt Measure for Sulphuric Acid
h) 01 No. Butyrometer Stand (12T)
i) 01 No. Pipette Stand Plastic
j) 01 Gross - Butyrometer Brush 01 Gross - Pipette Brush
k) 01 No. - 100 ml S.S Sample

SNF TESTING KIT
a) 3 No's. Digital Thermometer-10 to -110 deg C
b) 2 No's Glass Thermometer
c) 10 No. Lactometer 0-40
d) 2 No. Lactometer Jar Plastic Small

DETERMINATION OF TOTAL SOLID KIT
a) 24 No. Aluminium moisture dish
b) 3 No's. Rectangular water bath
c) 1 No. Hot Air Oven (300 x 300 x 300 mm)
d) 1 No. Analytical Balance 1mg 2 digit accuracy

ELECTRONIC MILK TESTING
Two No' s Milk Analyzer for analysis of Fat, SNF, Density, Protein, Lactose, Added water, Freezing Point, pH.
Provided with software to maintain record of milk samples and the software will also be able to record data from the milk weighing bowl.

OTHER EQUIPMENT
a) Bunsen burner
b) Pipettes,Test tubes,test-tube,burrtete,flask,test tube stand,beakers,moisture dish,dessicator,other glasswares
c) Consumables & chemicals
d) Split AC of 1.5 MT with voltage stabilizer for office building.

PS-The above list is indicative; the bidders are instructed to propose their own design with testing equipment during technical bid, however all the applicable tests fulfilling the scope of works, FSSAI and other industrial norms must be fulfilled.

CONTROL PANEL:

The control panel helps in proper electrical synchronization and control of all the machines from a single place. All the machines can be switch on or off from a single place by a single person.

- PLC based Panel provided with all required motor starters, MCB's, voltmeter, ammeter, push buttons, R-Y-B indicator. M.S powder coated cabinet. Complete with necessary wirings of suitable sizes.
- MCB and Starter.
- SS Sheet 304 Grade

TRANSFORMER-demand in KW 415 In KVA 520 Selection of Transformer Considering 630KVA 80% of Efficiency Factor

Outdoor type (considering load of all machinery mention of the equipment in scope of this tender & for warehouse-25 kVA), 11/0.433kV oil cooled transformer including all accessories. The degree of protection shall be suitable for outdoor application. The transformer is designed to suit design temperature of 50deg. All standard accessories is to be provided like, name plated with tech details, lifting hooks, jacking pads, breather, bidirectional rollers, winding temperature indicators, relays, alarm and trip contacts etc., Painting is carried out as per IS, shade is 631, impedance of the transformer shall be as per IS. The transformer is provided with suitable neutral CT to cater REF protection. The equipment shall satisfy Indian standards, local governing authorities, fire etc.

DG SET (320 kVA)

Supplying of 3 phase, 415 volts, 50 cycles, 0.8 power factor for electric starting diesel generator comprising the following units: - (make) water cooled and multi stroke, multi cylinders, cold starting. The engine shall conform to I.S. 10002 with latest amendments. It can take 10% overload for one hour in every 12 hours of continuous operation including 6 Nos. of anti-vibration pads. The engine shall be complete with the following accessories: Electrical starting provision, engine cooling fan, fuel and lubricating oil filters, oil bath, air filter, lub oil pressure gauge, fuel tank, hour meter with exhaust manifold, flexible pipe, 12 /24 volts electric starting equipment complete with starter, alternator and two numbers of 12 volts with 21 plates battery (with Guarantee cards) of adequate capacity and low lubricating oil pressure/high temperature varying engine shut down devices. The Acoustic enclosure shall have the following: Acoustic enclosure shall be powder coated and fabricated out of 16 SWG CRCA MS sheet. The silent canopy shall be of nut bolt type construction. Powder coating is done after seven tank surface preparation process of sheet metal. Canopy panel and doors shall have inside lining of FIRE-RETARDANT foam/Rock Wool as acoustic material. Four hinged doors shall be provided to canopy, one door shall have glass window for control panel. Base frame is fabricated either in ISMC channel or in sheet metal. The base frame is to rugged in construction and designed for mounting engine and alternator, with cross members mounted on AVM. The base frame shall have provision for mounting of acoustic enclosure, and it is having provision of lifting hook for convenient lifting of complete set, i.e. along with canopy, engine and alternator. Fuel tank shall be fabricated out of 14 SWG CRCA MS sheet and is part of base frame. It is duly painted and fitted with inlet and outlet connections of suitable capacity. The Acoustic enclosure shall be Type test approved as per CPCB norms. The average sound level, when measure in green field condition (ISO m3744 OR 8528 PT 10) at 1-meter distance from all four sides shall be less than 75-dBA average or as per CPCB norms. The average stabilized hot air temperature rise with in the canopy is maintained within 10 C over and above ambient temperature. Acoustic enclosure is suitable for Outdoor / Indoor installation. Lockable doors shall be provided. Lockable fuel filling arrangement to be provided external to the canopy. Residential Silencer is housed in the canopy. The exhaust gasses shall be taken out through a suitable flexible pipe to prevent any back pressure on the engine. Base frame sturdy, fabricated welded construction, channel iron / sheet metal base frame for mounting the above engine and alternator. Standard Tools and Spares: Double ended spanners complete set (small and big size sets) - 12 Nos Screw driver (30cm long). Screw driver (45cm long) .Cutting plyer. Diesel filter with elements - 2 Nos. Oil filter with elements - 1 No.All the above accessories with complete set. Alternator The alternator shall be self-excited, self-regulated, screen protected, drip proof alternator with static excitation system capable of developing 380KVA at 0.8 power factor 415 volts, 3 phase, 50 cycles, generally conforming to I.S.4722 under normal condition, the voltage regulation will be plus or minus 5% of rated voltage. It shall be with end shield/ball roller bearings complete. Control Panel. A wall/pedestal mounting (cubical type) fabricated sheet steel construction suitable for manual operation, rated for system output incorporating the

following devices/instruments. The panel is made of 1.6mm sheet with one/two hinged front door, bolted back totally enclosed and vermine proof. It shall be with all electrical connections and internal copper wiring with proper color coding for internal wiring. All control equipment and indicating instruments shall be mounted on the control panel. The control panel shall have the following equipments:1 No. Amps/Volt/Frequency meter (96mm x 96 mm) 3 Nos. of suitable current transformers2 Nos. of suitable selector switches for voltmeter and ammeter main switch rotary type on/off pilot lamp (Standard make).1 No. input terminal board.1 No. output terminal board1 No. Kilowatt hour meter 1 No. MCCB of suitable capacity. The DG set should contain AMF panel as per latest specifications.

****DG Set & Transformer are to be as per actual loads as per bidder's design**

HT & LT Panel:

The successful contractor shall provide HT & LT panel for the entire system as per electrical load requirement.

HT Cable-100 m

XLPE Insulated, heavy duty, aluminium conductor. 11KV grade armored cable conforming to IS:1554/Part-I/1970.

WEIGHBRIDGE-

Weighbridge of 100 MT capacity of pit less type including all accessories, standard weights (1000 Kg), Computer, Printer, UPS, installation, commissioning, stamping for legal metrology etc means complete in all means with weighbridge room/portacabin and required furniture.

TRIAL RUN AND TRAINING

Successful Contractor has to make a provision of arranging a training of 2 weeks within 3 months of trial run period to train the HAFED staff/Technicians for further operation and maintenance (O&M) of the facility (all the equipment in scope of the tender).

Trial Run of 15 days duration is to done by the contractor after commissioning of the facility. This trial run (of 15 days) will be arranged by the contractor within 3 months after commissioning of the facility.

Raw material for trail run is to be given by the contractor.

The contractor has to deploy manpower at the plant for the entire three months (after commissioning) for smooth handover.

Defect liability period will be of 24 months from the date of commissioning.

APPROVED MAKE OF ITEMS

Description	Make
Semi Hermetic Reciprocating Compressors for Freon	Frascold /GEA /Bitzer/Emerson/Patton/Blue Star/ Refcomp
Air Cooled Condensing Units for Freon	Frascold/GEA/Bitzer/Rinac/Blue Star/Arctic/ Emerson/Frick/ Bluecold /Airtech
Electric Motors	L&T/ Siemens / ABB / Kirloskar / CGL
Electronic soft starter	Siemens / Allen Bradley / SCHNEIDER / L&T/ AMTECH/ ABB/ DANFOSS/ GE
Variable Frequency Drive (VFD)	Siemens / Allen Bradley / DANFOSS/ SCHNEIDER/ABB
Air curtains	Almanord/ Russel /Raden/Cosyst/Eutronics
Air handling units - DX Type	Alfa Laval / Blue Star / Star Coolers / Help man/Guntner/Rinac/Arctic/Luve/Roller//Thermofin/Frick/Airtech/ Bluecold

Cold store door / Hatch door/ Rolling Shutters	SALCO /Metaflex/ MTH / Gandhi Automation/ Rinac/ Lloyd / Shakti Hormann/Infraca/DAN-doors/Metecno/ MIV door
Pallet Racking System	Nilkamal/ Godrej/Silver Lining/Kirby/Schaefer/Craftsman Automation/ Vinar
PUF Insulated Wall & Ceiling panels	KingspanJindalMectec/ Rinac / Lloyd / Beardsell/ Honeywell/Metecno/Frick/Walco/Hurree/ Arctic/ BNAL
Dock Leveler/Dock Shelter/SOHD	Gandhi Automation/Metaflex/MTH/Arco Italy/Horman/Novoferm/Dorhan/Avains/Salco/Spanker
Pallet / Crates	Nilkamal / Godrej/Pilco/Vishaka/Sea Plast/Supreme/Swastik
Stackers / Electric Pallet Truck	Godrej/Crown/Linde/Toyota/Nilkamal/Jughenrich/Toyo ta
Hand Pallet Truck	Nilkamal / Godrej/Voltas/Jughenrich
Freon Refrigeration Valves & Controls like expansion valve, Solenoid valve, Drier & Sight glass etc.	Danfoss/Sporlan/Henry/Parker/Alco
MS & GI Pipes (ISI marked)	TATA /Jindal/ Kalyani /MSL / ISMT/BEC/Precision/Polypack
Copper Piping	Kwality/Nissan/ Mandev/ Muller
Refrigerant	Dupoint/Flouron/Honeywell/Mexichem
Suction Line/LPR Insulation	Armaflex/K-Flex/Superion
Dial type Pressure/ Temperature gauges	H.GURU / PRICOL / FIEBIG/ WARREE
Digital temperature sensors/ indicator / Controller (Micro-processer)	Carrel/Dixell/Yokogawa /Chino / Tata Honeywell
PLC for Refrigeration System	Honeywell/ Carrell/Dixcel/ Danfoss
On-line UPS	APC / Emerson- Liebert / APLAB/ DB Power
Electric contactors	ABB/L&T/Telemechanic
Power Cables	Polycab/CCI/Gloster/Finolex/Lap/Esbee/KEI/ RR
Control cables	Polycab/CCI/Gloster/Finolex/Lap/Esbee/KEI/ RR
HT Cable	CCI/ Finolex / KABEL/Polycab/Finolex
DG Set	Kirloskar/Leyland/Ruston/CG /Cummins
Weighbridge	Leotronic Scales/Stat Weigh/Star Weigh Microtech/Essae /Star Weigh/Equivalent
Air Compressor	AtlasCopco/ELGI/Ingersollrand/Equivalent
Milk Chiller	GEA/Tetrapack/Alfa Laval
Milk Transfer Pump	Zuetch/SSP/Alfa Laval/Fab tech
Water Pump for milk chilling unit	Kirloskar/CRI/Wilo
Air Conditioner (Split)	Daikin/ Voltas/ Hitachi/ Equivalent

Transformer	Kappa/ MECO/ABB/ Siemens/ Kirloskar/ Equivalent

**The recommended makes are listed in Tender Documents.
In case of any other competitive makes/reputed makes, the bidder may submit the same with compliance statement to technical specifications & parameters at the time of PRE BID meeting only. In that case, vendor shall submit all compliance statement to technical specifications, similar nature of work done by the OEM make, performance certificate & parameters well in advance for final approval from HAFED. No changes in the Approved Make shall be entertained during execution of work except for special cases which can hamper the project progress (the OEM has stopped supply of materials; the OEM is taking too long time to deliver the materials etc). In such cases, the successful vendor shall submit all the required documentation complying the technical specifications mentioned in tender documents to HAFED.

The procurement of that particular make shall be started by the vendor only after receiving approval from HAFED.
The bidders are advised to consider reputed makes only for milk chilling unit including Quality testing Lab for Milk confirming all technical specifications relevant codes and industrial norms without any deviation and shall submit the same in technical bid.
The Successful Bidder after work award should take approval in written from HAFED for equipment brand & technical specifications before procurement.

TECHNICAL SPECIFICATIONS OF CIVIL, MEP, FIREFIGHTING WORKS

General Conditions for Civil Works

- The work shall be carried out as per the latest Haryana PWD specifications only. In absence of specifications from Haryana PWD specifications, specifications from standard Engineering practice, IS codes and as per direction of the Engineer-in-charge shall be followed.

- All material to be arranged by contractor himself, shall be confirming to relevant ISI specification, duly ISI marked and as per list of approved manufactures/ makes by HAFED attached in the DNIT. Wherever referred ISI codes shall be with its latest amendments.

- Contractor will have to supply manufacturer's certificate certifying that materials have been manufactured as per ISI specification, duly supported by necessary documentation.

- Necessary certificate from the manufacturer for all the material brought at site shall be supplied to the Engineer-in-charge, certifying that this lot of material have been manufactured as per Standard of BIS and confirms to relevant ISI Code.

- HAFED reserves its right to get any material tested from M/s Shri Ram Institute for Industrial research or other equivalent reputed test house to ensure for quality of material/work. Testing charges shall be borne by HAFED, but in Case of failure of any lot of material, all the work executed with that lot of the material shall be rejected.

- Sampling of work in progress shall be carried out by representative of Engineer-in-Charge, Contractor and shall be got tested from M/s Shri Ram Institute for Industrial research Delhi / M/s Delhi Test House, New Delhi and NIT Kurukshetra. Fee of testing shall be borne by the

HAFED. But in case, if any sample fails, cost (testing charges) shall be recovered from agency with a fine of Rs. 10,000.00 per sample, in addition to rectification of defective work, to the entire satisfaction of Engineer in Charge, as defined in the Haryana P.W.D. specifications.

- All types of concreting is to be done with use of mechanical mixer and vibrator, which are to be arranged by the contractor at his own expenses.

- The contractor shall submit the CAR (Contractor's All Risks) Policy for the awarded value of the work and valid of the work and valid for the entire duration of the work including the extended period of work, it any. The contractor shall provide to the Federation copy of the insurance policies and document taken out by him pursuance of the contract immediately after such insurance coverage. If the contractor fails to effect and keep in force insurance, as per the terms of contract, the Federation may effect and keep in fore 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 Federation as aforesaid from any money due or which may become due to the contractor, or recover the same as debit due from the contractor.

- The contractor shall be responsible for preparing all claims and make good for all damage or loss by way of repairs and or replacement of portion of any works damaged or lost. The transfer of title shall not in any way relieve the contractor of his responsibilities during the period of the contract including the Defects Liability Period.
- The contractor shall abide by the local laws and regulations governing labour applicable from time to time. During continuance of the contract, the contractor shall abide at all times by all existing labour enactments and rules made there under, regulations, notification and by laws (including rules), regulation, bye-laws that may be passed or notification that may be issued under any labour law in future either by the state or the Central Government or the local authority.

- The rate to be quoted shall include all allowances for hardness, wetness, sales tax, royalty(compensation) due to octroi and all such other charges and taxes leviable if any and noting extra shall be payable to the agency on this account.

- Nothing shall be paid for any loss and damages done to rain, floods or any other act of God and payment shall be made only for material acceptable to the department.

- Material purchased in excess shall not be measured and paid for and if not removed within one month after completion of the work, the material shall become the property of the HAFED and no claim on this account shall be entertained.

- The contractor shall provide suitable measuring arrangement at site for checking of various material supplied by him.

- In case of duplicity/variation/contradiction of term & condition in the printed Tender Document and in special terms & conditions, terms and conditions mentioned in the Special terms & conditions will prevail.

- The rate will be firm and biding on the contractor during the currency of contractor including extended time period. No escalation shall be paid for any increase in cost of material & labour.

- The contractor shall use Cement of OPC 43 grade as per IS-269-1976 (with latest amendments) of approved makes or equivalent as approved by competent authority / Engineer- In charge as per details given in Approved Make Section.
- The contractor shall use Fe-415 / Fe-500 steel as per relevant IS standards of approved make as per details given in Approved Make Section.
- The BoQ mentioned in this tender is indicative only. The quantities may vary invariably upto any limit. The contractor is required to execute the job with the rates of each items quoted at the time of tendering.
- Civil contractor need proper Coordination & Clearance at the time of Anchor Bolts, Base Plates or as applicable casting / pedestal casting / Executing the job.

INTRODUCTION

1. These Specifications contain guidelines and directions to be followed jointly and severally in the implementation of the subject project to deliver a quality product.

2. These specifications have been prepared with regard being given to the Central PWD and the various states P.W.D. Specifications and, in the absence of specific requirements herein, the relevant provisions in the above documents shall apply.

3. Rates provided in the bid document or the rates quoted by the Contractor for all items of works while submitting the tender will be deemed to include cost of all materials, taxes, duties, levies, GST etc., cost of all labour, all protection works to the site as well as portions and premises of works in progress, arrangements and related works to ensure safety to the site, personnel and materials and all other inputs involved in the execution of the items.

4. The Engineer will be the authority to interpret or clarify the provisions of these specifications and the outcome shall be made known to the Contractor, in writing. Interpretations/ clarifications once issued will be final as far as the particular contractual works are concerned.

5. Any Indian Standard/ International Standard/ manual referred to in the Specifications shall mean the latest revision/edition of the standard/Manual with all additions and amendments issued thereto.

6. Definitions-Unless specified otherwise in related clauses or sections, definition of terms and expressions in the Specifications, will be those given against the terms below.

   a. Best: The most superior material/article and workmanship obtainable in the context of the work.

   b. IS: The standards, specifications and code of Practices issued by the Bureau of Indian Standards. Any IS designated by a number means its latest revision and edition including all additions and amendments thereto.

   c. Site: The land or other places on, in, into or through which the work is to be executed under the contract or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the Contract.

   d. Floor level: For ground floor, top level of finished floor and for other floors above ground level, top level of the structural slab.

   e. Measurements: In booking dimensions, the order shall be in the sequence of length, width, height/depth/thickness if measured in linear terms. In certain cases, booking of quantity executed may be in terms of numbers, weight, volume etc.

   f. Rounding off: Significant places rounded off as specified. Where not specified, in accordance with IS: 2.

   g. Materials: Any article for the work as per samples duly approved by the Engineer. The approved samples duly authenticated and stamped shall be kept in the custody of the Engineer till the completion of the work. All materials to be provided by the contractor shall be brand new and as per the samples approved by the Engineer.

   h. Safety Measures: All precautionary measures to be undertaken by the contractor to ensure safety of materials, tools and plants, works, workmen, inspecting officials, and general public. Safety on works like excavation, centering and shuttering, trenching, blasting, demolition, electrical connections, scaffolds, ladders, working platforms, mixing of materials, electric and gas welding, use of hoisting and construction machinery shall be in accordance with the safety rules and regulations and directions of the Engineer.

TECHNICAL SPECIFICATIONS

CONTENTS

1. EARTHWORK, EXCAVATION AND SUB BASE

1.1. Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest editions including all applicable official amendments and revisions shall be referred to.

a)	IS: 783	-	Code of practice for laying of concrete pipes.
b)	IS: 3764	-	Excavation work - Code of Safety .
c)	IS: 2720	-	Methods of test for soils:
d)	(Part-1)	-	Preparation of dry soil samples for various tests.
e)	(Part-2)	-	Determination of Water Content.
f)	(Part-4)	-	Grain size analysis.
g)	(Part-5)	-	Determination of liquid and plastic limit.
h)	(Part-7)	-	Determination of water content - dry density relation using light compaction.
i)	(Part-8)	-	Determination of water content - dry density relation using heavy compaction.
j)	(Part-9)	-	Determination of dry density – moisture content by constant weight of soil method.
l)	(Part-14)	-	Determination of density index (relative density) of cohesionless soils.
m)	(Part-22)	-	Determination of organic matter.
n)	(Part-26)	-	Determination of pH Value.
o)	(Part-27)	-	Determination of total soluble sulphates.
p)	(Part-28)	-	Determination of dry density of soils in place, by the sand replacement method.
q)	(Part-33)	-	Determination of the density in place by the ring and water replacement method.
r)	(Part-34)	-	Determination of density of soil in place by rubber balloon method.
s)	(Part-38)	-	Compaction control tests (Hilf Method).

1.2. Excavation

1.2.1 General

Excavation for trenches over areas and for pits, etc. shall be done to widths, lines and levels as shown in drawings or to such lesser or greater widths, lines and levels as directed. The bottom and sides of excavation shall be trimmed to require levels, profile, etc. watered and thoroughly rammed. Should any excavation be taken below the specified levels, the contractor shall at his own cost fill up such excavation with cement concrete (M-10) to required levels. Filling in such excavation with excavated material is prohibited.

All excavation work shall be carried out by mechanical equipment unless, in the opinion of Engineer-in-charge, the work involved requires it to be carried out by manual methods.

1.2.2 Grubbing and Clearing

Before excavation is started, the area coming under cutting / excavation shall be thoroughly grubbed and cleared off shrubs, rank vegetation, grass, bush wood, debris, trees / sapling of girth upto 300 mm. The roots shall be removed upto depth of 600 mm below ground. The rubbish shall be removed outside the site as directed by the Engineer-in-charge.

1.2.3 Dewatering

The Contractor shall ensure that the excavation and the structures are free from water during construction and shall take all necessary precautions and measures to exclude ground/rain water so as to enable the works to be carried out in reasonably dry conditions in accordance with the construction programme. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. The method of pumping shall be approved by Engineer-in-charge, but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction. The dewatering shall be continued for at least (7) seven days after the last pour of the concrete. The Contractor shall, however, ensure that no damage to the structure results on stopping of dewatering.

The Contractor shall study the sub-soil conditions carefully and shall conduct any tests necessary at the site with the approval of the Engineer-in-charge to test the permeability and drainage conditions of the sub-soil for excavation, concreting etc., below ground level.

The scheme for dewatering and disposal of water shall be approved by the Engineer-in-charge. The Contractor shall suitably divert the water obtained from dewatering from such areas of site where a build up of water in the opinion of the Engineer-in-charge obstructs the progress of the work, leads to unsanitary conditions by stagnation, retards the speed of construction and is detrimental to the safety of men, materials, structures and equipment.

When there is a continuous inflow of water and the quantum of water to be handled is considered in the opinion of Engineer-in-charge, to be large, a well point system- single stage or multistage, shall be adopted. The Contractor shall submit to the Engineer-in-charge, details of his well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval.

Unless separately provided for in the Schedule of quantities, cost of dewatering is deemed to have been included in the unit rates quoted for excavation. If separately provided for, the unit of measurement shall be as indicated in the Schedule of Quantities.

1.2.4 Timbering to excavation (shoring)

Where the soil is soft and sides of excavation needs supporting, suitably designed planking and strutting shall be provided.

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as approved by the Engineer-in-charge. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal walings of strong wood at maximum 1.2 metre spacings, strutted with ballies or as approved by the Engineer-in-charge. The length of the ballie struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed horizontally against each side of the excavation and supported by vertical wallings, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by the Engineer-in-charge. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of excavations, trenches, pits, etc. from collapsing.

Timber shoring may also be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only after approval from the Engineer-in-charge-in-charge.

The withdrawal of the timber shall be done carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with, systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber.
In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of the Engineer-in-charge. In all other respects, the Specifications for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. The load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If however, Engineer-in-charge directs any timbering to be left-in, keeping in mind the type of construction or any other factor, Contractor shall be paid for at the scheduled item rate for such left-in timbering.

Unless otherwise separately provided for in Schedule of Quantities, the timber shoring is deemed to have been included in the unit rates quoted for excavation. If separately provided for, then the actual effective area of shored faces as approved by Engineer-in-charge shall be measured in sq.mtrs. The area of planking embedded in the bed/sides of excavation will not be considered, nor the area supporting inclined struts in case of large pits/open excavation. All planks, boards, wallings, verticals, struts, props and all other materials required for shoring and subsequent safe dismantling and removal shall be included in the quoted unit rates.

1.2.5 Soil / Rock Classification

1.2.5.1 General

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

a) Ordinary and Hard Soils

These shall include all kinds of soils containing kankar, 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 metre in any direction and not more than 200 mm in any one of the other two directions.

b) Hard Rock
This shall include all rock occurring in large continuous masses, which cannot be removed except by blasting for losening it. Hard varieties of rock with or without veins and secondary minerals, which, in the opinion of Engineer-in-charge require blasting, shall be considered as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item unless a separate provision is made in the Schedule of Quantities.

c) Soft and Decomposed Rock
This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite, sand stone and all other materials which in the opinion of Engineer-in-charge 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”.

1.2.5.2 Stripping Loose Rock

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Engineer-in-charge, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion, which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Engineer-in-charge, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

1.2.6 Blasting

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.

a) Permission from all the connected Public Authorities such as Municipal Corporation, Inspector of Explosives, Police, Highway Authorities, etc. shall be obtained.

b) Fees, royalties and any other levies, attendant on such blasting work shall be entirely borne by the contractor.

c) 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.

d) 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.

e) Storing of blasting materials shall be strictly as per Explosive Regulations.

The tendered must acquaint himself with the site conditions in regard to blasting, nature of rock likely to be met with, timing and other restrictions to blasting etc. No. Claims whatsoever in these regards shall be entertained.

1.2.7 Disposal of Surplus excavated materials

All materials considered surplus shall be removed to destinations and disposed off as approved by Engineer in charge. The disposal of the material can be in any of the following ways as directed by the Engineer-in-charge.

1. Filling in low lying areas

2. Filling in at places of filling such as under floors, in roads, etc.

3. Stacking of material in pre-designated stacking yard.

4. Removal of material outside the plot for disposal.

1.2.8 Measurements

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	:	Volume shall be determined by levels taken before commencement of excavation and after completion up to the required level.
- 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.
- Stack measure as in rubble, etc.	:	Volume of stack less 40%

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

a) 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. Excavation for trenches and pipes & cables shall be measured separately.

b) 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.

c) Where such measurement is not possible as in the case of strata intermixed with soil, excavated rock shall be properly stacked as directed by the Engineer-in-charge and the volume of rock calculated on the basis of stack measurements after making appropriate allowance for voids.

d) Excavation beyond the widths or depths required will not be paid for, any additional concrete or bedding material required as a result of over-excavation shall be at the Contractor's expense.

1.2.9 Rates

The rates shall be inclusive of all the operations described above including clearing and grubbing, dewatering, shoring and disposal at site as directed by the Engineer-in-charge.

1.3 Earth Filling, Backfilling and Site Grading

1.3.1 General

All fill material shall be subject to the Engineer-in-charge's approval. If any material is rejected by Engineer-in-charge, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited /disposed off as directed by Engineer-in-charge after the fill work is completed.

No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the Engineer-in-charge.

The Contractor shall not commence the placement of any fill or back fill at any location without the approval of the Engineer-in-charge.

1.3.2 Material

To the extent available, good earth from outside (source to be approved by E-I-C) shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall make arrangements to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the Engineer-in-charge. The pH value of soil shall be between 5.5 to 9 and the soil shall have the following grading analysis.
Sand : 20% to 75%
Silt : 10% to 60%
Clay : 05% to 30%
The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Topsoil containing foreign material shall be removed. The materials so removed shall be disposed off as directed by Engineer-in-charge. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist, at his cost.

1.3.3 Filling in pits and trenches around foundations of structures, walls, etc.

As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches, etc., shall be cleared of all debris, and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer-in-charge. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the Engineer-in-charge is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the Engineer-in-charge.

1.3.4 Sand Filling in Plinth and Other Places

At places where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 24 hours and drained to ensure maximum hydraulic compaction. Any temporary work required to contain sand under flooded condition shall be on Contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer-in-charge has inspected and approved the fill.

1.3.5 Murrum Filling

The liquid limit & plasticity index of such materials shall be below 20 and 6 respectively and the fraction passing 75-micron sieve does not exceed 10 %. It shall be laid in layers not exceeding 15 cm & compacted as per the directions of Engineer-in-charge.

1.3.6 Filling in Trenches

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with approved excavated soil. The filling up to the level of the center line of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the center line of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the

top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

1.3.6.1 Measurement

Excavation for trenches for pipes, cables etc. shall be paid as under.

(a) Upto 1 meter depth, the width of the trench for the purpose of measurement of excavation shall be arrived at by adding 40 cm to the external diameter of the pipe (not the sockets), cable, conduits etc. When a pipe is laid on concrete bed/cushioning layer the authorized width shall be cable external diameter of the pipe/cable plus 40 cm for the width of concrete bed/cushioning layer, whichever is more.

(b) For depths exceeding 1 meter as allowance of 5 cm per meter of depth for each side of the trench shall be added to the authorized width (i.e. External diameter of the pipe plus 40 cm) except where battering or benching has been ordered. This allowance shall be the entire depth of the trench. The authorized width in such case shall, here fore, be equal to (depth of trench) /10 plus external diameter of pipe plus 40 cm or the width of concrete Bed/cushioning, whichever is more

(c) When more than one pipe, cable, conduit etc. are laid, the diameter shall be reckoned as the horizontal distance from outside to outside of the outermost pipes, cables, conduits etc.

1.3.7 General Site Grading

Site grading shall be carried out as indicated in the drawings and as approved by the Engineer-in-charge. Excavation shall be carried out as specified in the Specifications. Filling and compaction shall be carried out as specified and elsewhere unless specified otherwise shall be carried out as indicated below.

The fill shall be placed in layers not exceeding 200 mm and leveled uniformly and mechanically compacted before the next layer is deposited.

To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by the Contractor at his own cost.

Field compaction tests shall be carried out in each layer of filling until the fill to the entire height has been completed. This shall hold good for embankments as well. The fill will be considered as incomplete if the desired compaction has not been obtained.

The Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur the Contractor should remove the affected material and make good the slip at his cost.

If so specified, the rock as obtained from excavation may be used for filling and leveling to indicate grades without further breaking. In such an event, filling shall be done in layers not exceeding 50cms approximately. After rock filling to the approximate level, indicated above has been carried out, the voids in the rock filling shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken material and earth shall be laid and consolidation carried out by a 8 -10 ton roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

1.3.8 Fill Density

The compaction, where so called for, shall comply with minimum 95% of maximum dry density as per IS 2720 (Part 8) at moisture content differing not more than 4% from the optimum moisture content. The Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.

1.3.9 Lead

Lead for deposition/disposal of excavated material, shall be the crow flight distance as specified in the respective item of work. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or 'katcha' land/route.

1.3.10 Measurements

Backfilling as per specification the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches etc. with excavated material will be paid for separately. It shall be clearly understood that the rate quoted for excavation shall include stacking of excavated material as directed, excavation/packing of selected stacked material, conveying it to the place specified etc. as specified. As a rule, material to be backfilled shall be stacked temporarily as directed by the Engineer-in-charge.

Backfilling, plinth filling etc. with borrowed earth will be paid for at rates quoted. The quoted rate shall include all operations such as clearing, excavation, lead and transport, fill, compaction etc, as specified. Quantity of consolidated filling based on payment line for excavation shall be measured and paid for in cubic meters. The lead, lift etc. shall be as indicated in the schedule of quantities.

Actual quantity of consolidated sand filling and murrum filling shall be measured and paid for in cubic meters.

1.3.11 Rates

The rates shall be inclusive of clearing and grubbing, spreading, watering and compaction etc. as per specification above.

1.4 Anti Termite Treatment

1.4.1 Type of Treatment

Anti Termite Treatment is for prevention of termites infecting the building. The treatment shall be done during the time of construction with application of chemical / insecticide emulsions.

1.4.2 Chemical / Emulsion

Chloropyrifos Emulsifiable concentrate of 1% conforming to IS:8944 shall be used. The chemical concentrate of above shall be procured by the contractor in sealed containers. Emulsion shall be prepared at site by diluting the concentrate with required amount of clean potable water to obtain specified emulsion concentration. For example one part of chemical of 30% concentration when mixed with 59 parts of water shall give 0.5% emulsion concentration.

1.4.1 Applicator

The treatment work at site shall be got done only from qualified and competent applicator agencies using chemicals procured from reputed manufacturers

1.4.4 Treatment

The treatment shall be applied for masonry foundations and basements, RCC foundation and basements, top surface of filling for floor, junction of walls and floor, external perimeter of building, soil under plinth protection, on the basement wall surfaces and around pipes traversing from below ground to the building.

1.4.1.1 Chemical treatment of soils for the protection of buildings from attack of subterranean termites shall be done as per IS: 6313 (Part II). Treatment shall be got done only from the approved specialized agencies using the chemical procured directly from reputed and authorized dealers. Graduated containers shall be used for dilution

and spraying of the chemical shall be done using hand operated pressure pumps. Proper stock account should be kept to ensure that the specified quantity of chemical is used for the required area during the operation.

1.4.4.3 Time of Application

Soil treatment should start when foundation trenches and pits are ready to take bed concrete / leveling course in foundations. Laying of bed concrete/leveling course should start when the chemical emulsion has been absorbed by the soil and the surface is quite dry. Treatment should not be carried out when it is raining or soil is wet with rain or sub soil water. Treatment to the surface of earth filling within the plinth shall also be done in the same manner before laying the sub-grade for flooring.

1.4.4.3 Disturbance

The treated soil barriers shall not be disturbed. If for some reasons the treated soil barriers are disturbed, immediate steps shall be taken to restore the continuity and completeness of the barrier system.

1.4.4.4 Treatment for Masonry Foundations and Basements

a. The bottom surface and the sides (up to a height of 300 mm) of the excavations made for masonry foundations and basements shall be treated with the chemical at the rate of 5 litters per square metre surface area.

b. After the masonry foundations and the retaining wall of the basements come up, the backfill in the immediate contact with the foundation structure shall be treated at the rate of 7.5 litters per sq.m of the vertical surface of the substructure for each side. If water is used for ramming the earth fill, the chemical treatment shall be carried out after the ramming operation is done by rodding the earth at 150 mm centers close to the wall surface and spraying the chemical with the above dosage. The earth is usually returned in layers and the treatment shall be carried out in similar stages. The chemical emulsion shall be directed towards the concrete or masonry surfaces of the columns and walls so that the earth in contact with these surfaces is well treated with the chemical.

1.4.4.5 Treatment for RCC Foundation and Basements

In the case of RCC foundations, the concrete mix is dense (being 1:2:4 or richer). It is, therefore, unnecessary to start the treatment from the bottom of excavations. The treatment shall start at the depth of 500 mm below ground level except when such ground level is raised or lowered by filling or cutting after the foundations have been cast. In such cases, the depth of 500 mm shall be determined from the new soil level resulting from the filling or cutting mentioned above, and soil in immediate contact with the vertical surfaces of RCC foundations shall be treated at the rate of 7.5 litres per square metre. The other details of treatment shall be as laid down in 1.4.4.4.

1.4.4.6 Treatment of Top Surface of Plinth Filling

The top surface of the filled earth within the plinth walls shall be treated with chemical emulsion at the rate of 5 litres per sqm of the surface before the sand/sub-grade is laid. Holes upto 50 to 75 mm deep at 150 mm centers both ways shall be made with crow bars on the surface to facilitate saturation of the soil with chemical emulsion.

1.4.4.7 Treatment at Junction of the Walls and the Floor

To achieve continuity of the vertical chemical barrier on inner wall surfaces from the ground level, a small channel 30 x 30 mm shall be made at all the junctions of walls and columns with the floor (before laying the sub-grade) and rod holes made in the channel upto ground level 150 mm apart and the chemical emulsion poured along the channel @ 7.5 litres per sqm of the vertical wall or column surface so as to soak the soil right to bottom. The soil shall be tamped back into place after this operation.

1.4.4.8 Treatment of soil along External Perimeter of Building

After the building is complete, 300 mm deep holes shall be provided in the soil with iron rods along the external perimeter of the building at intervals of about 150 mm and these holes shall be filled with chemical emulsion at the rate of 7.5 litres per sqm of vertical surfaces of external walls. If the depth of filling is more than 300 mm, the external perimeter treatment shall extend to the full depth of filling up to the ground level so as to ensure continuity of the chemical barrier. In case the earth outside the building is graded on completion of building, this treatment shall be carried out on completion of such grading.

1.4.4.9 Treatment of Soil under Apron (Plinth Protection) along External Perimeter of Buildings

Top surface of the consolidated earth over which the apron is to be laid shall be treated with chemical emulsion at the rate of 5 litres per square metre of the surface before the apron is laid. If consolidated earth does not allow emulsion to seep through, holes upto 50 to 75 mm deep at 150 mm centers both ways may be made with 12 mm diameter mild steel rod on the surface to facilitate saturation of the soil with the chemical emulsion.

1.4.4.10 Treatment for expansion joints

Anti-termite treatment shall be supplemented by treating with chemical emulsion through the expansion joint after the sub-grade has been laid @ 2 litres per linear metre of expansion joint.

1.4.4.11 Treatment of Walls Retaining Soil above Floor Level

Retaining walls like the basement walls or outer walls above the floor level retaining soil need to be protected by providing chemical barrier by treatment of retained soil in the immediate vicinity of the walls, so as to prevent entry of termites through the voids in masonry, cracks and crevices, etc. above the floor level. The soil retained by the walls shall be treated at the rate of 7.5 litres per square metre of the vertical surface so as to effect a continuous outer chemical barrier, in continuation of the one formed under 1.4.4.4.

1.4.4.12 Treatment of Soil Surrounding Pipes, Wastes and Conduits

When pipes, wastes and conduits enter the soil inside the area of the foundations, the soil surrounding the points of entry shall be loosened around each such pipe water or conduit for a distance of 150 mm and to a depth of 75 mm before treatment is commenced. When they enter the soil external to the foundations, they shall be similarly treated for a distance of over 300 mm unless they stand clear of the walls of the buildings by about 75 mm.

1.4.4.13 Measurements

All dimensions shall be measured correct to a cm. The measurements for all the operations described above shall be the plinth area of the building in square-meters at floor 1 level (Ground floor). Nothing extra shall be measured for payment.

1.4.4.14 Rate

The rate for the anti-termite treatment shall include the cost of labour, concentrated chemical and all other inputs involved in all the operations described above.

1.5 Sub Base Formation

1.5.1 Types of Sub Base

The sub base is laid on the dressed sub grade prepared as per specification in 1.2 & 1.3.

- Rubble Soling

- WBM

- WMM

It will be done by any one method as directed by the Engineer-in-charge.

Where plinth area is small and covered by foundations, columns, beams and walls, invariably rubble soling shall be provided.

When large areas are available, WBM shall be resorted to.

1.5.2 Rubble Soling

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 grade is prepared 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 packed with stone chips of appropriate sizes. These shall be hammered in to obtain a finished hard and compact and level surface. Mere spreading of loose spalls or stone chips is 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 so laid shall be compacted with suitable mechanical rammers. Dry Rolling is continued till the movement of the stones under roller load stops. Dry screenings consisting of gravel of stone aggregates upto 12 mm size is then spread very gradually to fill up the interstices and dry rolling is continued till the voids are filled. At this stage the surface is copiously sprinkled with water and ramming continued simultaneously pushing the screenings in voids if any. Surface shall be allowed to dry and loose excess screening if any shall be removed.

1.5.3 WBM Sub base

This shall be laid in one or two layers as directed by the Engineer-in-charge, compacted thickness of each layer being 75 mm thick.

1.5.3.1 Stone aggregates of grading I 90 mm to 45 mm shall be spread uniformly on the prepared sub grade and rolled with 8-10 T wt power roller till the movement of aggregate stops. Further work i.e. filling interstices with screenings is carried out as specified in 1.5.2 to obtain a neat even surface without loose materials on the surface. Binding materials shall be added as directed by the Engineer-in-charge. For 100 mm compacted thickness of layer following quantities shall be consumed for area of 10 sq. meters.

Graded aggregates	1.21 to 1.43 cubic meters
Screenings	0.27 to 0.44 cubic meters
Binding materials	0.08 to 0.10 cubic meters

1.5.4 Measurements

Measurements for rubble soling and WBM shall be on volumetric basis taking plan area of actual work multiplied by compacted thickness.

1.5.5 Rates

Rates shall be inclusive of all work as per specification above.

2.0 PLAIN & REINFORCED CONCRETE

2.1. Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest editions including all applicable official amendments and revisions shall be referred to.

2.1.1. Materials

1)	IS.269	Specification for 33 grade ordinary Portland cement.
2)	IS.455	Specification for Portland slag cement.
3)	IS.1489	Specification for Portland-pozzolana cement (Part 1 & 2).
4)	IS: 8112	Specification for 43 grade ordinary Portland cement.
5)	IS: 12330	Specification for sulphate resisting Portland cement.
6)	IS: 383	Specification for coarse and fine aggregates from natural sources for concrete.
7)	IS: 432	Specification for mild steel and medium (tensile steel bars and hard-drawn steel) wires for concrete reinforcement. (Part 1 & 2)
8)	IS: 786	Specification for high strength deformed steel bars and wires for concrete reinforcement.
9)	IS: 1566	Specification for hard-drawn steel wire fabric for concrete reinforcement.
10)	IS: 9103	Specification for admixtures for concrete.
11)	IS: 2645	Specification for integral cement water- proofing compounds.
12)	IS: 4990	Specification for plywood for concrete shuttering work.

2.1.2. Material Testing

1)	IS.4031	Methods of physical tests for hydraulic cement (Parts 1 to 15)
2)	IS: 4032	Method for chemical analysis of hydraulic cement.
3)	IS: 650	Specification for standard sand for testing of cement.
4)	IS: 2430	Methods for sampling of aggregates for concrete.
5)	IS.2386	Methods of test for aggregates for concrete (Parts 1 to 8)
6)	IS: 3025	Methods of sampling and test (physical and chemical) for water used in industry.
7)	IS: 6925	Methods of test for determination of water soluble chlorides in concrete admixtures.

2.1.3. Material Storage

1)	IS: 4082	Recommendations on stacking and storing of construction materials at site.

2.1.4. Concrete Mix Design

1)	IS: 10262	Recommended guidelines for concrete mix design.
2)	SP: 23 (S&T)	Handbook on Concrete Mixes

2.1.5. Concrete Testing

1)	IS.1199	Method of sampling and analysis of concrete.
2)	IS: 516	Method of test for strength of concrete.
3)	IS: 9013	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
4)	IS: 8142	Method of test for determining setting time of concrete by penetration resistance.
5)	IS: 9284	Method of test for abrasion resistance of concrete.
6)	IS: 2770	Methods of testing bond in reinforced concrete.

2.1.6. Equipments

1)	IS: 1791	Specification for batch type concrete mixers.

2)	IS: 2438	Specification for roller pan mixer.
3)	IS: 4925	Specification for concrete batching and mixing plant.
4)	IS: 5892	Specification for concrete transit mixer and agitator.
5)	IS: 7242	Specification for concrete spreaders.
6)	IS: 2505	General Requirements for concrete vibrators: Immersion type.
7)	IS: 2506	General Requirements for screed board concrete vibrators.
8)	IS: 2514	Specification for concrete vibrating tables.
9)	IS: 3366	Specification for pan vibrators.
10)	IS: 4656	Specification for form vibrators for concrete.
11)	IS: 11993	Code of practice for use of screed board concrete vibrators.
12)	IS: 7251	Specification for concrete finishers.
13)	IS: 2722	Specification for portable swing weigh batchers for concrete (single and double bucket type).
14)	IS: 2750	Specification for steel scaffoldings.

2.1.7. Codes of Practice

1)	IS: 456	Code of practice for plain and reinforced concrete.
2)	IS: 457	Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
3)	IS: 3370	Code of practice for concrete structures for storage of liquids (Parts 1 to 4)
4)	IS: 3935	Code of practice for composite construction.
5)	IS: 2204	Code of practice for construction of reinforced concrete shell roof.
6)	IS: 2210	Criteria for the design of reinforced concrete shell structures and folded plates.
7)	IS: 2502	Code of practice for bending and fixing of bars for concrete reinforcement.
8)	IS: 5525	Recommendation for detailing of reinforcement in reinforced concrete works.
9)	IS: 2751	Code of practice for welding of mild steel plain and deformed bars used for reinforced concrete construction.
10)	IS: 9417	Specification for welding cold worked bars for reinforced concrete construction.
11)	IS: 3558	Code of practice for use of immersion vibrators for consolidating concrete.
12)	IS: 3414	Code of practice for design and installation of joints in buildings.
13)	IS: 4326	Code of practice for earthquake resistant design and construction of building.
14)	IS: 4014	Code of practice for steel tubular scaffolding (Parts 1 & 2)
15)	IS: 2571	Code of practice for laying in situ cement concrete flooring.
16)	IS: 7861	Code of practice for extreme weather concreting: Part 1 Recommended practice for hot weather concreting.
17)	IS: 1893	Criteria for earthquake resistant structures subjected to seismic forces.
18)	IS: 13920	Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic forces.
19)	IS: 13827	Improving Earthquake Resistance of Earthen Buildings-Guidelines.
20)	IS: 13828	Improving Earthquake Resistance of Low Strength Masonry Buildings-Guidelines

2.1.8. Construction Safety

1)	IS.3696	Safety code for scaffolds and ladders. (Parts 1 & 2)
2)	IS: 7969	Safety code for handling and storage of building materials.
3)	IS: 8989	Safety code for erection of concrete framed structures.

2.1.9. Measurement

1)	IS 1200	Method of measurement of building and Engineer-in-charge Works
2)	IS 3385	Code of practice for measurement of Civil Engineer-in-charge Works

2.2. General

Concrete and reinforced concrete work shall be carried out generally in conformity with the latest Indian Standard 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.

2.3. Materials

2.3.1. Cement

Cement for the work shall be Portland Pozzolana Cement conforming to the latest Indian Standards IS: 1489 grade. Cement to be of a reputed brand manufactured by a well known major cement manufacturing plant. Cement from a mini cement manufacturing unit would not be permitted. Cement to be procured after approval of the Engineer in charge directly from manufacturer (the invoice of the same will have to be produced by the Contractor Cement 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 the Engineer-in-charge. Only one type of cement shall be used in any one mix. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from the Engineer-in-charge. The contractor shall always purchase Portland cement as fresh as possible after manufacture and shall supply the manufacture's test certificate, corresponding to the batch of cement intended for use in work. Where there is reason to believe the cement has been long stored, the Engineer-in-charge may demand a Laboratory Test Certificate regarding the character of cement and the contractor shall furnish the same at no extra cost. The Engineer-in-charge shall reject any cement, which in his opinion does not meet the required standards.

All bags and containers in which cement is packed shall be stored in a dry, weather-tight, and properly ventilated structure with adequate provision for prevention and absorption of moisture. The contractor shall at all times maintain for the inspection of the Engineer-in-charge 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 its receipt at site. Cement reclaimed from cleaning of bags or from spillage from containers or otherwise shall on no account be used.

If cement is not stored properly and has deteriorated, the material shall be rejected. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage arrangement shall be approved by the Engineer-in-charge. Storage under tarpaulins shall not be permitted.

2.3.2. Sand (Refer Table No. I)

Sand (fine aggregated) shall generally conform to 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. Sand 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 bulk age of sand shall be made. The fineness modulus of sand shall neither be less than 2.2 nor more than 3.2.

2.3.3. Coarse Aggregate (Refer Table No. II & III)

Coarse aggregate shall be approved hard aggregate generally conforming to IS 383.

Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

2.3.4. Water

Water for all concrete work shall be clean, free from deleterious matter such as oils, acids, alkalies, 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.

The Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

TABLE – I

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

Fine aggregate conforming to Grade Zone IV shall not be used for RCC works.

I.S. Sieve Designation	PERCENTAGE PASSING FOR			
	Grading Zone I	Grading Zone II	Grading Zone III	Grading 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

TABLE – II

GRADING OF COARSE AGGREGATE

I.S. Sieve Designation	Percentage passing for single sized aggregate of nominal size					Percentage passing for Grading aggregate of nominal size			
	40 mm	20 mm	16 mm	12.5 mm	10 mm	40 mm	20 mm	16 mm	12.5 mm
63 mm	100	-	-	-	-	100	-	-	-
40 mm	85 - 100	100	-	-	-	95– 100	100	-	-
20 mm	0 – 20	85 – 100	100	-	-	30 – 70	95 –100	100	100
16 mm	-	-	85 –100	100	-	-	-	90 –100	-
12.5 mm	-	-	-	85 –100	100	-	-	-	90 –100
10 mm	0 – 5	0 – 20	0 – 30	0 – 45	85 – 100	10 – 35	25 – 55	30 – 70	40 – 85
4.75 mm	-	0 – 5	0 – 5	0 – 10	0 – 20	0 – 5	0 – 10	0 – 10	0 – 10
2.36 mm	-	-	-	-	0 – 5	-	-	-	-

TABLE – III

UPPER LIMIT FOR DELETERIOU MATERIALS IN COARSE & FINE AGGREGATES

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

			Percent by Weight	
			Uncrushed	**Crushed**
i)	Material finer than 75 micron I.S sieve - Coarse Aggregates (CA)		3.00	3.00
	- Fine Aggregates (FA)		3.00	15.00
Ii)	Coal and lignite	(CA) and (FA)	1.00	1.00
iii)	Clay lumps	(CA) and (FA)	1.00	1.00
iv)	Soft fragments	(CA)	3.00	0.00
		(FA)	0.00	0.00
v)	Total of all above substances	(CA)	5.00	5.00
		(FA)	5.00	2.00

2.3.5. Reinforcement Steel

2.3.5.1 Material Specification

Steel used for reinforcement shall be any of following types specifically applicable as per Bill of Quantities

- Mild steel and medium tensile bar IS 432 Part I

  (FE 415)
- HYS deformed bars IS 1786
- Structural steel section (Grade A) IS 2062

2.3.5.2 Tolerance in Mass

Refer to the following: -

TABLE

(Tolerance of Nominal Mass)

Sr. No.	Nominal Size in mm	Tolerance on the nominal mass percent		
		Batch	Individual Sample +	Individual sample for coil (-x-)
a)	upto and including 10	± 7	-8	± 8
b)	over 10, upto and including 16	± 5	- 6	± 6
c)	over 16	± 3	- 4	± 4

\+ For individual sample plus tolerance is not specified

(x) For coil batch tolerance is not applicable.

Tolerance shall be determined in accordance with method given in IS 1786.

2.3.5.3 a) HYS Deformed Bars

High strength deformed bars and wires shall conform to IS : 1786. The physical properties for all sizes of steel bars are mentioned below in Table below.

TABLE

Sr. No.	Property	Grade		
		Fe 415	Fe 500	Fe 550
1.	0.2% proof stress / yield stress, min N/mm^2	415	500	550
2.	Elongation, percent min. on gauge length 5.65 √A, Where A is the X-Sectional Area of the test piece.	14.5	12	8
3.	Tensile strength(min)	10% more than actual 0.2% proof stress but not less than 485 N/mm^2	8% more than actual 0.2% proof stress but not less than 545 N/mm^2	6% more than actual 0.2% proof stress but not less than 585 N/mm^2

Tests: Selection and preparation of Test sample. All the tests pieces shall be selected by the Engineer-in-charge or his authorized representative in accordance with provisions as laid in IS: 1786 either –

a) From cutting of bars

Or

b) If he so desires, from any bar after it has been cut to the required or specified size and the test piece taken from any part of it.

In no case, the test pieces shall be detached from the bar or coil except in the presence of the Engineer-in-charge or his authorized representative.

The test pieces obtained in accordance with as above shall be full sections of the bars as rolled and subsequently cold worked and shall be subjected to physical/chemical tests without any further modifications. No deductions in size by machining or otherwise shall be permissible. No test piece shall be enacted or otherwise subject to heat treatment. Any straightening, which a test piece may require shall be done cold.

2.3.5.4 Stacking and Storage

Steel for reinforcement shall be stacked on top of timber sleepers to avoid contact with ground / water and shall be stored in such a way to prevent distorting and corrosion. Bars of different classifications, sizes and lengths shall be stored separately to facilitate issue in such sizes and lengths to cause minimum wastage in cutting from standard length.

2.3.5.5 Fabrication and Fixing of Reinforcement

a) General Requirements

Steel for reinforcement shall be clear and free from loose miscalls, dust, loose rust, coats of paints, oil or other coatings, which may destroy or reduce bond. It shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. Prior to assembly of reinforcement on no account any oily substance shall be used for removing the rust.

b) Assembly of Reinforcement

Bars shall be bent correctly and accurately to the size and shape as shown in the detailed drawing or as directed by the Engineer-in-charge. Preferably bars of full length shall be used. Necessary cutting and straightening is also included. Over lapping of bars, where necessary shall be done as directed by the Engineer-in-charge. The overlapping bars shall not touch each other and these shall be kept apart with concrete between them by 25 mm or 1 ¼ times the maximum size of the coarse aggregate whichever is greater. But where this is not possible, the overlapping bars shall be bound together at intervals not exceeding twice the dia. Of such bars with two strands annealed steel wire of 0.90 mm to 1.6 mm twisted tight. The overlaps / splices shall be staggered as per directions of the Engineer-in-charge. But in no case the over lapping shall be provided in more than 50% of cross sectional area at one section.

c) Bonds and Hooks Forming End Anchorages

Reinforcement shall be bent and fixed in accordance with procedure specified in IS 2502, code of practice for bending and fixing of bars for concrete reinforcement.

d) Anchoring Bars in Tension

Deformed bars may be used without end anchorages provided, development length requirement is satisfied. Hooks should normally be provided for plain bars in tension. Development length of bars will be determined as per IS : 456.

e) Anchoring Bars in Compression

The anchorage length of straight bar in compression shall be equal to the “Development Length” of bars in compression as specified in IS : 456. The projected length of hooks, bends and straight lengths beyond bend, if provided for a bar in compression, shall be considered for development length.

f) Binders, stirrups, links and the like

In case of binders, stirrups, links etc. the straight portion beyond the curve at the end shall be not less than eight times nominal size of bar.

g) Welding of Bars

Welded joints or mechanical connections in reinforcement may be used but in all cases of important connections, tests shall be made to prove that the joints are of full strength of bars connected.
The Engineer-in-charge shall be approved the location and type of welding. Welding shall be as per IS: 2751 for mild steel bars and for cold worked bars.

h) Placing in Position

Fabricated reinforcement bars shall be placed in position as shown in the drawings or as directed by the Engineer-in-charge. The bars crossing one another shall be tied together at every intersection with two strands

of annealed steel wire 0.9 to 1.6 mm thickness twisted tight to make the skeleton of the steel work rigid so that the reinforcement does not get displaced during deposition of concrete.

The bars shall be kept in correct position by the following methods:

i. In case of beam and slab construction pre-cast cover blocks in cement mortar 1:2 (1 cement: 2 coarse sand) about 4 x 4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcement.

ii. In case of cantilevered and doubly reinforced beams or slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 metre or at shorter spacing to avoid sagging.

iii. In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them; or with block of cement mortar 1:2 (1 cement : 2 coarse sand) of required size suitably tied to the reinforcement to ensure that they are in correct position during concreting.

iv. In case of other RCC structure a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in-charge.

i) Tolerance on Placing of Reinforcement

Unless otherwise specified by the Engineer-in-charge, reinforcement shall be placed within the following tolerances:

		Tolerance In spacing
a)	For effective depth, 200 mm or less	± 10 mm
b)	For effective depth, more than 200 mm	± 15 mm

The cover shall in no case be reduced by more than one third of specified cover or 5 mm whichever is less.

j) Bending at Construction Joints

Where reinforcement bars (up to 12 mm for HYSD bars and up to 16 mm for MS bars) are bent aside at construction joints and afterwards bent back into their original position care should be taken to ensure that at no time the radius of the bend is less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

k) Measurement

Reinforcement including authorized spacer bars, chairs and lap pages shall be measured in length of different diameters, as actually (not more than as specified in the drawings) used in the work nearest to a centimeter and their weight calculated on the basis of standard weight given in Table below. Wastage and unauthorized overlaps shall not be paid for. Annealed steel wire required for binding or tack welding shall not be measured, its cost being included in the rate of reinforcement.

Chairs separators etc. shall be provided as directed by the Engineer-in-charge and measured separately and paid for.

TABLE

Cross Section Area and Mass of Steel Bar

Nominal Size Mm	Cross Sectional Area Sq.mm	Mass per meter Run Kg.
6	28.3	0.222
7	38.5	0.302
8	50.3	0.395
10	78.6	0.617
12	113.1	0.888
16	201.2	1.58
18	254.6	2.00
20	314.3	2.47
22	380.3	2.98
25	491.1	3.85
28	616.0	4.83
32	804.6	6.31
36	1018.3	7.99
40	1257.2	9.85
45	1591.1	12.50
50	1964.3	15.42

l) Rate

The rate for reinforcement shall include the cost of labour and materials required for all operations described above such as cleaning of reinforcement bars, straightening, cutting, hooking, bending, binding, placing in position etc. as required or directed including tack welding on crossing of bars in lieu of binding with wires.

2.3.6 Testing of Materials:

(a) (I) Manufacturer's Tests

For each batch of materials supplied Manufacturer's Test Certificate as per IS :1786 shall be submitted for approval.

(ii) Field Tests – Following type of lab test shall be carried out.

1) Tensile Tests

This shall be done as per IS 1608

2) Bend Test

This shall be done as per IS 1599

3) Re-test

This shall be done as per IS 1786

4) Rebend Test

This shall be done as per IS 1786

5) Chemical composition Test

This shall be done as per IS 228

6) Unit weight Test

This shall be done as per IS 1786

Should any one of the test pieces first selected fail to pass any of the tests specified above, two further samples shall be selected for testing in respect of each failure. Should the test pieces from both these additional samples pass, the materials represented by the test samples shall be deemed to comply with the requirement of the particular test. Should the test piece from either of these additional samples fail, the material represented by the test samples shall be considered as not having complied with standard.

(b) Acceptance Criteria

Based on the results of tests carried out as mentioned above, the Engineer-in-charge will decide the acceptance of the batch under test for use in RCC structures, and his decision shall be final and binding on the Contractor.

The charges for all the tests shall be borne by the Contractor and are deemed to have been included in the price quoted for the relevant BOQ item. It shall be clearly understood by the Contractor that the confirmatory test stipulated above is mandatory and the time required for such testing shall be catered for in the delivery schedule for materials.

All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirt, dust, or any other substance that will destroy or reduce bond.

2.4 Concrete

All structural concrete shall be Mix designed & weight batched.

2.4.1 Design Mix

Design mix concrete is that in which design of mix i.e. the proportion by weight of cement, aggregates and water is arrived as to have mean target strength with required workability in wet condition and the desired durability in hardened state. Contractor would be allowed to use nominal mix equivalent to M25 grade of concrete(1:1:2 by volume) for an initial period of one month after which he shall use mix design as approved by a Govt Institute like NIT/IIT/IISc

2.4.2 Grade of Concrete

The compressive strength of various grades of designed concrete shall be as per Table below (Table IV)

TABLE IV

GRADE OF CONCRETE

Sr. No.	Type of Concrete	Min. Cement Content in Kg/Cum of Concrete	Compression Strength	
			7 day N/mm^2	28 days N/mm^2
1.	M 15 (PCC)	240	10.0	15
2.	M 20 (RCC)	300	13.5	20
3.	M 25 (RCC)	300	17.0	25

Compressive Strength indicated above pertains to pressure test on works test cubes 15 cm x 15 cm x 15 cm after normal curing for 14 days as per IS: 516.

The minimum cement content stipulated above should be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventuality and nothing extra shall become payable to the Contractor in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor.

The Contractor shall not commence concreting in the Permanent Works until details of trial mixes and test results for each class of concrete have been submitted to and approved by the Engineer-in-charge.

The Contractor shall not alter the approved mix proportions nor the approved source of supply of any of the ingredients without having previously obtained the approval of the Engineer-in-charge.

During production, the Engineer-in-charge may require trial mixes to be made before a substantial change is made in the materials or in the proportions of the materials to be used.

It shall be the Contractor's sole responsibility to carry out the mix designs at his own cost from a reputed institute as approved by Engineer-in-charge-in-charge. He shall furnish to the Engineer-in-charge at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained.

A range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer-in-charge, is given below:

Structure/Member	**Slump in millimeters**	
	Maximum	**Minimum**
Reinforced foundation walls and footings	75	40
Plain footings, caissons and substructure walls	75	40
Slabs, Beams and reinforced walls	100	40
Pump & miscellaneous Equipment Foundations	75	40
Building columns	100	40
Pavements	50	40
Heavy mass construction	75	25

Note: All concreting done for water retaining structures shall have a minimum slump value of 60 mm and maximum of 100 mm

2.4.3 Design Procedure for Concrete Mix (refer IS 10262)

2.4.3.1 Data to be stipulated / specified

1. Characteristics compressive strength of concrete at 28 days
2. Degree of workability
3. Limitations on Water Cement ratio
4. Standard Deviation
5. Minimum Cement Content as per IS: 456
6. Standard Deviation (Table V)
7. Degree of Control (Table VI)

2.4.3.2 Target Strength

As per IS 456 and IS 1343 target average Compressive strength at 28 days is fck + 1.65s
Where fck = characteristics compressive strength at 28 days
S = standard deviation.

2.4.3.3 Batching

In proportioning concrete, the quantity of cement and aggregates shall be determined by mass. Water shall be measured by volume in calibrated tanks. Uniform quality of graded aggregates and water cement ratio shall be maintained.
Admixtures if required shall be mixed as per the relevant IS: 9103/456.

2.4.3.4 Mixing

Concrete shall be mixed in a mechanical mixer. The mixer should comply with IS 1791. It shall be fitted with hopper. The mixing shall be continuous until there is uniform distribution of the material and the mass is uniform in colour and consistency. If there is segregation after unloading from the mixer, the concrete should be remixed. The mixing time shall not be less than 2 minutes.

Each time the work stops, the mixer shall be cleaned out, and while recommencing; the first batch shall have 10% additional cement to allow for sticking in the drum.

2.4.5 Transporting, Placing and Compacting

2.4.5.1 Transportation

Concrete shall be transported from the mixer to the place of laying as rapidly as possible by methods, which will prevent the segregation or loss of any of the ingredients, and maintaining the required workability.

2.4.5.2 Placing

The concrete shall be deposited as nearly as practicable in its final position to avoid rehandling. It shall be laid gently (not thrown) and shall be thoroughly vibrated and compacted before setting commences and should not be subsequently disturbed. Method of placing shall be such as to preclude segregation. Care shall be taken to avoid displacement of reinforcement or movement of form work and damage due to rains. Concrete shall not be dropped from a height of more than 1 m.

While placing concrete the Contractor shall proceed as specified below and also ensure the following:

(a) Continuously between construction joints and pre- determined abutments.

(b) Without disturbance to forms or reinforcement.

(c) Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.

(d) Without dropping in a manner that could cause segregation or shock.

(e) In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.

(f) Do not place if the workability is such that full compaction cannot be achieved.

(g) Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the linings progressively as concrete is placed.

(h) If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.

(i) Ensure that there is no damage or displacement to sheet membranes.

(j) Record the time and location of placing structural concrete.

(k) Maintain separate pour card for each pour as per the format approved by Engineer-in-charge-in-charge.

2.4.5.3 Compaction

Concrete shall be thoroughly compacted and fully worked around embedded fixtures and into corners of the form work. Mechanical vibrator of appropriate type shall do compaction till a dense concrete is obtained. The mechanical vibrators shall conform to IS 2505,IS 2506,IS 2514,IS 4656 specifications for concrete vibrators (immersion type). To prevent segregation, over vibration shall be avoided. The use of mechanical vibrator may be relaxed by the Engineer-in-charge at his discretion for certain items and permit hand compaction.

Hand compaction shall be done with the help of tamping rods. Compaction shall be completed before the initial setting starts. For the items where mechanical vibrators are not to be used, the contractor shall take permission of the Engineer-in-charge in writing before the start of the work. After compaction the top surface shall be finished even and smooth with wooden trowel before the concrete begins to set.

2.4.5.4 Construction Joints

Concreting shall be carried out continuously upto construction joints. The position and arrangement of construction joints shall be as shown in the structural drawings or as directed by the Engineer-in-charge. Number of such joints shall be kept minimum. Joints shall be kept as straight as possible.

Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as approved by the Engineer-in-charge.

As soon as the exposed concrete has sufficiently hardened, the surface of the joint shall be water jetted or brushed with a stiff brush to expose the larger aggregate without being disturbed. Alternatively, if the preparation is not satisfactory, or proper joint preparation is not possible due to inclement weather, the Contractor shall thoroughly remove the laitance of hardened concrete by mechanical chipping after seven days of concrete work at his own cost. Before placing fresh concrete against a construction joint all loose material shall be removed and the surface sluiced with water until it is perfectly clean, thereafter all pounded water should be removed.

When concreting is to be resumed on a surface, which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this, a layer of concrete not exceeding 150 mm thickness shall be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

2.4.5.5 Standard of Acceptance

(a) The average strength of group of cubes for each grade cast for each day shall not be less than the specified work cube strength. 20 per cent of cubes cast for each day may have values less than the specified strength provided that the lowest value is not less than 85% of the specified strength.

(b) Concrete strength less than specified may as a special case be accepted in a member with the approval of Engineer-in-charge-in-charge provided that the maximum stress in the member under the maximum design live load does not exceed the permissible safe stress appropriate to the lower strength of the concrete.

(c) Concrete which does not meet the strength requirements as specified but has a strength greater than that of the lowest value of 85% may, at the discretion of the designer, be accepted as being structurally adequate without further testing. However in such cases pro-rata reduction in the rate of concrete shall be incorporated for payment.

(d) Concrete of each grade shall be assessed separately.

(e) Concrete shall be assessed daily for compliance.

2.4.5.6 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.

d) Quantum of cubes and testing

A set of 6 cubes shall be cast per every sample of concrete. The minimum frequency of sampling of concrete of each grade shall be as under:

Quantity of Concrete (in m3)	No. of samples
1 – 5	1
6 – 15	2
16 – 30	3
31 – 50	4
51 and above	4+1 additional sample for each additional 50 m3 or part there of.

At least one sample shall be taken from each shift and a set of 6
Cubes on every important element as decided by the Engineer-in-charge-in-charge.

The decision of The Engineer-in-charge in this regard shall be final and binding.

TABLE 5

Grade of concrete	Standard Deviation for different degree of control in N / mm^2		
	Very Good	Good	Fair
M15	2.5	3.5	4.5
M20	3.6	4.6	5.6
M25	4.3	5.3	6.3
M30	5.0	6.0	7.0
M35	5.3	6.3	7.3

(e) Degree of quality control expected under different site conditions is described in table 6.

TABLE 6

Degree of Control	Condition of production of concrete
Very Good	Fresh cement from single source and regular tests, weigh batching of all materials, aggregates supplied in single size, control of aggregates grading and moisture content, control of water added, frequent supervision, regular workability and strength tests and field laboratory facilities.
Good	Carefully stored cement and periodic test, weigh batching of all materials, controlled water, graded aggregate supplied, occasional grading and moisture tests, periodic check of workability & strength, intermittent supervision and experienced workers.
Fair	Proper storage of cement, volume batching of all of the aggregates, allowing for bulking of sand, weigh batching of cement, water content controlled by inspection of mix & occasional supervision and tests.

2.4.5.7 Finish to concrete surfaces

Finish to concrete surfaces at various situations shall be as per directions of The Engineer-in-charge. 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 carborundum 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 Engineer-in-charge and the contractor will implement the instructions accordingly.

2.4.5.8 Concrete cover for reinforcement

Where not specifically indicated in the drawings, concrete cover for reinforcement shall be as per the latest IS 456 or 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.

2.4.5.8a) Specification for self levelling floor topping

- Surface Preparation

The substrate must be cleaned thoroughly by wire brush to make it free from loose particles, laitaince, oil, grease etc. substrate must be from any moisture

- Priming with Sikafloor 80 Primer

On the prepared surface, application of a solvent free epoxy resin based primer of density approximate 1 Kg/litre (A+B) at 30^{o}C. Mixing ratio of primer should be comp. A : Comp. B = 1:2.5 by weight.

- Application of normal setting epoxy modified cementitious self-levelling floor topping Sikafloor 81 Epocem.

On the primed surface application of 2mm thick, self leveling floor topping floor topping Sikafloor 81 Epocem @ 4.4 Kg/M^2.

- Application of Sikafloor 80 Primer

On the top of Sikafloor 81 Epocem further application of Sikafloor 80 primer

Finally application of Epoxy based self-smoothening floor topping Sikafloor 261 S of 1mm thickness.

2.4.5.9 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 premature drying, winds, directed sun rays, rapid cooling during the first few days after placing, vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement. Membrane curing shall be allowed with prior permission of Engineer-in-charge-in-charge without any extra payment.

2.4.5.10 a) 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 Engineer-in-charge 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 etc. 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.

b) Liquid Retaining Structures

The Contractor shall take special care for concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness. All such concrete shall be mixed with water proofing compound and placed with least number of joints.

All such structures shall be hydro-tested.

The Contractor shall make all arrangements for hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipe lines etc.

Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.

Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement/epoxy pressure grouting, guniting or such other methods as may be approved by the Engineer-in-charge. All such rectification shall be done by the Contractor to the entire satisfaction of the Engineer-in-charge at no extra cost to the HAL.

c) Testing Concrete Structures for Leakage

Hydro-static test for water tightness shall be done at full storage level or soffit of cover slab, as may be directed by the Engineer-in-charge, as described below:

In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.

In the case of structures whose external faces are buried and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs. Over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven days shall be taken as an indication of the water tightness of the structure. The Engineer-in-charge shall decide on the actual permissible nature of this drop in the surface level, taking into account whether the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

Each compartment/segment of the structure shall be tested individually.

For structures such as pipes, tunnels etc. the hydrostatic test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

2.4.5.11 Repair and Replacement of Unsatisfactory Concrete

Immediately after the shuttering is removed, all the defective areas such as honey-combed surfaces, rough patches, holes left by form bolts etc. shall be inspected by the Engineer-in-charge who may permit patching of the defective areas or reject the concrete work.

All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

Rejected concrete shall be removed and replaced by the Contractor at no additional cost to the client.

For patching of defective areas all loose materials shall be removed and the surface shall be prepared as approved by the Engineer-in-charge.

Bonding between hardened and fresh concrete shall be done either by placing cement mortar with approved bonding agent or by applying epoxy. The decision of the Engineer-in-charge as to the method of repairs to be adopted shall be final and binding on the Contractor. The surface shall be saturated with water for 24 hours before patching is done with 1:4 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as approved by the Engineer-in-charge.

All the form bolt repairs and delayed repairs shall be carried out using a proportion of white cement in repair mix to the approval of the Engineer-in-charge, so as to match the colour of the surrounding area.

Tolerances for R.C. Buildings

a) Variation from the Plumb

(I) In the lines and surfaces of columns, piers, and walls and in arrises 5 mm per 2.5 m or 25 mm, whichever is less?

(ii) For exposed corner columns and other conspicuous lines

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

b) Variation from the level or from the grades indicated on the drawings

(I) In slab soffits, ceilings, beam soffits, and in arrises

In 2.5 m	-	5 mm
In any bay or 5 m maximum	-	10 mm
In 10 m or more	-	15 mm

(ii) 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

c) 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

d) Variation in the sizes and locations of sleeves, openings in walls and floors – 5 mm except in the case of and for anchor bolts.

e) Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls

Minus	-	5 mm
Plus	-	10 mm

f) Footings

(I) Variation in dimension in plan

Minus	-	5 mm
Plus	-	50 mm

(ii) Misplacement or eccentricity

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

(iii) Reduction in thickness

Minus - 5% of specified thickness subject to a maximum of 50 mm

g) Variation in Steps

(I) In a flight of stairs

Rise	-	3 mm
Tread	-	5 mm

(ii) In consecutive steps

Rise	-	1.5 mm
Tread	-	3.0 mm

2.4.5.12 Measurement

Dimensions shall be measured nearest to a cm except for the thickness of slab, which shall be measured correct to 0.5 cm. The areas shall be worked out nearest to 0.01 sq.mt. The cubical contents shall be worked out to nearest 0.01 cubic meters.

Reinforced cement concrete whether cast-in-situ or precast shall be classified and measured separately as per Bill of Quantity.

No deduction shall be made for the following: -

a) Opening upto 0.1 sq.m

Note: In calculating area of openings upto 0.1 sqm the size of opening shall include the thickness of any separate lintels or sills. No extra labour for forming such openings or voids shall be paid for.

b) The volume occupied by reinforcement.

c) The volume occupied by water pipes conduits etc. not exceeding 25 sq cm each in cross sectional area. Nothing extra shall be paid for leaving and finishing such cavities and holes.

The measurement of RCC work of various units shall be regulated as below;

a) Slabs shall be taken as running continuously.

b) Beams shall be measured from face to face of columns and shall include haunches, if any, between columns and beam. The depth of the beam shall be from the bottom of slab to the bottom of beam.

c) The columns measurement shall be taken upto the underside of slab.

d) Chajjas along with the bearing on wall shall be measured in cubic meter nearest to two places of decimal. When chajjas is combined with lintel, slab or beam, the projecting portion shall be measured as chajjas, built in bearing shall be measured as per item of lintel, slab or beam in which chajja bears.

e) Where the band and lintels are of the same height and the band serves as llintel, the length of the band to be measured as lintel shall be for clear length of opening plus twice the over all depth of band.

2.4.5.13 Rate

The rate includes the cost of materials and labour involved in all the operations described above including cost of centering and shuttering work.

2.5 Nominal Mix Concrete

2.5.1 Mix Design & Testing

Mix design and preliminary tests are not necessary for Nominal Mix Concrete. However works tests shall be carried out as per IS:456. Proportions for Nominal Mix Concrete may be adopted as per Table 9 of IS:456. However it will be the Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

2.5.2 Batching & Mixing of Concrete

Based on the adopted nominal mixes, aggregates shall be measured by volume. However cement shall be by weight only, using whole bags of cement.

2.6 Optional Tests

If the Engineer-in-charge is not satisfied with the results of the tests or otherwise considers that the materials i.e. cement, sand, coarse aggregates, reinforcement and water are not in accordance with the Specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the Engineer-in-charge, as per relevant IS Codes. Contractor shall have to pay for these tests.

In the event of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths, the Engineer-in-charge reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure as referred to in IS 456, etc. The Engineer-in-charge also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work, at no cost to the HAL.

If the structure is certified as failed by Engineer-in-charge, the cost of the test and subsequent dismantling/ reconstruction shall be borne by the Contractor.

The quoted unit rates/prices of concrete shall be deemed to provide for all tests mentioned above.

2.7 Grouting

a) Standard Grout

Grout shall be provided as specified on the drawings. The proportion of Standard Grout shall be such as to produce a flowable mixture consistent with minimum water content and shrinkage. Surfaces to be grouted shall be thoroughly roughened and cleaned. All Structural steel elements to be grouted shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by Engineer-in-charge. The grout proportions shall be limited as follows:

Use	**Grout Thickness**	**Mix Proportions**	**W/C Ratio (max)**
a) Fluid mix	Under 25mm	One part Portland Cement to one part sand	0.44
b) General mix	25mm and over but less than 50mm	One part Portland Cement to 2 parts of sand	0.53
c) Stiff mix	50mm and over	One part Portland Cement to 3 parts of sand	0.53

b) Non-Shrink Grout

Non – shrink grout where required shall be provided in strict accordance with the manufacturer's instructions / specifications on the drawings.

2.8 Form Work (Centering and Shuttering)

2.8.1 Form Work

Form work shall include use of all temporary or permanent forms or moulds required for forming the concrete, which is cast-in-situ, together with all temporary construction required for their support.

2.8.2 Design and Tolerance in Construction

Form work shall be designed and constructed to the shapes, lines and dimensions shown on the drawings with the tolerances given below :

a) Deviation from specified dimensions of cross section
Of columns and beams + 12 mm
- 6 mm

b) Deviation from dimensions of footings

i) Eccentricity in plan 0.02 times the width of the footings in the direction of deviation but not more than 50 mm.

ii) Thickness
+ 0.05 times the specified thickness.

(**Note** – Tolerance apply to concrete dimensions only, and not to positioning of vertical steel or dowels).

2.8.3 General Requirement

It shall be strong enough to withstand the dead and live loads and forces caused by ramming and vibrations of concrete and other incidental loads, imposed upon it during and after casting of concrete. It shall be made sufficiently rigid by using adequate number of ties and braces, Screw jacks or hard board wedges where required shall be provided to make up any settlement in the form work either before or during the placing of concrete.

Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Care shall be taken to see that no piece is keyed into the concrete.

2.8.3.1 Material for Form Work

a) Propping and centering

All propping and centering should be either of steel tubes with extension pieces or built up sections of rolled steel.

2.8.3.2 a) Centering / Staging

Contractor shall design the staging as per design for slabs / beams etc. and as per levels as shown in drawings. All the staging to be either Tubular steel structure with adequate bracings as approved or made of built-up structural sections made from rolled structural steel sections.

b) In case of structures with two or more floors, the weight of concrete, centering and shuttering of any upper floor being cast shall be suitably supported on one floor below the top most floor already cast.

c) Form work and concreting of upper floor shall not be done until concrete of lower floor has set atleast for 14 days.

2.8.3.3 Shuttering

Shuttering used shall be of sufficient stiffness to avoid excessive deflection and joints shall be tightly butted to avoid leakage of slurry. New waterproof ply / steel shuttering only shall be used.

If steel shuttering is used for concreting it should be sufficiently stiffened. The steel shuttering should also be properly repaired before use and properly cleaned to avoid stains, honey combing, seepage of slurry through joints etc.

2.8.3.4 Form work shall be properly designed for self weight, weight of reinforcement, weight of fresh concrete, and in addition, the various live loads likely to be imposed during the construction process (such as workmen, materials and equipment). In case the height of centring exceeds 3.50 meters, the prop may be provided in multi-stages.

2.8.3.5 Camber

Suitable camber shall be provided in horizontal members of structure, especially in cantilever spans to counteract the effect of deflection. The form work shall be so assembled as to provide for camber. The camber for beams and slabs shall be 4 mm per meter (1 to 250) or as directed by the Engineer-in-charge, so as to offset the subsequent deflection. For cantilevers the camber at free end shall be $1/50^{th}$ of the projected length or as directed by the Engineer-in-charge.

2.8.3.6 Removal of Form Work (Stripping time)

In normal circumstances and where ordinary Portland cement is used, forms may generally be removed after the expiry of the following periods or as specified by engineer-in-charge:

a) Walls, columns and vertical Faces of all structural members	16 to 24 hours as may be decided by the Engineer-in-charge

b) Slabs

i) Spanning upto 4.50 M	7 days
ii) Spanning over 4.50 M	14 days

c) Beams and arches

i) Spanning upto 6 M	14 days
ii) Spanning over 6 M & upto 9 m	21 days
iii) Spanning over 9 M	28 days

2.8.4 Surface Treatment

2.8.4.1 Oiling the Surface

Shuttering gives much longer service life if the surfaces are coated with suitable mould oil, which acts both as a parting agent and also gives surface protections.

A typical mould oil is heavy mineral oil or purified cylinder oil containing not less than 5% pentachlorophenol conforming to IS 716 well mixed to a viscosity of 70-80 centipoise.

After 3-4 uses and also in cases when shuttering has been stored for a long time, it should be recoated with mould oil before the next use.

2.8.5 Inspection of Form Work

The completed form work shall be inspected and approved by the Engineer-in-charge before the reinforcement bars are placed in position.

Proper form work should be adopted for concreting so as to avoid honey combing, blow holes, grout loss, stains or discolouration of concrete etc. Proper and accurate alignment and profile of finished concrete surface will be ensured by proper designing and erection of form work which will be approved by Engineer-in-charge.

Shuttering surface before concreting should be free from any defect / deposits and fully cleaned so as to give perfectly straight smooth concrete surface. Shuttering surface should be therefore checked for any damage to its surface and excessive roughness before use. Inserts and reinforcement shall be correctly positioned and securely held; and, necessary openings, pockets, etc. provided.

2.8.5.1 General

The form work shall include the following;

i) Splayed edges, notching, and allowance for overlaps and passing at angles, sheathing battens, strutting, bolting, nailing, wedging, easing, striking and removal.

ii) All supports, struts, braces, wedges as well as mud sills, piles or other suitable arrangements to support the form work.

iii) Bolts, wire ties, clamps, spreaders, nails or any other items to hold the sheathing together.

iv) Working scaffolds, ladders, gangways and similar items.

v) Filleting to form stop chamfered edges of splayed external angles not exceeding 20 mm wide to beams, columns and the like.

vi) Where required, the temporary openings provided in the forms for pouring concrete, inserting vibrators, and cleaning holes for removing rubbish from the interior of the sheathing before pouring concrete.

vii) Dressing with oil to prevent adhesion and

viii) Raking or circular cutting.

2.8.5.2 Classification of Measurements

Where it is stipulated that the form work shall be paid for separately, measurements shall be taken of the area of shuttering in contact with the concrete surface. Dimensions of the form work shall be measured correct to a cm. The measurements shall be taken separately as per items in Bill of Quantity.

2.9 Damp Proof Course

2.9.1 Cement Concrete Layer

This shall consist of cement concrete of specified proportions and thickness. The surface of brick or stone masonry work shall be leveled and prepared before laying the cement concrete. Edge of damp proof course shall be straight, even and vertical. Side shuttering shall consist of steel forms and shall be strong and properly fixed so that it does not get disturbed during compaction and the mortar does not leak through. The concrete mix shall be of workable consistency and hall be tamped thoroughly to make a dense mass. When the sides are removed, the surface should come out smooth without honeycombing. Continuity shall be maintained while laying the cement concrete layer and laying shall be terminated only at the predetermined location where damp proof course is to be discontinued. There shall be no construction joint in the Damp Proof Course.

2.9.2 Curing

Damp proof course shall be cured for at least seven days, after which it shall be allowed to dry.

2.9.3 Application of Hot Bitumen

Where so directed, hot bitumen in specified quantity shall be applied over the dried up surface of cement concrete, properly cleaned with brushes and finally with a piece of cloth soaked in kerosene oil. Bitumen of penetration A 90 or equivalent where used shall be heated to a temperature of $160^{o} \pm 5^{o}C$. The hot bitumen shall be applied uniformally all over, so that no blank spaces are left anywhere. It will be paid for separately.

2.9.4 Water Proofing Materials

Where so specified or as directed by Engineer-in-charge, water proofing material of approved quality shall be added to the concrete mixture in accordance with the manufacture's specifications stating the quantity of water proofing material in litres per 50 kg of cement, waterproofing material will be paid for separately.

2.9.5 Measurements

The length and breadth shall be measured correct to a cm and its area shall be calculated in square meters correct to two places of decimal. The depth shall not be less than the specified thickness at any section.

2.9.6 Rate

The rate is inclusive of the cost of materials and labour involved in all the operations described above except for the application of a coat of hot bitumen and addition of water proofing materials, which shall be paid for separately, unless otherwise specified.

2.10 Preformed Fillers and Joint Sealing Compound

2.10.1 Materials

Preformed filler for expansion/isolation joints shall be non-extruding and resilient type of bitumen impregnated fibers conforming to IS: 1838 (Part I).

Bitumen coat to concrete/masonry surfaces for fixing the preformed bitumen filler strip shall conform to IS: 702. Bitumen primer shall conform to IS: 3384.

Sealants shall be:

Sealant Polysulphide

Sealant shall be a cold pouring compound complying with BS 4254/IS 12118, suitable for sealing movement and construction joints in concrete and other areas. It shall be water tight & non-sagging. It shall be tough, abrasion-resistant and shall not decompose in strong sunlight.

Hardness (Shore A)	:	15-20
Transverse Movement Accommodation	:	±12.5%

2.10.2 Workmanship

The thickness of the preformed filler shall be 25mm for expansion joints and 50mm for isolation joints around foundation supporting rotatory equipments. Contractor shall procure the strips of the desired thickness and width in lengths as manufactured. Assembly of small pieces/thicknesses of strips to make up the specified size shall not be permitted.

The concrete/masonry surface shall be cleaned free from dust and any loose particles. When the surface is dry, one coat of industrial blown type bitumen of grade 85/25 conforming to IS:702 shall be applied hot by brushing at the rate of 1.20 kg/sq.m. When the bitumen is still hot the preformed bitumen filler shall be pressed and held in position till it completely adheres. The surface of the filler against which further concreting/masonry work is to be done shall similarly be applied with one coat of hot bitumen at the rate of 1.20 kg/sq.m.

Sealing compound shall be heated to a pouring consistency for enabling it to run molten in a uniform manner into the joint. Before pouring the sealing compound, the vertical faces of the concrete joint shall be applied hot with a coat of bitumen primer conforming to IS:3384 in order to improve the adhesive quality of the sealing compound.

The Contractor shall construct recesses at all joints and on both faces of the concrete work except on the underside of ground slabs. The recesses shall be accurately formed to the lines and dimensions shown on the Drawings or as agreed with the Engineer-in-charge.

The Contractor shall prepare the surfaces of the recess and shall supply a joint sealer and fill or caulk the recess completely with it.

Joint sealing shall not be commenced without the approval of the Engineer-in-charge.

All joint sealers shall be from an approved manufacturer. The Contractor shall supply the manufacturer's test certificates for each consignment of each type of joint sealant delivered to the Site and shall if requested supply to the Engineer-in-charge sufficient samples of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate test procedure.

Sealants shall be installed in strict accordance with the manufacturer's instructions. De-bonding strip shall be used in conjunction with the sealers as indicated on the Drawings. The de-bonding strip shall be compatible with the joint sealer and shall be resistant to attach from the primer used to bond the sealer to the concrete.

Polysulphide sealants shall not abut bitumen sealers. Surfaces to receive Polysulphide sealants shall be kept free from bituminous paints. All sealants shall be appropriate for the prevailing climatic conditions. Bituminous sealants shall comply with the BS 2499 and Polysulphide sealants shall comply with IS 12118/BS 4254.

2.10.3 Measurement

Measurement for the preformed joint filler shall be in sq.m correct to two places of decimal for the specified thickness as per items of work. Measurement for applying the bitumen coat to concrete/masonry surfaces shall be in sq.m correct to two places of decimal. Measurement for the joint sealing compound shall be in running meters correct to two places of decimal for the specified width and thickness as per the items of work.

2.11 Concreting Records

A written record of the concrete works shall be made each day by the Contractor and kept available for inspection by the Engineer-in-charge. The diary shall contain notes and records of :

- The names of the Contractor's Engineer-in-charge who are responsible for the different phases of the concrete work and also the names of their assistants.

- The temperatures of air, water, cement, aggregates, together with the air humidity and type of weather.

- Deliveries to the Site of concrete materials (quantity, brand of concrete, etc).

- Inspections carried out, tests performed, etc. and their results.

- Times of commencement and completion of different parts of the concrete works and times of erection and striking of forms.

- Quantity of cement, fine and coarse aggregate and admixture used for each section of work and the number and kind of test samples taken on these ingredients and water.

2.12 Admixtures

Accelerating, retarding, water-reducing and air entraining admixtures shall conform to IS:9103 and integral water proofing admixtures to IS:2645.

Admixtures may be used in concrete as per manufacturer's instructions only with the approval of the Engineer-in-charge. Trial mixes shall verify an admixture's suitability and effectiveness with the other materials used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedment.

Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

3.0 GENERAL CIVIL WORKS

MASONRY, PLASTERING AND PAINTING

3.1 Applicable Codes and Specifications

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest editions including all applicable official amendments and revisions shall be referred to.

IS: 110 - Ready mixed paint, brushing, grey filler, for enamels for use over primers
IS: 269 - Specification for 33 grade ordinary Portland cement
IS: 280 - Specification for mild steel wire for general Engineering purposes
IS: 287 - Recommendations for maximum permissible moisture content of timber used for different purposes
IS: 304 - High Tensile Brass Ingots and Castings.
IS: 337 - Varnish, finishing interior
IS: 348 - French polish
IS: 383 - Specification for coarse and fine aggregates from natural sources for concrete
IS: 412 - Expanded metal steel sheets for general purposes
IS: 419 - Specification for putty for use on window frames
IS: 428 - Distemper, oil emulsion, colour as required

IS: 459	-	Specification for unreinforced corrugated and semi-corrugated asbestos cement sheets
IS: 702	-	Specification for industrial bitumen
IS: 710	-	Specification for marine plywood
IS: 712	-	Specification for building limes
IS: 730	-	Specification for hook bolts for corrugated sheet roofing
IS: 733	-	Wrought aluminum and aluminum alloys, bars, rods and sections for general Engineering purposes
IS: 777	-	Specification for glazed earthenware tiles
IS: 1003	-	Specification for timber panelled and glazed shutters (Parts 1 & 2)
IS: 1038	-	Specification for steel doors, windows and ventilators
IS: 1077	-	Specification for common burnt clay building bricks
IS: 1081	-	Code of practice for fixing and glazing of metal (steel & aluminum) doors, windows and ventilators
IS: 1124	-	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones
IS: 1237	-	Specification for cement concrete flooring tiles
IS: 1322	-	Bitumen felts for water proofing and damp proofing
IS: 1346	-	Code of practice for water proofing of roofs with bitumen felts
IS: 1361	-	Specification for steel windows for industrial buildings
IS: 1397	-	Specification for kraft paper
IS: 1443	-	Code of practice for laying and finishing of cement concrete flooring tiles
IS: 1477	-	Code of practice for painting of ferrous metals in buildings (Parts 1 & 2)
IS: 1542	-	Specification for sand for plaster
IS: 1580	-	Specification for bituminous compounds for water-proofing and caulking purposes
IS: 1597	-	Code of practice for construction of stone masonry: Part 1 Rubble stone masonry
IS: 1659	-	Specification for block boards
IS: 1661	-	Code of practice for application of cement and cement-lime plaster finishes
IS: 1834	-	Specification for hot applied sealing compound for joint in concrete
IS: 1838	-	Specification for preformed fillers for expansion joint in concrete pavements and structures (non extruding and resilient type): Part 1 Bitumen impregnated fiber
IS: 1948	-	Specification for aluminum doors, windows and ventilators
IS: 1949	-	Specification for aluminum windows for industrial buildings
IS: 2074	-	Ready mixed paint, air-drying, red oxide- zinc chrome, and priming
IS: 2098	-	Asbestos cement building boards
IS: 2114	-	Code of practice for laying in-situ terrazzo floor finish
IS: 2116	-	Specification for sand for masonry mortars
IS: 2185	-	Specification for concrete masonry units (Parts 1,2 & 3)
IS: 2202	-	Specification for wooden flush door shutters (Solid core type): Parts 1 & 2
IS: 2212	-	Code of practice for brickwork
IS: 2250	-	Code of practice for preparation and use of masonry mortars
IS: 2338	-	Code of practice for finishing of wood and wood based materials (Parts 1 & 2)
IS: 2339	-	Aluminum paint for general purposes, in dual container
IS: 2395	-	Code of practice for painting concrete, masonry and plaster surfaces (Parts 1 & 2)
IS: 2402	-	Code of practice for external rendered finishes
IS: 2571	-	Code of practice for laying in-situ cement concrete flooring
IS: 2572	-	Code of practice for construction of hollow concrete block masonry
IS: 2645	-	Specification of integral cement waterproofing compounds
IS: 2690	-	Specification for burnt clay flat terracing tiles: Part 1 Machine made
IS: 2691	-	Specification for burnt clay-facing bricks
IS: 2750	-	Specification for steel scaffoldings
IS: 2835	-	Flat transparent sheet glass
IS: 2932	-	Specification for enamel, synthetic, exterior type (a) undercoating, (b) finishing
IS: 3007	-	Code of practice for lying of asbestos cement sheets - corrugated and (Part 1 & 2) semi-corrugated sheets
IS: 3036	-	Code of practice for laying lime concrete for a waterproofed roof finish
IS: 3067	-	Code of practice of general design details and preparatory work for damp-proofing and water-proofing of buildings
IS: 3068	-	Specification for broken brick (burnt clay) coarse aggregates for use in lime concrete
IS: 3384	-	Specification for bitumen primer for use in waterproofing and damp proofing
IS: 3461	-	Specification for PVC-asbestos floor tiles
IS: 3462	-	Specification for unbacked flexible PVC flooring
IS: 3495	-	Method of test for burnt clay building bricks: Part 1 to 4
IS: 3536	-	Specification for ready mixed paint, brushing, wood primer, pink
IS: 3564	-	Specification for door closers (hydraulically regulated)
IS: 3696	-	Safety code of scaffolds and ladders (Parts 1 & 2)

IS: 4020	-	Methods of test for wooden flush door: Type test
IS: 4021	-	Specification for timber door, window and ventilator frames
IS: 4351	-	Specification for steel doorframes
IS: 4443	-	Code of practice for use of resin type chemical resistant mortars
IS: 4457	-	Specification for ceramic unglazed vitreous acid resisting tile
IS: 4631	-	Code of practice for laying epoxy resin floor toppings
IS: 4832	-	Specification for chemical resistant mortars (Part II)
IS: 4860	-	Specification for acid resistant bricks
IS: 4948	-	Specification for welded steel wire fabric for general use
IS: 5318	-	Code of practice for laying of flexible PVC sheet and tile flooring
IS: 5410	-	Cement paint, colour as required
IS: 5411	-	Specification for plastic emulsion paint (Parts 1 & 2)
IS: 5437	-	Wired and figured glass
IS: 5491	-	Code of practice for laying of in-situ granolithic concrete floor topping
IS: 6041	-	Code of practice construction of autoclaved cellular concrete block masonry
IS: 6042	-	Code of practice for construction of light weight concrete block masonry
IS: 6248	-	Specification for metal rolling shutters and rolling grilles
IS: 7193	-	Specification for glass fiber base coal tar pitch and bitumen felts
IS: 7452	-	Specification for hot rolled steel sections for doors, windows and ventilators
IS: 8042	-	Specification for white Portland cement
IS: 8543	-	Methods of testing plastics
IS: 8869	-	Specification for washers for corrugated sheet roofing
IS: 9197	-	Specification for epoxy resin, hardeners and epoxy resin composites for floor topping
IS: 9862	-	Specification for ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and chlorine resisting
IS: 12200	-	Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams
BS: 476 (Part – 20)	-	Methods for determination of the fire resistance of elements of construction (General Principles)
BS: 476 (Part – 21)	-	Methods for determination of the fire resistance of load bearing elements of construction
BS: 476 (Part – 22)	-	Methods for determination of the fire resistance of non-load bearing elements of construction
Part – IV Fire Protection	-	National Building code of India

3.2 Brick Masonry

3.2.1 Materials

Bricks used in the works shall conform to the requirements laid down in IS: 1077. The class of the bricks shall be as specifically indicated in the respective items of work.

The nominal size of the modular brick shall be 200mmx100mmx100mm with the permissible tolerances over the actual size of 190mmx90mmx90mm as per IS: 1077. The nominal thickness of one brick and half brick walls using modular bricks shall be considered as 200 mm and 100 mm respectively. In the event of use of traditional bricks of nominal size 230 mmx115mmx75mm with tolerance up to ±3 mm in each dimension, one brick and half brick walls shall be considered as 230 mm and 115 mm respectively.

Bricks shall be sound, hard, homogenous in texture, well burnt in kiln without being vitrified, hand/machine molded, deep red, cherry or copper coloured, of regular shape and size & shall have sharp and square edges with smooth rectangular faces. The bricks shall be free from pores, cracks, flaws and nodules of free lime. Hand molded bricks shall be molded with a frog and those made by extrusion process may not be provided with a frog. Bricks shall give a clear ringing sound when struck and shall have a minimum crushing strength of 35N/sq.mm unless otherwise specified in the items of work.

The average water absorption shall not be more than 20 percent by weight up to class 12.5 and 15 percent by weight for higher classes. Bricks, which do not conform to this requirement, shall be rejected. Over or under burnt bricks are not acceptable for use in the works.

Sample bricks shall be submitted to the Engineer-in-charge for approval and bricks supplied shall conform to approve samples. If demanded by Engineer-in-charge, brick samples shall be got tested as per IS: 3495 by Contractor. Bricks rejected by Engineer-in-charge shall be removed from the site of works within 24 hours.
If good quality burnt clay bricks are not available, Contractor may use Fly ash
bricks conforming to IS specifications, at no extra cost. Fly Ash Bricks should maintain as per IS : 13757

3.2.2 Mortar

Mortar for brick masonry shall consist of cement and sand and shall be prepared as per IS: 2250. Mix shall be in the proportion of 1:6 for brickwork of thickness one brick or above and 1:4 for brickwork of thickness half brick or below, unless otherwise specified in the respective items of work. Sand for masonry mortar shall conform to IS: 2116. The sand shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by Engineer-in-charge. If so directed by the Engineer-in-charge, sand shall be screened and washed till it satisfies the limits of deleterious materials.

For preparing cement mortar, the ingredients shall first be mixed thoroughly in dry condition. Water shall then be added and mixing continued to give a uniform mix of required consistency. Mixing shall be done thoroughly in a mechanical mixer, unless hand mixing is specifically permitted by the Engineer-in-charge. The mortar thus mixed shall be used as soon as possible preferably within 30 minutes from the time water is added to cement. Incase, the mortar has stiffened due to evaporation of water, this may be re-tempered by adding water as required to restore consistency, but this will be permitted only up to 30 minutes from the time of initial mixing of water to cement. Any mortar, which is partially set, shall be rejected and shall be removed forthwith from the site. Droppings of mortar shall not be re-used under any circumstances.

The Contractor shall arrange for test on mortar samples if so directed by the Engineer-in-charge.

3.2.3 Soaking of Bricks

Bricks shall be soaked in water before use for a period for the water to just penetrate the whole depth of the bricks. Alternatively, bricks may be adequately soaked in stacks by profusely spraying with clean water at regular intervals for a period not less than six hours. The bricks required for masonry work using mud mortar shall not be soaked. When the bricks are soaked they shall be removed from the tank sufficiently early so that at the time of laying they are skin-dry. Such soaked bricks shall be stacked on a clean place where they are not again spoiled by dirt earth etc.

Note I

The period of soaking may be easily found at site by a field test in which the bricks are soaked to water for different periods and then broken to find the extent of water penetration. The least period that corresponds to complete soaking will be this one to be allowed for in construction work.

Note II

If the bricks are soaked for the required time in water that is frequently changed the soluble salt in the bricks will be leached out, and subsequently efflorescence will be reduced.

3.2.4 Laying

Bricks shall be laid in English Bond unless otherwise specified. For brick work in half brick wall, bricks shall be laid in stretcher bond. Half or cut bricks shall not be used except as closer where necessary to complete the bond. Closers in such cases, shall be cut to the required size and used near the ends of the wall. Header bond shall be used preferably in all courses in curved plan for ensuring better alignment.

Note

Header bond shall also be used in foundation footings unless thickness of walls (width of footing) makes the use of headers impracticable. Where thickness of footing is uniform for a number of courses, the top course of footing shall be header.

All loose materials, dirt and set lumps of mortar which may be lying over the surface on which brick work is to be freshly started, shall be removed with a wire brush and surface wetted. Bricks shall be laid on a full bed of mortar, when laying, each brick shall, be properly bedded and set in position by gently pressing with the handle of trowel. Its inside face shall be buttered with mortar before the next brick is laid and pressed against it. Joints shall be fully filled and packed with mortar such that no hollow spaces are left inside the joints.

The walls shall be taken up truly in plumb or true to the required batter where specified. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in the alternate course shall come directly one over the other. Quoin, Jambs and other angles shall be properly plumbed as the work proceeds. Care shall be taken to keep the perpends properly aligned within following maximum permissible tolerances:

a) Deviation from vertical within a storey shall not exceed 6 mm per 3 m height.

b) Deviation in vertically in total height of any wall of building more than one storey in height shall not exceed 12.5 mm.

c) Deviation from position shown on plan of any brick work shall not exceed 12.5 mm.

d) Relative displacement between loads bearing wall in adjacent storeys intended to be vertical alignments shall not exceed 6 mm.

e) A set of tools comprising of wooden straight edge, Masonic spirit levels, square, 1-meter rule line and plumb shall be kept on the site of work for every 3 masons for proper check during the progress of work.

All quoins shall be accurately constructed and the height of brick courses shall be kept uniform. This will be checked using graduated wooden straight edge or storey rod indicating height of each course including thickness of joints. The position of damp proof course, windowsills, bottom of lintels, top of the wall etc. along the height of the wall shall be marked on the graduated straight edge or storey rod. Acute and obtuse quoins shall be bonded, where practicable in the same way as square quoins. Obtuse quoins shall be formed with squint showing three quarters brick on one face and quarter brick on the other.

The brickwork shall be built in uniform layers.

No part of the wall during its construction shall rise more than one metre above the general construction level. Parts of wall left at different levels shall be raked back at an angle of 45 degrees or less with the horizontal. Toothing shall not be permitted as an alternative to raking back. For half brick partition to be keyed into main walls, indents shall be left in the main walls.

All pipe fittings and specials, spouts, hold fasts and other fixtures which are required to be built into the walls shall be embedded, as specified, in their correct position as the work proceeds unless otherwise directed by the Engineer-in-charge.

Top courses of all plinths, parapets, steps and top of walls below floor and roof slabs shall be laid with brick on edge, unless specified otherwise. Brick on edge laid in the top courses at corner of walls shall be properly radiated and keyed into position to form cut (maru) corners. Where bricks cannot be cut to the required shape to form cut (maru) corners, cement concrete 1:2:4 (1 cement; 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) equal to thickness of course shall be provided in lieu of cut bricks.

Bricks shall be laid with frog (where provided) up. However, when top course is exposed, bricks shall be laid with frog down. For the bricks to be laid with frog down, the frog shall be filled with mortar before placing the brick in position.

In case of walls one brick thick and under, one face shall be kept even and in proper plane, while the other face may be slightly rough. In case of walls more than one brick thick, both the faces shall be kept even and in proper plane.

To facilitate taking service lines later without excessive cutting of completed work, sleeves (to be paid separately) shall be provided, where specified, while raising the brickwork. Such sleeves in external walls shall be sloped down outward so as to avoid passage of water inside.

Top of the brickwork in coping and sills in external walls shall be slightly tilted. Where brick coping and sills are projecting beyond the face of the wall, drip course / throating shall be provided where indicated.

Care shall be taken during construction that edges of jambs, sills and projections are not damaged in case of rain. New built work shall be covered with gunny bags or tarpaulin so as to prevent the mortar from being washed away. Damage, if any, shall be made good to the satisfaction of the Engineer-in-charge.

Vertical reinforcement in the form of bars (MS or high strength deformed bar), considered necessary at the corners and junction of walls and jamb opening doors, windows etc. shall be encased with cement mortar not leaner than 1:4 (1 cement: 4 coarse sand), or cement concrete mix as specified. The reinforcement shall be suitably tied, properly embedded in the foundation and at roof level. The diameter of bars shall not be less than 8 mm and concrete grade shall be minimum 1:3:6 (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size).

In retaining walls and the like, where water is likely to accumulate, weep holes, 50 to 75 mm square shall be provided at 2 m vertically and horizontally unless otherwise specified. The lowest weep hole shall be at about 30 cm above the ground level. All weep holes shall be surrounded by loose stones and shall have sufficient fall to drain out the water quickly.

Work of cutting chases, wherever required to be made in the walls for housing G.I pipe, CI pipe or any other fixtures shall be carried out in various locations as per guidelines given below:

a) Cutting of chases in one brick thick and above load bearing walls.

   i) As far as possible services should be planned with the help of vertical chases. Horizontal chases should be avoided.

   ii) The depths of vertical chases and horizontal chases shall not exceed one third and one-sixth of the thickness of the masonry respectively.

   iii) When narrow stretches of masonry (or short length of walls) such as between doors and windows, cannot be avoided they should not be pierced with openings for soil pipes or waste pipes or timber joints, etc. where there is a possibility of load concentration such narrow lengths of walls shall be checked for stresses and high strength bricks in mortar or concrete walls provided, if required.

   iv) Horizontal chases when unavoidable should be located in the upper or lower one-third of height of storey and not more than three chases should be permitted in any stretch of a wall. No continuous horizontal chase shall exceed one metre in length. Where unavoidable, stresses in the affected area should be checked and kept within the permissible limits.

   v) Vertical chases should not be closer than 2 m in any stretch of a wall. These shall be kept away from bearings of beams and lintels. If unavoidable, stresses in the affected area should be checked and kept within permissible limits.

   vi) Masonry directly above a recess, if wider than 30 cm horizontal dimension) should be supported on lintel. Holes in masonry may be provided up to 30 cm width and 30 cm height without any lintel. In the case of circular holes in the masonry, no lintel need be provided for holes up to 40 cm in diameter.

b) Cutting of chases in half brick load bearing walls.

   No chase shall be permitted in half brick load bearing walls and as such no recessed conduits and concealed pipes shall be provided with half brick thick load bearing, walls.

c) Cutting of chases in half brick non-load bearing wall:

   Services should be planned with the help of vertical chases. Horizontal chase should be provided only when unavoidable.

3.2.5 Joints

The thickness of all types of joints including brick wall joints and cross joints shall be such that four course and three joints taken consecutively shall measure as follows:

i) In case of modular bricks conforming to IS: 1077 specification for common burnt clay buildings bricks, equal to 39 cm.

ii) In case of non-modular bricks, it shall be equal to 31 cm.

Note

Specified thickness of joints shall be of 1 cm deviation from the specified thickness of all joints shall not exceed one-fifth of specified thickness.

Finishing of Joints

The face of brick work may be finished flush or by pointing. In flush finishing either the face joints of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work or the joints shall be squarely raked out to a depth of 1 cm while the mortar is still green for subsequently plastering. The faces of brick work shall be cleaned with wire brush so as to remove any splashes of mortar during the course of rising the brick work. In pointing, the joints shall be squarely raked out to a depth of 1.5 cm while the mortar is still green and raked joints shall be brushed to remove dust and loose particles and well wetted, and shall be later refilled with mortar to give ruled finish. Some such finishes are 'flush', 'weathered', ruled, etc.

3.2.6 Curing

The brickwork shall be constantly kept moist on all faces for a minimum period of seven days. Brickwork done during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period.

3.2.7 Scaffolding

Scaffolding shall be strong to withstand all dead, live and impact loads, which are likely to come on them. Scaffolding shall be provided to allow easy approach to every part of the work.

3.2.8 Double Scaffolding

For all brick masonry work double scaffolding having two independent supports, clear of the work, shall be provided.

3.2.9 Measurements

Brickwork shall be measured in cubic metres unless otherwise specified. Any extra work over the specified dimensions shall be ignored. Dimensions shall be measured correct to the nearest 0.01 m i.e. 1 cm. Areas shall be calculated to the nearest 0.01 sq mtrs and the cubic contents shall be worked out to the nearest 0.01 cubic metres.

No deductions or additions shall be done and no extra payment made for the following:

Note

Where minimum area is defined for deduction of an opening, void or both, such areas shall refer only to opening or void within the space measured.

a) Ends of dissimilar materials (that is, joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps, etc); up to 0.1 m^2 in section;

b) Opening up to 0.1 m^2 in area

c) Wall plates, bed plates, and bearing of slabs, chajjas and the like, where thickness does not exceed 10 cm and bearing does not extend over the full thickness of wall;

d) Cement concrete blocks as for hold fasts and holding down bolts;

e) Iron fixtures, such as wall ties, pipes up to 300 mm diameter and hold fasts for doors and windows; and

f) Chases of section not exceeding 50 cm in girth.

g) Bearing portion of drip course, bearing of molding and cornice.

Note

In calculating area of an opening, any separate lintel or sills shall be included with the size of the opening but end portions of lintel shall be excluded. Extra width of rebated reveals, if any, shall also be excluded.

Walls half brick thick and less shall each be measured separately in square metres stating thickness.

String courses, projecting pilasters, aprons, sills and other projections shall be fully described and shall not be measured separately.

Circular pillars shall be measured separately in cubic metres as per actual dimensions.

Brick work curved on plan shall be measured like the brick work in straight walls and shall include all cutting and wastage of bricks, tapered vertical joints and use of extra mortar, if any. Brickwork curved on plan to a mean radius not exceeding six metres shall be measured separately and extra shall be payable over the rates for brick work in straight walls. Nothing extra shall be payable if the mean radius of the brickwork curved in plan exceeds six metres.

Tapered walls shall be measured net as walls and no extra payment shall be allowed for making tapered surface for brickwork in walls.

3.2.10 Rate

The rate shall include the cost of materials and labour required for all the operations described above except the vertical reinforcement and its encasement in cement mortar or cement concrete. The rate shall also include the following:

a) Raking out joints or finishing joints flush as the work proceeds;

b) Preparing tops of existing walls and the like for raising further new brickwork.

c) Rough cutting and waste for forming gables, splays at eaves and the like.

d) Leaving holes for pipes up to 150 mm diameters And encasing hold fasts etc.

e) Rough cutting and waste for brick work curved in plan and for backing to stone or other types of facing.

f) Embedding in ends of beams, joists, slabs, lintels, sills, trusses, etc.

g) Bedding wall plates, lintels, sills, roof tiles, corrugated sheets, etc. in or on walls if not covered in respective items and

h) Leaving chases of section not exceeding 50 cm in girth or 750 sq. cm in cross-section.

i) Brick on edge courses, cut brick corners, splays reveals, cavity walls, brick works

3.3 Random Rubble Masonry

Squared Rubble Masonry (cut-size).

3.3.1 Stone

The stone shall be of the type specified in BOQ or as directed by Engineer-in-charge-in-charge such as granite, trap, limestone, sand stone, quartzite, etc. and shall be obtained from the quarries, approved by the Engineer-in-charge. Stone shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible stones shall be of uniform colour, quality or texture. Generally stone shall not contain crypts crystalline silica or chart, mica and other deleterious materials like iron-oxide organic impurities etc.

Stones with round surface shall not be used.

The compressive strength of common types of stones shall be as per Table 1 and the percentage of water absorption shall generally not exceed 5% for stones other than specified in Table 1. For literate this percentage is 12%.

TABLE 1

Type of stone	Maximum water Absorption percentage by weight	Minimum compressive strength kg/sq.cm.
Granite	0.5	1000
Basalt	0.5	400
Lime stone (Slab & Tiles)	0.15	200
Sand stone (Slab & Tiles)	2.5	300
Marble	0.40	500
Quartzite	0.40	800
Literate (Block)	12	35

Note 1: Test for compressive strength shall be carried out as laid down in IS: 1121 (Part I)

Note 2: Test for water absorption shall be carried out as laid down in IS: 1124.

3.3.2 Size of Stones

Normally stones used should be small enough to be lifted and placed by hand. Unless otherwise indicated, the length of stones for stone masonry shall not exceed three times the height and the breadth or base shall not be greater than three-fourth the thickness of wall, or not less than 15 cm. The height of stone may be up to 30 cm.

3.3.3 (i) Random Rubble Masonry shall be uncoursed or brought to courses as specified. Uncoursed random rubble masonry shall be constructed with stones of sizes as referred to in para 4.2.2 and shapes picked up random from the stones brought from the approved quarry. Stones having sharp corners or round surfaces shall however, not be used.

(ii) Random rubble masonry brought to the course is similar to uncoursed random rubble masonry except that the courses are roughly leveled at intervals varying from 30 cm to 90 cm in height according to the size of stones used.

3.3.4 (a) Uncoursed: In this type, the stones shall be roughly squared as risers or jumpers and stretchers with varying heights and shall be laid uncoursed.

(b) Brought to course: The stones shall be similar to those used for uncoursed rubble but the work is leveled to coursed of varying depth from 30 cm to 60 cm in height.

(c) Coursed: Coursed walling shall be built in coursed which may vary in height from 10 to 30 cm but the stones in any one course are roughly squared to the same height.

3.3.5 Dressing

(i) Random Rubble Masonry
Each stone shall be hammer dressed on the face, the sides and the bed. Hammer dressing shall enable the stones to be laid close to neighboring stones such that the building in the face shall not project more than 40 mm on the exposed face and 10 mm on the face to be plastered.

(ii) Size Stone Masonry
Face stone should be hammer dressed on all beds & joints so as to give them approximately rectangular shape. The bushes on the face shall not be more than 20 mm. The bed joint shall be chisel drafted for at least 8 cm back from the face and for the side joints at least 4 cm. No portion of chisel dressed surface shall show a depression of more than 6 mm from a straight edge placed on it. The remaining portion of the stone shall not project beyond the surface of Bed and side joints.

3.3.6 Mortar

The mortar used for joining shall be as specified.

3.3.7 Laying

All stones shall be wetted before use. Each stone shall be placed close to the stones already laid so that the thickness of the mortar joints at the face is not more than 20 mm. Face stones shall be arranged suitably to stagger the vertical joints and long vertical joints shall be avoided. Stones for hearting or interior filling shall be hammered down with wooden mallet into the position firmly bedded in mortar. Chips or sprawls of stones may be used for filling of interstices between the adjacent stones in heartening and these shall not exceed 20% of the quantity of stone masonry for Random Rubble & 10% for squared rubble masonry. To form a bond between successive courses plum stones projecting vertically by about 15 to 20 cm shall be firmly embedded in the heartening at the interval of about one metre in every course. No hollow space shall be left any where in the masonry.

The masonry work in wall shall be carried up true to plumb or to specified batter.

Also for squared coursed Rubble Masonry the face stone, quoin and jamb stones and bond stones shall be roughly squared to the same height in any one course. The height of courses shall be 10 to 30 cm.No course shall be of greater height than the course below and all bond stone shall be provided at 1.4 to 1.8 meters apart in every course.

Random rubble masonry shall be brought to the level courses at plinth, windowsills, lintel and roof levels. Leveling shall be done with concrete comprising of one part of the mortar as used for masonry and two parts of graded stone aggregate of 20 mm nominal size.

The masonry in structure shall be carried uniformly. Where the masonry of one part is to be delayed, the work shall be raked back at an angle not steeper than 45^{o}.

3.3.8 Bond Stones

Bond or through stones running right through the thickness of walls, shall be provided in walls up to 60cm thick and in case of walls above 60cm thickness, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided in a line from face of the wall to the back.

For all thick nesses of such walls, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Length of each such bond stone shall not be less than two-third of the thickness of the wall.

Where bond stones of suitable lengths are not available precast cement concrete block of 1:2:4 mix (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm nominal size) of cross section not less than 225 square centimeters and length equal to the thickness of wall shall be used in lieu of bond stones. (This shall be applicable only in masonry below ground level and where masonry above ground level is finally required to be plastered).

At least one bond stone or a set of bond stones shall be provided for every 0.5 sq.m of the area of wall surface. All bond stones shall be marked suitably with paint as directed by the Engineer-in-charge.

3.3.9 Quoin and Jamb Stones

The quoin and jamb stones shall be of selected stones neatly dressed with hammer or chisel to form the required angle. Quoin stones shall not be less than 0.01 cum in volume. Height of quoins and jamb stones shall not be less than 15 cm. Quoins shall be header and stretcher alternatively.

3.3.10 Joints

Stones shall be so laid that all joints are fully packed with mortar and chips. Face joints shall not be more than 20 mm thick.

The joints shall be struck flush and finished at the time of laying when plastering or pointing is not to be done. For the surfaces to be plastered or pointed, the joints shall be raked to a minimum depth of 20 mm when the mortar is still green.

3.3.11 Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars less than one meter in width or near the skew back of arches. The holes left in masonry work for supporting scaffolding shall be filled and made good with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size).

3.3.12 Curing

Masonry work in cement or composite mortar shall be kept constantly moist on all faces for a minimum period of seven days. In case of masonry with fat lime mortar curing shall, commence two days after laying of masonry and shall continue for at least seven days thereafter.

3.3.13 Protection

Green work shall be protected from rain by suitably covering. The work shall also be suitably protected from damage, mortar dropping and rain during construction.

3.3.13.1 Measurements

The length, height and thickness shall be measured correct to a cm. The thickness of wall shall be measured at joints excluding the bushing. Only specified dimensions shall be allowed; anything extra shall be ignored. The quantity shall be calculated in cubic metre nearest to two places of decimal.

3.3.13.2 No deduction shall be made nor extra payment made for the following:

i) Ends of dissimilar materials (that is joists, beams, lintels, posts, girders, rafters purlins, trusses, corbels, steps, etc.) up to 0.1 sqm in section.

ii) Openings each up to 0.1 sqm in area. In calculating the area of openings, any separation lintels or sills shall be included along with the size of opening but the end portions of the lintels shall be excluded and the extra width of rebated reveals, if any, shall also be excluded.

iii) Wall plates and bedplates, and bearing of chajjas and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the wall.

Note: The bearing of floor and roof shall be deducted from wall masonry.

iv) Drain holes and recesses for cement concrete blocks to embed hold fasts for doors, windows, etc.

v) Building in masonry, iron fixture, pipes up to 300 mm diameter, hold fasts of doors and windows, etc.

vi) Forming chases in masonry each up to section of 350 sq.cm.

3.3.14 Square or Rectangular Pillars

These shall be measured as walls, but extra payment shall be allowed for stonework in square or rectangular pillars over the rate for stone work in walls. Rectangular pillar shall mean a detached masonry support rectangular in section, such that its breadth does not exceed two and a half times the thickness.

3.3.15 Circular Pillars (Columns)

These shall be measured as per actual dimensions, but extra payment shall be allowed for stone work in circular pillars over the rate for stone work in walls. The diameter as well as length shall be measured correct to a cm.

3.3.16 Tapered walls shall be measured net, as per actual dimensions and paid for as other walls.

3.3.17 Curved Masonry

Stone masonry curved on plan to a mean radius exceeding 6 metres shall be measured and included with general stonework. Stonework circular on plan to a mean radius not exceeding 6 metres shall be measured separately and shall include all cuttings and waste and templates. It shall be measured as the mean length of the wall.

3.3.18 Rate

The rate shall include the cost of materials and labour required for all the operations described above and shall include the following :

(a) Raking out joints for plastering or pointing done as a separate item, or finishing flush as the work proceeds.

(b) Preparing tops and sides of existing walls for raising and extending.

(c) Rough cutting and waste for forming gables cores, skew backs of spandrels or arches, splays at eaves and all rough cutting in the body of walling unless otherwise specified.

(d) Bond stones or cement concrete bond blocks.

(e) Leading and making holes for pipes etc.

(f) Bedding and pointing wall plates, lintels, sills etc. in or on walls, bedding roof tiles and corrugated sheets in or on walls.

(g) Building in ends of joists, beams, lintels, etc.

3.4 Cement Plastering Work

3.4.1 Materials

The proportions of the cement mortar for plastering shall be 1:4 (one part of cement to four parts of sand) or as specified in respective items. Cement and sand shall be mixed thoroughly in dry condition and then just enough water added to obtain a workable consistency. The quality of water and cement shall be as per relevant IS standards. The quality and grading of sand for plastering shall conform to IS:1542. The mixing shall be done thoroughly in a mechanical mixer unless hand mixing is specifically permitted by the Engineer-in-charge. If so desired by the Engineer-in-charge sand shall be screened and washed to meet the Specifications. The mortar thus mixed shall be used as soon as possible preferably within 30 minutes from the time water is added to cement. In case the mortar has stiffened due to evaporation of water this may be re- tempered by adding water as required to restore consistency but this will be permitted only up to 30 minutes from the time of initial mixing of water to cement. Any mortar, which is partially set, shall be rejected and removed forthwith from the site. Droppings of plaster shall not be re-used under any circumstances.

3.4.2 Workmanship

Preparation of surfaces and application of plaster finishes shall generally conform to the requirements specified in IS: 1661 and IS: 2402.

Plastering operations shall not be commenced until installation of all fittings and fixtures such as door/window panels, pipes, conduits etc. are completed.

All joints in masonry shall be raked as the work proceeds to a depth of 10mm/20mm for brick/stone masonry respectively with a tool made for the purpose when the mortar is still green. The masonry surface to be rendered shall be washed with clean water to remove all dirt, loose materials, etc., Concrete surfaces to be rendered shall be roughened suitably by hacking or bush hammering for proper adhesion of plaster and the surface shall be evenly wetted to provide the correct suction. The masonry surfaces should not be too wet but only damp at the time of plastering. The dampness shall be uniform to get uniform bond between the plaster and the masonry surface.

Interior plain faced plaster - This plaster shall be laid in a single coat of 15mm thickness. The mortar shall be dashed against the prepared surface with a trowel. The dashing of the coat shall be done using a strong whipping motion at right angles to the face of the wall or it may be applied with a plaster machine. The coat shall be trowelled hard and tight forcing it to surface depressions to obtain a permanent bond and finished to smooth surface. Interior plaster shall be carried out on jambs, lintel and sill faces, etc. as shown in the drawing and as directed by the Engineer-in-charge.

Plain Faced Ceiling plaster - This plaster shall be applied in a single coat of 10 mm thickness. Application of mortar shall be as stipulated in above paragraph.

Exterior plain faced plaster - This plaster shall be applied in 2 coats. The first coat or the rendering coat shall be approximately 14mm thick. The rendering coat shall be applied as stipulated above except finishing it to a true and even surface and then lightly roughened by cross scratch lines to provide bond for the finishing coat. The rendering coat shall be cured for at least two days and then allowed to dry. The second coat or finishing coat shall be 6 mm thick. Before application of the second coat, the rendering coat shall be evenly damped. The second coat shall be applied from top to bottom in one operation without joints and shall be finished leaving an even and uniform surface. The mortar proportions for the coats shall be as specified in the respective item of work. The finished plastering work shall be cured for at least 7 days.

Exterior Sand Faced Plaster for Stone Masonry, Roof gutters etc. - This plaster shall be applied in 2 coats. The first coat shall be approximately 14mm thick and the second coat shall be 6mm thick. These coats shall be applied as stipulated above. However, only approved quality sand shall be used for the second coat and for the finishing work. Sand for the finishing work shall be coarse and shall be of even size and shall be dashed against the surface and sponged. The mortar proportions for the first and second coats shall be as specified in the respective items of work.

Wherever more than 20mm thick plaster has been specified, which is intended for purposes of providing beading, bands, etc. this work shall be carried out in two or three coats as directed by the Engineer-in-charge duly satisfying the requirements of curing each coat (rendering/floating) for a minimum period of 2 days and curing the finished work for at least 7 days.

In the case of pebble faced finish plaster, pebbles of approved size and quality shall be dashed against the final coat while it is still green to obtain as far as possible a uniform pattern all as directed by the Engineer-in-charge.

Where specified in the drawings, rectangular grooves of the dimensions indicated shall be provided in external plaster by means of timber battens when the plaster is still in green condition. Battens shall be carefully removed after the initial set of plaster and the broken edges and corners made good. All grooves shall be uniform in width and depth and shall be true to the lines and levels as per the drawings.

Curing of plaster shall be started as soon as the applied plaster has hardened sufficiently so as not to be damaged when watered. Curing shall be done by continuously applying water in a fine spray and shall be carried out for at least 7 days.

For waterproofing plaster, the Contractor shall provide the water-proofing admixture as specified in manufacturers instruction while preparing the cement mortar.

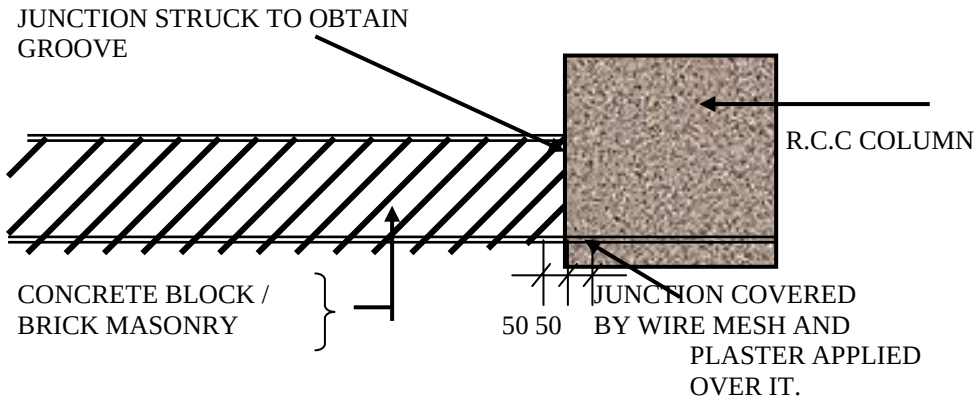
For external plaster, the plastering operations shall be commenced from the top floor and carried downwards. For internal plaster, the plastering operations for the walls shall commence at the top and carried downwards. Plastering shall be carried out to the full length of the wall or to natural breaking points like doors/windows etc. Ceiling plaster shall be completed first before commencing wall plastering.

The finished plaster surface shall not show any deviation more than 4mm when checked with a straight edge of 2m lengths placed against the surface.

To overcome the possibility of development of cracks in the plastering work following measures shall be adopted.

a) Plastering work shall be deferred as much as possible so that fairly complete drying shrinkage in concrete and masonry works takes place.

b) Where plastering is to be done over junction of two different materials e.g. concrete and masonry, a chicken mesh of 100 mm width shall cover the junction 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 groove as shown below:



Ceiling plaster shall be done, with a trowel cut at its junction with wall plaster. Similarly trowel cut shall be adopted between adjacent surfaces where discontinuity of the background exists.

3.4.3 Measurements

Measurement for plastering work shall be in sq.m correct to two places of decimal. Unless a separate item is provided for grooves, moldings, etc., these works are deemed to be included in the unit rates quoted for plastering work. The quantity of work to be paid for under these items shall be calculated by taking the projected surface of the areas plastered after making necessary deductions for openings for doors, windows, fan

openings etc. The actual plasterwork carried out on jambs/sills of windows, openings, etc. shall be measured for payment.

3.4.3.1 The rate includes for following:

(a) Preparation of surfaces
(b) Thickness of plasters Key in joints.
(c) Arrisers, chamfers of any width, internal rounded angles up to 80 mm in Width on girth except in case of mud plaster and leaping when angle etc. Of any girth are included.
(d) All labors & equipment necessary for incorporating admixtures in the manner specified by the manufacturer and in proportions indicated. The admixture (liquid water proofing compound) supplied shall be paid for Separately under relevant item of work, if not included in relevant item.
(e) Scoring surface of plastering for key, when the surface is not required to be finished fair.
(f) Providing Chicken mesh at the joints of dissimilar materials.
(g) Curing of plaster surface.
(h) Cleaning stains & dripping mortar from floors & walls etc.

3.5 Cement Pointing

3.5.1 Materials

The cement mortar for pointing shall be in the proportion of 1:3 (one part of cement to three parts of fine sand). Sand shall conform to IS: 1542 and shall be free from clay, shale, loam, alkali and organic matter and shall be of sound, hard, clean and durable particles. Sand shall be approved by Engineer-in-charge and if so directed it shall be washed/screened to meet specification requirements.

3.5.2 Workmanship

Where pointing of joints in masonry work is specified, the joints shall be raked at least 15mm/20mm deep in brick/stone masonry respectively as the work proceeds when the mortar is still green.

Any dust/dirt in the raked joints shall be brushed out clean and the joints shall be washed with water. The joints shall be damp at the time of pointing. Mortar shall be filled into joints and well pressed with special steel trowels. The joints shall not be disturbed after it has once begun to set. The joints of the pointed work shall be neat. The lines shall be regular and uniform in breadth and the joints shall be raised, flat, sunk or 'V' as may be specified in the respective items of work. No false joints shall be allowed.

The work shall be kept moist for at least 7 days after the pointing is completed. Whenever coloured pointing has to be done, the colouring pigment of the colour required shall be added to cement in such proportions as recommended by the manufacturer and as approved by the Engineer-in-charge.

3.5.3 Measurement

The quantity of work to be paid for under this item shall be measured in sq.m. Correct to two places of decimal by taking the projected surface of the area pointed after making necessary deductions for openings, etc.

3.6 Metal Lath and Wire Fabric

3.6.1 Materials

Welded steel wire fabric shall conform to IS: 4948.
Expanded metal shall conform to IS: 412.
Galvanized wire mesh shall be of approved quality.

3.6.2 Workmanship

The type and details of the steel material to be used for metal lath plastering work and at the junctions of masonry/concrete before wall plastering shall be as specified in the respective items of work.

For metal lath plastering work, the weight of steel material shall be not less than 1.6 kg/sq.m.

Steel material for use at the junction of masonry/concrete shall have the mesh dimensions not greater than 50 mm.

Steel material shall be obtained in maximum lengths as manufactured to restrict joints to the minimum. Overlap at the joints shall be minimum 25 mm which shall be securely tied with wires of diameter not less than 1.25 mm at spacing not more than 100 mm for lath plastering work. Nailing to wall shall be at spacing not exceeding 200 mm. The material shall be straightened, cut and bent to shape if required for fixing as per the details indicated in the drawings.

3.6.3 Measurement

Measurement shall be in sq.m correct to two places of decimal for the type as specified in the respective items of work.

3.7 Water-Proofing Admixtures

For use in cement works: Waterproofing admixture shall be liquid conforming to the requirements of relevant IS and shall be of approved manufacturer as approved by Engineer-in-charge-in-charge. The admixture shall not contain calcium chloride. The quantity of the admixture to be used for the works and method of mixing etc. shall be as per manufacturer's instructions and as directed by the Engineer-in-charge.

3.8 Painting of Concrete, Masonry & Plastered Surfaces

3.8.1 Materials

Oil bound distemper shall conform to IS: 428. The primer shall be alkali resistant primer of the same manufacture as that of the distemper.

Cement paint shall conform to IS: 5410. The primer shall be a thinned coat of cement paint.

Lead free acid, alkali and chlorine resisting paint shall conform to IS: 9862.

White wash shall be made from good quality fat lime conforming to IS: 712. It shall be slaked at site and mixed with water in the proportion of 5 liters of water to 1 kg of un-slaked lime stirred well to make a thin cream. This shall be allowed to stand for a minimum period of one day and strained through a clean coarse cloth. Four kg of adhesive dissolved in hot water shall be added to each cu.m of cream. 1.30 kg of sodium chloride dissolved in hot water shall then be added per 10 kg of lime used for the white wash to be ready for application.

Colour wash shall be made by addition of a suitable quantity of mineral pigment, not affected by lime, to the prepared white wash to obtain the shade/tint as approved by the Engineer-in-charge.

All the materials shall be of the best quality from an approved manufacturer. Contractor shall obtain prior approval of the Engineer-in-charge for the brand of manufacture and the colour/shade. All materials shall be brought to the site of works in sealed containers.

3.8.2 Workmanship

Contractor shall obtain the approval of the Engineer-in-charge regarding the readiness of the surfaces to receive the specified finish, before commencing the work on painting.

Painting of new surfaces shall be deferred as much as possible to allow for thorough drying of the sub- strata.

The surfaces to be treated shall be prepared by thoroughly brushing them free from dirt, mortar droppings and any loose foreign materials. Surfaces shall be free from oil, grease and efflorescence. Efflorescence shall be removed only by dry brushing of the growth. Cracks shall be filled with Gypsum. Workmanship of painting shall generally conform to IS: 2395.

Surfaces of doors, windows etc. shall be protected suitably to prevent paint finishes from splashing on them.

3.8.3 White Wash

The prepared surfaces shall be wetted and the finish applied by brushing. The operation for each coat shall consist of a stroke of the brush first given horizontally from the right and the other from the left and similarly, the subsequent stroke from bottom upwards and the other from top downwards, before the first coat dries. Each coat shall be allowed to dry before the next coat is applied. Minimum of 2 coats shall be applied unless otherwise specified. The dry surface shall present a uniform finish without any brush marks.

3.8.4 Colour Wash

Colour wash shall be applied in the same way as for white wash. A minimum of 2 coats shall be applied unless otherwise specified. The surface shall present a smooth and uniform finish without any streaks. The finished dry surface shall not show any signs of peeling/powdery and come off readily on the hand when rubbed.

3.8.5 Cement Paint

The prepared surfaces shall be wetted to control surface suction and to provide moisture to aid in proper curing of the paint. Cement paint shall be applied with a brush with stiff bristles. The primer coat shall be a thinned coat (50% consistency) of cement paint. The quantity of thinner shall be as per manufacturer's instructions. The coats shall be vigorously scrubbed to work the paint into any voids for providing a continuous paint film free from pinholes for effective water proofing in addition to decoration. Cement paint shall be brushed in uniform thickness and the covering capacity for two coats on plastered surfaces shall be 3 to 4 kg/sq.m. A minimum of 2 coats of the same colour shall be applied. At least 24 hours shall be left after the first coat to become sufficiently hard before the second coat is applied. The painted surfaces shall be thoroughly cured by sprinkling with water using a fog spray at least 2 to 3 times a day. Curing shall commence after about 12 hours when the paint hardens. Curing shall be continued for at least 2 days after the application of final coat. The operations for brushing each coat shall be as detailed above.

3.8.6 Oil Bound Distemper

The prepared surfaces shall be dry and provided with one coat of alkali resistant primer by brushing. The surface shall be finished uniformly without leaving any brush marks and allowed to dry for at least 48 hours. A minimum of two coats of oil bound distemper shall be applied, unless otherwise specified. The first coat shall be of a lighter tint. At least 24 hours shall be left after the first coat to become completely dry before the application of the second coat. Broad, stiff, double bristled distemper brushes shall be used for the work. The operations for brushing each coat shall be as detailed above.

3.8.7 Plastic Emulsion Paint

Paint shall be as per IS 5411. The prepared surface shall be dry and provided with one coat of primer, which shall be a thinned coat of emulsion paint. The quantity of thinner shall be as per manufacturer's instructions. The paint shall be laid on evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off constitutes one coat. The next coat shall be applied only after the first coat has dried and sufficiently become hard which normally takes about 2 to 3 hours. A minimum of 2 finishing coats of the same colour shall be applied unless otherwise specified. Paint may also be applied using rollers. The surface on finishing shall present a flat velvety smooth finish and uniform in shade without any patches.

3.8.8 Painting Priming coat on Wood, Iron or Plastered Surfaces:

Primer

1. The primer for woodwork, ironwork or plastered surface shall be as specified in the description of the item.

2. Primer for wood work / Iron & Steel / Plastered / Aluminum surfaces shall be as specified below:

	Surfaces	**Primer to be used**
a.	Wood work (hard and soft wood)	Pink conforming to IS 3536 – 1966
b.	Resinous wood and ply wood	Aluminum Primer
c.	Iron & Steel, aluminum and galvanized steel work:	Zinc chromate primer conforming to IS 104-1962

d.	Plastered surfaces, cement brick work, Asbestos surfaces for oil bound distemper and paint	Cement primer

3. The primer shall be ready mixed primer of approved band and manufacture.

Preparation of Surface:

Wood work:

The wood work to be painted shall be dry and free from moisture

The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any, shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material with same shade as paint shall be used where so desired by the Engineer-in-charge.

The surface treated for knotting shall be dry before painting is applied. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glaziers putty or wood putty (for specifications for glaziers putty and wood putty – refer as mentioned herein before). Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in the stopping and the latter is therefore liable to crack.

3.8.8.1 Application**:**

The primer/paint shall be applied with brushes, worked well into the surface and spread even and smooth. Crossing and laying off as described herein before shall do the painting.

3.8.9 Measurement

Measurement for all painting work shall be in sq.m correct to two places of decimal. Measurement shall be for the areas as executed duly deducting for any openings etc. as specified in MES mode of measurement Rate quoted shall also take into account the provision of necessary enabling works such as scaffolding, painter's cradle, tools & plants and cleaning of paint / primer spillage etc.

3.9 Flashing

3.9.1 Materials

Anodized Aluminum sheets shall be 1.00mm thick with anodic film thickness of 0.025 mm.

Galvanized mild steel sheets shall be 1.00mm thick with zinc coating of 800 gms/sq.m.

Bitumen felt shall be either Hessian base self finished bitumen felt Type-3 Grade I conforming to IS: 1322 or glass fiber base self finished felt Type-2 Grade 1 conforming to IS: 7193.

3.9.2 Workmanship

The type of the flashing and method of fixing shall be as specified.

Flashing shall be of the correct shape and size as indicated in the construction drawings and they shall be properly fixed to ensure their effectiveness.

Flashing shall be of long lengths so as to provide minimum number of joints. The minimum overlap at joints shall be 100mm.

Fixing of the flashing shall be either by bolting with bitumen washers or by tucking into the groove 75 mm wide x 65 mm deep in masonry/concrete along with cement mortar 1:4 filletting as indicated in the Drawings. Curing of the mortar shall be carried out for a minimum period of 4 days.

Bitumen felt flashing of the type as specified shall be provided with 2 coats of bituminous paint at the rate of 0.10 liter/sq.m after the installation.

3.9.3 Measurement

Measurement shall be in sq.m correct to two places of decimal. Measurement shall be for the actual area of the flashing material provided and the rate shall include for all the incidental works of bending to shape and fixing details as per the construction drawings.

FLOORING, TILING AND DADO

3.10 Terrazzo and Plain Cement Tiling Work

3.10.1 Materials

Terrazzo tiles and cement tiles shall generally conform in all respects to standards stipulated in IS: 1237. Tiles shall be of the best quality manufactured adopting hydraulic pressure of not less than $14N/mm^2$.

The type, quality, size, thickness colour etc, of the tiles for flooring/dado/skirting shall be as specified.
The aggregates for terrazzo topping shall consist of marble chips, which are hard, sound and dense. Cement to be used shall be either ordinary Portland cement or white cement with or without colouring pigment or ordinary Portland cement mixed with white cement. The binder mix shall be with 3 parts of cement to 1 part of marble powder by weight. The proportion of cement shall be inclusive of any pigments. For every one part of cement-marble powder binder mix, the proportion of aggregates shall be 1.75 parts by volume, if the chips are between 1mm to 6mm and 1.50 parts by volume if the chips are between 6mm to 25mm.

The minimum thickness of wearing layer of terrazzo tiles shall be 5mm for tiles with chips of size varying from 1mm up to 6mm or from 1mm up to 12mm. This shall be 6mm for tiles with chips varying from 1mm up to 25mm. The minimum thickness of wearing layer of cement/coloured cement tiles shall be 5mm. This shall be 6mm for heavy-duty tiles. Pigment used in the wearing layer shall not exceed 10 percent of the weight of cement used in the mix.

3.10.2 Workmanship

Laying and finishing of tiles shall conform to the requirements of workmanship stipulated in IS: 1443.

Tiling work shall be commenced only after the door and window frames are fixed and plastering of the walls/ ceiling is completed. Wall plastering shall not be carried out up to about 50mm above the level of proposed skirting/dado.

The base concrete shall be finished to a reasonably plane surface about 40 to 45mm below the level of finished floor. Before the tiling work is taken up, the base concrete or structural slab shall be cleaned of all loose materials, mortar droppings, dirt, laitance etc. using steel wire brush and well wetted without allowing any water pools on the surface.

A layer of 25mm average thickness of cement mortar consisting of one part of cement to 6 parts of sand shall be provided as bedding for the tiles over the base concrete. The thickness of bedding mortar shall not be less than 10mm at any place. The quantity of water to be added for the mortar shall be just adequate to obtain the workability for laying. Sand for the mortar shall conform to IS: 2116 and shall have minimum fineness modulus of 1.5. The surface shall be left rough to provide a good bond for the tiles. The bedding shall be allowed to harden for a day before laying of the tiles.

Neat cement slurry using 4.4 kg of cement per sq.m of floor area shall be spread over the hardened mortar bedding over such an area at a time as would accommodate about 20 tiles. Tiles shall be fixed in this slurry one after the other, each tile being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joints shall be in straight lines and shall normally be 1.5mm wide. On completion of laying of the tiles in a room, all the joints shall be cleaned and washed fairly deep with a stiff broom/wire brush to a minimum depth of 5mm. The day after the tiles have been laid, the joints shall be filled with cement grout of the same shade as the colour of the matrix of the tile. For this purpose white cement or grey cement with or without pigments or mixed cement as specified shall be used. The flooring should be kept moist and left undisturbed for 7 days for the bedding/joints to set properly. Heavy traffic shall not be allowed on the floor for at least 14 days after fixing of the tiles.
About a week after laying the tiles, each and every tile shall be lightly tapped with a small wooden mallet to find out if it gives a hollow sound; if it does, such tiles along with any other cracked or broken tiles shall be removed and replaced with new tiles to proper line and level. The same procedure shall be followed again after grinding the tiles and all damaged tiles replaced, properly jointed and finished to match. For the purpose of

ensuring that such replaced tiles match with those laid earlier, it is necessary that the Contractor shall procure sufficient quantity of extra tiles to meet this contingency.

Wherever a full tile cannot be provided, tiles shall be cut to size and fixed. Floor tiles adjoining the wall shall go about 10mm under the plaster, skirting or dado.

Tile skirting and dado work shall be executed only after laying tiles on the floor. For dado and skirting work, the vertical wall surface shall be thoroughly cleaned and wetted. Thereafter it shall be evenly and uniformly covered with 10mm thick backing of 1:4 cement sand mortar. For this work the tiles as obtained from the factory shall be of the size required and practically full polished. The back of each tile to be fixed shall be covered with a thin layer of neat cement paste and the tile shall then be gently tapped against the wall with a wooden mallet. Fixing shall be done from the bottom of the wall upwards. The joints shall be in straight lines and shall normally be 1.5mm wide. Any difference in the thickness of the tiles shall be evened out in the backing mortar or cement paste so that the tile faces are in conformity & truly plumb. Tiles for use at the corners shall be suitably cut with bevelled edges to obtain a neat and true joint. After the work has set, hand polishing with carborundum stones shall be done so that the surface matches with the floor finish.

Wall plastering of the strip left out above the level of skirting/dado shall be taken up after the tiles are fixed.

Chequered terrazzo tiles for flooring and for stair treads shall be delivered to site after the first machine grinding.

Machine grinding and polishing shall be commenced only after a lapse of 14 days of laying. The sequence and three numbers of machine grinding operations, usage of the type of carborundum stones, filling up of pin holes, watering etc. shall be carried out all as specified in IS: 1443.

Tiles shall be laid to the levels specified. Where large areas are to be tiled the level of the central portion shall be kept 10mm higher than that at the walls to overcome optical illusion of a depression in the central portion. Localized deviation of ±3mm in any 3m lengths is acceptable in a nominally flat floor.

3.11 Shahabad / Tandur/ Kota/Mandana Stone Slab work

3.11.1 Materials

The slabs shall be of approved selected quality, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. The percentage of water absorption shall not exceed 5 percent as per test conducted in accordance with IS: 1124.

The slabs shall be hand or machine cut to the required thickness.

Slabs shall be supplied to the specified size with machine cut edges or fine chisel dressed to the full depth. All angles and edges of the slabs shall be true and square, free from any chipping giving a plane surface. Slabs shall have the top surface machine polished (first grinding) before being brought to site. The slabs shall be washed clean before laying.

3.11.2 Workmanship

The type, size, thickness and colour/shade etc. of the slabs for flooring/dado/skirting shall be as specified in the respective items of work.

Preparation of the concrete base, laying and curing shall be as per clause 3.10.2.

Dado / skirting work shall be as per clause 3.10.2. The thickness of the slabs for dado/skirting work shall not be more than 25mm. Slabs shall be so placed that the back surface is at a distance of 12mm. If necessary, slabs shall be held in position temporarily by suitable method. After checking for verticality, the gap shall be filled and packed with cement sand mortar (with or without pigment) of proportion 1:3. After the mortar has acquired sufficient strength, the temporary arrangement holding the slab shall be removed.

Grinding and polishing shall be as per preceeding clause 3.10.2.

3.12 Glazed Tile Flooring

Providing and laying white glazed tiles 148.5 mm X 148.5 mm in size and 8 mm 19.5 mm thick for flooring in required positions, laid on a bed of 1: 4 cement mortar including neat cement float, all specials required like

round edge tiles, corner cups, etc. filling joints with neat white cement slurry, curing and cleaning complete. Tiles shall conform to IS: 13753-1993

3.12.1 Mortar bedding: -

The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in the preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed, the base shall be cleaned of all dirt, scum or laitance and loose materials and then well wetted without forming any pools by the use of screed battens to proper level or scope. The thickness of the bedding shall not be less than 12 mm or more than 20 mm any one place. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly cushion for the tiles.

3.12.2 Fixing tiles: -

The tiles before laying shall be soaked in water for at least 2 hours. Tiles, which are fixed in the floor adjoining the wall, shall be so arranged that the surface of the round edge tiles shall correspond to the skirting or dado. Neat cement grout of honey like consistency shall be spread over the bedding mortar just to cover so much area as can be tiled within half an hour. The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight lines. The joints between the tiles shall not exceed 1.5 mm wide. The joints shall be grouted with a slurry of white cement . After fixing the tiles finally in an even plane, the flooring shall be covered with wet saw dust and allowed to mature undisturbed for 14 days.

3.12.3 Cleaning: -

After the tiles have been laid in a room or the day's fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, the floor shall be carefully washed clean and dried. When dry, the floor shall be covered with oil free dry saw dust which shall be removed only after completion of the construction work and just before the floor is occupied

3.12.4 Item to include: -

The rate shall include all labour, materials, tools and tools and equipment required for the following operations to carry out the item as specified above

(1) Providing and laying the bedding mortar and leveling

(2) Providing and fixing the tiles including round edges, corner cups, etc. in neat cement float over the bedding.

(3) Grouting the joints of the tiles with white cement slurry.

(4) Curing

(5) Cleaning the floor

3.12.5 Mode measurement and payment: -

The contract rate shall be per square metre of the finished floor area covered by the flooring of the specified type. All work shall be measured net. The length and width of the flooring shall be measured net between the faces of skirting or dados or plastered faces of walls. Paving under the dado, skirting or plaster shall not be measured.
No deduction shall be made nor extra paid for voids not exceeding 0.20 square metres. Deduction for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square metres.

3.13 Glazed tiles in Dado and Skirting

Providing and fixing white glazed tiles 148.5 mm X 148.5 mm in size an 6.5 mm thick for dado and skirting in required positions, on plaster of cement mortar 1:4 including all specials required like round tiles, angles, corner cups, etc. and filling joints with white cement slurry, curing and cleaning complete.

3.13.1 Materials: -

White glazed tiles including specials shall be of the approved make and quality and shall conform to I.S: 13755-1993 in all aspects. The Engineer, who will keep them in his office for verification as to whether the materials brought for use confirm to the approved samples except that the thickness of tiles shall be 6.5 mm, shall be approved samples of tiles.

3.13.2 Plastering: -

Cement plaster of about 12 mm (about ½") for brick walls and 20 mm for stone masonry walls shall be applied to the part of the wall where dado or skirting is to be fixed as per specification No. B.11. The proportion of mortar shall be as mentioned in the item.

3.13.3 Fixing tiles: -

Dado or skirting work shall be done by only after fixing tiles on the floor. The white glazed tiles shall be soaked in water for at least 2 hours before being used for skirting or dodo work. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff. The back of tiles shall be covered with a thin layer of neat cement plastic and the tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from the bottom of wall upwards without any hollows in the bed or joints. Each tile shall be fixed as close as possible to the one adjoining. The tiles shall be joined with white cement slurry. Any difference in the thickness of tiles shall be evened out in cushioning mortar to that all tile faces are in one vertical plane. The joints between the tiles shall not exceed 1.5 mm in width and they shall be uniform. While fixing tiles in dado work care shall be taken to break joints vertically. After fixing the dado, skirting etc., they shall be kept continuously wet for 14 days.

If doors, windows or other opening are located within the dado area, the skills, jambs, angles etc., shall be approved with white glazed tiles and appropriate specials according to the foregoing specification and such tiled area shall be measured not along with the dado.

3.13.4 Cleaning: -

After the files have been fixed the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado of skirting work shall be washed thoroughly clean.

3.13.5 Item to include: -

The rate shall include all labour, materials, tools and equipment required for the following operations to carry out the item as specified above.

(1) Plastering

(2) Fixing the tiles including all angles, etc. after applying neat cement paste.

(3) Joining the tiles with white cement slurry

(4) Curing

(5) Cleaning the dado and skirting

3.13.6 Mode of measurement and payment: -

The contract rate shall be per square metre of the net area actually covered by the dado or skirting tiles including special tiles on walls, jambs, sills etc. if necessary. All work shall be measured net. The length of the dado face shall be measured net between its face edges at the ends excluding overlap. The width of the face shall be measured between the top of dado or skirting and the top of flooring. The dimensions shall be measured correct up to two places of decimals of a metre and the area worked out correct up to two places of decimals of a square metre. Teak wood cover moldings if provided shall be paid separately. No deduction shall be made nor extra paid for voids not exceeding 0.20 square metres.Deduction for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 square metres not exceeding 0.10 square metres.

3.13.(a) PVC Flooring: -

Providing and laying 2 mm thick Antistatic unbacked flexible P.V.C. flooring / skirting using vinyl sheets of approved colour and shade with or without and confirming to IS 3642-1986 and IS 4-1986 for general properties confirming to BS 2050-1978 for antistatic and conducting properties. The sheets shall be aid over existing / newly laid cement concrete / terrazzo flooring / skirting to the required sixe and patter as directed accordingly to the size of the room / hall using approved quality rubber based ashesive of approved brand or as per manufacturers specifications. The adjusting / newly laid floor shall be cleaned thoroughly to make it free from floor shall be made good suitably before laying vinyl flooring. All joints of the PVC flooring shall be welded using antistatic and conductive PVC electrode so as to get uniform seamless and water proofing surface proper strips (15 mm X 1 mm) shall be fixed to the underside of the antistatic flooring and laid all along the edge of the antistatic flooring and laid all along the edges of the room / all and or as recommended by the manufacturer with necessary MS push button as required and directed to create and effective route for electrostatic discharge. The finished vinyl flooring shall be free from air bubbles and undulations and it shall be thoroughly cleaned and polished, with all lead and lifts as directed Engineer in charge (Note: Sample material shall be furnished to the Engineer in charge and got approved before commencement of laying.

3.13 (a).1. Mode of Measurement : -

As stated under Clause 3.13.6 & 3.12.5

3.14 Vitrified tile Flooring, Dado / Skirting / Facia:

3.14.1 Materials : -

The tiles shall be of approved make and shall generally conform to ISO: 13006 They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. The glazing shall be of uniform shade.

The tiles shall be as specified in the schedule of quantity or drawings. The length of all four sides shall be measured correct to 0.1 mm and average length breadth shall not vary more than ±0.8 mm from specified dimensions. The variation of individual dimensions from average value of length / breadth shall not exceed ± 0.5 mm. Tolerance in thickness shall be (±) 0.4 mm.

The thickness of the tiles shall not be less than 6.5 mm or as specified in the items and shall conform to ISO: 13006 in all respects. The Engineer-in-charge before use on the work shall be approved samples of tiles.

3.14.2 Preparation of Surface and laying:

Sub grade concrete or RCC slab or side brick wall / or plastered surfaces on which tiles are to be laid shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc. brushed, washed with water to remove mud, dirt etc. from the surface, wetted and mopped.

12 mm thick plaster of CM 1.3 shall be applied and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonal lines 1.5 mm deep at 7.5 mm center both ways.

The back of tiles shall be buttered with a cost of grey cement slurry paste and edges with white cement slurry and set in the bedding mortar. The tiles shall be tapped and corrected to proper planes and lines. The tile shall be butt jointed in pattern and joints shall be as fine as possible. The top of skirting / dado shall be truly horizontal and joints truly vertical.

After a period of curing of 7 days minimum, the tiles shall be cleaned and shall not sound hollow when tapped.

The surface during laying shall be checked with a straight edge 2m. Long.

Tiles shall enter not less than 10mm under side skirting.

After the tiles have been laid, surplus cement grout shall be cleaned off.

3.14.3 Mortar and Bedding:

Cement mortar for bedding shall be of proportion specified in items schedule and shall conform to the specification for materials, preparation etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned of all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified

proportion and thickness shall then be even and smoothly spread over the base by use of screed battens to proper level or slope.

Cement mortar of thickness and proportion as specified in the schedule for dado shall be applied to the wall after preparing the wall surface as specified under cement plaster 20 mm thick and brought to correct line and plumb and the surface left rough to receive the tiles.

3.14.4 Fixing of tiles for flooring: -

The tiles before laying shall be soaked in water for at least 2 hours. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Neat cement mortar grout 1:2, using fine sand (table III, zone IV and as per IS 383) of honey like consistency shall be spread over the bedding mortar just to cover as much area as can be tiled within half an hour. The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints, shall be kept as close as possible and in straight line. The joints between tiles shall not exceed 1.00 mm, in width. The joint shall be grouted with white cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered with wet sand and allowed undisturbed for 14 days.

3.14.5 Fixing tiles for Dado and Skirting / Facia: -

The dado work, shall be done only after fixing the tiles / slabs on the floor. The approved glazed tiles before laying shall be soaked in water for at least 2 hours. Tiles shall be fixed when the cushioning mortar is still plastic and before it gets very stiff.

The back of the tile shall be covered with this layer of cement mortar 1:3 using fine sand (table III, zone IV, IS383-1963), and the edge of the tile smeared with neat white cement slurry. The tile shall then be pressed in the mortar and gently tapped against the wall with a wooden mallet. The fixing shall be done from bottom of wall upwards without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. The tiles shall be jointed with white cement slurry. Any thickness difference in the thickness of the tiles shall be arranged out in cushioning mortar so that all tiles faces are in one vertical plane. The joints between the tiles shall not exceed 1.00 mm in width and they shall be uniform.

While fixing tiles in dado work, care shall be taken to break the joints vertically. The top of the dado shall be touched up neatly with the rest of the plaster above.

After fixing the dado / skirting etc. they shall be kept continuously wet for 7 days.

If doors, windows or other openings are located within the dado area, the corners, sills, jambs etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

3.14.6 Cleaning: -

After the tiles have been laid in a room or the day fixing work is completed, the surplus cement grout that may have come out of the joints shall be cleaned off before it sets. After the complete curing, the dado or skirting over shall be washed thoroughly clean. In the case of flooring, once the floor has set, the floor shall be carefully washed clean and dried. When dry, the floor shall be covered with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

3.14.7 Pointing and Finishing: -

The joints shall be cleaned off with wire brush to a depth of 3 mm and all dust and loose mortar removed. Joints shall then be flush pointed with white cement and floor kept wet for 7 days and then cleaned. Finished floor shall not sound hollow when tapped with a wooden mallet.

3.14.8 Mode of measurement: -

As stated under Clause 3.13.6 & 3.12.5

3.14.9 The rate for all works mentioned above in preceding Clause heads 3.10, 3.11, 3.12, 3.13 & 3.14 shall include all the cost of labour and materials involved, nothing extra shall be paid for the use of cut (swan) tiles in work.

3.15 Indian Patent Stone

3.15.1 Granolithic Flooring (Indian Patient Stone)

Granolithic flooring shall consist of cement, sand and aggregates. The proportion and thickness shall be as specified in drawings & BOQ. Fine aggregates shall be 4.75 mm downwards and coarse aggregates 10 mm down. All aggregates specified above should consist of 10 mm screenings and 3 mm 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.

Hacking and Saturated shall roughen the sub base concrete 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 lightly floated to the required level and slopes. As soon as the initial set takes place, the surface shall be trowelled and broom finished as per approved pattern. Dry cement or mixture of dry cement and sand shall not be sprinkled on the surface with the object of absorbing moisture or stiffening the mix. Final trowelling 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. While laying panel adjacent to one another care shall be taken to provide a groove of size 0.5 cm. wide and 2.5cm deep.

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.

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 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 fiber. 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.

Note: For proper adhesion of bitumen to the floor, the groove should be completely free from moisture and greasy/oily substances throughout the operation.

3.15.2 I.P.S. for the Water Tanks, ducts etc. shall be 2.5cm. thick and shall be laid without panels as specified above. In case of large areas however, the construction joints shall be rendered waterproof with bitumen joint filling as mentioned earlier.

DOORS AND WINDOWS

3.16 Timber Doors& Windows

3.16.1 Wood work

The work consists of supply of materials, fabrication, joinery, carpentry, delivery and erection at site of wooden doors & window frames, wooden flush doors/ paneled doors, and partition etc.

3.16.2 Materials

All timber shall be of best quality or hard wood well seasoned, 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 and conforming to the relevant IS code.

Woodwork abutting against or embedded in masonry or concrete shall be painted with bitumen coat before being placed in position. All timberwork shall be treated with an approved anti-termite treatment.

3.16.3 Fixing/erection in position of door frames

Before the frames are fixed in position these shall be inspected and passed by the Engineer-in-charge. The frames shall be placed in proper-position and fixed to the walls with suitable holdfasts as shown in drawing. The frames shall have dovetailed joints. The posts shall be through jamb tenoned into the mortise of the transoms. Thickness of the tenons shall be more than 25 mm. Tenons shall closely fit into the mortise without any gap.

In case the doorframes are without sills the vertical members shall be buried in floor 50mm. deep. Sills shall be provided where so directed. The doorframes without sills while being placed in position shall be provided with temporary wooden bracings well wedged between the styles at the sill level. The sills shall be retained to keep the frames from warping during construction. These frames shall also be protected from damages during construction.

3.16.4 Flush door Shutters (Block Board)

Flush door shutter shall be solid core type with block board core, as indicated,
And shall conform to IS: 2202, Specification for wooden flush door shutter (soild core type) Part – I plywood face panels; except with regard to the size of shutters which shall be as indicated. Flush door shutters shall be non-decorative (commercial)type; or decorative type when indicated.

3.16.5 Tolerance

Tolerance on width and height shall be ± 2mm Tolerance on thickness shall be ± 1.2mm. The thickness of shutter shall be uniform throughout with a variation not exceeding 0.8mm when measured at any two points.

3.16.6 Adhesives

Only Synthetic resin adhesives conforming to I.S.S. No. IS-851 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 (Phenolic and Amino plastic), or equivalent IS standards.

3.16.7 Fittings

Fitting as indicated in drawings shall be approved by Engineer-in-charge and provided as specified .The fittings shall be measured & paid for separately.
All fittings shall be of approved make.

Details of Fittings:

Sr. No.	Description	Location
1.	Iron Oxidized But Hinges (125 x 85 x 5.5 mm) (Heavy type)	Flush shutters
2.	Aluminum Butt Hinges (125 x 85 x 5.5 mm) (Heavy type)	Aluminum Doors
3.	Aluminum Sliding door bolt 300 x 16 mm	Flush Shutters / Alu. Shutters
4.	Tower Bolts – Iron Oxidized (250 x 10 mm)	Flush Shutters / Alu. Shutters
5.	Casement stays – (300 mm – wt 200 gm)	M.S. Windows
6.	Handles – Aluminum 125 mm long	Flush shutters / Alu. Shutter
7.	Pull Bolt Lock (85 x 42 mm) M.S. Bright polished nickel plated	Toilet Doors
8.	Brass Mortice Lock – 100 mm – 6 lever	Alu. Shutters in VIP Cabins

9.	Brass hydraulic door closers (Sleek design)	Alu. Shutters in VIP Cabins
10.	Aluminum bolt lock (anodized 15 micron)	Aluminum Windows
11.	Double action hydraulic floor springs	Aluminum Doors
12.	Floor Door Stopper – MS Oxidized	Flush shutters
13.	Floor Door Stopper – Aluminum	Alu. Shutters

3.16.8 Measurements

Measurements shall be in sq mtr on the basis of out to out width & height of the Shutter. Nothing extra shall be measured for rebated and or splayed meeting stiles of door & windows.
Glass or wire cloth/mesh etc. shall be measured separately.

3.16.9 Rate

The rate shall be inclusive of materials, labour and construction as per description above for single/Double including sand papering to an even & smooth texture, fitting of shutters to frames all complete.

3.17 M.S. Door Frames, Rolling Shutters, Steel Sliding Doors, M.S. Grating and Cat Ladders

3.17.1 M.S. Door Frames

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 Zinc Chromate Primer.

The work shall have to be done in co-ordination with other agencies working at site.

The mode of measurement for payment shall be per number of door or running meter of frames as specified in the Bill of Quantities.

3.17.2 Rolling Shutters

Rolling shutters shall be of an approved manufacture, conforming to the requirements specified in IS: 6248.

The type of rolling shutter shall be self-coiling type (manual) for clear areas up to 12 sq.m; gear operated type (mechanical) for clear areas up to 35 sq.m and electrically operated type for areas up to 50 sq.m. Mechanical type of rolling shutters shall be suitable for operation from both inside and outside with the crank handle or chain gear-operating mechanism duly considering the size of wall/column. Electrical type of rolling shutter shall also be provided with a facility for emergency mechanical operation.

Rolling shutters shall be supplied duly considering the type, specified clear width/height of the opening and the location of fixing as indicated in the drawings.

Shutters shall be built up of interlocking laths 75 mm width between rolling centers formed from cold rolled steel strips. The thickness of the steel strip shall not be less than 0.90 mm for shutters up to 3.50m widths and not less than 1.20 mm for shutters above 3.50 m width. Each lath section shall be continuous single piece without any welded joint.

The guide channels out of mild steel sheets of thickness not less than 3.15 mm shall be of either rolled, pressed or built up construction. The channel shall be of size as stipulated in IS: 6248 for various clear widths of the shutters.

Hood covers shall be of mild steel sheets not less than 1.0 mm thick and of approved shape.

Rolling shutters shall be provided with a central hasp and staple safety device in addition to one pair of lever locks and sliding locks at the ends.

All component parts of the steel-rolling shutter (excepting springs and insides of guide channels) shall be provided with one coat of zinc chrome primer conformity to IS: 2074 at the shop before supply. These surfaces

shall be given an additional coat of primer after erection at the site along with the number of coats and type of finish paint as specified in the respective items of works prepared by the Contractor.

In case of galvanized rolling shutter, the lath sections, guides, lock plate, bracket plates, suspension shaft and the hood cover shall be hot dip galvanized with a zinc coating containing not less than 97.5 percent pure zinc. The weight of the zinc coating shall be at least 610gms/sq.m.

Guide channels shall be installed truly plumb at the specified location. Bracket plate shall be rigidly fixed with necessary bolts and holdfasts. Workmanship of erection shall ensure strength and rigidity of rolling shutter for trouble free and smooth operation.

3.17.3 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 locking arrangement shall also be provided along with one coat of zinc chromate primer

3.17.4 Measurement for Rolling shutter and Steel doors.

The measurement for payment shall be equal to area of the opening in the wall.

3.17.5 Rate

The rate quoted shall be inclusive all necessary fittings i.e. hinges/sliding arrangement, locking arrangement and one coat of zinc oxide primer.

3.18 M.S.Windows

3.18.1 All window shutters shall be fabricated to correct shape and size as per drawings approved by The Engineer-in-charge However, before fabricating any item the contractor has to check the opening dimensions at site. Any discrepancy therein shall be brought to The Engineer-in-charge's notice in writing mentioning the particular windows.

3.18.2 All sections for windows shall be extruded sections of approved quality. All extruded sections shall be of approved size as per IS 1038 & IS 1361.

3.18.3 Glass for windows shall be indicated in drawing. These shall be of best quality approved by The Engineer-in-charge. HPG or equivalent, clear/ ground.

3.18.4 The contractor shall have to make all necessary holes in concrete, masonry for fixing of windows. The contractor shall also fix and grout the windows in line, level and plumb.

3.18.5 The steel members shall be given a coat of approved anti-rust paint.

3.18.6 Channel shaped Aluminum beading to be provided around periphery of glass pane. Glass panes to be secured to shutter frames by 10 mm x 10 mm aluminum extruded beading and rubber, PVC gasket around the glass panel.

3.18.7 Hardware: Pegstay arms, handles, hinges etc. shall be heavy duty of approved quality.

3.18.8 Fixed or open able panels of the windows shall be as shown in the drawing.

3.18.9 Rates

The rates quoted by the Contractor under each item in Bill of Quantities shall be for a complete finished item or work. Supplying and fixing of all the fittings and iron monglery shall be deemed to have been included in Contractor's rates. The rates quoted by the Contractor shall also be inclusive of painting and/or 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.

3.19 Aluminum Doors & Windows

3.19.1 Aluminum Sections

All the luminum windows, doors and ventilators shall be fabricated as per specified section as directed by the Engineer-in-charge. The Aluminum sections for Side hung, Top hung, Center hung, sliding and fixed windows and ventilators shall have an adequate thickness so that they can withstand flash-butt welding. In case of sliding windows, the bottom member of the frame shall have drainage provision.

Aluminum alloy used in the manufacture of extruded sections for the fabrication of doors, windows, and ventilators shall conform to designation 63400 of IS: 737.

Transparent sheet glass shall conform to the requirements of IS: 2835. Wired and figured glass shall be as per IS: 5437.

3.19.2 Corner Joints

All aluminum window frames and shutters for Side-hung, Top hung and Fixed will be flush-butt welded to obtain uniformly strong joints which are necessary for proper functioning without sagging or warp age over the years.

Corners of sliding window shutters and frames swing doors and fixed side shutters will be mechanically joined with properly designed cleats and fixtures.

3.19.3 Accessories

Side Hung Windows

a. All side-hung windows shall be provided with heavy gauge aluminum anodized handles and aluminum peg-stay, which have been so, designed to give trouble-free performance over the years.

b. All side hung windows shall be provided with sturdy aluminum butt-hinges with special alloy pins, which would ensure smooth movement of the shutters in addition to preventing any sagging due to the weight of the glass or continuous usage.

3.19.4 Top Hung Ventilators

All top hung ventilators shall be provided with sturdy butt type aluminum hinges and are provided with heavy gauge 300 mm long aluminum pegstays.

3.19.5 Center Hung Ventilators

a. Specifically extruded neoprene lining

b. All windows shall be made weather-tight by means of special rayon weather lining fitted in the grooves around the periphery of the shutters.

c. Specially designed nylon rollers, with brass axles shall be provided (two numbers per shutter).

d. Locking arrangement.

e. Aesthetically appealing and sturdy handles, one per shutter.

3.19.6 Entrance Doors and Fixed Panels

a. Aluminum swing doors shall be provided with double action heavy duty. Everite floor springs with necessary locks and aluminum handles as per design.

b. Fixed sidelights shall be fabricated as per design with relevant hardware.

3.19.7 Finish

Anodized in light dull sliver grey finish/or as specified. All the aluminum sections shall be mechanically polished and buffed for the removal of extrusion defects.

Thoroughly cleaned aluminum sections shall be anodized. The anodizing process results in aluminum oxide film of 15 microns shall be provided.

All the aluminum sections shall be coated with lanolin paper wrapping which will prevent the sections from getting damaged due to handling or due to vagaries of construction work at site. This coating will be removed after the completion of erection.

3.19.8 Erection

The erection of aluminum windows/doors in position would involve the following work: -

a. All the items shall be fixed in level, line and plumb.

b. The joints between aluminum and masonry shall be adequately caulked with approved sealant to prevent any seepage of water.

c. The frame shall be fixed to the masonry with the help of suitable screws/holdfasts.

d. In case of aluminum windows erected in rough ground, contractor shall ensure that the joint between the aluminum windows and the rough ground is made completely water-tight with approved sealant.

3.19.9 Rates

The quoted price is inclusive of all materials, labour, fabrication and carryout the construction as described above.

3.19.10 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 approved from the Engineer-in-charge.

3.19.11 Sample

The Contractor shall present one sample of any type of window for approval and comments by the Engineer-in-charge.

WATER PROOFING

3.20 General

Various methods of waterproofing are in practice. The recommended specifications are described hereinafter. The contractor shall satisfy himself about adequacy, effectiveness and effective service life of these methods. In most cases specialized agencies may have their own 'proprietary' methods and chemicals. The contractor shall give a specific bond on Rs.100/- stamp paper for water tightness of the structure or building for a period of 5 years reckoned from date of handing over the building.

3.20.1 Brickbat Coba & Top stop Method Cement based Water-proofing for WCs, Sanitary Blocks, Kitchen, washing places etc.

Before waterproofing work is started, all cutting or chasing in the floor and/or walls and all the plumbing work shall be completed and the normal plaster to the ceiling and upper part of walls shall be provided.

The water proofing treatment to vertical and horizontal surfaces of depressed portions of W.C kitchen and the like shall consist of:

1) 1st course of applying cement slurry @ 4.4 kg/sqm mixed with water proofing compound conforming to IS: 2645 in recommended proportions.

2) 2nd course of 20 mm cement plaster 1:3 (1 cement: 3 coarse sand) mixed with water proofing compound in recommended proportion.

3) 3rd course of applying blown or / residual bitumen applied hot at 1.7 kg per sq.m of area.

4) 4th course of 400 micron thick PVC sheet (Overlaps at joints of PVC sheet should be 100 mm wide and pasted to each other with bitumen @ 1.7 kg/sq.m)

3.20.2 Brickbat Coba & Top stop Method Cement based Water-proofing for Terraces, chajjas, Canopies, Staircases, Gutters, etc.

This method is recommended for terraces and gutters. Water proofing treatment shall start directly over the RCC slab setting brickbats on a grout consisting of chemical and cement mortar to provide necessary gradient of 1 in 120 (1 inch in 10 feet) for the easy flow away of rainwater. The treatment shall consist of laying integral cement based water proofing treatment including preparation of surface as required for treatment of roofs, balconies, terraces, etc. consisting of following operations.

a) Applying and grouting a slurry coat of neat cement using 2.75 kg/sq.m of cement admixed with proprietary liquid water proofing compound conforming to IS 2645 over the RCC slab including cleaning the surface before treatment.

b) Laying cement concrete using broken bricks / brick bats 25 mm to 100 mm size with 50% of cement mortar 1:5 (1 cement: 5 coarse sand) admixed with proprietary liquid water proofing compound conforming to IS: 2645 over 20 mm thick layer of cement mortar of mix 1:5 (1 cement: 5 coarse sand) admixed with proprietary liquid water proofing compound conforming to IS: 2645 to required slope and treating similarly the adjoining walls with plaster up to 300 mm height including rounding of junctions of walls and slabs.

c) After two days of proper curing applying a second coat of cement slurry admixed with proprietary water proofing compound conforming to IS: 2645.

d) Finishing the surface with 20 mm thick joint less cement mortar of mix 1:4 (1 cement: 4 coarse sand) admixed with proprietary water proofing compound conforming to IS: 2645 and finally finishing the surface with trowel with neat cement slurry and making of 300 x 300 mm square.

e) The whole terrace so finished shall be flooded with water for a minimum period of two weeks for curing and for final test. All above operations to be done in order and as directed and specified by the Engineer-in-charge.

The average thickness of the above treatment shall be 120 mm and minimum thickness at water outlet shall be 65 mm.

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. The average thickness of coba shall be 150 mm.

3.20.3 Chemical Based Waterproofing

This method is recommended on inclined terraces. The surface on which the waterproofing is to be provided shall be cleaned thoroughly from any loose material, after removing any abrupt/sharp undulation. The surface shall be made bone dry before applying any chemical.

The adhesive coat or the primer, as the case may be, shall be applied to the surface in desired layers/ coats, as specified by the manufacturers. Consideration for pot life of the material for effective bond shall 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. 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 shall 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 shall be resistive to such rays and also against normal vagaries of weather.

Before using the material, the material has to be got approved by the Engineer-in-charge.

3.20.4 Testing

The contractor shall test the work carried out for a period for minimum 72 hours and diligently rectify if leakages are detected: -

Terraces

Impound 10 – 15 cm of water for 72 hours and check underside.

Under ground water tanks

No back filling is to be done outside perimeter. Tank to be completely filled with water and check water levels and physical inspection on the exterior side.

Water Storage Tanks

Inside surface area of tank, Bottom and sides up to underside of top slab.

Internal walls and top slab shall not be measured and paid for.
Terraces, Chajjas and RCC roof gutters

Surface area of terrace, surface area of parapet for a height 300 mm measured from top of RCC roof slab.

Surface area of canopies and chajjas. Surface area of sidewalls abutting the chajja for a height of 300 mm measured from RCC top of chajja / canopy / gutter. Covings to be done at the junction of slabs and wall is deemed to be included in above and shall not be separately measured.

3.20.5 Rates

The rates shall be inclusive of work to be carried out as above and including all materials, labour, testing rectification, etc.

CHAPTER-4 -STRUCTURAL STEEL WORKS

4.1 Applicable Codes and Specifications

1) The supply, fabrication, erection and painting of structural steel works shall comply with the following specifications, standards and codes unless otherwise specified herein. All standards, specifications and codes of practices referred to herein shall be the latest editions including all applicable official amendments and revisions.

IS: 808	Dimensions for Hot Rolled Steel sections
IS : 814	Covered Electrodes for Manual Metal Arc Welding of Carbon and Carbon Manganese Steel
IS : 817	Code of practice for training and testing of metal arc welders
IS : 800	Code of Practice for General Construction in Steel
IS : 801	Code of Practice for Use of Cold Formed Light Gauge Steel Structural Members in General Building Construction.
IS : 806	Code of Practice for Use of Steel Tubes in General Building Construction
IS : 7205	Safety Code for Erection of Structural Steel Work
IS : 7215	Tolerances for Fabrication of Steel Structures

IS : 4000	High Strength Bolts in Steel Structure – Code of Practice
AISC	Specifications for Design, Fabrication and Erection of Buildings
IS : 1161	Steel Tubes for structural purposes
IS:102	Mixed paint, Brushing, Red Lead, Non-setting, Priming.
IS:110	Ready Mixed paint, brushing, grey filler for enamels for use over primers.
IS:117	Ready Mixed paint, Brushing, Finishing, Exterior Semi gloss for general purposes, to Indian Standard colors.
IS:158	Ready Mixed paint, Brushing, Bituminous, and Black; Lead free, Acid, Alkali and heat resisting.
IS:159	Ready Mixed paint, Brushing, Acid resisting for protection against acid fumes, colour as required.
IS:341	Black Japan, Types A, B and C
IS:2339	Aluminum paint for general purposes, in Dual container
IS:2932	Specification for enamel, synthetic, exterior, type 1, (a) undercoating, (b) finishing
IS:2933	Specification for enamel, exterior, type 2, (a) undercoating, (b) finishing
IS:3613	Acceptable tests for wire flux combination for submerged arc welding
IS:5905	Sprayed Aluminum and Zinc coatings on Iron and Steel.
IS:6005	Code of practice for phosphating of Iron and Steel.
IS:9862	Specification for ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water & chlorine resisting.
IS:13183	Aluminum paint, Heat resistant.
IS : 1239	Mild steel tubes, tubular and other Wrought steel fittings Part 1 – Mild steel tubes Part 2 – Mild steel tubular and other wrought steel pipe fittings
IS : 1363 (Parts 1to3)	Hexagon Head Bolts, Screws and Nuts of product Grade C (Size range M5 to M64)
IS : 1367 (All parts)	Technical Supply Conditions for Threaded Fasteners
IS : 1852	Rolling and Cutting Tolerances for Hot Rolled Steel Products
IS : 1977	Structural Steel (Ordinary Quality)
IS : 2062	Steel for General Structural Purposes
IS : 2074	Ready Mixed Paint, Air drying, Red Oxide Zinc Chrome and Priming
IS : 3502	Steel Chequered Plate
IS : 3757	High Strength Structural Bolts
IS : 5369	General Requirements for Plain Washers and Lock Washers
IS : 5372	Taper Washers for Channels
IS : 5374	Taper Washer for 1 Beams
IS : 6610	Heavy Washers for Steel Structures
IS : 7318	Approval tests for welders when welding procedure approval is not required (Part 1 and 2)
IS : 8500	Structural Steel-micro alloyed (medium and high strength qualities)
IS : 803	Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded storage tanks
IS : 816	Code of Practice for use of Metal Arc Welding for General construction in Mild Steel
IS : 822	Code of Procedure for Inspection of Welds
IS : 1182	Recommended Practice for Radiographic examination of Fusion – Welded Butt Joints in Steel Plates
IS : 1200	Method of Measurement in Building Civil Works
IS : 1477	Code of Practice for Painting of (Parts 1&2) Ferrous Metals in Buildings
IS : 2595	Code of Practice for Radiographic Testing
IS : 3658	Code of Practice for Liquid Penetrate Flaw Detection
IS : 5334	Code of Practice for Magnetic Particle Flaw Detection of Welds
IS : 9595	Recommendations for Metal Arc Welding of Carbon and Carbon Manganese Steel

4.2 Steel Materials

Steel materials shall comply with the Codes and Standards referred to herein under.

All materials used shall be new, unused and free from defects.

Steel conforming to IS codes mentioned below shall be only be used for the following:

Fe310-0(St 32-0)	IS:1977	For general purposes such as door/window frames, window bars, grills, steel gates, handrails, fence posts, tee bars and other non-structural use.
Fe410 W A	IS:2062	For all structural purposes in welded, bolted and nutted structures.
Fe410 W B	IS:2062	For all structural purposes in welded, bolted and nutted structures subjected to severe fluctuation of stresses.
	IS: 3502	For steel Chequered Plates.

4.3 Fabrication: -

Fabrication shall conform to IS: 800

All fabrication shall be done on a, well lit, laid up platform, big enough to accumulate men & material for the fabrication at the rate as specified by the work schedule. The Contractor shall ensure sufficient arrangement with back up arrangement for the continuous supply of welding power in order to adhere the work schedule.

All members shall be punch marked for identification before transportation from fabrication yard to erection yard.

4.3.1 General

All materials shall be straight and if necessary before being worked shall be straightened and or flattened by pressure, unless required being of curvilinear form and shall be free from twists. workmanship and finish shall be of the best quality and shall conform to the best approved method of fabrication. All materials shall be finished straight and shall be machined/ground smooth true and square where so specified. All holes and edges shall be free of burrs. Shearing and chipping shall be neatly and accurately done and all portions of work exposed to view shall be neatly finished. Unless otherwise approved by the Engineer-in-charge, reference may be made too relevant IS codes for providing standard fabrication tolerance. Material at the shops shall be kept clean and protected from weather.

The work shall be done as per approved fabrication drawings.

4.3.2 Connections

Shop/field connections shall be as per approved fabrication drawings.

Bolts and nuts shall be of grade 'Black' (B) conforming to the requirement given in the following IS specifications.

(a) IS: 1363 – Specification for Black Hexagonal bolts, nuts & locknuts (dia 6 to 39 mm) and Black Hexagonal screws (dia 6 to 24 mm).

(b) IS: 1367 – Technical Supply condition for threaded fasteners.

(c) IS: 6639 – Specifications for Hexagonal bolts for steel structures.

The electrode for manual metal arc welding shall conform to the requirement of IS: 814.The electrodes for Gas shielded welding procedure shall conform to IS: 6419 and the shielding gapes shall conform to as provided for in IS: 9595.

In case of bolted connections, taper washers or flat washers or spring washers shall be used with bolts as necessary. The length of the bolt shall be such that at least one thread of the bolt projects beyond the nut.

In all cases where bearing is critical, the unthreaded portion of bolt shall bear on the members assembled. A washer of adequate thickness may be provided to exclude the threads from the bearing thickness, if a longer grip bolt has to be used for this purpose.

All connections and splices shall be designed for full strength of members or loads. Column splices shall be designed for the full tensile strength of the minimum cross section at the splice.

Splicing shall be avoided at critical locations and be done only after the approval of Engineer-in-charge as per the splice drawing submitted by Contractor and approved by Engineer-in-charge.

All members likely to collect rain water shall have drain holes provided.

4.3.3 Straightening

All materials shall be straight and, if necessary, before being worked shall be straightened and/or flattened by pressure and shall be free from twists. Heating or forging shall not be resorted to without the prior approval of the Engineer-in-charge in writing.

4.3.4 Welding

Only welding Generators and rectifiers shall be used for welding, transformers shall not be used for structural welding.
Welding procedure shall be submitted to the Engineer-in-charge for approval. Welding shall be entrusted to qualified and experienced welders who shall be tested periodically and graded Reference shall be made to IS 817, IS: 7310 (Part 1) and IS: 7318 (Part 1), as the case shall be.
Electrodes for use shall be approved by HAL before use. The mechanical properties of the weld deposit shall be such as to satisfy all the requirements such as tensile strength, elongation strength & impact strength of parent metal.

Approval of the welding procedure by the Engineer-in-charge shall not relieve the Contractor of his responsibility for correct and sound welding without undue distortion in the finished structure.

No welding shall be done when the surface of the members is wet nor without adequate protection during periods of high wind.

Base metal shall be preheated to the temperature as per relevant IS codes.

Electrodes other than low-hydrogen electrodes shall not be permitted for thick nesses of 20 mm and above.

Deep penetration electrodes shall be used as specified.

All welds shall be inspected for flaws by any of the methods described under Sub-clause 6.5.3. The method adopted shall be agreed with the Engineer-in-charge.

The correction of defective welds shall be carried out without damaging the parent metal in a manner approved by the Engineer-in-charge. When a crack in the weld is removed, magnetic particle inspection or any other equally positive means approved by the Engineer-in-charge shall be used to ensure that the whole of the crack and material upto 25 mm beyond each end of the crack has been removed. The cost of all such tests and operations incidental to correction shall be borne by the Contractor.

4.4 Tolerances

The dimensional and weight tolerance for rolled shapes shall be in accordance with IS: 1852 for indigenous steel and equivalent applicable codes for imported steel. The tolerance for fabrication of structural steel shall be as per IS: 7215.

Cutting, punching, drilling, welding and fabrication tolerances shall be generally as per relevant IS codes.

4.5 End Milling

Where compression joints are specified to be designed for bearing, the bearing surfaces shall be milled true and square to ensure proper bearing and alignment.

4.6 Inspection

4.6.2 General

The Contractor shall give due notice to the Engineer-in-charge in advance of the works being made ready for inspection. All rejected material shall be promptly removed from the shop and replaced with new material for the Engineer-in-charge's inspection. The fact that certain material has been accepted at the Contractor's shop shall not invalidate final rejection at site by the Engineer-in-charge if it fails to conform to the requirements of these specifications, fails to be in proper condition or has fabrication inaccuracies which prevent proper assembly nor shall it invalidate any claim which the Employer may make because of defective or unsatisfactory materials and/or workmanship.

No materials shall be painted or dispatched to site without inspection and approval by the Engineer-in-charge unless such inspection is waived in writing by the Engineer-in-charge.

The Contractor shall provide all the testing and inspection services and facilities for shop work except where otherwise specified.

For fabrication work carried out in the field the same standard of supervision and quality control shall be maintained as in shop fabricated work. Inspection and testing shall be conducted in a manner satisfactory to the Engineer-in-charge.

Inspection and tests on structural steel members shall be as set forth below.

4.6.3 Material Testing

If mill test reports are not available for any steel materials the same shall be tested by the Contractor to the Engineer-in-charge satisfaction to demonstrate conformity with the relevant specification, before consumption in the work.

4.6.4 Tests on Welds

a) Liquid Penetrate Inspection

In the case of welds examined by Liquid Penetrate Inspection, such tests shall be carried out in accordance with relevant IS Code. All defects shown shall be repaired and rechecked.

b) Radiographic Inspection

Generally full Strength butt weld shall be tested with Ultrasound as per IS provision of IS. Raw material plates shall also be tested to check for laminar tearing, if any.
All full strength butt welds for important connection shall be radio graphed as specified in accordance with the recommended practice for radiographic testing as per relevant IS code.

4.6.5 Dimensions, Workmanship & Cleanliness

Members shall be inspected at all stages of fabrication and assembly to verify that dimensions, tolerances, alignment, surface finish and painting are in accordance with the requirements shown in the Contractor's approved fabrication drawings.

4.6.6 Test Failure

In the event of failure of any member to satisfy inspection or test requirement, the Contractor shall notify the Engineer-in-charge. The Contractor must obtain permission from the Engineer-in-charge before any repair `is undertaken. The quality control procedures to be followed to ensure satisfactory repair shall be subject to approval by the Engineer-in-charge.

The Engineer-in-charge has the right to specify additional testing as he deems necessary, and the additional cost of such testing shall be borne by the Employer, only in case of successful testing.

The Contractor shall maintain records of all inspection, testing & retesting which shall be made available to the Engineer-in-charge.

4.7 Drilling Holes for other Works

As a part of this Contract, holes in members required for installing equipment or steel furnished by other manufacturers or the Contractor at no extra cost of the Employer shall drill other contractors. The information for such extra holes will be supplied by the Employer/Engineer-in-charge.

4.8 Marking of Members

After checking and inspection, all members shall be marked for identification during erection. This mark shall correspond to distinguishing marks on approved erection drawings and shall be legibly painted and stamped on it.

4.9 Errors

Any error in shop fabrication which prevents proper assembling and fitting up of parts in the field by moderate use of drift pins or moderate amount of reaming will be classified by the Engineer-in-charge as defective workmanship. Where the Engineer-in-charge rejects such material for defective workmanship, materials and workmanship conforming to these HAL's Requirements by the Contractor, at no cost to the HAL, shall replace the same.

4.9.2 Site Operations

The Contractor shall complete all preliminary works at site well before the arrival of structural steel, such as establishment of a well equipped and adequately staffed site office, stores, unloading gantry, unloading and pre-assembly yard, labour quarters if any, electrical and water connections, electrical winches, derricks, cranes, compressors, all tools and tackles, rivet guns, welding sets, torque wrenches, spud wrenches, staging, etc., as well as experienced erection and supervisory personnel as part of this contract and any other work that may be necessary so as to start erection immediately after the arrival of the first batch of steel on site.
The Contractor shall furnish at his own expense, the necessary non-inflammable staging and hoisting materials or equipment required for the erection work and shall remove and take them away after completion of the job. The Contractor shall also provide necessary passageways, fences, safety belts, helmets, lights and other fittings to the satisfaction of the Engineer-in-charge and to meet the rules of local authorities and for protection to his men and materials. A licensed electrician shall be kept on the job for the entire duration of the work to maintain the Contractor's electrical equipment and connections.

The Contractor shall protect all existing plant, structures, piping, conduits, equipment and facilities against damage during erection. Any damage caused by Contractor shall be rectified entirely at his cost, to the satisfaction of the Engineer-in-charge. If work has to be carried out adjacent to existing switch yards or electrical installations which are live, the Contractor must ensure suitable safety precautions in consultation with Engineer-in-charge.

If a portion of the work of the project area cannot be made available to the Contractor for his activities due to operations being carried out by other agencies, he shall suitably modify his sequence of operations so as to continue work without interruption. The Contractor shall work in co-ordination with other agencies working on the project site and plan his work suitably so as not to hinder the progress of construction at site.

4.10 Acceptance of Steel, its Handling and Storage

The Contractor shall carefully check the steel to be erected at the time of acceptance. Any fabrication defects observed should be brought to the notice of the Engineer-in-charge.

No dragging of steel shall be permitted. All steel shall be stored 300mm above ground on suitable packing to avoid damage. It shall be stored in the order required for erection, with erection marks visible. All storage areas shall be prepared and maintained by the Contractor. Steel shall not be stored in the vicinity of areas where excavation or grading will be done and, if so stored temporarily, the Contractor well before such excavation shall remove this and/or grading commences to a safe distance to avoid burial under debris.

Scratched or abraded steel shall be given a coat of primer in accordance with these HAL's Requirements for protection after unloading and handling prior to erection. All milled and machined surfaces shall be properly protected from rust/corrosion by suitable coating and also from damage.

Proper record of movement of shop-tested steel from Fabrication yard to erection yard shall be maintained.

4.11 Anchor Bolts & Foundations

The Contractor shall carefully check the location and layout of anchor bolts embedded in foundations constructed, to ensure that the structures can be properly erected as shown on the drawings. Any discrepancy in the anchor bolts/foundation shall be reported to the Engineer-in-charge.
Leveling of column bases to the required elevation may be done either by providing shims or three nuts on the upper threaded portion of the anchor bolt. All shim stock required for keeping the specified thickness of grout and in connection with erection of structures on foundations, crane brackets or at any other locations shall be of good M.S. plates and shall be supplied by the Contractor at his cost.

A certain amount of cleaning of foundations and preparing the area is considered normal and shall be carried out by the Contractor at no extra cost.

Where beams bear in pockets or on walls, bearing plates shall be set and leveled as part of the work. The Contractor as specified by the Engineer-in-charge will carry out all grouting under column base plates or beam bearing plates.

4.12 Assembly & Connections

Field connections may be effected by riveting, bolting, welding or by use of high strength friction grip bolts as shown on the design and erection drawings.

The Contractor shall carry all field connection work as per the shop drawings prepared. All bolts, nuts, washers, rivets, electrodes required for the Contractor shall supply field connections.

All assembling shall be carried on a level platform.

Drifts shall be used only for drawing the work to proper position and must not be used to such an extent as to damage the holes. Size of drifts larger than the normal diameter of hole shall not be used. Any damaged holes or burrs must be rectified to the satisfaction of the Engineer-in-charge.

Corrections of minor misfits and reasonable amount of reaming and cutting of excess stock from rivets shall be considered as a part of erection. Any error in the shop, which prevents proper fit on a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to the Engineer-in-charge.

4.13 Erection

All structural steel shall be erected as shown on the drawings. Proper size steel cable slings, etc., shall be used for hoisting. Guys shall not be anchored to existing structures, foundations, etc., unless so permitted by the Engineer-in-charge in writing. Care shall be taken to see that ropes in use are always in good condition.

Reference shall be made to IS: 7205 for safety precautions during the erection of steel.
Structural steel frames shall be erected plumb and true. Frames shall be lifted at points such that they are not liable to buckle and deform. Trusses shall be lifted only at node points. In the case of trusses, roof girders, all of the purlins and wind bracing shall be placed simultaneously and the columns shall be erected truly plumb on screed bars over the pedestals. All steel columns and beams shall be checked for plumb and level individually before and after connections are made. Temporary bracings shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment and the operation thereof. Such bracings shall be left in place as long as may be required for safety and stability.

Chequered plates shall be fixed to supporting members by tack welding or by countersunk bolts as shown/specified in relevant drawings and/or as approved by the Engineer-in-charge. The edges shall be made smooth and no burrs or jagged ends shall be left. While splicing, care should be taken so that there is continuity in pattern between the two portions. Care should also be taken to avoid distortion of the plate while welding. The erection of chequered plates shall include:

(a) Welding of stiffening angles/vertical stiffening ribs

(b) Cutting to size and making holes to required shape wherever necessary to allow service piping and/or cables to pass through

(c) Splicing as shown in relevant drawings

(d) Smoothening of edges

(e) Fixing of chequered plates by tack welding or by countersunk bolts

(f) Providing lifting hooks for ease of lifting.

As erection progresses, the work shall be securely bolted or tied to take care of all dead load, wind, seismic and erection stresses.

No riveting or welding or final bolting shall be done until the structure has been properly aligned and approved by the Engineer-in-charge. No cutting, heating or enlarging of the holes shall be carried out without the prior written approval of the Engineer-in-charge.

The erection scheme shall be got approved from Engineer-in-charge before start of erection work.

The Contractor shall furnish test certificates.

4.14 Inspection

The Engineer-in-charge shall have free access to all parts of the job during erection and all erection shall be subjected to his approval. In case of faulty erection, all dismantling and re-erection required will be at the Contractor's cost. No paint shall be applied to rivet heads or field welds or bolts until these have been approved by the Engineer-in-charge.

4.15 Tolerances

Tolerances mentioned in the relevant MES/IS codes of practice shall be achieved after the entire structure or part thereof is in line, level and plumb.

4.16 Painting

4.16.2 Surface Treatment

All the surfaces of steel work to be painted shall be thoroughly cleaned of all loose mill scale, rust, grease, dirt and other foreign matter. The workmanship shall generally conform to the requirements of IS 1477- Part I.

Oil and grease removal shall be carried out either by solvent cleaning or by using alkali type degreasing agents. The procedure for cleaning shall be as per manufacturer's instructions.

Loose mill scale, loose rust and loose paint shall be removed by wire brushing, scrapping, chipping, rubbing with abrasive paper or steel wool. This method shall not be employed when the surface has firmly adhering mill scale. After hand tool cleaning, the surface shall be rubbed with sand paper so as to ensure that no loose material exists and the surfaces shall be dusted off.

4.16.3 Materials: -

a) Primer Coat

Anti-corrosive primers shall be either lead based or lead free types.Zinc chrome primer shall conform to IS 2074.

All the materials shall be of the best quality from an approved manufacturer. The Contractor shall obtain prior approval of the Engineer-in-charge for the brand of manufacture and the color/shade prior to procurement for usage in the works.

Primer and finish paints shall be compatible with each other to avoid cracking and wrinkling. And shall be from the same manufacturer for each painting system.

b) Workmanship

The type and the number of coats of the primer paint and finish paint shall be as specified.

Painting shall be carried out only on thoroughly dry surfaces.

No painting shall be done in frosty/foggy weather or when the humidity is high enough to cause condensation on the surface to be painted. Paint shall not be applied when the temperature of the surface to be painted is at 5deg.C or lower.

Primers shall adhere to the surface firmly and offer a key to the subsequent coats.

Workmanship shall generally conform to requirements specified in IS: 1477-Part II.
It is essential to ensure that immediately after preparation of the surfaces, the first coat of primer paint shall be applied by brushing and working it well to ensure a continuous film. After the first coat becomes hard dry a second coat of primer shall be applied by brushing.

The dry film thickness of each coat of primer shall be not less than 25 microns. This shall be checked with the help of electrometer before delivery of material from fabrication yard to erection yard.

Application of finishing paints shall be carried out within the shortest possible time interval after primer since the primer coats are too thin to give adequate corrosion protection of the steel surface over a long duration.

Painting shall be carried out either by brushing or by spraying. The Contractor shall procure the appropriate quality of paint for this purpose as recommended by the manufacturer.

After the second coat of primer is hard dry, the entire surface shall be wet rubbed cutting down to a smooth uniform surface. When the surface becomes dry, the undercoat of paint of optimum thickness shall be applied by brushing/spraying with minimum of brush marks. The coat shall be allowed to hard dry. The under coat shall then be wet rubbed cutting down to a smooth finish, taking adequate care to ensure that at no place the undercoat is completely removed. The surface shall then be allowed to dry.

The first finishing coat of paint shall be applied at the fabrication yard by brushing or by spraying and allowed to hard dry. The gloss from the entire surface shall then be gently removed and the surface dusted off. The second finishing coat shall then be applied by brushing or by spraying at work site after erection.

At least 24 hours shall elapse between the applications of successive coats. Each coat shall vary slightly in shade and shall be approved by the Engineer-in-charge, prior to applying the next coat.

Minimum dry film thickness of each coat of finish paint of synthetic enamel shall be 25 microns. Minimum dry film thickness of other finish paints shall be as specified in the respective item of work.

The final finished surface shall look smooth and even. The contractor shall ensure this by providing additional coat, if and when required. Nothing extra shall be paid for this.

4.17 Rate for steel: -

Rate is inclusive of all items indicated above including men, material and equipments. However Enamel painting shall be paid separately.

4.17.2 Measurement for steel: -

The structural steel shall be measured as built. No deduction for holes less than 0.02 sq.m shall be made. Steel as erected and specified shall be paid.

4.18 Rate for Painting: -

Rate for painting shall include all item indicated above inclusive of men, material and equipments.

4.18.2 Measurement for Painting: -

Measurement for painting shall be as of Metric tones of Structural steel erected and completed.

4.19 Galvanising of Structural Steel

4.19.2 Galvanising Plant

Prior approval shall be obtained from Employer / Engineer-in-charge if galvanizing is proposed to be carried out outside Contractor's plant.

4.19.3 Workmanship

After all shop work is complete, all structural materials shall be punched with the erection mark and be hot-dip galvanized. Before galvanizing, the steel shall be thoroughly cleaned of any paint, grease, rust, acid or alkali or such other foreign matters as are likely to interfere with the galvanizing process or with the quality and durability of the zinc coating. Pickling shall be very carefully done and shall be proper.

The weight of the zinc coating shall be at least 0.610 kg/sq.m unless specified otherwise. Stub members and members for grillage type footing shall have heavier zinc coating not less than 0.80 kg/sq.m.

The galvanized surface shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surface of steel. The finished surface shall be clean and smooth, and shall be free from defects like discolored patches, bare spots, unevenness of coating, spelter that is loosely attached to the steel, globules, spikes, etc. The finish shall be as per IS: 2633 unless specified otherwise.

All galvanized members shall be treated with Sodium dichromate solution or an approved equivalent after galvanizing; so as to prevent white storage stains.

Galvanizing of each member shall be carried out in one complete immersion. Double dipping shall not be permitted. However, in case of members over 7.5 m long, the Contractor shall take prior approval of Engineer-in-charge for double dipping. When the steel section is removed from the galvanizing kettle, excess spelter shall be removed by 'bumping'.

Wherever galvanized bolts, nuts locknuts, washers, accessories etc. are specified, they shall be hot-dip galvanized. Spring washers shall be electro-galvanized. Excess spelter from bolts, nuts, etc. shall be removed by centrifugal spinning. Rechasing of bolt threads after galvanizing shall not be permitted. Nuts, however, may be tapped, but not to cause appreciable rocking of the nuts on the bolts. Readily available GI nuts, bolts and washers conforming to galvanizing requirements may also be used.

Defects in certain members indicating presence of impurities in the galvanizing bath in quantities larger than that permitted by the specifications, or lack of quality control in any manner in the galvanizing plant, shall render the entire production in the relevant shift liable to rejection.

Contractor shall ensure that galvanizing is not damaged in transit. In the event of occurrence of any damages Contractor shall at his own cost adopt scraping and regularizing the member to satisfy the specific requirements.

4.20 False Ceiling with Gypboard & G I framework:

4.20.2 Scope of work

The work envisaged under these specifications refer to supplying and fixing in position false ceiling at any floor, any location and at any height.

a) Providing and fixing suspended G.I frame work
b) Providing and fixing one layer of 12.5 mm gypboard over this frame work